https://doi.org/10.17895/ices.pub.18622151

Stock Annex: Brill (*Scophthalmus rhombus*) in Subarea 4 and divisions 3.a and 7.d–e (North Sea, Skagerrak and Kattegat, English Channel)

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Brill
Working Group:	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK)
Created:	
Authors:	
Last updated:	March 2013
Last updated by:	Kelle Moreau

A. General

General biology

Brill (*Scophthalmus rhombus*) is a shallow-water flatfish mainly found in areas close inshore. It prefers sandy bottoms, but can sometimes also be found on gravel and muddy grounds. Its vertical distribution ranges from 4 meters to 73 meters, although small juvenile fish are often common in sand shore pools. Mature brill are rarely observed inshore, whereas immature specimens are often caught near the coast and even in estuaries.

The distribution of brill in the North Eastern Atlantic ranges along the European coastline from 64° N (the Lofotes) down to 30° N, extending into the Mediterranean and even into the Black Sea (Nielsen, 1986). Brill is also found in the Skagerrak, the Kattegat, and small quantities in the Baltic Sea. The western limit of its distribution area is reached in southern Iceland. The distribution in the North Sea, Skagerrak and Kattegat, based on presence/absence in a number of surveys, is shown in Figure 9-1.

The feeding habits of this species closely resemble those of turbot and were extensively reviewed by de Groot (1971) and Wetsteijn (1981). The pelagic larvae feed primarily on copepod nauplii, decapod and mollusc larvae. With increasing size, this diet gradually changes from larger invertebrate prey and larvae of several fish species to small fish. Larger brill (> 40 cm) are primarily piscivorous.

More information on the biology of brill can be found in Annex 5 of WGNEW (2010).

Stock identity and possible assessment areas;

The oldest study that could be found containing information on the genetic structure of brill was carried out by Blanquer et al. (1992), using allozyme electrophoresis. No genetic differentiation could be found between Atlantic and Mediterranean populations, suggesting that there are also very low levels of differentiation in brill from different areas.

In the EU funded study on ‘Stock discrimination in relation to the assessment of the brill fishery’ the following was concluded (Delbare and De Clerck, 1999): “As a final conclusion, biological parameters (composition of Belgian brill landings, growth rate and reproduction characteristics) and the sequencing of the D-loop resulted in insignificant differences between brill from the different areas. Therefore, arguments favor the hypothesis that brill from the NE Atlantic might be considered to be only one population: the North-eastern Atlantic brill population. Further research on spawning areas and migration through respectively egg surveys and tagging experiments, could generate valuable information about (sub-) population structures of brill throughout its entire distribution area. Therefore it is advisable to extend the sampling area to the Mediterranean Sea and the Black Sea."

Currently, the genetic structure of brill over its entire distribution area is being characterized by ILVO and the University of Leuven. Genetic variation was found to be of mean to high levels, but the results show almost no differentiation between potential biological populations and/or management units. Therefore, WGNEW 2013 suggests treating brill in 3.a, 4 and 7.d-e as a single stock.

Further research on brill spawning areas (egg surveys), and of migration of adult (tagging experiments) and especially immature brill (tagging experiments and genetic analysis of the immature population components) could still generate valuable information about (sub-)population structure of brill throughout its entire distribution area.

More information on the delineation of potential brill stocks can be found in Annex 5 of WGNEW (2010).

Management regulations (TAC's, minimum landing size)

So far, no analytical assessments leading to fisheries advice have been carried out for brill by ICES. The available information is inadequate to evaluate stock trends. Therefore, the state of the stock(s) is unknown. No explicit objectives have been defined for potential stocks of this species, no precautionary reference points have been proposed, and no management plans are in place. However, for the EU-waters in Division 2.a and Subarea 4, precautionary TACs have been defined for brill and turbot (combined) in the past. These TACs belong entirely to the EU-fisheries, and a historical overview is presented in the table below.

Historical overview of combined TACs for brill *Scophthalmus rhombus* and turbot *Scophthalmus maximus* in Division 2.a and Subarea 4

YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TAC	9000	9000	6750	5738	4877	4550	4323	4323	5263	5263	5263	4642	4642	4642

No restriction on the minimum length for landing brill is imposed by the EC. In several geographical areas however, Minimum Landing Sizes (MLS) have been installed for brill by different authorities. The most frequently applied MLS is 30 cm (e.g., in Belgium, the Baltic, the English Sea Fisheries District Cornwall, …).

B. Data

Fisheries data

Landings

Table 2.1 and Figure 2.1.a summarize the official brill landings from the Greater North Sea, subdivided into Subarea 4, Division 3.a and Divisions 7.d-e (Source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium, Germany and the UK for 2012). Over the period 1950–1970, total landings ranged from 582 t to 947 t per year, followed by a gradual increase to 2121 t in 1977. During 1978–2010, total landings varied between 1517 t (in 1980) and 3141 t (in 1993). Since 2000, annual total landings fluctuated around an average of 2371 t (range: 2142 t–3141 t). The North Sea (IV) accounts for the major part of these landings (Figure 2.1.b), on average generating 68% of the totals over the time series (range: 50–86%). The English Channel and the Skagerrak are responsible for average contributions to the international brill landings of 19% and 13% respectively.

Landings in the Skagerrak/Kattegat (3.a)

International landing series from the Skagerrak/Kattegat were updated for brill (source: ICES Fishstat) and can be consulted in Table 2.2 and Figure 2.2.

Over the period 1950–2012, these landings ranged from 59 t to 388 t per year. On average, Denmark landed 85% of the Skagerrak/Kattegat brill (over the entire time series). Other countries contributing to the total landings were - in descending order of importance – Sweden, Norway, the Netherlands (mainly because of a peak in the second half of the seventies), Germany and Belgium. The Danish share has dropped to 75% of the landings in the last ten years, mainly due to an increase of Norwegian fisheries in the area.

Landings in the North Sea (4)

International landing series from the North Sea were composed for brill (source: ICES Fishstat and national submissions from Belgium, Germany and the UK to WGNEW 2013) and can be consulted in Table 2.3 and Figure 2.3.

During 1950–1970, total landings were about half of the values reached during 1971–1990, but as this is most likely attributable to incomplete statistics in the 50s and 60s (different reporting regulations in this period compared to later in the time series) only the data from 1971 onwards were used to calculate the following figures. Over the period 1971–2012, brill landings from the North Sea ranged from 893 t to 2439 t per year. The Netherlands landed on average 70% of the North Sea brill. Other countries contributing to the total landings were – in descending order of importance – Belgium, UK, Denmark, Germany and France. Norway, Ireland and Sweden only land negligible quantities of North Sea brill.

Landings in the English Channel (7.d-e)

International landing series from the English Channel were updated for brill (source: ICES Fishstat and national submissions from Belgium and the UK to WGNEW 2013) and can be consulted in Table 2.4 and Figure 2.4. Due to a change in reporting regulations in 1977, landings before and after this point in time cannot be quantitatively compared to each other. As a result, the dramatic increase in brill landings from 1977 onwards rather reflects an increase in reporting of the landings than a real increase in these landings. Prior to 1977, only the UK systematically reported brill landings from the English Channel, whereas later in the time series also France and Belgium have major contributions to the total landings. Therefore, only data from 1977 onwards were used for the calculation of the following figures. Over the period 1977–2012, brill landings from the English Channel ranged from 240 t to 759 t per year. France and the UK have always been the main contributors to the brill landings from the English Channel (44% and 33% respectively, over the entire time-line), with Belgium in third place (23%). The Netherlands, Ireland and Denmark landed negligible quantities.

More details on the Belgian, Dutch, French and UK fisheries catching brill, and information on length- and age-distributions of Belgian brill landings can be found in Annex 5 of WGNEW (2010).

Discards

Due to its high value and the absence of a European Minimum Landing Size, brill is not expected to be discarded easily by fishermen catching the species as long as the quota have not been fully taken. The fact that the species is characterized by a fast growth, quickly reaching commercially interesting lengths (unfortunately at relatively young ages and while still immature), smaller individuals are rather rare in commercial catches, which contributes to the low numbers of discards.

Although no discard data that were raised to fleet levels were available to WGNEW 2013, discard rates from the Belgian (ILVO) discard observer programme in the beam trawl fishery (mesh size range 70–99) for the years 2008–2012 in 4, 7.d and 7.e (Table 2.5) indeed illustrate very limited discarding (0–0.7% in 4, 0–0.1% in 7.d, 0% in 7.e). Keeping in mind these low numbers in beam trawls that are traditionally known for their aselective properties and large proportions of discards, and that other gear types are expected to exhibit even lower discard rates/quantities of this species, the amount of discarding of brill does not seem to be a substantial problem for the assessment of the state of the specie’s stocks in terms of data quality: landings can be considered to be a reliable proxy for total catch.

From a biological perspective, it’s a very different story, as most of the discarded fish have not reached sexual maturity yet, and as such have not had the chance to reproduce and contribute to the future generations. The low numbers of discards at low lengths in the Belgian observer programme are illustrated by quarter for Subarea 4 and Divisions 7.d and e in Figures 2.5–2.7.

More details on the numbers at length discarded per hour in the Dutch beam trawl fleet (North Sea) can be found in Annex 5 of WGNEW (2010).

Commercial LPUE series

Landings of brill from the North Sea, the accompanying effort and a corrected LPUE series from the Dutch beam trawl fleet > 221 kW were presented to WGNEW 2013. The landings (Figure 2.8) fluctuated with little variation between ca 600 and ca 800 tonnes between 2002 and 2009, and stabilized at a slightly higher level (900–1000 tonnes) in 2010–2012. Combined with an effort series (days at sea; Figure 2.9) that shows a consistent decline from 2002 to 2008 (with the biggest decline in the last year of this period) and a stabilization from 2008 to 2012, this results in a CPUE series (kg/day; Figure 2.10 and Table 2.6) that illustrates an increase from 22.3 brill/day in 2002 to 55.3 brill/day in 2012. Given the facts that the majority of the brill landings from the greater North Sea originate from Subarea IV, and that around 70% (on average) of these are landed by the Netherlands, this LPUE series may be considered a reliable time series when evaluating the stock trend of brill in the Greater North Sea stock area.

The Landings Per Unit of Effort (LPUE) were standardised for engine power and corrected for targeting behavior in a way similar to those used to analyse commercial LPUE data for North Sea plaice. The standardization for engine power is relevant as trawlers are likely to have higher catches with higher engine powers, as they can trawl heavier gear or fish at higher speeds. The correction for targeting behavior relies on reducing the effects of spatial shifts in fishing effort by calculating the fishing effort by ICES rectangle and subsequently averaging these over the entire fishing area.

More information on the data that were used (EU logbook auction data and, market sampling data), the calculation of the LPUEs, the standardization of engine power, the correction for targeting behavior and the results can be found in van der Hammen *et al*. (2011).

C. Assessment method and data

Survey data, recruit series

General

Catches of brill are generally very low on surveys. These low catch numbers very often result in an underrepresentation of some year-classes (mainly the older ones), leading to a poor quality of the resulting survey abundance series and indices, and poor agreement among different surveys.

WGNEW 2012 tested four surveys for their potential use in describing stock trends of brill in the greater North Sea. Three of these surveys take place in the North Sea (IBTS_TRI_Q1, BTS_TRI_Q3 and BTS_ISI_Q3) and one in the English Channel (CGFS_Q4). Time series of total numbers of brill caught by the three North Sea surveys and the Channel are depicted in WGNEW 2012 (Figures 9.5–9.7), but only the BTS_ISI_Q3 was found to catch a sufficient number of individuals to be useful in the context of evaluating stock trends of North Sea brill. WGNEW 2013 did not go into these surveys again, with exception for the BTS_ISI_Q3. For the Skagerrak/Kattegat, WGNEW 2013 dug into the data of the Danish IBTS_HAF_Q1&4 for the first time, and found the data of both quarters of this survey useful to the evaluation of brill abundance in this area.

North Sea (Subarea 4)

The ALK, length distributions (per 5 years) and length-at-maturity for the BTS_ISI_Q3 in IV are illustrated in Figures 2.11–2.13. These show that mainly brill of ages 1–2 and lengths of 20–45cm are caught in this survey and that no obvious shifts in length distributions are apparent over the time series (1987–2012). All brill under 30 cm are immature, and all above 40 cm are mature, with a mix of mature and immature individuals between 30 and 40 cm.

The corresponding abundance indices (numbers per hour) are spatially plotted per rectangle in Figure 2.14 and over time in Figure 2.15 and Table 2.7. These seem to illustrate a recovery of the species in IV since 2009 after a period of consistent lower catches during 2001–2008. The inter-annual variation between all other years is so big that no real trend is apparent over the entire time series. Therefore, the lower catches per hour in 2012 (1.2/hr) in comparison with the higher values in the three preceding years (1.5–2.5/hr) are not considered to represent an alarming signal so far.

Skagerrak/Kattegat (3.a)

Data on brill from the Danish BITS-survey in the Kattegat (BITS_HAF_Q1&4) were analysed separately for the two quarters in which this survey runs, revealing almost identical patterns for Q1 and Q4. Therefore, it was decided to combine the data from both quarters for the evaluation of the brill substock in 3.a, and only the results of this combined analysis are presented in this report. The fact that this survey only covers the Kattegat (3.aS) and not the Skagerrak (3.aN) was not considered to be a problem by WGNEW 2013 as the deeper northern waters do not harbour important numbers or densities of brill, which generally prefers more shallow waters.

The ALK, length distributions (per 5 years) and length-at-maturity for the BITS_HAF_Q1&4 in 3.a are illustrated in Figures 2.16–2.18. These show that mainly brill of ages 1–3 and lengths of 10–40cm are caught in this survey and that no alarming shifts in length distributions (no obvious loss of larger/older individuals from the population) are apparent over the time series (1996–2012). All brill under 30 cm are immature, but there is a much bigger overlap in length between the immature and mature stages compared to the North Sea (Figure 2.13), with mature individuals of lengths lower than 20 cm. This illustrates the general phenomenon of slower growth at higher latitudes that was also published for brill by Delbare and Declerck (1999), that didn't include the Skagerrak/Kattegat in their overview.

The corresponding abundance indices (numbers per hour) are spatially plotted per rectangle in Figure 2.19 and over time in Figure 2.20 and Table 2.7. These illustrate a period with higher catches (2006–2011) after a period of consistent lower catches (1996–2005). In 2012, the numbers caught per hour dropped to the level of 2004–2005 again but given the noise in the data (large inter-annual variations) it may be preliminary to interpret this as a sign of a decreasing stock.

English Channel (Divisions 7.d–e)

No useful survey index was identified for the evaluation of the brill substock in the English Channel during WGNEW 2013.

C. Biological sampling

No new information was obtained compared to the report of WGNEW, 2010.

D. Population biology parameters and a summary of other research

No new information was obtained compared to the report of WGNEW, 2010.

E. Analyses of stock trends and potential status indicators

DLS – category 6

The ICES Data Limited Stocks methodological document (draft version 2012) mentions brill in the Greater North Sea as the example of a stock Category 6: "This category includes stocks where landings are negligible in comparison to discards, and stocks that are part of stock complexes and are primarily caught as by-catch species in other targeted fisheries; e.g. North Sea brill in the targeted North Sea plaice and sole fishery. The development of indicators may be most appropriate for such stocks."
WGNEW 2013 feels that this stock can be upgraded to a higher category as there is available information that allows this, and explored the possibilities for an upgrade to categories 4 and 3.

DLS – category 4

This category includes stocks for which a time series of catch can be used to approximate MSY. Although raised discard estimates are currently unavailable to WGNEW 2013, landings can be safely used as discards are negligible in brill.
When a sufficient catch history is available to determine a suitable exploitation rate, the methodological document prescribes to apply the Depletion-Corrected Average Catch (DCAC) model (MacCall, 2009).

DCAC is calculated as:

$$\mathrm{DCAC} = \frac{\sum C_t}{n + \Delta\left[B_{peak}\left(F_{msy}/M\right)M\right]^{-1}}$$

Where:

C_t is the catch during year t,

n is the length of catch time-series in years,

Δ is the relative stock status,

B_{peak} is the biomass that corresponds to maximum sustainable yield relative to carrying capacity (B_{msy}/K),

M is the instantaneous rate of natural mortality, and

F_{msy}/M is the ratio between the fishing mortality rate that corresponds to B_{peak} and M.

With exception of C_t and n, all other parameters are not know for brill in the Greater North Sea, but standard settings and/or typical values for other flatfish can be used as described by the help function on http:\\ntf.nefsc.noaa.gov, where the DCAC model can be downloaded from the NOAA Toolbox. The major problem is created by the relative stock status Δ, also known as the depletion factor. This is a measure of the amount of change in abundance that occurred between the first and last year of the catch series, expressed as a fraction of unfished biomass, i.e., (B_{last}-B_{first})/$B_{unfished}$. In most data-poor cases, the value of Depletion Delta requires an "educated guess."

For brill in the Greater North Sea, the DCAC-model was run with a range of input parameters, but the results varied greatly and the model proved to be very sensitive to these in this case. Additionally, the results were not in line with the signals that emerged from survey analyses (see below). Therefore, WGNEW 2013 decided not to base its advice for this stock on the DCAC-results.

DLS – category 3

Method 3.2.0 in the ICES Data Limited Stocks methodological document specifies that catch advice can be derived from the survey-adjusted status-quo catch in situations where there are survey data on abundance (e.g. CPUE over time), but survey-based proxies for MSY $B_{trigger}$ and F values are not known. Also other indicators of stock size can be used.

Three time series that are considered indicative of the stock trend of brill in the Greater North Sea are presented by WGNEW 2013: two survey indices (BTS Q3 and BITS Q1&4) and one commercial LPUE series (Dutch beam trawl fleet > 221 kW). These time series of abundance indicate increasing stock trends over the last decade although there is high inter-annual variability in the survey indices. The exploitation status remains unknown.

Landings are stable and considered a reliable approximation of catches as only little discarding of brill occurs. Effort in the main fleets (beam trawls) with brill catches have declined almost 50% between 2002 and 2012.

An assessment of brill in the English Channel fisheries using the data sampled by France tonnes.

F. Conclusion

WGNEW 2013 recommends that brill in the Greater North Sea be treated as a Category 3 stock, and that method 3.2.0 be applied to calculate catch advice for this stock. Three time series of abundance have been identified as useful for this purpose: 1) numbers per hour from the BTS Q3 (ISIS), 2) numbers per hour from the BITS Q1&4 (Havfisken) and 3) kg per day from the corrected LPUE series for the Dutch beam trawl fleet. Because of the large interannual variability (a lot of noise) in the survey series, it is not recommended to use the ratio of the average of the last two years over the average of the last three years for the calculation, as this would give too much weight to the noise and drive quota to go up and down too much in consecutive years. Calculations over longer periods of time are recommended.

G. References

Blanquer, O.A., Alayse, J.P., Berrada-Rkhami, O. and Berrebi S. (1992). Allozyme variation in turbot (Psetta maxima) and brill (Scophthalmus rhombus) (Osteichthyes, Pleuronectiformes, Scophthalmidea) throughout their range in Europe. J. of Fish Biol., 41: 725–736.

de Groot, S.J. 1971 On the inter-relationships between the morphology of the alimentary tract, food and feeding behaviour in flatfishes. Netherlands Journal of Sea Research, 5: 121–196

Delbare, D. and De Clerck, R. 1999. Stock discrimination in relation to the assessment of the brill fishery - Study in support of the Common Fisheries Policy. Final Report EC-Study Contract DG XIV 96/001.

Dunn, M. R., Rogers, S.I., Morizur, Y., Tetard, A., Aublet, B., Le Niliot, P., and Miossec, D. (1996). Biological Sampling of Non-Quota Species. Final Report for EC Study Contract C934CO18.

ICES. 2010. Report of the Working Group on Assessment of New MoU Species (WGNEW), 11–15 October 2010, ICES Headquarters, Denmark. ICES CM 2010/ACOM: 21. 185 pp.

MacCall, A.D. 2009. Depletion-corrected average catch: a simple formula for estimating sustainable yields in data-poor situations. – ICES Journal of Marine Science, 66: 2267–2271.

Nielsen, J.G., 1986. Scophthalmidae. In: Fishes of the North-eastern Atlantic and the Mediterranean. Volume III. P.J.P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese (Eds.). Published by the United Nations Educational, Scientific and Cultural Organizations.

van der Hammen, T., J.J. Poos & F. Quirijns (2011). Data availability for the evaluation of stock status of species without catch advice. Case study: Turbot (*Psetta maxima*) and brill (*Scophthalmus rhombus*). IMARES-report C109/11.

Wetsteijn, B. 1981. Feeding of North Sea turbot and brill. ICES CM 1981/G:74.

Table 2.1. Total international landings (t) of brill in Subarea 4, Divisions 3.a and 7.d-e (Source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium, Germany and the UK for 2012).

Year	3.a	4	7.d–e	TOTAL
1950	319	384	59	**762**
1951	337	511	78	**926**
1952	236	565	72	**873**
1953	246	589	62	**897**
1954	234	529	60	**823**
1955	212	571	61	**844**
1956	213	516	60	**789**
1957	148	468	70	**686**
1958	203	480	67	**750**
1959	233	424	59	**716**
1960	318	486	52	**856**
1961	305	581	47	**933**
1962	207	591	55	**853**
1963	120	620	51	**791**
1964	106	565	60	**731**
1965	155	535	48	**738**
1966	187	546	53	**786**
1967	106	409	67	**582**
1968	100	579	57	**736**
1969	99	658	190	**947**
1970	97	618	59	**774**
1971	104	1073	66	**1243**
1972	120	994	75	**1189**
1973	131	989	90	**1210**
1974	200	1152	81	**1433**
1975	187	1222	137	**1546**
1976	224	1208	285	**1717**
1977	388	1410	323	**2121**
1978	216	1375	411	**2002**
1979	184	1366	459	**2009**
1980	82	1033	402	**1517**
1981	59	1218	490	**1767**
1982	74	1294	487	**1855**
1983	83	1448	526	**2057**
1984	97	1522	531	**2150**
1985	109	1709	494	**2312**
1986	106	1207	456	**1769**
1987	103	970	493	**1566**
1988	101	1085	452	**1638**
1989	97	1302	425	**1824**
1990	127	893	543	**1563**
1991	99	1682	470	**2251**
1992	146	1810	463	**2419**
1993	212	2439	490	**3141**
1994	220	1916	490	**2626**
1995	150	1434	558	**2142**
1996	111	1247	608	**1966**
1997	105	957	501	**1563**
1998	131	1283	451	**1865**
1999	156	1280	240	**1676**
2000	140	1508	678	**2326**
2001	98	1573	738	**2409**
2002	89	1302	716	**2107**

2003	128	1346	759	**2233**
2004	155	1249	666	**2070**
2005	133	1160	611	**1904**
2006	139	1175	649	**1963**
2007	160	1240	741	**2141**
2008	182	1004	593	**1779**
2009	146	1162	591	**1899**
2010	122	1500	695	**2317**
2011	131	1495	622	**2248**
2012	121	1515	617	**2253**

Table 2.2. Total international landings (t) of brill in the Skagerrak/Kattegat (Division 3.a) by country over the period 1950–2012 (source: ICES Fishstat).

Year	BEL	DEU	DNK	NLD	NOR	SWE	TOTAL
1950	0	0	234	0	0	85	**319**
1951	0	0	260	0	4	73	**337**
1952	0	0	170	0	1	65	**236**
1953	0	0	175	0	0	71	**246**
1954	0	0	155	0	1	78	**234**
1955	0	0	150	0	0	62	**212**
1956	0	0	163	0	0	50	**213**
1957	0	0	110	0	0	38	**148**
1958	0	0	166	0	0	37	**203**
1959	0	0	175	0	0	58	**233**
1960	0	0	272	0	0	46	**318**
1961	0	0	255	0	0	50	**305**
1962	0	0	207	0	0	0	**207**
1963	0	0	120	0	0	0	**120**
1964	0	0	106	0	0	0	**106**
1965	0	0	155	0	0	0	**155**
1966	0	0	187	0	0	0	**187**
1967	0	0	106	0	0	0	**106**
1968	0	0	100	0	0	0	**100**
1969	0	0	99	0	0	0	**99**
1970	0	0	97	0	0	0	**97**
1971	0	0	104	0	0	0	**104**
1972	0	0	120	0	0	0	**120**
1973	0	0	131	0	0	0	**131**
1974	0	0	200	0	0	0	**200**
1975	0	0	167	1	0	19	**187**
1976	1	0	185	26	0	12	**224**
1977	1	0	276	99	0	12	**388**
1978	0	0	178	27	0	11	**216**
1979	0	0	156	17	0	11	**184**
1980	2	0	69	1	0	10	**82**
1981	0	0	54	0	0	5	**59**
1982	1	0	64	1	0	8	**74**
1983	0	0	73	3	0	7	**83**
1984	0	0	89	0	0	8	**97**
1985	0	0	100	0	0	9	**109**
1986	0	0	94	0	0	12	**106**
1987	0	0	93	0	0	10	**103**
1988	0	0	91	0	0	10	**101**
1989	0	0	88	0	0	9	**97**
1990	1	0	116	0	0	10	**127**
1991	1	0	81	0	7	10	**99**
1992	1	0	123	0	7	15	**146**
1993	2	0	184	0	10	16	**212**

1994	0	0	191	0	12	17	**220**
1995	0	0	124	0	13	13	**150**
1996	0	0	94	0	12	5	**111**
1997	0	0	83	0	11	11	**105**
1998	0	0	108	0	10	13	**131**
1999	0	0	126	0	13	17	**156**
2000	0	0	112	0	12	16	**140**
2001	0	0	73	0	13	12	**98**
2002	0	0	66	0	12	11	**89**
2003	0	0	99	1	12	16	**128**
2004	0	0	119	4	15	17	**155**
2005	0	0	101	3	16	13	**133**
2006	0	1	105	3	16	14	**139**
2007	0	1	119	3	15	22	**160**
2008	0	2	138	1	13	28	**182**
2009	0	1	98	1	14	32	**146**
2010	0	1	95	1	9	16	**122**
2011	0	1	103	0	15	12	**131**
2012	0	0	90	0	16	15	**121**

Table 2.3. Total international landings (t) of brill in the North Sea (Subarea 4) by country over the period 1950–2012 (source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium, Germany and the UK for 2012).

Year	BEL	DEU	DNK	FRA	GBR	NLD	NOR	SWE	TOTAL
1950	34	0	39	0	183	108	1	19	**384**
1951	23	0	53	0	322	93	1	19	**511**
1952	21	0	65	0	350	117	3	9	**565**
1953	23	0	49	0	376	130	0	11	**589**
1954	19	0	53	0	330	106	14	7	**529**
1955	23	0	51	0	357	137	3	0	**571**
1956	28	0	47	0	276	156	0	9	**516**
1957	32	0	27	0	247	154	0	8	**468**
1958	43	0	42	0	223	162	0	10	**480**
1959	41	0	30	0	219	125	0	9	**424**
1960	55	0	37	0	235	150	1	8	**486**
1961	102	0	40	0	264	166	0	9	**581**
1962	97	0	42	0	238	214	0	0	**591**
1963	79	0	59	0	307	175	0	0	**620**
1964	79	0	46	0	161	279	0	0	**565**
1965	71	0	56	0	127	281	0	0	**535**
1966	100	0	63	0	119	264	0	0	**546**
1967	138	0	29	0	105	137	0	0	**409**
1968	152	0	43	0	110	274	0	0	**579**
1969	145	0	47	0	102	364	0	0	**658**
1970	114	0	42	0	76	386	0	0	**618**
1971	187	0	72	0	94	720	0	0	**1073**
1972	213	0	65	0	51	665	0	0	**994**
1973	185	0	55	0	39	710	0	0	**989**
1974	135	0	68	0	44	905	0	0	**1152**
1975	164	0	76	13	44	925	0	0	**1222**
1976	148	0	65	10	45	940	0	0	**1208**
1977	166	0	88	17	60	1079	0	0	**1410**
1978	175	0	123	26	84	967	0	0	**1375**
1979	188	0	154	10	103	908	0	0	**1366**
1980	129	0	104	8	45	747	0	0	**1033**
1981	148	0	66	5	42	957	0	0	**1218**
1982	182	0	53	11	41	1007	0	0	**1294**
1983	182	0	62	23	28	1153	0	0	**1448**

1984	190	0	73	30	29	1200	0	0	**1522**
1985	187	0	71	35	46	1370	0	0	**1709**
1986	131	0	76	4	46	950	0	0	**1207**
1987	140	0	50	17	48	715	0	0	**970**
1988	102	0	33	18	52	880	0	0	**1085**
1989	112	0	43	9	58	1080	0	0	**1302**
1990	168	0	139	24	82	480	0	0	**893**
1991	205	38	145	28	147	1111	8	0	**1682**
1992	203	59	77	34	218	1196	22	1	**1810**
1993	291	63	118	38	268	1647	14	0	**2439**
1994	208	90	109	28	235	1235	11	0	**1916**
1995	194	67	55	24	145	943	6	0	**1434**
1996	206	47	64	15	175	732	8	0	**1247**
1997	129	48	38	1	135	590	16	0	**957**
1998	160	58	58	11	172	808	16	0	**1283**
1999	161	51	91	0	156	805	16	0	**1280**
2000	167	77	93	16	141	998	16	0	**1508**
2001	182	66	67	12	158	1075	13	0	**1573**
2002	145	58	52	10	120	907	10	0	**1302**
2003	145	70	57	9	119	934	12	0	**1346**
2004	140	66	77	7	168	772	19	0	**1249**
2005	120	62	89	7	138	716	28	0	**1160**
2006	105	55	75	9	154	765	12	0	**1175**
2007	110	47	52	12	156	854	9	0	**1240**
2008	117	42	86	5	93	650	11	0	**1004**
2009	109	54	96	8	105	786	4	0	**1162**
2010	104	75	97	12	136	1072	4	0	**1500**
2011	101	57	122	11	137	1061	6	0	**1495**
2012	111	72	127	12	102	1084	7	0	**1515**

Table 2.4. Total international landings (t) of brill in the English Channel (Divisions 7.d-e) by country over the period 1950–2012 (source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium and the UK for 2012).

Year	BEL	DNK	FRA	GBR	IRL	NLD	XCI	TOTAL
1950	11	0	0	48	0	0	0	**59**
1951	8	0	0	70	0	0	0	**78**
1952	6	0	0	66	0	0	0	**72**
1953	2	0	0	60	0	0	0	**62**
1954	1	0	0	59	0	0	0	**60**
1955	4	0	0	57	0	0	0	**61**
1956	2	0	0	58	0	0	0	**60**
1957	4	0	0	66	0	0	0	**70**
1958	2	0	0	65	0	0	0	**67**
1959	1	0	0	58	0	0	0	**59**
1960	6	0	0	46	0	0	0	**52**
1961	1	0	0	46	0	0	0	**47**
1962	3	0	0	52	0	0	0	**55**
1963	1	0	0	50	0	0	0	**51**
1964	0	0	0	60	0	0	0	**60**
1965	2	0	0	46	0	0	0	**48**
1966	0	0	0	53	0	0	0	**53**
1967	1	0	0	66	0	0	0	**67**
1968	3	0	0	54	0	0	0	**57**
1969	2	0	121	67	0	0	0	**190**
1970	10	0	0	49	0	0	0	**59**
1971	18	0	0	48	0	0	0	**66**
1972	20	0	0	52	0	3	0	**75**
1973	20	0	0	70	0	0	0	**90**

1974	25	0	0	56	0	0	0	**81**
1975	24	0	55	56	0	0	2	**137**
1976	41	0	170	72	0	0	2	**285**
1977	45	0	197	77	0	0	4	**323**
1978	58	3	227	120	0	0	3	**411**
1979	55	0	262	140	0	0	2	**459**
1980	64	2	213	118	3	0	2	**402**
1981	83	0	271	130	0	0	6	**490**
1982	105	0	225	149	0	1	7	**487**
1983	107	0	234	181	0	1	3	**526**
1984	114	0	226	186	0	0	5	**531**
1985	94	0	213	177	0	0	10	**494**
1986	115	0	183	147	0	0	11	**456**
1987	126	0	216	141	0	0	10	**493**
1988	112	0	202	133	0	0	5	**452**
1989	89	0	213	121	0	0	2	**425**
1990	99	0	249	187	0	0	8	**543**
1991	81	0	249	140	0	0	0	**470**
1992	82	0	223	151	0	0	7	**463**
1993	78	0	256	152	0	0	4	**490**
1994	88	0	227	170	0	0	5	**490**
1995	91	0	248	200	1	0	18	**558**
1996	105	0	240	253	0	0	10	**608**
1997	107	0	185	198	1	0	10	**501**
1998	70	0	196	173	0	2	10	**451**
1999	97	0	0	127	0	3	13	**240**
2000	164	0	260	232	1	4	17	**678**
2001	212	0	256	251	0	2	17	**738**
2002	204	0	268	227	0	1	16	**716**
2003	217	0	287	238	1	1	15	**759**
2004	165	0	259	223	1	3	15	**666**
2005	138	0	267	183	0	2	21	**611**
2006	180	0	281	170	0	3	15	**649**
2007	205	0	325	199	0	1	11	**741**
2008	154	0	225	199	0	2	13	**593**
2009	131	0	278	171	0	1	10	**591**
2010	145	0	340	198	0	1	11	**695**
2011	141	0	277	204	0	0	0	**622**
2012	121	0	263	232	0	1	0	**617**

Table 2.5. Discard rates from the Belgian (ILVO) discard observer programme 2008–2012 for brill in the North Sea (4) and the Eastern (7d) and Western English Channel (7.e).

Year	Discard Rate		
	4	7.d	7.e
2008	0	0	0
2009	0	0	0
2010	0	0	0
2011	0.07	0.01	0
2012	0.04	0.01	0

Table 2.6. Commercial LPUE (kg/day) for brill *Scophthalmus rhombus* in the Dutch beam trawl fleet, Subarea 4.

Year	LPUE (kg/day)
2002	22.3
2003	27.8
2004	26.8

2005	25.8
2006	26.5
2007	32.2
2008	39.1
2009	39.2
2010	46.4
2011	51.1
2012	55.3

Table 2.7. Survey index (N°/hr) for brill in the BTS_ISI_Q3, Subarea 4 and BITS_HAF_Q1&4, Division 3.a.

	BTS_ISI_Q3	BITS_HAF_Q1&4
Year	N/hr	N/hr
1987	1.49	
1988	0.81	
1989	1.16	
1990	1.46	
1991	0.83	
1992	2.41	
1993	2.36	
1994	1.39	
1995	0.82	
1996	0.52	1.91
1997	1.32	0.39
1998	1.36	0.50
1999	0.83	1.83
2000	2.52	0.56
2001	0.67	1.04
2002	0.77	1.80
2003	1.12	1.36
2004	0.82	2.20
2005	0.61	2.08
2006	0.87	3.82
2007	1.10	3.62
2008	0.51	4.05
2009	1.48	3.09
2010	2.18	3.89
2011	2.52	3.61
2012	1.16	2.27

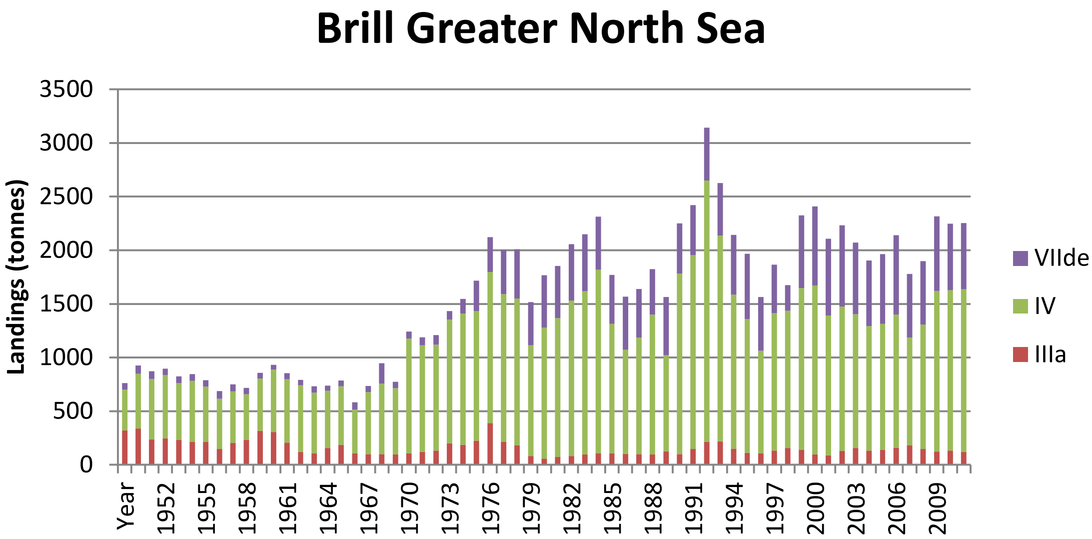

Figure 2.1.a. Total international landings (t) of brill in the Greater North Sea over the period 1950–2012, subdivided into Subarea IV, Division IIIa and Divisions VIIde (Source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium, Germany and the UK for 2012).

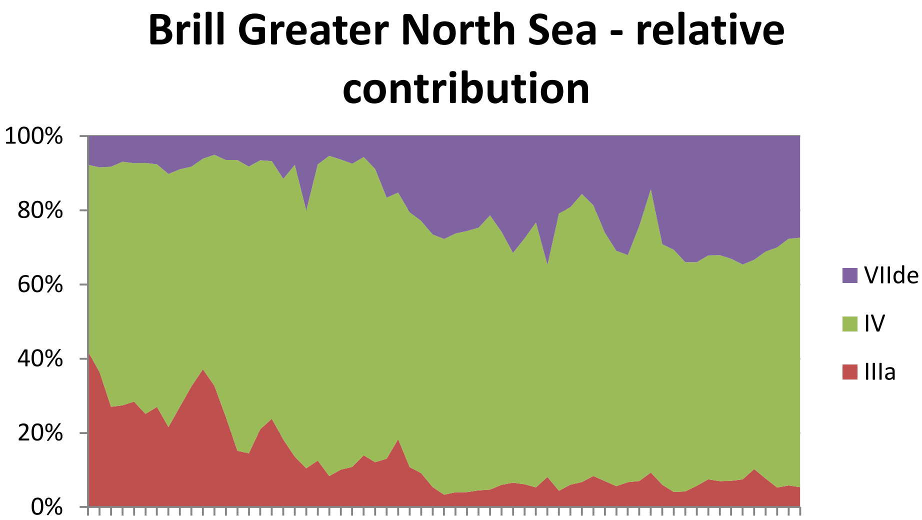

Figure 2.1.b. Relative contribution of landings of brill from Subarea IV, Division IIIa and Divisions VIIde to the total international landings (t) in the Greater North Sea over the period 1950–2012 (Source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium, Germany and the UK for 2012).

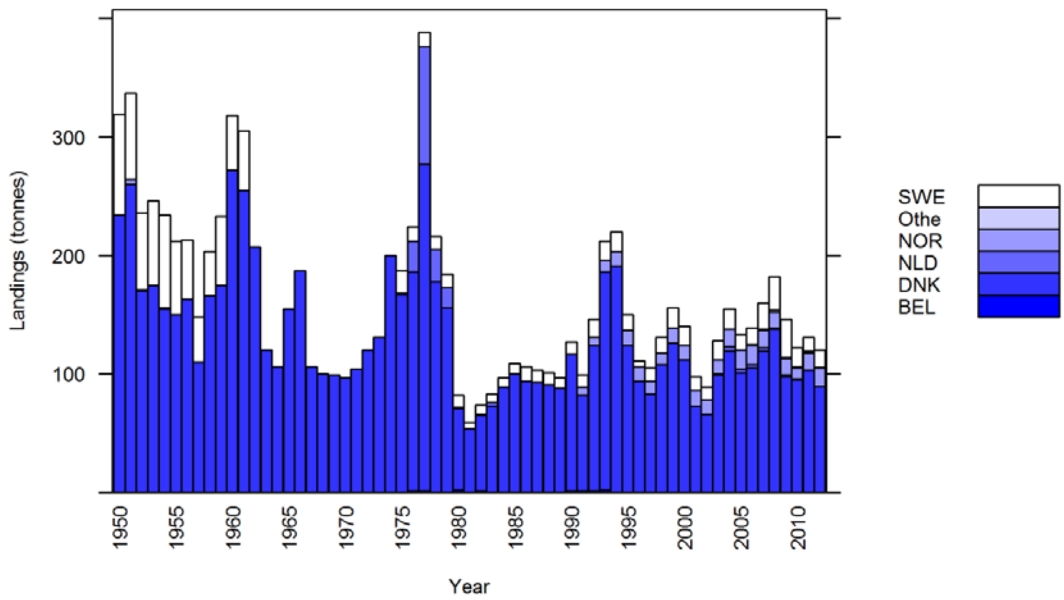

Figure 2.2. Total international landings (t) of brill in the Skagerrak/Kattegat (Division 3.a) by country over the period 1950–2012 (source: ICES Fishstat).

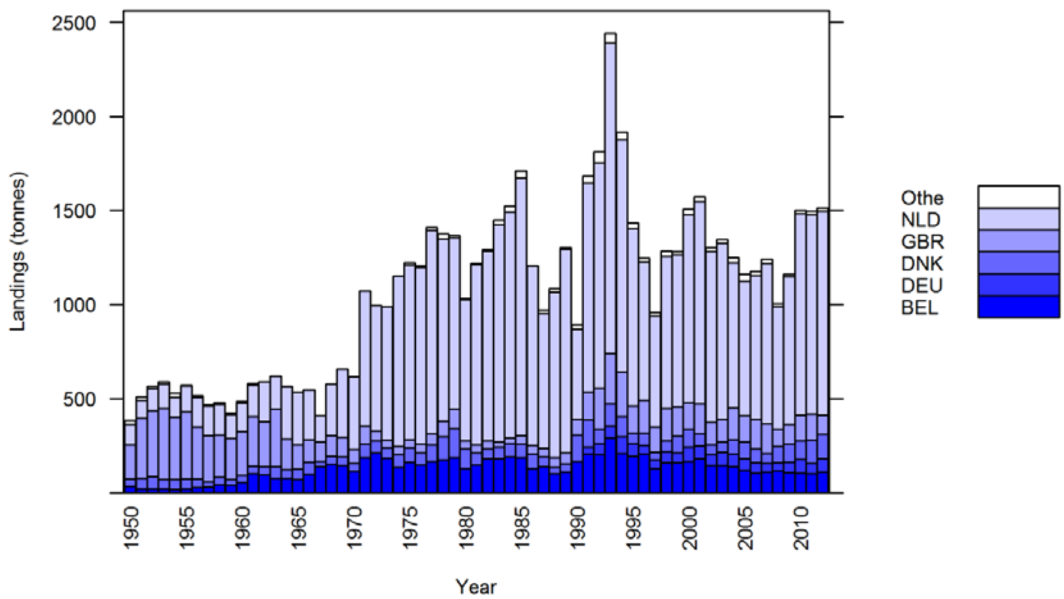

Figure 2.3. Total international landings (t) of brill *Scophthalmus rhombus* in the North Sea (Subarea 4) by country over the period 1950–2012 (source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium, Germany and the UK for 2012). The lower landings prior to 1971 are probably attributable to incomplete statistics.

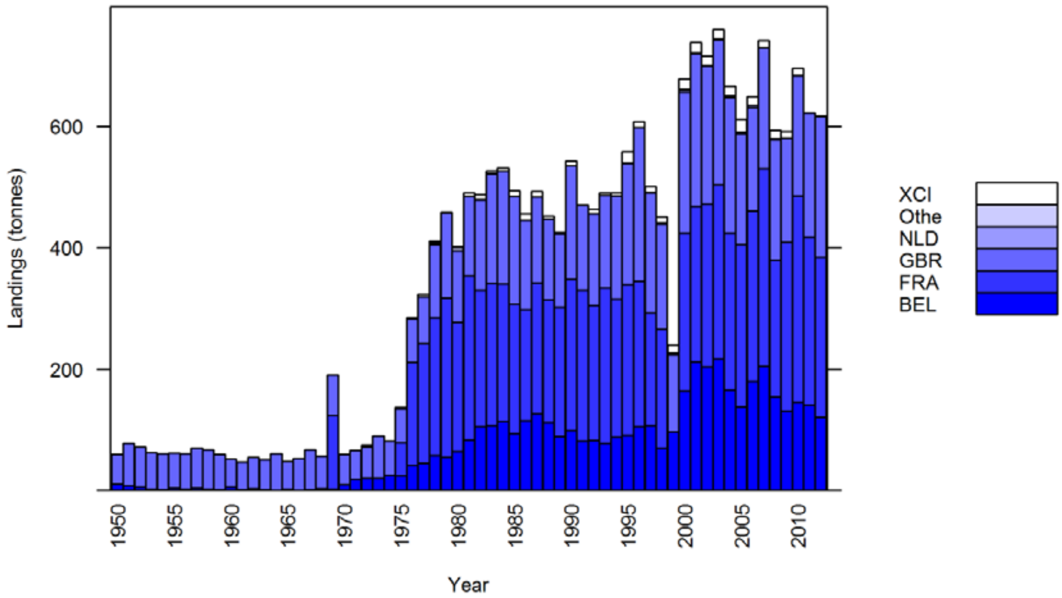

Figure 2.4. Total international landings (t) of brill in the English Channel (Divisions 7.d-e) by country over the period 1950–2012 (source: ICES Fishstat, updated with national submissions to WGNEW 2013 for Belgium and the UK for 2012). The lower landings prior to 1976 are probably attributable to incomplete statistics.

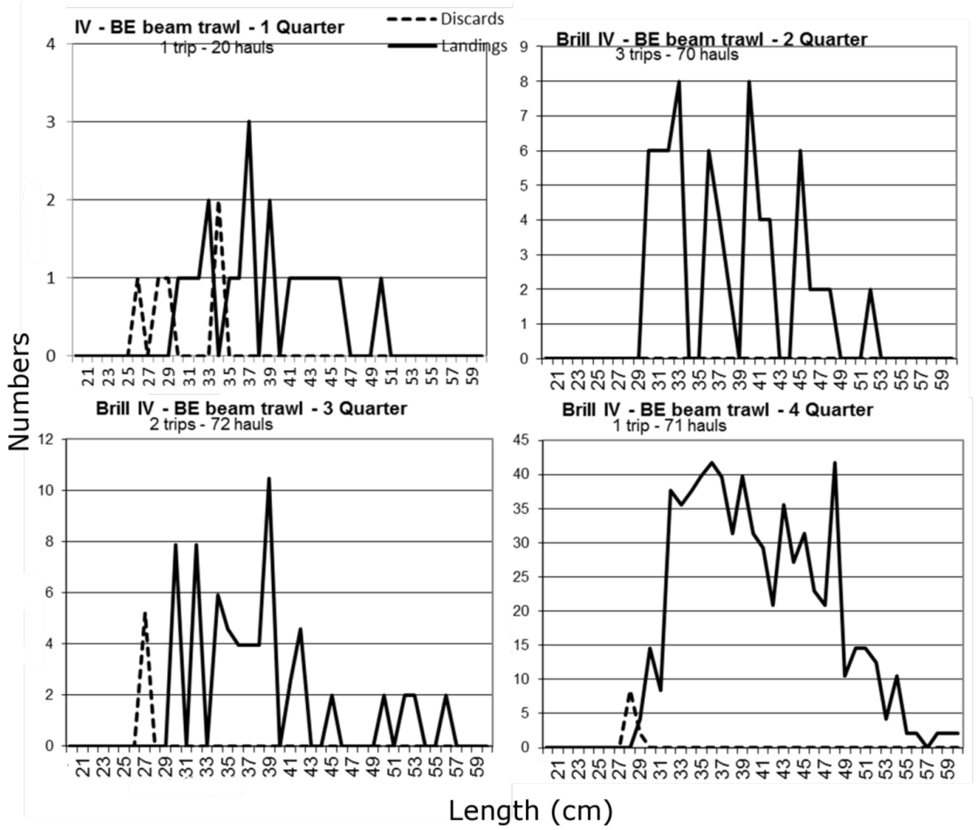

Figure 2.5. Numbers at length of landings and discards of brill *Scophthalmus rhombus* in the Belgian (ILVO) 2012 observer programme in the North Sea (4).

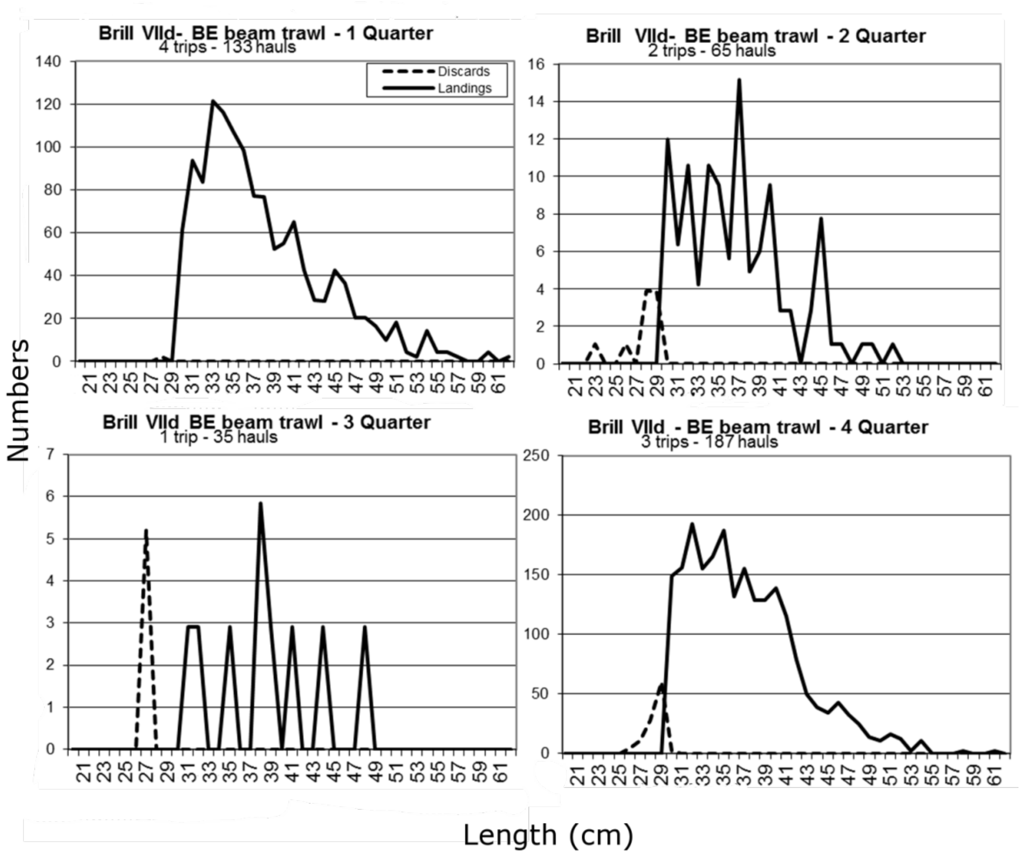

Figure 2.6. Numbers at length of landings and discards of brill in the Belgian (ILVO) 2012 observer programme in the Eastern English Channel (7.d).

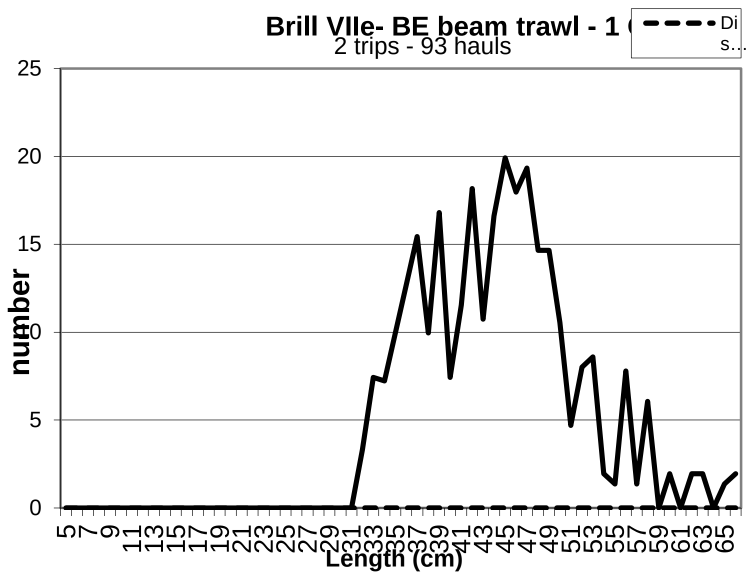

Figure 2.7. Numbers at length of landings and discards of brill in the Belgian (ILVO) 2012 observer programme in the Western English Channel (7.e).

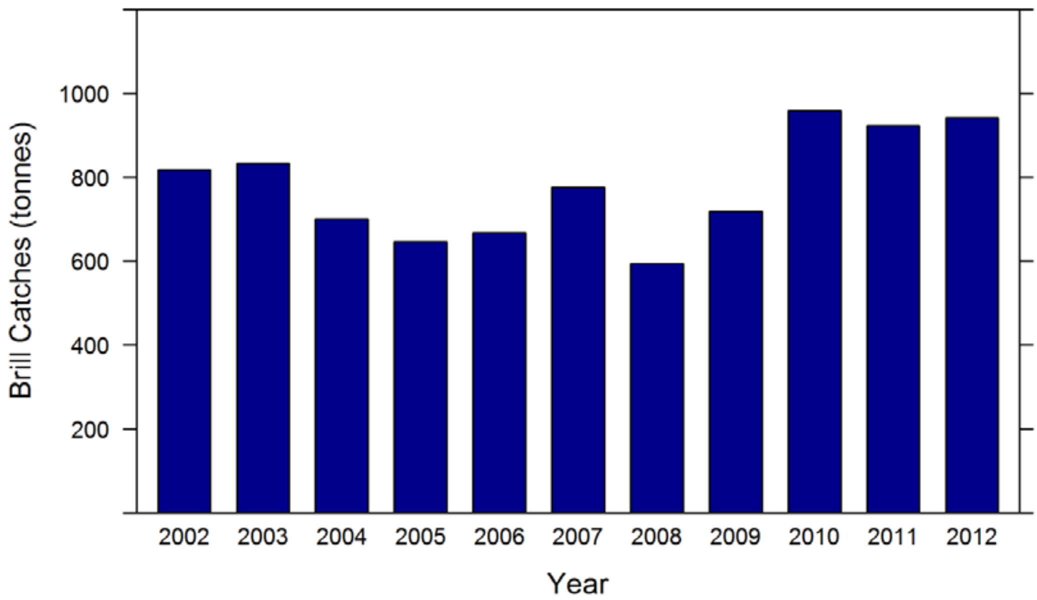

Figure 2.8. Landings (tonnes) of brill *Scophthalmus rhombus* by the Dutch beam trawl fleet > 221 kW over the period 2002–2012, Subarea 4.

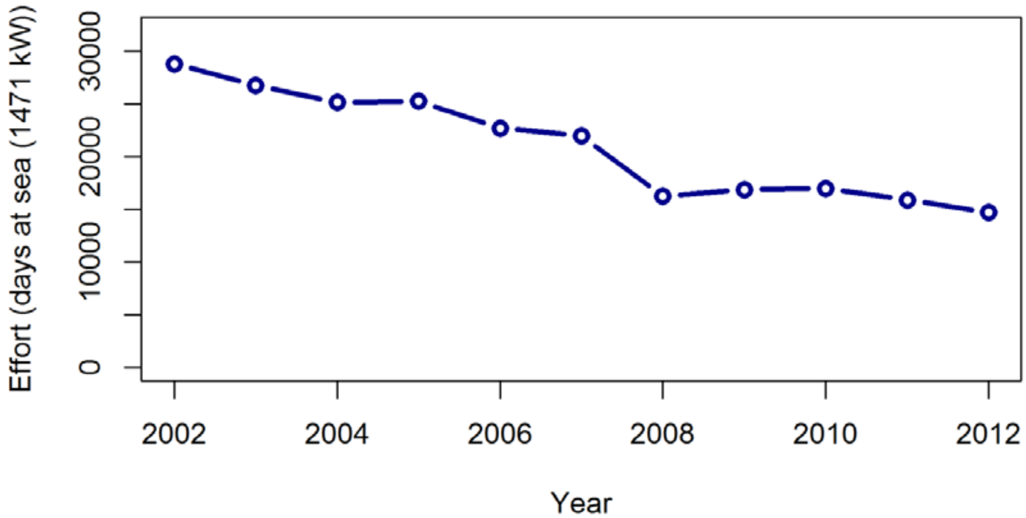

Figure 2.9. Effort (days at sea) of brill *Scophthalmus rhombus* for the Dutch beam trawl fleet > 221 kW over the period 2002–2012, Subarea 4.

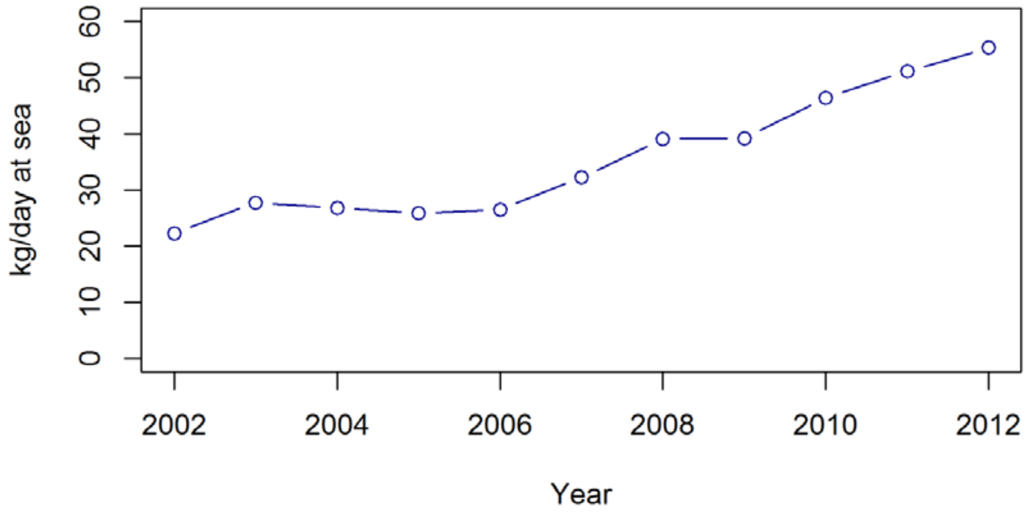

Figure 2.10. Corrected effort (kg/day at sea) of brill *Scophthalmus rhombus* for the Dutch beam trawl fleet > 221 kW over the period 2002–2012, Subarea 4.

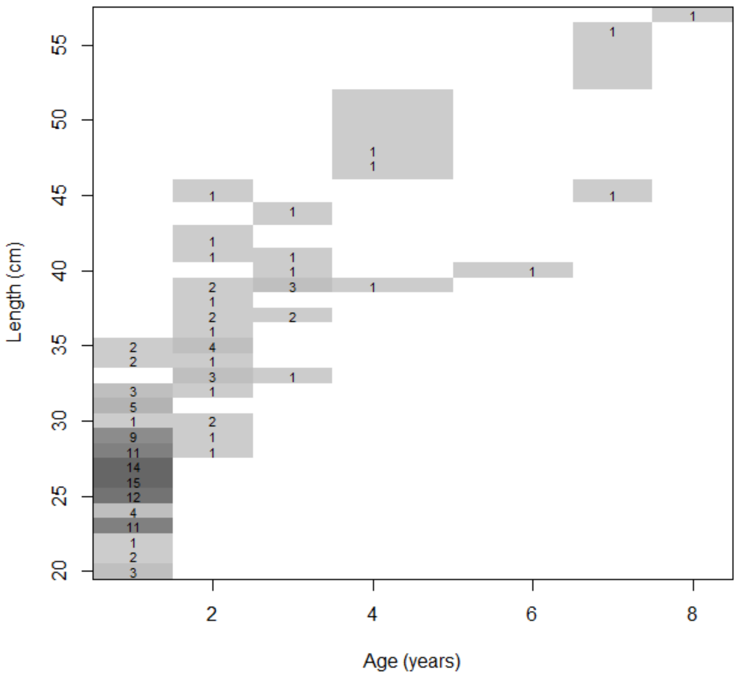

Figure 2.11. ALK of brill *Scophthalmus rhombus* derived from the catches of BTS_ISI_Q3 in the North Sea (4).

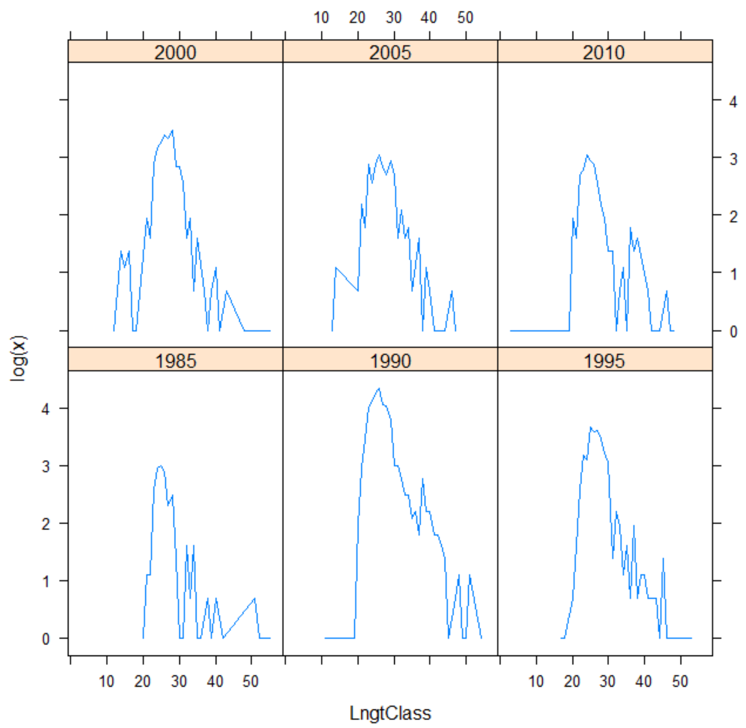

Figure 2.12. Length distributions of brill *Scophthalmus rhombus* caught by BTS_ISI_Q3 in the North Sea (4).

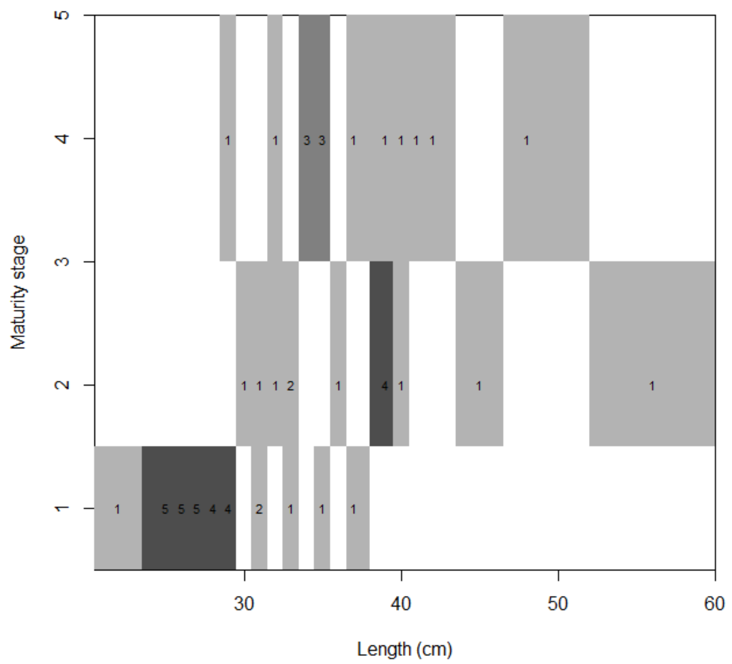

Figure 2.13. Length at maturity of brill *Scophthalmus rhombus* derived from the catches of BTS_ISI_Q3 in the North Sea (4).

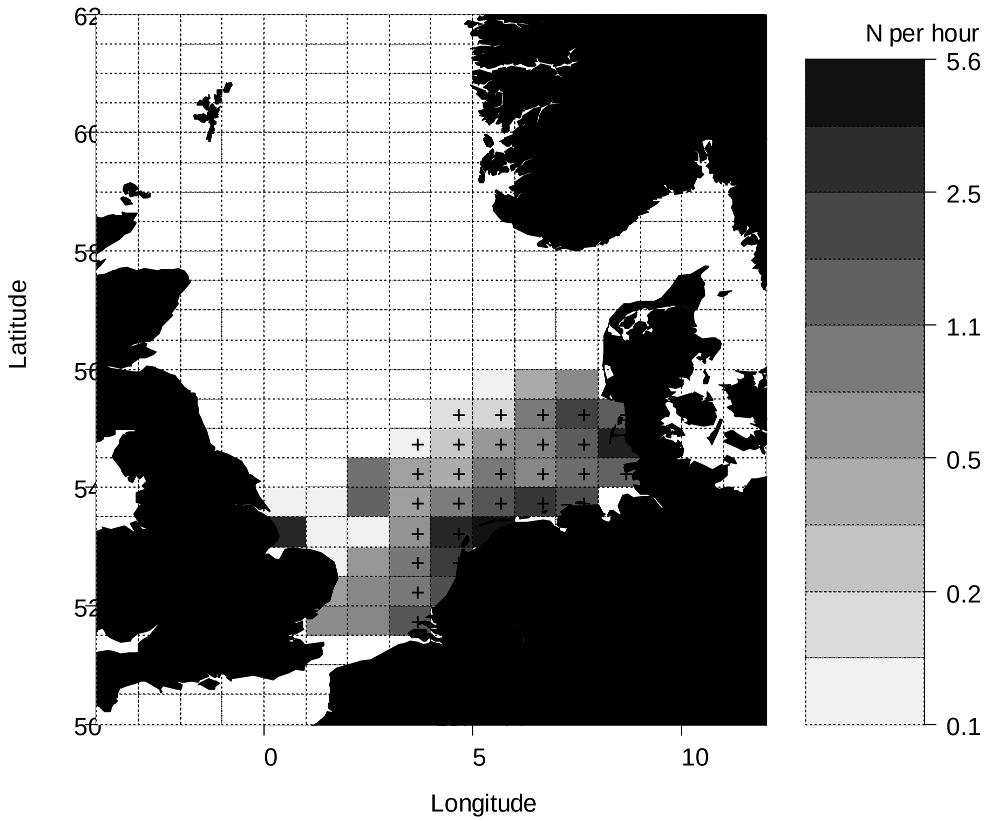

Figure 2.14. Numbers of brill caught per hour and rectangle by BTS_ISI_Q3 in the North Sea (4).

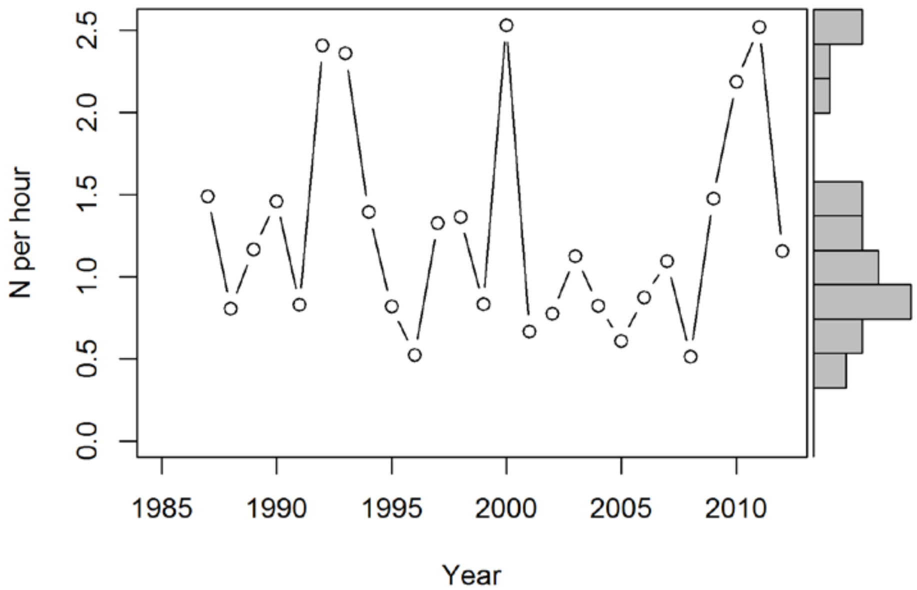

Figure 2.15. Numbers of brill *Scophthalmus rhombus* caught per hour by BTS_ISI_Q3 in the North Sea (4).

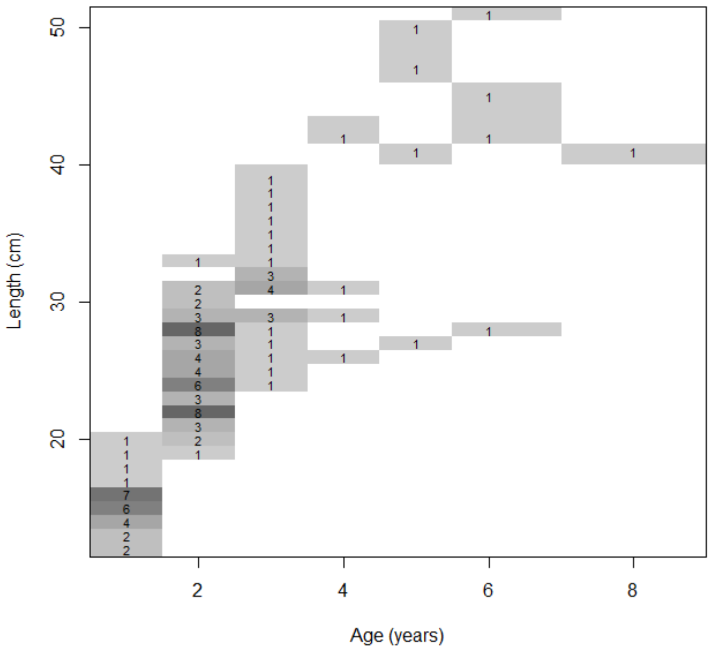

Figure 2.16. ALK of brill *Scophthalmus rhombus* derived from the catches of BITS_HAF_Q1&4 in the Kattegat (3.aS).

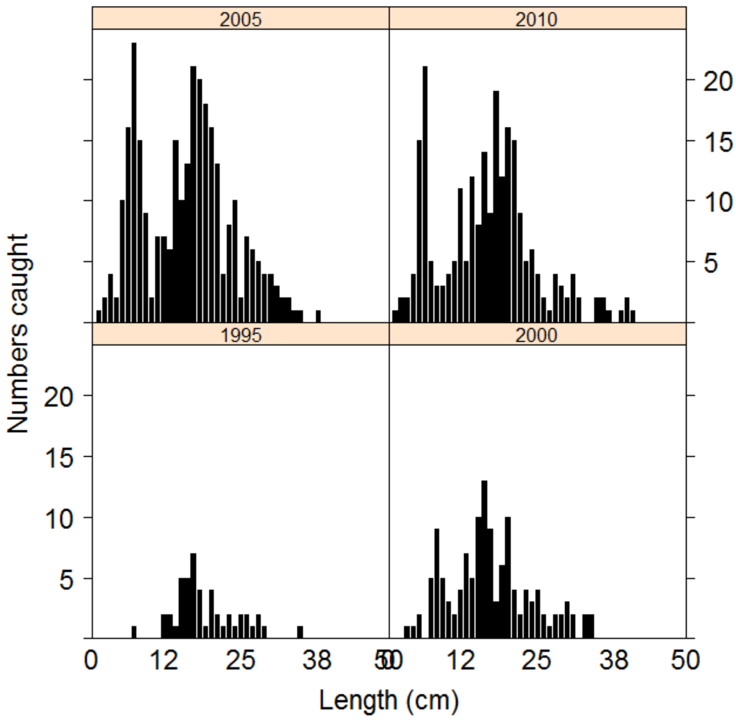

Figure 2.17. Length distributions of brill *Scophthalmus rhombus* caught by BITS_HAF_Q1&4 in the Kattegat (3.aS).

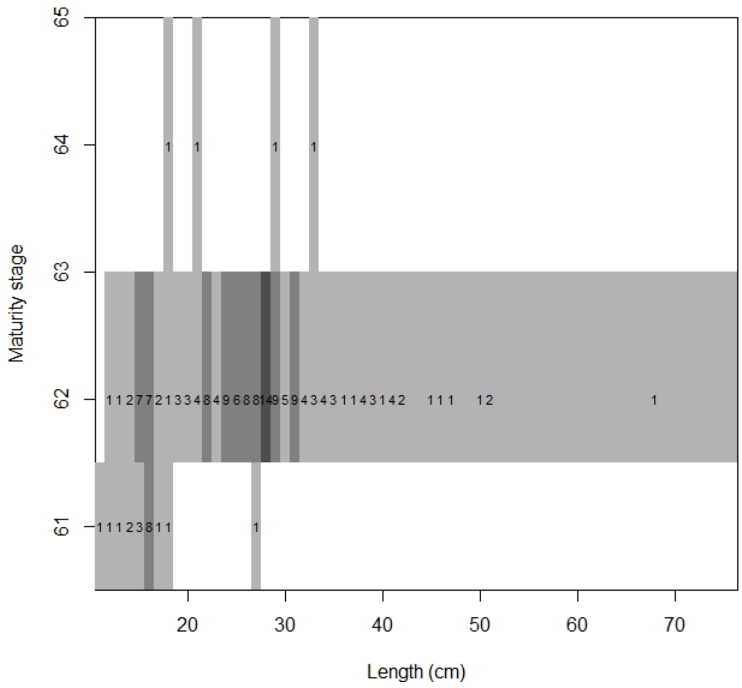

Figure 2.18. Length at maturity of brill *Scophthalmus rhombus* derived from the catches of BITS_HAF_Q1&4 in the Kattegat (3.aS).

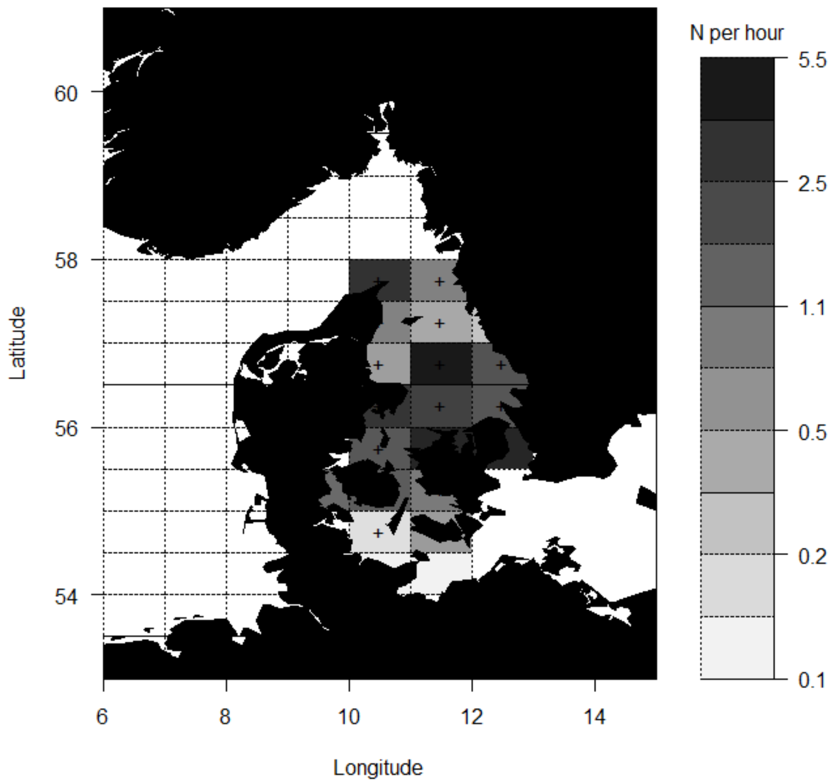

Figure 2.19. Numbers of brill *Scophthalmus rhombus* caught per hour and rectangle by BITS_HAF_Q1&4 in the Kattegat (3.aS).

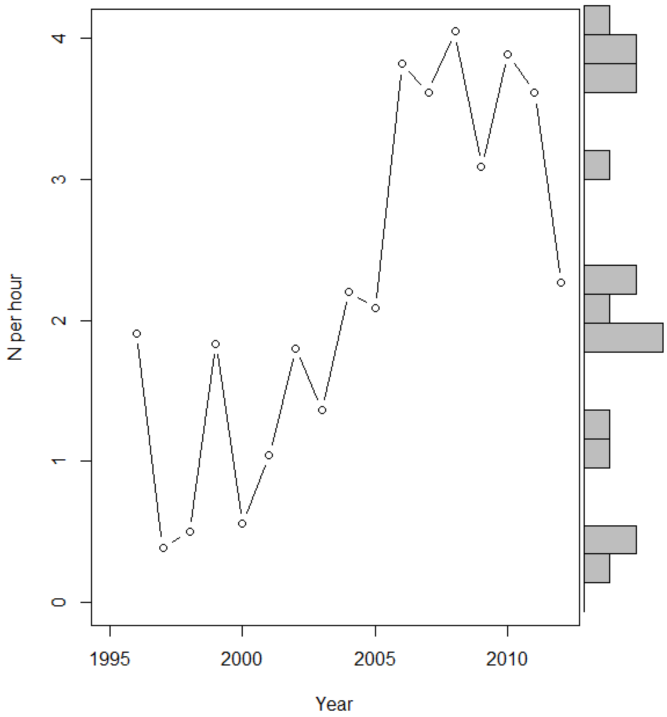

Figure 2.20. Numbers of brill *Scophthalmus rhombus* caught per hour by BITS_HAF_Q1&4 in the Kattegat (3.aS).