WORKING GROUP ON BEAM TRAWL SURVEYS (WGBEAM)

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i Executive summary

The Working Group on Beam Trawl Surveys (WGBEAM) coordinates and implements European inshore and offshore beam trawl surveys, including planning, standardization, data transmission and data quality assurance. The group also coordinates the Italian/Croatian/Slovenian beam trawl survey in the Adriatic Sea as there is no other body in the EU coordinating beam trawl surveys, and the EU Data Collection Framework requires survey coordination.

In 2020 eleven beam trawl surveys were planned, covering the North Sea, 5a, 7d, 7e, 7fg, 7a, 8a, 8b and the Northern Adriatic Sea. Despite the COVID-19 pandemic most surveys could be carried out according to schedule, but often with less staff, only 7a has not been sampled. All data have been transmitted to the ICES Database of Trawl Surveys (DATRAS).

In 2021, a combined session with North Sea and Celtic Sea stock coordinators took place where all surveys were presented. Stock coordinators discussed developments in data use and provided an overview of current beam trawl survey data use in the assessments.

The 2018 cohort for sole (*Solea solea*) and plaice (*Pleuronectes platessa*) in the North Sea and 7d is still visible as 2-year olds in the 2020 beam trawl surveys. No additional strong year classes could be seen for sole and plaice.

R scripts to evaluate the combined offshore and inshore beam trawl surveys data by region and cross-regionally have been further developed, and a preferred calculation method for swept area has been created.

The manual for the offshore beam trawl surveys has been updated (full update foreseen in 2023), and the manual for the inshore beam trawl surveys has been further developed (first version expected mid 2022).

WGBEAM has also decided to maintain an overview of the current and future industry beam trawl surveys.

ii Expert group information

Expert group name	Working Group on Beam Trawl Surveys (WGBEAM)
Expert group cycle	Multiannual
Year cycle started	2020
Reporting year in cycle	2/3
Chair(s)	Ingeborg de Boois, the Netherlands
Meeting venue(s) and dates	23-25 March 2020, webmeeting (due to COVID-19), 13 participants
	22-26 March 2021, webmeeting (due to COVID-19), 14 participants

1 General information

Participation

Due to the COVID-19 pandemic the meeting took place as a web meeting. 14 participants joined the meeting (Annex 1), from 8 countries. On Tuesday, five stock coordinators for the relevant flatfish and elasmobranch stocks participated in a joint session.

Meeting goals

The group's terms of reference (Annex 2) relate mostly to the role of the group, i.e. to coordinate beam trawl surveys in the ICES area, including planning, standardisation, data transmission and data quality assurance. The group also coordinates the Italian/Croatian/Slovenian beam trawl survey in the Adriatic Sea as there is no other body in the EU coordinating beam trawl surveys, and the EU Data Collection Framework requires survey coordination.

For 2021, the specific tasks were:

1. Compilation of survey summary sheets
2. Provide tabular overview of survey planning, including geographical areas for overlapping tows
3. To upload data for all beam trawl surveys (inshore and offshore) including litter in DATRAS for at least the last two years, as far as DATRAS allows the survey data to be submitted. For datasets where index calculation is done directly from DATRAS, as many years of the time-series should be uploaded as is feasible.
4. Develop R scripts for and results from the data evaluation by region as well as across regions
5. To provide a draft of an inshore beam trawl survey manual following the outlines of SISP 14
6. If relevant, to provide updated SISP 14 at the WGBEAM sharepoint (full update in 2022)

Follow-up of recommendations

Recommendations 2020 ID 26, 35, 36, 37 from WGBEAM 2020 and 2019 to other recipients have been communicated. Recommendation 2020 26 (organising GitHub training) has been completed. The updates on 2020 36 and 37 are under chapter Recommendation 2020 ID 46 from WGNSSK to WGBEAM and IBTSWG has been taken into consideration by WGBEAM 2021, by inviting the relevant stock assessors to the presentation session on the 2020 achievements.

2 Survey results (ToR a, b, d, f, i)

Survey achievements 2020 (ToR f)

For the offshore and the inshore surveys survey summary sheets (Annex 5) have been prepared, containing the main data end-users for fish stock assessment, data collected during the survey, and specific comments on the 2020 surveys.

Offshore surveys

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 2.1. Further details (areas covered, technical specifications) by country are given in Annex 5.

- The UK Q1SWBEAM survey was -due to COVID-19- moved from March/April to June, and shortened to two weeks. As a result, it was not possible to sample the Celtic Sea part of the survey, but all planed Western Channel stations were sampled. It has been delivered to DATRAS as a 'Q1 survey'
- UK 7fg, 7a NWGFS: a positive COVID-19 test at the start of the survey delayed the survey with 14 days and left limited time for its remainder (9 days including steaming time-5 days of fishing). As a consequence, a selection of stations has been sampled, only in 7fg. The background of the choice was pragmatic, as it was the only manner to complete a significant part of the survey.
- The Dutch and German survey have been carried out with a limited number of staff due to COVID-19 (no students allowed on board), despite that all stations could be sampled. It was chosen to only take experienced staff on board.
- Due to bad weather conditions, during the Belgian survey some stations were cancelled and many were fished for 15 minutes instead of 30 minutes.
- The Italian/Slovenian/ Croatian SoleMon survey could not cover the stations Croatian waters due to COVID-19 and administrative limitations. Number of staff was reduced due to COVID-19.

Table 2.1. Overview of offshore beam trawl surveys during 2020.

Country	Vessel	Area	Dates	Gear
Belgium	Belgica	western-southern North Sea	24 Aug – 04 Sept 2020	4 m beam
France	Côtes de la Manche	8a, 8b	09 Nov – 03 Dec 2020	4 m beam
Germany	Solea	German Bight	24 Aug – 08 Sept 2020	7 m beam
Iceland	Bjarni Saemundsson	Entire coast of Iceland	26 Aug – 11 Sept 2020	4 m beam
Italy/ Slovenia	G. Dallaporta	Northern Adriatic Sea (GSA 17)	01 Dec – 16 Dec 2020	2x 3.5m modified beam
Netherlands	Tridens	southern North Sea, German Bight	27 Jul–14 Aug 2020	2x 8 m beam
Netherlands	Tridens	central and western North Sea	17 Aug–11 Sep 2020	2x 8 m beam + flip-up rope
UK	Cefas Endeavour	English Channel /Celtic Sea	14–28 Jun 2020	4 m beam
UK	Cefas Endeavour	7d, 4c	13 – 25 Jul 2020	4 m beam
UK	Cefas Endeavour	7fg, 7a	20 – 30 Sept 2020	4 m beam

Inshore surveys

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 2.2. Details on the surveys are given in Annex 9. Details on the 2020 survey achievements are in Annex 7.

- The Dutch SNS survey started with one week delay due to technical issues and weather conditions. As a result, the survey in the Dutch coastal zone (DYFS) was also postponed by one week.
- The Dutch DYFS in the Wadden Sea was carried out with only one WMR staff member due to COVID-19 restrictions. The ship's crew assisted with the sampling.
- The German DYFS was carried out as planned and there were no restrictions because of COVID-19. One day in the North Frisian was cancelled because of bad weather condition but the full spatial coverage of the survey was achieved.
- The Belgian DYFS suffers from tight ship's planning, and the priority given to 'scientific projects' (i.e. University projects). In 2020 no technical issues arose and the weather was fine, so the survey could be fully carried out. WGBEAM points out that for future, it is a point of concern.

Table 2.2. Overview of surveys during 2020.

Country	Vessel	Area	Dates	Gear
Belgium	Simon Stevin	Belgian coastal zone	14 – 23 Sept 2020	6 m shrimp trawl
Germany (DYFS)	Chartered vessels	German Wadden Sea	21 Aug – 23 Sep0 Oct 2020	3 m shrimp trawl
Germany (DYFS)	RV Clupea	German Bight coastal zone	13 Sep – 05 Oct 2020	3m Shrimp trawl
Netherlands (SNS)	Isis	Dutch coastal zone	9-25 Sep 2020	6 m beam trawl
Netherlands (DYFS)	Luctor	Scheldt estuary	31 Aug–18 Sep 2020	3 m shrimp trawl
Netherlands (DYFS)	Stern	Dutch Wadden Sea	24 Aug–25 Sep 2020	3 m shrimp trawl
Netherlands (DYFS)	Isis	Dutch coastal zone and German Bight	28 Sep–30 Oct 2020	6 m shrimp trawl

Data transmission to DATRAS (ToR d)

(1) Evaluate achievable deadlines for data delivery

In 2020, WGBEAM proposed new data delivery deadlines for beam trawl survey data submission to DATRAS. Apart from some specific issues related to the COVID-19 pandemic, all deadlines could be met and there is no reason to change those set in WGBEAM 2020. The deadlines for submission of the 2021 beam trawl survey results are in Annex 4.

(2) Coordinate and evaluate data delivery to DATRAS

Fish trawl data

Unaggregated beam trawl data are stored in DATRAS up and until the survey of the year previous to the meeting year. For 2020 all countries managed to upload their data to DATRAS prior to the meeting. These data are available in the database, but not all of them are already available for download in exchange format. A full overview of the DATRAS submission status is available at https://datras.ices.dk/Data_products/Submission_Status.aspx (select one of the Beam Trawl Surveys, Inshore beam trawl survey or Sole Net Survey).

Exceptions in data submission:

- For the offshore beam trawl surveys, only the Icelandic survey data are not delivered, as DATRAS does not allow for that data yet.
- For the inshore surveys, the 2020 German age data are not complete yet due to COVID-19 logistic issues. Final submission is scheduled for April 2021.

Marine litter

Data on bycatches of marine litter are also stored in the DATRAS database. In the offshore beam trawl surveys (BTS) in the North Sea litter is being registered and submitted to DATRAS on a regular basis. Litter data from the English BTS surveys are regularly added for western Channel and Celtic Sea (Q1), North sea and eastern Channel (Q3), Irish Sea and Bristol Channel (Q3).

Exceptions in data submission:

- Belgian BTS and DYFS litter data have not been submitted yet for 2020, as the aim is to upload the data within the year after the survey.

Blocked time frames for resubmission of data to DATRAS

In order to provide the stock coordinators sufficient time to prepare their input for the stock assessment groups, some closure times for resubmission of files to DATRAS have been agreed upon (Table 2.3, Annex 4.3), unless induced by the end-user.

Table 2.3. Overview of open (green) and closed (grey marked with X) periods for resubmission of data to DATRAS.

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Greater North Sea				X	X	X						
7d				X	X	X						
7a, fg				X	X	X						
Bay of Biscay					X	X						
Adriatic Sea						X					X	X
Icelandic Sea				X	X	X						

Survey indices (Tor a, b, i)

The full text and figures for the index series are in Annex 7.

North Sea – Subarea 4

For sole (offshore text Annex 7.1, figures Annex 7.1.1 7.1.1-7.1.4; inshore text Annex 7.2, figures Annex 7.2.1) strong 2016 and 2018 yearclasses can be tracked in multiple surveys (offshore and inshore). Depending on the exact survey area, the cohort consistency is stronger. For sole the strong 2018 cohort is visible in 2020 in both the offshore (BTS) and the inshore (SNS) surveys. For sole a benchmark has taken place in 2020 and since spring 2020 the NL 1985-2020, DE 1993-2020,

BE 2004-2020 offshore beam trawl survey data south of 57°30'are taken into account, as a swept-area based index series, next to the SNS series and the DYFS recruit series.

For plaice (offshore text Annex 7.1, figures Annex 7.1.2.1-7.1.2.6; inshore text Annex 7.2, figures Annex 7.2.2) the strong 2018 yearclass is still present as 2-years old. From the Dutch offshore survey in the western and central North Sea (Figure 7.1.2.3) it seems that older age groups have disappeared from the survey area. It is in line with the field observation that less larger plaice have been caught during the 2019 and 2020 survey. In 2018, 2019 and 2020 the decreased mean length may have been influenced by extreme recruitment (2018 yearclass).

Western waters-subarea 7 and 8

Sole (text Annex 7.1.1, figures 7.1.5–7.1.7) as well as plaice (text Annex 7.1.1, figures 7.2.7–7.2.9) from area 7 stocks develops differently between the areas.

7d

The year-class pattern in division 7d overlaps strongly with those in subarea 4 for both sole and plaice. Cohorts can be generally well tracked between years in this survey.

7f

In 2020, all planned Division 7f stations were successfully completed despite a delay to the start of the survey following a COVID-19 positive test (Section 2, Annex 5).

In division 7f the abundance of age 1 sole at first glance appears to have been rather stable across the time-series with one very large cohort observed in 1999, and another strong cohort in2017. Due to the large contrast the survey has been able to track both cohorts well through its existence.

For plaice the survey index is highly informative on long-term stock dynamic trends but estimates of individual cohort abundance are not necessarily tracked that well in all but the smallest and largest cohorts. Some age-based models may confuse these signals with rapid selectivity changes in the fleet. Particularly age-1 abundance seems to be affected by this which may be linked to variable rates of unintended fishing mortality in the area.

7a

In 2020 no survey took place in Division 7a, due to delay by a COVID-19 positive test at the start of the survey (Section 2, Annex 5).

Sole in division 7a has in recent years been of concern to managers due to low SSB values. The most recent survey trends indicate that following the strong decrease in sole abundance at age 1 until 2014 is starting to reverse with higher recruitment rates being observed since then.

In contrast to the sole stock the 7a plaice stock seems to be in a very healthy condition, although the reduction in recent recruitment indicates that it is unlikely that the recent period of high productivity may not be maintained. A change in productivity might be indicative of some changes to the ecosystem relevant to plaice reproduction and that historic levels of catches applied to the current stock would require further analysis to ensure that they would remain sustainable.

8

There is no evidence of the synchrony in recruitment pattern observed between division 8 (text Annex 7.1.1, figure 7.1.1.8) and divisions 7a and 7f. Since 2018, the time-series of age group abundances of sole are marked by 1-group recruitments below average. There is good cohort tracking of abundance estimates from age 1 to 3. Full selectivity appears to be reached at age 2.

Northern Adriatic Sea

Overall an increasing trend for all the ages in the second part on the time-series is visible (text Annex 7.1.1, Figure 7.1.1.9). In particular the high recruitment observed in 2013 can be followed in the succeeding years. Moreover the 2019 and 2020 seem to be good years for recruitment.

Icelandic Sea

The 2020 survey values for plaice mostly show similar values as in 2017 and 2018 (text Annex 7.1.2, Figure 7.1.2.10). The 2019 survey indicated that almost all the age groups (except for age 9) were lower than the long-term arithmetic mean, most likely due to it being conducted earlier in summer than in the other years. The internal consistency of the series is weak in the younger ages but becomes relatively good starting from age group 4, in particular the high value observed in 2016 can be followed in the succeeding years.

3 Survey coordination and standardisation (ToR e, g, h)

Offshore and inshore beam trawl survey planning 2021 and comparative tows (ToR e)

The survey planning for the offshore and inshore beam trawl surveys 2021 is largely in line with previous years. Annex 6 contains the detailed planning.

As in previous years, WGBEAM recommends that if time and weather allows, overlapping hauls should be carried out by countries operating in the same area.

During the Dutch and German surveys in the North Sea, some overlapping hauls should be attempted in the following rectangles, like in 2020: 40F4, 40F5, 40F6, 41F4, 41F5, 41F6, 42F4, 42F5, 42F6, 43F4, 43F5, 43F6. The responsible scientists will contact each other approx. one month before the start of the Dutch survey to make appointments on the execution of the comparative tows. Comparative fishing has always been on the WGBEAM task list, but has become more important since the index calculation takes into account all beam trawl survey data in the North Sea with DeltaGAM. The model is more reliable when overlapping tows are available in the dataseries.

The Belgian and Dutch surveys also include rectangles fished by both in the same time frame, but the bottom of the Belgian positions is very rough. It is not possible to fish on these locations with the gear used by The Netherlands.

Northern Adriatic Sea survey, conducted by Italy, could undergo spatial coverage changes as Croatia established the EEZ in early 2021. This mean that the 7 hauls in Croatian national waters could undergo changes. In 2021, hauls might not be performed within BTS-GSA17 or performed by Croatia with an independent survey.

Manuals (ToR g, h)

In 2020, an outline was made for the Manual on inshore beam trawl surveys (table of contents in Annex 10). The structure is based on the manual on offshore beam trawl surveys SISP 14 (ICES 2019). Intersessional actions have been defined (Annex 3.2). Throughout 2020 and at the WGBEAM 2021 meeting, further progress has been made. The first version should be available for internal review on 1st November 2021.

Based on the discussions on methodologies used in the inshore surveys, WGBEAM recommends that WGCRAN provides the following information:

- WGCRAN's preferred conservation method of shrimp to be measured (fresh, frozen, cooked, ethanol, etc.) for the DYFS;
- WGCRAN's view on the minimum number of measurements on shrimp per stratum (i.e., subarea) for a reliable assessment in the DYFS.

Based on the information, WGBEAM can then evaluate the current survey setup, including the current amount of measurements, and see if improvements in the procedures are achievable.

The Manual on offshore beam trawl surveys (ICES 2019) has been updated where necessary. The compy is stored on the WGBEAM sharepoint. The updated manual will be made available in year 3 of the cycle (2022).

4 Evaluation of combined survey data (ToR a, b, c)

Consistency analyses offshore and inshore beam trawl surveys

WGBEAM subgroups evaluated offshore and inshore data from DATRAS. The R scripts produced can be used to evaluate any beam trawl survey (BTS, DYFS, SNS) and any species in DATRAS. The R scripts have been stored at https://github.com/ices-eg/wg_WGBEAM.

(i) Regional evaluation of offshore and inshore data from DATRAS

The latest information on DATRAS is extracted by the getDATAS function (icesDatras package). Haul information (HH) and length information (HL) is combined into one dataset. Simple quality checks (e.g. tables to explore missing data, checks for NAs) are incorporated in the script.

In the script a species list is created from WoRMS (www.marinespecies.org), so valid Aphia codes in DATRAS can be linked to the correct scientific names. Before filtering to a specific species of interest, a list of the fished stations is created. In this way stations with zero observations can be taken into account when calculating average values.

In order to calculate CPUEs (preferably in numbers/km² or numbers/1000m²) from the beam trawl surveys total numbers per haul and the surface area that was fished (=swept area) for each haul need to be made available. With the script a bar plot can be created to check for the combinations of country, gear and year whether total numbers (TotalNo) are available. If the column for total numbers is not filled in (NA or -9), total catch numbers can be calculated based on haul numbers at-length (HLNoAtLngt) multiplied by the subsampling ratio (SubFactor).

a. Calculation of swept area

Swept area can be calculated in different ways. For beam trawl surveys the calculation of the swept area (SA) is quite straightforward, since the width of the beam does not change and the gear more or less follows the surface of the seafloor. However, swept area is sometimes calculated in different ways. Two options are suggested by WGBEAM:

For conditions where *GearExp*=SB (single beam; catch of one net sorted):

1) Swept area in km² = beam width * distance / 10^6
2) Swept area in km² = beam width *(haul duration/60)*fishing speed*1852/10^6
3) Calculate distance based on shooting and hauling position (formula available at ICES Data Centre), and apply calculated distance in formula 1)

For conditions where *GearExp*=DB (double beam; catches of two nets put together):

1) Swept area in km² = 2*beam width * distance / 10^6
2) Swept area in km² = 2*beam width *(haul duration/60)*fishing speed*1852/10^6
3) Calculate distance based on shooting and hauling position (formula available at ICES Data Centre), and apply calculated distance in formula 1)

Where (*Italics*=reference to DATRAS product terminology):

- beam width: numerical value in *Gear* (in meters)
- distance: *Distance* (in meters)
- haul duration: *HaulDur* (in minutes)
- fishing speed: *GroundSpeed* (in knots)
- shooting position: *ShootLat, ShootLong*
- hauling position: *HaulLat, HaulLong*

WGBEAM advises to always use option 1 based on beam width and distance, except when the distance is missing from DATRAS, then option 2 is the best alternative. Haul duration should always be between 5 and 40 minutes, except for incidental cases for the Netherlands (caused by sorting two nets at the same time; this will in 2021 be changed into GearExp=DB). Fishing speed differs depending on the survey and vessel that was used. The fishing speed for the all of the beam trawl surveys under coordination of WGBEAM can be found in the WGBEAM manual (ICES, 2019). When fishing speed is missing in DATRAS, the standard values reported in the manual can be taken as the average fishing speed, or calculation option 3 could be used (depending on the availability of information).

b. Example: the evaluation of brown shrimp (*Crangon crangon*) catches from the inshore surveys (DYFS) in the North Sea.

As an example the script was run to evaluate all DYFS surveys in DATRAS for the years 2004-2020. The focus species was shrimp. The trends for Germany and the Netherlands are similar, although the Dutch DYFS consistently seems to catch more shrimp. This may have to do with the catchability of the gear or with the spatial distribution of the shrimp. A full description of the example settings and the script output can be found in Annex 8.1.

(ii) Species consistency check across surveys

a. Spatial species identification consistency

In order to evaluate if species are recorded in a consistent way across surveys, the R script developed under (i) was modified and extended. DATRAS data were extracted and tabulated by overlapping survey areas to identify possible differences in species identification. One first result of this exercise was that obviously there exist some inconsistencies between the SpecVal numbers uploaded and the ValidAphiaID from WoRMS (http://www.marinespecies.org/). This was communicated to ICES Data centre and will be checked. In a second step, BTS Data from 2018 (North Sea) were tabulated and data from areas where survey activities overlap were checked in detail by a subgroup. There were no major inconsistencies spotted and it seems that the identification of species was consistent between surveys (NL, DE, BE, GB; Annex 8.2: Table 8.2.1, Figure 8.2.1). There are some differences in the general approach of recording species, i.e. which organisms beside fish and macro-epibenthos are recorded (e.g. jellies) or the identification level for more difficult species (e.g. *Ammodytes*). It is clear that it is not possible to identify all inconsistencies in species recording across surveys with such simple tables. However, it was concluded by the group that it will facilitate the evaluation of species recording consistency from year to year within WGBEAM. Another function included into the script was a check for new species recorded. This at least will give a hint if there is an error or there was really a new species encountered with the survey. This functionality already exists in DATRAS internal data checks but it is so far not listed in the warnings returned by the upload tool. It was discussed that this might be implemented in the future. The script for species consistency check will be further developed and discussed within WGBEAM.

b. Temporal new species identification consistency

In order to evaluate temporal new species identification consistency across the survey, the R script developed under (i) and (iia) was modified and extended. The script allowed to extract DATRAS data time-series (user can define period and survey to analyse; e.g. 2000-2018 BTS data) and to easily find the first year of appearance of all species in the series. After extraction of the table, one can select a specific year to view the list of species appearing in that specific survey year. To see if and which new species have been found in a specific survey compared to the previous year, the user needs to select only those two years.

The same analyses can be conducted in more details by country. A pie chart provides a simple overview of the percentage of new species by country in a specific year (Annex 8.2: Figure 8.2.2). Looking at the list by country allows WGBEAM to check if good consistency in new species identification is present in all survey areas.

Moreover, the script allows the user to produce maps of new species occurrence for a specific year to see in which area/areas the species was found. In the example (Annex 8.2: Figure 8.2.3), a new species *Limecola balthica* was found by three different country in 2018 survey. In particular, the species was found by DE in the North Sea near Denmark, by BE near the English Channel and by GB in Bristol Channel and in the Irish Sea. This spatial output can help survey coordinators to have better information of possible species finding in future survey. The script can be found and downloaded on the specific WGBEAM Github page (https://github.com/ices-eg/wg_WGBEAM/blob/master/New_Species_consistency.R).

5 Other topics

DATRAS developments

The recent and upcoming DATRAS developments have been presented by the ICES DATRAS team. Those included:

a. Unified format fields: the status of the new unified format fields is that some are used in BTS and some are not, and this varies between countries, especially for HH and HL records. For almost all beam trawl surveys the new fields in CA are used.
b. The use of headers for the HH, HL and CA data file will be compulsory from 2021 Q4: In 2020 headers for each record type were introduced. Headers will provide flexibility in the submission of non-mandatory information, as submitters can leave out headers for which they don't provide information. In 2020 all submitters have been asked to submit their files with header line. The screening program also checks the header text next to the data column value checking. In 2020 and 2021 it is allowed to submit data with or without headers. From Q4 2021 onwards all data submitted to DATRAS need have headers otherwise it will not pass from screening program.
c. DevStage check in DATRAS: currently DATRAS does not allow submission of two values of Devstage for the same species, sex and haul. A check will be added into the procedure to be able to include this vocabulary in the submitted data (https://vocab.ices.dk/?ref=1397).
d. Swept area calculation for SNS, DYFS, BTS-VIII: DATRAS has implemented swept are calculation for SNS, DYFS and BTS-VIII. Originally the BTS logic is used for the calculation procedure. Although the BTS swept area product was examined and used by data users, the DATRAS team asked to WGBEAM to examine the result for new products and verify with theirs calculation methods (response in "WGBEAM Feedback to ICES DATRAS team"). The DATRAS in the process of calculating swept area product for Adriatic survey and result will be share with the group member for verification.
e. Distance cross-check: as distance is one of the major parameter for the swept area calculation it is essential to implement an additional check on distance in the DATRAS checking program. The current check warn when the difference between distance and calculated distance is more than 300 meter. The new check should give more assurance to the end user on the distance field. The DATRAS team proposes that new check will be implemented using use the speed as reported in the submitted file and haul duration parameter to estimate distance and raise a warning if the reported distance value is out of the range.
f. Survey codes: the current survey naming varies and is often not consistence between report, stock annex and advice sheets, so a new survey coding is proposed (controlled vocabulary). The survey code is a one-letter prefix (describing survey type) and a running number. In the end there will be a direct link between sock annexes, advice sheets and survey groups. WGBEAM response and discussion in "WGBEAM Feedback to ICES DATRAS team".
g. A question was raised regarding that the survey group felt that it was to confined to have ICES stock codes linked to surveys, since these are multispecies surveys and should reflect that in the coding. Also, each country is targeting and catching different species, this they also think should be reflected in the survey code. Therefore, an addition to the list was made, where each country can fill in information regarding the fields currently in the survey code to elaborate on area and species. They also found that having some connection to what sort of data were collected from the surveys would be beneficial for the end product.
h. DATRAS dataflow chart: a flow chart has been developed for DATRAS data. WGBEAM response and discussion in "WGBEAM Feedback to ICES DATRAS team".

i. GitHub Training: like in 2020, ICES Datacentre has offered to host a joint DATRAS GitHub training in 2021 for survey groups. Contact DATRAS administration (DatrasAdministration@ices.dk).

WGBEAM Feedback to ICES DATRAS team

WGBEAM provided feedback by ICES DATRAS Team on the following topics:

- Completing the survey code list for the beam trawl surveys: the survey group wondered that it was to confined to have ICES stock codes linked to surveys, since these are multispecies surveys and should reflect that in the coding. Also, each country is targeting and catching different species, this they also think should be reflected in the survey code. Therefore, an addition to the list was made, where each country can fill in information regarding the fields currently in the survey code to elaborate on area and species. They also found that having some connection to what sort of data were collected from the surveys would be beneficial for the end product.
- The proposed data flow description: the data flow has been evaluated by a subgroup. Main points of attention were:
    - The flow now implies that assessments are peer-reviewed by a group. The output from assessment group is reviewed by the advice drafting group, but the assessment itself not;
    - It is unclear if the flow is only aiming at the fish stock assessment process, or also considers a wider scope such as ecosystem assessments. In that case, also external partners may have to be taken into consideration, like OSPAR and HELCOM;
    - Although the flow describes the current transfer of data from survey group to assessment group correctly, it is important to realise that a clear feedback loop on the outcomes of the benchmark process to the survey groups.

- The proposed swept-area DATRAS product for BTS-VIII, SNS and DYFS:
    - The BTS-VIII product has been reviewed, and the calculation seems to be in line with the expectation;
    - The DYFS and SNS products contain a number of aphiaID codes with two different species names connected to it, sometimes even within the same survey, year and haul, for example:
        - NL DYFS & SNS 2018-2020: 105814, 126425, 126927, 127147, 127149, 127160, 127262, 150630, 153131, 293624
        - Evaluation of the DYFS 2002-2020 revealed aphiaID codes not leading to a valid aphiaID: 235, 801, 106964, 106925, 137084, 137734, 138439, 139908, 144296, 152367, 405451, 428647, 587704, 836033

      WGBEAM recommends that ICES Data Centre reviews the mapping of the aphiaIDs with species names, not only for the newly developed products, but also for the existing CPUE products. The species name in the product should always be the valid species name as available in www.marinespecies.org, and a valid aphiaID should always be available in the file.

    - The comparison for NE DYFS and SNS 2018-2020 was carried out comparing the proposed data product with the standard calculation done directly from the Dutch database for measured specimens and resulted in:
        - No differences in numbers per haul;
        - One discrepancy on the swept area calculation, caused by rounding (368.93 vs 368.94 fish per km^2);
        - No discrepancies on the calculation of numbers per hour.

The data taken into account are however only the measured specimens, which results in only fish data and no CPUE per swept area is calculated for benthos species other than *Crangon crangon*. WGBEAM recommends that ICES Data Centre also takes into account benthos data without lengths in the new products, in line with the BTS product CPUE_per_length_per_Hour_and_Swept_Area.

- All DYFS and SNS data products: although in the data reporting format the DYFS and SNS area codes are allowed in HH (in StatRec) as well as in CA (AreaType-AreaCode combination), the values return as ICES statistical rectangles in the products (Exchange data nor Swept area). It is therefore impossible to analyse the DYFS and SNS data in the way they have been collected. WGBEAM recommends that the values entered in StatRec and AreaType be returned in all data products, so not to apply a calculation to ICES statistical rectangle. If it is in the eyes of ICES Data Centre preferred to either change the field name StatRec (HH) into a term that better covers the needs, or to add a field to HH for area codes not being ICES statistical rectangles, WGBEAM recommends that WGDG further decides on the way forward.
- With respect to the proposed additional values liver weight and liver parasites (CA), WGBEAM does not see an issue for incorporation of the field liver weight in the unified format once only headers are allowed. For parasites and other diseases a separate record type seems to be a more appropriate choice, as it provides the opportunity to provide multiple disease registrations for an individual fish.

Requests for new DATRAS developments

WGBEAM noted requirements for further developments of DATRAS and recommends that this is discussed in WGDG:

- Record methodology of distance (calculated by speed and duration, by ship's log, by calculation shoot-haul position, etc.)
- Record conservation status of species: fresh, frozen, cooked, ...
- Although WGBEAM suggests not to add so-called 'seeded ages' and upload individual fish for which no age has been collected with Age=-9, it may be considered to add additional coding in TS_AgeSource, e.g. 'estimate'.
- It appeared that DATRAS does not allow for submission of HH records of valid tows without HL and/or CA records. WGBEAM concluded that this should be allowed, as valid tows may occur, but in single-species surveys (stdspecrec=1, bycspecrec=0) it may lead to wrong estimates of average catches if 0-hauls are not taken into account.

Industry surveys

Presentations were given on the achievements of the UK Western Channel Sole and Plaice industry survey (http://data.cefas.co.uk/#/View/20717), and on the set up of the Netherlands industry survey on Turbot and Brill (Schram *et al.*, 2021). For the latter survey, the data have been submitted to DATRAS.

The group discussed if Industry beam trawl surveys should be coordinated by WGBEAM. In principal, WGBEAM is the natural focal point for any beam trawl survey in the ICES areas of which the data are used in the stock assessments. It is proposed that presentations on achievements of the industry surveys are incorporated in the session on last year's achievements, and incorporate industry surveys in the survey summary sheets. Although it is not possible to force anyone to make data publicly available, WGBEAM strongly suggests that this is done, especially when data will be or are used in stock assessment.

Quality assurance

Presentations were given on the outcomes of the age reading workshops for dab and plaice. Age readings of dab show considerably lower percentage agreement than plaice. For both species no country-effect could be seen.

The setup of species identification tests and workshops in the Netherlands was presented, for inspiration (de Boois, 2020). A similar setup is done in Belgium. Based on the experiences, it was concluded that species identification tests and workshops are an effective way to open the dialogue on species recognition, and also clearly shows the expertise of the technicians.

The proposed terms of reference of a follow-up of the Workshop on unavoidable survey effort reduction (WKUSER-2) have been provided to the group.

Presentations by data end-users

The following topics were presented:

- North Sea sole, implementation of benchmark 2019
- North Sea plaice, the possibility to combine indices -prelim results
- North Sea dab and flounder, current data use in stock assessment
- 7d sole benchmark results
- WKSKATE follow-up actions for beam trawl surveys
- Adriatic Sea sole benchmark
- Planned incorporation of beam trawl survey data in Icelandic Sea

WGBEAM evaluated the combined session, and found it useful as it linked up people and provided information to the survey group as well as to the stock coordinators. WGBEAM found it easier to follow-up on questions raised during that session. The stock assessors also appreciated the opportunity to be informed on the survey's achievements. It was useful to have many short presentations, together providing a good overview of the work achieved and the use of data.

Suggestion for improvement:

- Invite all potential stock coordinators for flatfish species: Irish Sea stocks, lemon sole in the North Sea.

6 References

Boois, I.J. de. 2020. Species identification workshop 2020: demersal fish and macro-zoobenthos. Wageningen Marine Research internal report 20.003.

ICES. 2019. Manual for the Offshore Beam Trawl Surveys, Version 3.4, April 2019, Working Group on Beam Trawl Surveys. 54pp. http://doi.org/10.17895/ices.pub.5353

Schram, E., N. Hintzen, J. Batsleer, T. Wilkes, K. Bleeker, W. van Broekhoven, D. Ras, E. de Boer, B. Trapman, N. A. Steins. 2021. Industry survey turbot and brill in the North Sea: Set up and results of a fisheries-independent survey using commercial fishing vessels 2018-2020. Report C037/21 https://doi.org/10.18174/544588

Annex 1: List of participants

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Stock coordinators in the joint session

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Annex 2: Resolutions

WGBEAM – Working Group on Beam Trawl Surveys

2019/FT/EOSG10 A **Working Group on Beam Trawl Surveys** (WGBEAM), chaired by Ingeborg de Boois*, the Netherlands, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 1	24-27 March 2020	Reykjavik, Iceland	The first interim report by 30 April 2020 to SCICOM and ACOM	**Incoming Chair:** Ingeborg de Boois (meeting took place online)
Year 2	2021	Reykjavik, Iceland	The second interim report by 30 April 2021 to SCICOM and ACOM	(meeting took place online)
Year 3	2022	Reykjavik, Iceland	Final report by XX YYYY 20XX to SCICOM and ACOM	

ToR descriptors[1]

ToR	Description	Background	Science plan codes	Duration	Expected Deliverables
a	Evaluate the combined offshore and inshore beam trawl surveys data by region data in a reproduceable manner for the species used in fish stock assessment, including elasmobranchs and brown shrimp. Compare internal and external consistency of indicies age based indices where provided. Document inconsistencies or correct errors or omissions where identified.	Evaluation by region will ensure that patterns in the data (e.g. time-series, cohort strength) are consistent and sampling artefacts including year effects are identified, even when inter survey trends contradict.	3.1, 3.2	annually	(a) Updated, consistent and quality controlled beam trawl survey data are available in DATRAS; (b) R script to evaluate the results by region
b	Evaluate the cross regional offshore beam trawl data in a reproduceable manner for the overlapping species used in fish stock assessment in multiple regions (e.g. sole, elasmobranch species). Document inconsistencies and correct errors or omissions where relevant.	Evaluation of species that are assessed in multiple regions cross-regionally will provide insight in the commonalities and differences in stock dynamics in different regions.	3.1, 3.2	annually	(a) Updated, consistent and quality controlled beam trawl survey data are available in DATRAS; (b) R script to evaluate the results cross-regionally
c	Evaluate the combined survey results of the offshore and inshore beam trawl surveys by region on consistency, including litter data in a reproduceable manner.	Evaluation of e.g. species composition and litter registrations will ensure that patterns in the data (e.g. time-series non-commercial species, litter, species	3.1, 3.2	annually	(a) Updated, consistent and quality controlled (e.g. species composition, litter coding, consistent species identification in overlapping survey

[1] Avoid generic terms such as "Discuss" or "Consider". Aim at drafting specific and clear ToR, the delivery of which can be assessed

ToR	Description	Background	Science plan codes	Duration	Expected Deliverables
		composition, length frequencies) are based on correct data and not due to artefacts, even when the signals contradict. By doing this in a reproduceable manner (R script), the focus can be shifted or extended over the years without re-inventing the wheel. Moreover, traceability of analyses increases.			areas) beam trawl survey data are available in DATRAS. (b) R script to evaluate the results by region
d	Coordinate and evaluate the data delivery into the ICES database for offshore and inshore beam trawl surveys of (at least) the last two years and document gaps.	Unaggregated beam trawl survey data are stored in DATRAS up and until the survey of the year previous to the meeting year. Data from the year(s) before that, should be checked for completeness (final data submitted).	3.1	annually	(1) Achievable deadlines for data delivery of the next survey (2) Updated ICES database for inshore and offshore beam trawl surveys.
e	Coordinate and plan inshore and offshore surveys including overlapping tows	Dates, sampling areas and contact details of key persons are shared in order to (a) identify opportunities for tows on the same location, to support the deltaGAM methodology for index calculation in combining different survey gears. (b) coordinate effort in case of unforeseen circumstances hampering one of the surveys, primarily North Sea	3.1	annually	Finalized planning for the inshore and offshore beam trawl surveys, including areas where overlappinig tows may occur.
f	Report on the performance and abnormalities in the inshore and offshore surveys in the past year	For interpretation of the results, information on the performance of the sampling has to be provided to end-users	3.1	annually	Survey summary sheet by region.
g	Review and update the manual for offshore beam trawl surveys (SISP 14)	Review and update the survey manual.	3.1, 3.2	Year 3	Updated BTS manual (SISP 14)
h	Review and update the manual for inshore beam trawl surveys (DYFS, SNS)	Finalize the current draft manual in line with SISP 14 and hand in for review.	3.1, 3.2	Year 2	Manual for inshore beam trawl surveys
i	Provide indices for plaice, sole and if necessary other species if not yet derived directly from DATRAS	Indices are needed for the stock assessments. Especially for the Q1SWECOS survey, North Sea inshore surveys and offshore surveys outside the North Sea where indices are not (always) yet derived from DATRAS directly	3.1, 3.2	annually	Indices for plaice and sole if needed

Summary of the Work Plan

Year 1	(1) Compilaton of survey summary sheets (2) Provide tabular overview of survey planning, including geographical areas for overlapping tows (3) Data for all beam trawl surveys (inshore and offshore) including litter uploaded in DATRAS for at least the past two years, as far as DATRAS allows the survey data to be submitted. For datasets where index calculation is done directly from DATRAS, as many years of the time-series should be uploaded as is feasible (4) R scripts for and results from the data evaluation by region as well as across regions (5) First draft of inshore beam trawl survey manual following the outlines of SISP 14 (6) If relevant, updated SISP 14 at sharepoint
Year 2	(1) Compilaton of survey summary sheets (2) Provide tabular overview of survey planning, including geographical areas for overlapping tows (3) Data for all beam trawl surveys (inshore and offshore) including litter uploaded in DATRAS for at least the past two years, as far as DATRAS allows the survey data to be submitted. For datasets where index calculation is done directly from DATRAS, as many years of the time-series should be uploaded as is feasible (4) R scripts for and results from the data evaluation by region as well as across regions (5) Final version of inshore beam trawl survey manual following the outlines of SISP 14 (6) If relevant, updated SISP 14 at sharepoint
Year 3	(1) Compilaton of survey summary sheets (2) Provide tabular overview of survey planning, including geographical areas for overlapping tows (3) Data for all beam trawl surveys (inshore and offshore) including litter uploaded in DATRAS for at least the past two years, as far as DATRAS allows the survey data to be submitted. For datasets where index calculation is done directly from DATRAS, as many years of the time-series should be uploaded as is feasible (4) R scripts for and results from the data evaluation by region as well as across regions (5) If relevant, updated SISP 14 for review and publication

Supporting information

Priority	The scientific surveys coordinated by this Group provide major fishery-independent tuning information for the assessment of several fish stocks in the a number of regions. 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 about 12 beam trawl survey experts
Secretariat facilities	Report finalization, support ICES Data Centre with respect to DATRAS-related topics
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	The survey data feed into to the assessments of flatfish stocks, brown shrimp and elasmobranch species carried out by various stock assessment EGs. Linked to ACOM through the quality of stock assessments and management advice.
Linkages to other committees or groups	Outcomes of and data supplied by WGBEAM are relevant to WGML and integrated ecosystem assessment groups.
Linkages to other organizations	The offshore beam trawl survey data are used in the large fish indicator (OSPAR).

Annex 3: Actions

Topic	Action	Action by (lead=Italics)	Milestone dates
Inshore manual (tor h)	Fill in information on Dutch, Belgian and German inshore beam trawl surveys, based on example text for The Netherlands	*Ulrika*, Loes/Heleen, Holger	1st November 2021 (milestone=draft version ready for review)
Update offshore survey manual (tor g)	If relevant, add or adapt information up and until the 2020 survey	Kay, Ingeborg, Jean-Baptiste, Yann, Francesco, Gudjon/Magnús, Gary, Loes/Heleen	1st May 2021
Industry beam trawl surveys	Invite industry survey leads for presentation at WGBEAM 2022 on 2021 achievements	*Ingeborg*	1st February 2022
Industry beam trawl surveys	Add industry beam trawl surveys to the survey summary sheets	*Ingeborg*	1st February 2022
Connection with data users	Invite data users (WGNSSK: sole, plaice, turbot, brill, lemon sole, dab, flounder; WGCSE: sole, plaice, lemon sole; WGBIE: sole; WGEF: co-chairs; WGCRAN: chair(s)) for presentation session at WGBEAM 2022 on 2021 achievements, and invite them to present on their data use	*Ingeborg*	1st February 2022
Data products	Compile Adriatic Sea Data product for Solemon	*Vaishav, Francesco*	1st November 2021
Data quality	Cross-check and improve BE offshore distance information in DATRAS	*Loes, Heleen*	1st September 2021

Annex 4: Deadlines for data delivery to DATRAS

The deadlines for beam trawl survey data delivery to DATRAS are based on a realistic timeline where data for all species that are relevant for stock assessment can be delivered at the same moment. That is different from to the current situation, where, under high pressure, plaice and sole data for the offshore beam trawl surveys in the North Sea, mainly targeting older flatfish, are made available for the update assessment in autumn. Recruit information comes from the inshore surveys (SNS, DYFS) that are still running when the update assessment is carried out. The distributional range of the younger age class (0-2) ranges for both plaice and sole is only properly covered by the combination of the DYFS, SNS, BTS, NS-IBTS.

Annex 4.1 Deadlines for data delivery to DATRAS of the offshore beam trawl surveys in 2021.

COUNTRY	AREA	END DATE SURVEY	DATRAS SURVEY CODE	DEADLINE DATRAS DELIVERY	DEADLINE DATRAS LITTER DELIVERY
Belgium	western-southern North Sea	mid September	BTS	Incomplete: 5th December[2] Complete: 1st March	1st March
Germany	German Bight	mid September	BTS	Complete: 5th December	1st March
Netherlands	North Sea	mid September	BTS	Incomplete: 5th December [3] Complete: 1st March	1st March
UK	English Channel / Celtic Sea	mid April	BTS	Incomplete: 5th August [4] Complete: 1st December	1st December
UK	7d, 4c	end July	BTS	Incomplete: 5th December [5] Complete: 1st March	1st March
UK	7fg, 7a	mid September	BTS	Incomplete: 5th December [6] Complete: 1st March	1st March
Italy/ Slovenia	Northern Adriatic Sea (GSA 17)	mid December	BTS-GSA17	Complete: 1st June	No litter data delivery
France	8a, 8b	mid December	BTS-VIII	Complete: 1st April	No litter data delivery
Iceland	Entire coast of Iceland	end July	No code	Complete: 1st April (currently no delivery to DATRAS)	No litter data delivery

[2] file includes complete HH information, HL information for fish species, CA information for commercial flatfish species (brill, dab, flounder, lemon sole, plaice, sole, turbot)
[3] file includes complete HH and HL information; CA information available for commercial flatfish species (brill, dab, flounder, lemon sole, plaice, sole, turbot)
[4] file includes complete HH and HL information; CA information available for commercial flatfish species (brill, lemon sole, plaice, sole, turbot, megrim)
[5] file includes complete HH and HL information; CA information available for commercial flatfish species (brill, lemon sole, plaice, sole, turbot)
[6] file includes complete HH and HL information; CA information available for commercial flatfish species (brill, lemon sole, plaice, sole, turbot)

Annex 4.2 Deadlines for data delivery to DATRAS of the inshore beam trawl surveys in 2021.

COUNTRY	AREA	END DATE SURVEY	DATRAS SURVEY CODE	DEADLINE DATRAS DELIVERY
Belgium	Belgian coastal zone	end September	DYFS	Complete: 1st February
Germany	German Bight and German Wadden Sea	mid October	DYFS	Complete: 1st February
Netherlands (SNS)	Dutch coastal zone	end September	SNS	Complete: 1st February
Netherlands (DYFS)	Scheldt estuary, Dutch Wadden Sea, Dutch coastal zone and German Bight	end October	DYFS	Complete: 1st February

Annex 4.3 Overview of open (green) and closed (grey marked with X) periods for resubmission of beam trawl survey data to DATRAS.

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Greater North Sea				X	X	X						
7d				X	X	X						
7a, fg				X	X	X						
Bay of Biscay					X	X						
Adriatic Sea						X					X	X
Icelandic Sea				X	X	X						

Annex 5: Survey summary sheets 2020

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
Beam Trawl Survey (BTS), Belgium	Southwestern North Sea	1992	WGBEAM beam trawl survey manual	**WGNSSK:** *Pleuronectes platessa* (ple.27.420), indices by age group, age 1-10+; *Solea solea* (sol.27.4), indices by age group, age 1-9+ **WGEF:** elasmobranch species, CPUE per species per haul	Unaggregated data: (2004-2020) datras.ices.dk Area based age information from 2004-2009. Haul based age information from 2010-2020. Density plots per species: http://ecosystemdata.ices.dk/map/	The Belgian BTS was carried out from 24 Aug to 3 Sept 2020 with RV Belgica. There were minor technical problems, but this did not cause any substantial delay or loss of stations. Due to bad weather a lot of time was lost and in most of the stations there was only time for 15 minute tows. The stations 25, 29, 64 and 83 had to be skipped due to lack of time. Stations 16 and 20 had to be cancelled due to the presence of passive fishing gear (crab pots) on the fishing track. Sampling design remained the same as last year. Conclusion: 56 out of a total of 62 planned stations were successfully fished and declared valid. This	**Fish species:** all species **Fish length:** all species, elasmobranch by sex **Fish weight:** sample weight per species, elasmobranch by sex **Fish biological data:** individual weight, length, sex, yearclass for plaice, sole, cod, turbot, brill, dab and lemon sole. Maturity data for summer spawner lemon sole. **Benthos:** all species, numbers and total weight per species per haul. Length measurements *for Sepia sp., Loligo vulgaris*. Carapax width measurements for *Cancer pagurus (by sex)*, carapax length measurement for *Nephrops norvegicus (by sex) and Homarus gammarus (by sex).*

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
						is within the margin of 90% of the plan to be achieved imposed by the European Commission (DG Mare).	Only presence absence for Anthozoa, Bryozoa, Hydrozoa and Porifera. **Marine litter:** all hauls **CTD:** continuous tow profile **Other:** /
Beam Trawl Survey (BTS), Germany	German Bight (North Sea)	1991	WGBEAM beam trawl survey manual	**WGNSSK:** Limanda limanda (dab.27.3a4), Pleuronectes platessa (ple.27.420), Solea solea (sol.27.4), indices by age group, age 1-10+ **WGEF:** elasmobranch species, CPUE per species per haul	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	The survey was carried out as planned. One invalid tow was repeated. A total of 63 valid stations were fished (approx. 31.5 hours fishing time).	**Fish species:** all species **Fish length:** all species; dab, plaice, elasmobranch by sex. **Fish weight:** sample weight per species, elasmobranch by sex Fish biological data: individual weight, length, sex, yearclass for dab, plaice, sole **Benthos:** all species, numbers and total weight per species per haul. Cephalopods, edible crab, *Nephrops norvegicus* length measurements. **Marine litter:** all trawls **CTD:** vertical profile planned for all hauls **Other:** -

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
Beam Trawl Survey (BTS), Netherlands	Southern and Eastern North Sea	1985	WGBEAM beam trawl survey manual	**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://ecosystemdata.ices.dk/map/ Hydrographic data: ocean.ices.dk	Original survey planning modified in 2019 based on number of invalid/shortened tows in previous years and continued in 2020 after agreement by WGBEAM 2020 on the new setup. Spatial coverage has remained the same. All planned stations have been fished, 1 invalid haul. Strong 2018 yearclasses for sole clearly visible in index as 2 year olds.	**Fish species:** all species **Fish length:** all species, elasmobranch by sex. **Fish weight:** no sample weight per species till 2017, elasmobranchs by sex. **Fish biological data:** individual weight, length, sex, yearclass for plaice, sole, dab, lemon sole, turbot, brill, long rough dab, flounder, cod. Maturity data for summer spawners such as lemon sole. **Benthos:** all species, numbers. Cephalopods, edible crab, *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 2020 survey	Data collected
Beam Trawl Survey (BTS), Netherlands	Central and Western North Sea	1998	WGBEAM beam trawl survey manual	**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/ Hydrographic data: ocean.ices.dk	Survey conducted as planned. All planned stations have been fished, 1 invalid haul. One additional station on the Scottish coastal area. Strong 2018 yearclasses for plaice slightly visible in index.	**Fish species:** all species **Fish length:** all species, elasmobranch by sex. **Fish weight:** sample weight per species, elasmobranchs by sex. **Fish biological data:** individual weight, length, sex, yearclass for plaice, sole, dab, lemon sole, turbot, brill, long rough dab, flounder, scaldfish, solenette, thickback sole, cod, hake. Maturity data for summer spawners such as lemon sole and thickback sole. **Benthos:** all species, numbers and total weight per species per haul. Commercial cephalopods, edible crab, *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.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
							Other: selection of box corer samples for pulse trawling research for NIOZ PhD.
Western Channel Beam Trawl Survey, VIIe, 1st quarter (SWECOS), England	Western English and Celtic Sea	2006	WGBEAM beam trawl survey manual	WGCSE Sole 7e Plaice 7e WGEF 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	Unaggregated data: Cefas Density plots per species: Cefas	Survey undertaken between 14 to 28 June 2020, which was delayed whilst Covid safety was being approved. Duration reduced from 4 weeks to 2 weeks so that the rest of the RV programme could be accommodated. Only the English Chanel part of the survey was targeted and the Celtic Sea survey had to be dropped so that the English Chanel time-series could be protected. Once underway 81 planned tows were completed without incident, although failure of multibeam to go over ground before tow hindered progress.	**Fish species:** all species **Fish length:** all species. Elasmobrach species, four-spot megrim, megrim, plaice by sex. **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.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
				Common skate 6 7a-ce-k			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. **Other:** zoo-plankton (ring net), 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 & tritium analysis, opportunistic tagging of species of elasmobranch.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
Beam Trawl Survey (BTS), England	Eastern English Channel and Southern North Sea	1988	WGBEAM beam trawl survey manual	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/	Survey completed between 13 to 25 July 2020 without incident, and in good weather. The duration for a number of tows had to be reduced from the standard 30 mins due to historic large catches or the presence of static gear, which is usual for the survey. 76 valid tows were completed in the English Chanel and southern North Sea plus an additional 4 off the Belgium coast. 3 stations were invalid, one of which was repeated and in total 3 stations had to be abandoned due to static gear or rough ground.	**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 counted. Length measurements collected for cephalopods and commercial shellfish.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
							Marine litter: all trawls **CTD:** average surface and bottom temperatures and salinities collected for each tow. **Other:** environmental data (ESM2), collection of water samples for nutrient analysis, opportunistic tagging of species of elasmobranch.
ISBCBTS (September) (ISBCTS), England	Irish Sea and Bristol Channel	1988	WGBEAM beam trawl survey manual	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	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	The survey was completed between 20 and 30 September 2020. The beginning of the survey was severely hampered by a Covid related situation, which meant that the vessel was delayed in port for two weeks. There was only enough time to sample the Bristol Chanel (7.f) only, and the Irish Sea (7.a) could not be attempted. All 32 planned stations in the Bristol Chanel were successfully sampled, with one being invalid, which was later repeated.	**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).

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
				Smooth-hound Nea Lesser-spotted dogfish 7a-ce-j Greater-spotted dogfish 6 7 Category 5 stocks Blonde ray 7afg			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 counted. Length measurements collected for cephalopods and commercial shellfish. **Marine litter:** all trawls **CTD:** average surface and bottom temperatures and salinities collected for each tow. **Other:** environmental data (ESM2), collection of surface water samples for analysis of tritium and water samples to determine alkalinity, opportunistic tagging of species of elasmobranch.
Beam Trawl Survey, France	Bay of Biscay	2007	WGBEAM beam trawl survey manual	WGBIE : Sole 8ab	Unaggregated data: datras.ices.dk	54 hauls (48 stations of reference + 6 stations) were carried out during 2020 survey.	**Fish species:** all species **Fish length:** all species, meagre, monkfish, red mullet, sea bass, sole and elasmobrach species by sex.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
						Main issue in 2020 : Two hauls of the 48 reference stations were invalidated because the trawl was loaded with Haploops and mud. These stations need to be moved because of the dangerousness of operating in these conditions (haploops and mud). Impact of the invalid hauls will be presented at the WGBEAM-2021. Restriction following from COVID-19 (15 operating days instead of 22 days) did not affect the survey, thanks to great conditions weather.	**Fish weight:** sample weight by species. **Fish biological data:** maturity, sex, otoliths for meagre, red mullet, sea bass and sole. Illicium for monksfish. **Benthos:** Numbers and total weight per species **Marine litter:** all trawls. **CTD:** bottom temperatures collected for each tow (end).
Beam Trawl Survey, Iceland	Waters around Iceland	2016	WGBEAM beam trawl survey manual	**NWWG:** Used for local assessments for *Limanda limanda* and *Microstomus kitt* since 2016 and for *Pleuronectes platessa* since 2020	Upon request	The survey was completed as scheduled between the 28th of August and the 10th of September. A total of 74 valid hauls were carried out. Additional 52 shorter hauls for sea cucumbers were conducted for the first time. All benthos was identified and weighted at a	**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

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
						subset of the stations for the second time.	rough dab, flounder, witch flounder. At the additional stations for sea cucumber, all sea cucumbers were measured (length, weight, circumference, drained weight), while **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. All benthos identified and weighted for daytime stations. **Marine litter:** all trawls, recorded and weighted **CTD:** continuous during haul; CTD attached to net. **Other: -**

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
Beam Trawl Survey, Italy-Slovenia-Croatia	North Adriatic Sea (GSA 17)	2005	WGBEAM beam trawl survey manual; SoleMon handbook (available here: http://dcf-italia.cnr.it/reserved/linee-guida/1)	**FAO-GFCM-SAC-WGSAD,** **STECF**: *Melicertus kerathurus, Pecten jacobeus, Scophthalmus maximus, Scophthalmus rhombus, Sepia officinalis, Solea solea, Squilla mantis, Bolinus brandaris* Index of Abundance by size and/or age for sole, mantis shrimp, cuttlefish and Mediterranean scallops.	Unaggregated data: datras.ices.dk for sole	The 2020 survey was carried out from 1/12-16/12/2020 with RV G. Dallaporta. 58 hauls (57 Italian + 1 Slovenian) were carried out during 2020 survey. Croatian waters hauls had to be dropped due to the restrictions following from COVID-19. Main issues in 2020 survey were the overlap of 1) limited ship-time; 2) bad weather conditions; 3) Covid-19 restrictions (only 5 scientific members on board) Also, CTD profiles were not performed in 2020. Spatial coverage effect on the survey index have to be explored.	**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. **Fish length:** all species **Fish weight:** individual weight for target species, total weight for the other. Fish biological data: individual weight, length, sex and maturity for target species. Length and total weight for other species. **Benthos:** all hauls **Marine litter:** all hauls
Inshore beam trawl	Coastal zone Belgium	1971	Inshore beam trawl survey	**WGNSSK:** *Pleuronectes platessa* (ple.27.420), *Solea*	Unaggregated data (2010 – 2020): datras.ices.dk	The Belgian DYFS was planned to be carried out from 14-23 Sept 2020 with RV Simon	**Fish species:** all species (since 2020), before only commercial species.

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
survey (DYFS)			manual in progress	*solea* (sol.27.4), combined BEL/GER/NED recruitment index		Stevin. Due to the Covid-19 pandemic, the starting date had to be delayed to 15 Sept and due to the high competition for ship time the campaigns end date was put forward to 22 Sept. The weather did not interfere with the seagoing operations and no technical problems were encountered. Despite the short campaign, all 33 sampling stations were completed successfully. For the first time there was also recordings of epi-benthos taken from each tow.	**Fish length:** selected list of commercial species; elasmobranchs by sex **Fish weight:** sample weight per species for species that are measured **Fish biological data:** individual weight, length, sex, yearclass for plaice and sole **Benthos:** *Crangon crangon* weight per size fraction (small and large) and length of minimal 250 individuals per haul. Subsample of epi-benthos: numbers and sample weight (since 2020). Marine litter: all hauls **CTD:** continuous tow profile **Other:** /
Inshore beam trawl survey (DYFS)	Coastal zone Germany and German Wadden Sea	1972	Inshore beam trawl survey manual in progress	**WGNSSK:** *Pleuronectes platessa* (ple.27.420), *Solea solea* (sol.27.4), combined	Unaggregated data: (2012 – 2020) datras.ices.dk	All cruises were realized as planned. In total 91 hauls were carried out by the RV Clupea and 149 hauls (4 invalid) were carried out by chartered shrimp vessels. The indices for	**Fish species:** all species **Fish length:** all species **Fish weight:** sample of all species

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
				BEL/GER/NED recruitment index		plaice and whiting were above average while the indices for sole and cod remained below average. Catches of *Crangon crangon* were exceptionally high in the East Frisian Wadden Sea area.	Fish biological data: individual weight, length, sex, year class for plaice. **Benthos:** all species, *Crangon crangon* total weight and length measurements of 250g subsample. **Marine litter:** only on RV Clupea **CTD:** continuous during haul, CTD attached to net. **Other:** Secchi-Depth
Inshore beam trawl survey (DYFS)	Coastal zone Netherlands, Dutch Wadden Sea, Eastern and Western Scheldt	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	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	Surveys in the Wadden Sea carried out with only one WMR researcher, due to COVID-19 restrictions (one person per cabin). Survey coverage as planned. Survey in Eastern and Western Scheldt conducted as planned. Survey in the coastal zone started one week later than planned due to the delayed	**Fish species**: all species **Fish length:** all species **Fish weight:** no sample weight per species Fish biological data: individual weight, length, sex, yearclass for plaice, dab, sole, flounder, turbot, brill. Maturity data only to separate between immature and maturing. **Benthos:** all species numbers. *Crangon crangon*, Cephalopods, edible crab length measurements

Survey, country	Area coverage	Running since	Methodology described in	Information to assessment WG	Data availability	Comments on 2020 survey	Data collected
						SNS (see below). A number of stations had to be dropped due to the restrictions following from COVID-19 (no entry in foreign port), leading to extra steaming time. Spatial coverage has been maintained, so limited effect on the survey index is to be expected.	**Marine litter:** no **CTD:** continuous during haul, CTD attached to net. **Other:** additional hauls conducted for national programmes.
Sole net survey (SNS)	Dutch EEZ and southern German Bight	1969	Inshore beam trawl survey manual in progress	**WGNSSK:** *Pleuronectes platessa* (ple.27.420), *Solea solea* (sol.27.4), indices by age group age 1-4+	Unaggregated data: datras.ices.dk Density plots per species: http://ecosystemdata.ices.dk/map/	Survey suffered from one week delay, caused technical issues and weather circumstances. The timing was shifted with a week compared to planning. A number of stations had to be dropped due to the restrictions following from COVID-19 (no entry in foreign port), leading to extra steaming time. Spatial coverage has been maintained, so limited effect on the survey index is to be expected.	**Fish length:** all species **Fish weight:** no sample weight per species **Fish biological data:** individual weight, length, sex, yearclass for plaice, dab, sole, flounder, turbot, brill. Maturity data only to separate between immature and maturing. **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 2020 survey	Data collected
						Strong 2018 yearclasses for sole still clearly visible in 2020 index as 2-year olds.	**CTD:** continuous during haul, CTD attached to net. **Other:** -

Annex 6: Survey planning 2021

a. Timing of the offshore beam trawl surveys in 2021.

Country	Vessel	Area	Dates	Gear	Contact
Belgium	Belgica	western-southern North Sea	23 Aug – 03 Sept 2021	4 m beam	heleen.raat@ilvo.vlaanderen.be; lies.vansteenbrugge@ilvo.vlaanderen.be ; Cc: els.torreele@ilvo.vlaanderen.be
France	Côtes de la Manche	8a, 8b	03 Nov – 30 Nov 2021	4 m beam	jean.baptiste.lecomte@ifremer.fr yann.coupeau@ifremer.fr
Germany	Solea	German Bight	23 Aug – 10 Sept 2021	7 m beam	kay.panten@thuenen.de
Iceland	Bjarni Saemundsson	Entire coast of Iceland	26 Aug – 11 Sept 2021	4 m beam	magnus.thorlacius@hafogvatn.is
Italy/ Slovenia	G. Dallaporta	Northern Adriatic Sea (GSA 17)	28 Nov – 19 Dec 2021	2x 3.5m modified beam	giuseppe.scarcella@cnr.it
Netherlands	Tridens	southern North Sea, German Bight	2–20 Aug 2021	2x 8 m beam	ingeborg.deboois@wur.nl Cc: betty.vanos@wur.nl
Netherlands	Tridens	central and western North Sea	23 Aug–17 Sep 2021	2x 8 m beam + flip-up rope	ingeborg.deboois@wur.nl Cc:
Netherlands	Industry survey on Turbot and Brill	southern North Sea	Oct 2021	Commercial beam trawl	Edward.schram@wur.nl
UK	Cefas Endeavour	English Channel /Celtic Sea	8 Mar – 3 Apr 2021	4 m beam	ian.holmes@cefas.co.uk
UK	Cefas Endeavour	7d, 4c	30 Jun – 13 Jul 2021	4 m beam	joanne.smith@cefas.co.uk Cc: ian.holmes@cefas.co.uk
UK	Cefas Endeavour	7fg, 7a	10 – 29 Sept 2021	4 m beam	stephen.shaw@cefas.co.uk Cc: ian.holmes@cefas.co.uk
UK	Industry survey	7e (western English Channel)	Aug – Sept 2021		gary.burt@cefas.co.uk

b. Timing of the inshore beam trawl surveys in 2021.

Country	Vessel	Area	Dates	Gear	Contact
Belgium	Simon Stevin	Belgian coastal zone	8 – 10 Sept & 20-24 Sept 2021	6 m shrimp trawl	heleen.raat@ilvo.vlaanderen.be; lies.vansteenbrugge@ilvo.vlaanderen.be; Cc: els.torreele@ilvo.vlaanderen.be
France	Industry survey	Dieppe to Authie Bay	23-27 Aug 2021	3 m beam trawl	Victor.Martin.Baillet@ifremer.fr
Germany	Chartered vessels	German Wadden Sea areas	26 Aug – 24 Sep 2021	3 m shrimp trawl	holger.haslob@thuenen.de
Germany	RV Clupea	German coastal zone	13 Sep – 01 Oct 2021	3 m shrimp trawl	holger.haslob@thuenen.de
Netherlands (SNS)	Isis	Dutch coastal zone	13-24 Sep 2021	6 m beam trawl	Maarten.vanhoppe@wur.nl Cc: ulrika.beier@wur.nl
Netherlands (DYFS)	Luctor	Scheldt estuary	6-23 Sep 2020	3 m shrimp trawl	Andre.dijkman@wur.nl Cc: ulrika.beier@wur.nl
Netherlands (DYFS)	Stern	Dutch Wadden Sea	30 Aug–1 Oct 2021	3 m shrimp trawl	Marcel.devries@wur.nl Cc: ulrika.beier@wur.nl
Netherlands (DYFS)	Isis	Dutch coastal zone and German Bight	27 Sep–29 Oct 2021	6 m shrimp trawl	Thomas.pasterkamp@wur.nl Cc: ulrika.beier@wur.nl

Annex 7: Survey indices

Annex 7.1 Offshore surveys

Sole

North Sea – Subarea 4

The combined sole BTS delta-GAM index was calculated by the North Sea sole stock coordinator (Annex 7.1.1: Figure 7.1.1.1.). The combined index confirms the strong 1-age group in 2019 and the following drop in 2020. The 2019 1-age group can be found with a good consistency in 2020 2-group index (highest value observed for the 2-group in the 2000s). This is also noticeable for the separate Dutch and Belgian indices (see below). Overall, the combined index largely averages the trends between the single surveys as expected. Nevertheless, before 1993, where only Dutch survey was present, for the older ages (7-8-9) some higher values were predicted in the GAM model respect the single survey index.

The indices for sole from different surveys in area 4 stocks are summarized in Figure 7.1.1.2 – 7.1.1.4.

Time-series trends for sole in the southeastern North Sea and the German Bight, based on the Netherlands BTS-I (previously Isis) offshore survey indicate that recent year classes have been mainly poor with the 1-group below the long-term arithmetic mean for the years (2012–2020) except for 2019. In fact, the 1-group observed in 2019 was the second highest observed value of the time-series and can be found with a good consistency in 2020 2-group index (second highest observed for the 2-group). The 3-group and 4-group indices were observed above the long term mean in 2020. In 2020 the 5-group index was below the long-term arithmetic mean despite being above the mean over the past 6 years (2014-2019).

Time-series trends for sole in the Southern North Sea (4c), based on the UK offshore survey show that number of age group 1 is highly variable, and numbers of one-year olds were below the long-term mean from 2012–2014. Since then, observed age group 1 values increased and in 2017 the highest age group 1 survey index was observed for the whole time-series. The strong 2017 cohort is well trackable in the survey indices and formed the second highest observed index value for age group 2 in 2018, and the third highest of age group 3 in 2019. However, in 2018 the value for the 1-group was well below the average again. Similar to the Dutch survey index, a strong 1- group in 2019, led to the highest recorded 2-group value in 2020 survey. The number of older fish (4+ group) fluctuated around the long-term arithmetic mean for the last 10 years.

Time-series trends for sole in the Southern North Sea (4c), based on the Belgian offshore survey show variations in age group 1, with high observed age group 1 values in 2015, 2017 and also in 2019. In 2020 the value is below the long-term mean. The 2017 cohort is tracked good by this survey until 2020, where a strong age group 4 was observed. The strong 2019 1-group is also tracked good in 2020 2-group index. The observed age group 2 value in 2020 was the highest recorded in this time-series and reflects the strong age group 1 observed in 2019. This is similar to the UK survey which has a strong geographical overlap with the Belgian survey. The strong 2013 age group 3 cohort is visible until 2015 where a strong age group 5 was observed. However, age group 5 for the recent four years was observed below the average mean. For age group 6 a decreasing trend was observed from 2016 onwards with an increase in 2020 in line with the long-term mean.

Western Waters - Subareas 7 and 8

The indices for sole from area 7 stocks are summarized in Annex 7.1.1, Figures 7.1.1.5-7.1.1.8.

Division 7d

Figure 7.1.1.5 shows the sole indices for the UK survey in the eastern Channel. 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. In fact, the observed 1-group value in 2019 was the highest in the time-series followed by one of the lowest observed 1-group values for 2020. The strong 2019 cohort is reflected by one of the highest observed 2-group in 2020. The 3-group was under the long-term average for 2020, this cohort is consistent with an arrival of below average year classes in 2018 at age 1. The 4+-group was above the long-term average for the last eight years now, even if a decrease is observed since 2018.

Division 7f

Due to a positive COVID-19 test at the start of the survey, delaying the survey with 14 days and resulting in limited time left (9 days including steaming time-5 days of fishing), only a selection of stations has been sampled in Division 7f. The background of the choice was pragmatic, as it was the only manner to complete a significant part of the survey.

Figure 7.1.1.6 shows the sole indices for the UK survey in the Bristol Channel. Except a very large cohort observed in 1999, 1-group recruitments have been quite stable across the whole time-series. In 2020, the 1-group is below average following a recruitment above average in 2019. The 2-group is also below average in 2020, despite the good recruitment in 2019. For the past three years, the 3-goup is above average with ones of the highest values in 2018 and 2019. The 4+-group was rather stable over the time-series and was above the long-term average for the last six years now with an increase since 2014. The survey has been able to track the last strong 1-group recruitments in 2017 very well through its existence.

Division 7a

There was no survey in 2020, see report section 2 and Annex 5. Figure 7.1.1.7 shows the sole indices for the UK survey in the Irish Sea until 2019. Sole in 7a has in recent years been of concern to managers due to low SSB values. The most recent survey trends indicate that following the strong decrease in sole abundance at age 1 until 2014 is starting to reverse with higher recruitment rates being observed since then. In 2019, the 1-group is well above average as well as the 2-group, 3-group and 4+-group. The survey index seems to be able to pick up the long-term population dynamic trends well and demonstrates internal consistency. For example, the strong 1-group recruitments arrival in 2015 is well tracked to the 4+-group by this survey. However, unlike other sole stocks the recruitment autocorrelation seems quite high and the lack of year-to-year contrast in cohort strengths is likely to make it difficult for an age-based assessment model to distinguish rapid changes in fishing mortality or selectivity.

Division 8 a, b

Figure 7.1.1.8 shows the time-series of sole abundance indices for the French survey in the Bay of Biscay. Since 2018, the time-series of age group abundances of sole are marked by 1-group recruitments below average. The 1-group recruitments in 2008 is the highest of the time-series, which contrasts with a decrease in the interannual variability of recruitment in recent years. The population up to 3-group appears to have been largely stable over the time-series. The 4+-group abundance indices indicate a sudden jump from 2011 to 2012 inconsistent with the weakly estimated year class coming in, but the 4+-group remains stable ever since. The observed contrast in cohort strength appears to be smaller than Celtic Sea sole stocks. There is no evidence of a synchrony in recruitment pattern observed between division 7a and 7f. The index suggests little if any change in the rate of mortality over the period for the observed age groups. Full selectivity appears to be reached at age 2.

Northern Adriatic Sea

Figure 7.1.1.9 shows the time-series trends in the indices for the northern Adriatic Sea common sole, 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. For consistency between years, age slicing, based on von Bertalanffy parameters (Linf: 39.6; k: 0.44, t0: -0.46), was carried out using FSA R script.

The 2020 survey indicates that the 0, 1, 2 and 4+ age groups were higher than the long-term arithmetic mean. Differently from 2019, age 3 in 2020 survey has been lower than the level of the long-term arithmetic mean. Ages 4+ trend is quite fluctuating due to the very few specimens that reach this ages ($\simeq$ 0.99 number/km^2). Overall is possible to notice an increasing trend for all the ages in the second part on the time-series, in particular the high recruitment observed in 2013 can be followed in the succeeding years. Moreover the 2019 and 2020 seem to be good years for recruitment.

Plaice

North Sea – Subarea 4

The combined plaice BTS deltaGAM index was calculated by WGBEAM2021 (Annex 7.1.2: Figure 7.1.2.1). It has to be noted that this combined index might differ from that which will be calculated by the responsible stock coordinator for the final plaice assessment run. However, it was calculated following the stock annex for North Sea plaice and it combines Dutch, Belgian, German and UK data. The combined index shows the highest numbers for age group 1 in 2019 for the whole time-series. It also shows above average numbers for all age groups for the most recent years, with an increasing trend since the beginning of the 21st century. The strong decrease for the 9-group and 10+ group visible in the Dutch index (see below) is not reflected by the combined index. In the combined index the 10+ group in 2019 is even the strongest ever observed. There are some strong cohorts which can be tracked well (e.g. 1996, 2001, 2003, 2006) through the years (Annex 7.1.2: Figure 7.1.2.2).

Annex 7.1.2 figure 7.1.2.3 show trends in the indices for North Sea plaice from the Netherlands offshore survey carried out by Tridens. The survey is split up in two parts: one that covers mainly the southern North Sea (BTS-I; previously: Isis), and the other part extends substantially further north and west (BTS-II; previously: Tridens).

The BTS-I survey indicates that recruitment has been below average in most years since the strong 2001 year class became apparent as one year olds in 2002. In 2014, as detected in 2009, 2011 and 2013, the observed number of one year olds was higher than the long-term mean. In 2015, 2016 and 2018 it was again below the average, while it was above the long-term mean in 2017. In 2019, the strong 2018 year class, which was detected in the inshore surveys, reflects the highest 1-group index value since 1997. This cohort is recognisable as age 2 in 2020 above the mean. The new age-1 group in 2020 decreased just below the longterm mean.

The BTS-II survey documented seven incoming year classes that were above average from 2007 onwards. This pattern is visible at all ages in this survey, and the cohorts can be tracked well over time. The 2018-year class is by far the highest on record, evident by the high values of the 1-group in 2019, while the 2017 year class was lower than the average. The clear increasing trend in the age 4 ended in 2018, and also in 2019 there was a further decrease detected. The 2020 data, on the other hand, show a slight increase again. The 5+ group showed the highest record of the time-series ever for the 2018 value, but in 2019 and 2020 it also decreased.

The population abundance series for plaice from the UK offshore survey (depicted in Figure 7.1.2.4), confirms the strong incoming 2018 year class. The observed number of age groups 1 to 3 was the highest ever observed in the time-series. The age groups and 3 and 4 were significantly above the long-term average in the last 5 and 4 years respectively.

The plaice abundance time-series for plaice by the Belgian offshore survey are displayed in figure 7.1.2.5. Age group 1 shows variable values fluctuating around the long term average without

trend and close below the average in 2018. The strong incoming 2018 year class is also confirmed in this survey. Age group 2 values were observed above the average for the last seven years. Age group 3 was fluctuating without trend around the average, but the strong 2013 cohort is traceable until age group 3. Age group 4 values are since 2012 observed above the average with only the 2017 and 2019 values below the average.

The index calculated for the German survey data are presented in Figure 7.1.2.6. (Annex 7.1.2). Also this survey confirms the strong 1-age group in 2019, also the highest in this time-series. While the 2-group in 2018 was clearly above the long term mean it decreased strongly for 2019, but is still above average. The 3-group show below average values for the last four years. A decreasing trend for the 4-group is visible from 2016 to 2019, which is also the case for age groups 5 and 6. For the older age groups (8 to 10+) the 2019 values are the highest in the time-series. This trend for the older age groups stopped in 2020.

Western Waters - Subarea 7

The indices for plaice from area 7 stocks are summarized in Figure 7.1.2.7 to 7.1.2.9 in Annex 7.1.2.

Division 7d

Age group 1 has dropped significantly in 2020 compared to 2019 when it was the second highest observed of the time-series. The abundance at age 1 fluctuates, with strong cohorts of 2010 and 2013. As a result of the good year classes in the numbers of age 4+ were the highest ever observed in the time-series for the years 2013-2019. The decrease for the age-3 and 4+ groups from 2019 continues in 2020, but age-3 and 4+ groups remain above the long term mean (1989-2020) as it was observed since 2011for age-3 group and since 2013 for age-4+ group.

Division 7f

Due to a positive COVID-19 test at the start of the survey, delaying the survey with 14 days and resulting in limited time left (9 days including steaming time-5 days of fishing), only a selection of stations has been sampled in Division 7f. The background of the choice was pragmatic, as it was the only manner to complete a significant part of the survey.

For plaice the survey index is highly informative on long-term stock dynamic trends but estimates of individual cohort abundance are not necessarily tracked that well in all but the smallest and largest cohorts. Some age-based models may confuse these signals with rapid selectivity changes in the fleet. Particularly age 1 abundance seems to be affected by this which may be linked to variable rates of unintended fishing mortality in the area.

The relative abundance at age 1 increased considerably for plaice in the Bristol Channel in 2013, reaching a value similar to what was observed in 2010 and 2011. This trend continued in 2014 and resulted in the highest record for age group one in the time-series observed so far. However, in 2015-2018 and 2020 the lowest values ever were recorded interrupted in 2019 by a strong year class, but still below the long-term mean (1995-2020). 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 high from 2015 to 2018 and decreased in 2019 and 2020. In earlier years of this time-series, abundance peaks of age 1 fish could not always be tracked over the following years as well as in recent years.

Division 7a

Due to a positive COVID-19 test at the start of the survey, delaying the survey with 14 days and resulting in limited time left (9 days including steaming time-5 days of fishing), it was decided not to fish in Division 7a (see report section 2 and Annex 5).

Figure 7.1.2.9 shows the plaice indices for the UK survey in the Irish Sea until 2019. The age 1 abundance of plaice in the Irish Sea has been variable but generally increasing until reaching the maximum in 2014. Since then recruitment appears to have decreased persistently with some very

low abundances being recorded in the last 5 years. For age 2 – 4+ the picture is increasingly optimistic with these ages all increasing over the time-series with the strongest contrast observed in the oldest age. The apparent decrease in recruitment (after age 1 in 2014) is feeds through well in the 2018 and 2019 surveys indicating that it should be possible for an assessment models to distinguish the population dynamic trends of decreasing recruitment and mortality well despite the inter annual variability in the index.

In contrast to the 7a sole stock the plaice stock seems to be in a very healthy condition, although the reduction in recent recruitment indicates that it is unlikely that the recent period of high productivity may not be maintained. A change in productivity might be indicative of some changes to the ecosystem relevant to plaice reproduction and that historic levels of catches applied to the current stock would require further analysis to ensure that they would remain sustainable.

Icelandic Sea – Subarea 5a

Figure 7.1.2.10 shows the time-series trends in the indices for Iceland Sea plaice based on the offshore beam trawl surveys carried out along the entire coast of Iceland. Due to the recent establishment of the survey, plaice time-series is quite short. Moreover, the 2016 survey must be considered different from the other years, as it was a smaller pilot study (31 tows conducted vs 70-80 later), which focused on the main nursery areas of plaice.

For this reason, some important differences in abundance can be highlighted between 2016 survey and the others, especially for the younger age groups (0-4). The 2020 survey values mostly show similar values as in 2017 and 2018. The 2019 survey indicated that almost all the age groups (except for age 9) were lower than the long-term arithmetic mean, most likely due to it being conducted earlier in summer than in the other years. The 2020 survey values mostly show similar values as in 2017 and 2018. The internal consistency of the series is weak in the younger ages but becomes relatively good starting from age group 4, in particular the high value observed in 2016 can be followed in the succeeding years.

Annex 7.1.1 Figures and tables offshore indices sole

North Sea – Subarea 4

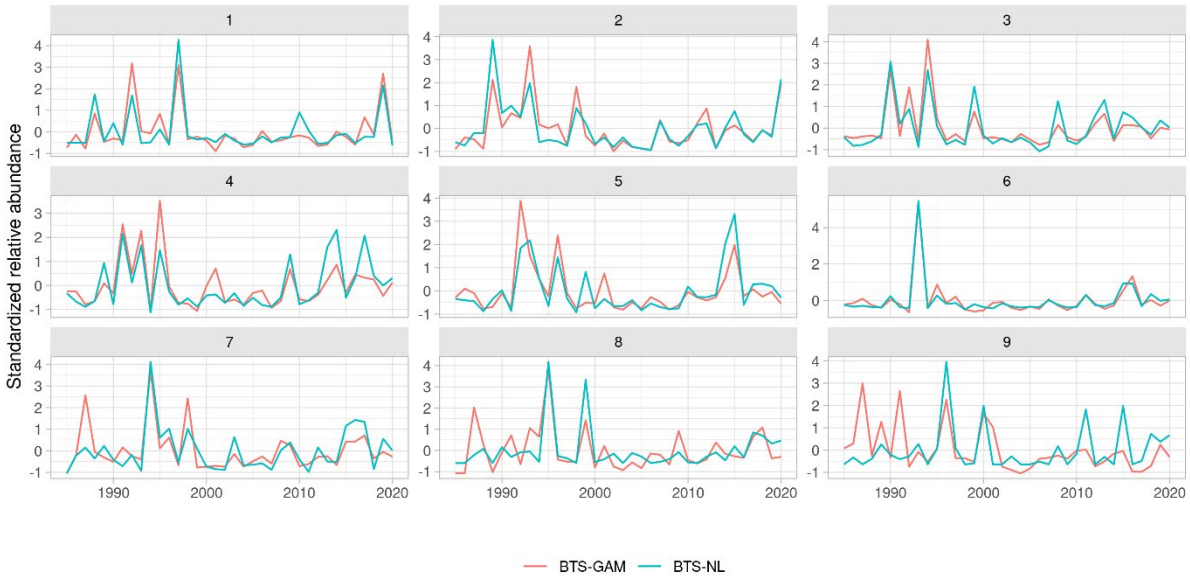

Figure 7.1.1.1 Combined sole BTS deltaGAM index North Sea, ages 1-9, combining NL 1985-2020, DE 1993-2020, BE 2004-2020 beam trawl survey data 57.5 N (red), and Dutch sole BTS index (blue).

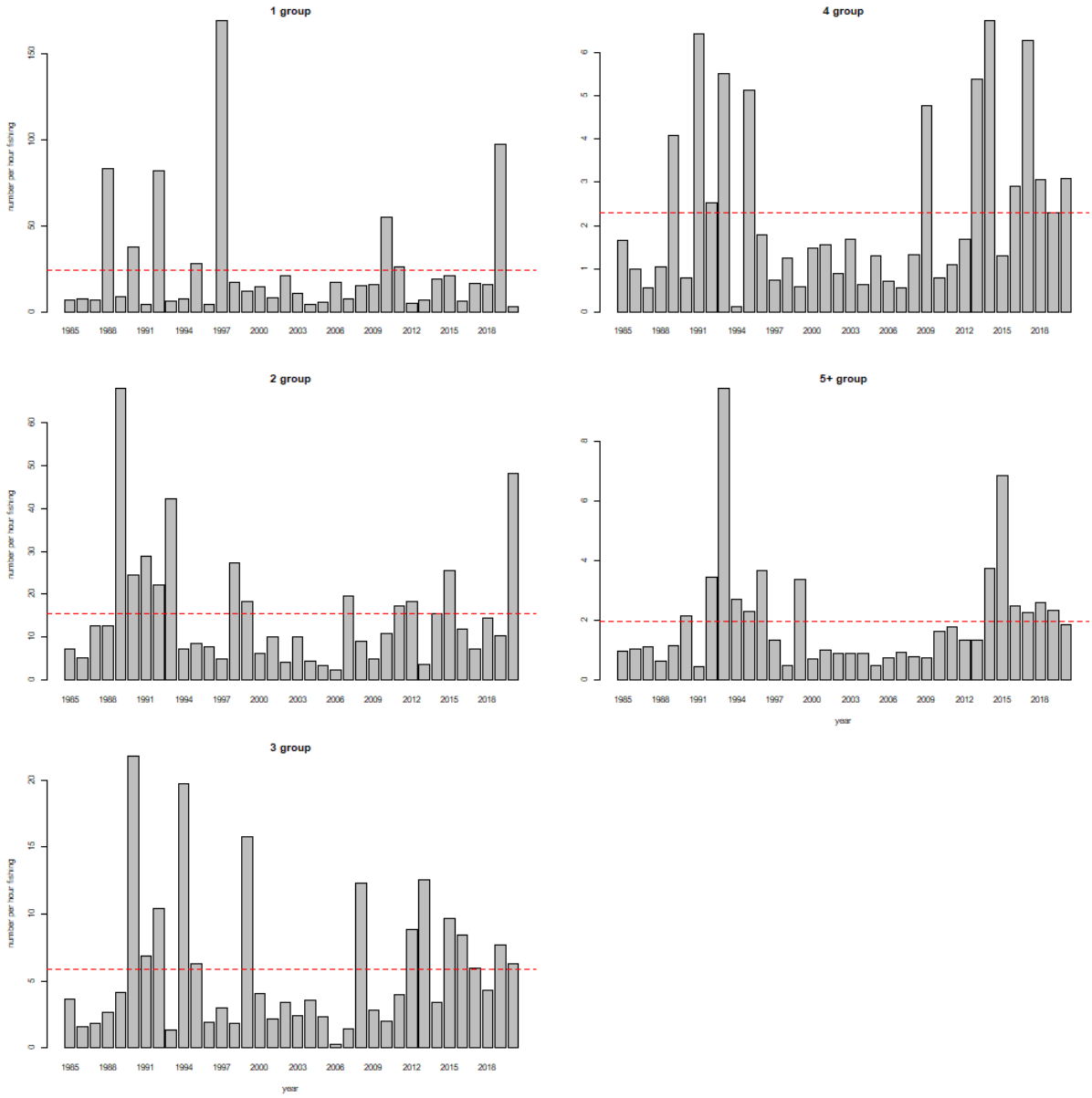

Figure 7.1.1.2 Sole indices Dutch offshore survey in southeastern North Sea and German Bight, ages 1-4 and 5+

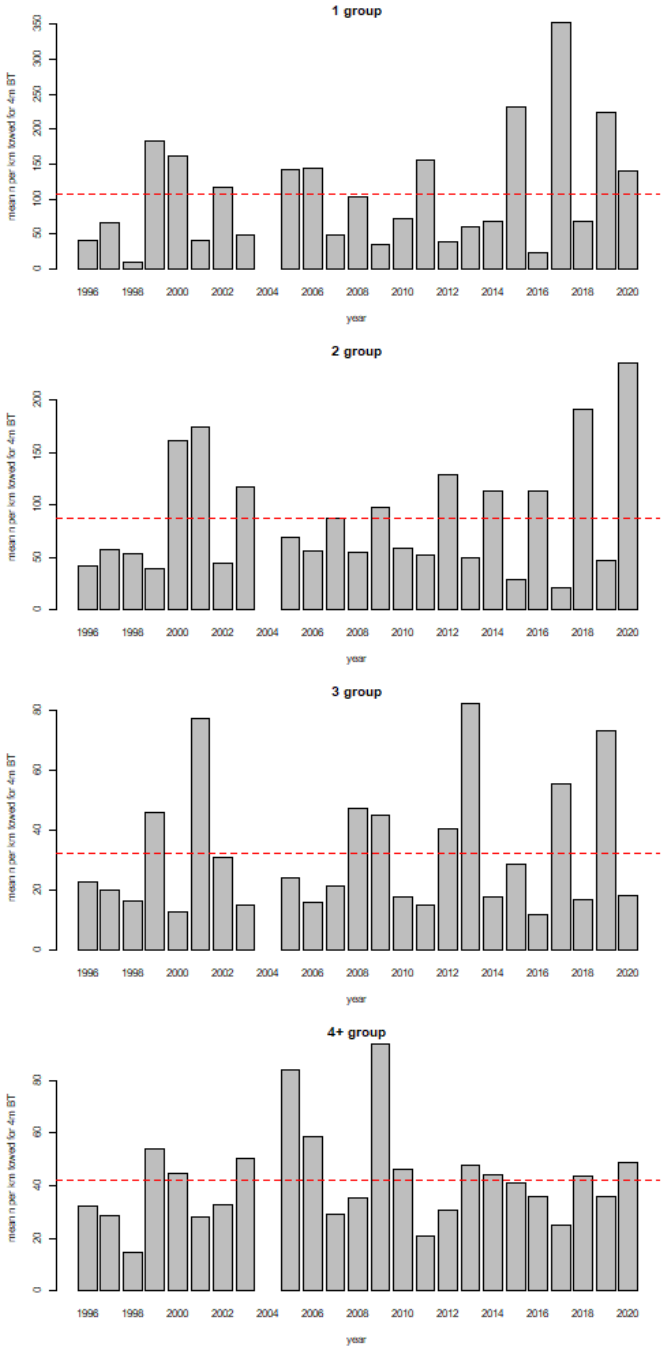

Figure 7.1.1.3 Sole indices UK survey in southeastern North Sea, ages 1-3 and 4+

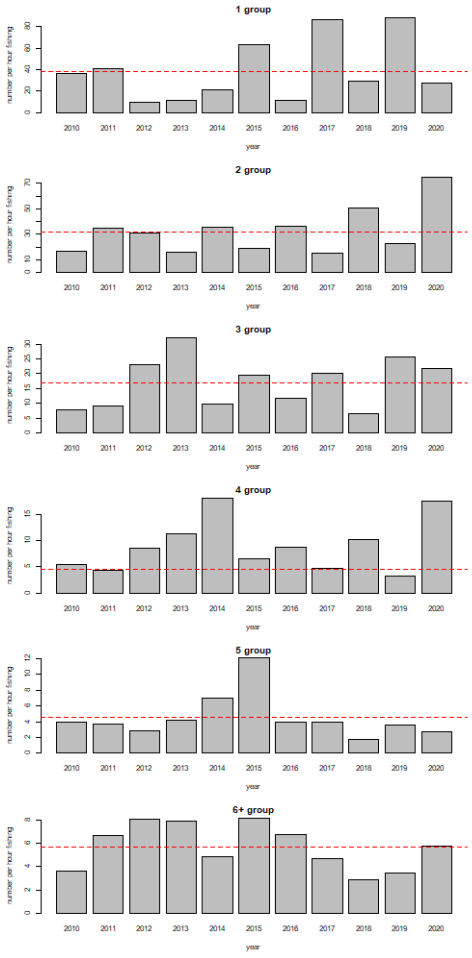

Figure 7.1.1.4 Sole indices Belgian survey in southwestern North Sea, ages 1-5 and 6+

Western Waters - Subarea 7 and 8

Division 7d

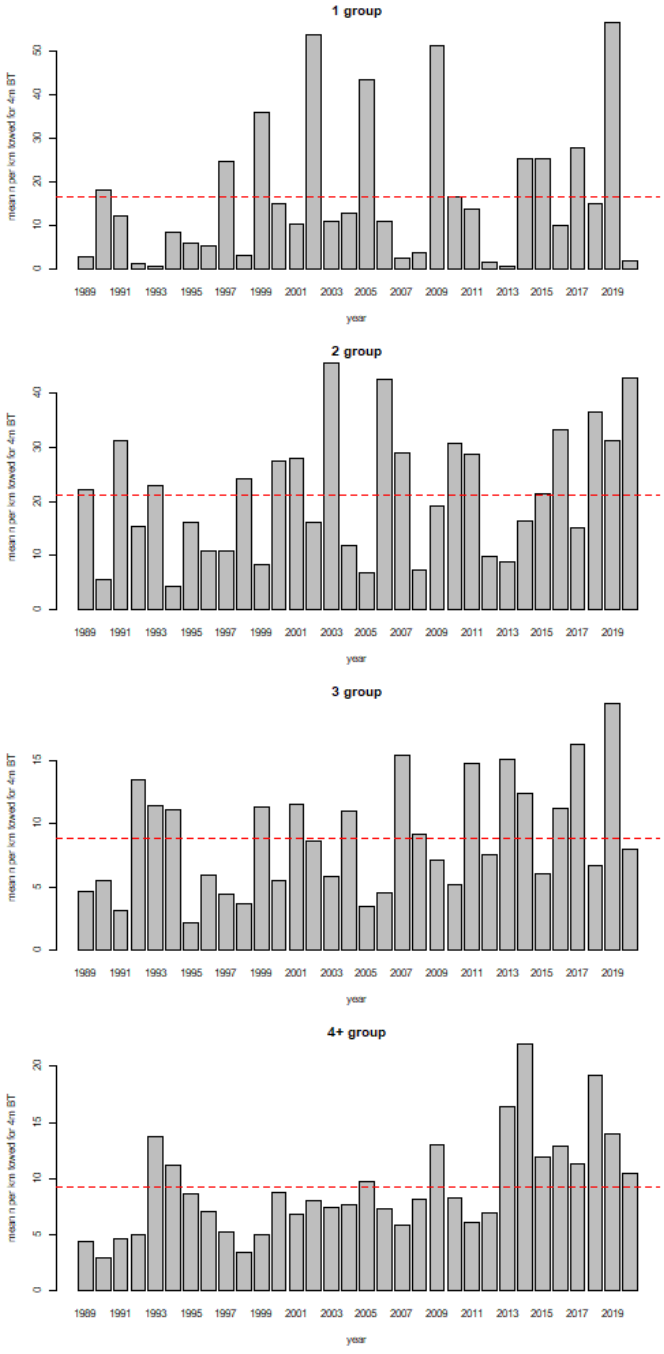

Figure 7.1.1.5 Sole indices UK survey in the eastern Channel, ages 1-3 and 4+

Division 7f

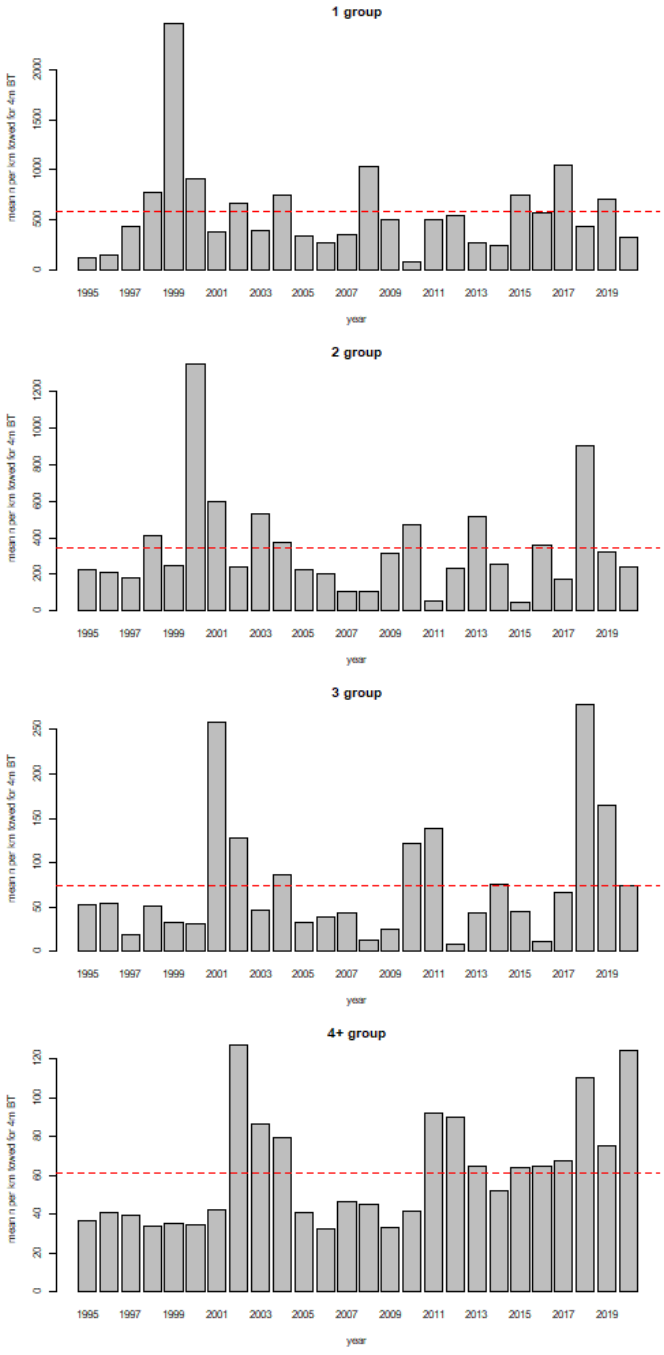

Figure 7.1.1.6 Sole indices UK survey in the Bristol Channel, ages 1-3 and 4+ (Limited spatial coverage for 2020 survey, see report section 2 and Annex 5)

Division 7a

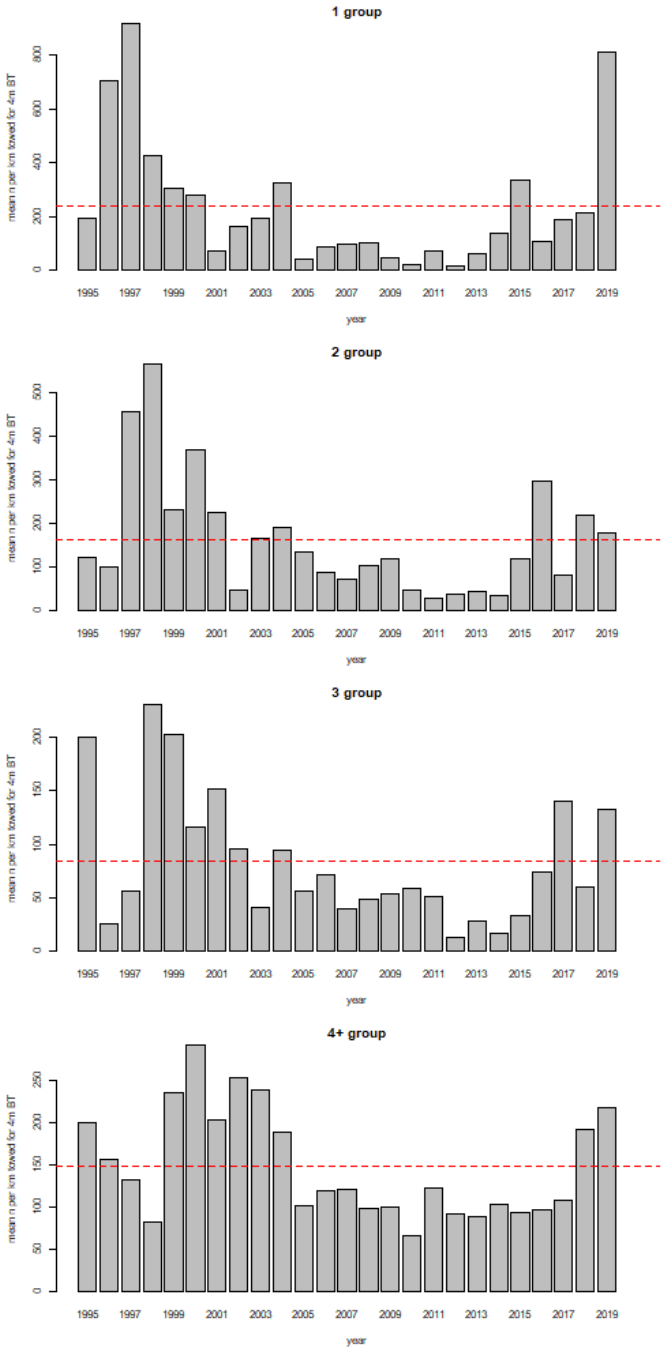

Figure 7.1.1.7 Sole indices UK survey in the Irish Sea, ages 1-3 and 4+ (No survey in 2020, see report section 2 and Annex 5)

Division 8 a,b

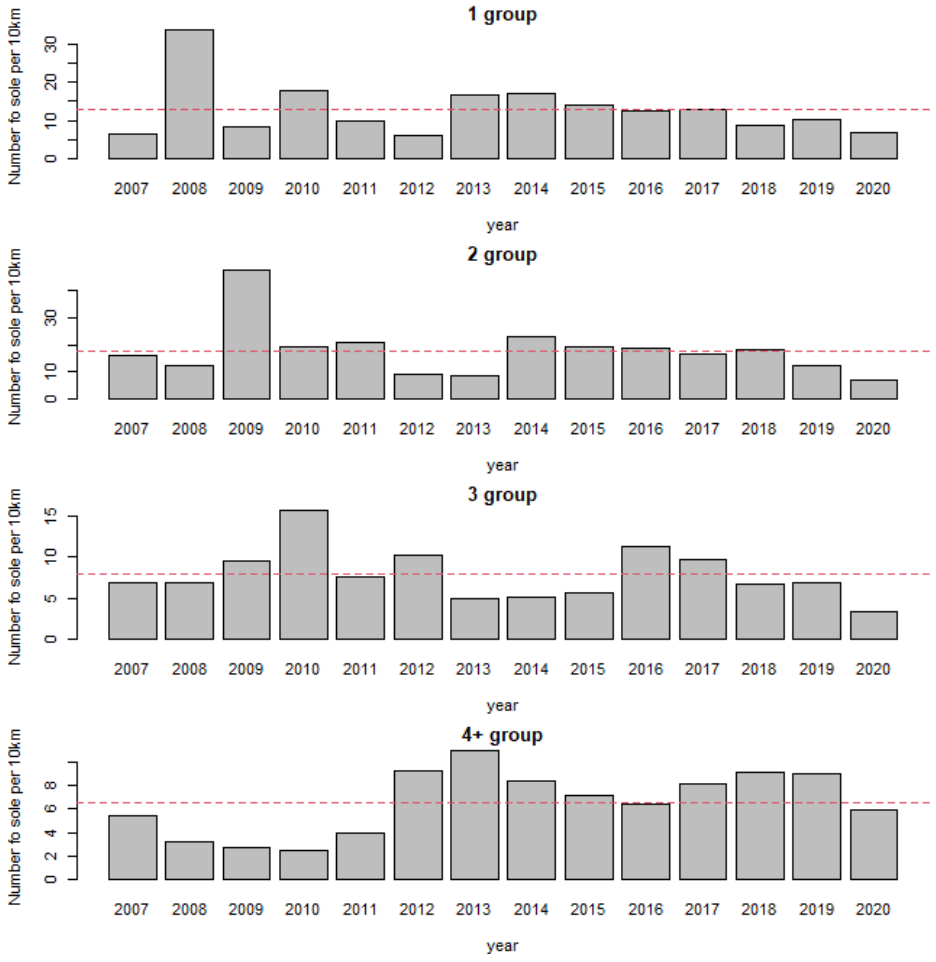

Figure 7.1.1.8 Sole indices French survey in the Bay of Biscay, ages 1-3 and 4+

Northern Adriatic Sea

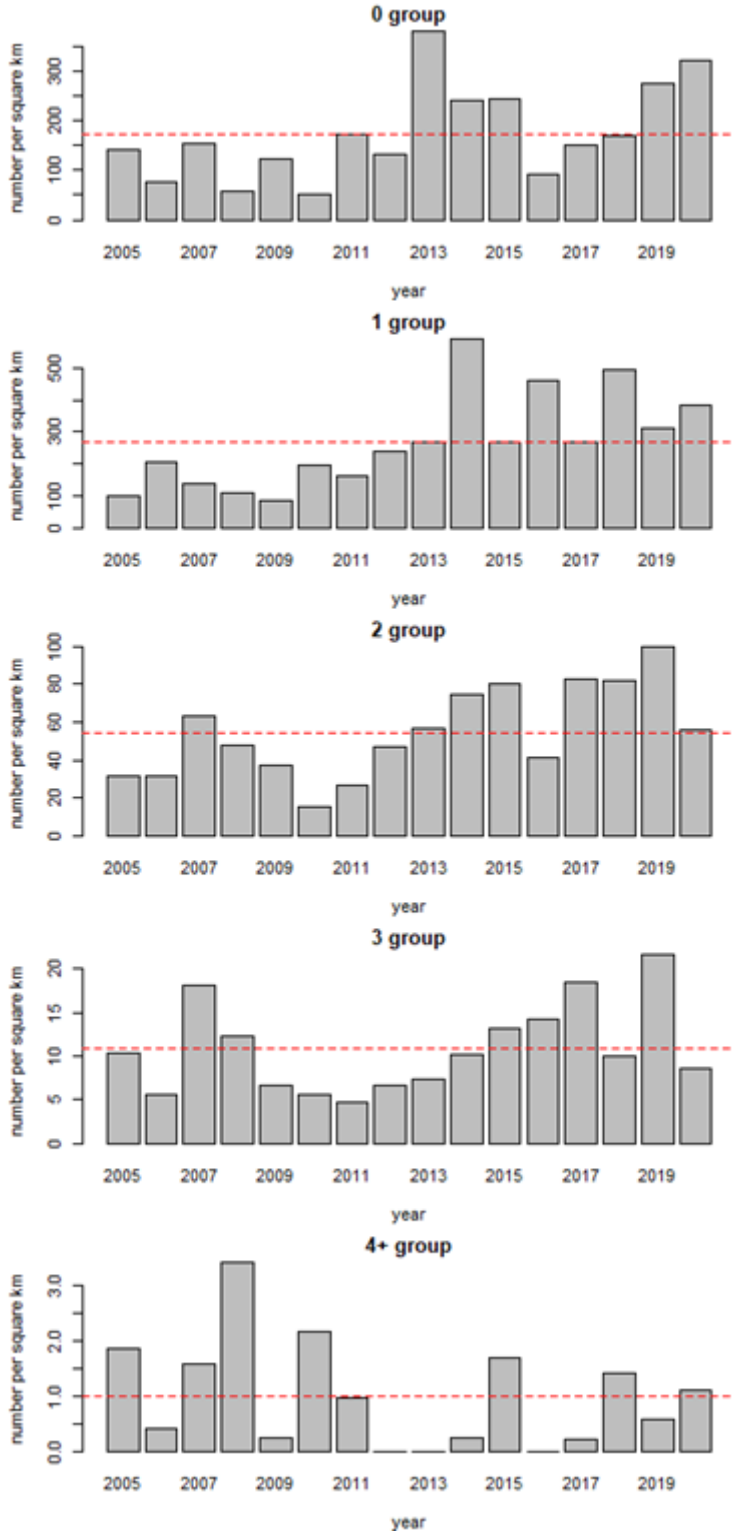

Figure 7.1.1.9 Common sole indices Adriatic survey in Adriatic Sea (BTS-GSA17), ages 0-3 and 4+

Annex 7.1.2 Figures and tables offshore indices plaice

North Sea – Subarea 4

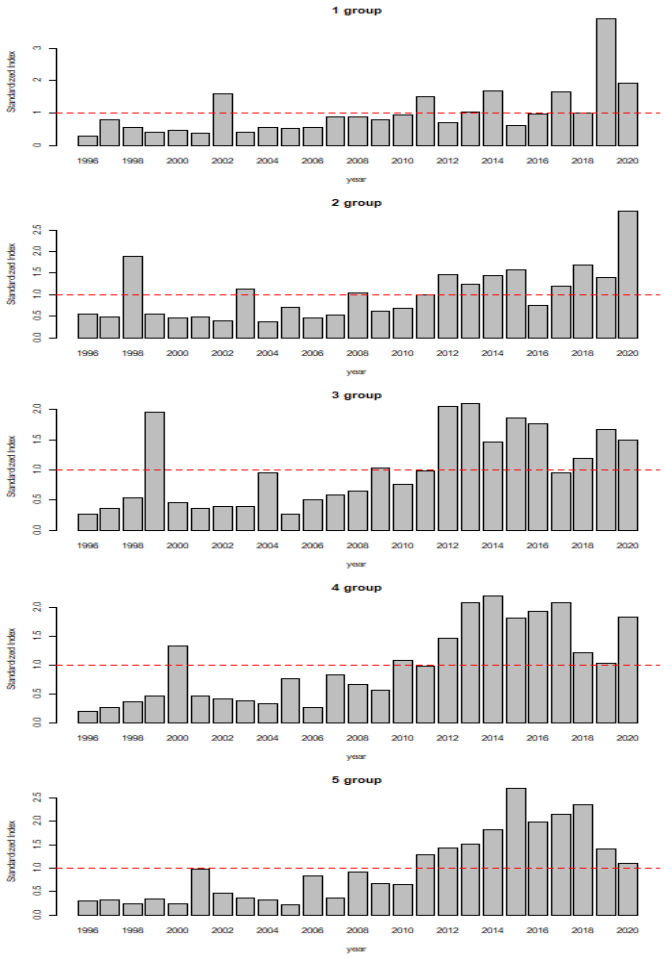

Figure 7.1.2.1 Combined plaice BTS deltaGAM index North Sea ages 1-5 (combining Dutch, Belgian, German and UK beam trawl survey data)

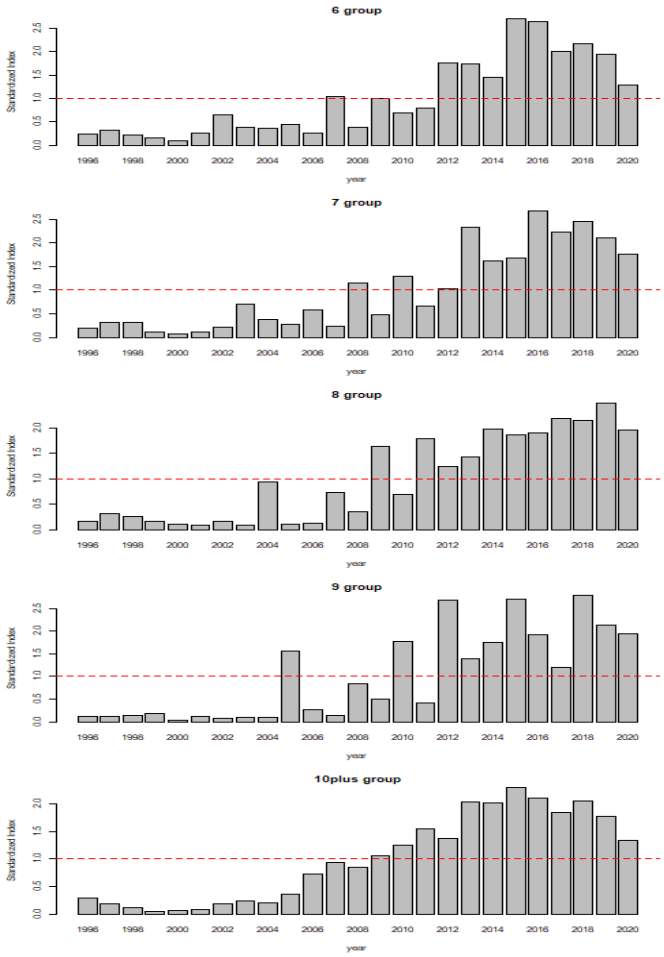

Figure 7.1.2.1 continued: Combined plaice BTS deltaGAM index North Sea ages 6-9 and 10+ (combining Dutch, Belgian, German and UK beam trawl survey data)

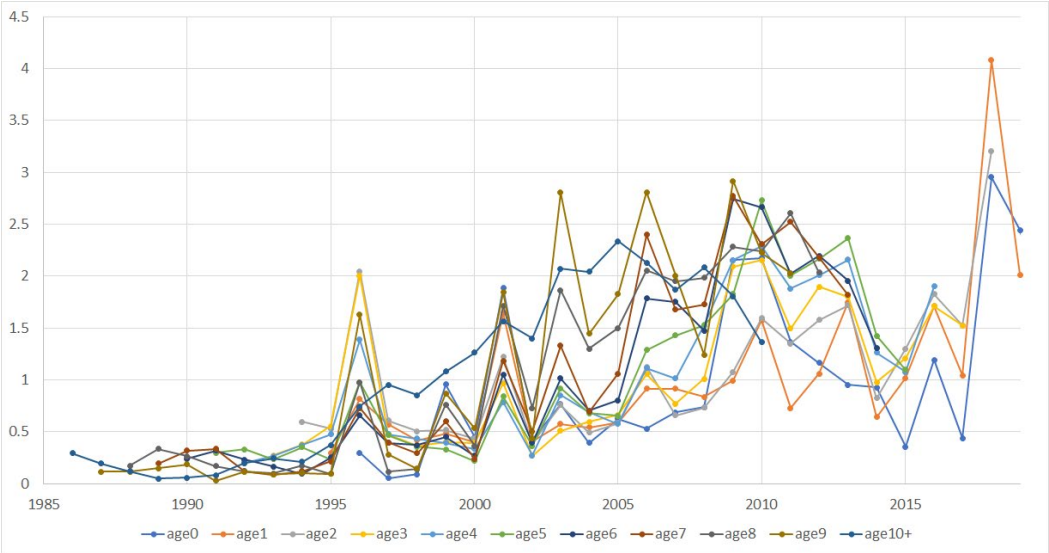

Figure 7.1.2.2 Cohort plot of the combined plaice BTS deltaGAM index North Sea ages 0-9 and 10+ (combining Dutch, Belgian, German and UK beam trawl survey data)

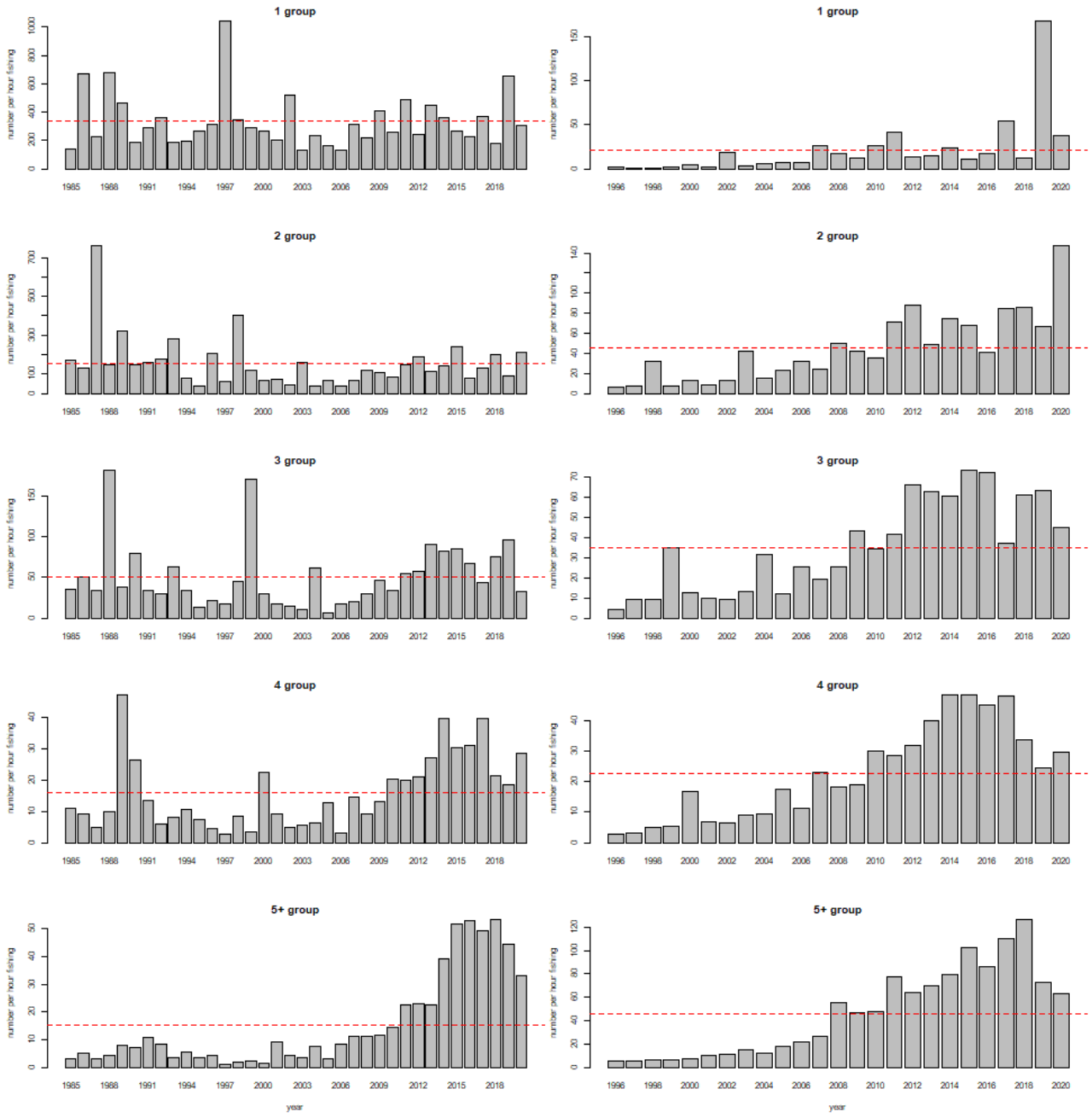

Figure 7.1.2.3 Plaice indices Dutch surveys in southeastern North Sea and German Bight (left) and central and western North Sea (right), ages 1-4 and 5+

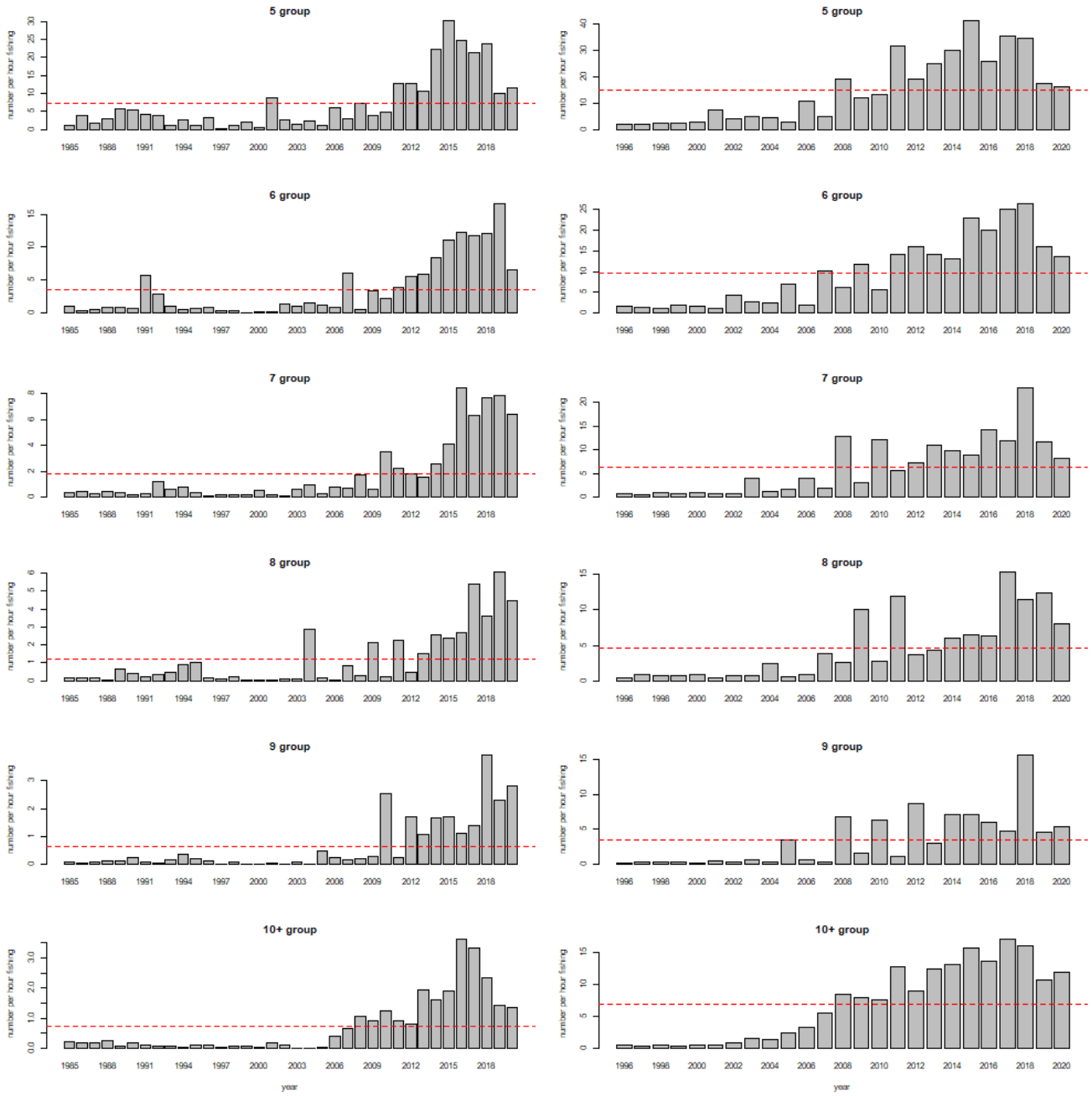

Figure 7.1.2.3 continued: Plaice indices Dutch surveys in southeastern North Sea and German Bight (left) and central and western North Sea (right), ages 5-9 and 10+

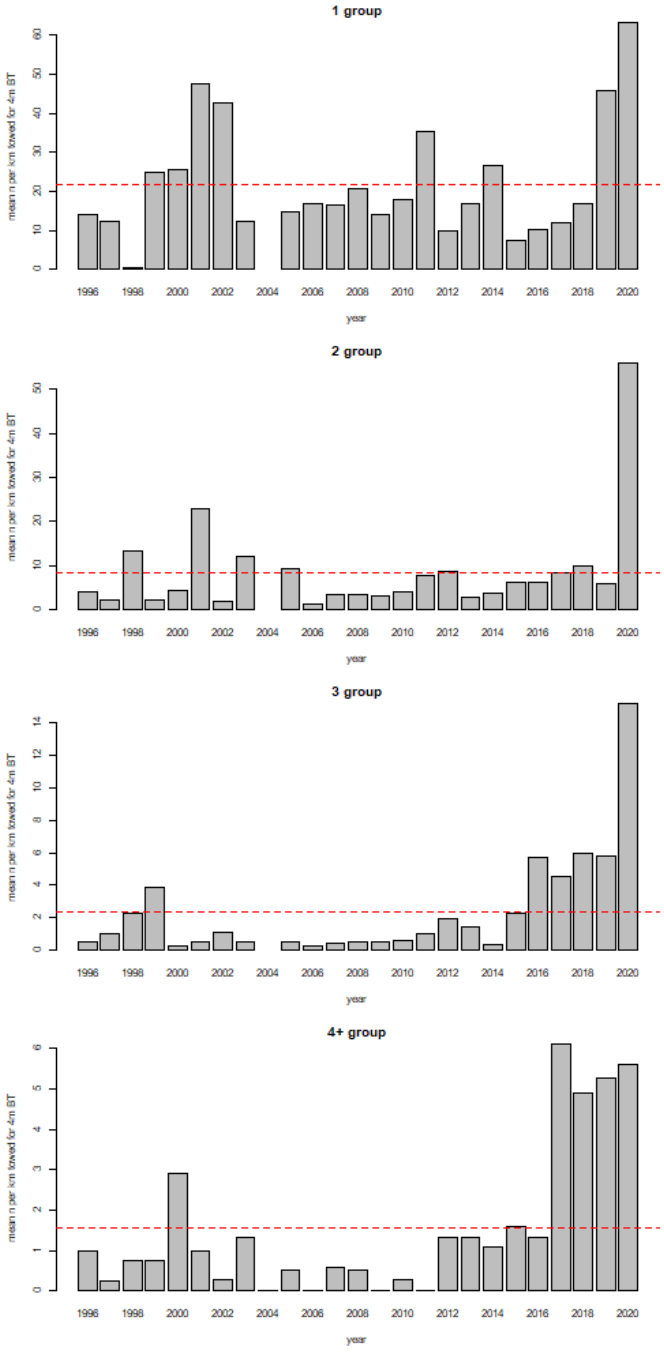

Figure 7.1.2.4 Plaice indices UK survey in southeastern North Sea (4c), ages 1-3 and 4+

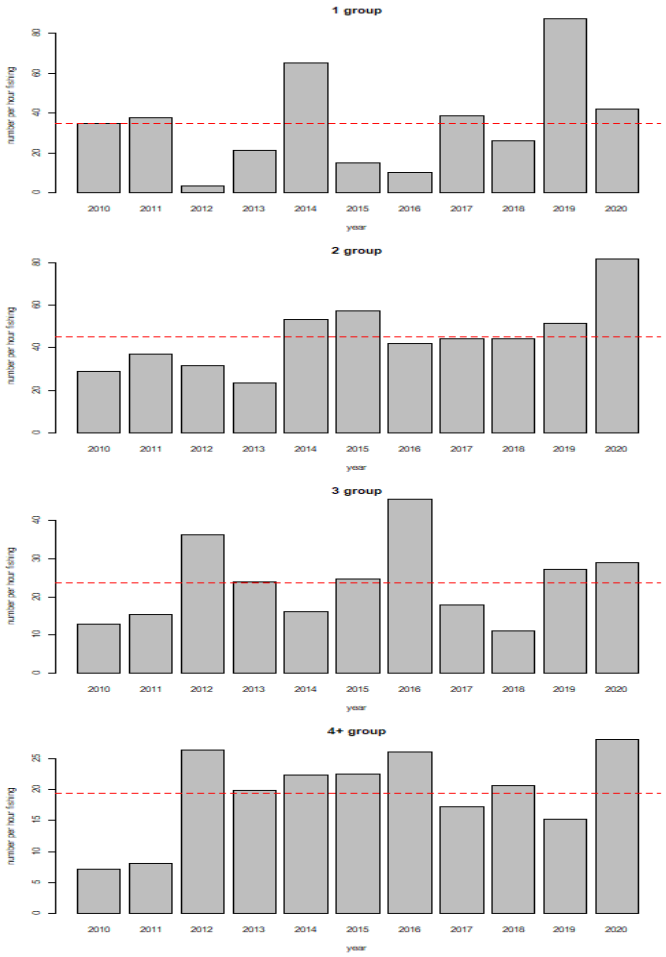

Figure 7.1.2.5 Plaice indices Belgian survey in southwestern North Sea (4c and 4b), ages 1-3 and 4+

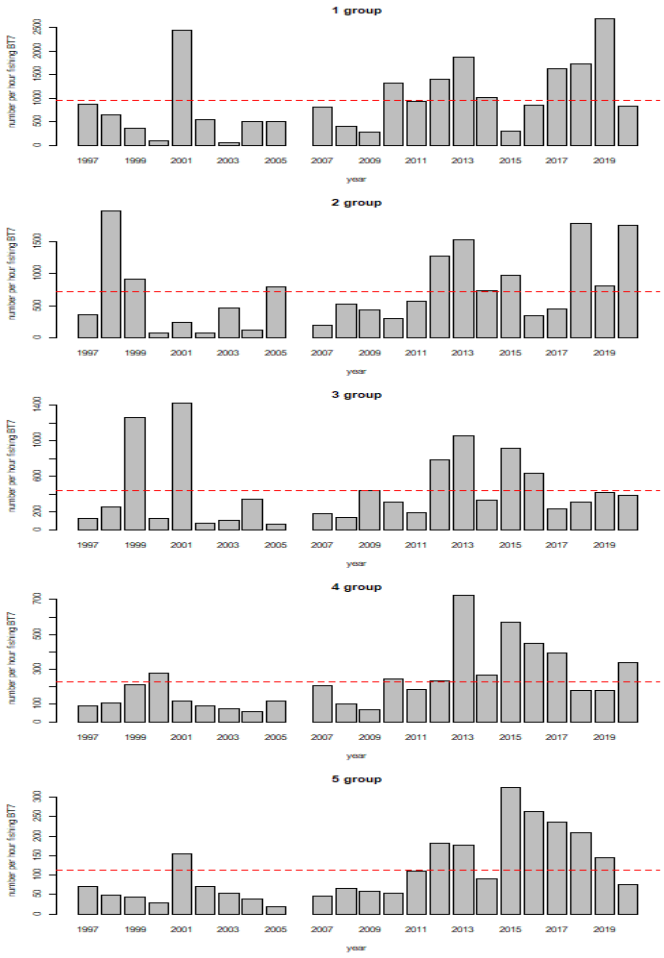

Figure 7.1.2.6 Plaice indices German survey in the central and northeastern North Sea (4b), ages 1-5

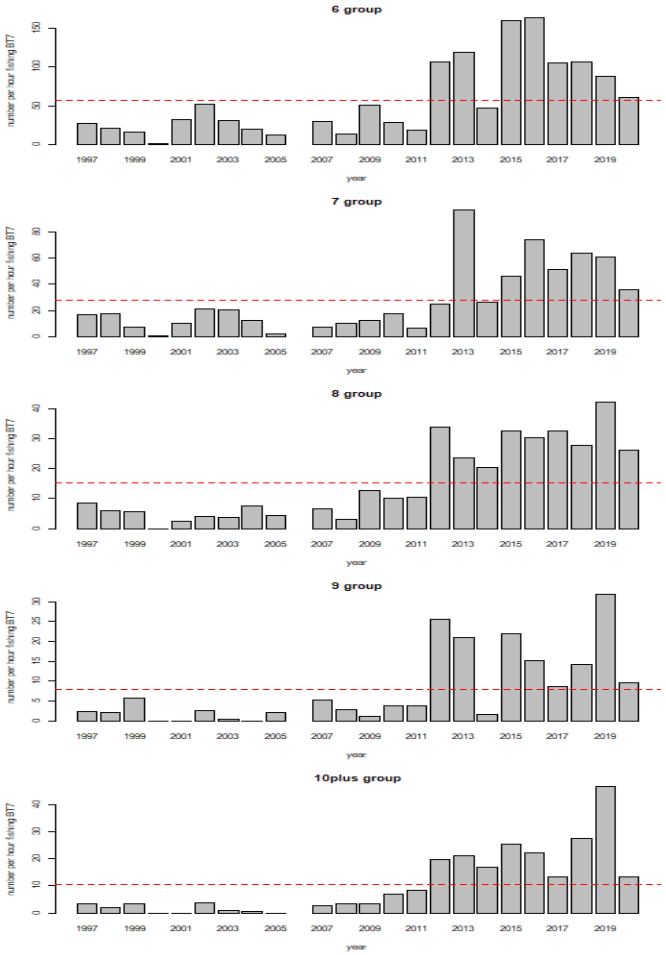

Figure 7.1.2.6 continued. Plaice indices German survey in the central and northeastern North Sea (4b), ages 6-9 and 10+

Western Waters - Subarea 7

Division 7d

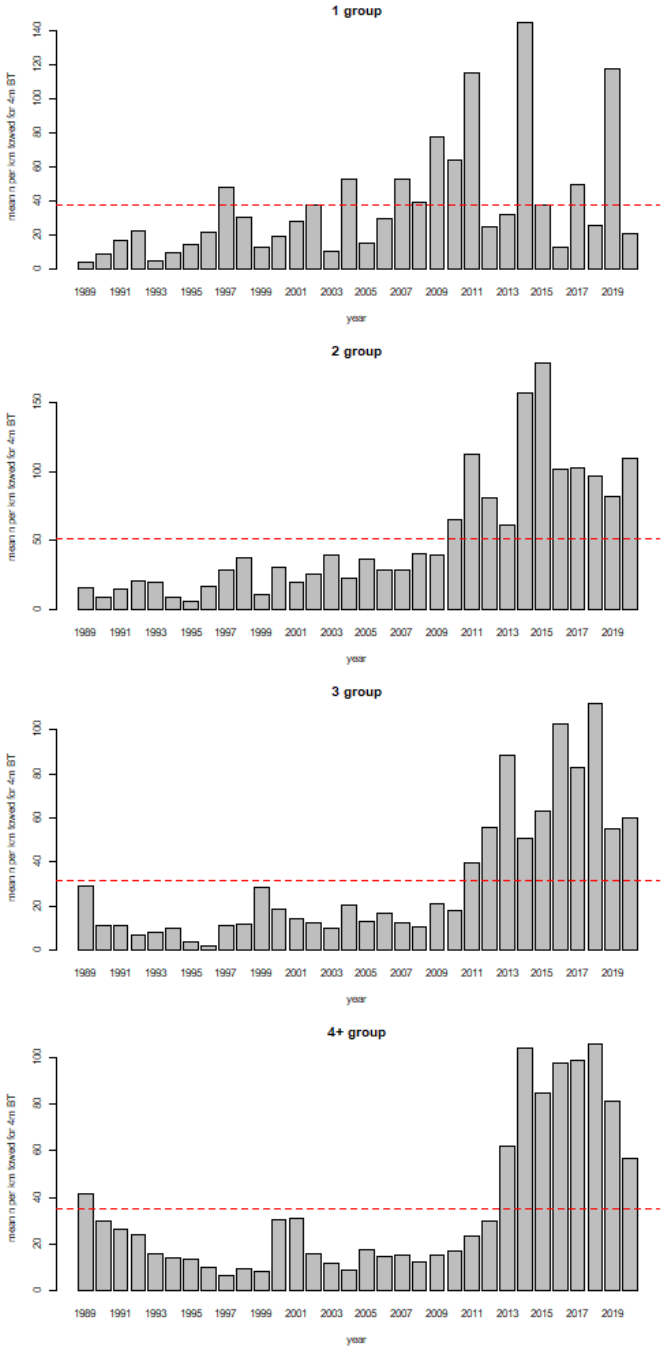

Figure 7.1.2.7 Plaice indices UK survey in the Eastern Channel, ages 1-3 and 4+

Division 7f

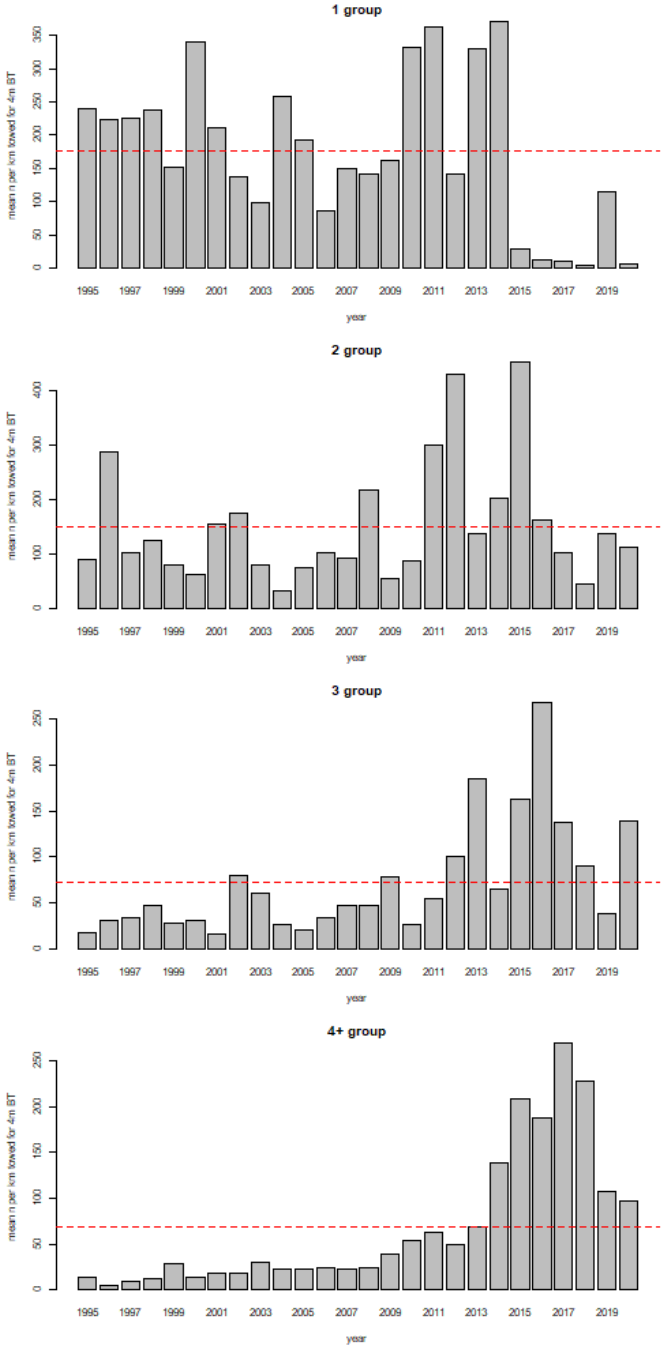

Figure 7.1.2.8 Plaice indices UK survey in the Bristol Channel, ages 1-3 and 4+ (Limited spatial coverage for 2020 survey, see report section 2 and Annex 5)

Division 7a

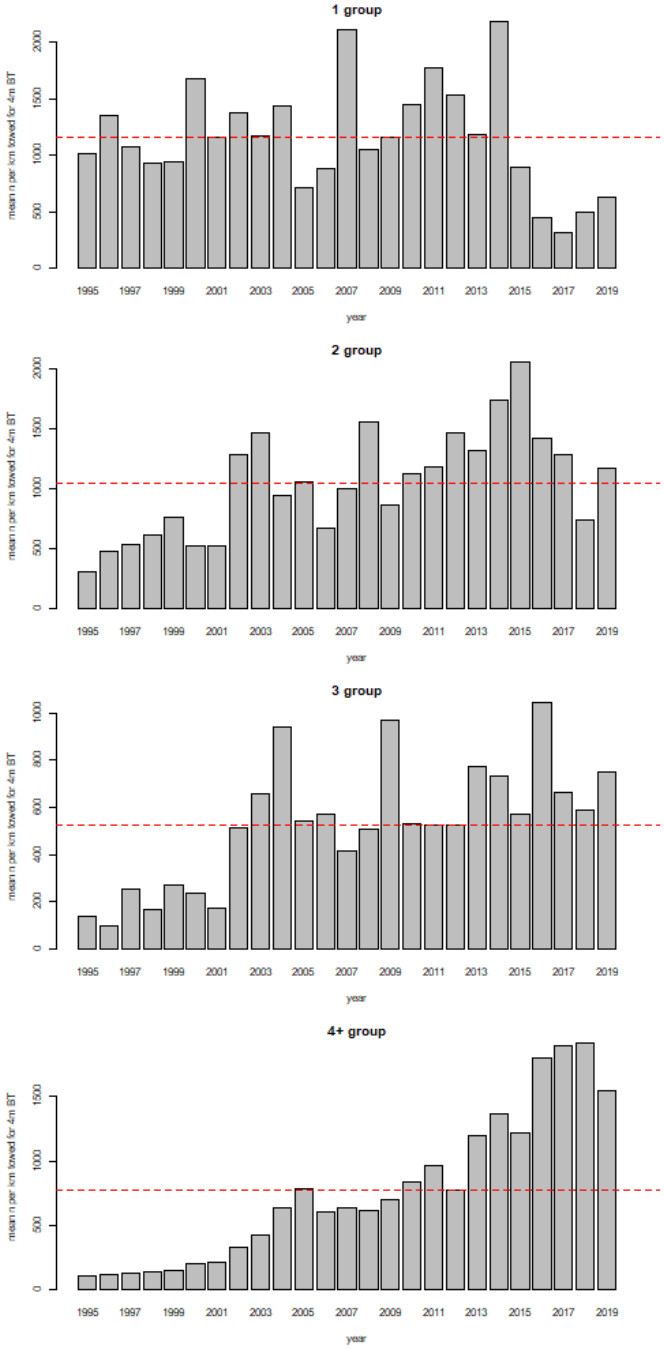

Figure 7.1.2.9 Plaice indices UK survey in the Irish Sea, ages 1-3 and 4+ (No survey in 2020, see report section 2 and Annex 5)

Icelandic Sea – Subarea 5a

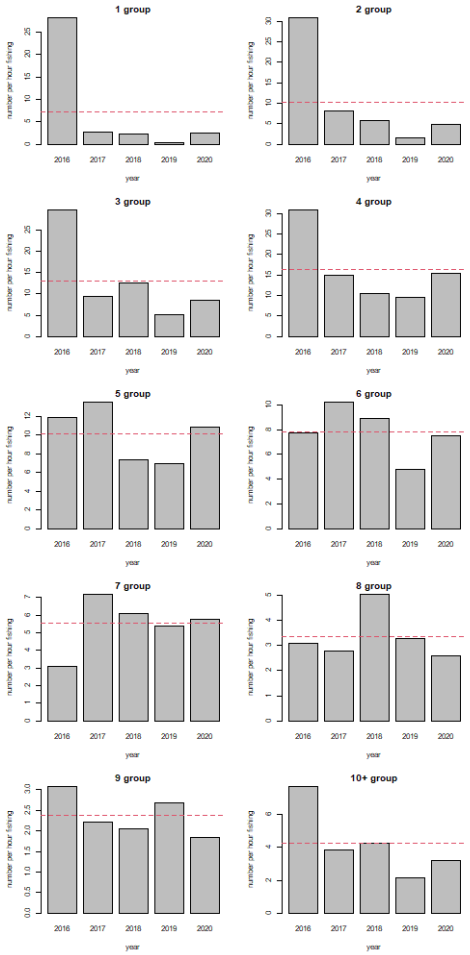

Figure 7.1.2.10 Plaice indices Icelandic survey in Icelandic Sea, ages 0-9 and 10+

Annex 7.2 Inshore surveys

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 DYFS and BTS.

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.

Index calculation DYFS

The combined 0 group indices are calculated using Belgian, Dutch and German data, and the combined 1 group indices using Belgian and Dutch data. The Dutch, and hence the combined indices, are calculated from 1990 onwards, mainly due to a change in the survey design of the Dutch DYFS in 1990. As in the Belgian survey no age information has been collected up to 2017, the index calculation for that area is done based on the age-length key from the Dutch inshore survey. It should be noted that incorporation of the age data collected during the Belgian survey leads to different index results.

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 in 2010 and spring survey of the German DYFS, the data selected for the index calculation has been re-defined in 2012.

Data use

The Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) uses the SNS indices and the combined inshore DYFS 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.

Sole North Sea – Subarea 4

Sole net survey (SNS)

The index from the 2020 survey (Annex 7.2.1: Figure 7.2.1.1, table 7.2.1.1) indicates that ages 1 and 3 were lower than the long-term arithmetic mean. The strong age 2 reflects the strong 2018 cohort, also seen in the offshore surveys. However, the 2013 cohort appeared even stronger as age 2 than the 2018 cohort did in the 2020 survey. Furthermore, ages 4 and 5+ in 2019 survey were higher than the level of the long-term arithmetic mean. Indices trends are quite fluctuating and record peaks well above the arithmetic mean from the 90's onwards (Figure 7.2.2.1). 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 7.2.2.1). In that year 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. In addition, the strong 2018 cohort is still visble as 2-group individuals in the 2020 survey. This is in line with the other surveys in the North Sea.

Demersal Young Fish survey (DYFS)

The international sole recruitment index (Annex 7.2.**1**: Figure 7.2.1.2) shows a low 2020 year class, similar to the 2019 year class, which is also seen in the age-1 index in 2020. The strong year class from 2018 is in line with the index patterns of the SNS (Figure 7.2.1.1).

Plaice North Sea – Subarea 4

Sole net survey (SNS)

The 2020 survey (Annex 7.2.2 Figure 7.2.2.1, Table 7.2.2.1) indicates that the plaice year class seen as age 1 group was lower than the long-term arithmetic mean, in contrast to the strong 2018 year class. Ages 2 and 3 in the 2020 survey were lower than the level of the long-term arithmetic mean. However, the age 4 group was above the long-term arithmetic mean in 2020. The 5+ group indices are above the average since 2015. Overall, indices were generally higher before 2000 (especially ages 1 and 2). However, in recent years (especially since 2010) an increasing trend is recorded for ages 4 and 5+.

Although a year effect in 2012 in the SNS is far less evident for plaice than for sole (Figure 5.5.1 in Annex 5), 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.

Demersal Young Fish survey (DYFS)

For plaice, the international recruitment index (Annex 7.2.2: Figure 7.2.2.2, Table 7.2.2.2) shows a weaker year class in 2020 as compared to the 2018 and 2019 year classes. The 2019 cohort is as age group 1 is lower than the long-term arithmetic mean, and in the same range as the 2018 cohort, which in contrast was clearly visible in the SNS and BTS indices. This further points to, that the distribution of especially age 1 plaice may have changed compared to the 1990's, when the age 1 indices of plaice in the DYFS were considerably higher.

Annex 7.2.1 Figures and tables inshore indices sole

North Sea – Subarea 4

Sole net survey

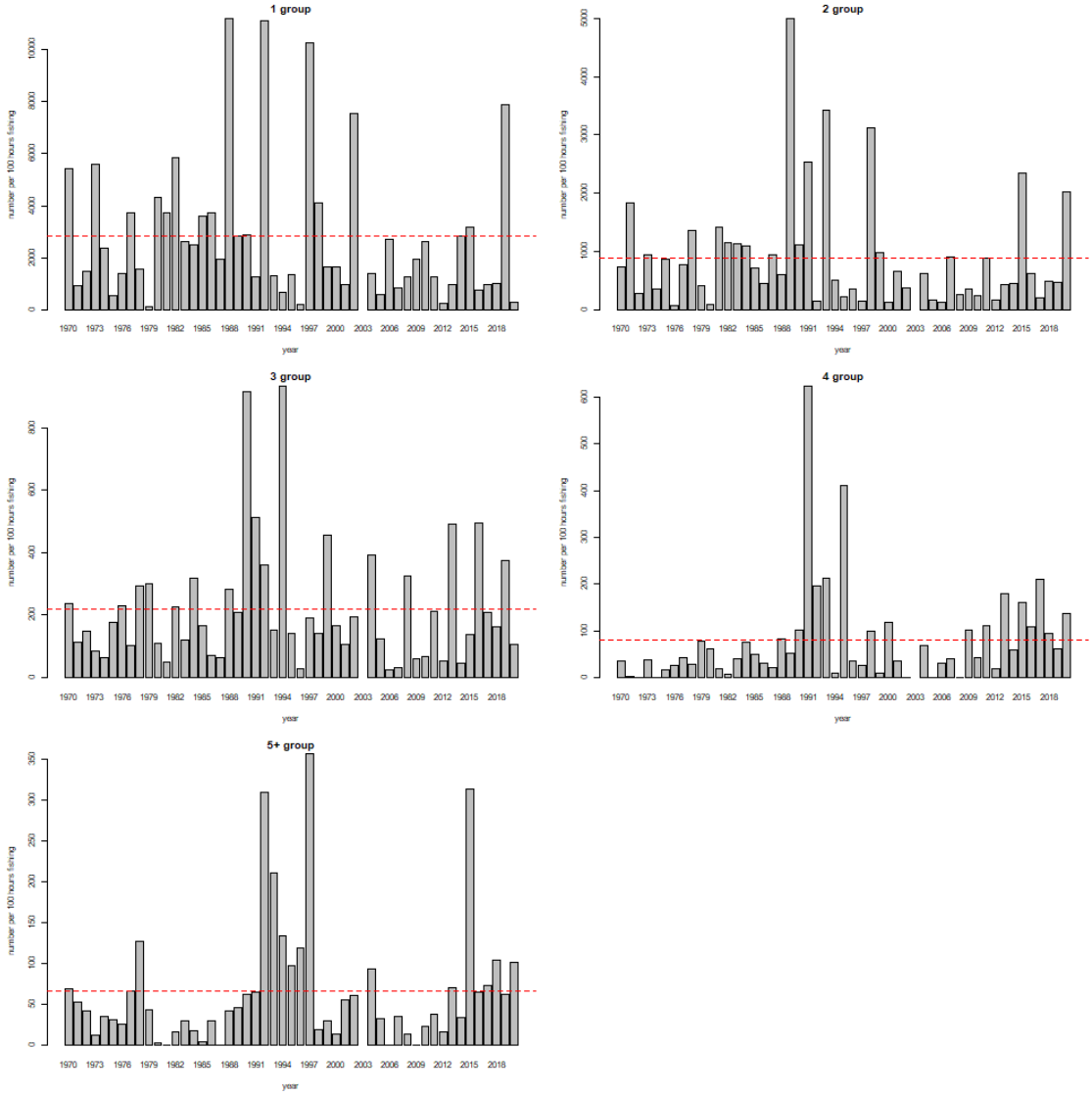

Figure 7.2.1.1 Sole indices from Sole Net Survey (SNS), in numbers per 100 hours fishing, age groups 1-4, 5+

Table 7.2.1.1 Sole indices from Sole Net Survey (SNS), in numbers per 100 hours fishing, age groups 1-4, 5+

year	1	2	3	4	5+
1970	5410.3	734.4	237.7	35.4	69.7
1971	902.7	1831.1	113.4	2.9	53.5
1972	1454.7	272.3	148.6	0.0	41.6
1973	5587.2	935.3	83.8	37.3	13.0
1974	2347.9	361.4	65.2	0.0	35.6
1975	525.4	864.5	177.0	17.5	32.1
1976	1399.4	73.6	229.1	26.7	25.7
1977	3742.9	776.1	103.8	43.1	66.2
1978	1547.7	1354.7	294.1	28.0	127.1
1979	93.8	408.3	300.8	76.9	43.3
1980	4312.9	88.9	109.3	61.3	3.3
1981	3737.2	1413.1	50.0	20.0	0.0
1982	5856.5	1146.2	227.8	6.7	16.7
1983	2621.1	1123.3	120.6	39.9	29.7
1984	2493.1	1099.9	318.3	74.4	18.0
1985	3619.4	715.6	167.1	49.3	4.4
1986	3705.1	457.6	69.2	31.4	30.7
1987	1947.9	943.7	64.8	21.3	0.0
1988	11226.7	593.8	281.6	81.5	42.4
1989	2830.7	5005.0	207.6	53.1	45.9
1990	2856.2	1119.5	914.3	100.4	62.1
1991	1253.6	2529.1	513.8	623.9	64.6
1992	11114.0	144.4	360.4	194.9	309.8
1993	1290.8	3419.6	153.8	212.8	211.4
1994	651.8	498.3	934.1	10.2	133.4
1995	1362.1	223.7	142.8	411.1	97.1
1996	218.4	349.1	29.6	35.5	118.6
1997	10279.3	153.6	189.8	26.5	356.4
1998	4094.6	3126.4	141.7	98.7	20.0
1999	1648.9	971.8	455.6	10.0	30.7
2000	1639.2	125.9	166.3	118.0	13.3
2001	970.3	655.4	106.7	35.5	56.2
2002	7547.5	379.0	195.3	0.0	60.8
2003	*	*	*	*	*
2004	1369.5	624.4	393.0	68.9	93.5
2005	568.1	162.9	124.0	0.0	33.0
2006	2726.4	117.1	25.0	30.0	0.0
2007	848.6	911.0	33.3	39.5	35.4
2008	1259.1	258.5	325.3	0.0	13.3
2009	1931.6	344.4	61.7	102.7	0.0
2010	2636.9	237.1	67.1	42.2	23.2
2011	1248.0	883.9	211.3	111.8	38.0
2012	226.6	159.5	54.0	18.0	16.0
2013	967.4	426.6	490.5	179.3	70.6
2014	2849.0	448.2	44.8	60.0	33.6
2015	3192.0	2333.9	137.8	159.9	313.0
2016	733.8	623.3	494.6	109.8	65.2
2017	956.7	204.3	209.6	209.7	73.6
2018	1002.3	482.4	163.1	94.1	103.9
2019	7896.7	476.3	375.2	60.7	62.6
2020	294.7	2023.2	105.1	137.9	101.3

*No survey

Demersal young fish survey

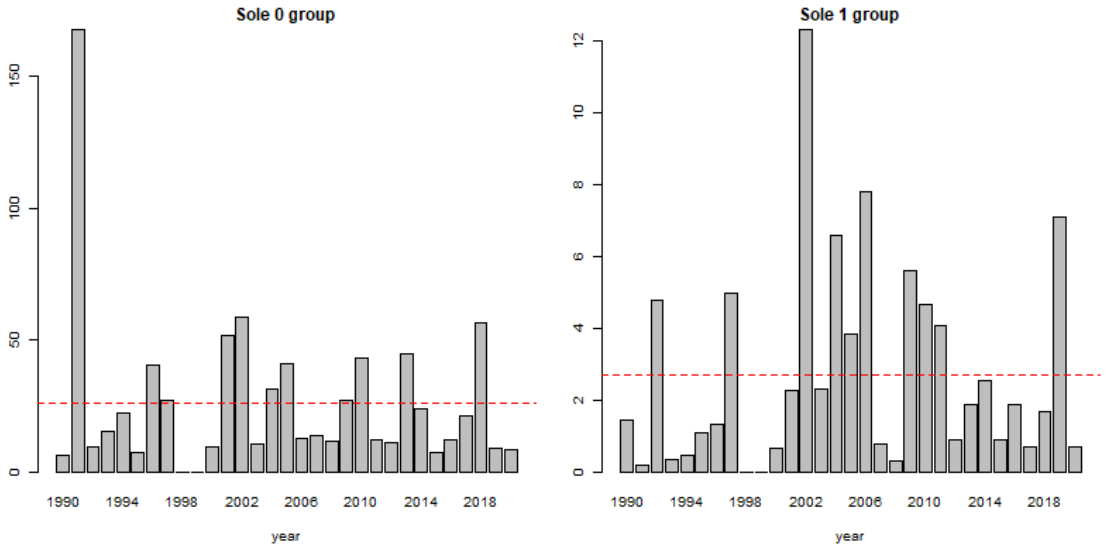

Figure 7.2.1.2 Sole indices from international DYFS survey (combined German, Dutch and Belgian data), in numbers per 1000 m² fished area, age groups 0 and 1

Table 7.2.1.2 Sole indices from international DYFS survey (combined German, Dutch and Belgian data), in numbers 1000 m² fished area, age groups 0 and 1 (*=invalid survey)

year	age0	age1
1990	6.381	1.435021
1991	167.5628	0.183961
1992	9.266028	4.770869
1993	15.32398	0.335254
1994	22.06324	0.456818
1995	7.064778	1.065177
1996	40.27174	1.305915
1997	26.93957	4.981413
1998	*	*
1999	*	*
2000	9.504133	0.63642
2001	51.42419	2.269092
2002	58.58299	12.30704
2003	10.60934	2.297676
2004	31.25178	6.585095
2005	40.98701	3.819168
2006	12.5667	7.813433
2007	13.72748	0.776117
2008	11.76762	0.291603
2009	27.33151	5.61977
2010	42.86197	4.673361
2011	12.12998	4.088182
2012	11.22614	0.880055
2013	44.81884	1.867842
2014	23.61608	2.521723
2015	7.448352	0.893179
2016	12.27554	1.88786
2017	20.96561	0.681463
2018	56.74828	1.693035
2019	8.749073	7.110469
2020	8.59870	0.69746

* Incomplete survey

Table 7.2.1.3 Sole indices by country and the combined international index, in numbers per 1000 m² fished area, age groups 0 and 1 (*=invalid survey)

	age0				age1		
Country	**NL**	**BE**	**DE**	**International**	**NL**	**BE**	**International**
Raising factor	*11.007*	*1.472*	*1.919*		*11.007*	*1.472*	
Gear correction factor	*1*	*1.59*	*1.59*		*1*	*1.9*	
1990	0.44	0.36	0.23	6.381	0.12	0.04	1.435021
1991	14.52	2.17	0.87	167.5628	0.02	0.01	0.183961
1992	0.76	0.16	0.19	9.266028	0.34	0.35	4.770869
1993	1.26	0.45	0.12	15.32398	0.02	0.02	0.335254
1994	1.82	0.69	0.15	22.06324	0.01	0.11	0.456818
1995	0.28	1.57	0.09	7.064778	0.08	0.08	1.065177
1996	2.45	4.95	0.55	40.27174	0.01	0.42	1.305915
1997	2.14	1.40	0.03	26.93957	0.25	0.80	4.981413
1998	*	3.48	0.18	*	*	2.34	*
1999	*	2.31	0.10	*	*	0.51	*
2000	0.72	0.53	0.12	9.504133	0.04	0.09	0.63642
2001	2.65	9.45	0.05	51.42419	0.03	0.69	2.269092
2002	2.43	13.39	0.18	58.58299	0.09	4.06	12.30704
2003	0.62	1.50	0.10	10.60934	0.09	0.48	2.297676
2004	0.59	10.52	0.05	31.25178	0.03	2.24	6.585095
2005	2.24	5.66	0.99	40.98701	0.03	1.24	3.819168
2006	1.04	0.34	0.12	12.5667	0.13	2.30	7.813433
2007	0.86	1.74	0.05	13.72748	0.01	0.23	0.776117
2008	0.97	0.43	0.02	11.76762	0.01	0.06	0.291603
2009	1.22	5.52	0.31	27.33151	0.03	1.87	5.61977
2010	2.24	7.72	0.024	42.86197	0.06	1.44	4.673361
2011	0.98	0.48	0.07	12.12998	0.14	0.90	4.088182
2012	0.92	0.43	0.05	11.22614	0.01	0.27	0.880055
2013	3.46	1.94	0.72	44.81884	0.04	0.53	1.867842
2014	1.98	0.69	0.07	23.61608	0.09	0.53	2.521723
2015	0.56	0.46	0.05	7.448352	0.02	0.22	0.893179
2016	0.88	1.11	0.00460	12.27554	0.08	0.36	1.88786
2017	1.36	2.41	0.12	20.96561	0.04	0.10	0.681463
2018	4.82	1.48	0.08	56.74828	0.08	0.31	1.693035
2019	0.63	0.71	0.05	8.749073	0.36	1.11	7.110469
2020	0.67	0.43	0.05	8.59870	0.04	0.10	0.69746

Annex 7.2.2 Figures and tables inshore indices plaice

Sole net survey

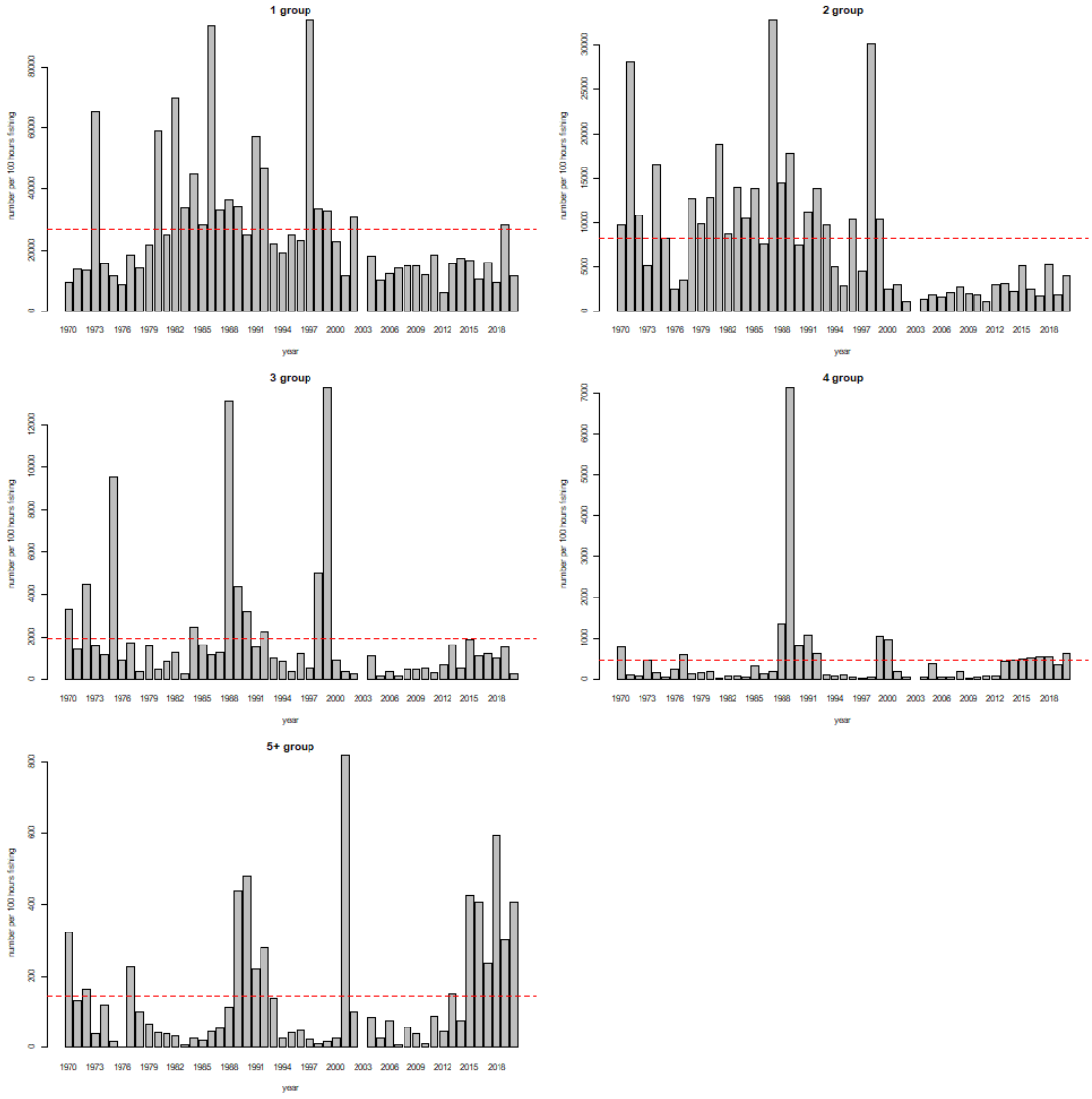

Figure 7.2.2.1 Plaice indices from the Sole Net Survey (SNS), in numbers per 100 hours fishing, age groups 1-4, 5+

Table 7.2.2.1 Plaice indices from Sole Net Survey (SNS), in numbers per 100 hours fishing, age groups 1-4, 5+

year	1	2	3	4	5+
1970	9311.4	9731.5	3273.0	769.7	323.3
1971	13538.5	28163.5	1414.7	100.8	130.6
1972	13206.9	10779.7	4477.8	89.1	160.7
1973	65642.5	5133.3	1578.2	461.4	37.7
1974	15366.4	16508.9	1128.8	160.0	117.5
1975	11628.2	8168.4	9556.3	65.2	15.2
1976	8536.5	2402.6	868.2	236.3	2.3
1977	18536.7	3423.8	1737.3	589.9	225.9
1978	14012.0	12678.0	345.5	134.8	99.4
1979	21495.4	9828.8	1574.9	161.2	65.8
1980	59174.2	12882.3	490.7	180.4	40.5
1981	24756.2	18785.3	834.4	38.3	36.7
1982	69993.3	8642.0	1261.0	87.9	32.1
1983	33974.2	13908.6	249.4	71.0	7.5
1984	44964.5	10412.8	2466.9	41.7	26.7
1985	28100.5	13847.8	1597.7	328.0	18.3
1986	93551.9	7580.4	1152.1	144.9	45.2
1987	33402.4	32991.1	1226.7	199.6	53.1
1988	36608.6	14421.1	13153.2	1350.1	113.7
1989	34276.3	17810.2	4372.8	7126.4	436.7
1990	25036.6	7496.0	3160.0	816.1	479.4
1991	57221.3	11247.2	1517.8	1076.8	219.8
1992	46798.2	13841.8	2267.6	613.0	279.9
1993	22098.3	9685.6	1006.3	97.8	137.8
1994	19188.4	4976.6	855.9	75.9	25.9
1995	24767.0	2796.4	381.3	97.0	42.3
1996	23015.4	10268.2	1185.2	44.7	46.5
1997	95900.9	4472.7	496.6	31.7	23.3
1998	33665.7	30242.2	5013.9	49.7	10.0
1999	32951.3	10272.1	13783.1	1058.2	16.7
2000	22855.0	2493.4	891.4	982.6	26.7
2001	11510.5	2898.5	370.2	175.8	816.7
2002	30809.2	1102.7	264.6	65.2	99.8
2003	*	*	*	*	*
2004	18201.6	1349.7	1080.7	50.8	83.1
2005	10118.4	1818.9	141.9	365.5	27.0
2006	12164.2	1571.0	384.7	52.4	75.6
2007	14174.5	2133.9	139.5	51.9	7.4
2008	14705.8	2700.4	464.1	178.5	57.5
2009	14860.0	2018.7	492.5	38.3	36.7
2010	11946.9	1811.5	529.3	55.5	10.0
2011	18348.6	1142.5	308.2	74.7	88.0
2012	5893.4	2928.6	681.5	82.0	45.0
2013	15394.9	3021.3	1638.5	427.6	149.7
2014	17312.7	2258.3	513.8	457.9	74.3
2015	16726.5	5040.4	1881.9	477.6	423.9
2016	10384.8	2434.3	1086.3	521.6	404.7
2017	15935.9	1715.5	1211.7	534.1	234.8
2018	9464.9	5250.0	993.1	533.0	594.1
2019	28308.6	1885.6	1533.3	337.9	301.7
2020	11392.8	3931.4	282.7	607.2	406.0

*No survey

Demersal young fish survey

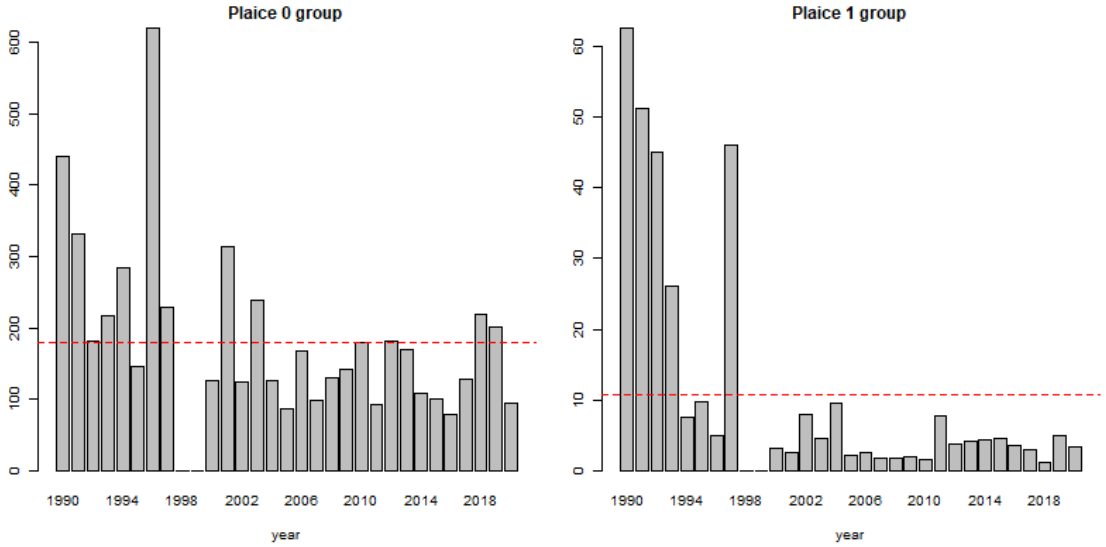

Figure 7.2.2.2 Plaice indices from international DYFS survey (combined German, Dutch and Belgian data), in numbers per 1000 m² fished area, age groups 0 and 1

Table 7.2.2.2 Plaice indices from international DYFS survey (combined German, Dutch and Belgian data), in numbers per 1000 m² fished area, age groups 0 and 1 (*=invalid survey)

year	age0	age1
1990	439.593	62.58831
1991	332.3579	51.25087
1992	180.3098	45.02041
1993	216.9896	26.17763
1994	283.4379	7.432426
1995	146.0756	9.749124
1996	619.6147	4.985129
1997	229.2426	46.11934
1998	*	*
1999	*	*
2000	124.9256	3.185394
2001	313.1752	2.422088
2002	122.907	7.86081
2003	238.6262	4.607383
2004	126.7383	9.45473
2005	85.87962	2.099852
2006	167.9882	2.584789
2007	98.25258	1.769902
2008	129.7098	1.707966
2009	141.8704	1.981376
2010	179.6146	1.536524
2011	92.96254	7.713137
2012	181.1218	3.713203
2013	168.4809	4.033875
2014	107.9918	4.294105
2015	100.1616	4.559275
2016	78.05228	3.447096
2017	127.1979	2.867452
2018	219.3361	1.136788
2019	200.1965	5.002348
2020	93.83044	3.237539

Table 7.2.2.3 Plaice indices by country and the combined international index, in numbers per 1000 m² fished area, age groups 0 and 1 (*=invalid survey)

	age0				age1		
Country	**NL**	**BE**	**DE**	**International**	**NL**	**BE**	**International**
Raising factor	*11.007*	*1.472*	*1.919*		*11.007*	*1.472*	
Gear correction factor	*1*	*1.22*	*1.22*		*1*	*1*	
1990	34.52	2.48	23.59	439.593	5.52	1.26	62.58831
1991	25.49	1.15	21.24	332.3579	4.63	0.17	51.25087
1992	15.33	0.32	4.72	180.3098	4.07	0.18	45.02041
1993	18.86	0.20	3.86	216.9896	2.36	0.12	26.17763
1994	23.90	1.31	7.71	283.4379	0.64	0.29	7.432426
1995	10.62	2.62	10.44	146.0756	0.79	0.72	9.749124
1996	45.34	12.65	41.77	619.6147	0.43	0.20	4.985129
1997	16.58	4.27	16.67	229.2426	3.73	3.45	46.11934
1998	*	2.76	8.11	*	*	1.54	*
1999	*	1.14	2.94	*	*	1.62	*
2000	8.95	1.29	10.28	124.9256	0.16	0.95	3.185394
2001	22.35	1.57	27.47	313.1752	0.14	0.63	2.422088
2002	10.01	5.61	1.12	122.907	0.09	4.69	7.86081
2003	19.20	3.22	9.20	238.6262	0.26	1.21	4.607383
2004	9.79	4.46	4.70	126.7383	0.59	2.00	9.45473
2005	6.59	3.94	2.68	85.87962	0.16	0.26	2.099852
2006	14.23	1.12	4.00	167.9882	0.14	0.69	2.584789
2007	7.07	4.30	5.41	98.25258	0.13	0.24	1.769902
2008	10.69	3.80	2.23	129.7098	0.07	0.66	1.707966
2009	9.76	7.40	9.05	141.8704	0.14	0.31	1.981376
2010	12.81	1.18	15.6	179.6146	0.07	0.50	1.536524
2011	6.90	2.18	5.61	92.96254	0.33	2.78	7.713137
2012	15.19	3.06	3.60	181.1218	0.11	1.69	3.713203
2013	12.37	5.72	9.42	168.4809	0.27	0.74	4.033875
2014	8.45	3.82	3.45	107.9918	0.21	1.37	4.294105
2015	8.12	1.50	3.43	100.1616	0.21	1.56	4.559275
2016	6.44	2.15	1.39	78.05228	0.19	0.89	3.447096
2017	10.88	1.70	1.89	127.1979	0.16	0.78	2.867452
2018	18.21	6.14	3.34	219.3361	0.08	0.16	1.136788
2019	15.53	2.46	10.59	200.1965	0.25	1.51	5.002348
2020	6.62	1.82	7.55	93.83044	0.21	0.64	3.237539

Annex 8: Results consistency analyses DATRAS BTS, SNS and DYFS data

Annex 8.1: Regional evaluation of offshore and inshore data from DATRAS, shrimp example

The relationship between haul duration (HaulDur) and distance (Distance) was plotted (Figure 8.1.1). We would expect a positive linear relationship between haul duration and distance. The figure shows a lot of variation in distance recordings for Belgium (BE). This issue needs to be sorted out first, before the swept area can be calculated properly from these data. There are also outliers to be observed from this plot. In a further stage, a new piece of code should be written so users can select the outliers from the plot they want to be removed.

A second plot was made to compare the results of swept area calculation by using the two different methods (Figure 8.1.2). The biggest difference were in the Belgian data, due to the big differences in distance that were recorded.

In Figure 8.1.3 the total numbers for shrimp were plotted. Here we could observe missing data from Germany in 2020 from the chartered commercial vessel (AA36) and from 2019-2020 for RV Clupea (06NQ). For the Netherlands the data for 2007 for RV Stern (64 ST) also seemed to be missing. Figures 8.1.4 and 8.1.5 show the results for the CPUE by haul and the CPUE by ICES statistical rectangle respectively.

Inshore surveys are unlike offshore beam trawl surveys not stratified to ICES statistical rectangles, but they have their own specific inshore area codes (inshore manual, in prep.). Consequently, this type of plot as presented in Figure 8.1.5 makes more sense for offshore surveys such as the BTS. Finally, the length distribution and length frequencies were looked at for shrimp. On Figure 8.1.6 all recorded lengths are plotted for the entire period. Here we can easily observe some outliers towards both ends of the plot. Figure 8.1.7 depicts the actual shrimp that were measured on the DYFS whereas Figure 8.1.8 shows the numbers raised to the catch and standardized by swept area. On this last plot, we can see that the trends for Germany and the Netherlands follow a similar trend, although the Dutch DYFS consistently seems to catch more shrimp, except for 2019. The catch differences between the two countries may have to do with the catchability of the gear or with the spatial distribution of the shrimp.

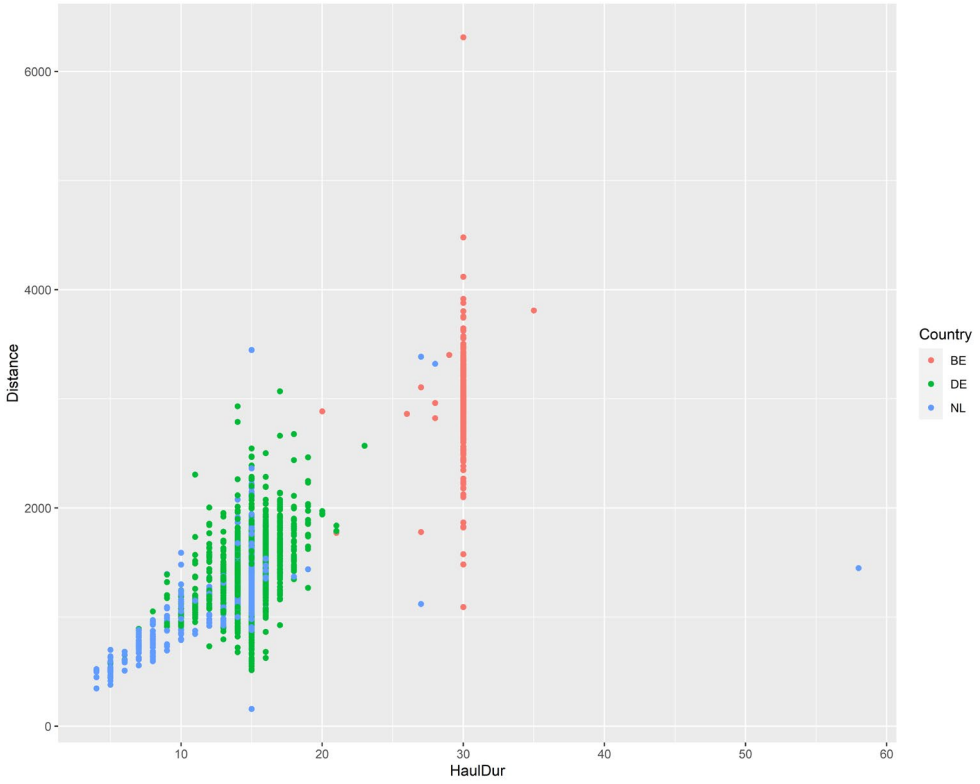

Figure 8.1.1: Relationship between haul duration (HaulDur) and distance (Distance) from DYFS data in DATRAS for the period 2004-2020. The colours show the different countries (blue = Netherlands, NE; red = Belgium, BE; green = Germany, DE).

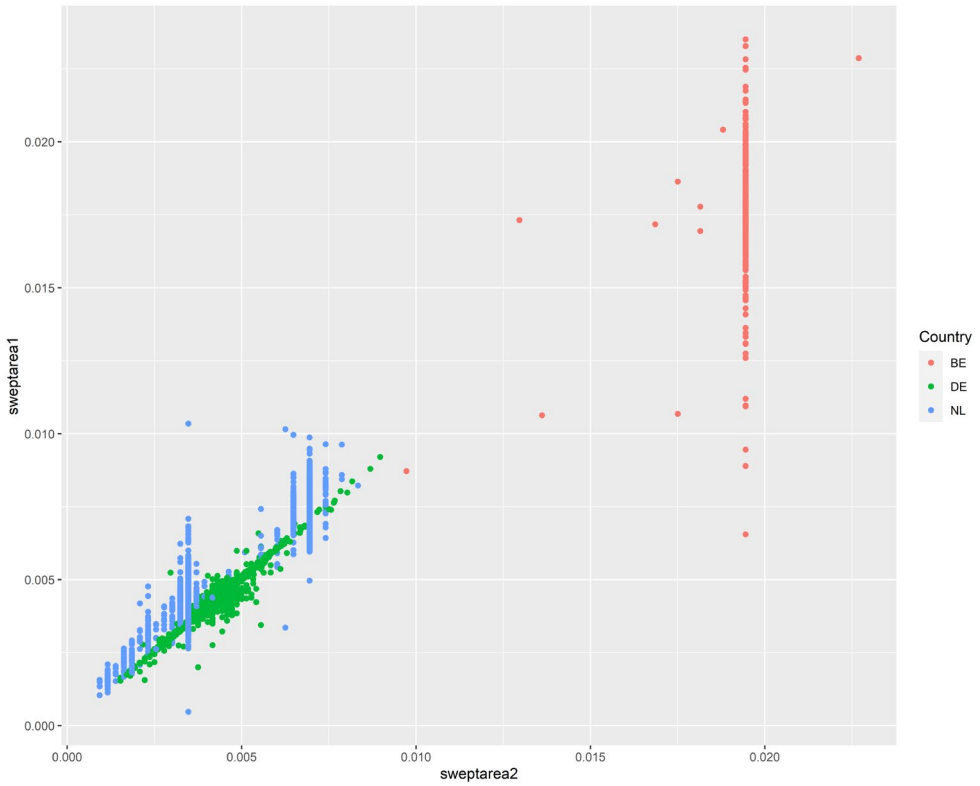

Figure 8.1.2: Relationship between two method of swept area calculation from DYFS data in DATRAS for the period 2004-2020. Sweptarea1 is based on beam width and distance. Sweptarea2 is based on beam width, haul duration and fishing speed. The colours show the different countries (blue = Netherlands, NE; red = Belgium, BE; green = Germany, DE).

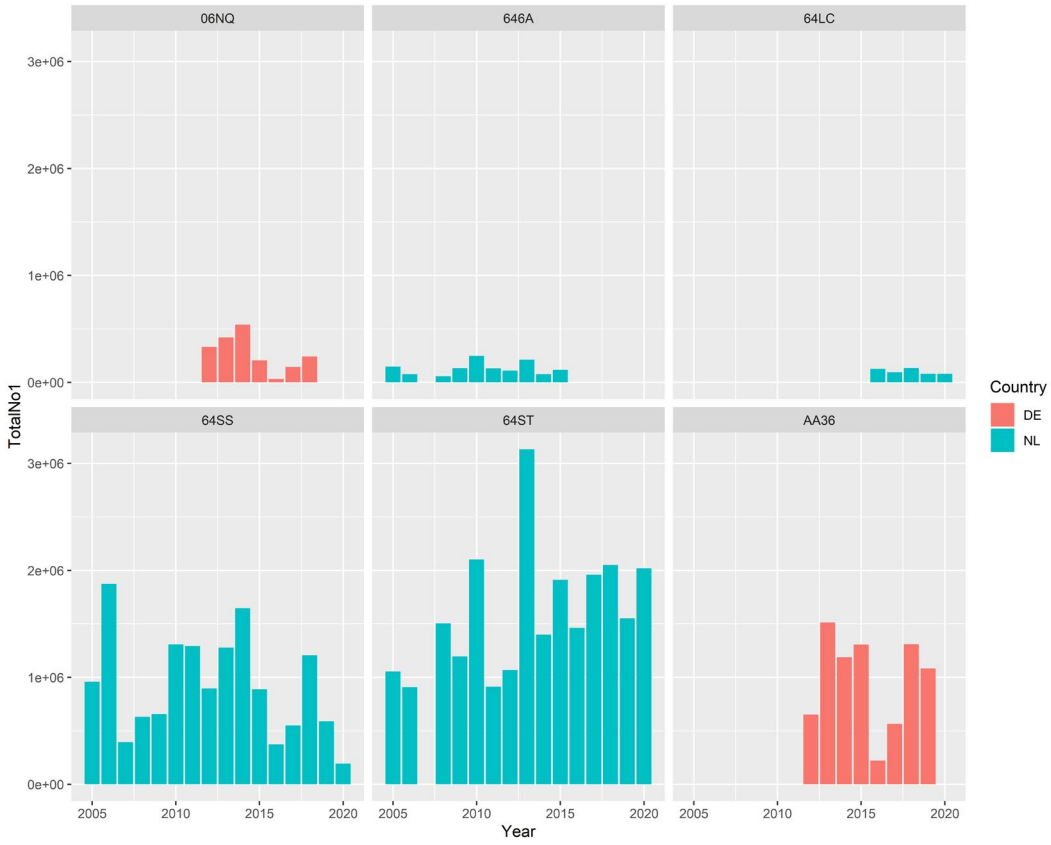

Figure 8.1.3: Total numbers of shrimp from DYFS data in DATRAS for the period 2004-2020. The panels are divided based on the different ships (06NQ = RV Clupea, 646A = RV Schollevaar, 64LC = RV Luctor, 64SS = RV ISIS, 64ST = RV Stern, AA36 = chartered commercial vessel). The colours show the different countries (blue = Netherlands, NE; red = Germany, DE).

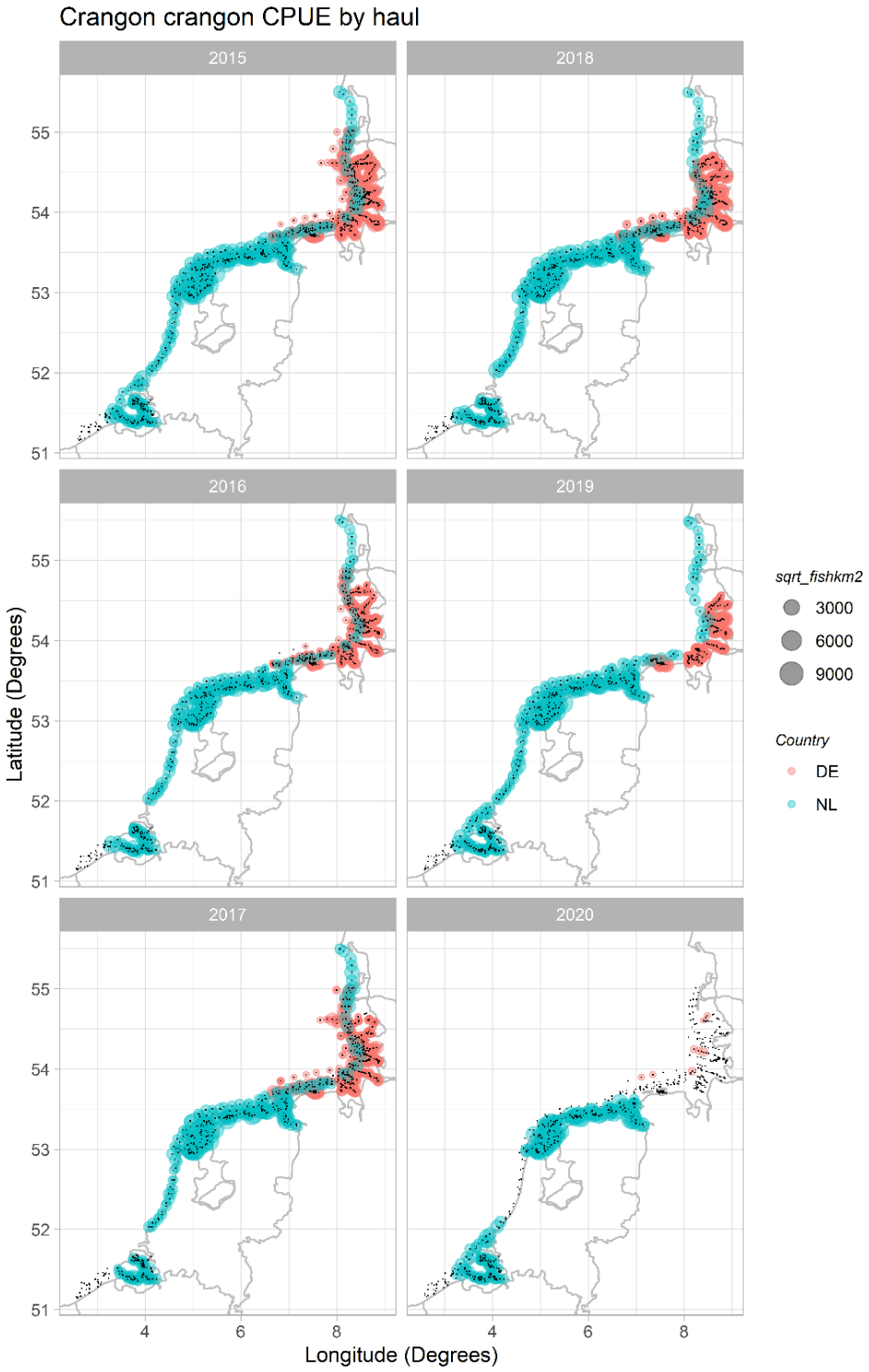

Figure 8.1.4: CPUE (square root of numbers/km²) by haul of shrimp from the DYFS for the years 2015-2020. The colours show the different countries (blue = Netherlands, NE; red = Germany, DE).

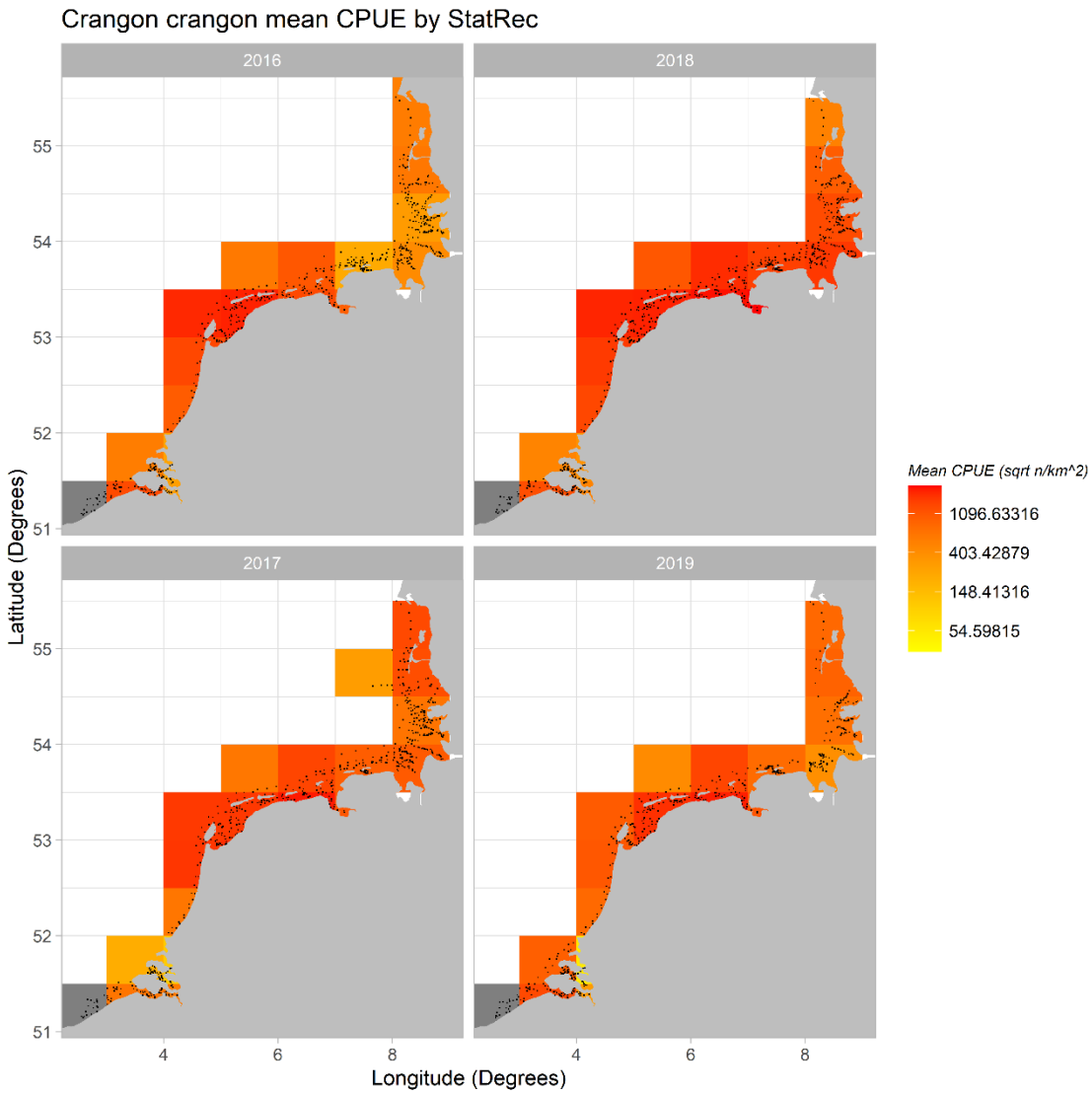

Figure 8.1.5: Average CPUE (square root of numbers/km²) by ICES Statistical rectangle of shrimp from the DYFS for the years 2016-2019. The colours change from yellow to orange to red depending on the average CPUE in the rectangle.

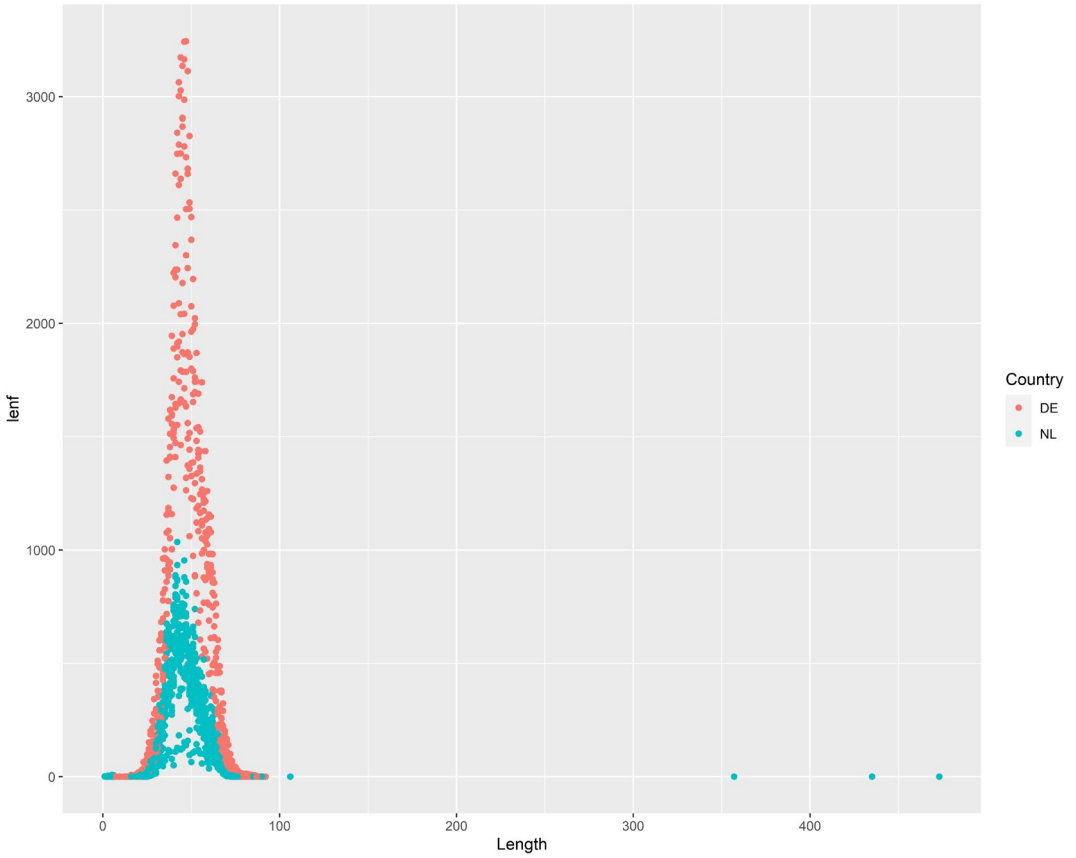

Figure 8.1.6: length measurements of shrimp from the DYFS for the years 2004-2020. The colours show the different countries (blue = Netherlands, NE; red = Germany, DE).

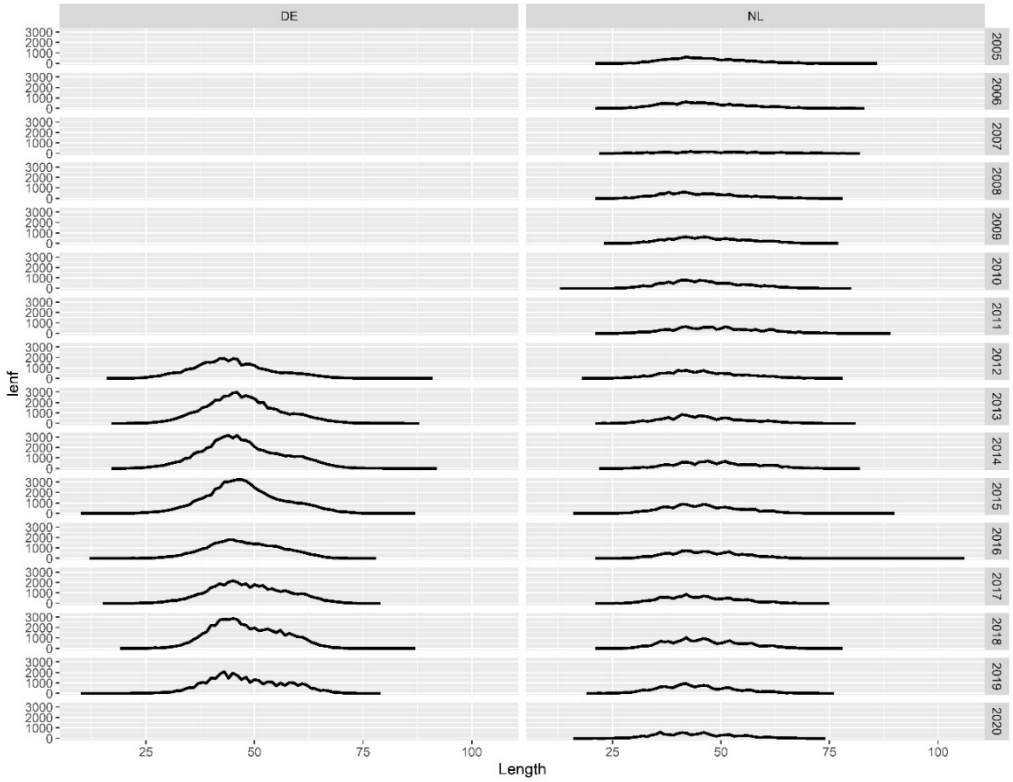

Figure 8.1.7: Length measurements of shrimp from the DYFS for the years 2005-2020. The left panel shows the German (DE) data, the right panel the Dutch (NL) data.

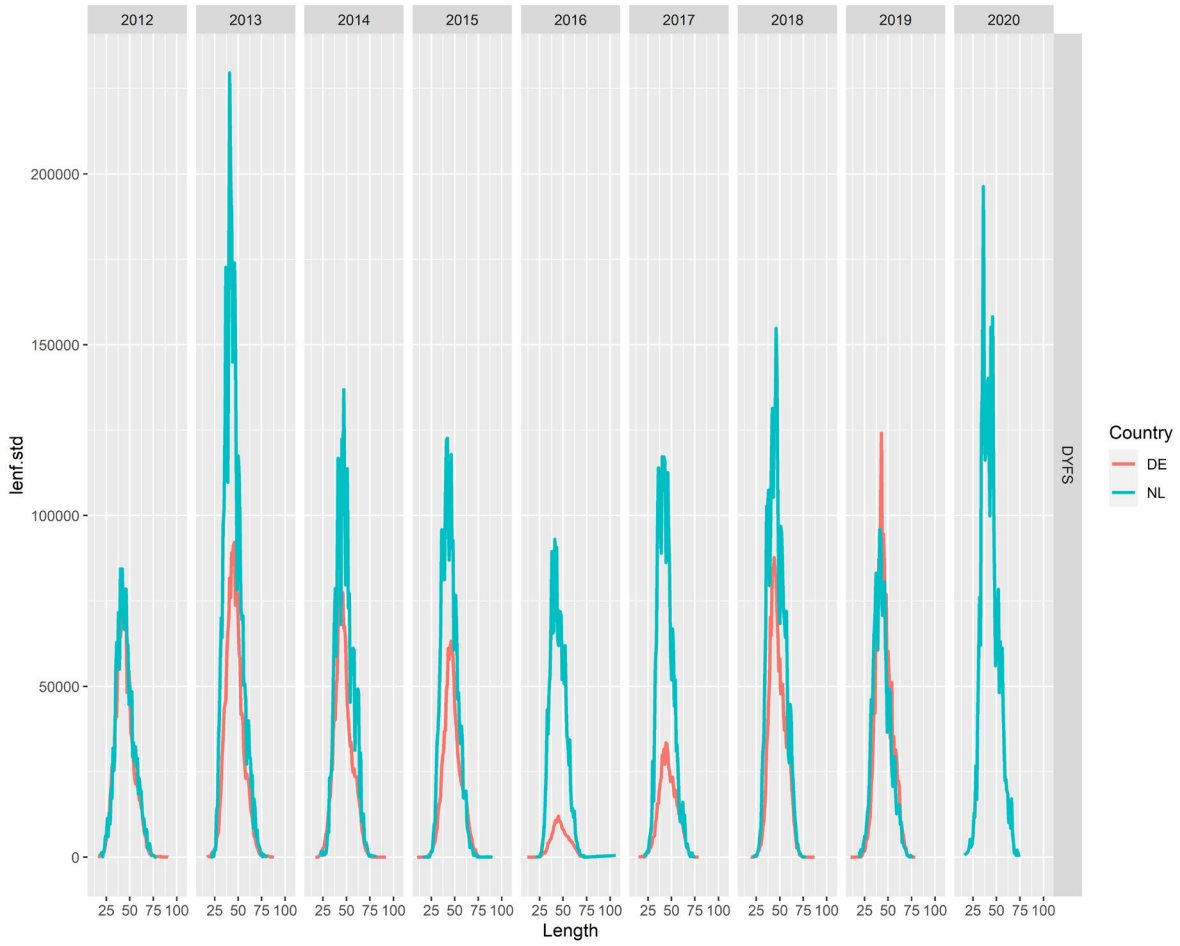

Figure 8.1.8: Length frequencies of shrimp from the DYFS for the years 2012-2020. The numbers are raised to the catch and standardized by swept area. The colours show the different countries (blue = Netherlands, NE; red = Germany, DE).

Annex 8.2: Species consistency

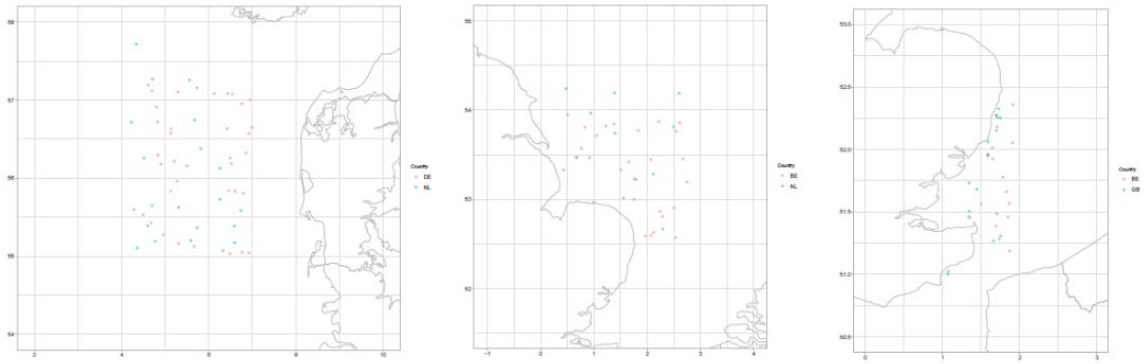

Figure 8.2.1: Overlapping hauls compared for species consistency across different offshore BTS.

Table 8.2.1: Example of total number caught per species table to compare species consistency in overlapping BTS survey areas (first 12 lines displayed). NA = not recorded.

Scientific name	NL	DE	Type
Acanthocardia echinata	19	86	Bivalvia
Actiniaria	NA	3	Cnidaria / Anthozoa
Aequipecten opercularis	45	33	Bivalvia
Agonus cataphractus	63	73	Osteichthyes
Alcyonidium diaphanum	179	NA	Cnidaria / Anthozoa
Alcyonidium gelatinosum	NA	2571	Cnidaria / Anthozoa
Alcyonium digitatum	46	108	Cnidaria / Anthozoa
Alloteuthis subulata	NA	1	Cephalopoda
Amblyraja radiata	28	68	Chondrichthyes
Ammodytes	39	NA	Osteichthyes
Ammodytes marinus	NA	1	Osteichthyes
Aphrodita aculeata	2381	2160	Polychaeta

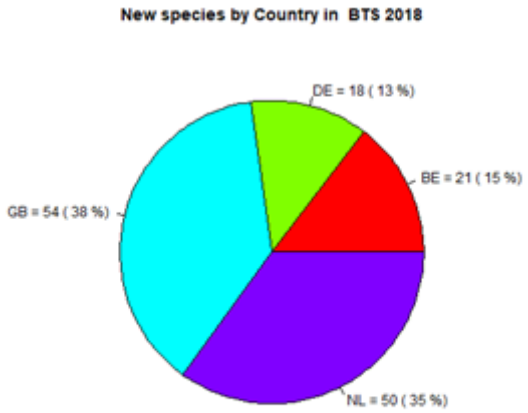

Figure 8.2.2: Pie chart showing the percentage of new species by country in BTS 2018 survey respect to 2017. The percentage is calculated on the total number of new species found in 2018.

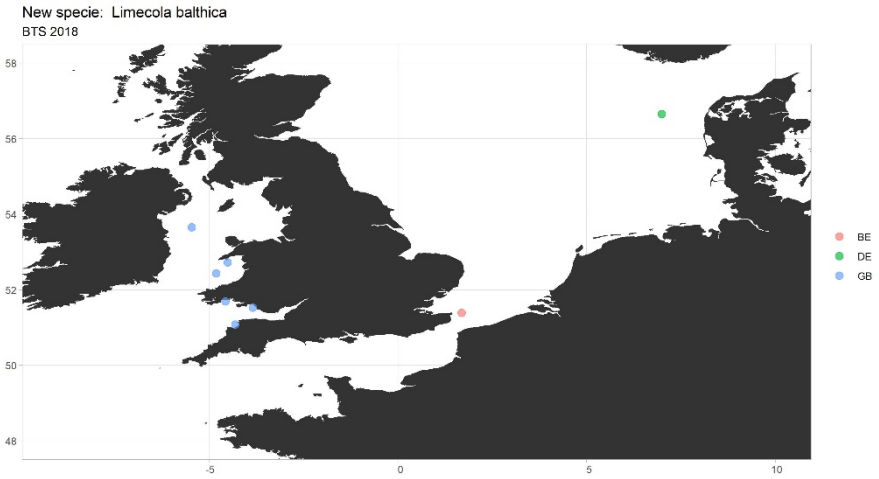

Figure 8.2.3: Map of new species occurrence by country for *Limecola balthica* in 2018 BTS survey.

Annex 9: Information on inshore beam trawl surveys

Country	Netherlands (SNS)	Netherlands (DYFS)			Belgium (DYFS)
Geographical area	Scheveningen (NL) to Esbjerg (DK)	Wadden Sea	Scheldt Estuary	Dutch coast to Danish coast	Belgian Coast
Ship	Tridens / Isis	Stern / Waddenzee	Luctor ##	Isis / Beukels / WR17 / GO29	Simon Stevin #
ship size (m)	73m / 28m	21m / 21m	34m	± 28m	36m
Date started	1969	1970	1970	1970	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
Usual Start date	12 Sept	29 Aug	5 Sept	26 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	7 within 2 weeks
Beam trawl type	6m beam trawl	3m shrimp trawl	3m shrimp trawl	6m shrimp trawl	6m shrimp trawl
Tickler Chains	4	1	1	1	0
Mesh size net	80mm	35mm	35mm	35mm	40mm
Mesh size codend	40mm	20mm	20mm	20mm	22mm
Speed fished	3.5–4 knots	3 knots	3 knots	3 knots	3.5 knots
Time Fished	15 min	15 min	15 min	15 min	30 min
Approx. number of stations per year	55	120	80	100	33

Target species	0– 4 group sole and plaice	0–1 group sole and plaice, *Crangon crangon*	0–1 group sole and plaice, *Crangon crangon*	0–1 group sole and plaice, *Crangon crangon*	0–2 group sole and plaice, *Crangon crangon*
Catch rate and LF distribution	All fish species	All fish species *Crangon*	All fish species *Crangon*	All fish species *Crangon*	Commercial fish species; *Crangon crangon* (1973–92, 2004–05)
Catch rate	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)	Epibenthos (quantity)	*Crangon crangon* (weight)
Age data for plaice and sole	All years	All years	All years	All years	Since 2018

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