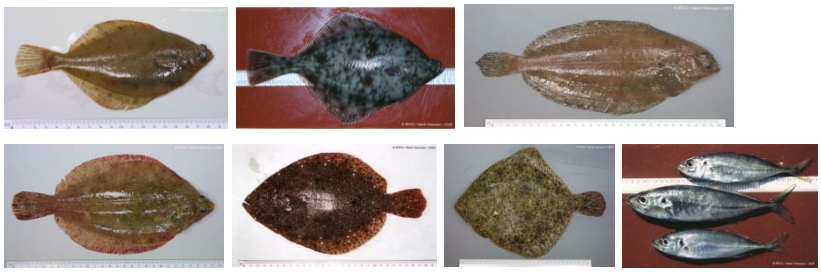
Data evaluation of data limited stocks: Dab, Flounder, Witch, Lemon Sole, Brill, Turbot and Horse mackerel

Tessa van der Hammen & Jan Jaap Poos

Report number C110/12



IMARES Wageningen UR

(IMARES - Institute for Marine Resources & Ecosystem Studies)

Client: Ministry of EL&I
Attn. Henk Offringa
PO box 20401
2500 EK Den Haag

BAS code: 12.04.001.036

Publication date: 10 oktober 2012

IMARES WAGENINGEN UR

IMARES is:

- an independent, objective and authoritative institute that provides knowledge necessary for an integrated sustainable protection, exploitation and spatial use of the sea and coastal zones;
- an institute that provides knowledge necessary for an integrated sustainable protection, exploitation and spatial use of the sea and coastal zones;
- a key, proactive player in national and international marine networks (including ICES and EFARO).

P.O. Box 68	P.O. Box 77	P.O. Box 57	P.O. Box 167
1970 AB IJmuiden	4400 AB Yerseke	1780 AB Den Helder	1790 AD Den Burg Texel
Phone: +31 (0)317 48 09 00	Phone: +31 (0)317 48 09 00	Phone: +31 (0)317 48 09 00	Phone: +31 (0)317 48 09 00
Fax: +31 (0)317 48 73 26	Fax: +31 (0)317 48 73 59	Fax: +31 (0)223 63 06 87	Fax: +31 (0)317 48 73 62
E-Mail: imares@wur.nl	E-Mail: imares@wur.nl	E-Mail: imares@wur.nl	E-Mail: imares@wur.nl
www.imares.wur.nl	www.imares.wur.nl	www.imares.wur.nl	www.imares.wur.nl

A_4_3_2-V12.3

Contents

Summary

Several commercially important demersal fish stocks for the North Sea fisheries are classified by ICES (International Council for the Exploration of the Sea) as "data limited" stocks, which are stocks for which the data are insufficient to perform a full analytical assessment and forecast (ICES 2012b). Until 2012 for most of these 'data-limited' stocks , there was no quantitative management advice that is based on the status of the stock, because the status is unknown.

In this report catch per unit of effort (CPUE) indices, spatial distributions, length frequencies and age-length relationships are analysed for 7 species that have commercial importance for Dutch fisheries: dab, flounder, witch flounder, lemon sole, brill, turbot and North Sea horse mackerel.

The data in this report may be used in future for catch advice by the International Council for Exploration of the Sea (ICES).

1 Introduction

Several commercially important fish stocks for the North Sea fisheries are classified as "data limited" stocks in the light of the EU policy paper on fisheries management (17 May 2010, COM(2010) 241). For stocks in this category, there is no STECF (Scientific, technical and economic committee for fisheries) management advice, due to the unknown status of the stocks. The reason for this is that the data and information available to perform analytical stock assessments are highly uncertain or lacking. For species of these stocks, the European Commission adjusts the TAC (Total Allowable Catch) towards recent catch levels, but the TAC should not be changed by more than 15% per year. Alternatively, if Member States can develop an implementation plan to provide advice within a short time, the European Commission can set the TAC on the basis of that plan.

Table 1-1 Data limited stocks of economic importance for the Netherlands

Area	*Species*	*ICES advice for 2012*
North Sea	Turbot	Do not increase catches
	Brill	Do not increase catches
	Dab	Do not increase catches
	Flounder	Do not increase catches
	Lemon sole	Do not increase catches
	Witch flounder	Reduce catches
	Horse mackerel	Reduce catches

2 Assignment

The Ministry of EL&I asked to collate and analyse the data on these species in order to provide an assessment of the status of the category 11 species (Table 1-1). These analyses can be used by the Ministry for giving advice. Also, the analyses can be used by ICES for its advice on these data limited stocks.

3 Methods

Several data sources were used in the analyses described below. This included data from 2 surveys and data from the commercial fleet from EU logbooks and from market sampling. Each data source is shortly described below.

3.1 Survey Data

BTS

An extensive description of the Beam Trawl Survey (BTS) can be found at http://datras.ices.dk/Documents/Manuals/Manuals.aspx. In short, the Dutch offshore beam trawl survey started in 1985 by the research vessel "Isis". The main goal of the survey was to create fisheries independent indices for plaice and sole in the South-eastern North Sea to be used in the ICES North Sea demersal working group (WGNSSK). Because the focus of the survey was on flatfish, the gear used was the beam trawl. Although the first focus was on plaice and sole, all fish species were measured. Otoliths have been collected for plaice, sole, dab, brill, turbot and cod since 1985. These otoliths can be used to determine the age of fish. Some otoliths are stored and the ages have not been read (see Appendix D for the number of otolith age readings per species per year). In 1996, the research vessel "Tridens" started carrying out a beam trawl survey in the Central North Sea (ICES 2009: WGBEAM Manual). Figure 3-1 shows the covered area of the BTS for both research vessels and the number of years with at least one haul in a specific rectangle.

The BTS survey data used in this report were extracted from the ICES database DATRAS (http://datras.ices.dk/Data_products). This DATRAS database is publicly available. However, not all biological data such as age, weight and length measurements were added to the DATRAS database. Therefore we used data from IMARES Frisbe database for analyses on biological data.

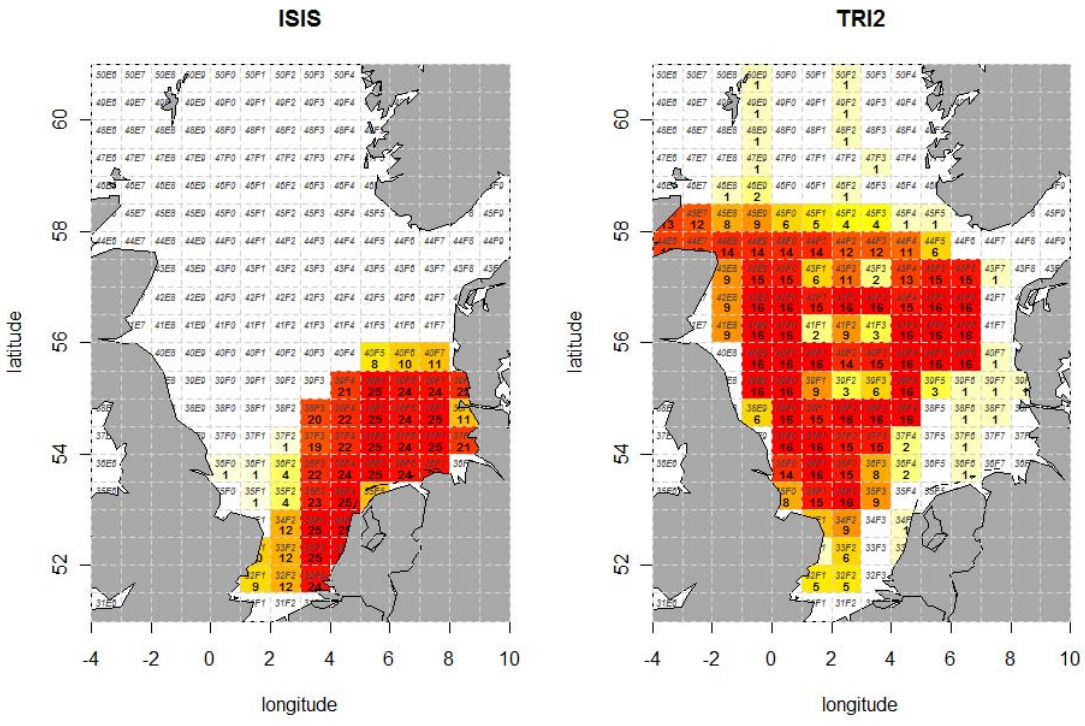


Figure 3-1 Number of years sampled by ICES rectangle in the BTS. Left: research vessel Isis, right: research vessel Tridens. Source: DATRAS

IBTS Q1 and Q3

The North Sea International Bottom Trawl survey (IBTS) survey aims to collect data on the distribution, relative abundance and biological information on a range of round- and flatfish species in ICES area IIIa and IV and VIId. The survey is executed during day-time and a bottom trawl is used (GOV: *Grand Ouverture Verticale*). A CTD (conductivity, temperature and depth) sampler was deployed at most trawl stations to collect temperature and salinity profiles. Age data are collected for cod, haddock, whiting, saithe, norway pout, herring, mackerel, and sprat, and a number of additional species (Appendix B). The survey takes place in quarter 1 (IBTS Q1) and quarter 3 (IBTS Q3). At present, seven countries participate in the quarter 1 survey: Sweden, Denmark, Norway, Scotland, France, Netherlands and Germany. Six countries participate in the quarter 3 survey: Denmark, Germany, Sweden, Norway, England and Scotland (ICES 2011, IBTSWG). The IBTS covers most of the North sea (Figure 3-2). IBTS survey data used in this report were extracted from the ICES database DATRAS (http://datras.ices.dk/Data_products). In quarter 1 most rectangles were sampled and present in DATRAS for 30-45 years, in quarter 3 most rectangles were sampled for 20 years (Figure 3-2, ICES 2011, IBTSWG). Age, weight and length measurements were not added to the DATRAS database by most countries.

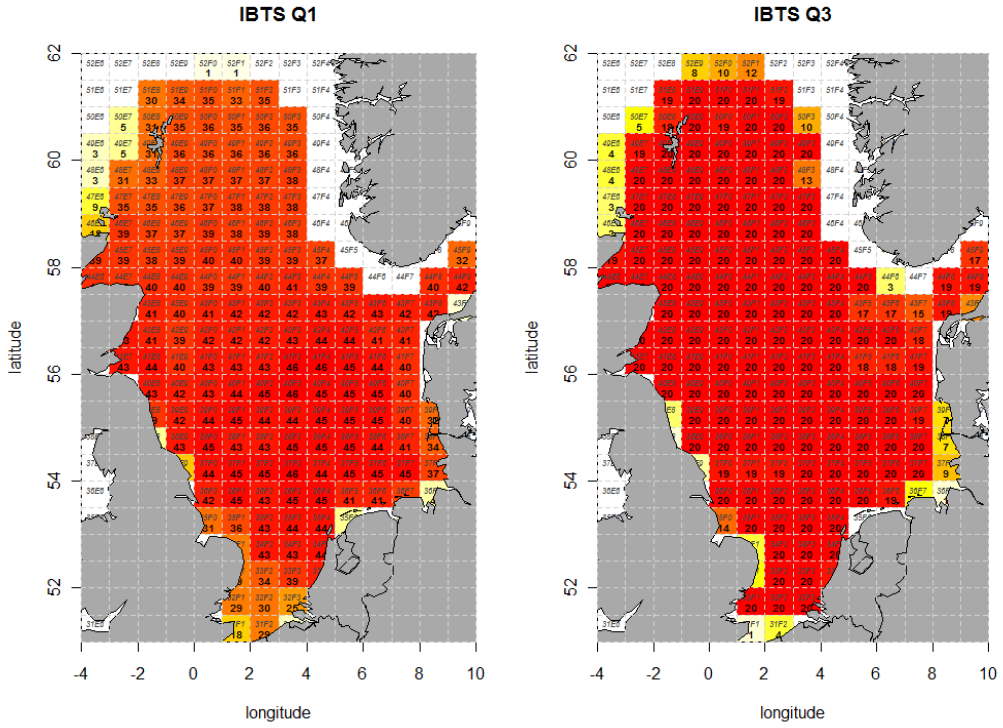


Figure 3-2 Number of years sampled by ICES rectangle by the research vessels IBTS quarter 1 (left) and 3 (right). Source: DATRAS

3.1.1 CPUE estimation

BTS

The CPUE is calculated as the number per hectare. Isis rectangles were included in the analysis only if no more than 5 (out of 25) years were missing in the time series (see Appendix A). Tridens rectangles were included if no more than 3 (out of 16) years were missing. For each year and vessel, the hauls were first averaged per selected ICES rectangle and consequently over the rectangles.

IBTS

The CPUE is calculated as the number per hour. ICES rectangles were included in the analysis only if no more than 3 (out of 20) years were missing in the time series (see Appendix A). For each year the hauls were first averaged per selected ICES rectangle and consequently over the rectangles.

3.2 Commercial fisheries data

Landings and effort data from the commercial fleet were obtained from the EU logbooks; market category composition of landings was obtained from the auction data (sale slips); and a characterisation of the relation between size and age was derived from age-length sampling data. The methods for deriving landings per unit effort indices from the commercial data are described by Van der Hammen et al. (2011) in a report on data availability for the evaluation of stock status of species without catch advice.

EU logbook data

Official EU logbook data of the entire Dutch fleet are maintained by the NVWA (formerly known as the General Inspection Service, AID). IMARES has access to these logbooks and stores the data in a database called VISSTAT. EU logbook data contain information on:

- landings (kg): by vessel, trip, ICES statistical rectangle and species;
- effort (days absent from port): by vessel, trip and ICES statistical rectangle, calculated from trip departure and arrival time; and
- vessel information: length, engine power and gear used.

Logbook data are available of the entire Dutch fishing fleet and of foreign vessels landing their catches in the Netherlands.

Auction data: landings by market category

Auction data cover both the total Dutch fishing fleet and foreign vessels landing their catches on Dutch auctions. These data are also stored in VISSTAT and contain information on:

- landings by market category (kg): by vessel, trip (landing date) and species

Market sampling data

In the IMARES market sampling data on length, age, sex and weight are collected for several commercially important species. This is often done on an irregular basis and for several species many years are missing (see Appendix B). In recent years, sampling was executed more regularly.

Discard sampling

In the IMARES discard sampling, data on length, age, sex and weight are collected for several commercially important species (see Appendix B).

4 Dab

Dab (*Limanda limanda*) is an abundant, widespread demersal species on the Northeast Atlantic shelf and distributed from the Bay of Biscay to Iceland and Norway; including the Barents Sea and the Baltic. Its centre of distribution in the North Sea is located in the southern North Sea (Lozán 1988; Daan et al. 1990, ICES 2010). Their diet consists mainly of crustaceans and echinoderms (Piet et al. 1998).

4.1 BTS

The BTS Isis and Tridens surveys in autumn catch substantial numbers of dab as a result of it being a very abundant species, and the BTS gear being designed to catch flatfish (Figure 4-1). There is considerable variability in the numbers of dab per hectare in BTS hauls for both vessels (Figure 4-1). The average BTS Isis CPUE is higher than the average CPUE in the BTS Tridens for almost all years in the dataset (Figure 4-2). A combined index for the two survey index series is available since 1996. From 1996 onwards, the combined index decreased until 2005, and increased since. In the BTS Tridens and the combined time-series, the index in 2011 has the highest observed value.

The BTS survey catches of dab are mainly done in the South-eastern part of the North Sea (Figure 4-3). In addition, dab is caught in the Moray Firth. As a result, most of the North-eastern hauls of the BTS Tridens catch less dab (< 100 n/ha).

Plotting the spatial distribution of the CPUE series for the BTS surveys since 1995 reveals no distinctive changes over time (Figure 4-4).

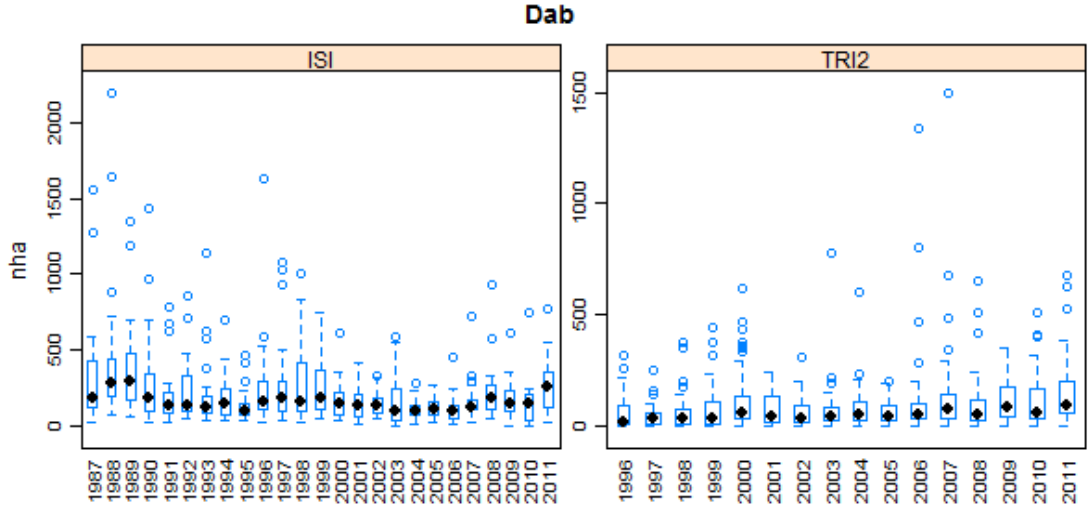


Figure 4-1 box and whisker plot of number of dab per hectare per year and ICES rectangle for the research vessels Isis (left) and Tridens (right). The plot shows the lower quartile (underside of the small blue boxes), median (black dot), upper quartile (upper side of the blue box). The whiskers are defined as the greatest value of the data points excluding outliers. The blue dots are outliers, which are data points that are no more than 1.5 times the length of the blue box away from the box.

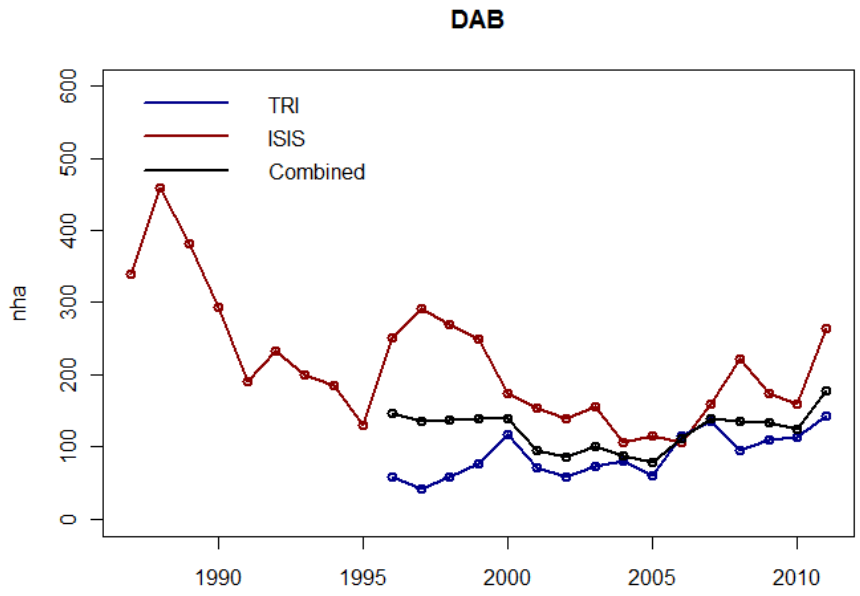


Figure 4-2 Dab CPUE series: number caught per hectare. 'Combined' includes both surveys.

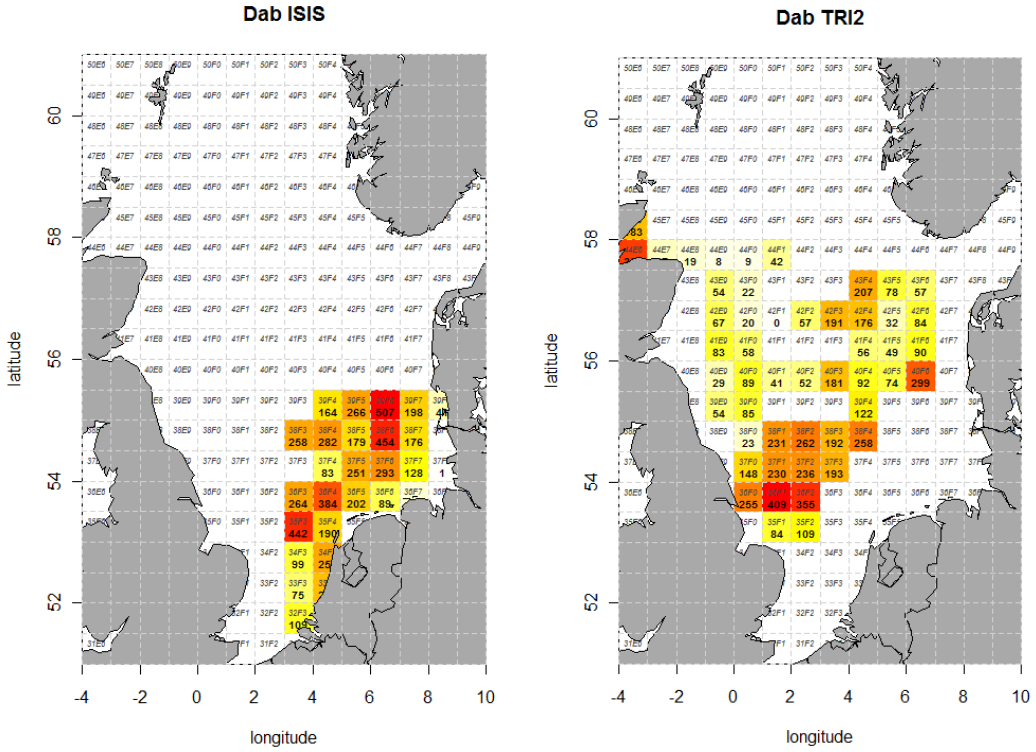


Figure 4-3 Mean CPUE (nha) for the period 2009-2011 per rectangle and vessel. Left: Isis, right: Tridens.

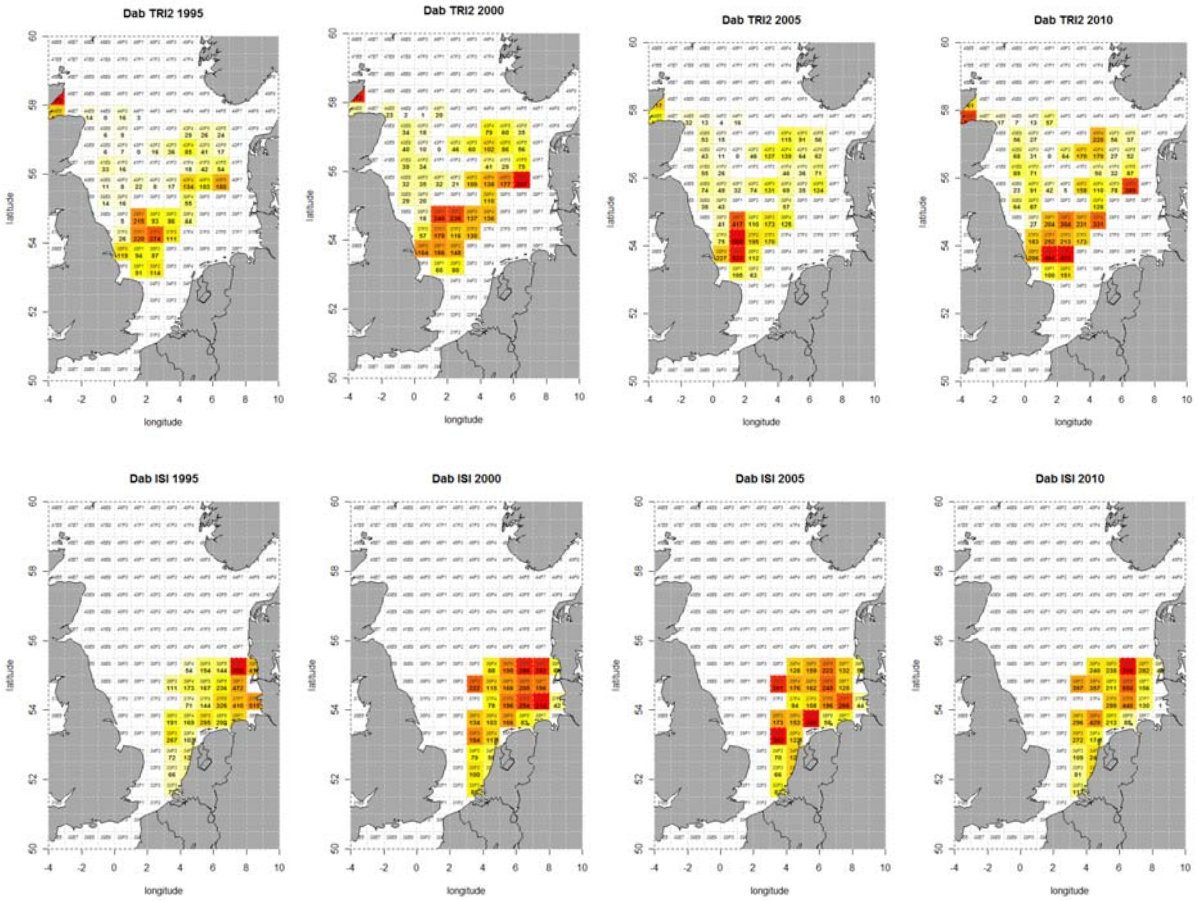


Figure 4-4 mean CPUE (number per hectare) for 5 year periods. Time periods: 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

4.1.1 Length distribution and growth

The main length classes caught in the BTS surveys are between 8 and 25 cm. Visual inspection does not reveal a shift in length frequency distribution in the period from 1987-2011 (Figure 4-6).

The relationship between the length and weight of a fish is used for two main purposes. First, the relationship is used to predict the weight from the length of a fish. Second, the parameter estimates of the relationship for a sub-selection of fish can be compared to average parameters or parameter estimates from previous years, or parameter estimates among groups of fish to identify the relative condition of the population.

Length-weight relationships are estimated by fitting the equation $W=a*L^b$ to the data, where W is weight, L is length and a and b are constant parameters that differ per species.

The length-weight relationship for dab is very similar for males and females (Figure 4-6). The combined estimate for a in the length-weight relationship is 0.0095, and the estimate for b is 3.01 (Figure 4-6, Appendix C).

Growth (age length relationships) are estimated by fitting the Von Bertalanffy growth curve, $L = L_{\underline{inf}} (1\text{-}e^{-K(t-t0)})$ to the age-length data, where L is length, t is age, $L_{\underline{inf}}$ is the ultimate length, K is the growth coefficient and t_0 is the time at which in theory the fish has a weight of 0.

For dab, as is common in flatfish species, the growth of the two sexes is different. The females grow larger than the males, with L_{inf} for females being 25.9 cm and L_{inf} for males being 21.5 cm (Figure 4-6, Appendix C).

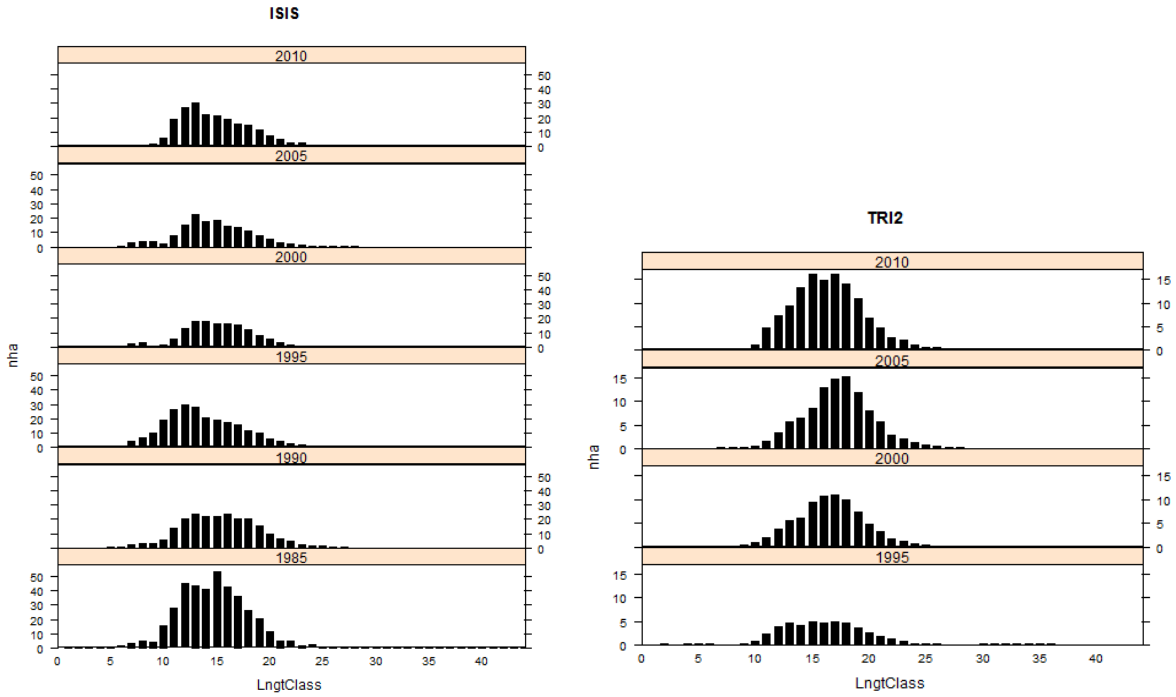


Figure 4-5 CPUE (number per hectare) per length class over time. Time periods: 1985 = 1987-1989, 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

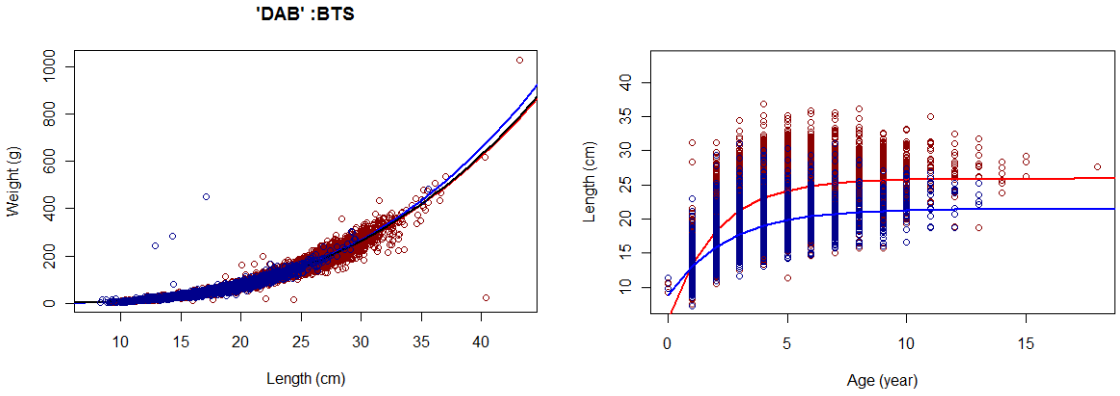


Figure 4-6 Left: Length Weight relationship for DAB (source FRISBE-BTS). Red females (a=0.0103, b=2.98), blue: males (a=0.0071, b=3.10). Black line: combined (a=0.0095, b=3.01). Right: Length age relationship for DAB (source FRISBE-BTS). Red: females (*Linf*=25.89, *K*= 0.50, *t0*=-0.46), blue: males (*Linf=21.48, K= 0.41, t0=-1.31*). Lines: von Bertalanffy fit.

4.2 Commercial Data

Almost all (~90%) dab is landed in only one market category (2, 23-30 cm) and for that reason is not sorted (Appendix D, Table D-1, Table D-2). Therefore, for this document no distinction between market categories was made. Tables of the data are listed in Appendix D.

4.2.1 Fishing Effort

Engine power has an effect on LPUE. With higher engine power, a vessel can trawl heavier gear or fish at higher speed, which likely results in higher landing rates. The majority of the Dutch beam trawl fleet consists of vessels with engine powers around 1471 kW (=2000 hp). The analyses have been restricted to the large cutters with engine power above 221 kW. To correct the effort for engine power, data were standardized to a vessel with a 1471 kW engine by applying the following relationship (Rijnsdorp et al. 2006, Quirijns et al. 2008):

$$Effort_{(1471)} = \left(Effort * kW^{\beta} / 1471^{\beta}\right)$$

where *L* are landings in kilograms; *Effort* is effort in days at sea; *kW* is engine power in kW; and β is a constant that varies between species. As the value of β for dab is unknown, β is set at 1.

Figure 4-7 shows that effort of TBB > 221 kW has more than halved in the period 1995 -2011. This decrease is the result of fisheries management, low profitability in the fleet and decommissioning. In the last 4 years, the level of fishing effort has remained relatively stable at a level of approximately 16 000 days at sea, adjusted to the fishing efficiency of a 1471 kW vessel.

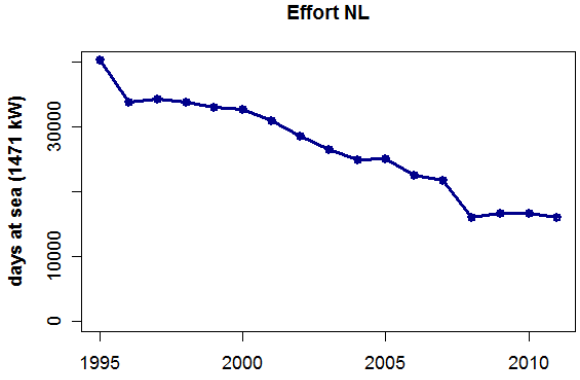


Figure 4-7 "Adjusted" Effort (days at sea per 1471 kW vessel) over time by Dutch large beam trawlers (< 221 kW).

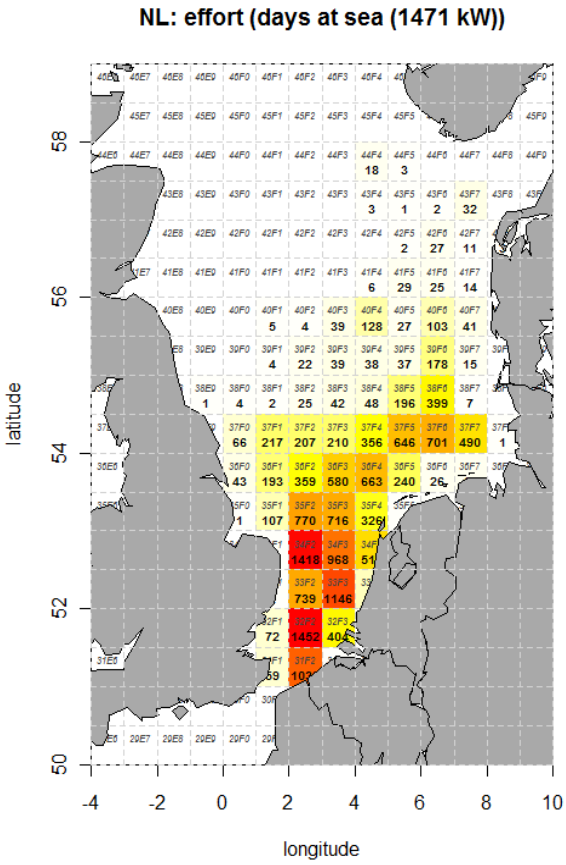


Figure 4-8 Annual fishing effort by the Dutch large beam trawling fleet operating in the North Sea. Source: Visstat.

4.2.2 Landings

Dab landings fluctuate between 6086 tonnes in 1999 and 2856 tonnes in 2009 (Figure 4-9).

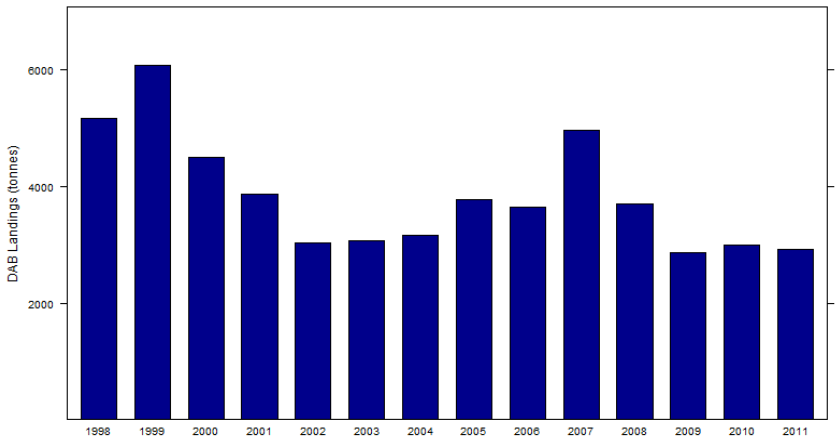


Figure 4-9 Dab landings by Dutch trawlers (TBB > 221 kW)

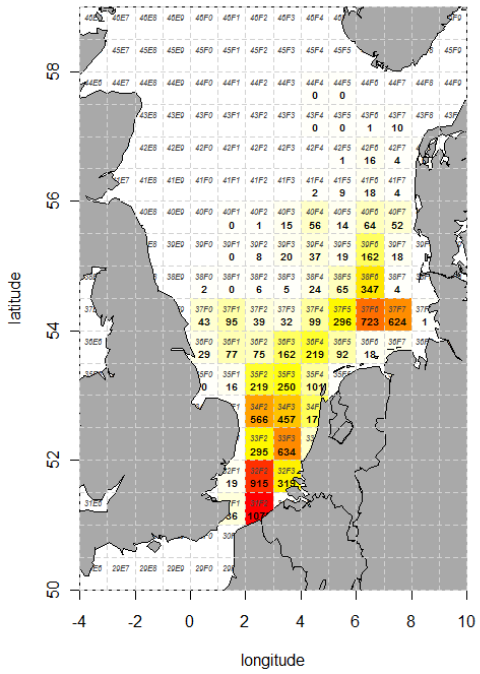


Figure 4-10 Average Dab landings (tonnes) per year per ICES rectangle (average 2009-2011) for large Dutch beam trawlers (>221 kW).

4.2.3 LPUE

This paragraph describes trends in Landings per Unit Effort (LPUE). Data from large Dutch trawlers are included. In the Dutch fleet average LPUE of dab is relatively stable since 1998, fluctuating around 175 kg per day at sea (Figure 4-11). No real interpretable cohort signal can be found in the age structured LPUE time series. (Figure 4-12).

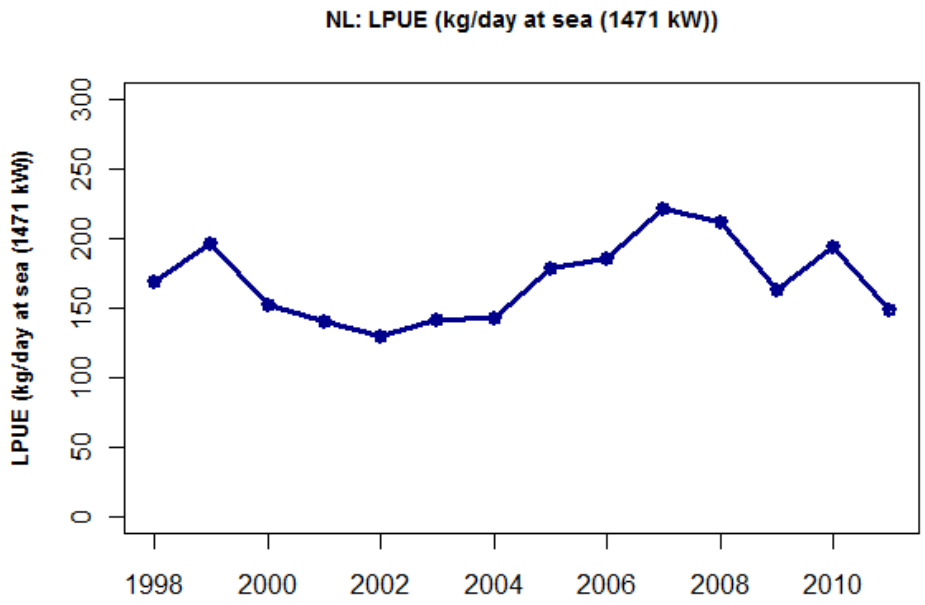


Figure 4-11 Dab LPUE of Dutch beam trawlers. Source: VISSTAT.

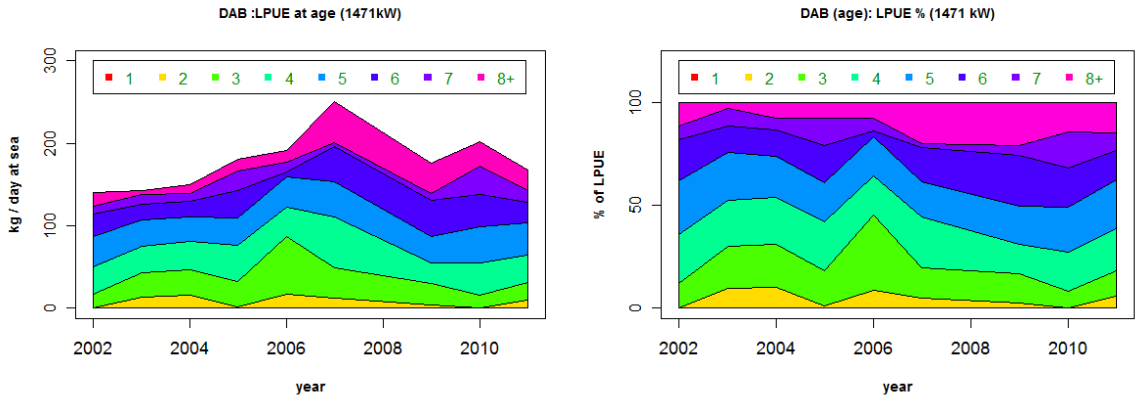


Figure 4-12 Age composition of Dab LPUE. Left in kg per day, right in percentage. Age and length data from 2008 are missing, because in 2008 no age sampling (market sampling) was done (Appendix B, Table B1).

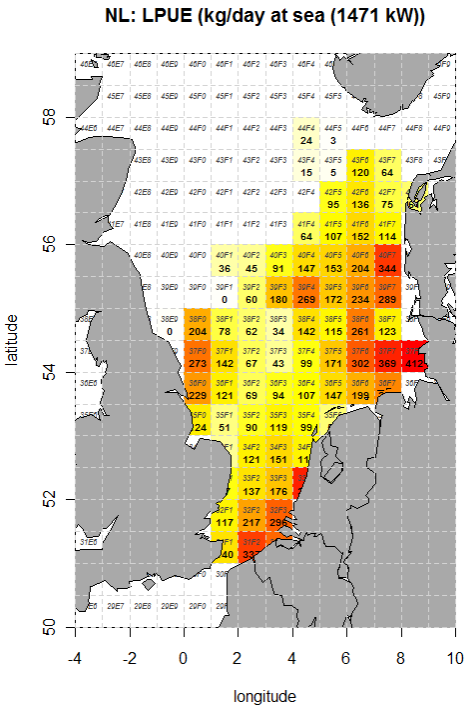


Figure 4-13 Mean LPUE per ICES rectangle (average 2009-2011). Source: Visstat

5 European Flounder

European Flounder (*Platichthys flesus*) occurs in the Eastern Atlantic in coastal and brackish waters including the white sea, black sea and the Mediterranean Sea. the smaller size classes of flounder feed mainly on polychaetes, the larger size classes feed on crustaceans (Piet et al 1998).

5.1 BTS

Flounder occurs mainly in coastal areas. For this reason it is caught regularly by the BTS Isis, whereas the BTS Tridens barely catches flounder (Figure 5-2). Data from the Isis show considerable variability in CPUE, ranging from 0 to over 60 individuals per hectare (Figure 5-1, the black dots show the medians and the blue dots show the outliers). The CPUE index for the Isis is available since 1987 and shows high numbers per hectare in the last two years (Figure 5-2). The average catch probability over the time series by the Isis is 20%, which means that in one out of five hauls flounder is caught. The catch probability shows a gradual increase since 1987 (Figure 5-2).

Plotting the spatial distribution of the CPUE series for the BTS Isis surveys shows high variability over time, but does not show an obvious change in the spatial distribution (Figure 5-3).

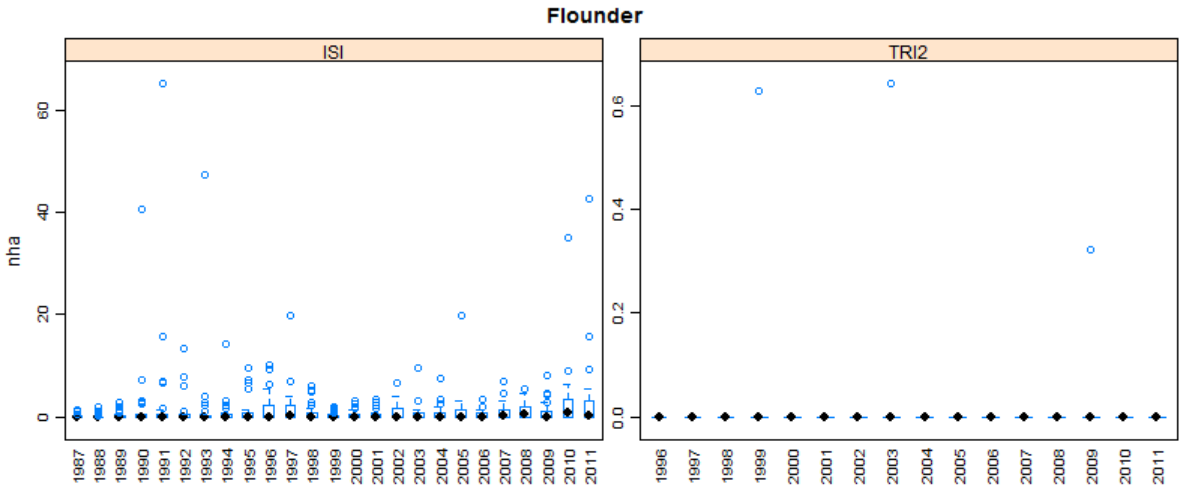


Figure 5-1 box and whisker plot of number of flounder per hectare per year and ICES rectangle for the research vessels Isis (left) and Tridens (right). The plot shows the lower quartile (underside of the small blue boxes), median (black dot), upper quartile (upper side of the blue box). The whiskers are defined as the greatest value of the data points excluding outliers. The blue dots are outliers, which are data points that are no more than 1.5 times the length of the blue box away from the box.

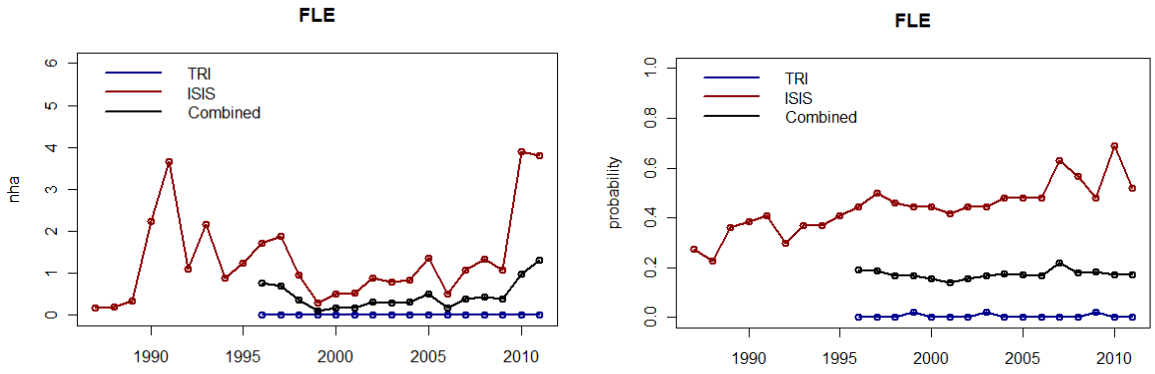


Figure 5-2 Flounder CPUE series. Left: number caught per hectare. Right: catch probability: the chance that a flounder is caught. For each year and survey, the hauls were first averaged per selected ICES rectangle and consequently over the rectangles. 'Combined' includes both surveys.

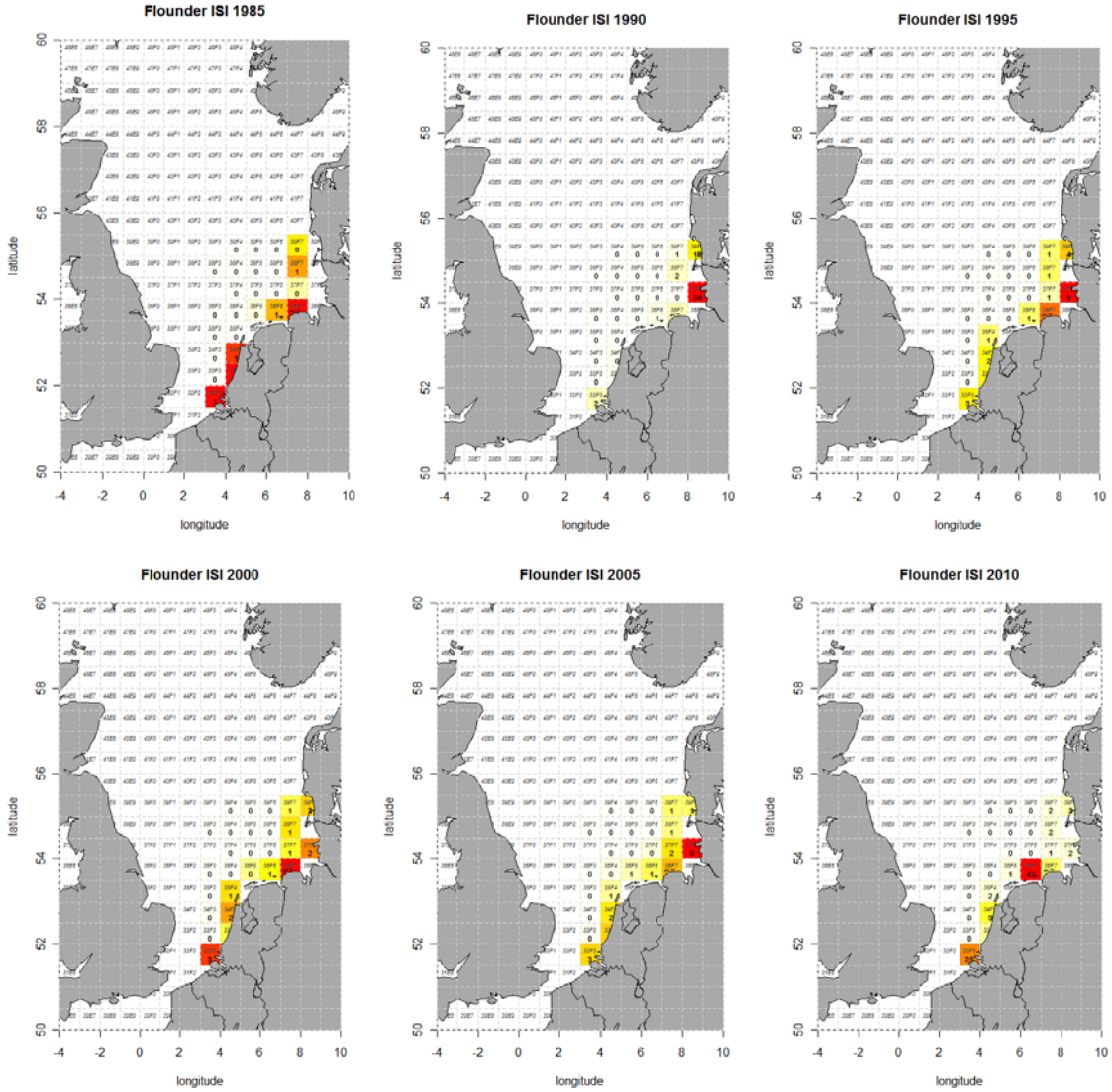


Figure 5-3 mean CPUE (number per hectare) for 5 year periods. Time periods: 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011.

5.1.1 Length distribution and growth

Especially in the period around 2010, many small individuals of 3 to 8 cm were caught by the Isis. This can bean indication of strong recruitment. Overall, the length distribution is variable and does not show a clear trend (Figure 5-4).

The length-weight relationship is similar for males and females (Figure 5-5). The combined estimate for *a* in the LW relationship $W=aL^b$ is 0.012, and the estimate for *b* is 2.98 (Figure 5-5). The growth of the two sexes is different, as is common in flatfish species. The females grow larger than the males, with the estimated L_{inf} for females being 44.9 cm and L_{inf} for males 35.7 cm (Figure 5-5, Appendix C). Do note that otolith sampling and reading in the BTS started only recently, resulting in a small amount of data points (Figure 5-5). The extreme difference in estimated length for small individuals is likely the result of a lack of data, rather than differences in growth.

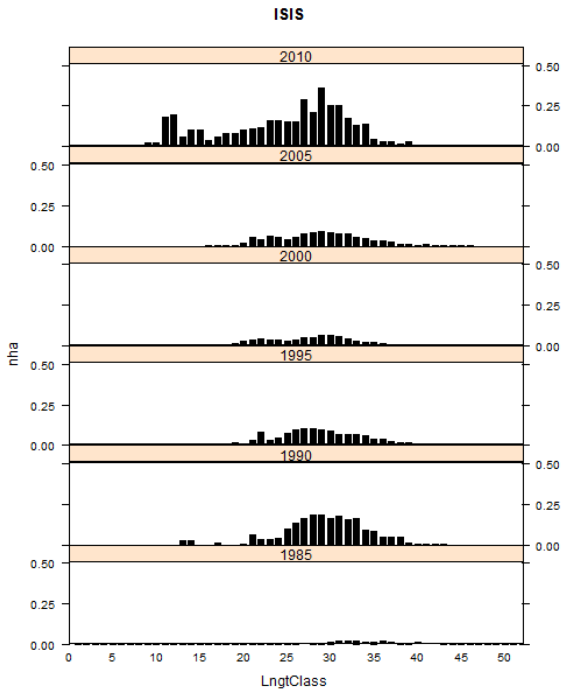


Figure 5-4 CPUE (number per hectare) per length class over time. Left: equal y-axis scales, right: variable scales. Time periods: 1985 = 1987-1989, 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

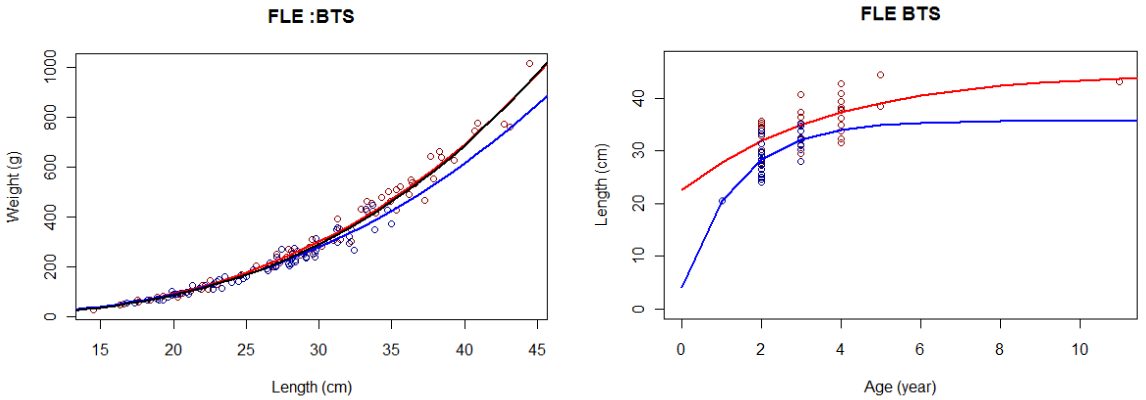


Figure 5-5 Left: Length Weight relationship for European flounder (source FRISBE-BTS). Red: females (a=0.016, b=2.89), blue: males (a=0.024, b=2.75). Black line: combined (a=0.012, b=2.98). Right: Length age relationship for European flounder (source FRISBE-BTS). Red: females (*Linf* = 44.87, *K* = 0.27, *t0* = -2.58), blue: males (*Linf = 35.67 , K = 0.73, t0 = -0.16*). Lines: von Bertalanffy fit.

6 Witch Flounder

Witch flounder (*Glyptocephalus cynoglossus*) is common in the northern North Sea, west of the British Isles, in Icelandic waters and along the North American east coast. This species is mainly found on soft bottoms, mostly clay, but in some cases on clean sandy bottoms (Molander, 1935, in ICES 2012). In the North Sea, witch flounder live at depths between 100 and 200 meters primarily in the Norwegian trench and in the northern parts of the North Sea. The main diet consists of crustaceans, polychaetes, brittle stars and fishes.

6.1 BTS

The BTS Isis catches virtually no witch flounder (Figure 6-1, Figure 6-2). The BTS Tridens survey catches some witch flounder (Figure 6-1, Figure 6-2), mainly in its north-western sampling area (Figure 6-3). The combined survey index fluctuates without a clear trend (Figure 6-2). The spatial distribution of witch flounder shows a an increase in the southern range (ICES rectangles 40F0-40F2) in the last time period (Figure 6-4).

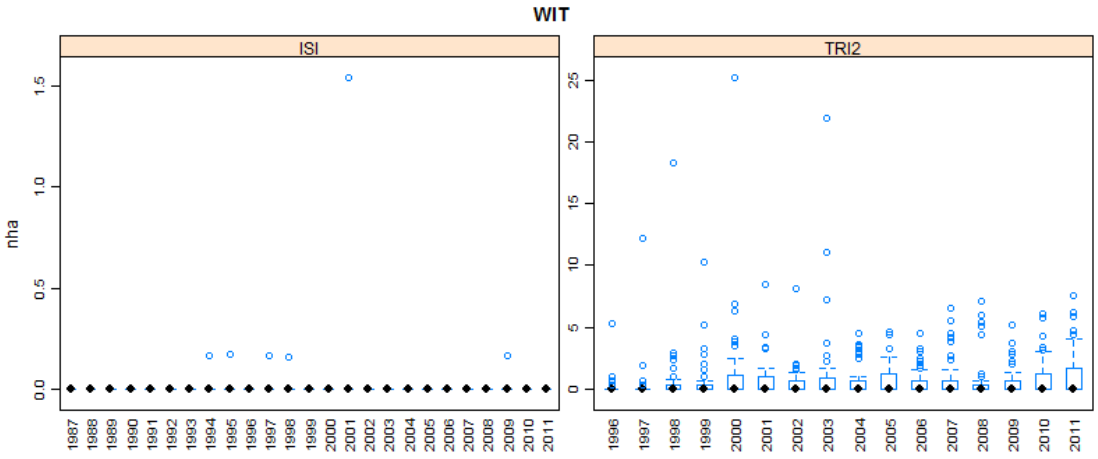


Figure 6-1 box and whisker plot of number of witch flounder per hectare per year and ICES rectangle for the research vessels Isis (left) and Tridens (right).

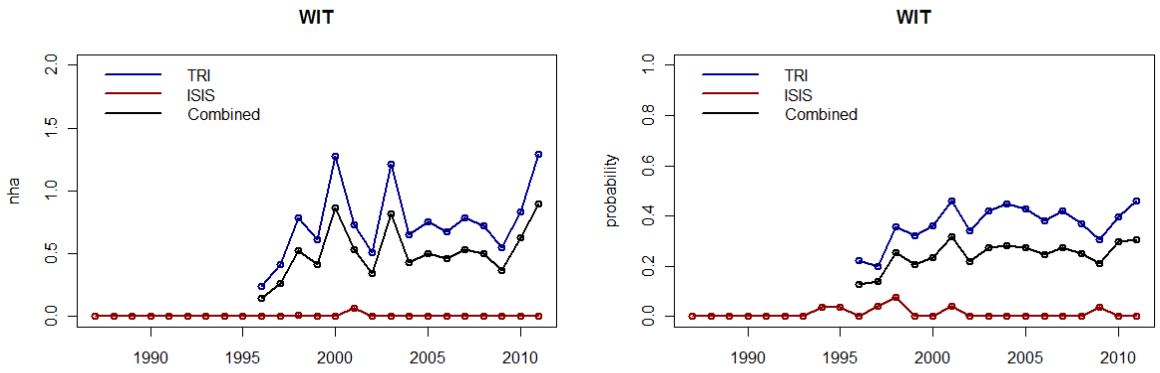


Figure 6-2 Witch flounder CPUE series. Left: number caught per hectare. Right: catch probability: chance that witch flounder is caught in the survey. 'Combined' includes both surveys.

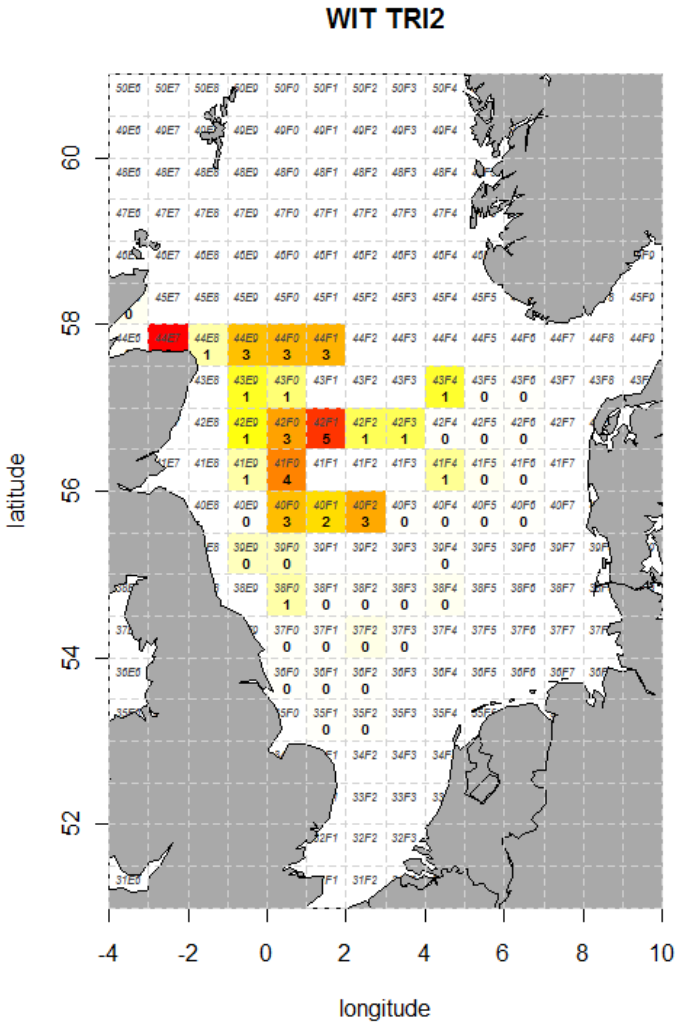


Figure 6-3 Mean CPUE (nha) for the period 2009-2011 per rectangle (Tridens).

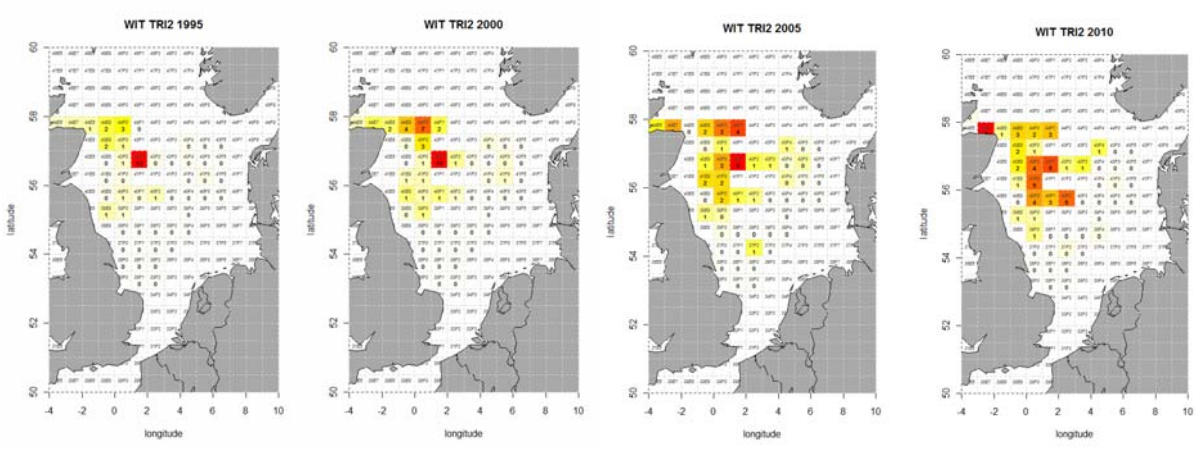


Figure 6-4 mean CPUE (number per hectare) for 5 year periods. Time periods: 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011.

6.1.1 Length and growth

In the period around 1995 and 2000 relatively many small individuals were caught by the Tridens. Overall, the length distribution is variable and does not show a clear trend (Figure 6-5). The length-weight relationship is similar for males and females (Figure 6-6). The combined estimate for *a* in the LW relationship $W=aL^b$ is 0.0020, and the estimate for *b* is 3.33 (Figure 6-6, Appendix C). Otholith sampling and age reading has not been done for witch flounder.

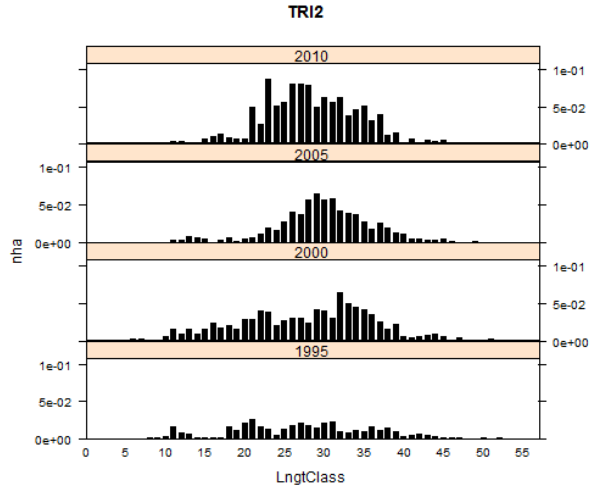


Figure 6-5 CPUE (number per hectare) per length class over time. Time periods: 1985 = 1987-1989, 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011.

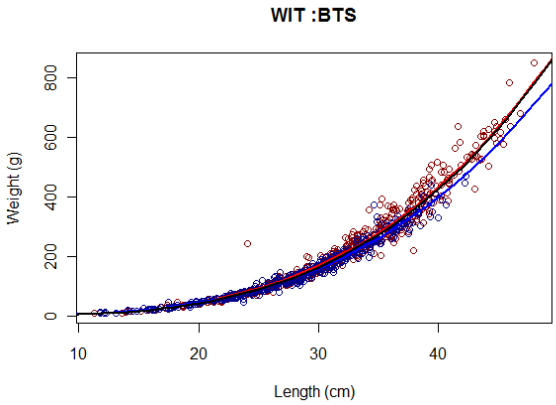


Figure 6-6 Length Weight relationship for witch flounder (source FRISBE-BTS). Red females (*a*=0.0024 , *b*=3.28) , blue: males (*a*=0.0031, *b*=3.19). Black line: combined (*a*=0.0020, *b*=3.33).

7 Lemon Sole

Lemon sole (*Microstomus kitt*) occurs in the Northeast Atlantic from the Bay of Biscay to the White Sea and off Iceland. Lemon sole mainly feeds on polychaetes (Fishbase).

7.1 BTS

Lemon sole is caught frequently by the BTS Isis and BTS Tridens. CPUE ranges between 0 to around 55 individuals per hectare (Figure 7-1). The CPUE index for the Isis shows an moderate increase in lemon sole catches, the BTS Tridens is available since 1996 and shows a stronger increase (Figure 7-1). The probability of catching lemon sole shows similar increasing trends for both the Isis as the Tridens (Figure 7-2). Plotting the spatial distribution of the CPUE series for the BTS surveys indicates an offshore move of the species: both in the BTS-ISIS and the BTS-Tridens (Figure 7-4).

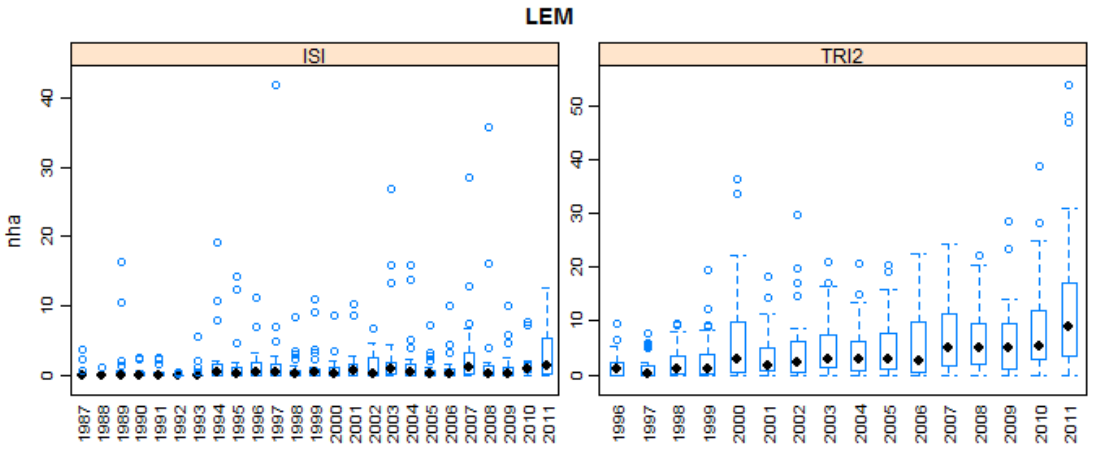


Figure 7-1 box and whisker plot of number of lemon sole per hectare per year and ICES rectangle for the research vessels Isis (left) and Tridens (right).

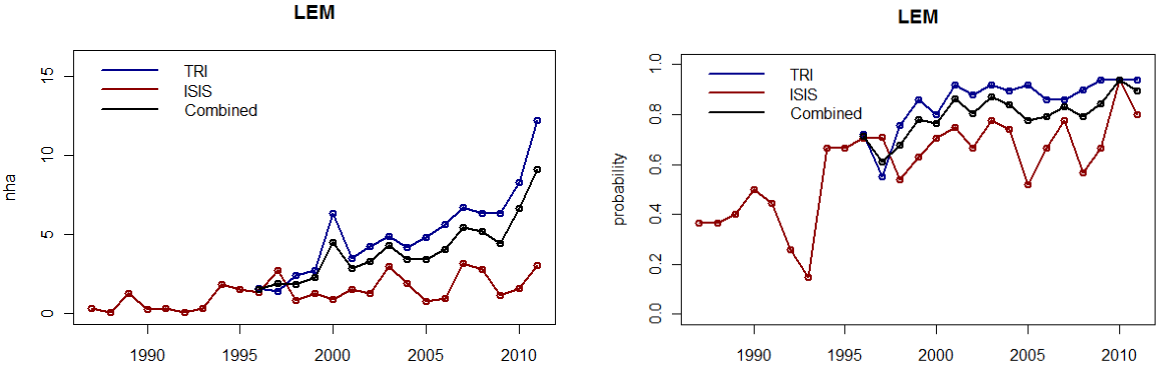


Figure 7-2 Lemon sole CPUE series. Left: number caught per hectare. Right: catch probability. 'Combined' includes both surveys.

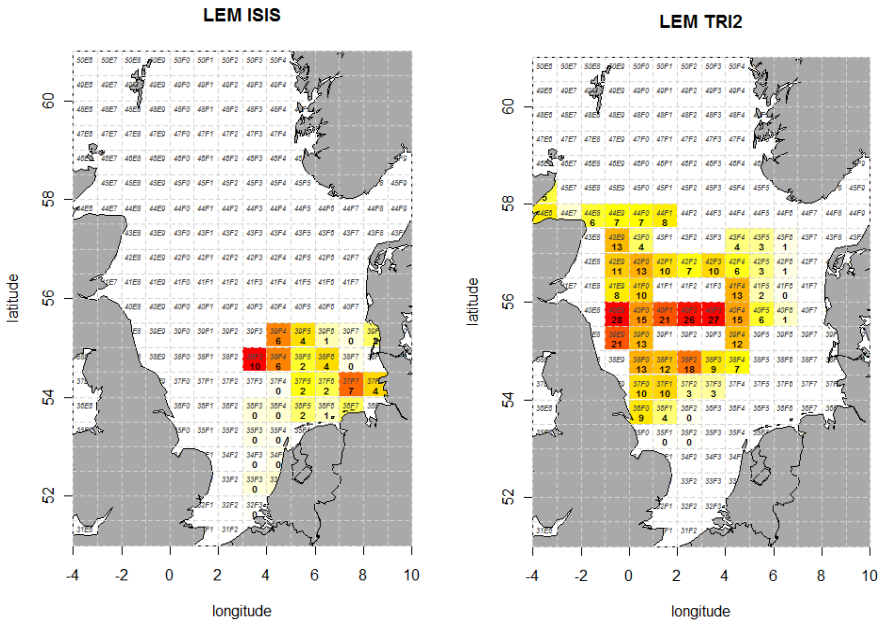


Figure 7-3 Mean CPUE (nha) for the period 2009-2011 per rectangle and vessel. Left: Isis, right: Tridens.

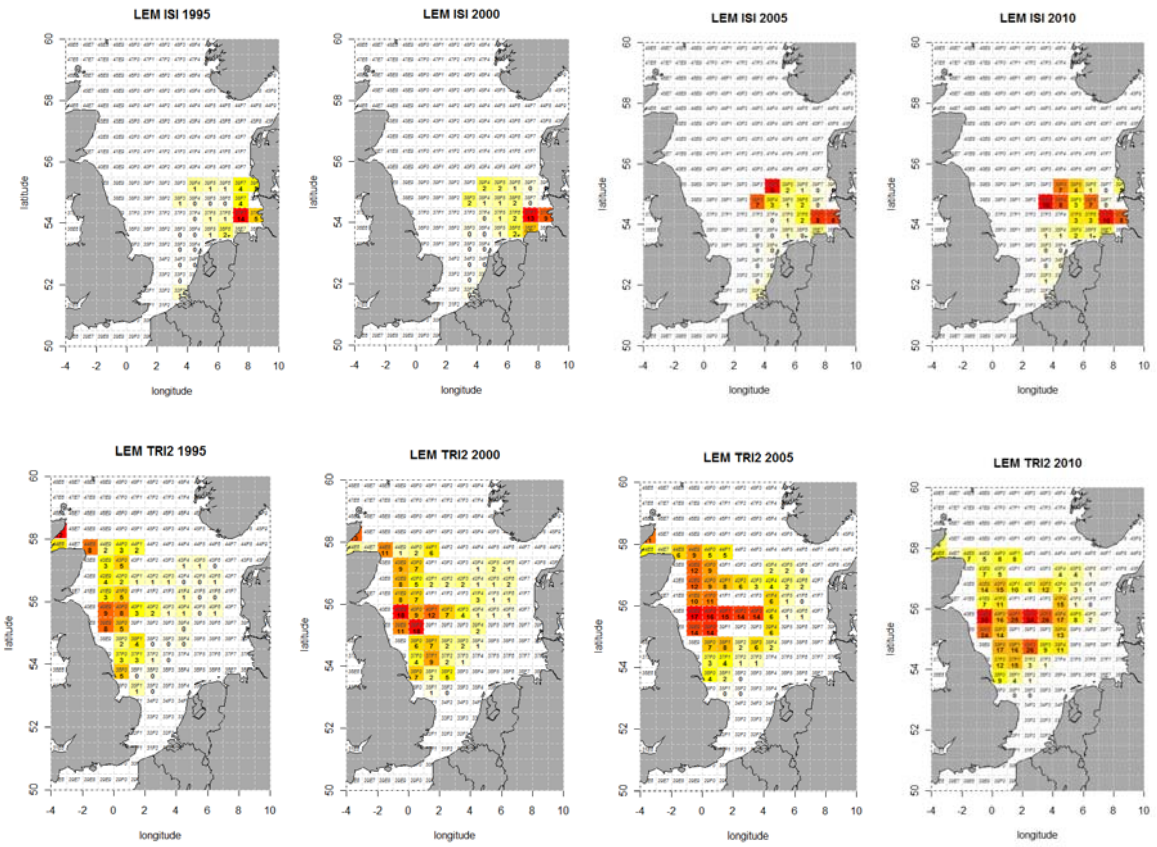


Figure 7-4 mean CPUE (number per hectare) for 5 year periods. Time periods: 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011.

7.1.1 Length distribution and growth

Both the BTS Tridens and the Isis indicate a decreasing trend in the average length in the catch (Figure 7-5). In the Tridens, the CPUE has increased over all length classes. The length-weight relationship is similar for males and females (Figure 7-6). The combined estimate for a in the LW relationship $W=aL^b$ is 0.0077, and the estimate for b is 3.08 (Appendix C). The growth of the two sexes differs: the females grow larger than the males, with L_{inf} for females being 29.8cm and L_{inf} for males 26.11cm (Figure 7-6, Appendix C).

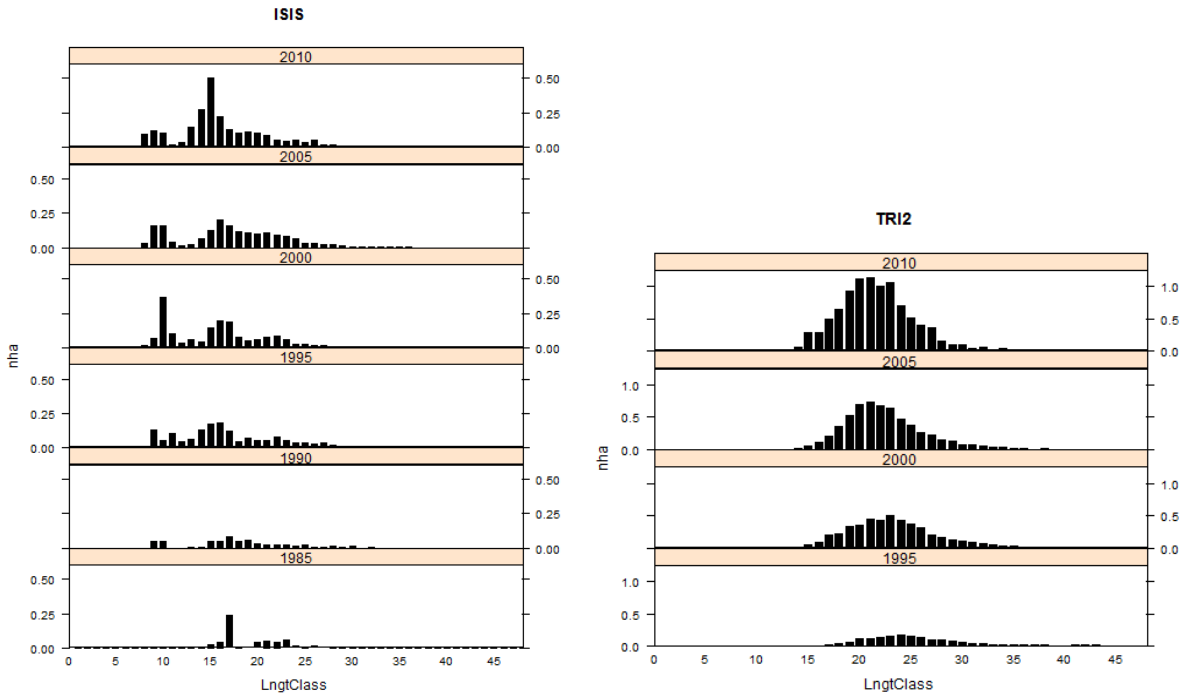


Figure 7-5 CPUE (number per hectare) per length class over time. Time periods: 1985 = 1987-1989, 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

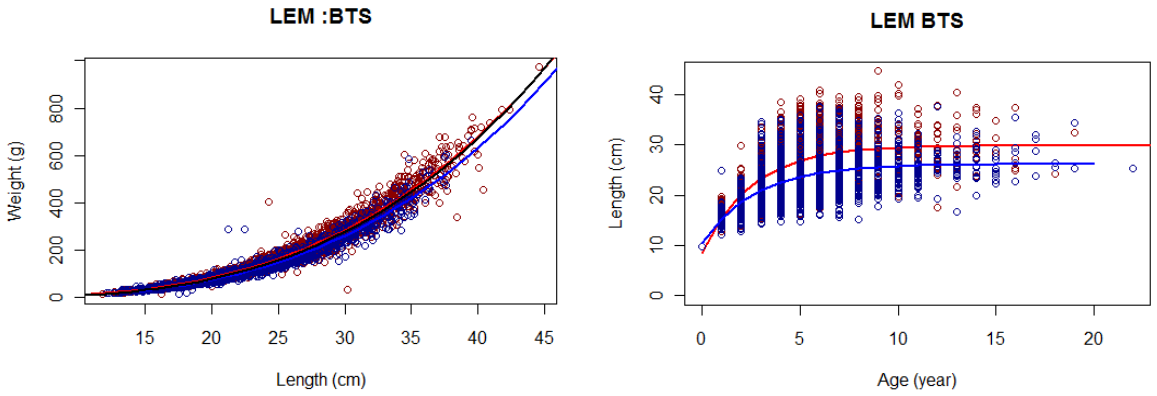


Figure 7-6 Left: Length-Weight relationship for lemon sole (source FRISBE-BTS). Red: females (*a*=0.0098, *b*=3.02), blue: males (*a*=0.0077, *b*=3.07). Black line: combined (*a*=0.0077, *b*=3.08). Right: length-age relationship (source FRISBE-BTS). Red: females (*Linf*=29.83*, K*= 0.39*, t0=-0.85*), blue: males (*Linf*=26.11*, K*= 0.37*, t0*=-1.35). Lines: von Bertalanffy fit.

8 Brill

The biogeographical range of brill (*Scophthalmus rhombus*) extends from the Mediterranean and North Atlantic Ocean in the south of the Irish Sea, North Sea, Skagerrak and Kattegat in the north. Brill is a demersal species that usually lives in sandy habitat and can reach a maximum length of 75 cm. Spawning is between March and August. Juvenile brill lives in the shallow coastal areas during the first two years, after which it moves to deeper water. Brill is a piscivorous species (from Teal and van Keeken 2011).

8.1 BTS

The BTS Isis survey in autumn often catches brill in low numbers, whereas the BTS Tridens only occasionally catches brill (Figure 8-1). The number caught per hectare lay between 0 and just above 3. Neither the CPUE in number per hectare nor the probability of catching brill in the Isis has changed much in the time-series. The highest average CPUE in the time-series is around 0.6 brill per hectare by the Isis in 1992 and 1993 (Figure 8-2). The Tridens has a low probability of catching brill. Although the combined index (in numbers per ha) shows an increase since 2007 (Figure 8-2) this increase is smaller than the inter-annual variation in the time series.

The BTS survey catches brill primarily in the Dutch and Danish coastal areas (Figure 8-3). Plotting the spatial distribution of the CPUE series for the BTS surveys since 1995 reveals no distinctive changes in its distribution over time (Figure 8-4).

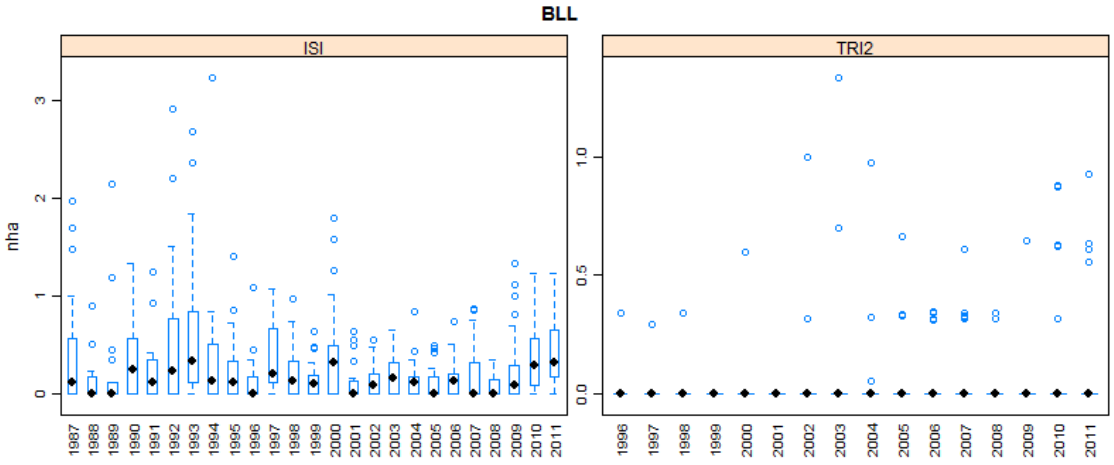


Figure 8-1 box and whisker plot of number of brill per hectare per year and ICES rectangle for the research vessels Isis (left) and Tridens (right).

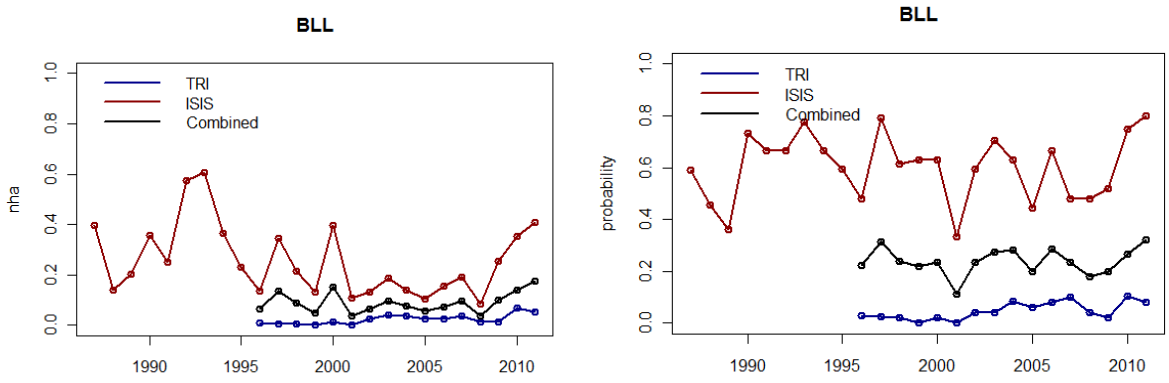


Figure 8-2 Brill CPUE series. Left: number caught per hectare. Right: probability per haul. 'Combined' includes both surveys.

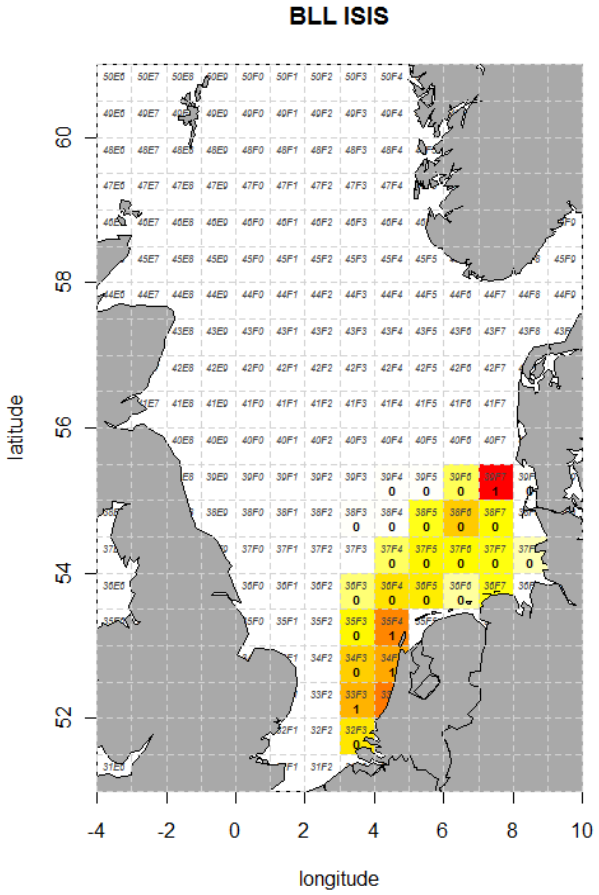


Figure 8-3 Mean CPUE (nha) for 2009:2011 per rectangle and vessel.

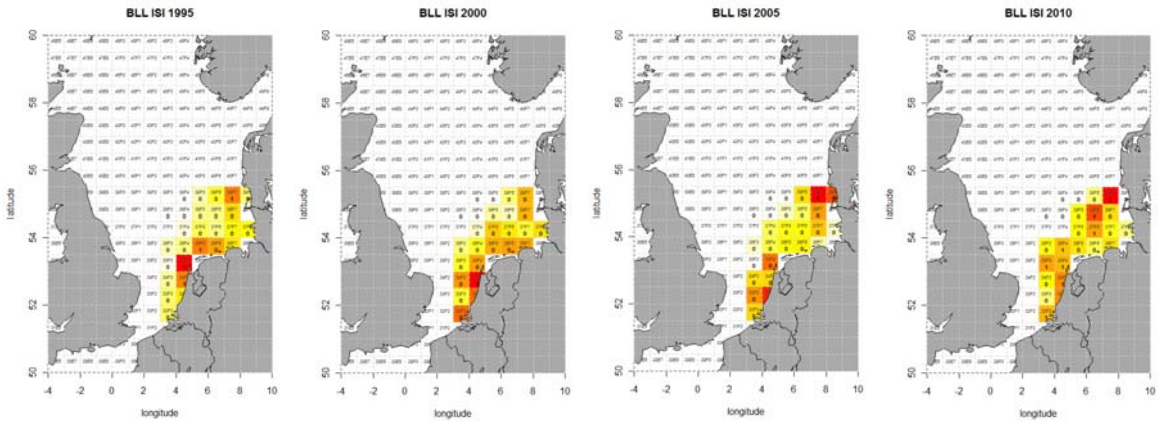


Figure 8-4 mean CPUE (number per hectare) for 5 year periods. Time periods: 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

8.1.1 Length distribution and growth

The main length classes caught in the BTS-Isis surveys are between 20 and 40 cm. Overall, the length distribution does not show a clear trend, which is probably caused by the low occurrences of brill catches (Figure 8-5).

The length-weight relationship is very similar for males and females (Figure 8-6). The combined estimate for *a* in the LW relationship $W=aL^b$ is 0.014 and the estimate for *b* is 2.99. Age readings for brill in the BTS are available from 2001 (Appendix B). The females grow larger than the males, with L_{inf} for females being 56.6 cm and L_{inf} for males 38.8 cm (Figure 8-6, Appendix C). Brill is a fast growing species that reaches large sizes (fishbase indicates $L_{inf} \approx 75$ cm). The large difference between the L_{inf} estimated from the BTS survey samples and the fishbase estimate may result from the low towing speed of the BTS (4 knots).This low towing speed reduces the catchability for larger specimens. This lack of large specimens in the sample likely causes a bias in the estimated growth curves.

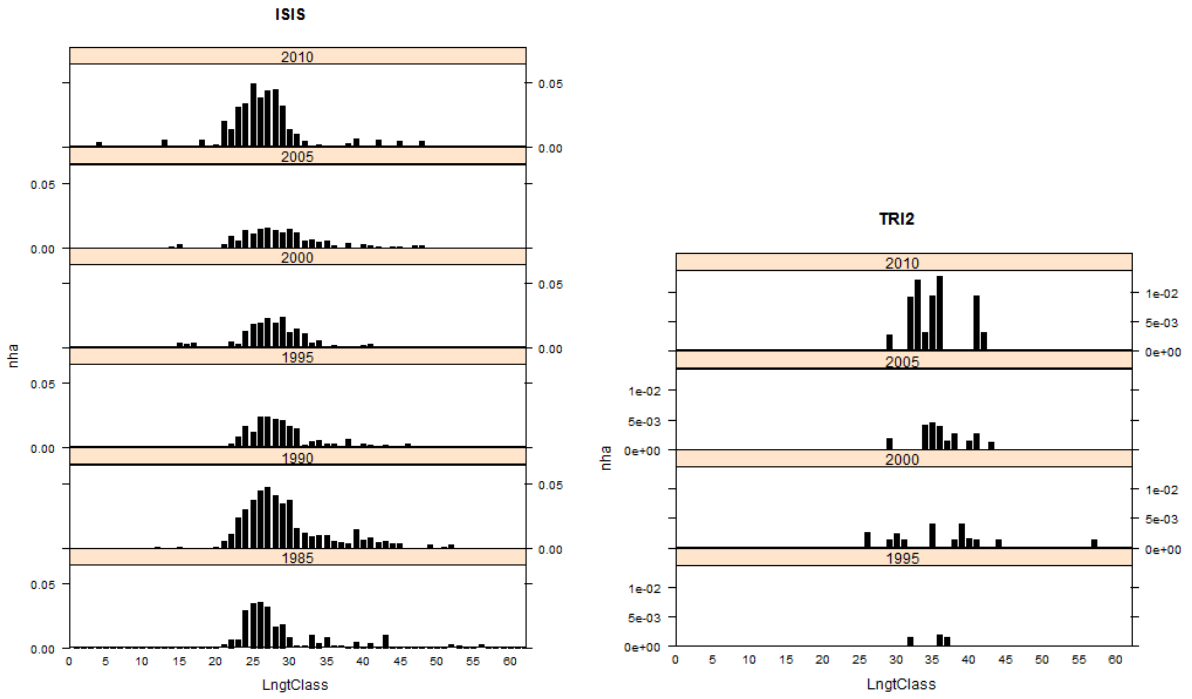


Figure 8-5 CPUE (number per hectare) per length class over time. Time periods: 1985 = 1987-1989, 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

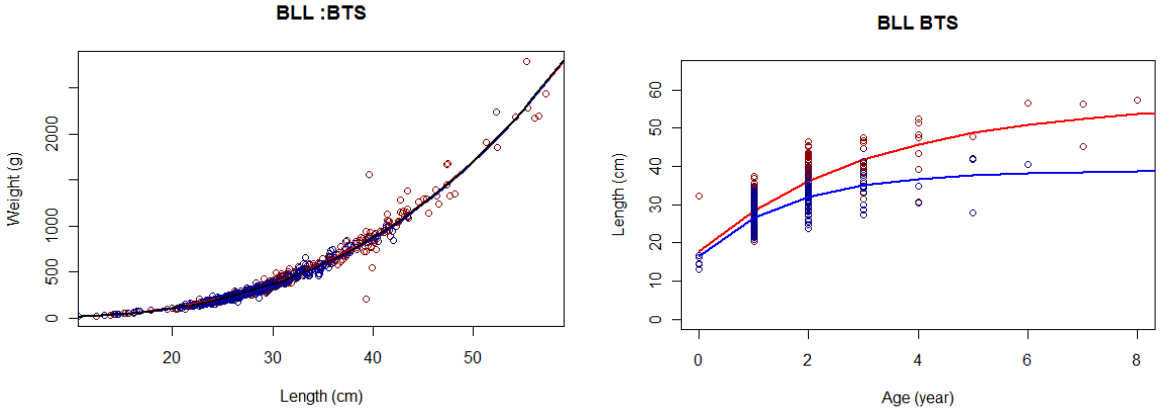


Figure 8-6 Left: Length-weight relationship for brill (source FRISBE-BTS). Red females (a=0.016, b=2.97) , blue: males (a=0.013, b=3.01). Black line: combined (a=0.014, b=2.99). Right: length-age relationship (source FRISBE-BTS). Red: females ($Linf$=56.62 , K= 0.32, $t0$=-1.19), blue: males ($Linf$=38.84, K= 0.59, $t0$=-0.94). Lines: von Bertalanffy fit.

9 Turbot

The geographical range of turbot extends from the Mediterranean and North Atlantic Ocean in the south to the Irish Sea, North Sea, Skagerrak and Kattegat in the north. Turbot is a demersal boreal species that lives in sandy and rocky habitat. Turbot spawns between April and August at 10-80 meters depth. Like brill, turbot is a piscivorous flatfish species (source: Teal and van Keeken 2011).

9.1 BTS

The BTS Isis survey in autumn frequently catches turbot in low numbers, whereas the BTS Tridens only occasionally catches turbot (Figure 9-1). The number caught per hectare in a rectangle lay between 0 and just above 8. Neither the CPUE in number per hectare nor the probability of catching turbot in the Isis has changed much in the time-series. The highest average number in the time-series are around 1 turbot per hectare by the Isis between 1990 and 1994 and in 2000 (Figure 9-2). The Tridens has a low probability of catching turbot over the whole time series, but similar to brill, the trend seems to be upwards (Figure 9-2).

The BTS survey catches turbot primarily in the Dutch and Danish coastal areas (Figure 9-3). Plotting the spatial distribution of the CPUE series for the BTS surveys since 1995 reveals no distinctive changes in its distribution over time (Figure 9-4).

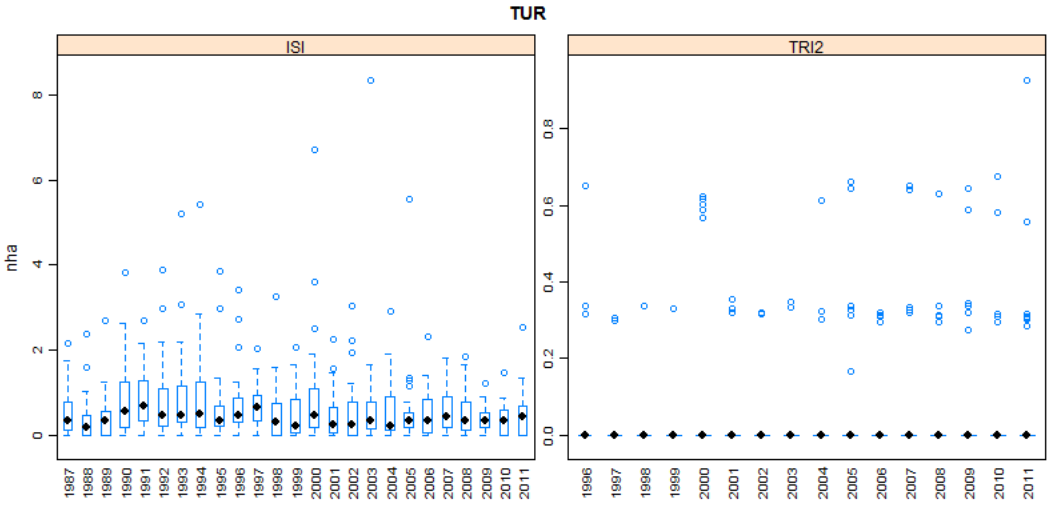


Figure 9-1 box and whisker plot of number of turbot per hectare per year and ICES rectangle for the research vessels Isis (left) and Tridens (right).

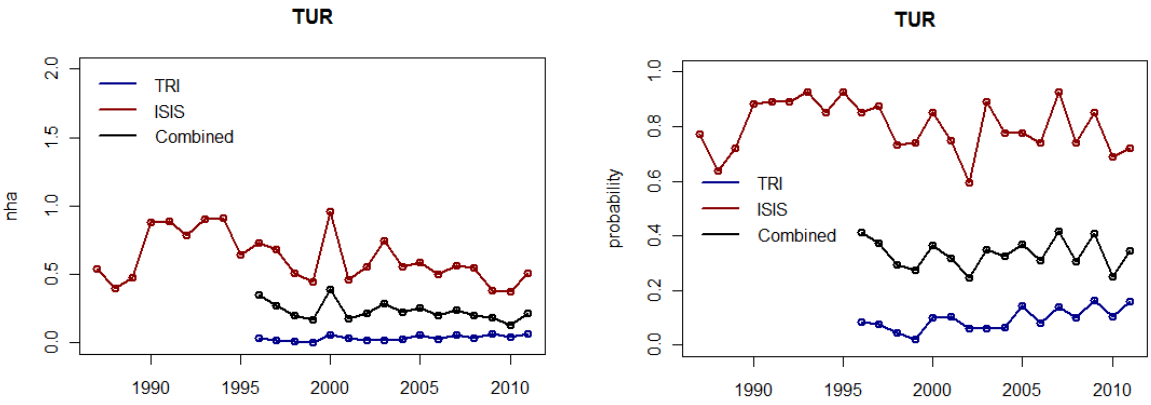


Figure 9-2 Turbot CPUE series. Left: number caught per hectare. Right: probability per haul. For each year and survey, the hauls were first averaged per selected ICES rectangle and consequently over the rectangles. 'Combined' includes both surveys.

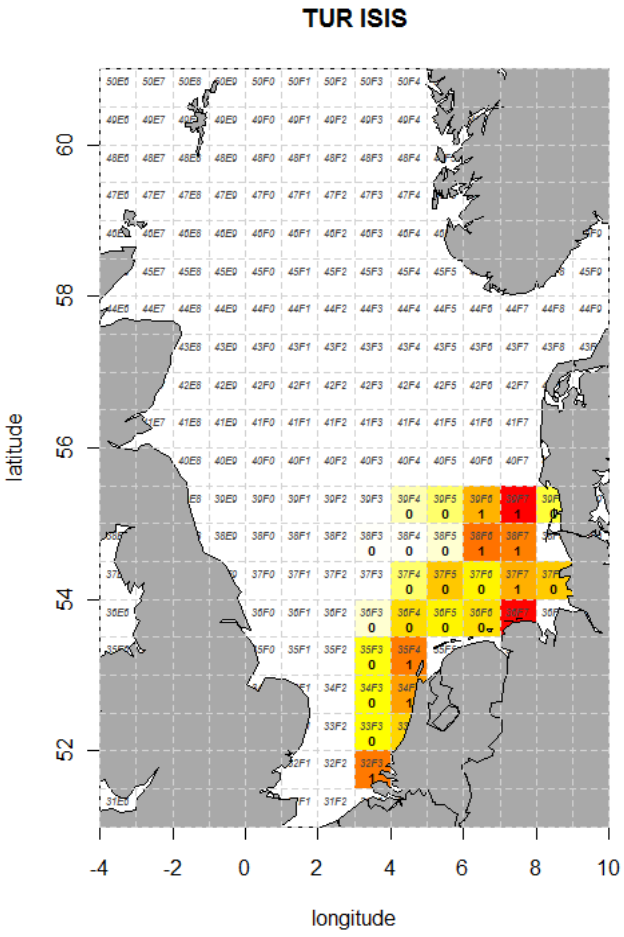


Figure 9-3 Mean CPUE (nha) for the period 2009-2011 per rectangle by research vessel Isis.

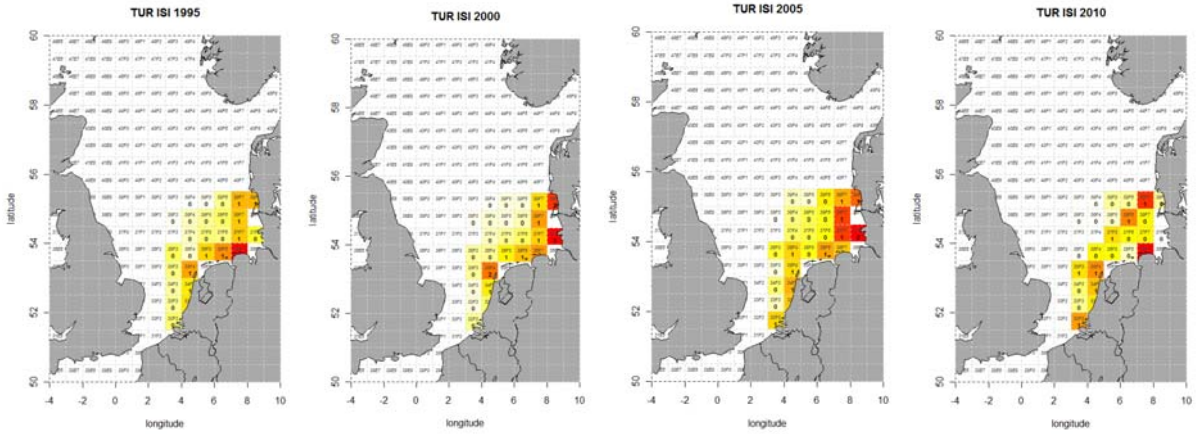


Figure 9-4 mean CPUE (number per hectare) for 5 year periods. Time periods: 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011.

9.1.1 Length distribution and growth

The main length classes caught in the BTS-Isis surveys are between 15 and 40 cm. Overall, the length distribution does not show a clear trend, which is probably caused by the low occurrences of turbot catches (Figure 8-5).

The length-weight relationship is very similar for males and females (Figure 8-6). The combined estimate for *a* in the LW relationship $W=aL^b$ is 0.014 and the estimate for *b* is 2.99 (Appendix C). Age readings for brill in the BTS are available from 2001 (Appendix B). The females grow larger than the males, with L_{inf} for females being 56.62 cm and L_{inf} for males 38.84 cm (Figure 8-6, Appendix C). Like brill, turbot is a fast growing species that reaches large sizes (fishbase indicates $L_{inf} \approx 100$ cm). The large difference between the L_{inf} estimated from the BTS survey samples and the fishbase estimate may result from the low towing speed of the BTS (4 knots).This low towing speed reduces the catchability for larger specimens. This lack of large specimens in the sample likely causes a bias in the estimated growth curves.

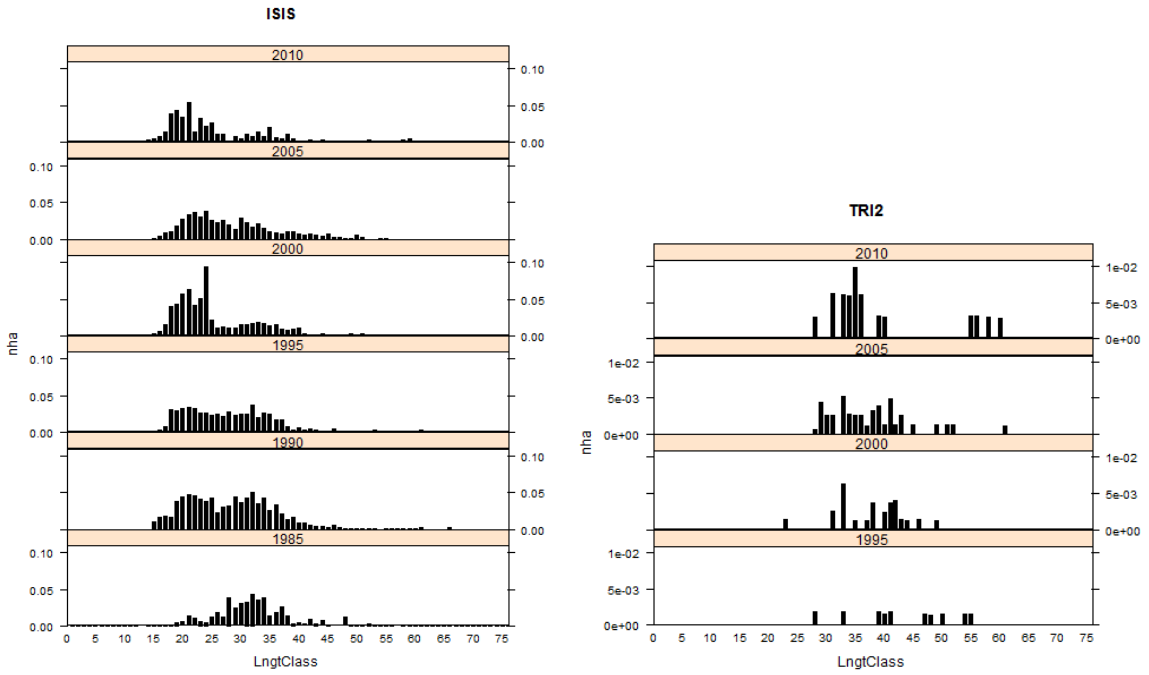


Figure 9-5 CPUE (number per hectare) per length class over time. Time periods: 1985 = 1987-1989, 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

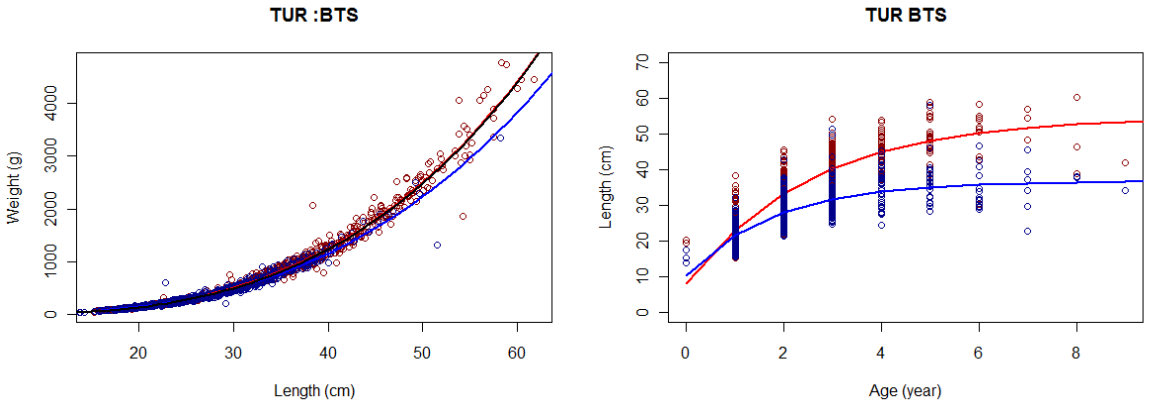


Figure 9-6 Left: Length weight relationship for turbot (source FRISBE-BTS). Red females (a=0.013, b=3.11) , blue: males (a=0.022, b=2.95). Black line: combined (a=0.012, b=3.13). Right: length-age relationship (source FRISBE-BTS). Red: females ($Linf$=54.74 , K= 0.39, $t0$=-0.39), blue: males ($Linf$=36.71, K= 0.56, $t0$=-0.58). Lines: von Bertalanffy fit.

10 Horse mackerel

Horse mackerel is widely distributed, occurring in the Eastern Atlantic from Norway to South Africa, as well as in the Mediterranean Sea (ICES 2011b). In the list of species described in this report, horse mackerel is the only pelagic species. ICES distinguishes 3 stocks, the Southern, the Western and the North Sea stock, the last two being of importance for the Netherlands (Figure 10-1). The Western stock consists of ICES divisions IIIa and IVa in quarter 3 and 4 and of ICES divisions IIa, Vb, VIa, VIIa–c,e–k and VIIIa-e for all quarters. The North Sea stock consists of divisions IIIa and IVa in quarter 1 and 2 and of divisions IVb,c and VIId for all quarters. In the Eastern part of the North Sea (off Jutland), horse mackerel were found to forage predominantly on fish (Dahl and Kirkegaard, 1987), with 0-group whiting being the most important prey item, followed by other gadoids and herring (www.homsir.com/biology/biology.html).

The ICES advice for the North Sea mackerel stock in the period 2002 – 2010 was to not increase the catches, in order to avoid an expansion of the fishery. For 2011 there was no ICES advice, and for 2012 the advice was to reduce catches (ICES 2011b).

For the North Sea stock, fisheries independent indices are scarce and debated by the working group (ICES WGWIDE). Opinions differ whether IBTS data is representative for the North sea horse mackerel stock given that this survey uses a bottom trawl gear; although with a very wide opening. During the third and fourth quarters, the commercial catches are taken by pelagic fisheries (pelagic trawlers and purse seiners) and it is therefore questioned how well horse mackerel are represented in the IBTS data.However, Ruckert et. al. (2002) argue that horse mackerel of 2 years and older are predominantly demersal in habit (Eaton 1983). In addition, the species apparently stays very close to the seabed during daylight and migrates upwards during the night (Barange et al. 1998). This would mean that for older ages, CPUE data from IBTS may be used as an abundance index (ICES 2011).

For the Western stock, ICES uses an egg survey to estimate the SSB (standing stock biomass), which is used in the stock assessment models. However, there is also discussion about the use of egg surveys for an index for horse mackerel. An assumption of the use of the egg survey is that horse mackerel is a determinate spawner. This means that fecundity can be determined prior to spawning. However, horse mackerel is now considered to be an indeterminate spawner, where the eggs to be spawned are not all present in the ovary at the start of the spawning season, and fecundity can therefore not be assessed at the start of the spawning season, whereas earlier, horse mackerel was assumed to be a determinate spawner. In addition, no egg surveys for horse mackerel were carried out in the North Sea since 1991 and the mackerel egg survey in the North Sea does not cover the spawning area of horse mackerel. Egg surveys for horse mackerel were carried out only during the period 1988-1991 (from ICES 2011b).

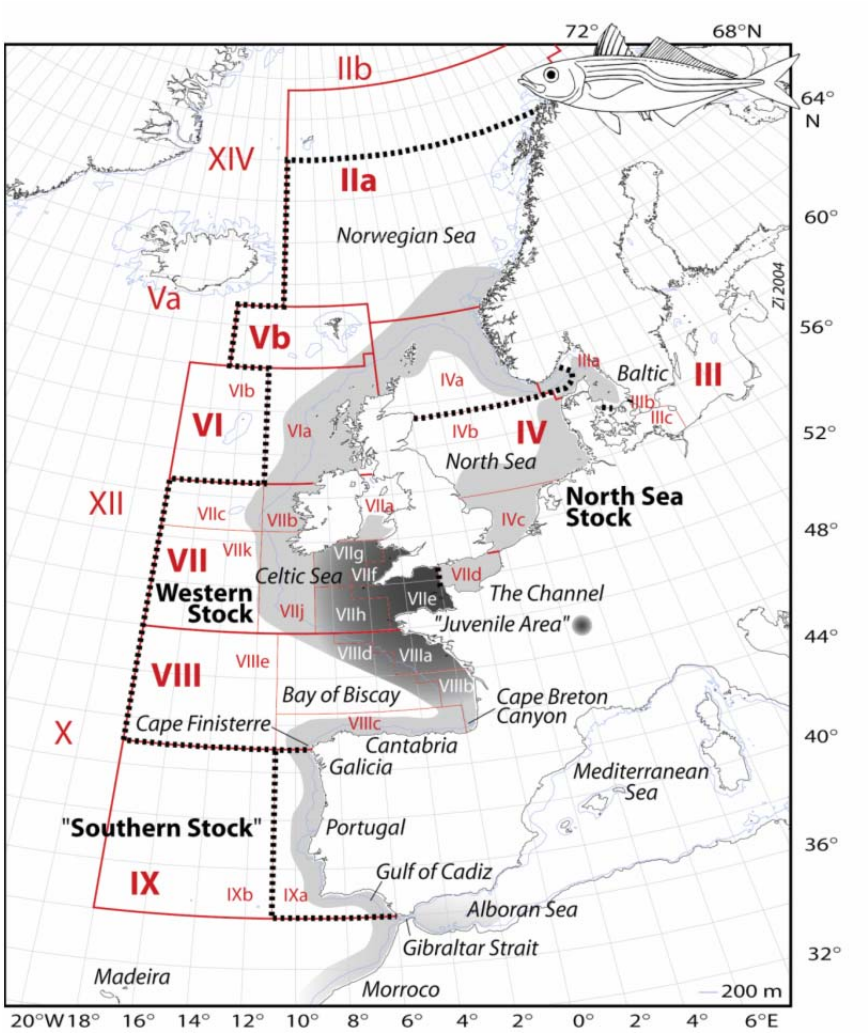


Figure 10-1 Distribution of Horse Mackerel in the Northeast-Atlantic and stock definitions. Map source: GEBCO, polar projection, 200 m depth contour drawn. (ICES WGWIDE 2011b)

10.1 IBTS Q3

Horse mackerel data from the IBTS Q3 shows very high variability in CPUE per haul, ranging from 0 to over 150.000 individuals per hour (Figure 10-2). The CPUE index is available since 1991 and also shows high variability per year in horse mackerel catches per hour. Since 2004, variability seems to have ceased, and the CPUE is also lower since 2004. The probability of catching horse mackerel in a haul shows a slowly declining trend over time (Figure 10-3). Horse mackerel CPUE in quarter 3 is highest in the Dutch and Danish coastal areas (Figure 10-4).

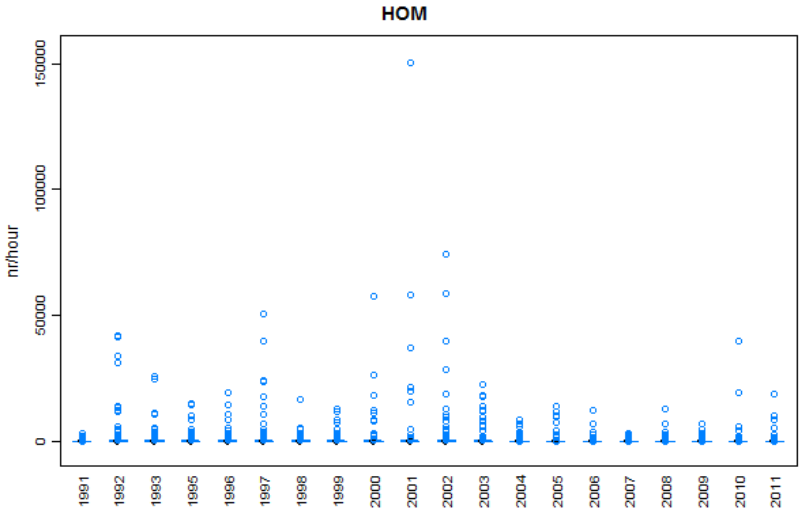


Figure 10-2 box and whisker plot of number of horse mackerel per hour per year and ICES rectangle in IBTS Quarter 3.

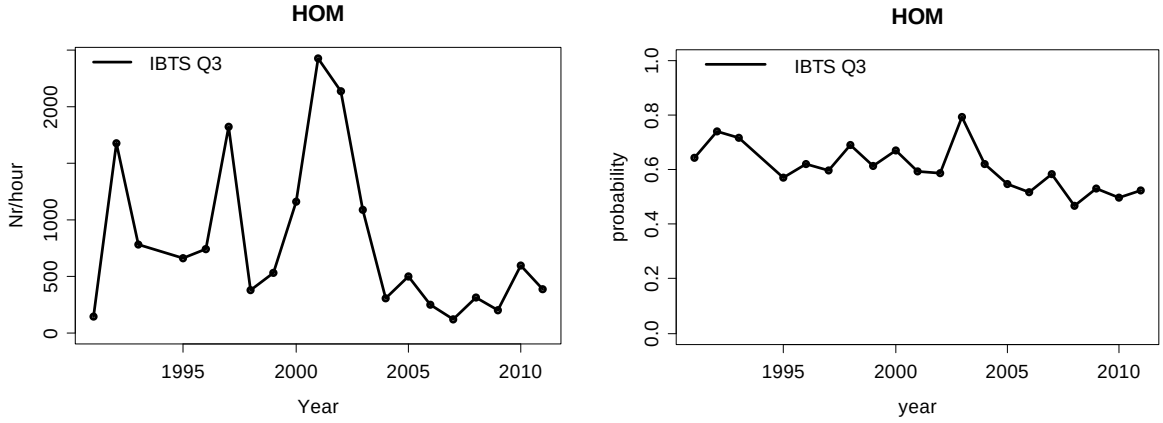


Figure 10-3 Horse mackerel CPUE series. Left: number caught per hour in the IBTS Q3 survey. Right: probability per haul in the IBTS Q3 survey. For each year the hauls were first averaged per selected ICES rectangle and consequently over the rectangles.

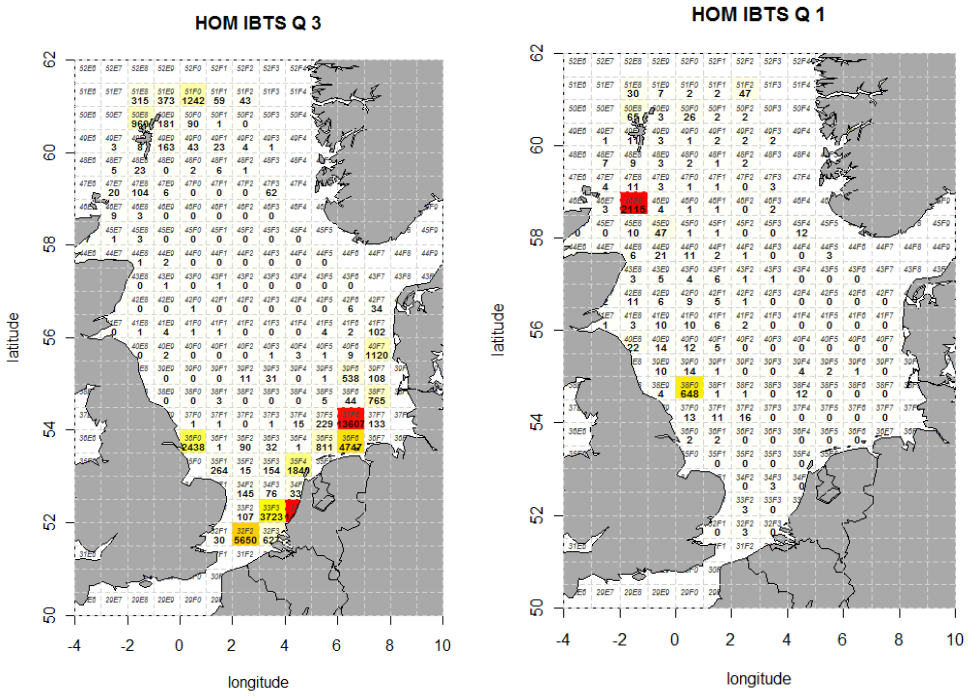


Figure 10-4 Mean CPUE (number per hour) for 2009:2011 per rectangle and vessel.

Length distribution and growth

The North Sea horse mackerel CPUE by length shows a peak at small individuals till 10 cm and a smaller peak at individuals between 20 and 25 cm. In the period between 2005 and 2009, the catches were very low. In 2010 and 2011 the CPUE of the older ages are also very low, but the CPUE of the younger ages has increased again.

The length-weight relationship is similar for males and females (Figure 10-6). The combined estimate for *a* in the LW relationship $W=aL^b$ is 0.019, and the estimate for *b* is 2.82 (Figure 10-6). The two sexes have similar growth (Figure 10-6); females grow to similar sizes as the males, with L_{inf} for females being 36.8 cm and L_{inf} for males 36.3 cm. Because there were no horse mackerel age readings present in the DATRAS database and otoliths from horse mackerel IBTS- Tridens catches are not analysed either, market samples are used to estimate the growth of horse mackerel.

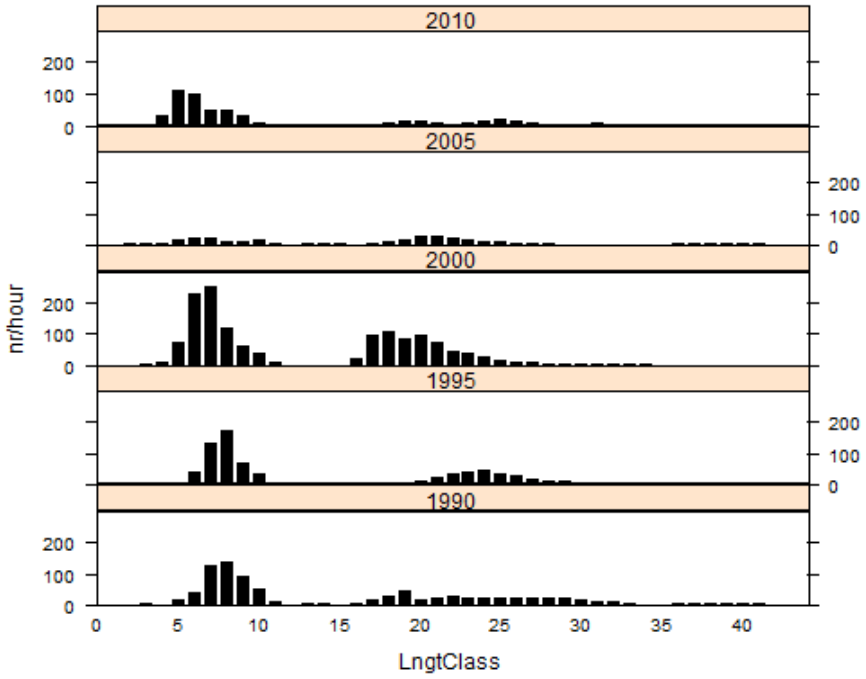


Figure 10-5 CPUE (number per hour) per length class over time. Time periods: 1990 = 1990-1994, 1995 = 1995-1999, 2000 = 2000-2004, 2005 = 2005-2009, 2010 = 2010-2011

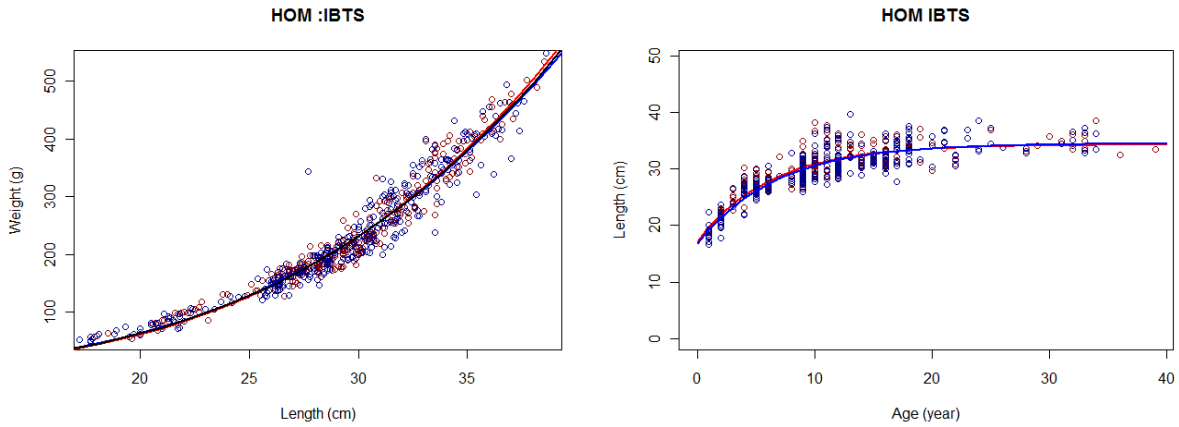


Figure 10-6 Left: Length weight relationship for horse mackerel (source Frisbe-IBTS). Red females (*a*=0.0032, *b*=3.29), blue: males (*a*=0.0044, *b*=3.19). Black line: combined (*a*=0.0039, *b*=3.23). Right: length-age relationship (source FRISBE-IBTS). Red: females (*Linf*=34.29, *K*= 0.16, *t0*=-4.27), blue: males (*Linf*=34.52 , *K*= 0.15, *t0*=-4.43). Lines: von Bertalanffy fit.

11 Conclusions and Interpretation

Time series such as the CPUE indices presented in this report only show how the state of the stock is relative to the other years in the time series. The starting point of the series is often the first year of the surveys. When interpreting the CPUE series, it is therefore essential to realize that the starting point of the series should not be interpreted as the unfished state of the stock.

The length frequency distribution presented here, does not only depend on the occurrence of the species, but also on the catchability of the gear used. Selectivity of the gear and catchability heavily influence our perception of the size composition and abundance. For example, because the towing speed and the gear of the BTS vessels results in relatively high catchability for the intermediate size-classes compared to the larger and very small size classes. It is therefore likely that there is an underestimation of the larger size classes relative to the smaller size classes. Likewise, very small size classes may also be underrepresented, because the mesh size used may be too large to catch them.

The spatial distribution of stocks may change over time. For example, plaice juveniles have moved offshore, away from coastal areas (van Keeken et al. 2007). This affects the indices as independent estimates of the overall stock size. We have visually inspected the spatial distribution of the survey CPUEs for such changes. Only in the case of lemon sole we detected off shore movement, and a possible southwards movement of witch flounder. The effects of changes in spatial distribution on the interpretation of survey indices should be studied.

Dab

- Commercial LPUE is stable over the time series. The catch cohort signal is difficult to track. Dab is of commercially low value and mainly caught as bycatch in the sole and plaice targeting fisheries and it is therefore discarded substantially (Helmond et al. 2011). Because of the high discard rate, LPUE has to be interpreted carefully.
- CPUE BTS-Isis decreases since beginning of time series, but increases in recent years.
- CPUE BTS-Tridens increases since beginning of time series.
- No shift in length frequency distribution is observed.
- No shift in spatial distribution is observed.

European Flounder

- CPUE BTS-Isis shows high numbers per hectare in the last two years.
- The average catch probability shows a gradual increase.
- The length distribution is variable and does not show a clear trend.
- No shift in spatial distribution is observed.

Witch Flounder

- The survey indices fluctuate without a clear trend.
- The length distribution is variable without a clear trend.
- The spatial distribution of witch flounder shows an increase in the southern range (ICES rectangles 40F0-40F2) in the last time period.

Lemon Sole

- The CPUE index for the BTS-Isis and BTS-Tridens show increasing trends.
- There is an offshore move of lemon sole, based on data from the BTS-ISIS and the BTS-Tridens.
- Both the BTS Tridens as the Isis indicate a weak decreasing trend in the average length in the catch.

Brill

- Neither the CPUE nor the probability of catching brill in the BTS-Isis has changed much.
- No changes in spatial distribution over the years.
- The length frequency distribution does not show a clear trend.

Turbot

- Neither the CPUE in number per hectare nor the probability of catching turbot in the BTS-Isis have changed much in the time-series.
- No changes in spatial distribution over the years.
- The length frequency distribution does not show a clear trend.

Horse Mackerel

- CPUE per haul in the IBTS is highly variable.
- The probability of catching horse mackerel in a survey haul shows a slowly declining trend over time.
- The length frequency distribution shows a peak at small individuals till 10 cm and a smaller peak at individuals between 20 and 25 cm, but no clear trend over the years
- Lack of fisheries independent indices. Opinions differ whether IBTS data is representative for the North sea horse mackerel stock.

11.1 Future management advice

For this report the authors collated the data available for 'data limited' fish stocks such as the flatfish species described in this report and horse mackerel in the North Sea.

For those 'data limited' stocks for which a TAC is defined, the future TACs depend on the management objectives and the harvest control rules supporting these objectives. At this moment there are no stock assessments for these stocks. In 2012, the methodology for advice on these stocks is being finalized. One approach for formulation of advice, is to use survey trends. In short, trends in research vessel surveys are used to look at the trends in stocks. The survey index of the last two years is compared with the survey index of the three preceding years. Based on the outcome of the comparison, an increase or decrease in catch is advised. As such, our analysis can be used as input for the ICES advice. If the described method is applied to the stocks under consideration, the future catch advice depends on the trends in the surveys.

Some of the species for which the stocks are described in this report are bycatch species in the fishery targeting plaice and sole (the so called 'associated stocks'). For that reason, the measures applied for management of plaice and sole influence the development of the associated stocks. Sole and plaice are managed under a long term management plan (Council Regulation (EC) No 676/2007). The aim of the long term management plan for sole and plaice is to fish these stock at fishing mortality levels associated with high long term yields. If fishing mortalities are above the target of the plan, they should be gradually reduced. For plaice, fishing mortality is currently below the target in the plan (ICES WGNSSK 2012). As a result, the stock has increased, as have the TACs. For sole however, the current fishing mortality is estimated to be above the target, and further cuts in TACs and fishing effort are to be expected.

Given the expected reductions of fishing effort in the long term management plan for sole and plaice, one could expect that the stock sizes of the associated stocks increase. However, the stock size of these associated stocks does not only depend on the fishing mortality. They also depend on the future recruitment and future growth of individuals, both are currently unknown. The recruitment of marine fish especially is highly variable. In addition, the spatial distribution differs per species. This may cause fishing fleets to change their fishing patterns as a result of fisheries management, and increasingly target the bycatch species. This would counteract the expected reductions in fishing mortality as a result of the

sole and plaice management plan. In conclusion, the advised TACs by ICES for the associated species will unlikely follow the TACs for sole and plaice.

References

Barange, M., Pillar, S. C., and Hampton, I. (1998) Distribution patterns, stock size and life-history strategies of Cape horse mackerel Trachurus trachurus capensis, based on bottom trawl and acoustic surveys. South African Journal of Marine Science, 19: 433–447.

Daan, N. Bromley, PJ. Hislop, JRG. (1990) Ecology of North Sea Fish. Netherlands Journal of Sea Research, 26: 343–386

Dahl, K. and Kirkegaard, E. (1987) The diet and consumption of horse mackerel (Trachurus trachurus) in the Eastern North Sea. ICES CM 1987/H:43.Eaton, D. R. 1983. Scad in the North-East Atlantic.

Laboratory Leaflet, Ministry of Agriculture, Fisheries and Food, Directorate of Fisheries Research, Lowestoft, 56: 20 pp.

Hammen, T. van der; Poos, J.J.; Quirijns, F.J. (2011). Data availability for the evaluation of stock status of species without catch advice: Case study: turbot (Psetta maxima) and Brill (Scophthalmus rhombus). IJmuiden : IMARES, (Report C109/11) - p. 35.

Handboek bestandsopnamen en routinematige bemonsteringen op het water. Versie 6, februari 2012

Helmond, A.T.M. van; Uhlmann, S.S.; Overzee, H.M.J. van; Bierman, S.M.; Bol, R.A.; Nijman, R.R. (2011) Discard sampling of Dutch bottom-trawl fisheries in 2009 and 2010. IJmuiden : Centrum voor Visserijonderzoek, (CVO report 11.008) - p. 101.

ICES (2009) Manual for the Offshore Beam Trawl Surveys, Revision 1.2, June 2009, Working Group on Beam Trawl Surveys. 30 pp.

ICES (2010) Report of the Working Group on Beam Trawl Surveys (WGBEAM), ICES CM 2001/SSGESST:17

ICES (2011) Report of the International Bottom Trawl Survey Working Group (IBTSWG), 28 March – 1 April 2011, ICES Headquarters, Copenhagen. ICES CM 2011/SSGESST:06. 237 pp.

ICES (2011b) Report of the Working Group on Widely Distributed Stocks (WGWIDE), 23 - 29 August 2011, ICES Headquarters, Copenhagen, Denmark. ICES CM 2011/ACOM:15. 642 pp.

ICES (2012) Report of the Working Group on Assessment of New MoU Species (WGNEW), 5 - 9 March 2012, ICES CM 2012/ACOM:20. 258 pp.

ICES (2012b) Report of the Workshop on the Development of Assessments based on LIFE history traits and Exploitation Characteristics (WKLIFE), 13–17 February 2012, Lisbon, Portugal . ICES CM 2012/ACOM:36. 122 pp.

Keeken, O.A. van, van Hoppe, M., Grift, R.E., Rijnsdorp, A.D. (2007) Changes in the spatial distribution of North Sea plaice (Pleuronectes platessa) and implications for fisheries management. Journal of Sea Research, 57: 187-197

Lozán, JL. (1988) Verbreitung, Dichte, und Struktur der Population der Klieschen (Limanda limanda L.) in der Nordsee mit Vergleichen zu Popualtionen um Island und in der Ostsee anhand meristischer Merkmale. Arch. Fischereiwiss, 38: 165–189

Molander, A. (1935) Further data concerning the witch (*Pleuronectes cynoglossus* L.). Svenska Hydrografiska-Biologiska Kommissionens Skrifter. Ny serie Biologi. Band I. NR 6. 1935. Tryckeriaktiebolaget Tiden, Stockholm.

Piet, G.J., Pfisterer, A.B., Rijnsdorp, A.D. (1998) On factors structuring the flatfish assemblage in the southern North Sea. Journal of sea research, 40(1-2): 143 -152

Punt, A. E., Smith, D. C., and Smith, A. D. M. (2011) Among-stock comparisons for improving stock assessments of data-poor stocks: the "Robin Hood" approach. – ICES Journal of Marine Science, 68: 972–981.

Rijnsdorp, A. D., W. Dekker, and N. Daan. 2006. Partial fishing mortality per fishing trip: a useful indicator for effective fishing effort in management of mixed demersal fisheries. ICES Journal of Marine Science 63:556-566.

Quirijns F.J., Poos J.J., Rijnsdorp AD (2008) Standardizing commercial CPUE data in monitoring stock dynamics: Accounting for targeting behaviour in mixed fisheries. Fisheries Research89:1-8

Rückert, C., Floeter, J., A. Temming. (2002) An estimate of horse mackerel biomass in the North Sea, 1991-1997. - ICES Journal of Marine Science, 59: 120-130.

Teal, L.R.; Keeken, O.A. van (2011) The importance of the surf zone for fish and brown shrimp in The Netherlands. IMARES, (Report C054/11).

Justification

Rapport C110/12

Project Number: 4308601031

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Floor Quirijns

Signature:

Date: 10 October 2012

Approved: Dr. ir. T.P. Bult

Head of Fisheries department

Signature:

Date: 10 October 2012

Appendix A. Number of years sampled per research vessel

Table A-1 BTS: Number of years sampled per ship. Grey areas represent the rectangles that are included in the analysis.

AREA_CODE	ISI	TRI2	AREA_CODE	ISI	TRI2
32F1	9	5	40F6	10	16
32F2	11	4	40F7	11	1
32F3	24	0	41E8	0	9
33F1	10	1	41E9	0	16
33F2	12	5	41F0	0	16
33F3	24	0	41F1	0	2
33F4	25	1	41F2	0	9
34F1	0	7	41F3	0	3
34F2	12	9	41F4	0	16
34F3	25	0	41F5	0	16
34F4	25	1	41F6	0	16
35F0	0	7	42E8	0	8
35F1	0	15	42E9	0	16
35F2	4	16	42F0	0	16
35F3	23	9	42F1	0	15
35F4	25	0	42F2	0	16
35F5	11	0	42F3	0	16
36F0	0	14	42F4	0	15
36F1	1	15	42F5	0	16
36F2	3	15	42F6	0	16
36F3	21	8	43E8	0	8
36F4	24	2	43E9	0	15
36F5	25	0	43F0	0	15
36F6	24	1	43F1	0	6
36F7	24	0	43F2	0	11
37F0	0	16	43F3	0	2
37F1	0	15	43F4	0	13
37F2	1	15	43F5	0	15
37F3	19	15	43F6	0	15
37F4	22	2	43F7	0	1
37F5	25	0	44E6	0	13
37F6	24	1	44E7	0	13
37F7	25	0	44E8	0	13
37F8	21	0	44E9	0	14
38E9	0	6	44F0	0	14
38F0	0	16	44F1	0	14
38F1	0	15	44F2	0	12
38F2	0	16	44F3	0	12
38F3	20	16	44F4	0	11
38F4	22	16	44F5	0	6
38F5	25	0	45E6	0	13
38F6	24	1	45E7	0	12
38F7	25	1	45E8	0	8
38F8	11	0	45E9	0	9
39E9	0	16	45F0	0	6
39F0	0	16	45F1	0	5
39F1	0	9	45F2	0	4
39F2	0	3	45F3	0	4
39F3	0	6	45F4	0	1
39F4	21	16	45F5	0	1
39F5	25	3	46E8	0	1
39F6	24	1	46E9	0	2
39F7	24	1	46F2	0	1
39F8	22	1	47E9	0	1
40E9	0	16	47F3	0	1
40F0	0	16	48E9	0	1
40F1	0	16	48F2	0	1
40F2	0	14	49E9	0	1
40F3	0	15	49F2	0	1
40F4	0	16	50E9	0	1
40F5	8	16	50F2	0	1

Table A-2 IBTS Q3: Number of years sampled. Grey areas represent the rectangles that are included in the analysis.

AREA_CODE	IBTS Q3	AREA_CODE	IBTS Q3	AREA_CODE	IBTS Q3	AREA_CODE	IBTS Q3
31F1	1	39F1	20	43F0	20	47E6	3
31F2	4	39F2	20	43F1	20	47E7	20
32F1	20	39F3	20	43F2	20	47E8	20
32F2	20	39F4	20	43F3	20	47E9	20
32F3	20	39F5	20	43F4	20	47F0	20
33F1	5	39F6	20	43F5	17	47F1	20
33F2	20	39F7	19	43F6	17	47F2	20
33F3	20	39F8	7	43F7	15	47F3	20
33F4	19	40E8	20	43F8	19	48E6	4
34F1	4	40E9	20	43F9	12	48E7	20
34F2	20	40F0	20	43G0	19	48E8	20
34F3	20	40F1	20	43G1	19	48E9	20
34F4	20	40F2	20	43G2	19	48F0	20
35F0	14	40F3	20	44E6	20	48F1	20
35F1	20	40F4	20	44E7	20	48F2	20
35F2	20	40F5	20	44E8	20	48F3	13
35F3	20	40F6	20	44E9	20	49E6	4
35F4	20	40F7	20	44F0	20	49E7	19
36F0	20	40G2	5	44F1	20	49E8	20
36F1	20	41E7	20	44F2	20	49E9	20
36F2	20	41E8	20	44F3	20	49F0	20
36F3	20	41E9	20	44F4	20	49F1	20
36F4	20	41F0	20	44F5	20	49F2	20
36F5	20	41F1	20	44F8	19	49F3	20
36F6	19	41F2	20	44F9	19	50E7	5
36F7	5	41F3	20	44G0	19	50E8	18
37F0	19	41F4	20	44G1	19	50E9	20
37F1	19	41F5	18	45E6	19	50F0	19
37F2	19	41F6	18	45E7	20	50F1	20
37F3	20	41F7	19	45E8	20	50F2	20
37F4	20	41G0	18	45E9	20	50F3	10
37F5	20	41G1	19	45F0	20	51E8	19
37F6	20	41G2	19	45F1	20	51E9	20
37F7	20	42E7	20	45F2	20	51F0	20
37F8	9	42E8	20	45F3	20	51F1	20
38E9	20	42E9	20	45F4	20	51F2	19
38F0	20	42F0	20	45F9	17	37E9	2
38F1	20	42F1	20	45G0	19	44F6	3
38F2	20	42F2	20	45G1	19	52E9	8
38F3	20	42F3	20	46E6	3	52F0	10
38F4	20	42F4	20	46E7	20	52F1	12
38F5	20	42F5	20	46E8	20	38G2	1
38F6	20	42F6	20	46E9	20	46G1	7
38F7	20	42F7	18	46F0	20	36F8	1
38F8	7	42G1	19	46F1	20	38E8	1
39E8	3	42G2	19	46F2	20		
39E9	20	43E8	20	46F3	20		
39F0	20	43E9	20	46G0	17		

Appendix B. Age and length samples by species

Table B-1 Number of length and age samples per survey per year (nr samples taken)

DAB	BTS		DFS		IBTS		SNS		MARKET		DISCARDS_BT		OTHER	
	length	age	length	age	length	age	length	Age	length	age	length	age	length	age
1966	0	0	0	0	384	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	277	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	256	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	467	0	450	0	0	0	0	0	0	0
1970	0	0	1674	0	594	0	1076	0	0	0	0	0	0	0
1971	0	0	1307	0	421	0	487	0	0	0	0	0	0	0
1972	0	0	1725	0	281	0	997	0	0	0	0	0	0	0
1973	0	0	2398	0	416	0	833	0	0	0	0	0	0	0
1974	0	0	3189	0	546	0	1450	0	0	0	0	0	99	0
1975	0	0	3481	0	591	0	1520	0	0	0	0	0	216	0
1976	0	0	2040	0	537	0	1560	0	0	0	851	0	98	0
1977	0	0	3083	0	693	0	1768	0	0	0	348	0	319	0
1978	0	0	3512	713	559	0	3684	958	0	0	894	0	28	0
1979	0	0	3938	0	251	0	3071	0	0	0	0	0	34	0
1980	0	0	5173	165	2049	0	2856	0	0	0	1560	0	49	0
1981	0	0	4833	164	2510	0	3675	0	0	0	0	0	247	0
1982	0	0	6430	169	1777	0	3335	0	0	0	363	0	378	0
1983	549	0	7182	192	1424	0	3701	0	0	0	212	0	83	0
1984	0	0	5404	271	1838	0	3534	0	0	0	0	0	0	0
1985	1683	392	4704	105	2231	0	3817	0	0	0	0	0	13	0
1986	1774	212	3715	170	2935	0	4025	0	0	0	0	0	0	0
1987	1407	111	2487	189	3431	0	3265	0	0	0	0	0	0	0
1988	2379	215	3939	288	1843	0	3389	0	0	0	0	0	0	0
1989	1223	249	3022	295	2086	0	3595	0	0	0	627	0	0	0
1990	1563	371	2281	294	2344	0	1307	0	0	0	918	0	0	0
1991	1463	325	1553	300	2943	0	1244	0	0	0	0	0	0	0
1992	1542	343	1614	283	2355	0	1218	0	0	0	0	0	15	0
1993	1652	361	1179	262	3237	0	1155	574	0	0	0	0	386	0
1994	1421	249	1002	0	2509	0	1602	0	0	0	0	0	376	0
1995	1306	257	1414	203	1683	0	1107	0	0	0	0	0	0	0
1996	2341	252	1382	184	765	0	931	0	0	0	0	0	769	0
1997	2190	249	1137	220	1362	0	600	0	0	0	0	0	1360	0
1998	2453	255	602	0	838	0	673	0	0	0	0	0	1308	0
1999	2717	0	534	0	740	0	564	0	0	0	1488	122	82	0
2000	2745	0	639	0	802	0	574	0	0	0	5643	406	2696	34
2001	2302	0	884	0	770	0	425	0	0	0	1815	0	2974	0
2002	3449	0	736	0	768	0	406	0	300	300	2285	221	3239	28
2003	3868	1234	670	149	912	0	1570	557	300	298	4131	349	2291	0
2004	5123	0	2086	0	1746	0	2626	0	538	275	3937	280	1519	0
2005	6372	1820	1744	14	1792	0	2082	0	581	297	4771	224	4681	330
2006	5250	1648	1344	558	1822	0	1832	0	576	296	5209	138	241	0
2007	6102	1836	1820	395	1628	0	1618	686	551	299	3613	217	8650	0
2008	5480	1606	2336	786	1809	0	2376	0	0	0	5268	298	8978	0
2009	5840	1618	3864	1034	2134	0	2588	0	1235	717	6327	1383	5264	645
2010	4432	1392	2636	866	1592	0	2608	0	1335	776	9687	2318	27744	998
2011	6086				1640		2516		1329	798	9112	579	12583	575

Flounder	BTS		DFS		IBTS		SNS		MARKET		DISBT		OTHER	
	length	age	length	age	length	age	length	age	length	age	length	age	length	age
1966	0	0	0	0	20	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	2	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	6	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	46	0	32	0	0	0	0	0	0	0
1970	0	0	246	0	32	0	78	0	0	0	0	0	0	0
1971	0	0	258	0	23	0	42	0	0	0	0	0	0	0
1972	0	0	238	0	7	0	110	0	0	0	0	0	0	0
1973	0	0	324	0	74	0	65	0	0	0	0	0	0	0
1974	0	0	554	0	72	0	82	0	0	0	0	0	9	0
1975	0	0	631	0	80	0	77	0	0	0	0	0	6	0
1976	0	0	796	0	54	0	70	0	0	0	0	0	8	0
1977	0	0	656	0	34	0	115	0	0	0	0	0	11	0
1978	0	0	427	0	45	0	179	0	0	0	30	0	0	0
1979	0	0	807	0	18	0	190	0	0	0	0	0	12	0
1980	0	0	1367	0	126	0	225	0	0	0	360	0	14	0
1981	0	0	1206	0	183	0	196	0	0	0	0	0	4	0
1982	0	0	1164	0	92	0	271	0	0	0	0	0	24	0
1983	0	0	1200	0	187	0	248	0	0	0	0	0	12	0
1984	0	0	784	0	181	0	79	0	0	0	0	0	0	0
1985	111	0	537	0	176	0	245	0	0	0	0	0	1	0
1986	30	0	527	0	260	0	228	0	0	0	0	0	0	0
1987	25	0	273	0	332	0	99	0	0	0	0	0	0	0
1988	44	0	293	0	220	0	107	0	0	0	0	0	0	0
1989	54	0	275	0	188	0	105	0	912	911	0	0	129	0
1990	144	0	252	0	192	0	45	0	425	0	7	0	53	0
1991	111	0	260	0	206	0	40	0	0	0	0	0	166	0
1992	80	0	308	0	154	0	40	0	0	0	0	0	877	15
1993	83	0	213	0	159	0	36	0	0	0	0	0	646	19
1994	110	0	355	0	133	0	74	0	0	0	0	0	1011	20
1995	165	0	541	0	75	0	75	0	0	0	0	0	851	45
1996	186	0	371	0	18	0	65	0	0	0	0	0	2877	0
1997	182	0	258	0	62	0	78	0	0	0	0	0	2454	0
1998	134	0	212	0	49	0	29	0	0	0	0	0	1706	76
1999	67	0	272	0	22	0	13	0	0	0	0	0	744	0
2000	107	0	479	0	26	0	15	0	0	0	153	0	1416	49
2001	101	0	462	0	21	0	36	0	0	0	134	0	2173	42
2002	143	0	529	0	38	0	25	0	0	0	13	0	2481	125
2003	105	0	340	0	33	0	50	0	0	0	27	0	3601	0
2004	284	0	736	0	106	0	242	0	0	0	61	0	2237	0
2005	384	90	1038	9	114	0	62	0	0	0	49	0	5497	78
2006	172	2	1172	552	88	0	142	0	0	0	169	0	1760	36
2007	340	0	1271	481	98	0	150	78	0	0	30	0	4726	46
2008	422	12	1924	790	271	0	176	74	0	0	107	0	5570	18
2009	310	4	1680	734	234	0	152	0	1663	849	38	0	5868	342
2010	282	14	1778	748	129	0	178	0	1716	900	256	0	4241	174
2011	458	0	NA	0	96	0	204	0	1489	900	112	0	1718	62

Lemon sole	BTS		DFS		IBTS		SNS		MARKET		DISBT		OTHER	
	length	age	length	age	length	age	length	age	length	age	length	age	length	age
1966	0	0	0	0	8	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	7	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	13	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	72	0	4	0	0	0	0	0	0	0
1970	0	0	3	0	32	0	3	0	0	0	0	0	0	0
1971	0	0	5	0	9	0	2	0	0	0	0	0	0	0
1972	0	0	11	0	7	0	8	0	0	0	0	0	0	0
1973	0	0	17	0	66	0	12	0	0	0	0	0	0	0
1974	0	0	9	0	18	0	31	0	0	0	0	0	0	0
1975	0	0	16	0	63	0	24	0	0	0	0	0	0	0
1976	0	0	12	0	59	0	30	0	0	0	20	0	0	0
1977	0	0	21	0	32	0	37	0	0	0	20	0	0	0
1978	0	0	6	0	52	0	60	0	0	0	6	0	0	0
1979	0	0	10	0	54	0	65	0	0	0	0	0	0	0
1980	0	0	33	0	158	0	44	0	0	0	0	0	0	0
1981	0	0	35	0	346	0	89	0	0	0	0	0	0	0
1982	0	0	19	0	174	0	89	0	0	0	0	0	0	0
1983	272	0	5	0	124	0	69	0	0	0	0	0	0	0
1984	0	0	10	0	145	0	47	0	0	0	0	0	0	0
1985	149	0	8	0	135	0	62	0	0	0	0	0	0	0
1986	90	0	11	0	376	0	51	0	0	0	0	0	0	0
1987	102	0	14	0	397	0	41	0	0	0	0	0	0	0
1988	94	0	12	0	81	0	42	0	0	0	0	0	0	0
1989	86	0	23	0	142	0	54	0	0	0	1	0	0	0
1990	77	0	16	0	220	0	33	0	0	0	0	0	0	0
1991	77	0	1	0	559	0	8	0	0	0	0	0	0	0
1992	30	0	3	0	456	0	7	0	0	0	0	0	0	0
1993	19	0	13	0	415	0	15	0	0	0	0	0	0	0
1994	98	0	9	0	358	0	80	0	0	0	0	0	1	0
1995	87	0	12	0	252	0	59	0	0	0	0	0	0	0
1996	489	0	15	0	85	0	33	0	0	0	0	0	23	0
1997	415	0	7	0	141	0	42	0	0	0	0	0	49	0
1998	568	0	7	0	103	0	26	0	0	0	0	0	69	0
1999	649	0	10	0	90	0	18	0	0	0	32	0	16	0
2000	745	0	54	0	118	0	33	0	0	0	267	0	60	0
2001	780	0	37	0	61	0	14	0	0	0	44	0	34	0
2002	955	0	26	0	104	0	15	0	136	133	22	0	23	0
2003	1545	0	12	0	123	0	22	0	437	437	222	0	31	0
2004	2012	0	13	0	252	0	94	0	417	415	119	0	18	0
2005	1974	852	7	0	186	0	34	0	394	387	141	0	19	0
2006	1908	764	66	0	178	0	28	0	211	205	83	0	21	0
2007	2408	898	1	0	202	42	54	0	220	215	93	0	218	0
2008	2404	946	12	0	534	0	18	0	216	210	219	0	150	0
2009	2310	886	118	0	268	0	34	0	461	0	127	0	160	0
2010	2122	890	98	0	186	0	60	0	396	0	364	0	384	0
2011	2762	0	0	0	174	0	64	0	729	153	716	0	555	0

Witch Flounder	BTS		DFS		IBTS		SNS		MARKET		DISBT		OTHER	
	length	age	length	age	length	age	length	age	length	age	length	age	length	age
1969	0		0		2		0		0		0		0	
1970	0		0		47		0		0		0		0	
1972	0		0		1		0		0		0		0	
1973	0		0		10		0		0		0		0	
1974	0		0		3		0		0		0		0	
1975	0		0		33		0		0		0		0	
1976	0		0		44		5		0		0		0	
1977	0		1		5		0		0		0		0	
1978	0		0		7		0		0		0		0	
1979	0		2		3		0		0		0		0	
1980	0		0		16		0		0		0		0	
1981	0		0		52		0		0		0		0	
1982	0		0		17		0		0		0		0	
1983	124		0		75		0		0		0		0	
1984	0		0		7		0		0		0		0	
1985	44		0		33		0		0		0		0	
1986	22		0		69		1		0		0		0	
1987	23		0		57		0		0		0		0	
1988	1		0		31		0		0		0		0	
1989	0		0		40		0		0		0		0	
1991	0		0		53		0		0		0		0	
1992	0		0		44		0		0		0		0	
1993	0		0		54		0		0		0		0	
1994	1		2		4		0		0		0		0	
1995	1		0		12		0		0		0		0	
1996	38		2		3		0		0		0		0	
1997	69		0		5		0		0		0		0	
1998	120		0		6		2		0		0		2	
1999	148		0		9		0		0		8		8	
2000	226		0		2		0		0		17		6	
2001	332		0		1		0		0		18		6	
2002	158		0		3		0		0		0		6	
2003	915		0		8		0		0		0		9	
2004	598		0		6		0		0		1		2	
2005	672		0		30		0		0		0		1	
2006	660		0		8		0		0		1		6	
2007	240		0		2		0		0		0		20	
2008	216		0		16		0		0		0		58	
2009	238		0		6		0		0		1		3	
2010	240		0		2		0		0		3		30	
2011	382		0		4		0		0		16		20	

Turbot	BTS		DFS		IBTS		SNS		MARKET		DISBT		OTHER	
	length	age	length	age	length	age	length	age	length	age	length	age	length	age
1966	0	0	0	0	1	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	1	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	1	0	13	0	0	0	0	0	0	0
1970	0	0	20	0	5	0	24	0	0	0	0	0	0	0
1971	0	0	17	0	0	0	13	0	0	0	0	0	0	0
1972	0	0	3	0	1	0	17	0	0	0	0	0	0	0
1973	0	0	11	0	0	0	10	0	0	0	0	0	0	0
1974	0	0	35	0	2	0	39	0	0	0	0	0	11	0
1975	0	0	9	0	5	0	40	0	0	0	0	0	6	0
1976	0	0	17	0	3	0	35	0	0	0	201	0	33	0
1977	0	0	35	0	6	0	97	0	0	0	31	0	31	0
1978	0	0	26	0	1	0	77	0	0	0	112	0	15	0
1979	0	0	14	0	2	0	42	0	0	0	0	0	4	0
1980	0	0	72	0	39	0	27	0	0	0	322	0	0	0
1981	0	0	71	0	32	0	43	0	316	315	0	0	52	0
1982	0	0	161	0	20	0	35	0	1181	1181	142	0	58	0
1983	11	0	155	0	44	0	78	0	1535	1535	10	0	12	0
1984	0	0	110	0	22	0	70	0	1509	1509	0	0	0	0
1985	70	0	60	0	51	0	51	0	1499	1499	0	0	3	0
1986	100	0	27	0	42	0	20	0	1240	1240	0	0	0	0
1987	93	0	37	0	28	0	14	0	423	423	0	0	0	0
1988	106	0	26	0	35	0	44	0	398	397	0	0	0	0
1989	87	0	51	0	49	0	48	0	477	477	41	0	0	0
1990	212	0	27	0	75	0	54	0	599	599	169	0	0	0
1991	214	0	36	0	51	0	24	0	0	0	0	0	0	0
1992	178	0	48	0	35	0	30	0	0	0	0	0	0	0
1993	225	0	63	0	65	0	41	0	0	0	0	0	17	0
1994	230	0	19	0	19	0	39	0	0	0	0	0	8	0
1995	172	0	39	0	19	0	42	0	0	0	0	0	0	0
1996	182	0	37	0	1	0	21	0	0	0	0	0	30	0
1997	183	0	18	0	8	0	14	0	0	0	0	0	24	0
1998	114	0	9	0	4	0	18	0	542	542	0	0	28	0
1999	126	0	24	0	2	0	42	0	0	0	12	0	0	0
2000	172	0	6	0	0	0	30	0	0	0	155	0	97	0
2001	245	112	31	0	1	0	13	0	0	0	37	0	47	0
2002	149	30	16	0	3	0	27	0	2378	2346	0	0	64	0
2003	343	212	46	19	3	0	10	0	2442	2421	70	0	58	6
2004	663	388	78	0	8	0	200	76	1020	1004	22	0	4	0
2005	564	288	78	16	4	0	122	52	1150	1138	253	0	231	0
2006	516	240	56	10	6	0	160	76	1178	1160	158	0	8	0
2007	642	342	35	16	24	12	92	56	1147	1139	232	0	1115	0
2008	592	324	114	38	32	0	136	92	949	927	62	0	954	0
2009	470	242	58	22	22	0	54	36	2030	875	1752	0	226	2
2010	422	228	94	40	4	0	90	0	1967	878	2309	6	952	0
2011	534	0	NA	0	4	0	96	54	2535	888	2042	0	1119	0

Brill	BTS		DFS		IBTS		SNS		MARKET		DISBT		OTHER	
	length	age	length	age	length	age	length	age	length	age	length	age	length	age
1970	0	0	18	0	0	0	26	0	0	0	0	0	0	0
1971	0	0	17	0	2	0	7	0	0	0	0	0	0	0
1972	0	0	11	0	0	0	13	0	0	0	0	0	0	0
1973	0	0	19	0	0	0	10	0	0	0	0	0	0	0
1974	0	0	18	0	7	0	18	0	0	0	0	0	7	0
1975	0	0	20	0	2	0	21	0	0	0	0	0	0	0
1976	0	0	31	0	2	0	17	0	0	0	32	0	5	0
1977	0	0	13	0	6	0	40	0	0	0	6	0	6	0
1978	0	0	16	0	0	0	50	0	0	0	38	0	0	0
1979	0	0	33	0	3	0	21	0	0	0	0	0	15	0
1980	0	0	120	0	10	0	29	0	0	0	159	0	0	0
1981	0	0	89	0	14	0	33	0	241	241	0	0	18	0
1982	0	0	119	0	10	0	24	0	559	559	40	0	22	0
1983	2	0	99	0	6	0	26	0	1311	1311	8	0	15	0
1984	0	0	45	0	9	0	34	0	1540	1540	0	0	0	0
1985	13	0	13	0	10	0	17	0	1185	1184	0	0	2	0
1986	17	0	9	0	13	0	9	0	1371	1371	0	0	0	0
1987	54	0	21	0	11	0	8	0	380	380	0	0	0	0
1988	41	0	12	0	4	0	12	0	318	318	0	0	0	0
1989	31	0	54	0	14	0	26	0	358	358	1	0	0	0
1990	96	0	24	0	27	0	15	0	442	441	78	0	0	0
1991	74	0	29	0	20	0	13	0	0	0	0	0	0	0
1992	133	0	58	0	29	0	28	0	0	0	0	0	0	0
1993	151	0	18	0	24	0	14	0	0	0	0	0	40	0
1994	102	0	36	0	2	0	14	0	0	0	0	0	15	0
1995	77	0	14	0	4	0	4	0	0	0	0	0	0	0
1996	42	0	13	0	2	0	2	0	0	0	0	0	21	0
1997	89	0	13	0	3	0	14	0	0	0	0	0	23	0
1998	54	0	14	0	0	0	1	0	458	458	0	0	42	0
1999	38	0	26	0	1	0	11	0	0	0	0	0	2	0
2000	88	0	32	0	1	0	15	0	0	0	94	0	162	0
2001	64	38	16	0	1	0	16	0	0	0	51	0	123	0
2002	60	4	22	0	2	0	13	0	2044	2026	3	0	91	0
2003	211	108	52	17	0	0	45	0	2042	2023	14	0	59	17
2004	217	109	58	0	10	0	46	12	746	737	15	0	44	10
2005	160	78	170	14	2	0	28	10	658	644	71	0	380	0
2006	190	90	50	12	0	0	66	32	731	713	85	0	14	0
2007	258	140	28	9	0	0	32	20	845	830	168	0	501	0
2008	122	74	208	102	0	0	94	56	997	978	60	0	537	4
2009	242	134	100	44	4	0	108	30	1719	752	524	0	194	0
2010	342	182	148	66	10	0	56	0	1712	781	1439	0	346	0
2011	444	0	0	0	0	0	98	60	2167	736	1492	0	770	0

Horse Mackerel	BTS		DFS		IBTS		SNS		MARKET		DISBT		OTHER	
	length	age	length	age	length	age	length	age	length	age	length	age	length	age
1969	0	0	0	0	0	0	13	0	0	0	0	0	0	0
1970	0	0	63	0	0	0	17	0	0	0	0	0	0	0
1971	0	0	78	0	0	0	4	0	0	0	0	0	0	0
1972	0	0	104	0	2	0	10	0	0	0	0	0	0	0
1973	0	0	80	0	7	0	10	0	0	0	0	0	0	0
1974	0	0	55	0	4	0	10	0	0	0	0	0	1	0
1975	0	0	160	0	7	0	48	0	0	0	0	0	0	0
1976	0	0	116	0	16	0	59	0	0	0	0	0	0	0
1977	0	0	112	0	12	0	38	0	0	0	0	0	27	0
1978	0	0	99	0	7	0	39	0	0	0	9	0	0	0
1979	0	0	102	0	3	0	59	0	0	0	0	0	10	0
1980	0	0	268	0	490	0	53	0	25	25	6	0	14	0
1981	0	0	196	0	524	0	84	0	0	0	0	0	11	0
1982	0	0	264	0	488	0	58	0	500	500	0	0	0	0
1983	26	0	66	0	245	0	42	0	700	700	11	0	0	0
1984	0	0	144	0	496	0	31	0	950	950	0	0	0	0
1985	20	0	103	0	786	0	23	0	1400	1400	0	0	0	0
1986	13	0	105	0	695	0	43	0	1050	1050	0	0	0	0
1987	27	0	95	0	891	0	21	0	1300	1300	0	0	0	0
1988	19	0	48	0	398	0	8	0	1498	1498	0	0	0	0
1989	32	0	68	0	357	0	24	0	1525	1525	0	0	0	0
1990	33	0	40	0	523	0	42	0	1775	1775	57	0	0	0
1991	25	0	96	0	1638	526	36	0	2049	2049	0	0	0	0
1992	69	0	96	0	656	45	66	0	1525	1525	0	0	0	0
1993	19	0	28	0	930	231	31	0	2775	2775	0	0	556	0
1994	63	0	17	0	805	201	43	0	2775	2775	0	0	1133	0
1995	55	0	22	0	290	0	96	0	1875	1875	0	0	314	0
1996	17	0	114	0	158	0	32	0	1900	1900	0	0	741	0
1997	85	0	42	0	285	0	48	0	2449	2449	0	0	0	0
1998	31	0	21	0	111	0	35	0	2825	2825	0	0	2	0
1999	63	0	35	0	4	0	10	0	3025	3025	13	0	5	0
2000	97	0	75	0	5	0	24	0	1950	1950	76	0	85	0
2001	84	0	70	0	19	0	55	0	3350	3350	1	0	136	0
2002	134	0	26	0	18	0	42	0	3125	3125	42	0	1641	0
2003	137	0	88	0	89	0	0	0	2225	2225	32	0	1195	0
2004	121	0	66	0	214	0	78	0	3046	2500	48	0	1111	0
2005	132	0	131	0	80	0	118	0	3646	2664	16	0	2706	0
2006	136	0	202	0	256	0	54	0	3089	2268	45	0	1981	0
2007	24	0	13	0	258	0	20	0	2531	1822	89	0	2957	0
2008	40	0	36	0	84	0	58	0	3545	2559	3	0	4415	0
2009	68	0	54	0	48	0	56	0	3519	2493	31	0	5377	0
2010	72	0	114	0	102	0	94	0	3387	2497	87	0	8642	0
2011	14	0	0	0	12	0	50	0	3903	2798	31	0	3932	0

Appendix C. Parameters of length-weight relationships and growth

Table C-1 Length weight parameters

Species		*a*	*b*	*Source*
Dab	female	0.0103	2.98	DATRAS BTS
	male	0.0071	3.10	
	all	0.0095	3.01	
European Flounder	female	0.016	2.89	DATRAS BTS
	male	0.024	2.75	
	all	0.012	2.98	
Witch Flounder	female	0.0024	3.28	DATRAS BTS
	male	0.0031	3.19	
	all	0.002	3.33	
Lemon Sole	female	0.0098	3.02	DATRAS BTS
	male	0.0077	3.07	
	all	0.0077	3.08	
Brill	female	0.016	2.97	DATRAS BTS
	male	0.013	3.01	
	all	0.014	2.99	
Turbot	female	0.013	3.11	DATRAS BTS
	male	0.022	2.95	
	all	0.012	3.13	
Horse Mackerel	female	0.0032	3.29	FRISBE IBTS Q3
	male	0.0044	3.19	
	all	0.0039	3.23	

Table C-2 Estimated Von Bertalanffy parameters

Species		*Linf*	*K*	*t0*	*Source*
Dab	female	25.9	0.50	-0.46	BTS (FRISBE)
	male	21.5	0.41	-1.31	
European Flounder	female	44.9	0.27	-2.58	BTS (FRISBE)
	male	35.7	0.73	-0.16	
Lemon Sole	female	29.8	0.39	-0.85	BTS (FRISBE)
	male	26.1	0.37	-1.35	
Brill	female	56.6	0.32	-1.19	BTS (FRISBE)
	male	38.8	0.59	-0.94	
Turbot	female	54.7	0.39	-0.39	BTS (FRISBE)
	male	36.7	0.56	-0.58	
Horse Mackerel	female	34.3	0.16	-4.27	IBTS (FRISBE)
	male	34.5	0.15	-4.43	

Appendix D. Commercial data on dab

Table D-1 Dab market sampling per category. Source: Frisbe

	2002	2003	2004	2005	2006	2007	2009	2010	2011
0	225	275	465	438	505	475	898	1181	1282
2	0	0	0	0	0	0	0	0	32

Table D-2 Total Dutch landings in tonnes per market category. Source: Visstat

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
0	1426	2261	1584	1811	0	0	0	0	0	0	0	0	0	1
1	73	2	2	4	9	11	6	5	11	3	4	11	14	2
2	3802	4595	3484	3262	4010	4424	4341	4829	4455	5561	4906	4831	4281	1860

**2011 market categories data are not yet complete*

Table D-3 Effort and landings estimation for Dutch beam trawlers (> 221kW). Corrected data: days at sea by 1471 kW vessel (equation 1). Uncorrected: days at sea. Landings in tonnes. Source: Visstat

year	corrected effort	uncorrected effort	Landings (tonnes)
1998	33841	30273	5172
1999	33002	29502	6086
2000	32661	29258	4497
2001	30949	27800	3860
2002	28654	25705	3032
2003	26572	23949	3068
2004	24882	22754	3163
2005	25081	22973	3777
2006	22488	20974	3652
2007	21725	20398	4960
2008	15958	15654	3703
2009	16625	16375	2856
2010	16635	16164	2994
2011	15956	15429	2914

Table D-4 Dab landings (kg) per rectangle and year (TBB >221 kW)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
31F1	73596	55025	43990	33480	10595	9030	11395	10295	7410	14060	9971	9102	18495	8470
31F2	265439	271057	303034	366037	354015	316373	343541	302734	293640	453318	619098	482414	333549	255857
31F3	11563	2556	2080	6260	2975	5245	8813	4413	4180	17500	6820	2340	1638	1400
31F5	0	0	40	0	0	0	0	0	0	0	0	0	0	0
31F6	400	0	0	0	0	0	1200	0	0	0	0	0	0	0
32F0	0	0	0	0	0	0	0	900	0	0	0	0	0	0
32F1	4440	6490	5790	3735	5540	19650	11510	5090	1830	6710	4145	4662	1855	12601
32F2	282096	346635	372025	491025	404480	363818	345519	316004	217676	493304	446215	388649	262731	263240
32F3	228164	171593	233876	195704	217779	111933	125775	98907	89013	278309	327864	114417	93624	111400
32F4	15993	1850	14090	6810	5590	2340	2278	1275	770	1950	1325	0	0	165
32F5	0	0	0	0	0	40	0	0	0	0	0	0	0	0
33F1	200	260	0	150	1350	980	0	1200	150	0	0	25	0	355
33F2	110892	76311	135835	55194	69693	82615	85548	92440	65140	87207	80807	107205	100591	87425
33F3	396286	341133	402144	255892	230809	198811	239373	230442	203371	405847	326990	166922	203869	263031
33F4	23813	21992	13063	31098	22620	21469	23345	36097	19193	59966	48185	27954	15528	13220
33F5	300	0	0	0	870	0	0	95	0	0	0	0	0	0
34F0	0	0	40	108	0	650	0	0	0	0	0	0	0	0
34F1	980	620	2430	1019	1500	3862	1688	330	160	0	0	0	88	415
34F2	111940	150911	168197	191133	153922	185403	108377	123089	132441	183256	98530	185684	237845	142152
34F3	201933	199914	146381	111809	128137	140915	151552	225675	218625	226651	132191	109010	196878	151362
34F4	71233	60795	72987	54917	55059	78771	90022	115838	134901	140205	85035	55253	55790	63085
34F5	0	200	100	520	2024	0	625	2170	50	480	0	50	0	411
34F6	200	0	100	2500	100	0	200	0	0	0	0	0	0	0
34F7	0	0	0	0	0	0	0	0	0	0	0	0	0	39

35F0	0	400	50	150	280	400	520	0	0	0	200	0	140	0
35F1	8471	4629	4991	25566	9168	8430	7332	8883	5449	7562	4020	3833	5447	6234
35F2	129245	133157	75349	114339	108074	99654	100604	83137	87345	118987	70888	87834	85307	46269
35F3	200092	223307	143920	157058	103231	111691	152901	211911	168586	262296	101996	93701	89388	67308
35F4	104088	103329	66114	58975	45974	62817	64569	102682	108830	83151	53815	32189	28726	40198
35F5	3578	2050	2100	1195	1488	1830	883	1267	2520	775	1142	553	340	242
35F6	0	0	0	250	1090	260	259	0	250	0	2545	0	0	0
36F0	9675	8045	17199	17750	18654	8265	10779	14434	15625	2650	5113	5042	13399	10476
36F1	39825	54688	34966	62019	42458	31019	30227	28596	42120	21852	13381	19904	21740	35142
36F2	70708	125574	72090	73935	33959	28819	39102	54649	54848	62712	18462	25067	23323	26218
36F3	80032	106011	43023	49332	26253	34878	44074	93313	64093	70133	39099	53824	63309	44712
36F4	103672	205247	60024	98118	68318	99702	157285	216273	184578	174848	140084	90634	73012	55089
36F5	45558	79728	34772	60811	42974	49038	57985	103463	79569	102281	75773	33878	37939	20459
36F6	12505	14529	13686	12594	5130	1950	7435	9849	5820	12051	5499	8179	6656	3602
36F7	4010	6275	3800	3360	790	1110	4150	4707	2879	3132	6896	3619	14982	280
36F8	40	0	0	0	0	200	0	0	0	0	0	0	0	0
37E9	0	0	250	0	0	0	0	0	0	0	0	0	0	0
37F0	79222	99740	78928	62205	30985	19201	16896	23756	21382	12744	5306	10028	14899	18030
37F1	155504	209709	157248	99310	61535	51354	51514	58008	61938	50406	15395	23309	30699	41025
37F2	192771	346595	166552	46898	48713	51218	47535	44750	18949	30602	4256	8460	11218	19285
37F3	82475	112285	34375	26737	14195	13070	11925	10781	10018	8999	3395	4975	4332	22529
37F4	91618	97170	41521	35374	33430	26181	34742	36453	24788	34055	9996	16383	37928	44217
37F5	95656	109511	51128	70514	32949	44848	74777	94629	94748	131100	61543	64589	104525	126436
37F6	343629	293909	305882	252931	106136	115793	202453	339159	400799	445610	243438	216459	220650	285527
37F7	302072	284359	175201	214145	80994	78907	151340	223589	220319	400674	330958	188099	196304	239591
37F8	120	0	0	0	250	0	0	0	0	0	960	0	760	80
38E8	0	0	0	980	0	0	0	0	0	0	0	0	0	0
38E9	190	175	240	930	1960	40	810	1365	0	120	0	0	0	0
38F0	14169	16138	17313	9645	7630	5720	1295	4220	750	2154	675	40	261	1798
38F1	47670	68520	24200	6027	3020	9280	7605	1375	750	600	0	0	200	133
38F2	335190	542889	213999	30600	30995	46915	43875	15720	9430	11746	2757	1046	1320	3581
38F3	177733	261876	41852	14709	12935	18425	1952	3128	2455	2475	1960	180	822	3517
38F4	38371	61997	21023	9835	14220	14588	4110	7330	2435	5856	2320	1938	7267	15259
38F5	30087	46293	34847	20691	20651	25065	20879	23703	31113	27531	18655	15362	24820	24425
38F6	110958	175141	150377	71322	74137	64886	49465	102301	126349	162368	95112	79716	149554	117538
38F7	4025	22845	5965	11880	5200	2260	1585	3900	26529	16205	9440	2909	410	340
38F8	0	100	500	550	810	0	0	0	0	200	0	0	0	0
39F0	2265	1380	140	0	200	0	0	0	80	0	0	0	0	0
39F1	11356	6100	790	1640	680	3980	2760	700	100	80	0	0	0	467
39F2	78845	51332	26155	7615	10785	26435	9545	14095	10700	300	0	1226	1730	4725
39F3	94945	102337	92190	37784	20063	32181	13298	13360	28225	4555	6075	2987	10163	6544
39F4	57879	108388	56232	33711	28856	30255	6490	18295	7675	420	6221	4022	23857	9518
39F5	14357	20665	18238	19286	35420	25954	12059	24306	10381	6126	3507	5319	7303	6527
39F6	58927	68848	78228	52609	67424	84005	24709	55425	65483	52659	50116	26576	68846	66293
39F7	4065	4835	19185	32801	36641	22395	17708	23530	37102	41610	11860	3949	7783	6200
39F8	0	0	0	0	100	0	0	0	0	0	0	0	0	0
40E9	150	0	0	0	0	0	0	0	0	0	0	0	0	0
40F0	80	0	0	0	0	0	0	40	0	0	0	0	0	0
40F1	1290	300	0	0	0	0	0	0	0	0	0	0	0	180
40F2	13200	3770	1405	900	1030	2270	1320	1790	678	40	0	80	0	989
40F3	18806	15766	27037	8645	8707	4760	4920	3350	12580	160	800	4853	1005	8958
40F4	51180	91624	86746	42175	15031	60109	35990	28765	34049	1710	39846	4577	14136	37630
40F5	5195	18716	18656	9090	14512	22651	13550	6790	5960	5756	12528	949	3770	9087
40F6	11195	21775	26922	26047	16122	36415	9531	19355	31077	27072	7085	14031	21671	28722
40F7	1750	5520	15100	26110	7220	8940	2040	24654	24620	132580	6200	9202	23983	19274
41F1	240	600	0	0	0	0	0	0	0	0	0	0	0	0
41F2	3315	20	0	0	0	0	0	0	0	0	0	0	0	0
41F3	378	585	0	0	0	800	0	25	0	340	0	0	0	0
41F4	1120	7581	1370	2160	1760	1875	1380	2455	2880	1445	735	0	1259	320
41F5	3448	6745	2295	5768	1070	2760	5560	4350	9663	3851	2620	4759	2730	1974
41F6	5555	4370	6850	12819	7220	6545	16770	9155	33210	10757	100	11536	4506	2395
41F7	320	480	640	7085	0	1300	2790	2460	5610	7450	80	776	2630	560
42F2	0	80	140	0	70	25	0	0	40	70	0	0	0	0
42F3	1014	753	226	35	130	1360	1900	0	950	300	500	0	0	0
42F4	955	2557	2030	2780	365	650	0	580	3596	835	1235	0	0	0
42F5	2193	2315	225	780	550	760	3615	90	1055	940	0	636	80	160
42F6	3520	3590	735	1100	1755	4710	12260	2800	17097	5480	680	9760	3241	3001
42F7	5350	80	0	120	0	280	100	1860	6800	1825	3117	940	974	1609
42F8	0	0	0	0	0	0	1000	0	0	0	0	0	170	0
43E8	0	0	0	0	0	0	320	0	0	0	0	0	0	0
43F2	130	900	660	0	60	30	0	0	0	0	0	0	0	0
43F3	2236	4016	1509	360	125	1890	40	0	230	130	0	0	0	0
43F4	540	1892	190	0	345	240	375	910	1060	2235	180	65	0	0
43F5	215	2230	825	5	0	300	1095	405	45	1080	2110	5	0	0
43F6	225	130	1640	40	80	1580	540	3700	7080	1050	2621	1254	48	80
43F7	2426	370	360	365	0	11715	8953	17864	25253	13420	10523	3057	2199	4636

44F2	270	400	455	40	20	140	0	30	170	0	0	0	0	0
44F3	780	730	310	0	0	1000	5	90	1500	0	0	0	0	0
44F4	20	335	100	0	60	0	315	120	560	290	1545	460	0	0
44F5	0	280	40	0	0	0	0	20	250	470	150	10	0	0
44F6	0	40	0	0	0	0	0	0	0	0	0	0	0	0
45F2	0	0	0	0	0	40	0	40	0	0	0	0	0	0
45F3	40	140	40	0	0	0	110	90	225	0	25	0	0	0
45F4	0	0	0	25	0	0	0	0	0	86	0	0	0	0
45F5	0	80	0	0	0	0	0	0	2625	0	0	0	0	0
46F5	0	120	0	0	0	0	0	0	0	0	0	0	0	0
46F6	0	0	0	285	0	0	0	0	0	0	0	0	0	0
49F4	0	0	0	0	0	0	0	760	0	0	0	0	0	0
49F5	0	0	0	0	0	0	0	400	0	0	0	0	0	0
52F3	0	0	0	0	0	0	0	365	0	0	0	0	0	0

Table D-5 DAB LPUE (kg landings/days at sea by 1471 kW vessel, see equation 1). First LPUE calculated by rectangle, subsequently averaged over the rectangles (for Dutch beam trawlers > 221kW). Source: VISSTAT

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
LPUE	173	201	154	143	133	141	145	177	185	232	202	160	194	157

Table D-6 NL Dab LPUE (kg/day at sea by 1471kW vessel) per age and year. No market sampling was done in 2008.

	year	2002	2003	2004	2005	2006	2007	2009	2010	2011
age	2	0.6	13.9	15.4	1.8	17	12.1	4.2	0.5	9.7
	3	16	28.9	31.5	31.1	69.5	37.3	25.6	15.8	21.2
	4	33.2	32	34.1	43.5	36.2	61.5	25.3	39	34
	5	36.8	33	29.6	33.7	36.2	42.9	32.4	44.1	39.4
	6	27.9	18	19.3	32.9	5.9	42	43.5	38.4	23.9
	7	9.5	11.9	9.0	24	11.8	4.7	8.4	35.2	14.9
	8	6.5	1.6	5.8	4.4	6.7	18.7	16.2	8.0	10.9
	9	2.4	0.5	0	5.3	0	2.8	2.3	8.5	0.4
	10	0	0.5	0	0	1.5	0	2.0	1.3	2.1
	11	0.6	0	0	0	0	10.3	0	2.9	0
	12	0	0.5	0	0	0	0	0	0	0.2
	13	0	0	0	0	0	0	0.3	0	0
	15	0	0	0	0	0	0	0	0	0.2
	19	0	0	0	0	0	0	0	0.3	0

Table D-7 Dab LPUE by rectangle (kg per day).

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
31F1	152	150	176	166	126	145	183	160	146	203	291	173	245	0
31F2	156	173	179	219	217	197	217	187	182	377	567	445	314	252
31F3	271	154	114	275	111	195	106	206	159	357	342	243	621	0
31F4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31F5	0	0	22	0	0	0	0	0	0	0	0	0	0	0
31F6	213	0	0	0	0	0	0	0	0	0	0	0	0	0
32F0	0	0	0	0	0	0	0	89	0	0	0	0	0	0
32F1	160	165	136	153	83	227	194	134	119	141	162	202	103	44
32F2	155	179	176	199	178	177	194	168	137	259	348	271	201	179
32F3	212	182	223	206	212	153	137	118	134	400	426	279	292	316
32F4	151	241	667	384	411	345	214	178	80	181	384	0	0	0
32F5	0	0	0	0	0	13	0	0	0	0	0	0	0	0
33F1	143	65	0	144	112	107	0	174	78	0	0	28	0	166
33F2	141	127	132	95	120	116	128	123	102	151	166	147	155	108
33F3	182	181	150	124	100	104	109	106	126	273	256	142	178	208
33F4	189	202	137	183	149	149	159	164	158	377	389	551	361	208
33F5	0	0	0	0	298	0	0	36	0	0	0	0	0	0
34F0	0	0	34	106	0	185	0	0	0	0	0	0	0	0
34F1	103	79	96	119	100	110	109	67	154	0	0	0	19	66
34F2	99	131	131	140	105	114	93	95	100	142	100	117	159	87
34F3	134	182	107	84	70	83	98	126	149	198	144	122	173	158

34F4	126	151	93	91	73	81	104	141	157	181	146	130	100	127
34F5	0	214	85	143	52	0	48	227	62	116	0	53	0	0
34F6	69	0	145	2783	87	0	122	0	0	0	0	0	0	0
34F7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35F0	0	287	61	165	61	59	96	0	0	0	179	0	124	0
35F1	66	130	111	141	87	64	73	77	68	77	64	64	54	35
35F2	102	120	102	102	78	81	82	101	93	143	112	96	115	59
35F3	116	156	99	88	74	90	104	163	156	189	138	110	133	112
35F4	115	142	91	73	61	81	102	151	159	137	128	98	90	110
35F5	77	88	76	53	84	104	71	159	144	161	104	83	46	42
35F6	0	0	0	59	163	57	216	0	49	0	493	0	0	0
36F0	133	244	202	184	142	121	146	231	227	154	173	137	202	347
36F1	102	147	171	156	102	90	97	127	165	157	112	98	108	159
36F2	116	151	163	110	73	69	85	133	146	144	95	68	74	65
36F3	112	137	79	65	46	61	84	153	152	149	132	106	107	69
36F4	86	135	59	55	52	67	111	156	162	134	139	87	95	138
36F5	98	103	51	57	49	72	100	166	164	167	182	114	124	202
36F6	116	133	118	119	69	93	123	156	174	197	355	208	228	160
36F7	208	171	199	115	59	140	186	276	275	233	570	281	472	0
36F8	37	0	0	0	0	53	0	0	0	0	0	0	0	0
37E9	0	0	125	0	0	0	0	0	0	0	0	0	0	0
37F0	115	248	220	194	109	120	118	162	133	152	142	175	162	480
37F1	145	252	211	143	88	88	90	121	126	170	124	121	148	157
37F2	197	265	287	91	92	78	109	130	117	118	44	69	68	62
37F3	125	164	124	73	51	46	69	96	131	93	53	47	47	36
37F4	66	99	54	56	56	58	89	100	115	89	51	55	116	126
37F5	79	89	44	67	50	66	105	127	133	155	119	110	128	277
37F6	170	141	123	123	79	125	153	234	274	297	279	240	276	391
37F7	394	309	182	294	130	179	201	307	386	559	350	323	427	357
37F8	95	0	0	0	313	0	0	0	0	0	1176	0	825	0
38E8	0	0	0	93	0	0	0	0	0	0	0	0	0	0
38E9	94	35	36	45	106	35	58	76	0	68	0	0	0	0
38F0	54	130	160	90	91	112	57	135	38	50	79	41	96	475
38F1	354	471	313	150	86	121	95	163	71	93	0	0	90	66
38F2	590	509	586	237	329	174	172	131	142	126	63	34	88	62
38F3	438	411	386	176	181	190	129	145	118	164	84	12	75	17
38F4	112	110	56	52	81	68	141	113	118	66	35	64	165	196
38F5	92	80	58	63	70	87	102	138	151	141	69	74	131	139
38F6	156	147	113	88	110	136	141	196	206	259	241	192	289	303
38F7	189	271	146	194	141	173	233	219	661	562	182	250	120	0
38F8	0	75	36	81	85	0	0	0	0	246	0	0	0	0
39F0	40	63	128	0	175	0	0	0	11	0	0	0	0	0
39F1	132	189	166	160	87	224	115	73	69	16	0	0	0	0
39F2	349	413	344	201	268	200	137	183	204	98	0	57	123	0
39F3	346	484	371	249	227	178	177	178	276	413	148	84	456	0
39F4	237	364	291	198	303	178	199	277	170	190	221	162	491	153
39F5	164	171	90	99	226	183	196	296	246	194	89	119	262	134
39F6	152	211	104	100	142	232	186	234	210	297	287	151	302	249
39F7	388	162	176	166	193	221	237	270	386	530	535	246	414	206
39F8	0	0	0	0	124	0	0	0	0	0	0	0	0	0
40E9	29	0	0	0	0	0	0	0	0	0	0	0	0	0
40F0	49	0	0	0	0	0	0	9	0	0	0	0	0	0
40F1	49	83	0	0	0	0	0	0	0	0	0	0	0	36
40F2	142	148	179	83	265	163	114	157	173	29	0	90	0	0
40F3	341	548	256	219	263	211	114	183	273	0	315	136	63	75
40F4	298	421	294	274	289	275	188	314	301	219	509	142	171	127
40F5	157	259	177	187	513	346	435	311	214	499	381	116	145	197
40F6	165	183	72	108	143	237	137	231	183	277	159	168	203	241
40F7	148	236	163	346	190	323	188	402	320	632	446	287	485	260
41F1	0	82	0	0	0	0	0	0	0	0	0	0	0	0
41F2	316	10	0	0	0	0	0	0	0	0	0	0	0	0
41F3	105	31	0	0	0	90	0	24	0	107	0	0	0	0
41F4	223	127	137	174	149	120	141	39	74	69	184	0	128	0
41F5	178	261	52	203	105	128	239	261	186	173	118	123	99	101
41F6	87	111	73	100	89	165	156	241	171	235	118	308	146	0
41F7	114	241	241	252	0	606	57	167	179	209	78	164	180	0
42F1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42F2	0	29	46	0	15	9	0	0	40	0	0	0	0	0
42F3	39	37	38	10	7	100	190	0	43	250	480	0	0	0
42F4	79	84	32	87	36	14	0	24	39	43	80	0	0	0
42F5	127	78	54	207	42	140	215	32	73	240	0	243	41	0
42F6	88	97	48	73	99	180	173	92	201	125	70	266	142	0
42F7	153	69	0	58	0	0	40	61	219	92	325	151	75	0
42F8	0	0	0	0	0	0	748	0	0	0	0	0	61	0
43E8	0	0	0	0	0	0	172	0	0	0	0	0	0	0
43F2	17	279	59	0	46	0	0	0	0	0	0	0	0	0

43F3	26	84	30	54	10	79	30	0	48	39	0	0	0	0
43F4	25	93	20	0	13	73	52	62	41	75	0	31	0	0
43F5	16	63	40	1	0	293	63	26	7	57	113	5	0	0
43F6	49	19	40	46	22	217	59	242	262	62	464	316	44	0
43F7	51	24	24	48	0	187	162	162	175	120	189	102	91	0
44F2	20	91	27	17	8	7	0	2	20	0	0	0	0	0
44F3	37	48	20	0	0	68	0	11	61	0	0	0	0	0
44F4	8	9	2	0	4	0	5	5	27	6	43	24	0	0
44F5	0	7	1	0	0	0	0	4	16	23	28	3	0	0
44F6	0	4	0	0	0	0	0	0	0	0	0	0	0	0
45F2	0	0	0	0	0	39	0	10	0	0	0	0	0	0
45F3	17	18	4	0	0	0	15	13	11	0	11	0	0	0
45F4	0	0	0	4	0	0	0	0	0	15	0	0	0	0
45F5	0	18	0	0	0	0	0	0	0	0	0	0	0	0
46F5	0	16	0	0	0	0	0	0	0	0	0	0	0	0
46F6	0	0	0	132	0	0	0	0	0	0	0	0	0	0
49F4	0	0	0	0	0	0	0	209	0	0	0	0	0	0
49F5	0	0	0	0	0	0	0	220	0	0	0	0	0	0
52F3	0	0	0	0	0	0	0	84	0	0	0	0	0	0