COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 2.4.2007
SEC(2007) 468

COMMISSION STAFF WORKING DOCUMENT

REPORT OF THE SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES

EVALUATION OF THE REPORT OF THE

STECF-SGRST 06-03 WORKING GROUP ON ANGLERFISH

STECF undertook this evaluation by correspondence in June-July 2006

This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area

Background

There are major uncertainties about catch and effort data for anglerfish (*Lophius piscatorius*), as well as limited knowledge about population dynamics and distribution. In addition, existing surveys have not proven useful in describing the population. In this situation, a two-stage approach has been advised. The first stage would be to substantially improve the quality and quantity of data collected on the fishery while maintaining exploitation at its current level, followed by a second stage of better informed advice and management.

Following this two-step approach, the fishing mortality experienced by anglerfish in the North Sea and West of Scotland should not increase until conclusive evidence is presented on an acceptable exploitation level. STECF has recommended that anglerfish fisheries in divisions IV and VI should be continued while not permitting an increase in fishing effort. STECF has not yet been able to recommend operational methods for implementing such a limitation. While such a system is being developed, there is a requirement for an in-year adaptation of the TAC in line with a status-quo fishing mortality.

An STECF SGRST 06-03 Working group was convened from 24-27 April 2006 in Brussels to address the following Terms of Reference:

1. Identify criteria for the management of anglerfish fisheries using effort management as the primary conservation instrument. The sub-group is requested to:

a. Identify, in terms of characteristics of fishing vessels, the gears they use and the areas and seasons in which they operate, the main fishing métiers that catch anglerfish in the North Sea and West of Scotland.

b. For each sector identified in (a), quantify the catches of anglerfish and of other species caught in the same fishing operations.

c. For each the sector identified in (a), provide details of historic effort deployed in each fishery, disaggregated by gear type and by Member State, for the longest available time-series.

2. Advise on a TAC for anglerfish in ICES areas IV and VI that is consistent with (a) no increase in fishing mortality or fishing effort on this species, (b) available information on commercial catch rates.

The Working Group report is attached as Annex 1.

Review of the SGRST 06-03 Working Group report

STECF reviewed the report of the 3rd STECF_SGRST (SGRST 06-03) meeting on anglerfish by correspondence during June-July 2006.

The SGRST 06-03 Working Group summarized its findings as follows:

The fishery for anglerfish (*Lophius piscatorius*) in the North Sea and West of Scotland (Division IIIa, Sub-areas IV and VI) should be continued while not permitting an increase in fishing effort. An analytical assessment of the status of the stock is not yet possible, due to incomplete understanding of the dynamics of the stock, and a lack of sufficient and reliable data. While more and better data are being collected, this report describes the current fishery, in terms of metiers, catch and by-catch, time trends in effort and landings; this report analyses the trend in abundance observed in the stock; and this report advises on a TAC consistent with no increase in fishing effort and moderately accommodating for the trend in commercial catch rates.

Total catches of anglerfish in the North Sea and West of Scotland rose to a peak of 34,000 t in 1996, but subsequently declined to just over 12,000 t in recent years. This catch is taken predominantly by otter trawlers (75%), with a smaller share of gill netting (11%) mainly focused in area VIb. The remainder of the catch is taken in a wide range of gears. An international data compilation of catch data indicates that in all gears, except for the gill netting, the catch of anglerfish makes up a minor share of the total catch of mixed fisheries; other species in the same fisheries include sole, plaice, megrim, saithe, haddock, cod and *Nephrops*.

In recent years, rising trends in catch rates have been reported, possibly resulting in a tighter restriction on landings due to the TAC. While this recent rising trend is not debated by current analyses, there is insufficient ground to specify an exact figure for an update of catch limits. It is therefore recommended to implement an adaptive management scheme. The current TAC (2006) should be raised by an initial modest 10%. This rise in TAC should be conditional on a re-evaluation of the upward trend in the abundance of the stock in one year from now (spring 2007). When a comprehensive assessment of the stock becomes available, this should of course override the current advice.

STECF observations.

The SGRST has produced a comprehensive evaluation of the information available to it at the time of the meeting and has made a laudable attempt at answering its terms of reference.

STECF notes that the main sub-group conclusions and recommendations were as follows:

- While the observed rising trends in catch rates are not debated by current analyses, there are insufficient grounds to specify an exact figure for an update of catch limits.
- An adaptive management plan should be implemented
- The 2006 TAC should be raised by an initial modest 10%.
- The rise in TAC should be conditional on a re-evaluation of the upward trend in the abundance of the stock in one year from now (spring 2007).
- When a comprehensive assessment of the stock becomes available, this should of course override the current advice.

STECF notes that the sub-group's recommendations are primarily based on the results of an analysis of catch rates over recent years. STECF also notes that while the observed increases in catch rates may be a reflection of increased recruitment to the fishery and/or increased survival of pre-recruits and juvenile recruits, they may also reflect changes in the fleet composition, fleet efficiency and/or fishing pattern. STECF is also aware that the changing quota possibilities for other species that are caught together with anglerfish may also have an influence on the observed catch rates of anglerfish. Nevertheless, the results of the analysis of both the Danish and UK commercial catch rates indicate similar trends, which may reflect an increase in the fishable stock.

STECF Conclusions and Recommendations

Based on the information presented in the SGRST 06-03 Working Group Report, STECF draws the following conclusions and recommendations:

The stock status of anglerfish in ICES Sub-areas IV and VI and its rate of exploitation are unknown. STECF is therefore unable to advise on a TAC for anglerfish in ICES areas IV and VI that is consistent with no increase in fishing mortality or fishing effort on this stock. Furthermore, in the absence of any reliable indicator of stock status of anglerfish in ICES areas IV and VI, STECF is unable to evaluate whether the agreed TAC of 15,000 t for 2006 will result in any change in fishing mortality on this stock.

STECF also notes that because anglerfish in ICES Sub-areas IV and VI are primarily caught in mixed demersal fisheries, management by TAC alone is unlikely to control the exploitation rate on the stock and **recommends** that that any agreed catch restrictions should be accompanied by complementary effort controls.

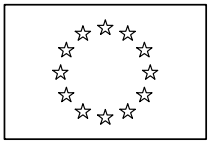
In the absence of any objective criteria on which to advise on appropriate catch or effort levels, STECF **recommends** managers adopt an adaptive and precautionary approach to managing the fisheries exploiting anglerfish in ICES Sub-areas IV and VI. Furthermore, because of the mixed species nature of the fisheries exploiting anglerfish, STECF **recommends** that the management measure most likely to result in a control on the exploitation rate is effort control.

STECF notes that at present, the only acceptable quantitative information likely to be indicative of relative trends in the fishable stock are commercial catch rates. STECF therefore suggests that in the short-term, management measures are adapted in response to relative changes in catch rates. STECF also notes that catch rates from some commercial fisheries have recently been increasing, which may reflect an increase in the fishable stock. However, the observed increases in catch rates are not necessarily an indication that recent exploitation rates are sustainable in the longer term, since the observed increases in catch rates may be primarily due to increased recruitment of anglerfish to the fishery, the causes of which remain unknown.

Hence, STECF suggests that until a reliable assessment of the state of the stock and its exploitation rate is available, managers should adopt a precautionary approach and implement measures with the aim of ensuring that fishing mortality on anglerfish does not increase. STECF therefore **recommends** that fishing effort for those fleets that exploit anglerfish (otter trawlers and gill netters) should not be allowed to increase. Furthermore, since there is no scientific basis to advise a TAC for anglerfish, that would correspond to no increase in fishing effort, and recognizing that setting a restrictive TAC that is out of line with the permitted effort for fleets exploiting anglerfish is unlikely to restrict fishing mortality on the stock, STECF **recommends** that catches and catch rates continue to be closely monitored throughout 2006 to determine whether the agreed TAC for anglerfish for 2006 is in line with the permitted effort. Any observed overall change in catch rate during 2006 could then provide the basis for adaptive management measures for 2007.

STECF **recommends** that when a comprehensive and acceptable assessment of the stock status of anglerfish in ICES Sub-areas IV and VI becomes available, the management measures for fleets exploiting this stock be re-assessed.

ANNEX I.



COMMISSION OF THE EUROPEAN COMMUNITIES

COMMISSION STAFF WORKING PAPER

REPORT OF THE THIRD MEETING OF THE
SUBGROUP ON REVIEW OF STOCKS. (SGRST-06-03)
OF THE
SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES
(STECF)

ANGLERFISH

Brussels, 24-27 April 2006

This report will be reviewed and evaluated by the Scientific, Technical and Economic Committee for Fisheries (STECF) by written procedure

This report does necessarily reflect the view of the STECF and the European Commission and in no way anticipates the Commission's future policy in this area.

Summary

Report of the STECF-SGRST-06-03 anglerfish meeting, 24-27 April 2006, Brussels.

The fishery for anglerfish (*Lophius piscatorius*) in the North Sea and West of Scotland (Division IIIa, Sub-areas IV and VI) should be continued while not permitting an increase in fishing effort. An analytical assessment of the status of the stock is not yet possible, due to incomplete understanding of the dynamics of the stock, and a lack of sufficient and reliable data. While more and better data are being collected, this report describes the current fishery, in terms of metiers, catch and by-catch, time trends in effort and landings; this report analyses the trend in abundance observed in the stock; and this report advises on a TAC consistent with no increase in fishing effort and moderately accommodating for the trend in commercial catch rates.

Total catches of anglerfish in the North Sea and West of Scotland rose to a peak of 34,000 t in 1996, but subsequently declined to just over 12,000 t in recent years. This catch is taken predominantly by otter trawlers (75%), with a smaller share of gill netting (11%) mainly focused in area VIb. The remainder of the catch is taken in a wide range of gears. An international data compilation of catch data indicates that in all gears, except for the gill netting, the catch of anglerfish makes up a minor share of the total catch of mixed fisheries; other species in the same fisheries include sole, plaice, megrim, saithe, haddock, cod and Nephrops.

In recent years, rising trends in catch rates have been reported, possibly resulting in a tighter restriction on landings due to the TAC. While this recent rising trend is not debated by current analyses, there is insufficient ground to specify an exact figure for an update of catch limits. It is therefore recommended to implement an adaptive management scheme. The current TAC (2006) should be raised by an initial modest 10%. This rise in TAC should be conditional on a re-evaluation of the upward trend in the abundance of the stock in one year from now (spring 2007). When a comprehensive assessment of the stock becomes available, this should of course override the current advice.

1. Introduction.

1.1. Background and Terms of Reference.

There are major uncertainties about catch and effort data for anglerfish (*Lophius piscatorius*), as well as limited knowledge about population dynamics and distribution. In addition, existing surveys have not proven useful in describing the population. In this situation, a two-stage approach has been advised. The first stage would be to substantially improve the quality and quantity of data collected on the fishery while maintaining exploitation at its current level, followed by a second stage of better informed advice and management. Following this two-step approach, the fishing mortality experienced by anglerfish in the North Sea and West of Scotland should not increase until conclusive evidence is presented on an acceptable exploitation level. STECF has recommended that anglerfish fisheries in divisions IV and VI should be continued while not permitting an increase in fishing effort. STECF has not yet been able to recommend operational methods for implementing such a limitation. While such a system is being developed, there is a requirement for an in-year adaptation of the TAC in line with a status-quo fishing mortality. In 2005, the UK has undertaken to provide revised data concerning catch rates from the commercial fishery.

The Terms of Reference for this meeting read:

1. Identify criteria for the management of anglerfish fisheries using effort management as the primary conservation instrument. The sub-group is requested to:
   a. Identify, in terms of characteristics of fishing vessels, the gears they use and the areas and seasons in which they operate, the main fishing métiers that catch anglerfish in the North Sea and West of Scotland.
   b. For each sector identified in (a), quantify the catches of anglerfish and of other species caught in the same fishing operations.
   c. For each the sector identified in (a), provide details of historic effort deployed in each fishery, disaggregated by gear type and by Member State, for the longest available time-series.
2. Advise on a TAC for anglerfish in ICES areas IV and VI that is consistent with (a) no increase in fishing mortality or fishing effort on this species, (b) available information on commercial catch rates.

1.2. No stock assessment.

The biology, stock identity and distribution of the anglerfish on the Northern Shelf are not well understood. Basic information required for regular stock assessment, such as the spatial entity of the stocks, growth and maturation patterns, and the potential effect of spawning migration, presumably to deeper waters to the West of Scotland, are quite uncertain. Consequently, no regular stock assessment is available. ICES has attempted a length-based assessment in 2005, but in the absence of a better understanding of the processes involved, results can only be used with extreme caution. Mature females are extremely rare in market samples, resulting in a low estimated female spawning stock biomass, and a high (fishing) mortality. However, the catch composition can equally well indicate an emigration of the maturing females, and a much lower fishing mortality.

These uncertainties remaining in place, opportunities for an improved assessment are currently absent. Consequently, the catch projections in this report will be based on observed trends in catch rates.

1.3. Overview of this report.

Following this introduction, chapter 2 of this report presents available information on catch and effort in anglerfish fisheries in the Northern Shelf area, describing the metiers, the species composition of the catch, and time trends in catch and effort data.

Chapter 3 analysis time trends in stock abundance, as observed in historical diaries, observer programmes and logbook information.

Catch predictions are developed in chapter 4. These include detailed predictions for well documented sectors as well as a general prediction.

Finally, chapter 5 presents the main recommendations from this meeting.

2. Catch and effort

2.1. Data sources

Within its current work the SGRST on management of fishing effort of STECF has compiled data bases on fleet specific catch data for 2003-2004 and effort data 2000-2004. There is ongoing process to update the data base for 2005 in advance of the Sub-group's meeting 5-9 June 2006 (SGRST 06-04). Such data bases are derived from the officially reported national logbook data bases hold by the member states. The aggregation processes applied to the data ensures that they are anonymous.

The defined fleet segmentation of the international landings, discard, age composition and effort data is by country, year, quarter, area, gear and mesh size groups which will allow the aggregation on an international level according to the fleets defined in Annex IIa of the Council Regulation No. 51/2006 subject to effort management. The provisional catch and effort data bases compiled during the first meeting of SGRST on management of fishing effort during 13-17 March 2006 (SGRST 06-01) do not consider the requested aggregation according to the special fishing conditions of Article 8.1, which allow additional days at sea for certain fleets. However, the fleet specific data bases on international catches and effort were provided to the SGRST meeting on anglerfish and analysed. The international fleet aggregation as consistently used among the member states' fleets is described in Annex 3 to this report.

In this report, these provisional catch and effort data bases have been used for several purposes. During the meeting, however, some concern arose that part of the data may still be incomplete, or not yet validated. However, the current group felt it was not in a position to improve the data bases consistently, and therefore used the data as they were.

The international catch data base does not include information of discards of anglerfish. The landings weights are given in t for the years 2003 and 2004. Anglerfish landings from France and Ireland are not included. The data from the Netherlands were provided to the present meeting on anglerfish and included into the tables and graphs as taken by the beam trawls ≥80 mm.

The data base on effort contains fleet specific nominal efforts given in kW*days at sea for the years 2000-2004. SGRST considers such effort values critical regarding static gears.

2.2. Catches by area, gear type and mesh size, year and quarter

2.2.1. International overview

A breakdown of catches by area, gear type and mesh size, year and quarter is presented in Table 2.2.1 and Figures 2.2.1 – 2.2.3.
The major share of anglerfish landings is derived from otter trawl fishing (67-99%). Gill netting is second in rank. Beam trawling adds a minor quantity, predominantly in the 3rd and 4th quarter.
However, in area VIb, the landings are dominated by gill net catches (50-95%), with some otter trawl catches predominantly in the 3rd quarter. Overall, otter trawls make up for 75% of the catch, gill nets for 11%, and beam trawls for less than 5%.

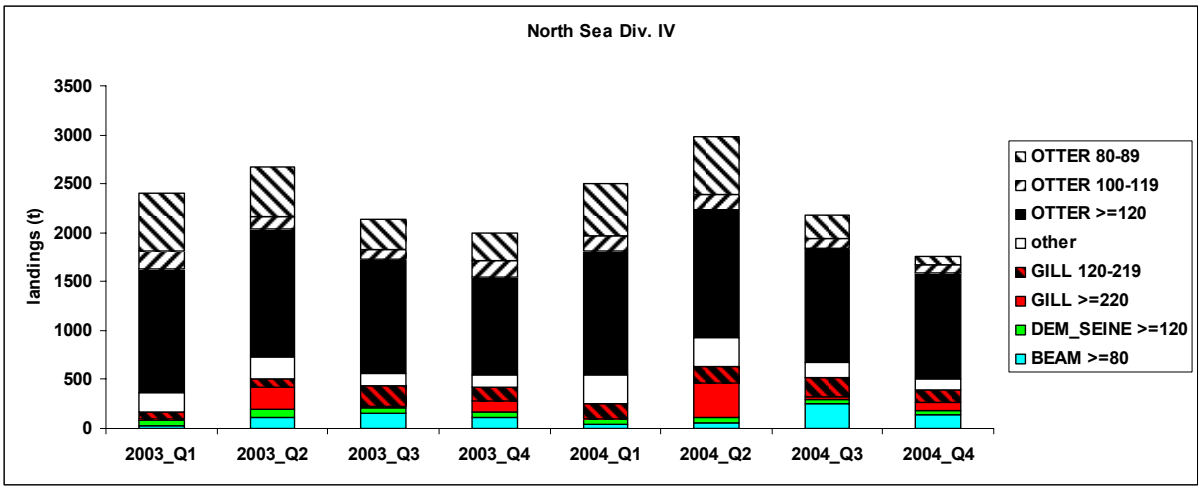


Figure 2.2.1 Officially reported landings of anglerfish in the North Sea, main gear type and quarter in 2003 and 2004. Data from the provisional and not yet validated STECF data base.

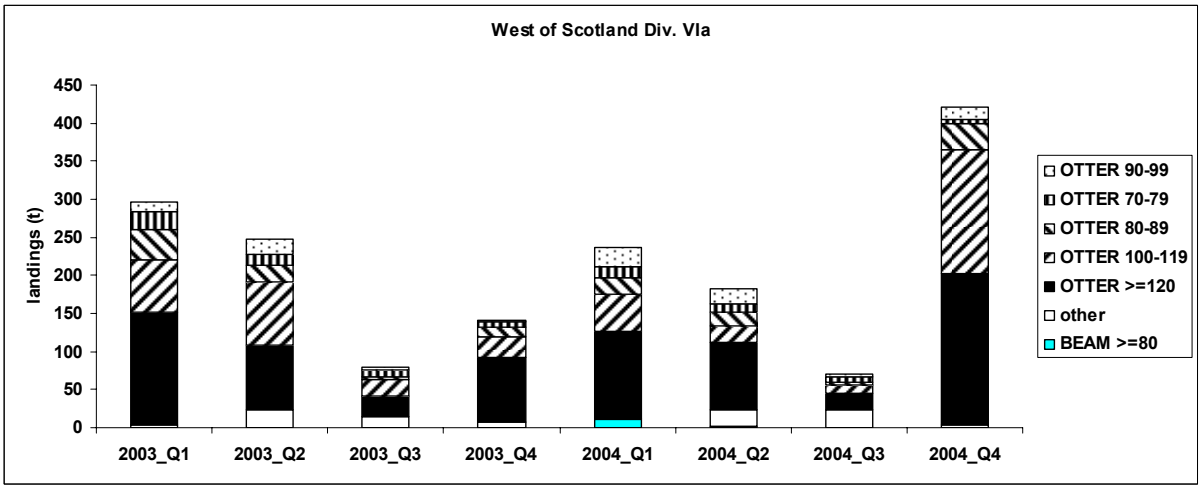


Figure 2.2.2 Officially reported landings of anglerfish in the area West of Scotland, main gear type and quarter in 2003 and 2004. Data from the provisional and not yet validated STECF data base.

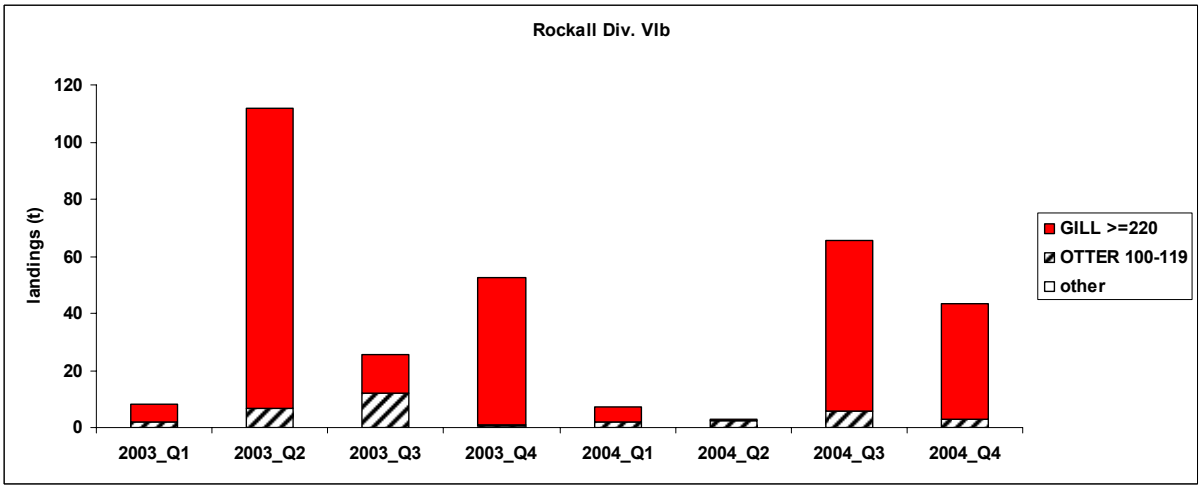


Figure 2.2.3 Officially reported landings of anglerfish in the Rockall area, main gear type and quarter in 2003 and 2004. Data from the provisional and not yet validated STECF data base.

Table 2.2.1 Officially reported landings (t) of anglerfish by area, main gear type and quarter in 2003 and 2004.

SGDFF_AREA	gear group	mesh group	AREA	GEAR	2003_Q1	2003_Q2	2003_Q3	2003_Q4	2004_Q1	2004_Q2	2004_Q3	2004_Q4
4	BEAM	>=80	4	BEAM >=80	33	117	156	117	35	60	247	135
4	DEM_SEINE	>=120	4	DEM_SEINE >=120	52	83	54	49	63	59	47	45
4	GILL	>=220	4	GILL >=220	17	216	8	120	4	345	23	86
4	GILL	120-219	4	GILL 120-219	66	96	211	138	148	171	200	127
4	other	other	4	other	193	215	137	126	302	290	165	110
4	OTTER	>=120	4	OTTER >=120	1270	1307	1156	995	1263	1305	1164	1091
4	OTTER	100-119	4	OTTER 100-119	189	135	109	171	148	160	95	80
4	OTTER	80-89	4	OTTER 80-89	582	496	304	280	537	589	234	89
6a	BEAM	>=80	6a	BEAM >=80	0	0	0	0	11	2	0	1
6a	other	other	6a	other	3	24	14	8	2	20	23	3
6a	OTTER	>=120	6a	OTTER >=120	149	83	28	84	113	90	23	200
6a	OTTER	100-119	6a	OTTER 100-119	69	83	21	27	49	21	10	162
6a	OTTER	70-79	6a	OTTER 70-79	23	14	9	8	14	11	7	6
6a	OTTER	80-89	6a	OTTER 80-89	39	22	4	12	22	20	4	35
6a	OTTER	90-99	6a	OTTER 90-99	13	20	3	3	26	19	4	16
6b	GILL	>=220	6b	GILL >=220	6	105	13	51	5	1	60	40
6b	other	other	6b	other		0		0				
6b	OTTER	100-119	6b	OTTER 100-119	2	7	12	1	2	2	6	3

2.2.2. Danish catch and Effort

The geographical distribution of the Danish anglerfish landings are shown in Figs. 2.2.4 for 2004 and 2005. In the North Sea, landings are taken mainly in the part constituting the Norwegian Deeps, which is situated in the Norwegian EEZ of the North Sea. The other main fishing areas for anglerfish are the northern part of Fladen Ground (also in IVa) and in the Skagerrak (IIIa).

The majority of the Danish vessels taking anglerfish with demersal trawls are trawlers, which can be distributed according to length group as shown in Figure 2.2.5.

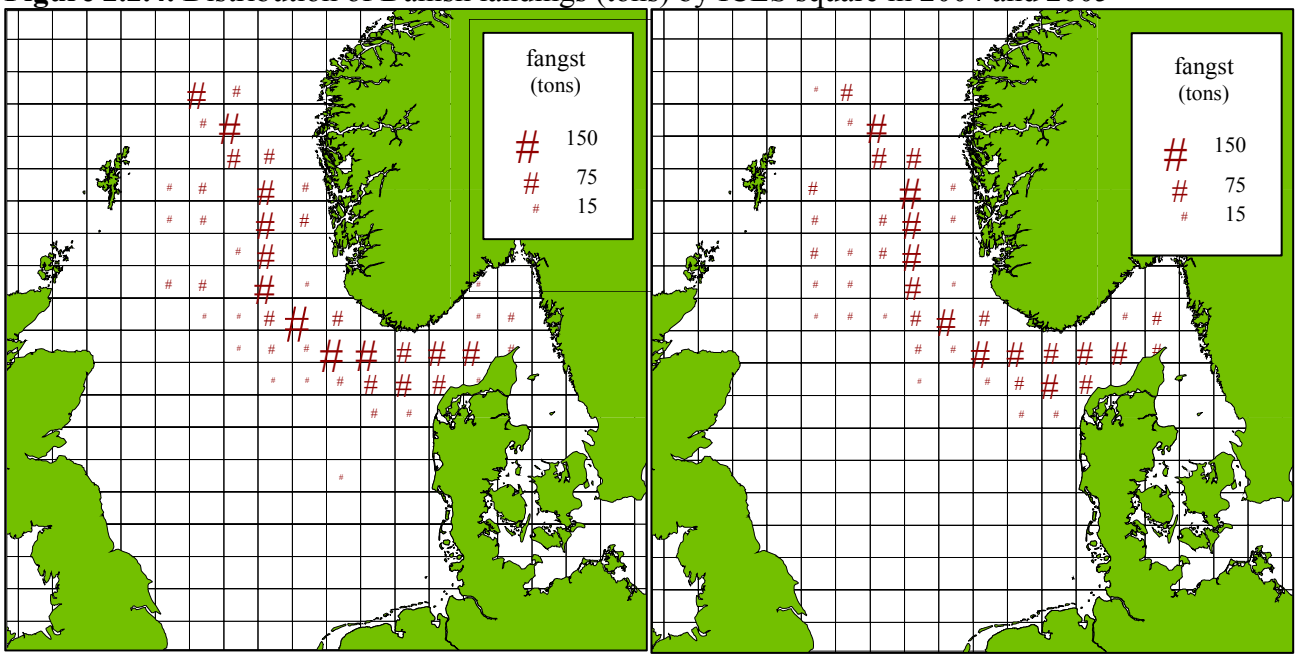
Tables 2.2.2 shows the distribution of Danish landings according to fishery defined by gear type and mesh size as currently used by Danish Fisheries Directorate for the North Sea, see text table below.

Fishery/gear	Mesh size, mm
Dem. Trawl	>= 100 mm
Nephrops trawl	70 - 99 mm
Shrimp trawl	33 - 69 mm
Industrial trawl	< = 32 mm
Beam trawl	>= 80 mm

This classification of the Danish fisheries is not as detailed as the one currently recommended by SGRST on management of fishing effort 13-17 March 2006 (SGRST 06-01). However, in relation to management of the fisheries for anglerfish it is sufficient at present, as the main Danish catches of anglerfish is taken by fisheries in the Norwegian zone of IV a applying demersal trawls with mesh size >= 120 mm. In recent years the fishery with demersal trawl in the Norwegian Deeps (in the Norwegian zone) has accounted for around 70 % of total Danish landings by all gears from the entire North Sea. In the Skagerrak (IIIa) the main fishery taking anglerfish is the *Nephrops* fishery, but the demersal trawl fishery also takes a significant part of the landings here. In IIIa the shrimp fishery comes in as no 3.
‘

In conclusion: The main Danish fishery taking anglerfish is carried out in the Norwegian Deeps, situated in the Norwegian EEZ, in ICES div. IVa by demersal trawl (mesh size >= 120 mm). second in overall importance is the fishery with *Nephrops* trawl conducted both in the North sea and IIIa, see Tables 2.2.2.

Figure 2.2.4. Distribution of Danish landings (tons) by ICES square in 2004 and 2005



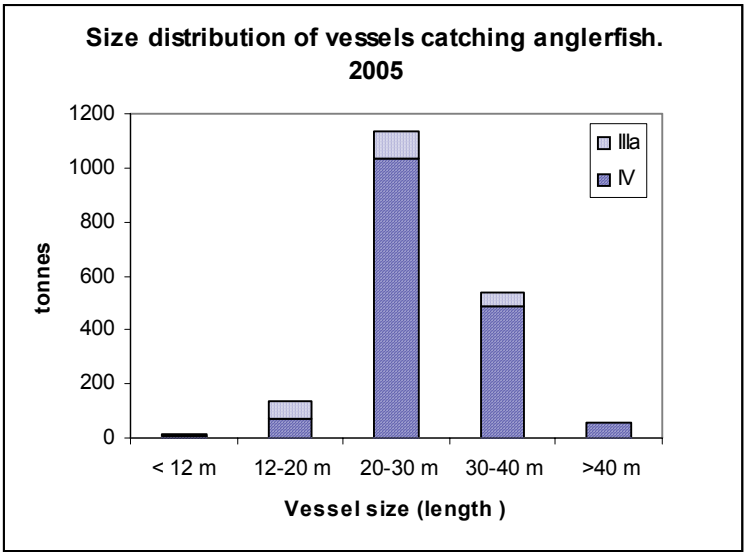


Figure 2.2.5. Danish vessel categories (by size) catching anglerfish.

Table 2.2.2a. Distribution of total Danish anglerfish landings by fishery. **North Sea**

Year	North Sea tons						North Sea
	Other gear	beam trawl	dem_trawl	Nephr_trawl	ind_trawl	shrimp_trawl	total
1992	124	80	811	348	260	63	1686
1993	88	45	621	94	347	98	1293
1994	87	59	822	283	195	64	1509
1995	72	57	345	254	127	172	1027
1996	48	17	756	280	129	234	1464
1997	47	64	1132	56	103	88	1489
1998	76	153	996	40	91	100	1456
1999	75	116	1106	39	84	76	1496
2000	52	88	1066	16	68	56	1347
2001	52	18	1343	7	67	53	1540
2002	41	59	1269	86	53	55	1563
2003	28	40	1508	59	30	42	1707
2004	57	45	1525	91	42	50	1809
2005	14	48	1412	96	26	17	1612

Table 2.2.2b. Distribution of total Danish anglerfish landings by fishery. **Skagerrak (IIIa)**

Year	IIIA tons						IIIA
	Other gear	beam trawl	dem_trawl	Nephr_trawl	ind_trawl	shrimp_trawl	total
1992	163	22	262	141	32	38	658
1993	83	12	263	163	9	35	565
1994	62	52	206	111	5	23	459
1995	48	82	97	62	1	21	312
1996	40	70	125	90	2	41	367
1997	58	137	183	139	8	25	550
1998	58	86	167	89	2	13	415
1999	82	41	121	105	1	12	362
2000	61	47	116	140	0	13	377
2001	44	18	86	211	4	11	375
2002	35	41	116	162	1	15	371
2003	27	4	27	147	1	10	217
2004	31	13	40	189	0	37	311
2005	18	5	83	135	0	30	272

2.2.3. Scottish catch and effort

Fishery descriptions based on standard ICES divisions are not very representative of the anglerfish fisheries landing into Scotland. Various sources of information including research vessel surveys, observer trips on board commercial boats, consultation with skippers and analysis of individual fishing trip records have been used to develop a description which is spatially more relevant to the biology of the species and activity of vessels. This approach has the advantage of being more aligned with the overall 'Northern Shelf anglerfish' stock definition used by ICES – which of course cuts across conventional ICES Areas.

FRS Marine Laboratory began a series of specific anglerfish surveys in 2005. Figure 2.2.6 shows the survey abundances derived from the coordinated activities of three charter vessels and RV Scotia – all using the same fishing gears and protocol in a predefined survey design. Using the distribution of survey abundances presented by statistical rectangle, those rectangles with abundance above the median (Figure 2.2.7) were defined as areas important for anglerfish. A similar approach was applied to the data collected during observer trips on board commercial vessels (described in more detail below) between 1999 and 2006 - there is a high degree of similarity. Figure 2.2.8 shows the combined area of high abundance from the survey and

observer work. The area of highest anglerfish abundance is located along the shelf edge extending from an area to the north of Shetland down to the west of Islay in the south with the Rockall area also included. It is important to note that significant elements of stock distribution probably occur further south in areas fished by Ireland and France but not covered in the Scottish survey.

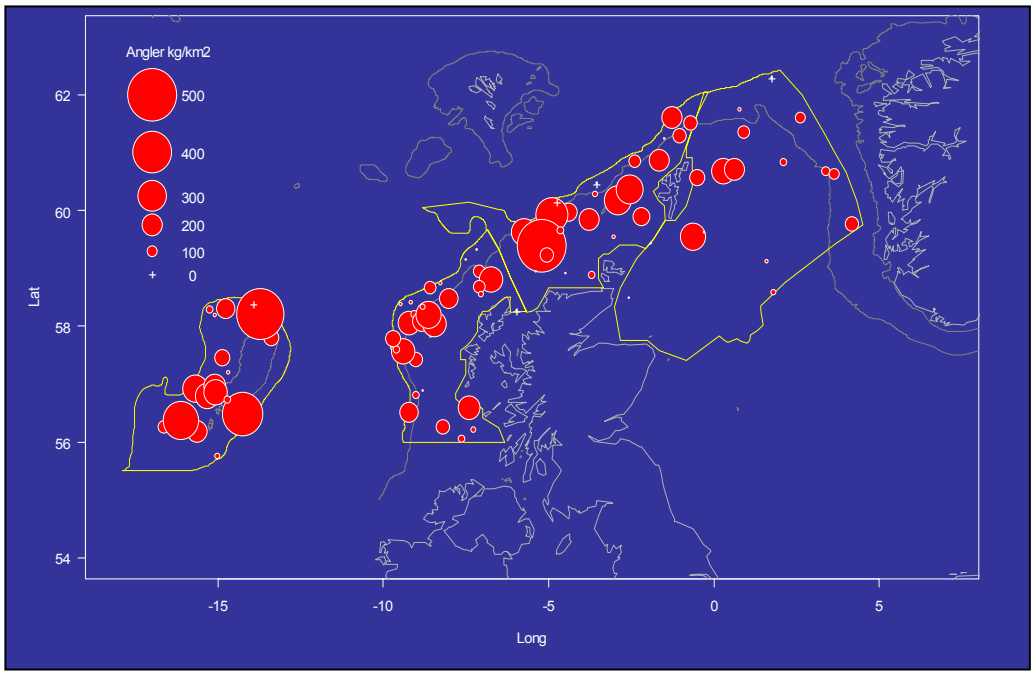


Figure 2.2.6 Distribution of sample stations and survey abundance in the Scottish anglerfish survey (joint FRS/ industry). Catch rates expressed as kg/km2. The yellow, irregular polygons signify the four strata used in the survey including Rockall, south west Scotland, north west Scotland and North Sea

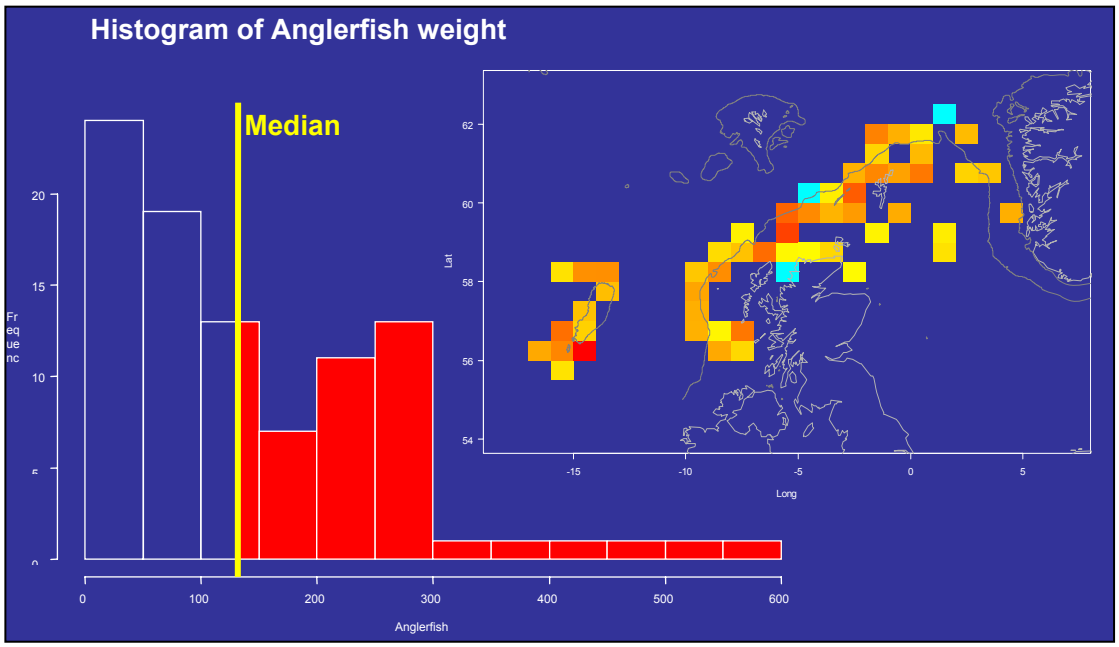


Figure 2.2.7 Histogram showing distribution of abundances (relatively large number of low abundance stations) from the survey. The vertical line provides an arbitrary median cut-off point and the sampled rectangles corresponding to abundances above this median are shown in the panel on the right

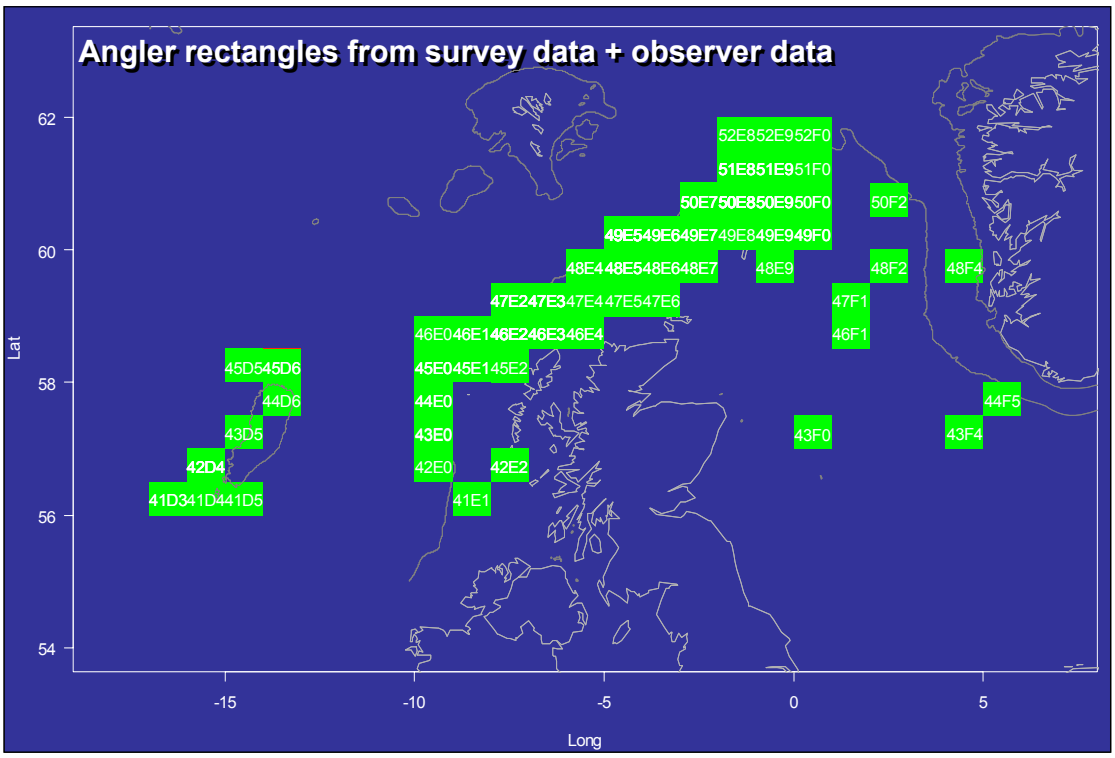


Figure 2.2.8 Overall distribution of statistical rectangles identified in FRS survey and from observer programme taken to represent the main 'anglerfish fishery area'.

Anglerfish also occur in shallower and more inshore areas and around Scotland and these areas frequently coincide with Nephrops grounds which are well defined by soft substrate and are described the in ICES WGs. Figure 2.2.9 shows the distributions of the Nephrops areas in relation to the anglerfish area described above. The areas are mostly separate but where overlaps occur (usually statistical rectangles on the outer margins of Nephrops areas, shown in red) these are taken to be part of the anglerfish area.

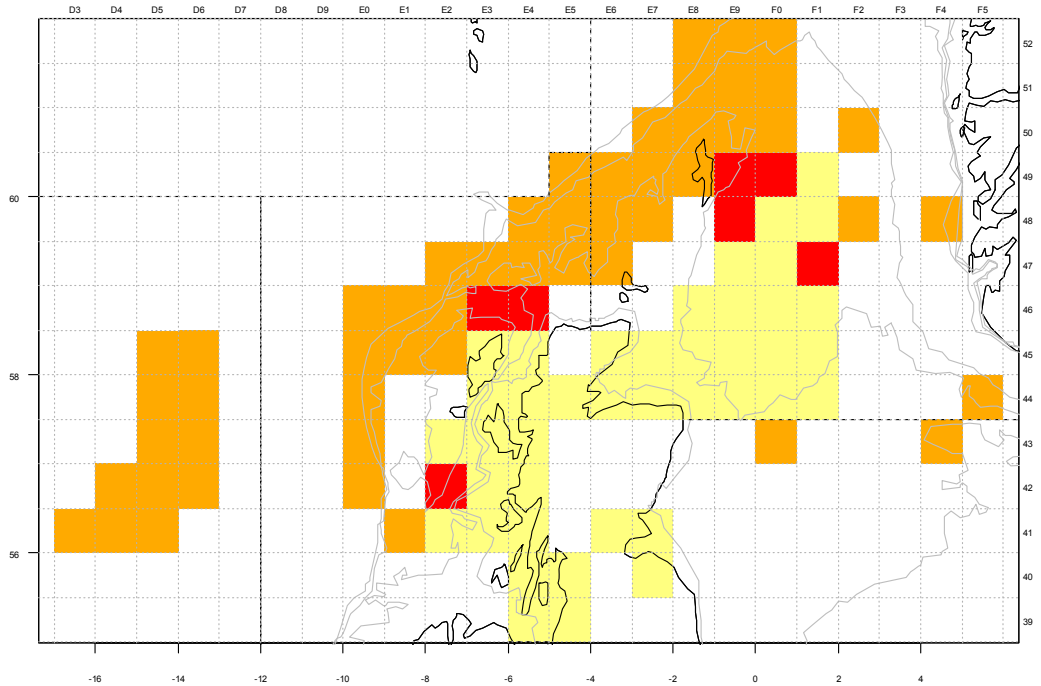


Figure 2.2.9 Statistical rectangle definition of the 'anglerfish fishery area' (orange), 'Nephrops fishery area' (buff) and 'other' (all other rectangles). Red rectangles indicate overlap between the anglerfish area and Nephrops area – these rectangles were subsequently included as part of the anglerfish area

Anglerfish are also found widely in squares outside the two areas defined and these form a third component of the overall distribution. All remaining statistical rectangles in areas IV ad VI were assigned to this fishery area. To the north and west, these squares sometimes contain moderate densities while further south in the North Sea the abundance declines.

These three areas, 'main anglerfish area', 'Nephrops area' and 'other' have been used to provide a spatial framework for a description of the fishery.

Within these areas, an analysis was then performed of the major gears and mesh sizes in use in order to identify key components of the fleet taking significant quantities of anglerfish. This work drew on the individual official logbook data held in the Scottish Executive fishery database FIN. Uncertainties in the completeness of information from this source limits the utility of this material but it is considered suitable for providing a broad based fishery description.

Table 2.2.3 shows fishing gears used by UK vessels landing anglerfish in Scotland from the three fishery areas. Data are shown for 2004 only but the picture is broadly similar for earlier years. Landings attributed to individual gear descriptions need to be treated cautiously since specific codes are sometimes entered incorrectly by fishermen. The gears are also grouped according to the broad EU gear categories and the pattern of overall landings for these gives a more reliable picture .The predominant gears involved in taking anglerfish are bottom trawls (71% of reported landings) and twin trawls (13.5%) with gill nets, pair trawls and Scottish Seine also contributing significant quantities. The analysis also shows that most of the landings come from the main anglerfish area (55%) with just over 22% coming from each of the other two areas.

Table 2.2.3 Fishing Gears used by UK vessels landing anglerfish in Scotland from the three fishery areas. Data shown for 2004 only. Landings listed by FIN gear code with description of the gear. Colour shading indicates the equivalent broad gear groups developed for categorising EU fleets.

FIN gear code	Gear Description	"Monk fishery" area Catch (Kg)	"Nephrops fishery" area Catch (Kg)	Other areas Catch (Kg)	Sum (Kg)
OTB	B trawls otter(side/stern not specified)	2,786,492	1,272,738	1,014,150	
OTB1	B trawls otter trawls (side)	138	0	0	5,389,420
OTB2	B trawls otter trawls (stern)	172,862	5,437	108,208	
TBN	B trawls nephrops trawls	15,499	11,732	2,164	
OTT	Twin trawls Otter twin multi trawls	573,716	201,217	156,239	
TBNT	Twin trawls (nephrops trawl)	4,015	76,116	6,115	1,017,418
GNS	Set gillnets (anchored)	377,791	0	72,810	
GN	Gill nets (not specified)	20,985	0	19,455	492,725
GTR	Trammel nets	0	0	1,683	
PTB	B trawls pair trawls (two vessels)	118,227	31,309	140,960	
PT	Pair trawls (two vessels) not specified	3,087	51	2,565	296,200
SSC	Boat/vessel seines-Scottish seines	61,552	54,547	82,469	198,568
TBB	B trawls Beam trawls	40,454	8,138	83,314	131,905
SPR	Boat/vessel Pair seines(two vessels)	5,452	1,815	12,930	20,197
LHP	Handlines and polelines (hand-operated)	0	0	36	36

An analysis of the mesh sizes in use provides a more informative breakdown and illustrates which are the key contributors to anglerfish landings. Table 2.2.4 concentrates on the bottom trawl and twin trawl categories (84.5% of landings). Within the main anglerfish fishery area there is a pattern of increasing landings contribution with increasing mesh size. Trawls using >100mm in the bottom trawl and twin categories account for 83.4% and 16.5% respectively of the total landings of these gears combined. The >120mm bottom trawl category makes the single biggest contribution of any gear. Within the Nephrops area, the landings of anglerfish are predominantly made by the smaller mesh gears (<100mm), in particular the 80 – 99mm category in both bottom trawl and twin trawl groups. Catches in the 'other' area are predominantly made by the >120mm mesh gear and particularly by the bottom trawl category.

Table 2.2.4 Landings of anglerfish by UK vessels into Scotland for the two main gear categories (bottom trawls above and twin trawls below). Data within each of the three fishery areas are shown by mesh size with summaries for <100mm and >100mm.

Bottom Otter Trawl Catches

Mesh Size (mm)	"Monk fishery" area Catch (Kg)	"Nephrops fishery" area Catch (Kg)	Other areas Catch (Kg)
32-54	8,045	2,021	4,579
70-79	11,234	23,853	1,077
80-99	129,535	1,140,546	116,847
Sum	**148,815**	**1,166,421**	**122,502**
100-119	384,141	30,596	321,587
>=120	2,440,795	92,690	680,433
Sum	**2,824,936**	**123,286**	**1,002,020**

Multi-rigged Otter Trawl Catches

Mesh Size (mm)	"Monk fishery" area Catch (Kg)	"Nephrops fishery" area Catch (Kg)	Other areas Catch (Kg)
16-31	384	0	0
70-79	0	0	205
80-99	19,071	263,097	28,197
Sum	**19,455**	**263,097**	**28,402**
100-119	19,171	4,462	20,570
>=120	539,106	9,774	113,382
Sum	**558,277**	**14,235**	**133,952**

An indication of the number of vessels operating in the main groups of gears contributing anglerfish landings is given in Table 2.2.5. In the >100mm bottom trawl operating in the anglerfish area there has been a marked reduction in vessel numbers largely through decommissioning programmes operated in the UK. A similar picture can be seen for the <100mm twin trawl category operating in this area. A less marked decline is evident in the <100mm fishery operating in the Nephrops area. Table 2.2.6 provides an indication of the numbers of >100mm boats spending different amounts of time in the main anglerfish fishery area. Out of the 94 vessels operating in 2004 , 10 of them spent 90-100 % of their time there, while 25 (just over a quarter) spent more than 50 % of their time there. Anglerfish landings from the main anglerfish area appear to be made by groups of boats operating a range of behaviours. Some are resident most of the time, others move in and out of the area more often. The extent to which any of these groups is more dependent on anglerfish is difficult to judge and insufficient time was available to examine this in more detail. Clarke (2004) used cluster analysis to analyse the Scottish fleet operating in area IV and identified a very clean anglerfish component operating to the North West of the area but it is not clear how significant the contribution to overall anglerfish landings was by this cluster.

Table 2.2.5 Changes in the numbers of vessels operating in each of the main metiers contributing to anglerfish landings

Single Rig Otter Trawl, Monk Area, 100mm+ mesh

1997	1998	1999	2000	2001	2002	2003	2004
336	302	292	251	258	198	149	94

Multi-Rig Otter Trawl, Monk Area, 100mm+ Mesh

1997	1998	1999	2000	2001	2002	2003	2004
89	96	88	96	96	77	45	25

Bottom Otter Trawl, Nephrops Area, <100mm Mesh

1997	1998	1999	2000	2001	2002	2003	2004
375	352	353	323	309	305	277	243

Table 2.2.6 Numbers of vessels in the bottom trawl >100mm grouping operating in the anglerfish main area for various percentages of their fishing time. For example in 2004, 10 vessels spent 90-100% of their time in the area, 25 vessels spent less than 10% of their time there.

	Percentage Time Operating In Metier									
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
1997	120	49	33	26	21	30	14	14	12	17
1998	107	42	40	26	26	20	15	7	7	12
1999	129	27	30	29	22	13	17	5	11	9
2000	97	34	27	24	18	16	12	6	8	9
2001	100	44	24	22	21	15	6	8	5	13
2002	64	36	26	16	16	15	7	1	5	12
2003	51	23	22	12	12	4	4	7	7	7
2004	25	13	19	7	5	10	2	1	2	10

2.2.4. UK (EW&NI) catch and effort

Landings of anglerfish by UK vessels landing into England, Wales and Northern Ireland (EW&NI), and by EW&NI vessels landing abroad, are given in Table 2.2.7 by ICES subdivision, all gears combined. Landings have declined from more than 3000 tonnes in 1997 to less than 300 tonnes in 2005. Figure 2.2.10 shows the relative contribution of anglerfish landings in each ICES division to the total anglerfish landings. ICES Division VIb has contributed substantially more in recent years, in relative terms, to the total landings. Table 2.2.8 shows a further breakdown into two gear groupings, namely all gears excluding nets, and gillnets. These were the only gear groupings available to the meeting. Table 2.2.9 gives the proportion of anglerfish landings (expressed as a percentage) taken by nets, highlighting the importance of nets in Divisions IVa and VIb.

The effort associated with landings that included anglerfish is shown in Figure 2.2.11 for all gears excluding nets, and in Figure 2.2.12 for nets. The effort is measured as number of days fished. A strong decline in effort since the mid- to late-1990's is indicated for both gear groups, but these trends should be interpreted with care because landings that did not include anglerfish (for reasons of availability, discarding or mis-reporting) are not incorporated.

Figure 2.2.13 describes the total number of landings that included anglerfish, categories by vessel length. The greatest number of anglerfish landings was made by vessels of 10-20m in length.

Table 2.2.7. Landings of anglerfish by UK vessels landing into EW&NI, and by EW&NI vessels landing abroad, by ICES subdivision, all gears combined.

	Area IV			Area VI		
	IVA	IVB	IVC	VIA	VIB	Total
1990	91	754	6	71	19	940
1991	129	670	6	270	99	1173
1992	143	998	17	351	173	1682
1993	160	1285	18	225	76	1764
1994	169	1277	136	371	50	2002
1995	177	934	357	320	105	1894
1996	439	676	256	201	178	1750
1997	2381	668	131	156	248	3585
1998	668	603	36	119	188	1614
1999	781	364	3	60	111	1319
2000	218	423	1	44	271	958
2001	183	475	0	40	197	894
2002	98	236	0	32	132	499
2003	104	168	10	30	133	447
2004	83	120	3	30	54	289
2005	34	95	0	20	93	242

Figure 2.2.10. Relative contribution of anglerfish landings in each ICES division to total anglerfish landings.

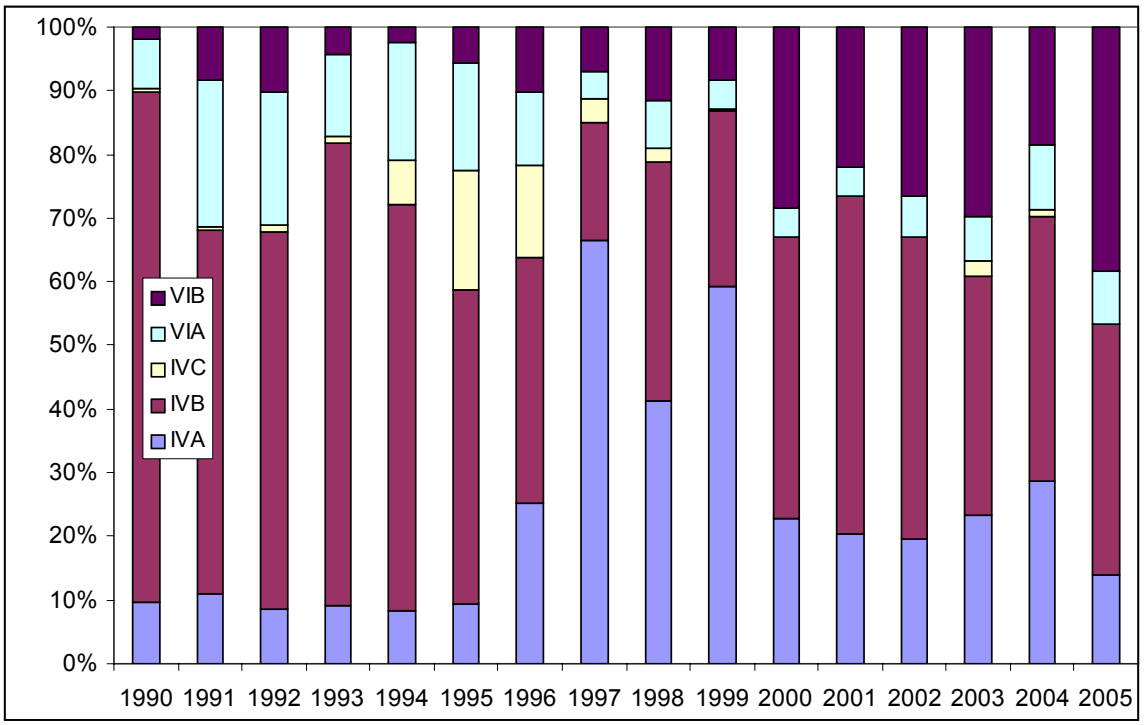


Table 2.2.8. Landings of anglerfish by UK vessels landing into EW&NI, and by EW&NI vessels landing abroad, by ICES division, for the all gears excluding nets, and for nets.

	All gears excluding nets						Nets					
	Area IV			Area VI			Area IV			Area VI		
	IVA	IVB	IVC	VIA	VIB	Total	IVA	IVB	IVC	VIA	VIB	Total
1990	91	752	5	71	16	935	0	2	0	0	3	5
1991	129	667	5	221	16	1038	0	3	0	49	83	135
1992	142	993	17	339	45	1536	0	5	0	13	127	146
1993	158	1279	18	211	31	1697	1	6	0	14	45	66
1994	169	1271	136	335	25	1936	0	5	0	36	26	67
1995	149	929	357	302	19	1757	28	5	0	18	86	137
1996	95	671	256	169	25	1217	344	5	0	31	153	533
1997	213	663	131	148	41	1196	2168	5	0	8	207	2389
1998	94	598	36	101	48	877	574	5	0	18	139	736
1999	102	361	3	58	16	541	679	3	0	2	95	778
2000	88	422	1	32	18	561	129	2	0	12	253	396
2001	66	472	0	25	15	579	117	3	0	15	181	315
2002	80	234	0	29	11	355	18	2	0	3	121	144
2003	33	167	10	27	22	259	71	1	0	3	111	187
2004	11	119	3	30	13	176	72	1	0	0	40	114
2005	14	95	0	14	24	147	20	0	0	6	69	95

Table 2.2.9. Proportion of anglerfish landings (expressed as a percentage) taken by nets. Data are for UK vessels landing into EW&NI, and by EW&NI vessels landing abroad, by ICES division.

	Area IV			Area VI		
	IVA	IVB	IVC	VIA	VIB	Total
1990	0%	0%	2%	0%	14%	1%
1991	0%	0%	5%	18%	84%	12%
1992	0%	1%	0%	4%	74%	9%
1993	1%	0%	0%	6%	59%	4%
1994	0%	0%	0%	10%	51%	3%
1995	16%	1%	0%	6%	82%	7%
1996	78%	1%	0%	16%	86%	30%
1997	91%	1%	0%	5%	84%	67%
1998	86%	1%	0%	15%	74%	46%
1999	87%	1%	0%	3%	86%	59%
2000	59%	0%	0%	27%	93%	41%
2001	64%	1%	32%	36%	92%	35%
2002	18%	1%	9%	10%	92%	29%
2003	68%	1%	0%	11%	84%	42%
2004	87%	1%	1%	0%	76%	39%
2005	59%	0%	0%	29%	74%	39%

Figure 2.2.11. Effort (number of days fished) associated with landings that included anglerfish, for all gears, excluding nets, given by ICES division.

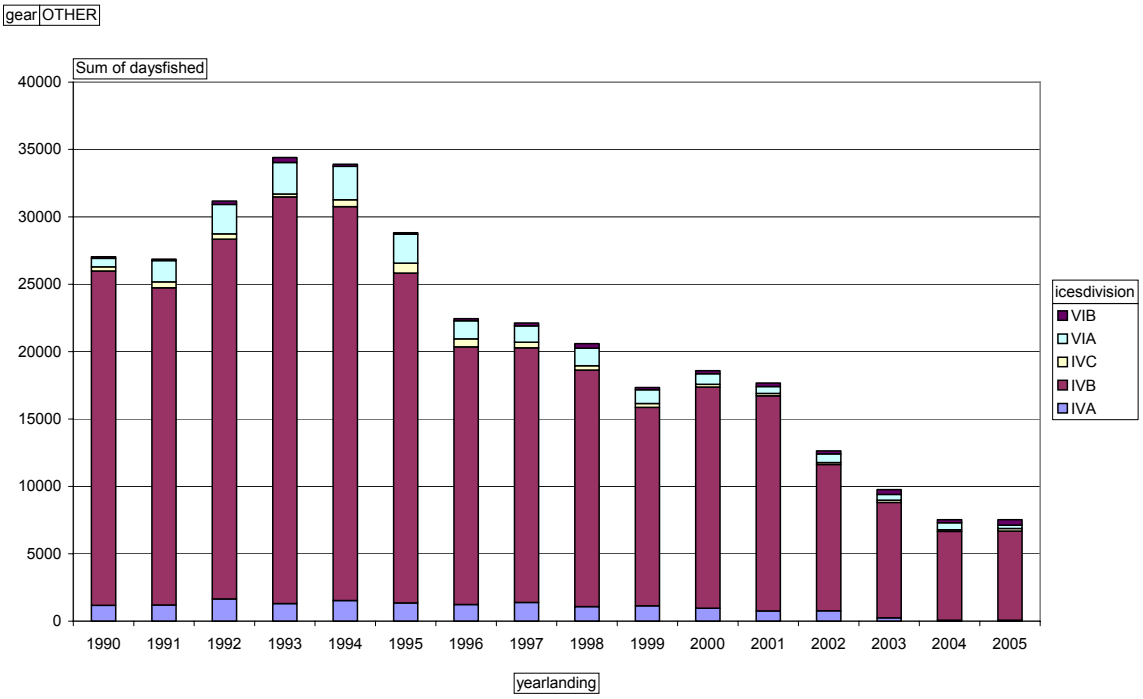


Figure 2.2.12. Effort (number of days fished) associated with landings that included anglerfish, for nets, given by ICES division.

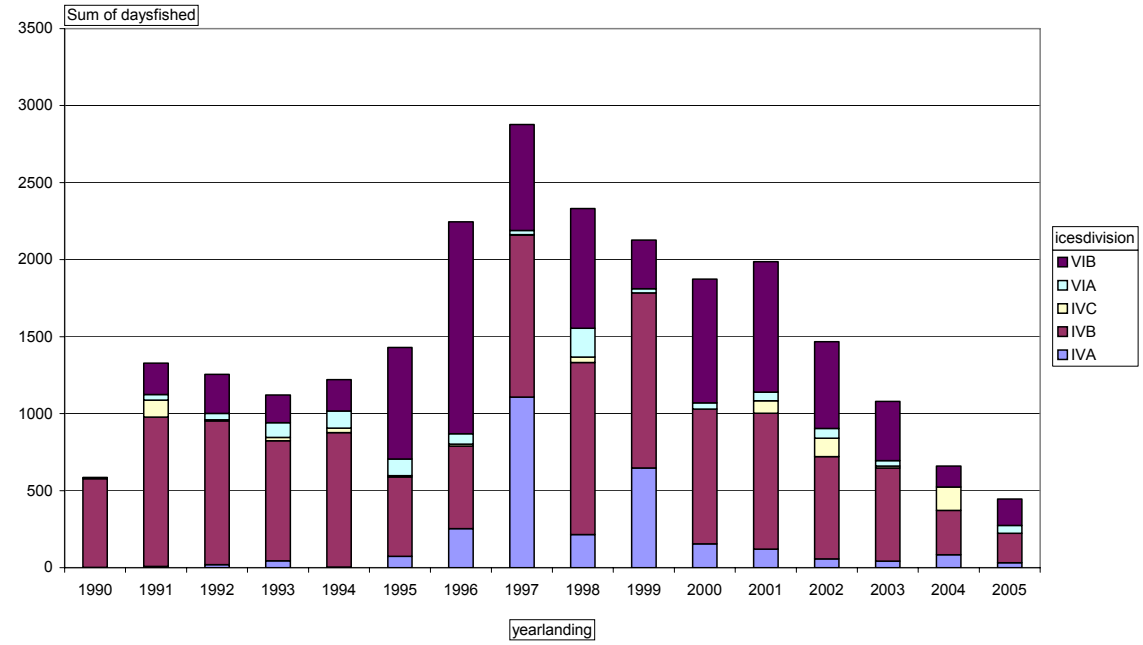
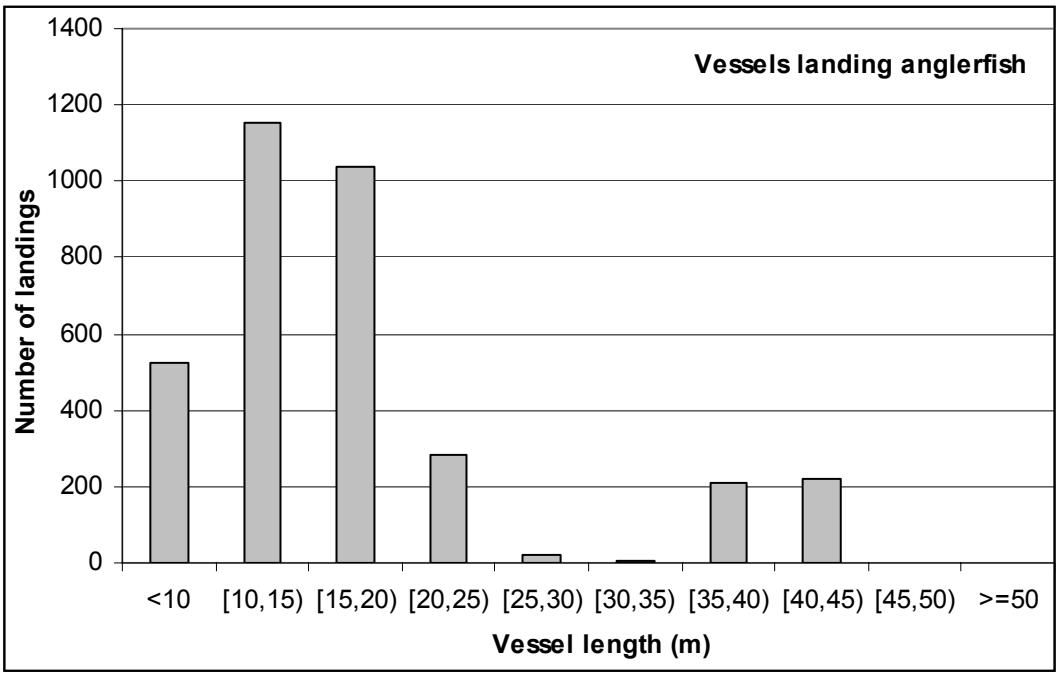


Figure 2.2.13. Number of landings that included anglerfish, categorised by vessel length in ICES Divisions IV and VI in 2005. A vessel in the [10,15) length category is 10m or larger, but less than 15m. Date are for UK vessels landing into EW&NI, and EW&NI vessels landing abroad.



2.3. Species composition in catches of trips catching anglerfish

2.3.1. International data

The species composition of the catches of the main gears catching anglerfish were analysed from the provisional (and incomplete) international data base on catches and efforts, as compiled during the first meeting of SGRST on management of fishing effort during 13-17 March 2006 (SGRST 06-01). As indicated above, some concern exists on the content of these data bases.
Results are presented in Figures 2.3.1 to 2.3.3 below. In the areas IV (North Sea) and Via (West of Scotland), the catch of anglerfish makes up a minor share of the total catch of mixed fisheries, predominantly taken by otter trawls; other species in the same fisheries include sole, plaice, megrim, saithe, haddock, cod and Nephrops. In area VIb, however, most anglerfish is taken in gill nets, and by-catches of other species make up a much smaller part. The additional catch of anglerfish in otter trawls in this area, however, do come with a by-catch of haddock, Nephrops and others.

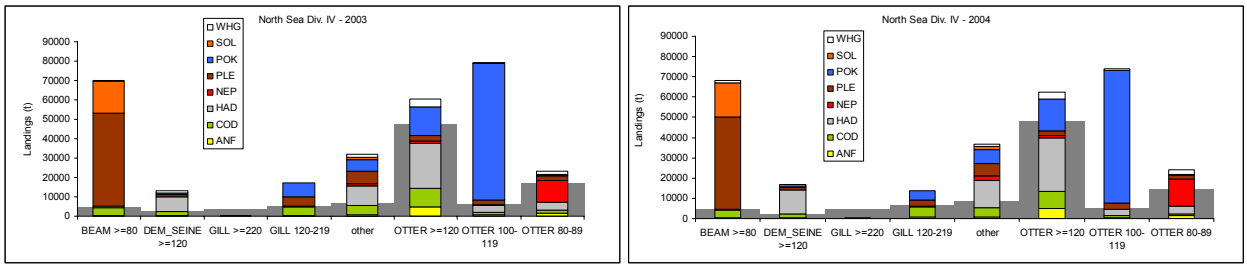


Figure 2.3.1 Landings composition (t) of anglerfish (ANF), cod (COD), haddock (HAD), Nephrops (NEP), plaice (PLE), saithe (POK), sole (SOL) and whiting (WHG) in the North Sea by gear in 2003 and 2004. The grey bars in the background present the contribution of anglerfish ten times enlarged.

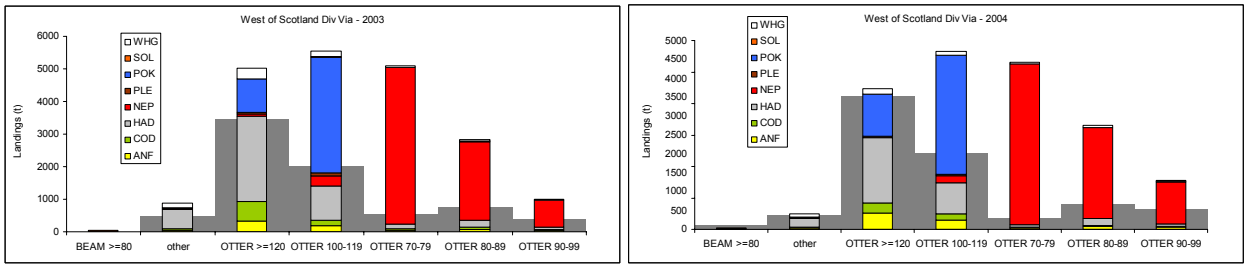


Figure 2.3.2 Landings composition (t) of anglerfish (ANF), cod (COD), haddock (HAD), Nephrops (NEP), plaice (PLE), saithe (POK), sole (SOL) and whiting (WHG) in the area West of Scotland in 2003 and 2004. The grey bars in the background present the contribution of anglerfish ten times enlarged.

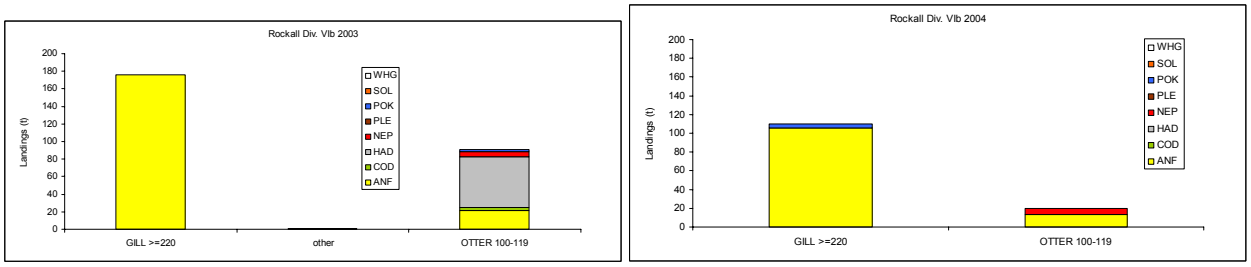


Figure 2.3.3 Landings composition (t) of anglerfish (ANF), cod (COD), haddock (HAD), Nephrops (NEP), plaice (PLE), saithe (POK), sole (SOL) and whiting (WHG) in the Rockall area by gear in 2003 and 2004.

Table 2.3.1 Landings composition (t) of anglerfish (ANF), cod (COD), haddock (HAD), Nephrops (NEP), plaice (PLE), saithe (POK), sole (SOL) and whiting (WHG) by area and gear in 2003 and 2004.

AREA	YEAR	GEAR	ANF	COD	HAD	NEP	PLE	POK	SOL	WHG
4	2003	BEAM >=80	422.790	4073.181	517.079	44.245	48066.670	31.938	16400.756	526.369
4	2003	DEM_SEINE >=120	238.601	2055.646	7552.539	1.807	1533.690	775.588	1.542	894.967
4	2003	GILL >=220	360.746	35.773	0.085	0.004	14.051	0.394	1.750	0.032
4	2003	GILL 120-219	510.643	4309.195	460.543	2.263	4611.178	7116.175	210.257	8.335
4	2003	other	671.493	5119.345	9693.789	1512.054	6236.590	5933.781	1368.719	1282.160
4	2003	OTTER >=120	4728.298	9517.092	23331.580	1191.476	2800.122	14935.628	16.581	3683.791
4	2003	OTTER 100-119	605.410	1512.702	3414.265	343.062	2463.614	70290.187	22.969	618.141
4	2003	OTTER 80-89	1662.386	1409.182	4187.538	11132.934	2363.639	562.600	165.740	1911.944
4	2004	BEAM >=80	477.875	3701.958	488.517	44.446	45309.468	32.680	16979.643	1190.040
4	2004	DEM_SEINE >=120	213.646	1962.012	11845.929	0.388	1476.585	682.683	0.146	842.813
4	2004	GILL >=220	457.275	52.997	0.764	0.019	18.593	0.435	2.638	0.178
4	2004	GILL 120-219	645.727	5180.714	394.131	0.011	3089.349	4362.114	162.208	2.537
4	2004	other	866.746	4467.773	13322.709	2398.979	6046.115	7104.659	1250.155	1341.744
4	2004	OTTER >=120	4823.457	8639.489	26427.166	920.734	2563.015	15467.223	9.768	3652.753
4	2004	OTTER 100-119	482.191	1163.133	2790.730	277.359	2905.321	65610.534	59.496	436.955
4	2004	OTTER 80-89	1448.856	1001.182	3766.423	13317.094	1859.579	500.005	117.485	2120.069
6a	2003	BEAM >=80	0.821	1.569	1.380	1.873	42.830	0.039	4.642	0.150
6a	2003	other	48.773	43.864	602.172	8.943	30.530	5.697	0.370	145.489
6a	2003	OTTER >=120	344.386	591.655	2604.195	67.197	67.532	1014.798	0.057	324.187
6a	2003	OTTER 100-119	200.428	158.227	1037.425	319.905	92.171	3560.635	0.886	168.938
6a	2003	OTTER 70-79	53.771	48.315	124.956	4809.307	2.373	6.158	0.198	53.207
6a	2003	OTTER 80-89	77.065	74.353	196.185	2413.657	12.059	4.753	0.171	56.142
6a	2003	OTTER 90-99	38.815	28.375	83.852	818.896	8.291	4.992	0.358	22.446
6a	2004	BEAM >=80	13.960	6.389	6.820	0.000	10.576	6.259	0.911	0.000
6a	2004	other	47.700	6.979	241.393	20.868	11.199	3.615	0.239	86.424
6a	2004	OTTER >=120	425.074	282.202	1711.215	10.881	45.006	1104.500	0.231	143.821
6a	2004	OTTER 100-119	241.949	171.794	823.731	173.002	47.993	3145.189	1.137	110.061
6a	2004	OTTER 70-79	37.451	15.813	75.087	4244.307	1.241	1.752	0.367	40.619
6a	2004	OTTER 80-89	80.209	24.246	180.529	2403.733	7.914	7.945	0.348	54.661
6a	2004	OTTER 90-99	65.069	17.677	68.159	1113.355	10.216	4.291	0.357	16.326
6b	2003	GILL >=220	175.767	0.421						
6b	2003	other	0.397			0.124				
6b	2003	OTTER 100-119	21.576	2.933	58.470	5.790		2.038		
6b	2004	GILL >=220	106.160					3.995		
6b	2004	OTTER 100-119	13.016			6.463				

2.3.2. Species composition in catches of Danish fisheries catching anglerfish

Information on the species composition of the landings from Danish fisheries taking anglerfish is available from the Danish logbook records. Table 2.3.2 shows the species composition in landings from the Norwegian Deeps by the common gear used in this fishery (trawls with mesh size >= 120 mm) for 2004 and 2005. The relative species composition appears to be rather similar for these two recent years. Anglerfish constitutes around 13% by weight of the landings, while the most important species by weight is saithe.

In addition to the logbook information, more detailed information of the composition of the catch, including the discard component is available for 2005 from the Danish at-sea-samples conducted in the 1st and 2nd quarter of 2005 in fishing trips for anglerfish and other demersal species (mesh size = 122 mm). In these samples anglerfish constituted around 25% of the landed component of total catch. This is a much higher fraction than recorded by logbooks. However, the logbook records also include many trips directed more at other species including Nephrops and therefore the overall percentage here is smaller. It is however noted that the overall patterns in species composition are similar, see Figs.2.3.4. Cod, saithe and *Nephrops* and to a lesser extent haddock, ling and witch flounder seem to be the other important components of the landings. The logbook data on landings composition are also available. The at-sea-samples also provide data on corresponding discards as shown in Figure 2.3.5 and 2.3.6. Note here the dominating 'other species' component. Cod also appears to be a significant component of the discards. One must be cautious to extrapolate to total discards corresponding to total landings from these few samples.

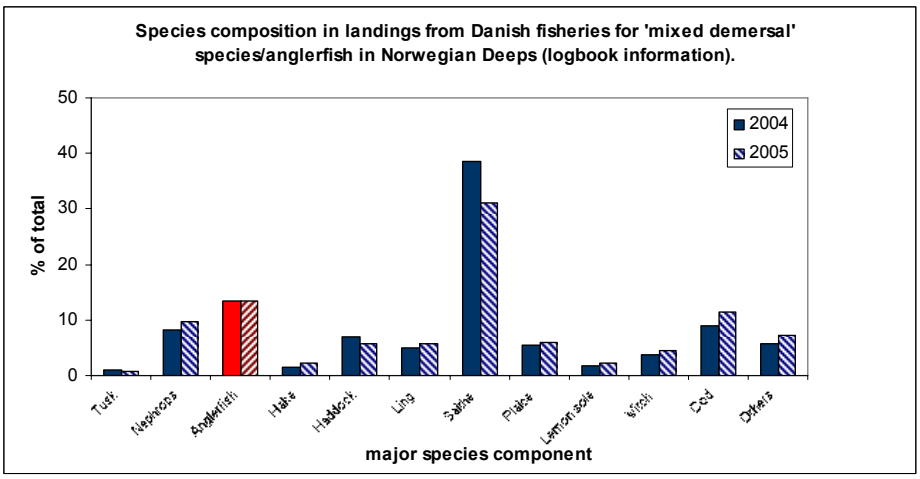


Figure 2.3.4 Species composition in Danish landings with anglerfish. Data from logbooks.

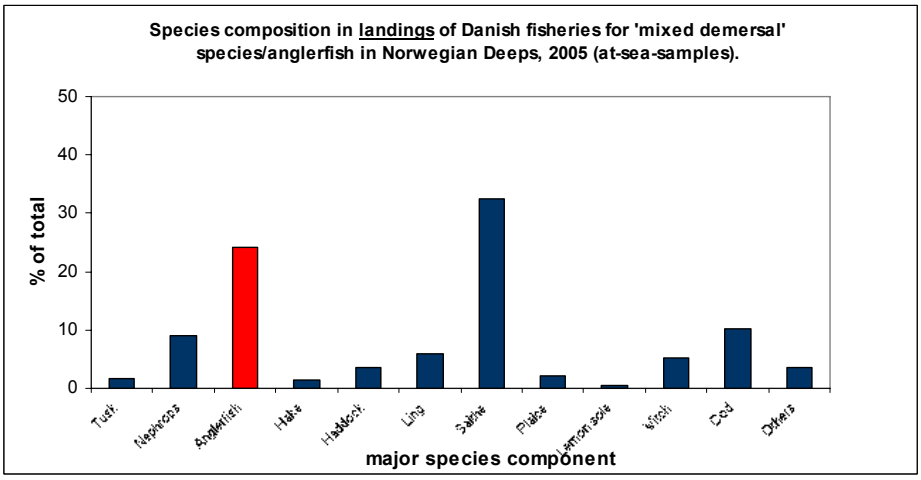


Figure 2.3.5 Species composition in Danish landings with anglerfish. Data from observer programmes.

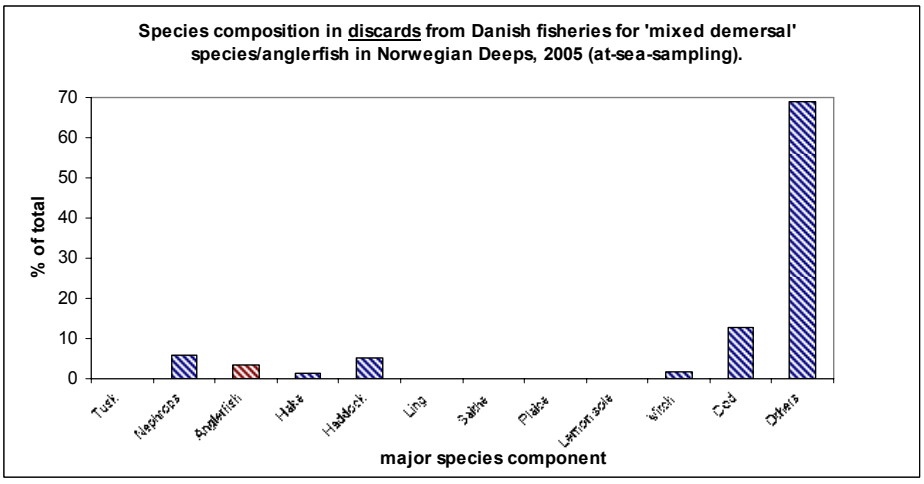


Figure 2.3.6 Species composition of discards in fisheries for anglerfish. Data from observer programmes.

Table 2.3.2 Species composition (see also Figures 2.3.5 and 2.3.6)

Speies	2004 tons landed	% of total	2005 tons landed	% of total
Tusk	98	1.1	80	0.8
Nephrops	730	8.2	910	9.7
Anglerfish	1200	13.4	1254	13.3
Hake	127	1.4	215	2.3
Haddock	616	6.9	545	5.8
Ling	447	5.0	543	5.8
Saithe	3442	38.5	2920	31.0
Plaice	480	5.4	556	5.9
Lemon sole	161	1.8	217	2.3
Witch	333	3.7	424	4.5
Cod	794	8.9	1081	11.5
Others	505	5.7	676	7.2
Grand Total	**8933**	**100.0**	**9421**	**100.0**

2.3.3. Species composition in catches of Scottish fisheries catching anglerfish

An analysis of catches of other species taken with anglerfish was performed for the main metiers contributing to anglerfish landings. Results for 2003 and 2004 are shown in Figure 2.3.7. The species included were anglerfish, megrim, ling, cod, haddock, whiting, saithe and Nephrops - note this does not represent all species caught and results are presented only in absolute terms, not as percentage compositions. Landings of other species were, however, relatively small. Information is provided for the main metiers described above and the overall importance of each metier in terms of total landings can be seen together with the relative importance of the associated species in each.

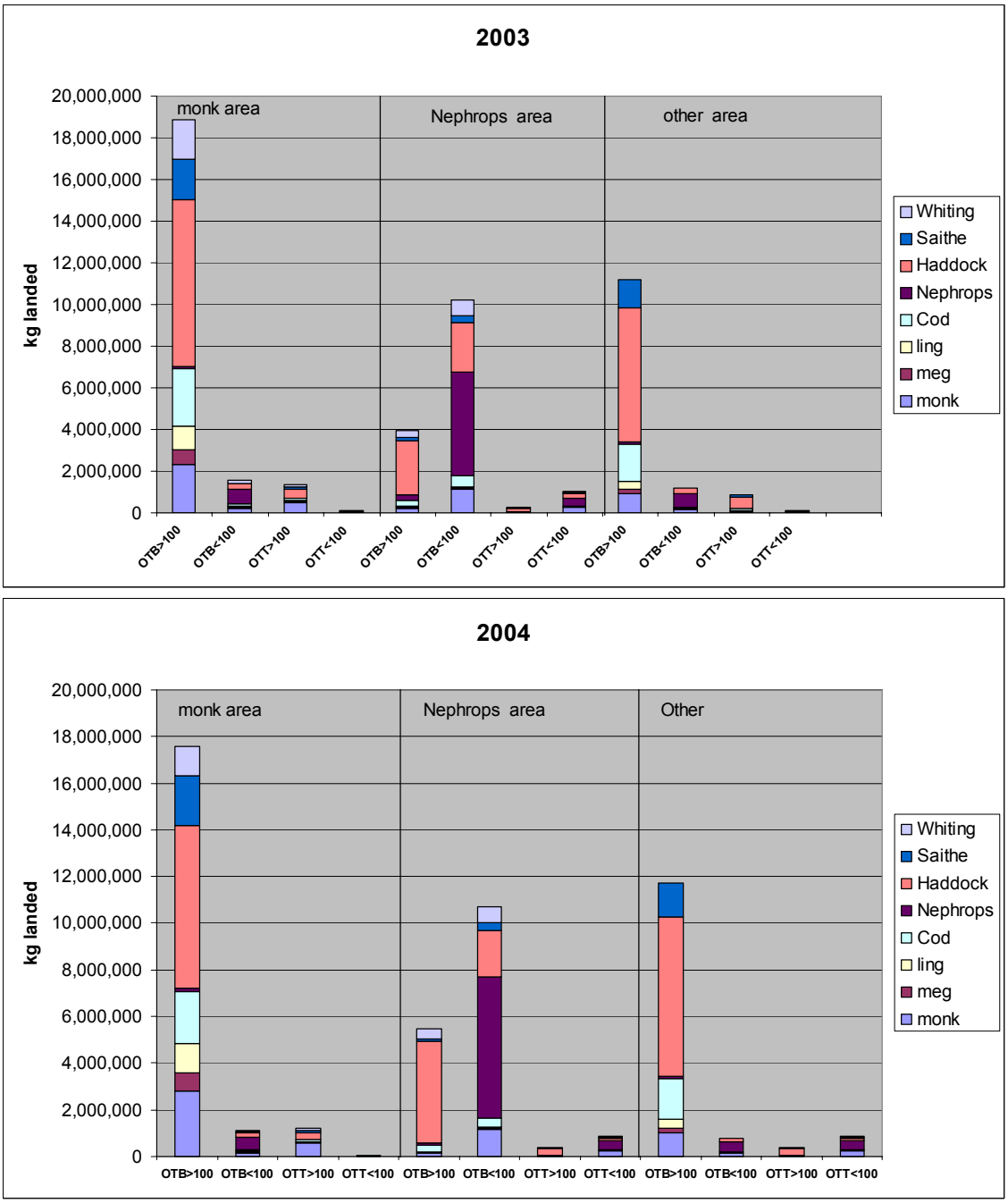


Figure 2.3.7 Landings (kg) of species caught in association with anglerfish in each of three main fishery areas and by principle metiers in 2003 (upper panel) and 2004 (lower panel). Results shown as a stacked histogram of UK landings into Scotland

The anglerfish area has the highest overall landings caught in association with anglerfish with the >100mm bottom trawls making the largest contribution. This metier has a mixed catch composition with haddock the most important species and cod and anglerfish the next most important. In the Nephrops area the largest overall landings associated with anglerfish come from the <100mm gears but here the predominant species is Nephrops, with anglerfish the third most important after haddock. Overall landings associated anglerfish in the 'other' area are greatest in >100mm bottom trawl category where haddock again predominates – anglerfish make a relatively small contribution in this category. Rather similar results are obtained for 2003 and 2004 with slight reductions in the amounts of cod in the large mesh metiers.

Anglerfish apparently contribute relatively low proportions to the landings in most of the metiers described. Care is, however, required here, since even within the main anglerfish metier,

individual vessels show considerable variability in time spent in the anglerfish area (see above) and can be expected to show marked variation in catch composition. Discussion with individual skippers suggests that even within a single statistical rectangle, catch composition can vary a great deal particularly where the bathymetry changes rapidly. The cluster analysis performed on individual landing records from ICES area IV (Clarke, 2004) showed that a very clean anglerfish fishery could be identified. As discussed above, further analysis of the main, large mesh trawl metier operating in the anglerfish area is required to provide a more comprehensive picture of catch composition. This was beyond the scope of the present meeting.

2.3.4. Species composition in catches of UK (EW&NI) fisheries catching anglerfish

The species composition of landings by ICES sub-division and gear groupings (all gears excluding nets, and nets) is given in Figure 2.3.8. Anglerfish landings are a relatively minor component (<10%) of landings by all gears excluding nets, but accounts for a larger component of net landings, particularly in Division IV. The proportion of species taken by nets in each area is shown in Table 2.3.3.

Figure 2.3.8. Species composition (by weight) of landings by sub-division and gear grouping for 2003-5. Data are for landings that included anglerfish by UK vessels landing into EW&NI, and EW&NI vessels landing abroad. Anglerfish has the species code "ANF" ; CRR indicates Red Crab.

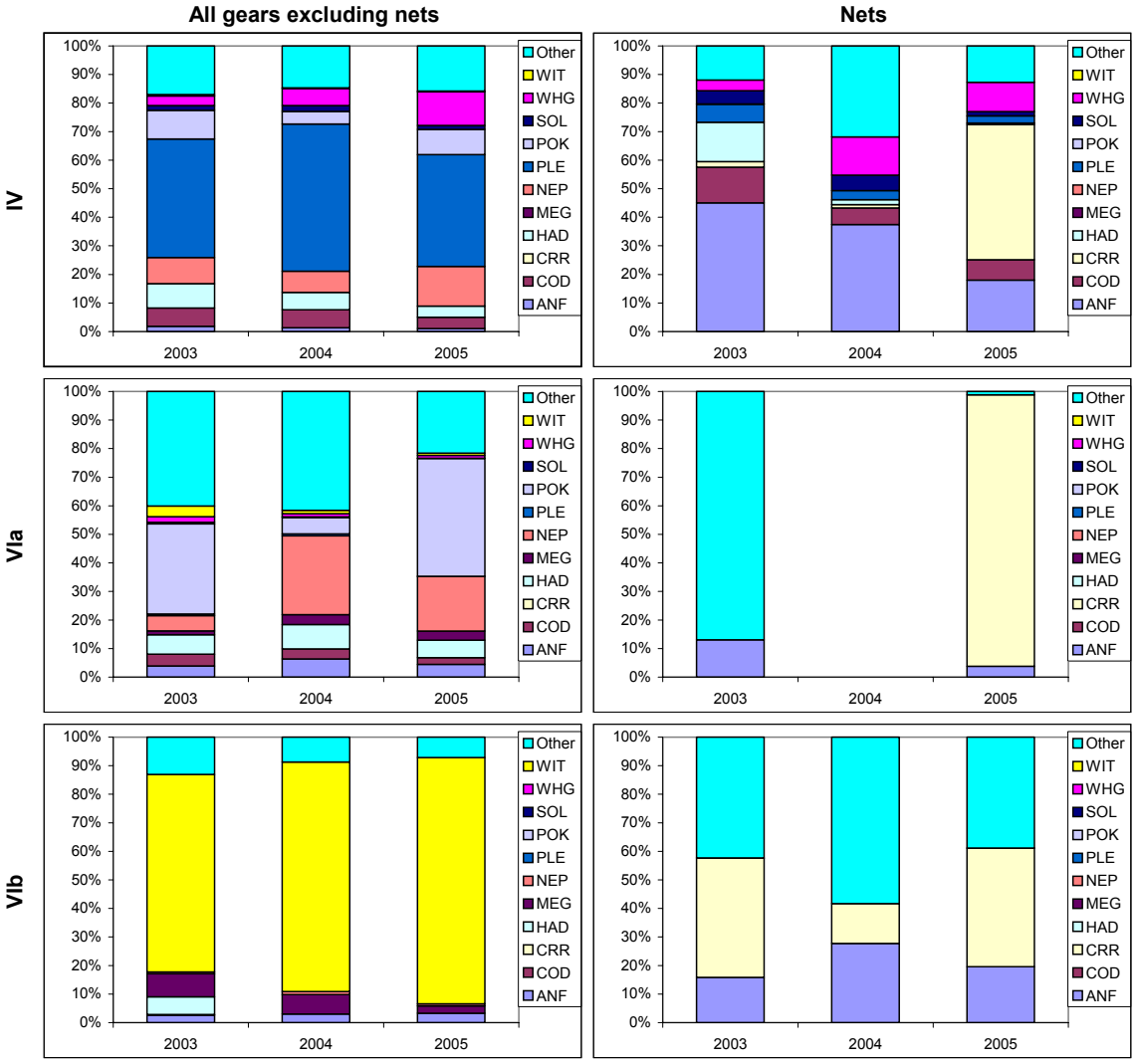


Table 2.3.3. Proportion of landings (expressed as a percentage) taken by nets for each species and ICES sub-division in 2005. Data are for landings that included anglerfish by UK vessels landing into EW&NI, and EW&NI vessels landing abroad. A "-" indicates that species did not occur with anglerfish landings in the relevant area. Anglerfish has the species code "ANF".

	IV	VIa	VIb
ANF	16%	29%	74%
COD	2%	0%	-
CRR	100%	100%	100%
HAD	0%	0%	-
MEG	0%	0%	1%
NEP	0%	0%	0%
PLE	0%	0%	-
POK	0%	0%	-
SOL	1%	0%	-
WHG	1%	0%	-
WIT	0%	0%	0%
Other	1%	3%	72%

2.4. Trends in catch and effort.

2.4.1. International data on landings

Total catches of anglerfish in the North Sea and West of Scotland rose to a peak of 34,000 t in 1996, but subsequently declined to just over 12,000 t in recent years. The majority of the landings is derived from area IVa. Most areas showed a maximum in landings in the mid-1990s, but landings from area IIIa peaked in the early 1990s, while the landings from area VIb showed a peak in 1999-2001.

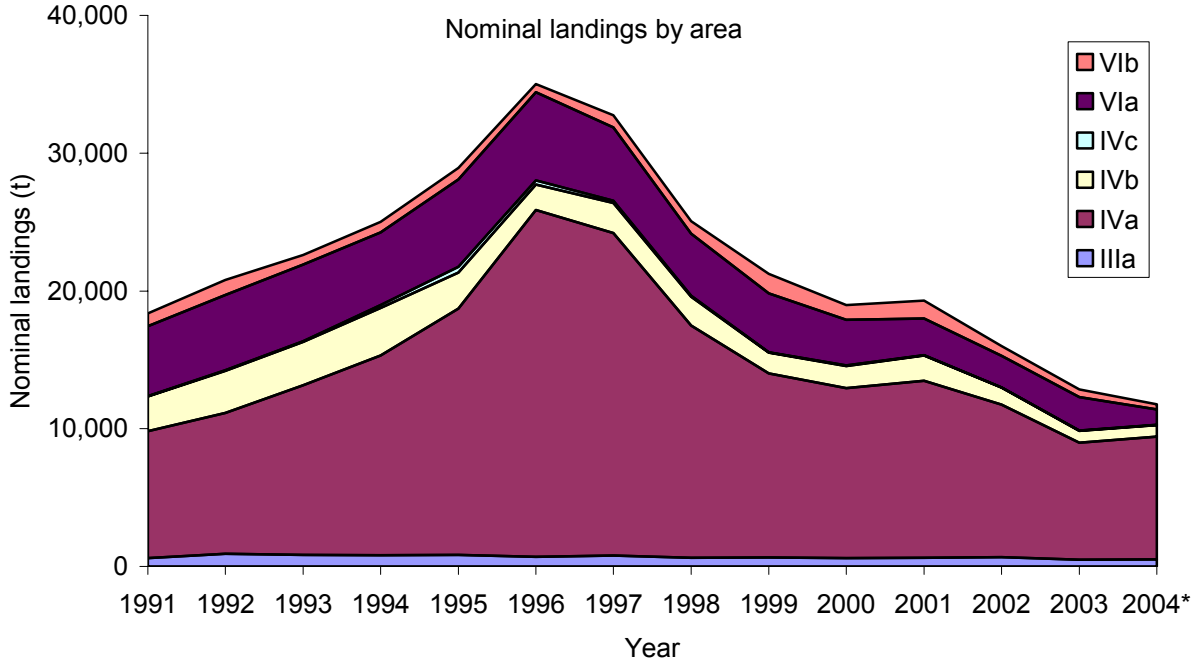


Figure 2.4.1 Trend in international landings of anglerfish per fishing area. Data for 2004 provisional.

Table 2.4.1.a Nominal landings (t) by year, updated: area IIIa.

Nominal catch (t) of Anglerfish in Division IIIa, 1991 2004, as officially reported to ICES.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	15	48	34	21	35	-	-	-	-	-	-	-	-	
Denmark	493	658	565	459	312	367	550	415	362	377	375	371	217	311
Germany	-	-	1	-	-	1	1	1	2	1	+	+	+	
Netherlands														4
Norway	64	170	154	263	440	309	186	177	260	197	200	241	187*	130
Sweden	23	62	89	68	36	25	39	33	36	27	46	55	71	55
Total	595	938	843	811	823	702	776	626	660	602	621	667	475	500

*Preliminary.

Table 2.4.1.b Nominal landings (t) by year, updated: area IV.

Northern North Sea (IVa)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	2005*
Belgium	2	9	3	3	2	8	4	1	5	12	-	8	1		
Denmark	1245	1265	946	1157	732	1239	1155	1024	1128	1087	1289	1308	1517	1538	1376
Faroes	1	-	10	18	20	-	15	10	6	n/a	2		2		
France	124	151	69	28	18	7	7	3*	18* **	8	9	7	6		
Germany	71	68	100	84	613	292	601	873	454	182	95	95	65		
Netherlands	23	44	78	38	13	25	12		15	12	3	8	9	38	
Norway	587	635	1224	1318	657	821	672	954	1219	1182	1212	928	771	999	
Sweden	14	7	7	7	2	1	2	8	8	78	44	56	8	5	
UK(E,W&NI)	129	143	160	169	176	439	2174	668	781	218	183	98	104	83	34
UK (Scotland)	7039	7887	9712	11683	15658	22344	18783	13319	9710	9559	10024	8539	6033		
UK (total)														6357	
Total	9235	10209	12309	14505	17891	25176	23425	16860	13344	12338	12861	11074	8516	8937	1410

* Preliminary. **Includes IVb,c.

Central North Sea (IVb)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	2005*
Belgium	357	538	558	713	579	287	336	371	270	449	579	435	178	258	
Denmark	345	421	347	352**	295	225	334	432	368	260	251	255	190	271	236
Faroes	-	-	2	-	-	-	-	-	-	n/a		9			
France	-	1	-	2	-	-	-	-*	2* ***	-	-	-	-		
Germany	4	2	13	15	10	9	18	19	9	14	9	17	11		
Ireland													1		
Netherlands	285	356	467	510	335	159	237	223	141	141	123	62	42	25	
Norway	17	4	3	11	15	29	6	13	17	9	15	10	13*	22	
Sweden	-	-	-	3	2	1	3	3	4	3	2	9	2	1	
UK(E,W&NI)	669	998	1285	1277	919	662	664	603	364	423	475	236	167	120	95
UK (Scotland)	845	733	469	564	472	475	574	424	344	318	378	210	241		
UK (total)														258	
Total	2522	3053	3144	3447	2627	1847	2172	2088	1517	1617	1832	1243	845	835	331

* Preliminary. **Includes 2 tonnes reported as Sub-area IV. ***Included in IVa.

Southern North Sea (IVc)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	2005*
Belgium	13	12	34	37	26	28	17	17	11	15	15	16	9	5	
Denmark	2	-	-	-	-	-	-	+	+	+	+	+	+	+	+
France	-	-	-	-	-	-	-	10	* **	+	-	+	-		
Germany	-	-	-	-	-	-	-	-	-	+	-	+	+		
Netherlands	5	10	14	20	15	17	11	15	10	15	6	5	1		
Norway	-	-	-	-	+	-	-	-	+	-	+	-	-*	-	
UK(E&W&NI)	6	17	18	136	361	256	131	36	3	1	+	+	10	3	0
UK (Scotland)	-	-	-	17	-	3	1	+	+	+	+	+	-	10	
Total	26	39	66	210	402	304	160	78	24	31	21	21	20	18	0

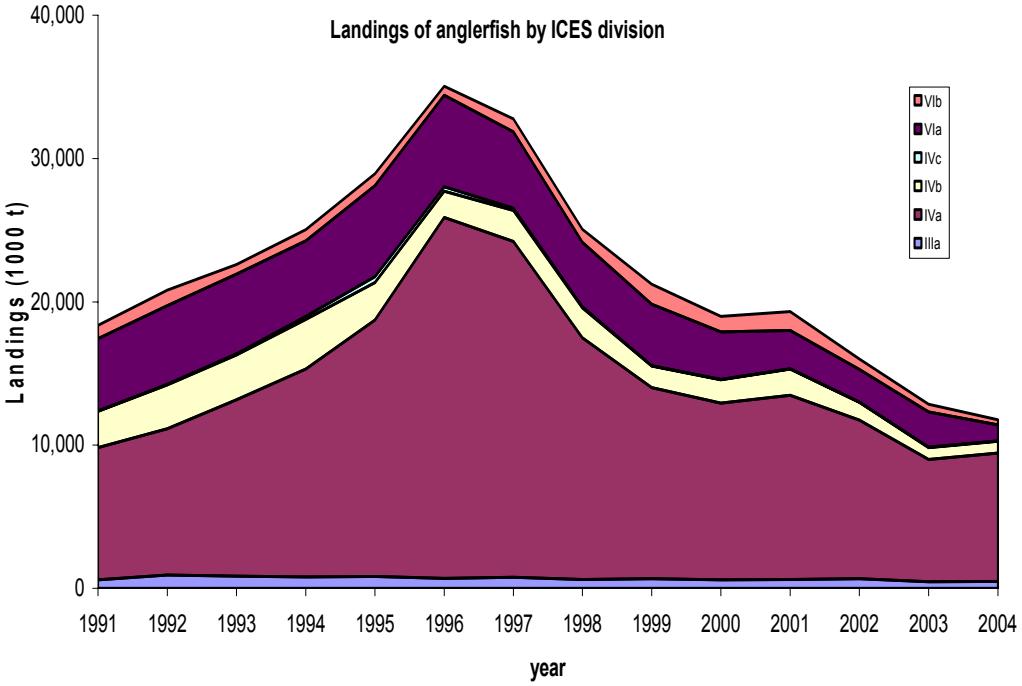
* Preliminary. **Included in IVa.

Total North Sea

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	2005*
Total	11783	13301	15519	18162	20920	27327	25757	19026	14885	13986	14714	12311	9381	9787	

* Preliminary.

Table 2.4.1.c Nominal landings (t) by year, updated: area VI.



2.4.2. **International data on effort**

Trends in effort of the main fisheries catching anglerfish were analysed from the provisional and not yet validated STECF data base. See figures 2.4.2 – 2.4.4 and Table 2.4.2. For several gears, a declining trend was observed, probably due to general fishing effort decommissioning schemes. In addition to this trend, effort by otter trawlers using 100-119 mm mesh sizes in areas IV and VIa declined, while that using mesh sizes <100 and >=120 increased; this indicates a shift away from the intermediate mesh sizes.

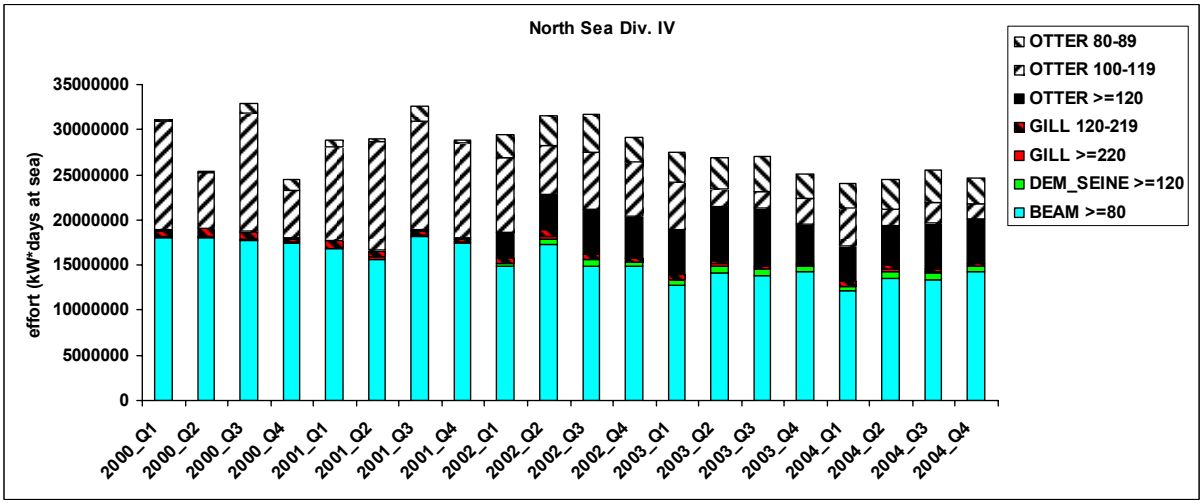


Figure 2.4.2 Nominal effort (kW*days at sea) in the North Sea by gear, year and quarter, 2000-2004. Data from the provisional and not yet validated STECF data base.

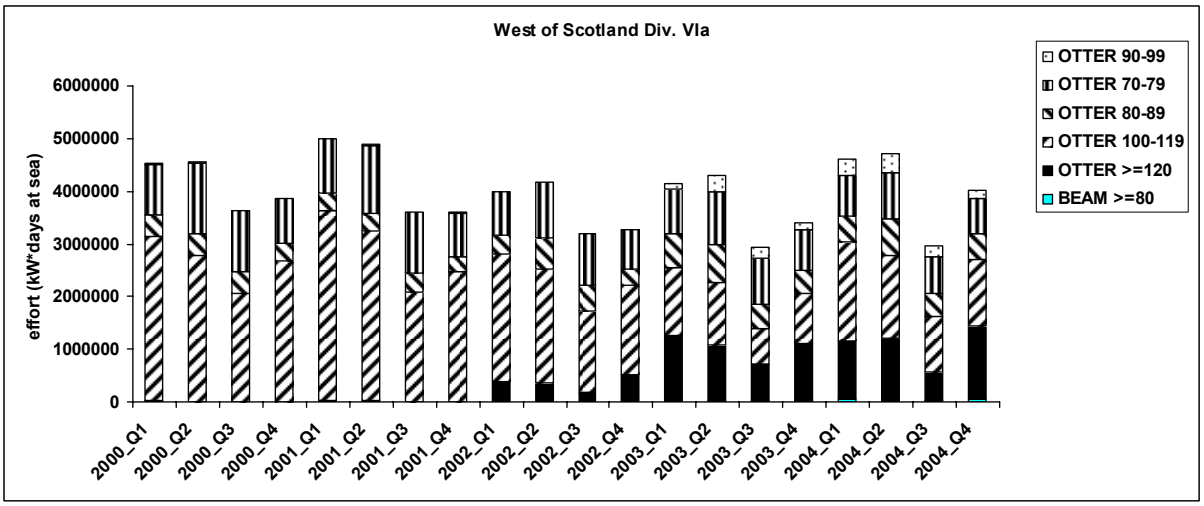


Figure 2.4.3 Nominal effort (kW*days at sea) in the area West of Scotland by gear, year and quarter, 2000-2004. Data from the provisional and not yet validated STECF data base.

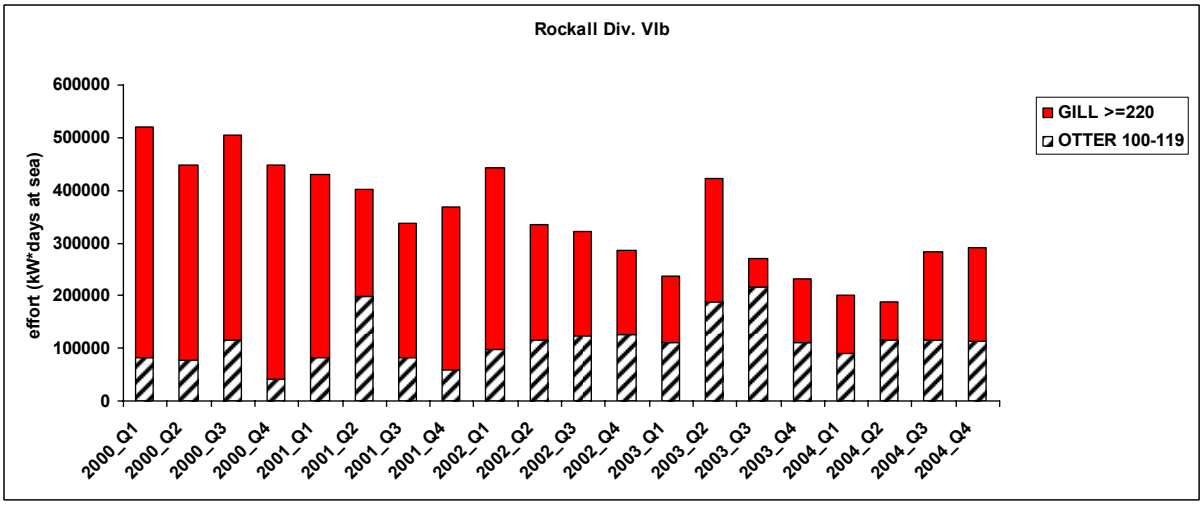


Figure 2.4.4 Nominal effort (kW*days at sea) in the Rockall area by gear, year and quarter, 2000-2004. Data from the provisional and not yet validated STECF data base.

Table 2.4.2 Nominal effort (kW*days at sea) by area, gear, year and quarter, 2000-2004.

AREA	GEAR	2000_Q1	2000_Q2	2000_Q3	2000_Q4	2001_Q1	2001_Q2	2001_Q3	2001_Q4	2002_Q1	2002_Q2	2002_Q3	2002_Q4	2003_Q1	2003_Q2	2003_Q3	2003_Q4	2004_Q1	2004_Q2	2004_Q3	2004_Q4
4	BEAM >=80	18022786	17971805	17770149	17414492	16893218	15669271	18128668	17498658	14847725	17232515	14927652	14934136	12703353	14050669	13748507	14324213	12134160	13533679	13382317	14195937
4	DEM_SEINE >=120	1802	21559	13644	4545		18351	15850	14122	333433	649383	704004	366555	644233	856983	783500	545639	529586	751465	797033	653581
4	GILL >=220	77874	222628	148547	84716	3358	180656	109697	26525	19985	226895	61009	58218	36845	216819	55297	104004	6792	263753	55717	58947
4	GILL 120-219	745436	810740	723665	436840	820757	636247	596200	377013	610549	756231	478191	433898	536759	392878	327483	230698	513128	444542	286206	336414
4	other	5129032	11957341	9310009	6399984	4957505	10576733	9007873	6222181	3328351	9643200	6276934	4774056	3064276	9040930	7250360	5814178	3648312	8936090	6778847	5542853
4	OTTER >=120	73557	102640	143312	98348	69767	150251	57083	75417	2782575	3952248	4964783	4614880	4978298	5987775	6388849	4385622	3901825	4396576	5120435	4909567
4	OTTER 100-119	11995577	6091708	13081877	5229795	10236933	12090553	11972297	10557470	8241772	5483114	6416768	6052498	5268229	1912489	1756242	2772480	4244748	1750952	2252188	1602082
4	OTTER 80-89	119141	201891	1055285	1256144	794306	264696	1704829	305703	2623679	3268057	4163791	2664378	3382889	3434217	3996386	2768153	2689963	3300511	3616604	2835783
6a	BEAM >=80	5119	1762	244	0		1550				399	462		34800	17870	16634	37217	61913	26083	26675	41567
6a	other	777436	625496	307559	173936	494815	564386	341215	210925	321121	560494	248349	247634	441543	521485	319421	189384	463411	522194	354777	247320
6a	OTTER >=120	10411	3193	1555	5980	25385	14137	10161	9360	382655	371121	182789	517228	1224983	1068072	702422	1082083	1089882	1184165	537070	1389289
6a	OTTER 100-119	3126017	2785116	2051102	2684512	3596366	3222555	2074857	2470732	2420217	2155993	1543621	1685384	1298545	1176236	659462	943740	1880338	1561475	1059507	1267730
6a	OTTER 70-79	960761	1346744	1159832	853881	1034317	1308081	1163802	837731	819695	1057838	964682	746650	851581	1025117	880594	789524	780354	889446	698563	670262
6a	OTTER 80-89	416594	406498	420400	319469	345826	332460	349274	274449	376633	592791	492821	314472	642094	714379	473698	428562	499209	698721	424656	484930
6a	OTTER 90-99	4074	3508	105	2431	0	4155	0	7752	1384	298	326	8964	86784	309917	214600	112145	296948	350880	206200	157930
6b	GILL >=220	439305	371565	388660	406708	348113	202697	255257	309176	344767	219583	197972	160346	127379	236420	54234	121602	111657	72172	166741	177756
6b	other				15080	49009	43997	44200	67907	43794	24050				1382		19626	13646			
6b	OTTER 100-119	82007	77791	116532	41451	81782	197837	82678	59763	98260	116100	124856	126210	110440	186840	216223	110883	88939	116428	116279	112457

2.4.3. Trends in the landings and effort in the Danish fisheries

Figure 2.4.5 (and Tables 2.4.3 and 2.4.4) show the development of in landings and corresponding effort in the main Danish fisheries where anglerfish is caught. Note that from 2000 to 2004 landings from the North Sea increased by around 34 %. However, considering the Norwegian deeps alone the increase was 43%. During this period effort, as recorded in logbooks, also increased, but not in a corresponding magnitude.

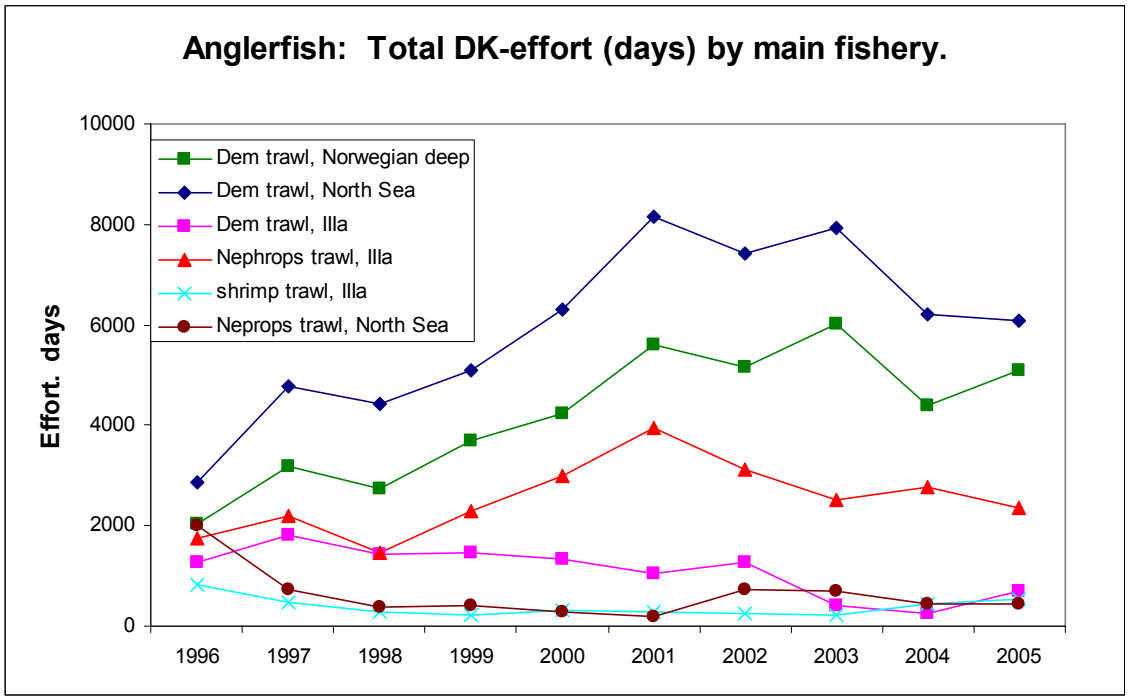


Figure 2.4.5 Development in Danish effort, 1996-2005 (logbook information)

Table 2.4.3. Danish landings (tons) of anglerfish distributed by gear/fishery.

Year	North Sea tons							IIIA tons							Grand Total
	Other gear	Beam trawls	dem trawl	Neph trawl	ind trawl	Shrimp trawl	total	Other gear	Beam trawls	dem trawl	Neph trawl	ind trawl	Shrimp trawl	total	(Kg)
1996	48	17	756	280	129	234	1464	40	70	125	90	2	41	367	1831
1997	47	64	1132	56	103	88	1489	58	137	183	139	8	25	550	2039
1998	76	153	996	40	91	100	1456	58	86	167	89	2	13	415	1871
1999	75	116	1106	39	84	76	1496	82	41	121	105	1	12	362	1858
2000	52	88	1066	16	68	56	1347	61	47	116	140	0	13	377	1724
2001	52	18	1343	7	67	53	1540	44	18	86	211	4	11	375	1915
2002	41	59	1269	86	53	55	1563	35	41	116	162	1	15	371	1934
2003	28	40	1508	59	30	42	1707	27	4	27	147	1	10	217	1924
2004	57	45	1525	91	42	50	1809	31	13	40	189	0	37	311	2120
2005	14	48	1412	96	26	17	1612	18	5	83	135	0	30	272	1884

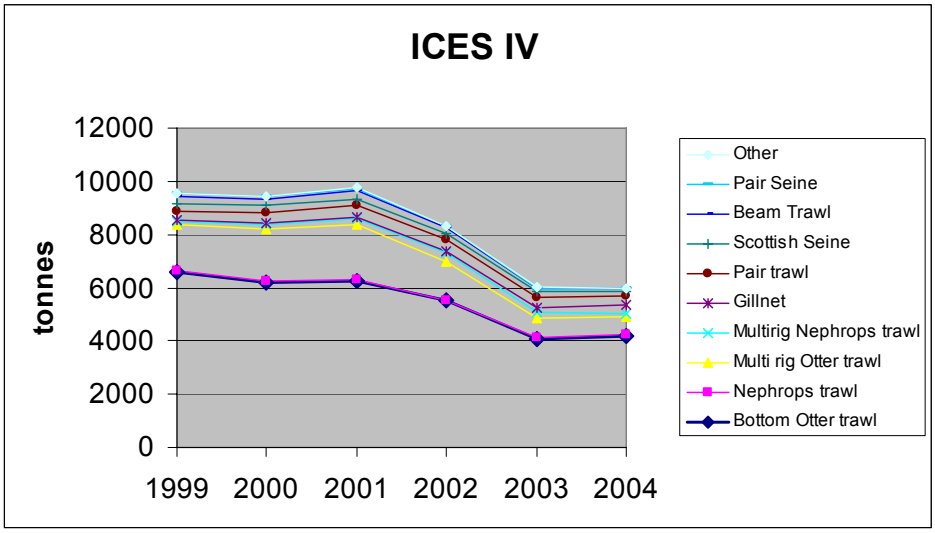
Table 2.4.4. Danish effort (days) of anglerfish distributed by gear/fishery

Year	Total Danish effort in IV (days)							Total Danish effort in IIIA (days)							Grand Total
	Other gear	Beam trawls	dem trawl	Neph trawl	ind trawl	Shrimp trawl	total	Other gear	Beam trawls	dem trawl	Neph trawl	ind trawl	Shrimp trawl	total	(days)
1996	462	117	2865	2022	1587	2361	9414	417	737	1264	1763	29	824	5034	14448
1997	636	268	4778	727	1535	1387	9332	520	980	1820	2207	106	473	6107	15438
1998	733	566	4413	376	1257	1636	8982	376	665	1446	1454	14	276	4231	13213
1999	748	687	5084	428	1043	1200	9190	621	475	1462	2304	23	237	5121	14311
2000	695	787	6297	285	808	1102	9974	437	567	1330	3004	6	314	5658	15632
2001	780	250	8164	182	1039	1137	11552	426	361	1047	3941	42	296	6112	17665
2002	676	537	7415	741	1155	1025	11548	362	434	1284	3131	22	256	5489	17037
2003	309	445	7917	711	528	810	10720	220	79	414	2505	9	237	3463	14183
2004	522	419	6212	448	517	606	8725	358	191	245	2762	5	458	4020	12744
2005	166	401	6077	436	240	268	7588	189	123	691	2344	4	526	3877	11465

2.4.4. Trends in the landings and effort in the Scottish fisheries

This section presents catch and effort trends according to the metiers outlined in section 2.2. For completeness, a brief summary is first given of the logbook catch and effort data by ICES area and gear. Data from 1999 to 2004 are included, unfortunately technical difficulties arising from changes to the Scottish Executive databases has resulted in delay in the production of reliable data for 2005.
There is some concern over the accuracy of the reported landings figures although effort data is considered to be more reliable in recent times as VMS legislation has been implemented. A consequence of the perceived lack of reliability in anglerfish landings data is that the logbook data cannot be used to construct reliable abundance time series (section 3).

Figure 2.4.6 shows that bottom trawls and multi-rig trawls contribute most of the landings in each of the ICES areas IV, VIa and VIb . The general trend in landings in recent years has been downward in all areas – probably as TACs have been reduced progressively. There was apparently a small upturn in landings in 2004 in area VIb. This was evident in all gears. Figure 2.4.7 shows the equivalent time trend in fishing effort (days absent) associated with anglerfish landings. This shows quite marked declines in ICES areas IV and VIa and for each gear. This is probably due to the combined effects of decommissioning of vessels, implementation of days limitations and the likely effects of reducing anglerfish TACs. Effort in area VIb has increased in the last couple of years.



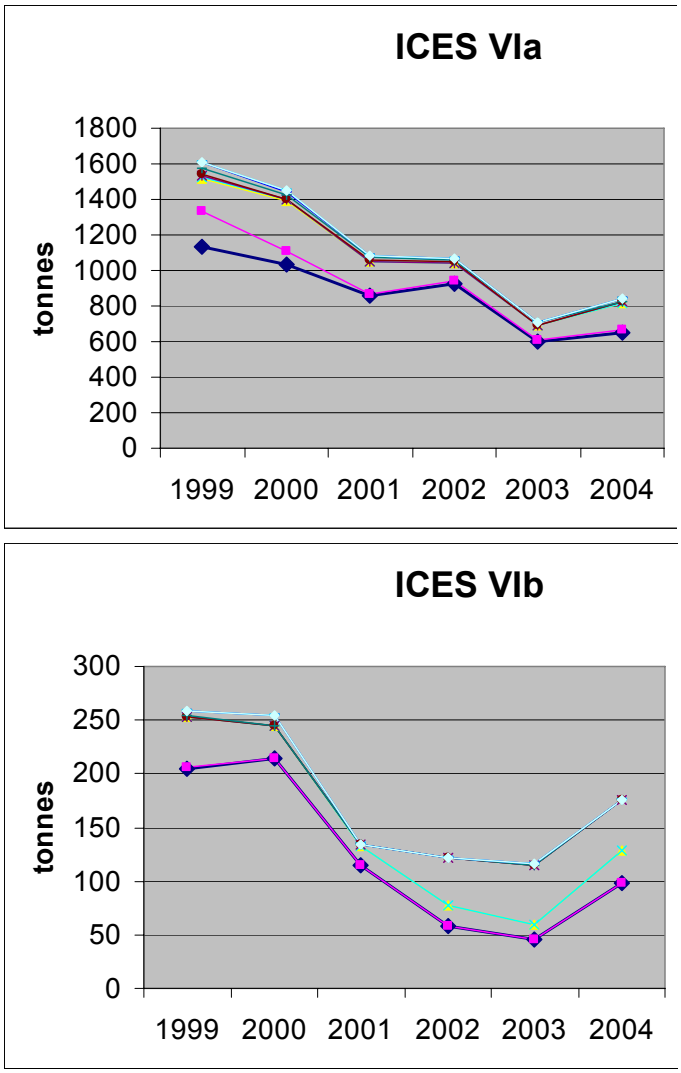


Figure 2.4.6 Stacked line graphs to show trends in UK landings of anglerfish into Scotland from ICES areas IV, VIa and VIb by different gears contributing anglerfish landings

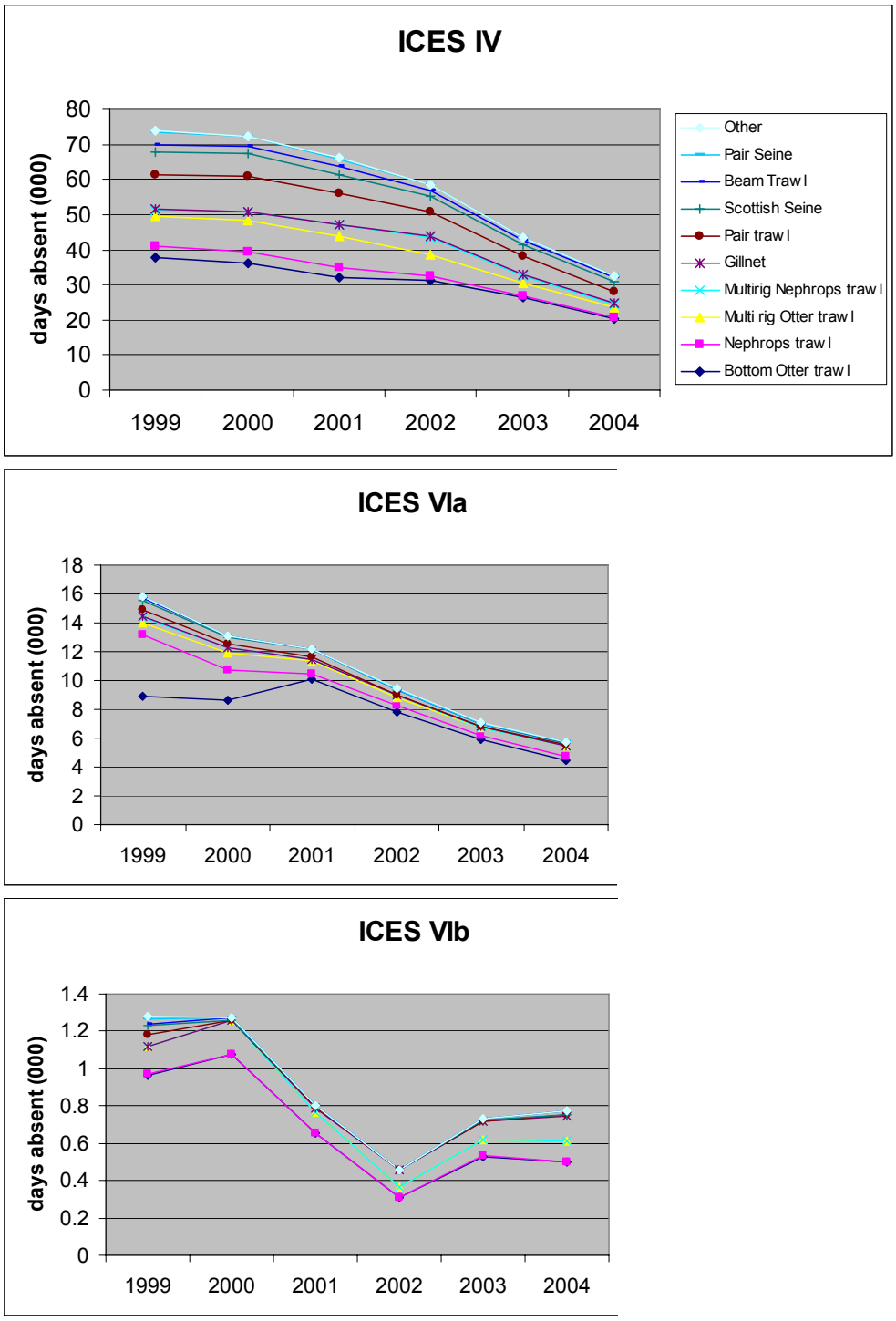


Figure 2.4.7 Stacked line graphs to show trends in UK effort for trips where anglerfish were landed into Scotland from ICES areas IV, VIa and VIb by different gears.

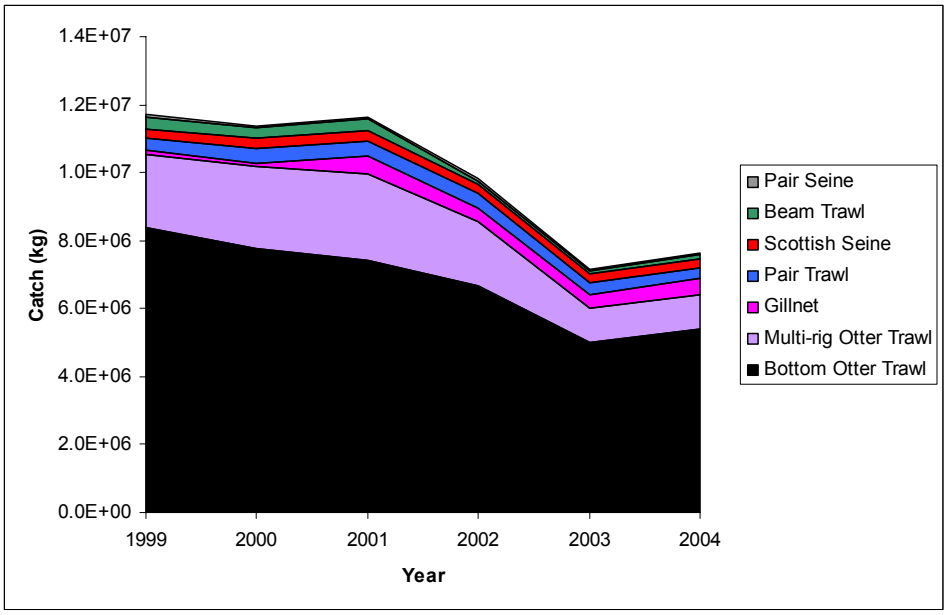


Figure 2.4.8 Overall trend in landings by major gear type.

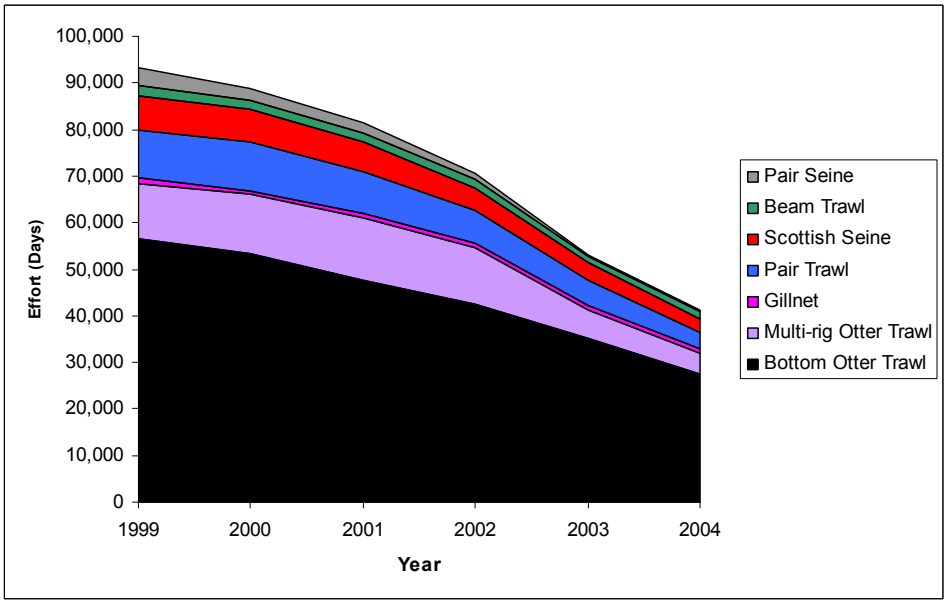


Figure 2.4.9 Overall trend in effort by major gear type.

Table 2.4.5 Overall combined landings (kg) of anglerfish by UK vessels into Scotland from the three areas defined in section 2.2. by major gear type 1999-2004 (these essentially cover all of IV, VIa and VIb).

			Catch			
Gear Grouping	1999	2000	2001	2002	2003	2004
Bottom Otter Trawl	8,361,815	7,753,636	7,430,672	6,669,031	4,983,147	5,389,420
Multi-rig Otter Trawl	2,166,466	2,434,848	2,516,330	1,909,889	1,033,096	1,017,418
Gillnet	119,618	100,029	538,671	394,834	388,252	492,725
Pair Trawl	359,267	429,946	458,376	438,636	372,147	296,200
Scottish Seine	281,953	276,923	276,134	259,059	246,483	276,923
Beam Trawl	321,563	324,829	353,446	82,070	107,848	131,905
Pair Seine	105,777	67,250	61,849	74,894	21,185	20,197

Table 2.4.6 Overall combined effort (days) associated with anglerfish landings by UK vessels into Scotland from the three areas defined in section 2.2. by major gear type 1999-2004 (these essentially cover all of IV, VIa and VIb).

			Effort			
Gear Grouping	1999	2000	2001	2002	2003	2004
Bottom Otter Trawl	56,646	53,402	47,556	42,593	35,118	27,479
Multi-rig Otter Trawl	11,583	12,776	13,393	11,917	6,145	4,467
Gillnet	1,265	531	1,082	1,116	954	1,045
Pair Trawl	10,260	10,469	8,971	6,939	5,495	3,441
Scottish Seine	7,482	7,042	6,205	4,737	3,594	2,952
Beam Trawl	2,230	1,918	2,071	1,898	1,381	1,434
Pair Seine	3,671	2,816	2,160	1,461	430	369

The overall landings and effort trends for the fishery operating across the area encompassing the metiers described in Section 2.2 is given by different gear groups in Tables 2.4.5 and 2.4.6 and Figures 2.4.8 and 2.4.9 These data show that that landings generally declined in each of the main gear groups until 2003, a slight rise followed in 2004. Similarly the trends in effort were also downward with no upturn in 2004. A more detailed picture of trends in landings in each of the three fishery areas is provided in Figure 2.4.10 for >100mm and <100mm towed gears. Landings in the larger mesh categories have generally declined, probably as a result of falling TACs. There was, however, a small increase in landings in the main anglerfish area in 2004. A different situation is apparent in the small meshed metier. This metier operates mainly in the Nephrops area and here a slight increase in anglerfish landings is apparent in recent years.

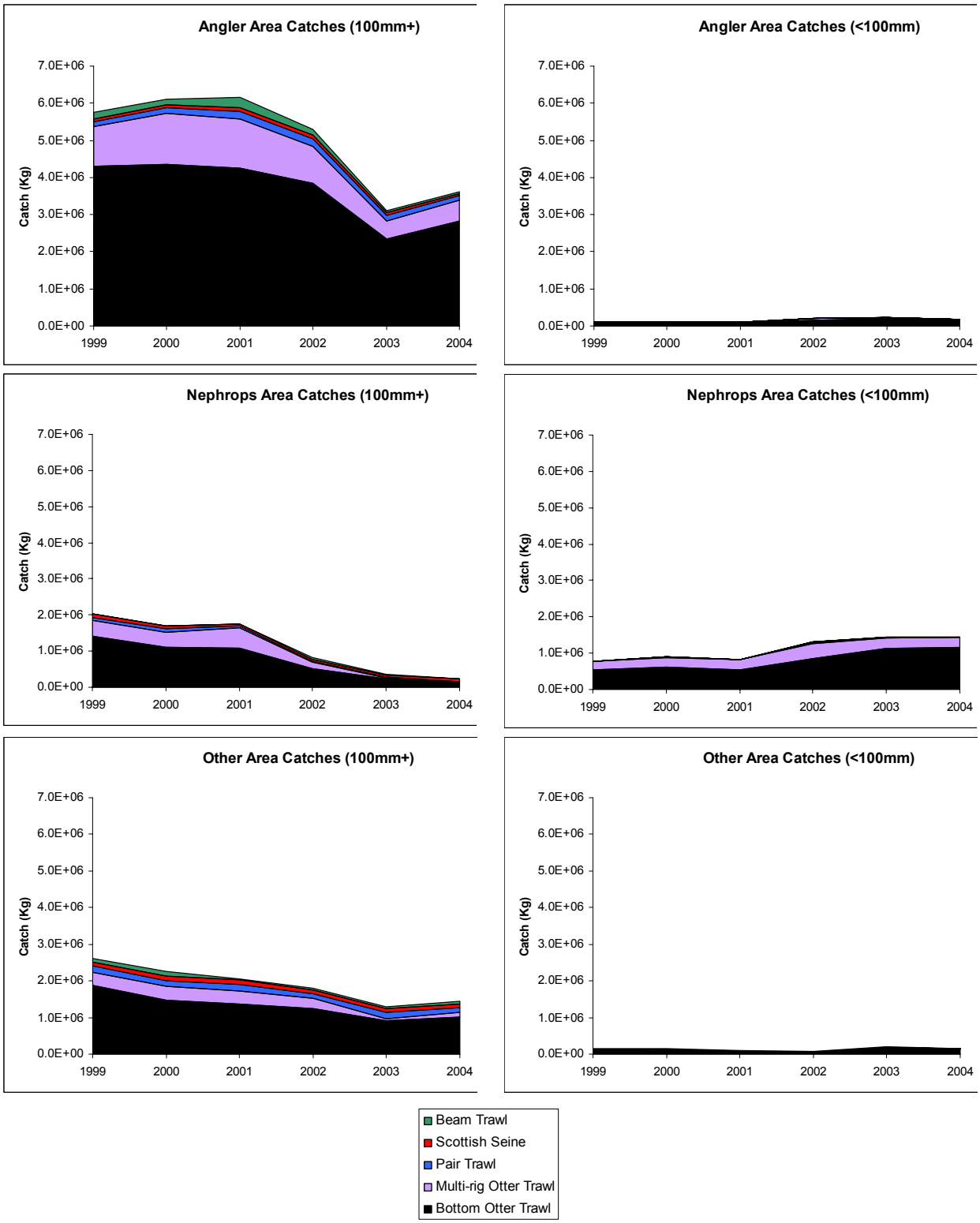


Figure 2.4.10 Stacked charts showing the trends in landings (kg) by towed gears with meshes >100mm (left panels) and <100mm (right panels) and operating in the three main fishery areas defined in Section 2.2 (top, middle and bottom panels).

Fuller details of landings and effort trends for the most important metiers, the bottom trawl and twin trawl gears of >100mm and <100mm, are shown in Tables 2.4.7 and 2.4.8 respectively. These data confirm the downward trend in both landings and effort in the larger mesh and also show the rise in landings in the small mesh gear fishery operating in the Nephrops area. Interestingly, the upward effort trend for this category is not so marked. This may indicate an increased abundance but LPUEs have not been calculated owing to uncertainty in the landings information.

Table 2.4.7 Trends in catch and effort in the large meshed (>100mm) bottom trawl metier (above) and twin trawl metier (below) operating in each of the three anglerfish fishery areas defined in section 2.2

	Catch(Kg) 100mm+ Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	4,306,149	1,403,391	1,869,236
2000	4,345,529	1,093,878	1,476,422
2001	4,248,465	1,089,852	1,381,362
2002	3,843,326	525,008	1,237,084
2003	2,350,445	228,011	914,442
2004	2,824,936	123,286	1,002,020

	Effort (Days) 100mm+ Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	19352	14162	8009
2000	17648	11642	7634
2001	16671	9296	7013
2002	14352	5164	5007
2003	9118	1534	4219
2004	7480	665	3354

	Catch(Kg) 100mm+ Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	1,072,563	462,341	371,231
2000	1,369,175	426,019	377,532
2001	1,321,650	544,506	338,055
2002	985,000	167,988	284,382
2003	480,324	36,322	55,393
2004	558,277	14,235	133,952

	Effort (Days) 100mm+ Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	2822	5069	1110
2000	3,886	4,168	1,513
2001	3,805	4,182	1,665
2002	2,809	1,573	1,289
2003	1,560	269	570
2004	1,270	152	266

Table 2.4.8 Trends in catch and effort in the small meshed (<100mm) bottom trawl metier (above) and twin trawl metier (below) operating in each of the three anglerfish fishery areas defined in section 2.2

	Catch(Kg) <100mm Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	106,744	542,367	131,646
2000	91,609	629,748	113,836
2001	96,720	537,757	67,519
2002	159,377	846,023	52,528
2003	190,969	1,135,232	161,910
2004	148,815	1,166,421	122,502

	Effort (Days) <100mm Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	1,796	11,385	1,926
2000	1,509	12,638	2,289
2001	1,502	11,352	1,672
2002	1,766	14,743	1,491
2003	2,102	15,369	2,758
2004	1,397	13,164	1,411

	Catch(Kg) <100mm Multi Rig Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	5,835	223,112	2,654
2000	4,025	247,789	7,383
2001	12,945	290,291	8,883
2002	43,372	420,503	8,644
2003	30,825	280,454	24,906
2004	19,455	263,097	28,402

	Effort (Days) <100mm Multi Rig Otter Trawl		
	Monk Area	Nephrops Area	Other Area
1999	60	2,475	39
2000	42	3,089	68
2001	90	3,597	56
2002	393	5,767	86
2003	298	3,122	326
2004	167	2,395	217

2.5. Anglerfish TACs by country and geographic area

The Official Journal of the European Union, L 16, Volume 49, 20 January 2006 lists the TACs for anglerfish for 2005 and 2006. Figure 2.5.1 and Table 2.5.1 summarises this information.

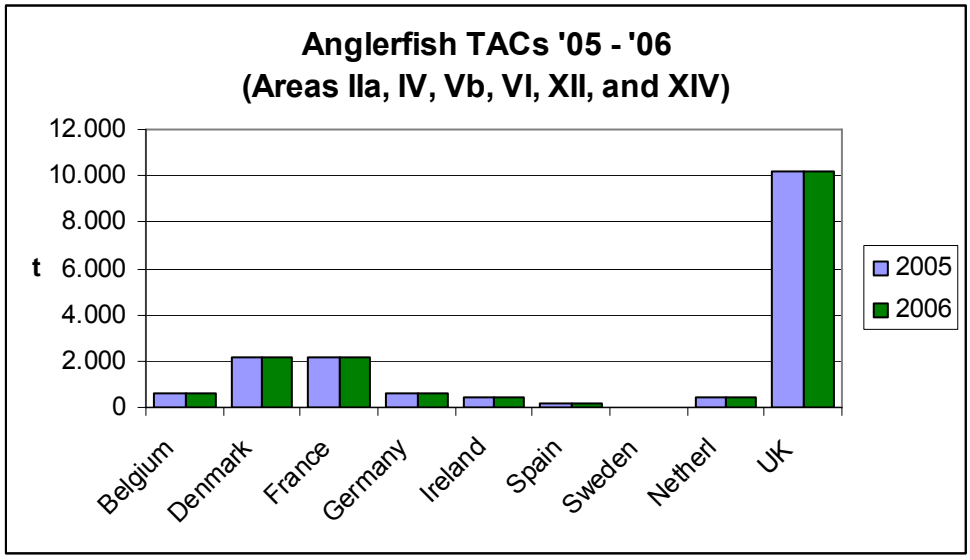


Figure 2.5.1. Total Allowable Catch of anglerfish in 2005 and 2006 by country.

Table 2.5.1. Total Allowable Catch of anglerfish in 2005 and 2006 by country and area.

Anglerfish *Lophiidae*	**Zone: IIa (EC waters), IV (EC waters) ANF/2AC4-C**
Belgium	365
Denmark	804
Germany	393
France	75
The Netherlands	276
Sweden	9
UK	8.392
EC	10.314
TAC	10.314

Anglerfish *Lophiidae*	**Zone: IV (Norwegian waters) ANF/04-N**
Belgium	53
Denmark	1.343
Germany	21
The Netherlands	19
UK	314
EC	1.750
TAC	Not relevant

Anglerfish *Lophiidae*	**Zone: Vb (EC waters), VI, XII, XIV ANF/561214**
Belgium	168
Germany	192

Spain	180
France	2.073
Ireland	469
The Netherlands	162
UK	1.442
EC	4.686
TAC	4.686

3. Trends in the stock

3.1. Scottish historical diary data

During 2004, in order to get a more accurate and detailed picture of the Scottish anglerfish fishery, information was collated from the personal diaries of Scottish skippers operating across the Northern Shelf. Diaries were obtained from vessels with a range of different sizes, different engine power and gear configuration and different target species. An analysis of these data was presented in a working paper provided to the WGNSDS Review Group (Bailey et al. 2004). Some additional data were obtained in 2005 from 2 new vessels and complete 2004 data for 3 of the original vessels. The complete data set, consisting of seventeen diaries with useful information on location and catch rate were considered by WGNSDS at its 2005 meeting. The diaries covered a range of time periods from 2 to 10 years. Annual mean catch rates of anglerfish ranged from approximately 10 Kg/hr for a vessel likely to be targeting Nephrops to over 70 Kg/hr for vessels targeting demersal fish species.
To take vessel size effects into account, generalized additive models were fitted using R (http://CRAN.R-project.org/). Catch rate in Kg/hr was modelled with month, year and vessel. The smooth terms (month and year) are represented using penalized regression splines with smoothing parameters selected by cross validation. While there were differences in seasonal patterns between areas, all the analyses indicated increased catch rates in recent years. The year effect from the analysis is shown in Figure 3.1.1. A more complete description of the analysis and discussion of the results can be found in ICES (2006).

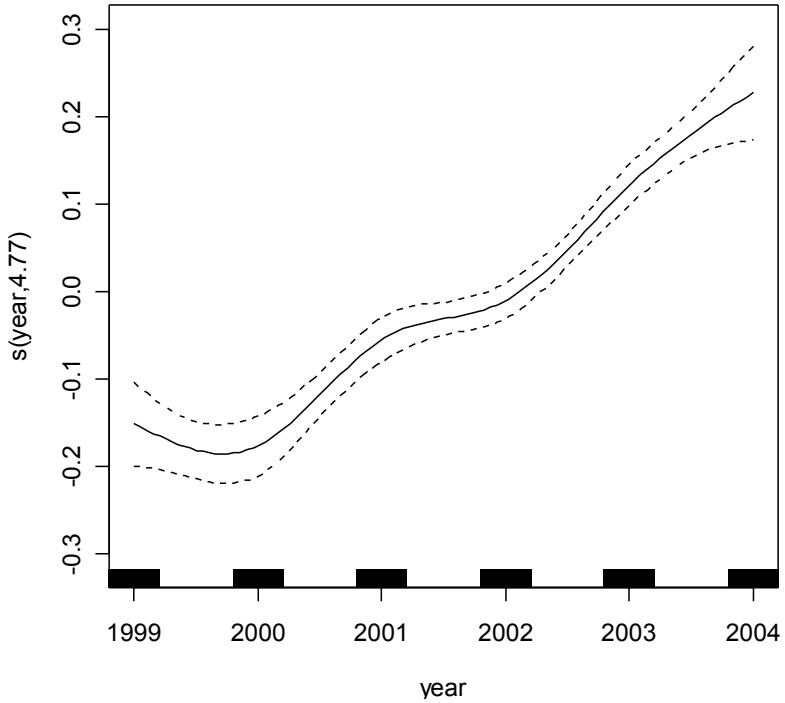


Figure 3.1.1. Annual trend from the GAM analysis of all the Scottish diary data.

Following recommendations made by ICES that the diary data scheme should be continued and extended, FRS (in consultation with the fishing industry) have recently established a new monkfish tallybook project. The project is being operated in conjunction with fisher's organizations who are responsible for distributing the tallybooks, co-ordinating the returns and allocating a vessel code before the data are forwarded to FRS. The tallybooks are filled in on a haul by haul basis to give weight caught by size category and information on haul location, duration and depth. So far, the time series is short, with the first returns from fishing trips at the end of December 2005 and the most recent from the first week of April 2006. Returns have so far been received from 36 vessels (over 3000 hauls in total) with a wide spatial coverage and different target species. Average catch rates cover a similar range to those calculated from the diary data (around 10 Kg/hr for boats targeting Nephrops to over 100 Kg/hr for whitefish boats.

Some of the vessels which provided diary data are now participating in the tallybook scheme and it has been possible with the help of the fisher's organizations involved, to match up some of these vessels. Mean first quarter catch rates from these vessels are shown in Figure 3.1.2. It is difficult to conclude whether there has been any overall change in catch-rate in the most recent year: some vessels appear to have experienced an increase in catch rate in the 1st quarter of 2006 compared to the years prior to 2005, while others have experienced a decrease or no change.

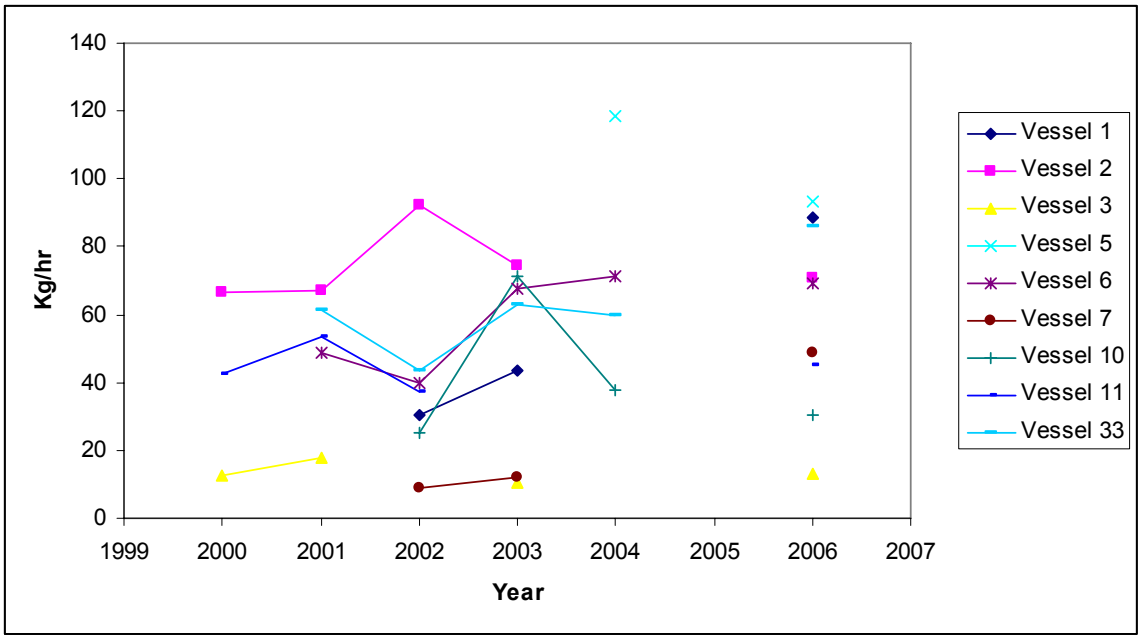


Figure 3.1.2. Mean first quarter catch rates from vessels provided both diary data and participating in the tallybook scheme.

3.2. Observer programmes

3.2.1. Scottish observer data.

FRS Marine Laboratory has conducted an on-board commercial vessel observer programme for over 30 years, these data are regularly fed into the ICES assessment Working Groups. Data on anglerfish observed catches are available since 1999 and were included in analysis of catch rates including data collected as recently as the first quarter 2006. As part of the enhanced programme of work on anglerfish, including survey work and the collection of tally book data from fishermen (see Section above), additional sampling was begun in 2005 by the Shetland Fishery College (under contract to FRS). This has continued and been further enhanced in 2006 and the total number of trips undertaken in the first quarter is shown in the text table below. FRS routinely carries out around 14 observer trips in the first quarter so the additional sampling represents a doubling of observer effort.

FRS Demersal Observer Trips	14
FRS Nephrops Observer Trips	2
Extra FRS Anglerfish Observer Trip s	4
NAFC Anglerfish Observer Trips*	6
SFF Observer Trips+	2
	Total Trips 28

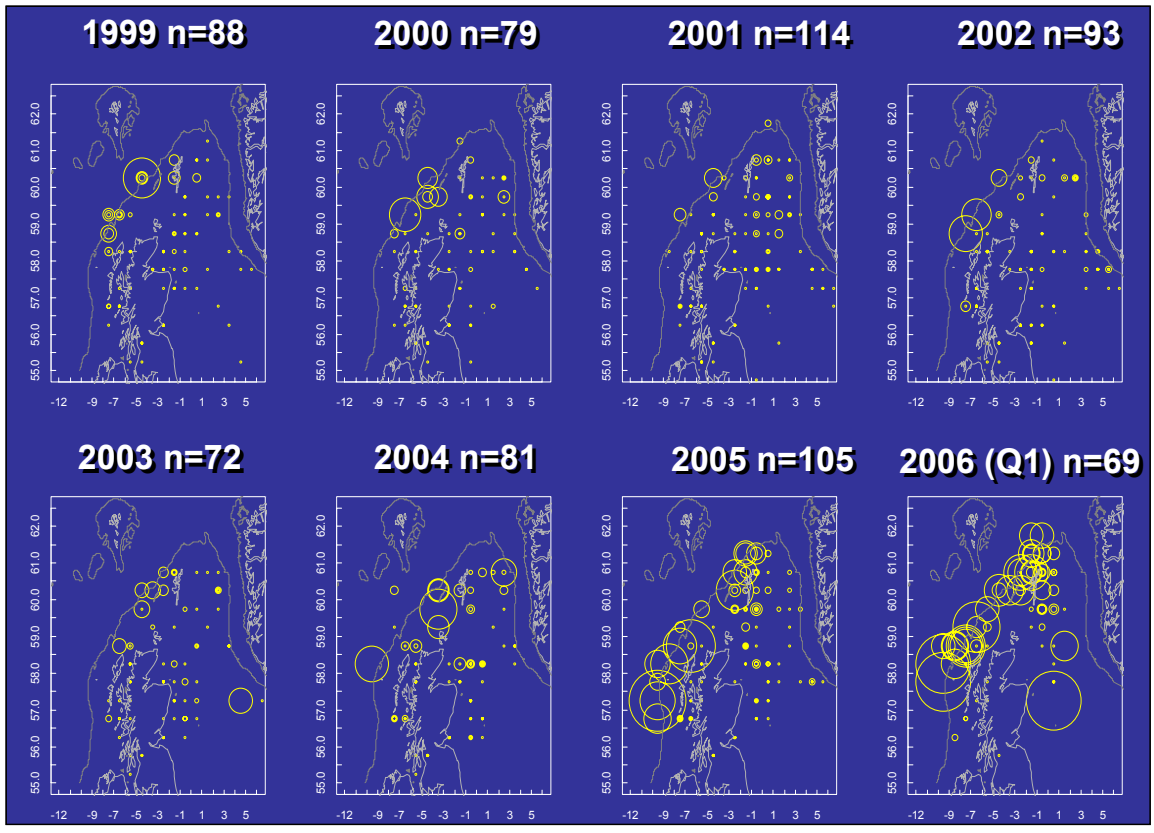


Figure 3.2.1 Distribution and catch rates of anglerfish from observer trips conducted in Scotland between 1999 and 2006(Q1 only). The number of statistical rectangles with available data is also shown.

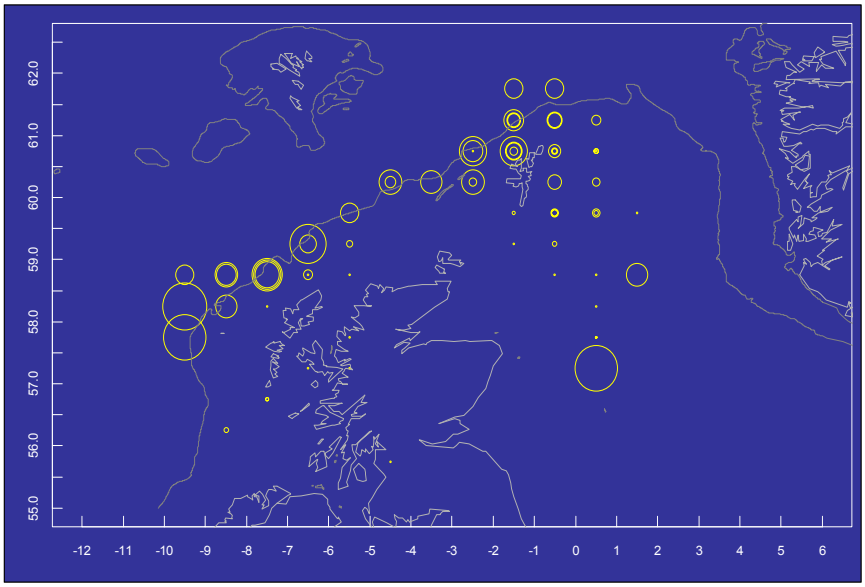


Figure 3.2.2 Distribution of observed catch rates from the 2006 Scottish Observer programme quarter 1 for all gears showing in more detail the relationship between higher catch rates and the 200m depth contour

Figure 3.2.1 shows the distribution of all observer trips between 1999 and 2006 together with an indication of the catch rate. Results suggest an increase in catch rate in recent years, particularly along the continental shelf edge although the inter-year spatial variability in sampling and the changing sampling numbers confound the interpretation.

Figure 3.2.2 shows the distribution and catch rates observed in the first quarter of 2006. Despite some variability between samples taken in the same statistical square, there is nevertheless a pattern of higher catch rate close to the continental shelf and lower values in shallower water. This distributional pattern is further shown in Figure 3.2.3 which plots average catch rates by statistical square for the entire data series. It is possible to subdivide the data into the different gears operating in different parts of the overall anglerfish distribution. Figure 3.2.4 shows the results for light and heavy trawl while Figure 3.2.5 shows Nephrops trawl results. The former operate widely over the northern North Sea and offshore west of Scotland where catch rates were highest while he latter are restricted to areas of soft mud bottom and tend to have lower catch rates.

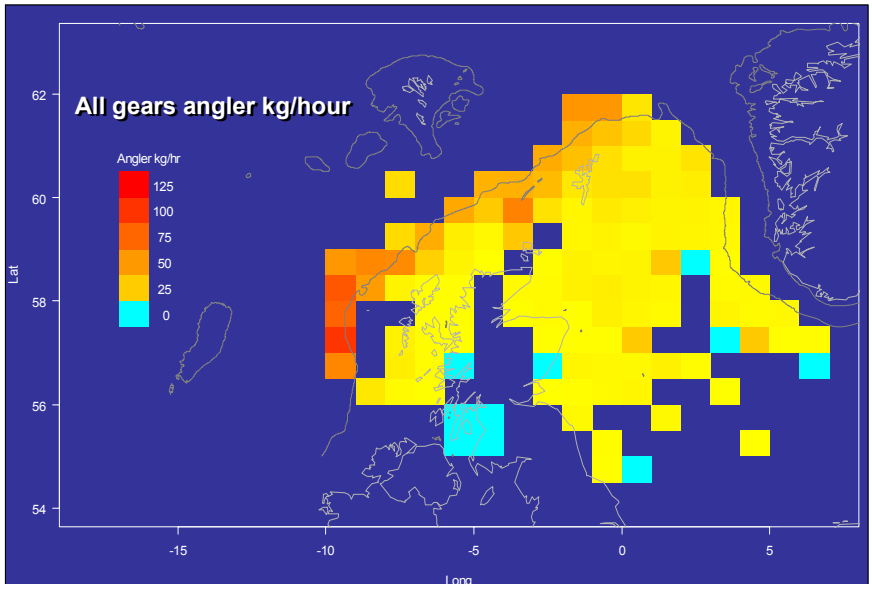


Figure 3.2.3 Average catch rate per sampled statistical square for all data across all years. Scale indicates that highest catch rates to the west of Scotland were around 100kg /hour

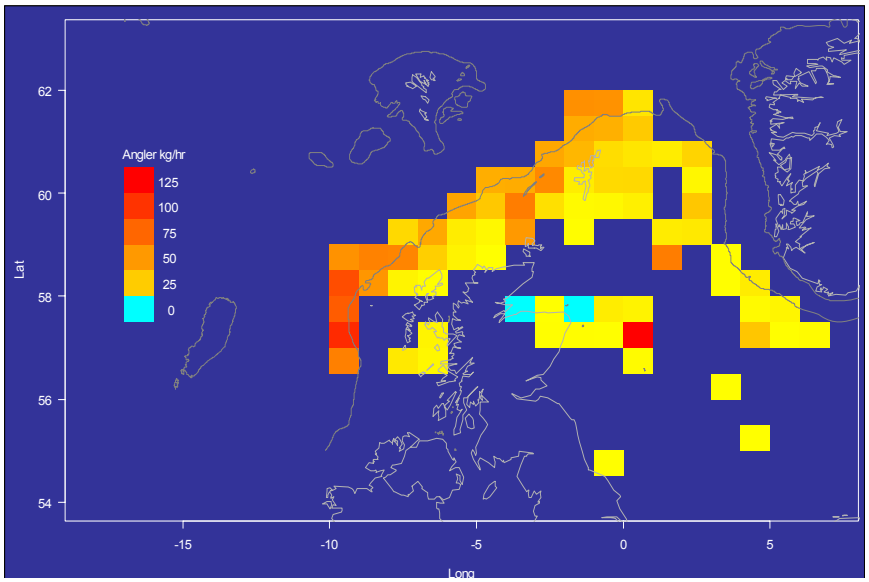


Figure 3.2.4 Average catch rate per sampled statistical square for light trawl and heavy trawl across all years.

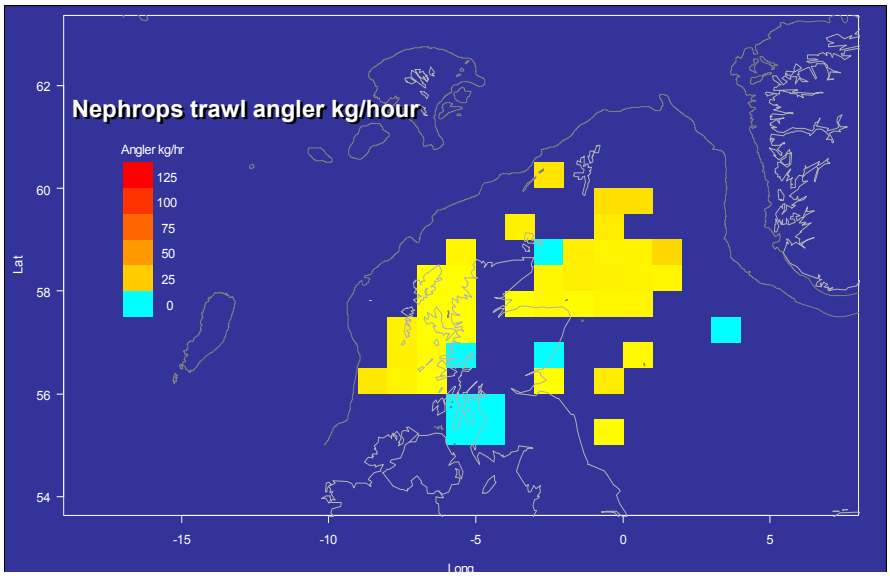
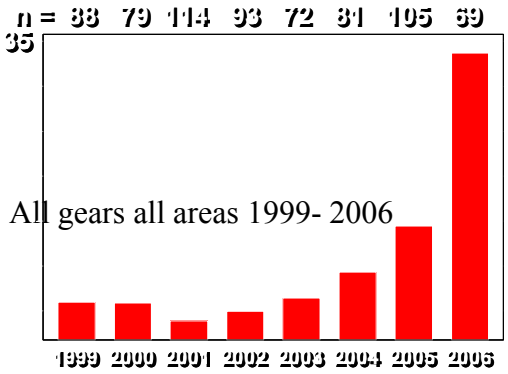
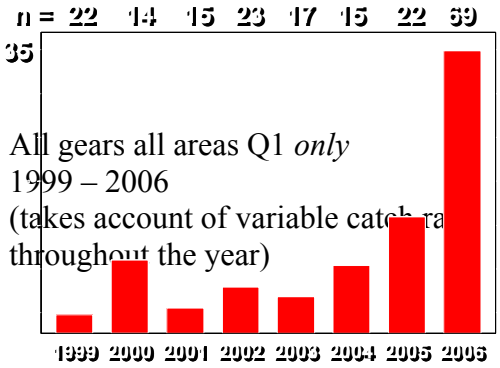
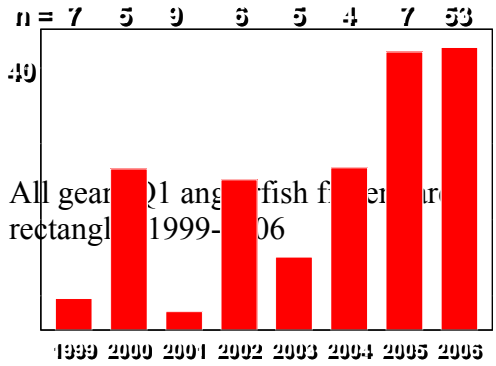


Figure 3.2.5 Average catch rate per sampled statistical square for Nephrops trawls across all years. Activity by these vessels is concentrated in soft sediment areas where catch rates are generally lower.

Figure 3.2.6 shows a series of catch rate trends for different groupings of the observer data. Combining all data gives the largest catch rate rise (top panel) but this includes only the first quarter 2006 data which distorts the picture. It is well known that catch rates of anglerfish vary seasonally with lower rates occurring in the second and third quarters. A more appropriate overall impression is gained in the second panel. These two plots, however, group all data and make no allowance for the different anglerfish population characteristics in different areas or the relative numbers sampled from year to year in different places. The third panel shows the catch rates observed in the main anglerfish fishery area. Increases in abundance in recent years are clearly apparent although with smaller sample numbers the data are noisier. The absolute catch rate is also at a higher level when this area is considered in isolation. The lowest panel indicates that in the Nephrops part of the anglerfish fishery, catch rates are much lower but that higher rates in the last couple of years can still be seen.

 All gears all areas 1999- 2006	
 All gears all areas Q1 *only* 1999 – 2006 (takes account of variable catch ra throughout the year)	
 All gear Q1 ang fish f ar rectangl 1999- 06	
All gears Q1 in Nephrops rectangles 1999-2006	

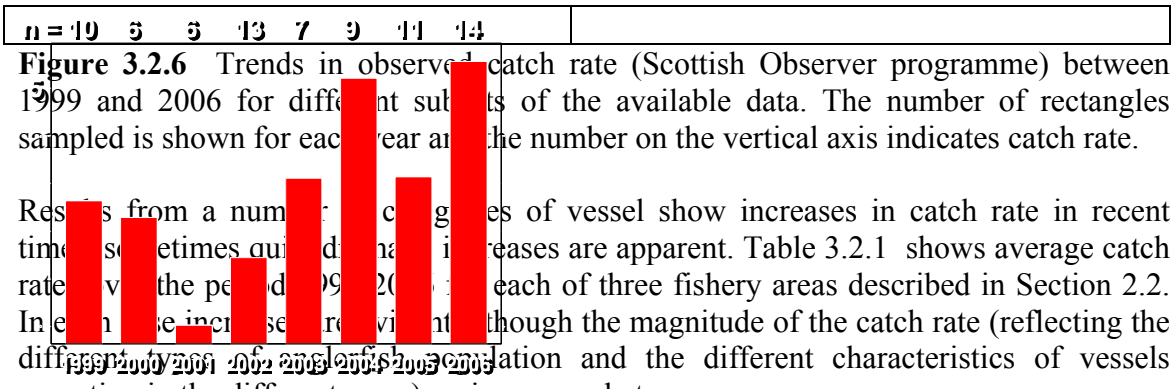


Figure 3.2.6 Trends in observed catch rate (Scottish Observer programme) between 1999 and 2006 for different subsets of the available data. The number of rectangles sampled is shown for each year and the number on the vertical axis indicates catch rate.

Results from a number of categories of vessel show increases in catch rate in recent times sometimes quite dramatic increases are apparent. Table 3.2.1 shows average catch rates over the period 1999-2006 for each of three fishery areas described in Section 2.2. In each case increases are evident although the magnitude of the catch rate (reflecting the different types of anglerfish population and the different characteristics of vessels operating in the different areas) varies somewhat.

Table 3.2.1 Average catch rates in Q1 (kg/hr) from UK Scotland observer programme between 1999 and 2006. Average applied across all gears in each of the three fishery areas defined within areas IV and VI combined.

Rectangles in anglerfish fishery area

1999	2000	2001	2002	2003	2004	2005	2006
9.64	26.67	9.16	25.27	15.14	26.86	42.08	42.35

Rectangles in Nephrops fishery area

1999	2000	2001	2002	2003	2004	2005	2006
2.64	2.29	0.03	1.44	3.11	5.21	3.14	5.56

Other rectangles:

1999	2000		2002	2003	2004	2005	2006
2.28	2.22		2.76	3.69	0.80	5.49	5.85

Improving the basic data for anglerfish is an important requirement for improved assessments in the future. Increasing the available directly observed catch rates are seen as a crucial element of this. The use of these enhanced data at the end of a data series, does however, potentially create difficulties in interpretation of trends observed, particularly where the extra effort has been directed at the species of interest. This problem is investigated in the next section.

3.2.2. Statistical analysis of the Scottish observer data.

The Scottish observer programme relevant for the anglerfish fishery has run from 1999 onwards. Over the years, the spatial coverage of this programme has changed. In recent years, observed catch rates have generally gone up, but it is yet unclear whether this was restricted to the core distribution area, and to what extend the change in spatial coverage of the observer programme might have blurred our view. In this paragraph, the data will be analysed to disentangle the spatial and temporal components.

Available data: Mean landing per unit of effort LPUE, broken down by year*quarter*gear type*ICES rectangle. Note that the original data by haul were already aggregated by rectangle; the number of hauls was therefore used as a weighing variable. The number of hauls and the number of data records available are summarised in Table

3.2.2. Five gear types were distinguished: heavy trawl, seines, light trawl, Nephrops trawls and pair trawls.
Statistical model: Generalised Linear Model of the LPUE as a function of the year, quarter, gear type and rectangle. The spatial pattern is coded by a simple class variable (rectangle), without spatial autocorrelation. Potential density dependence in the distribution is analysed by a so-called «Mandel`s bundle of straight lines» model (Mandel 1959; Milliken and Johnson 1989). This is essentially a two-step fitting procedure. In the first step, a simple model is fitted:

$$LPUE = \exp^{\text{year+quarter+gear+rectangle}} + \varepsilon$$

where year, quarter, gear and rectangle are class variables and ε is an error term with a Poisson distribution. The Poisson error distribution and logarithmic link function accommodate multiplicative effects, while allowing for zero observations. Posterior inspection of the residuals did not show major deviations from this assumed distribution. From this first simple model fit, parameter estimates for each rectangle are derived, which are subsequently added to the data set as an extra explanatory variable, using the parameter estimate corresponding to the rectangle of each record. Subsequently, a second model is fitted, including this extra variable in interaction with other variables of interest:

$$LPUE = \exp^{\text{year+quarter+gear+rectangle+year*Mandel(rectangle)}} + \varepsilon$$

where Mandel(rectangle) indicates the parameter estimate of the rectangle concerned in the first model. This procedure allows the estimation of general density dependent trends in the distribution, while using a very limited number of parameters.
The analysis of variance (Table 3.2.3) indicates that density dependent changes in the distribution pattern of catch rates, though statistically significant, play a minor role. About 1% of the total deviance is explained by «Mandel`s bundle of straight lines». Moreover, disproportionate concentration of the anglerfish LPUE in the rectangles of high average LPUE occurs in 2000 and 2005 (Table 3.2.4), where 2000 was one of the years with a low over-all abundance, and 2005 showed a high abundance (Figure 3.2.8). The absence of density dependent changes in the distribution makes it rather unlikely that the anglerfish shows density dependent migration, or that the observed temporal trend in the catch rates is merely the effect of the fishing effort shifting towards more profitable anglerfish areas.
The mean observed LPUE (Table 3.2.5) differs substantially from the mean predicted LPUE (Table 3.2.6 and 3.2.7). Most notable is that the pronounced rise in mean LPUE observed since 2003 (three-fold or more) is not completely reflected in the predicted LPUE. This indicates that during these years the sampling programme has unintentionally concentrated on the rectangles of high anglerfish catches. Following correction, a doubling in catch rates remains.
The lower bound to the 95% confidence intervals per year and quarter are listed in Table 3.2.8. On average, the lower bound of the 95% confidence interval for the years from 2004 onwards is more or less equal to the best estimate of the preceding years, that is: the rise is just or just not significant. It should be noted that the current analysis is based on data aggregated at the rectangle level. Re-analysis using the haul by haul data might yield a significant result.

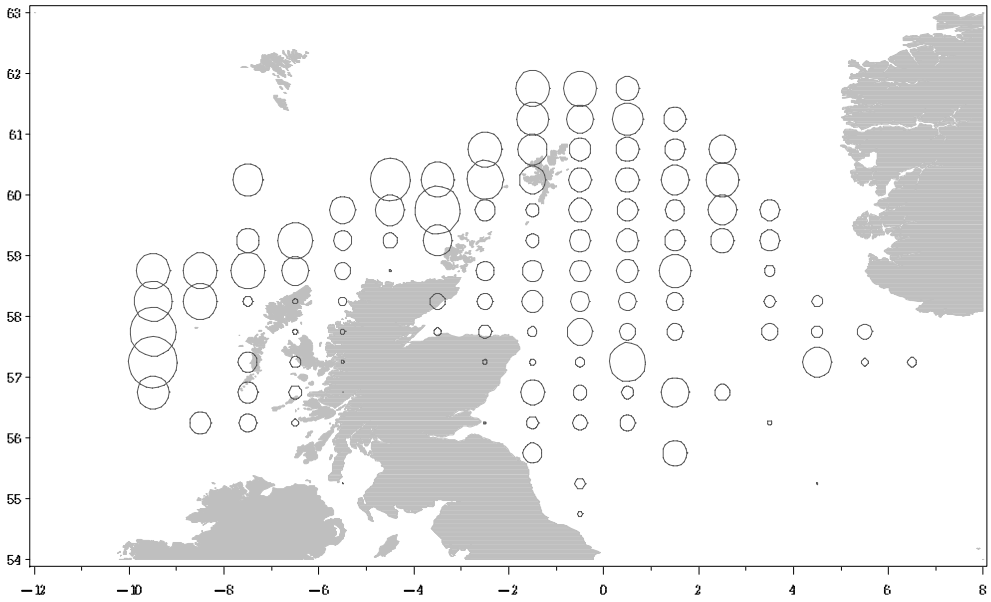


Figure 3.2.7. Predicted spatial distribution of the landings per unit of effort in the Scottish observer programme, following correction for gear and temporal trends.

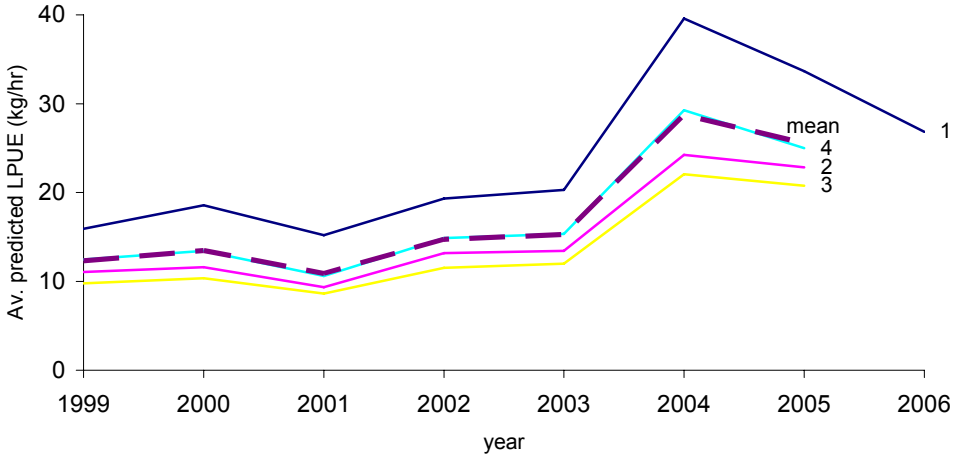


Figure 3.2.8. Trends in the average predicted landings per unit of effort (kg/hr) by year and quarter,s as derived from the statistical analysis of the Scottish observer programme.

Table 3.2.2. The number of hauls/observations by year and quarter in the Scottish observer programme.

	quarter				
Year	1	2	3	4	sum
1999	203 / 022	290 / 021	250 / 022	196 / 023	939 / 088
2000	184 / 014	276 / 022	220 / 019	308 / 024	988 / 079
2001	162 / 015	431 / 034	368 / 029	396 / 036	1357 / 114
2002	232 / 023	321 / 024	281 / 024	177 / 022	1011 / 093
2003	247 / 017	246 / 019	173 / 018	143 / 018	809 / 072
2004	127 / 015	390 / 027	237 / 020	149 / 019	903 / 081
2005	183 / 022	280 / 025	200 / 019	336 / 039	999 / 105
2006	422 / 069				(422 / 069)

Table 3.2.3 Analysis of variance of the landings per unit of effort in the Scottish observer programme. The analysis is developed as a type-1 model: terms were added to the analysis in the order specified.

Source	**Deviance**	**%**	**df**	**MS**	**F**	**p**
Year	26,719	19	7	3817.06	81.899	0.000
Quarter	3,719	3	3	1239.52	26.595	0.000
Gear	46,194	32	4	11548.45	247.783	0.000
Rectangle	40,800	28	121	337.19	7.235	0.000
Mandel(rectangle)*year	879	1	7	125.58	2.694	0.009
Explained	118,311	82	142	833.18	17.877	0.000
Unexplained	26,007	18	558	46.61		
Total	144,318	100	700	206.17		

Table 3.2.4 Parameter estimates of «Mandel`s bundle of straight lines». Positive parameter values indicate an increased LPUE in the rectangles with an above-average anglerfish density, that is: a more than proportionally accentuated spatial distribution in the year concerned.

Year	Mandel(rectangle)
1999	-0.2314
2000	0.0988
2001	-0.0384
2002	-0.1614
2003	-0.3103
2004	0.0460
2005	0.3530
2006	0.2438

Table 3.2.5 Average observed landing per unit of effort (kg/hr), by year and quarter, averaged over all rectangles visited in the observer programme.

	quarter				
Year	1	2	3	4	mean
1999	4.78	6.69	4.21	8.18	5.98
2000	10.98	7.41	3.23	3.61	5.88
2001	5.51	3.53	2.87	4.33	3.87
2002	7.89	4.45	3.55	4.02	4.97
2003	6.82	6.22	3.54	9.3	6.46
2004	10.39	10.76	10.6	5.26	9.36
2005	15.96	6.69	7.66	21.94	14.47
2006	33.82				

Table 3.2.6 Average predicted landing per unit of effort (kg/hr), by year and quarter, averaged over all rectangles in the data set. Predictions based on the simple, density-independent model.

	quarter				
Year	1	2	3	4	mean
1999	15.66	11.16	9.98	13.00	12.45
2000	19.05	12.22	11.04	14.56	14.20
2001	15.63	9.86	9.19	11.57	11.51
2002	19.87	13.86	12.29	16.13	15.52
2003	19.82	13.40	12.18	15.85	15.31
2004	39.24	24.64	22.70	30.60	29.24
2005	31.03	21.49	19.78	24.42	24.20
2006	28.24				

Table 3.2.7 Average predicted landing per unit of effort (kg/hr), by year and quarter, averaged over all rectangles in the data set. Predictions based on «Mandel`s bundle of straight lines» model.

	quarter				
Year	1	2	3	4	mean
1999	15.89	11.07	9.77	12.45	12.30
2000	18.56	11.59	10.34	13.42	13.46
2001	15.18	9.33	8.62	10.61	10.88
2002	19.32	13.19	11.54	14.86	14.71
2003	20.30	13.42	11.98	15.32	15.25
2004	39.57	24.23	22.04	29.26	28.72
2005	33.66	22.85	20.76	24.99	25.57
2006	26.83				

Table 3.2.8 Lower 95% confidence bounds of the predicted landing per unit of effort (kg/hr), by year and quarter, averaged over all rectangles in the data set. Predictions based on «Mandel`s bundle of straight lines» model.

	quarter				
Year	1	2	3	4	mean
1999	7.50	5.30	4.66	6.00	5.86
2000	9.42	5.85	5.18	6.81	6.80
2001	7.30	4.52	4.18	5.14	5.26
2002	9.43	6.42	5.62	7.21	7.16
2003	9.43	6.16	5.53	7.13	7.06
2004	19.72	12.02	10.98	14.75	14.34
2005	17.40	11.88	10.87	13.36	13.38
2006	15.28				

3.2.3. UK (EW) observer data

A time series of CPUE trends for three gear groupings (demersal, Nephrops and beam trawls) were derived using the CEFAS observer database (Figure 3.2.9). CPUE is calculated as kg caught per observed tow hours. Time series are given for all quarters combined, and for quarter 1 only by ICES sub-division. The number of observed trips is low (indicated on each plot by n), so an overall trend for all sub-divisions combined is shown in each plot. Only quarter 1 data are available for 2006, so trends are also shown for quarter 1 for comparability, although the number of observed trips for demersal and beam trawls are then very low.

The demersal trawl CPUE series shows an increase in CPUE level in 2003-5 compared to 1999-2002. For Nephrops trawls, where anglerfish occurs as a bycatch, the CPUE series fluctuates substantially prior to 2003, with a lower, more stable period in 2003-2006. The beam trawl CPUE shows a general decline, but is based on very few observed trips.

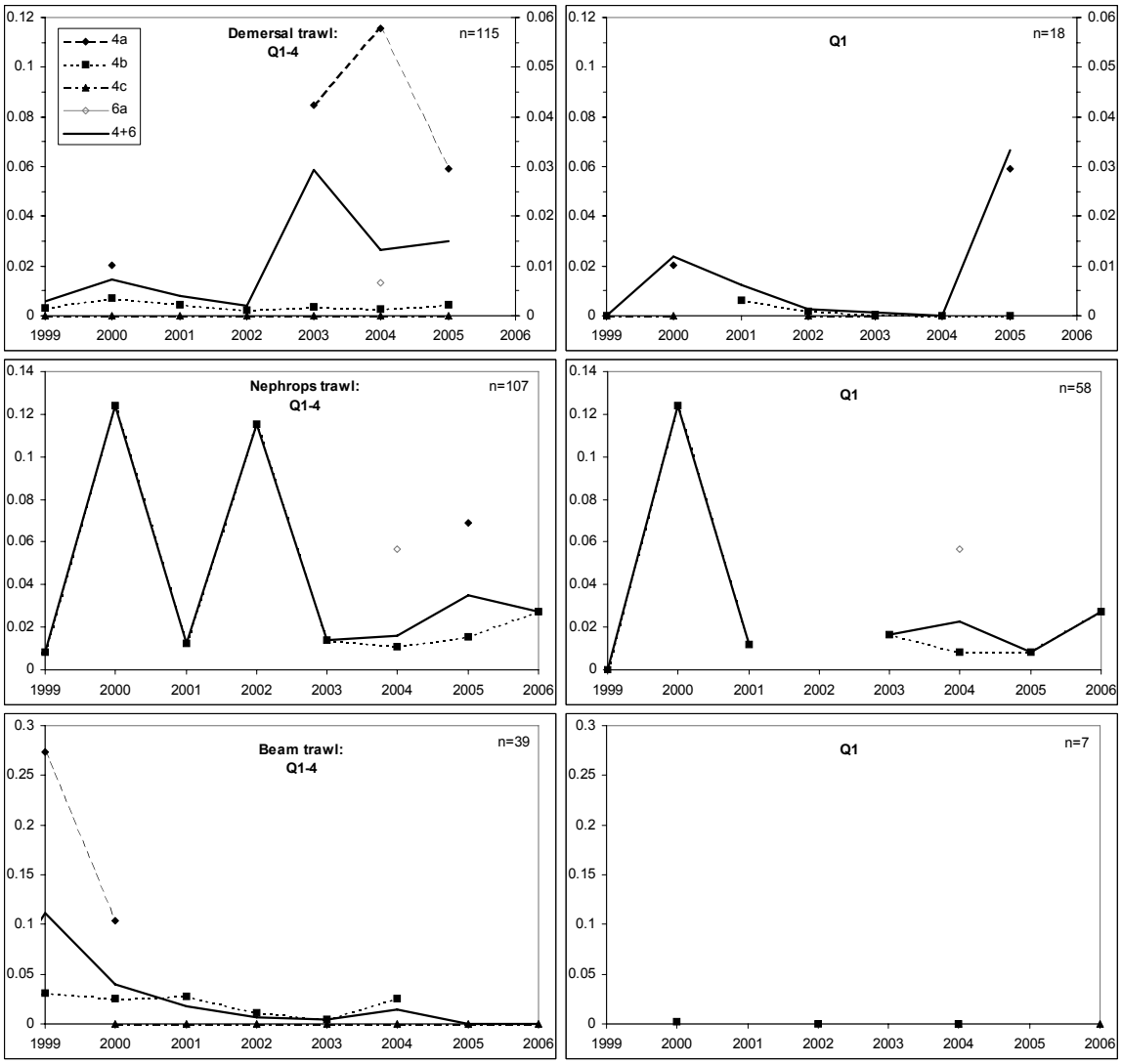


Figure 3.2.9. Anglerfish CPUE trends (kg per observed tow hours) by ICES sub-division, based on UK (EW) observer data for three gear groupings: demersal (top), Nephrops (middle) and beam trawls (bottom). The first column combines all four quarters, while the second column refers to quarter 1 only. The number of observed trips (n) on which the solid curves (Divisions IV and VI combined) are based is given in the top right corner. The secondary axis in the top plots applies to the solid curves only.

3.3. Logbook data

3.3.1. International data

An overview of the data from the provisional and not yet validated STECF data base of logbook information is presented in Table 3.3.1 and Figures 3.3.1-3.3.3. The time period covered (2003 and 2004) is rather short to conclude on trends.

Table 3.3.1 Relative trend in landings per unit of effort of anglerfish by area, gear, year and quarter, 2003-2004, each series standardised to its mean.

AREA	GEAR	2003_Q1	2003_Q2	2003_Q3	2003_Q4	2004_Q1	2004_Q2	2004_Q3	2004_Q4
4	BEAM >=80	0.369	0.985	1.354	0.985	0.369	0.492	2.215	1.231
4	DEM_SEINE >=120	0.977	1.170	0.833	1.086	1.448	0.953	0.712	0.821
4	GILL >=220	0.551	1.221	0.175	1.418	0.751	1.602	0.500	1.782
4	GILL 120-219	0.291	0.584	1.534	1.424	0.686	0.915	1.665	0.903
4	other	1.756	0.669	0.530	0.613	2.314	0.892	0.669	0.557
4	OTTER >=120	1.046	0.894	0.742	0.931	1.329	1.218	0.931	0.910
4	OTTER 100-119	0.641	1.265	1.105	1.105	0.624	1.621	0.748	0.891
4	OTTER 80-89	1.421	1.198	0.628	0.835	1.653	1.471	0.537	0.256
6a	BEAM >=80	0.250	0.525	0.000	0.075	4.375	2.375	0.000	0.400
6a	other	0.188	1.438	1.375	1.313	0.125	1.219	2.000	0.344
6a	OTTER >=120	1.429	0.914	0.457	0.914	1.218	0.890	0.492	1.687
6a	OTTER 100-119	1.178	1.578	0.711	0.622	0.578	0.289	0.200	2.844
6a	OTTER 70-79	1.964	1.018	0.727	0.727	1.309	0.873	0.727	0.655
6a	OTTER 80-89	1.737	0.883	0.228	0.797	1.224	0.797	0.285	2.050
6a	OTTER 90-99	2.304	1.012	0.233	0.374	1.385	0.840	0.311	1.541
6b	GILL >=220	0.204	1.969	1.100	1.876	0.204	0.049	1.592	1.007
6b	other	0.000	1.639	0.000	0.361	0.000	0.000	0.000	0.000
6b	OTTER 100-119	0.647	1.226	1.906	0.204	0.749	0.681	1.736	0.851

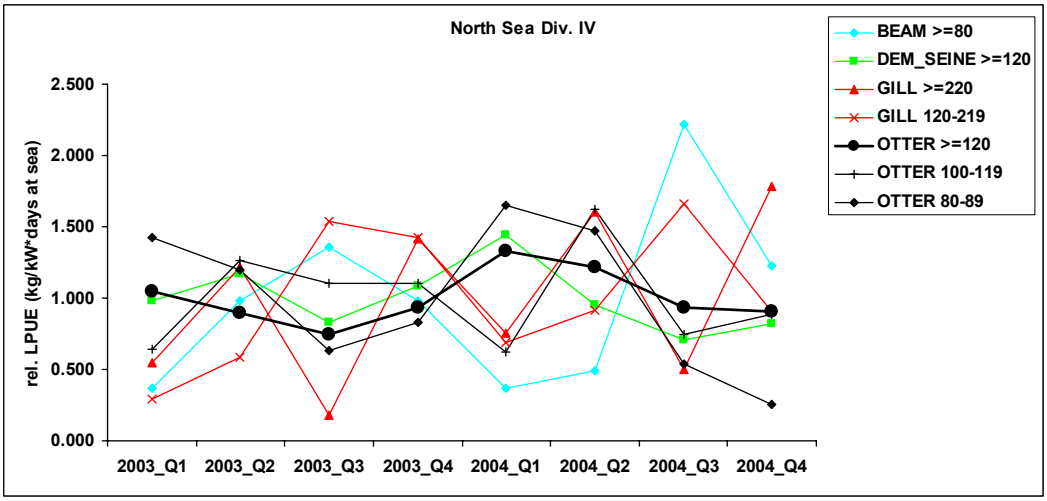


Figure 3.3.1 Relative landings per unit of effort of anglerfish in the North Sea by gear, year and quarter, 2003-2004, each series standardised to its mean.

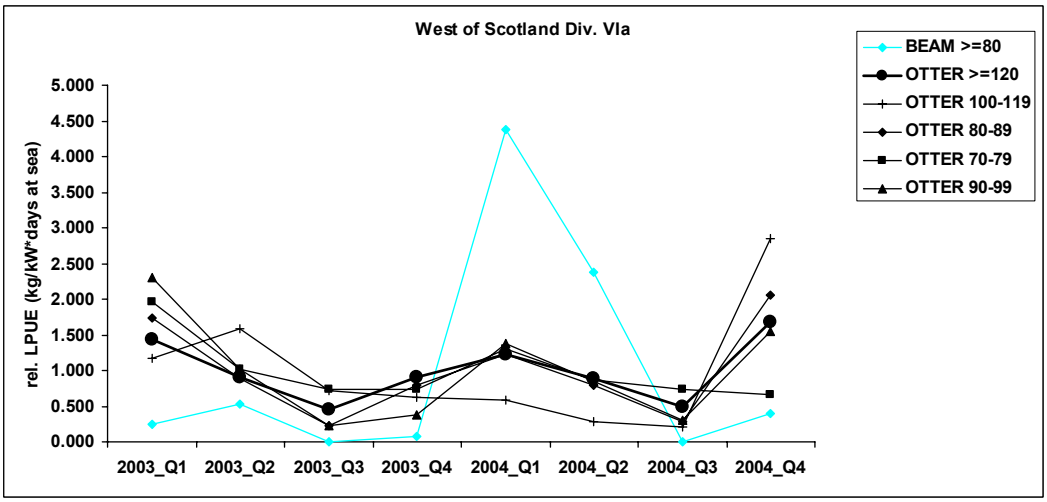


Figure 3.3.2 Relative landings per unit of effort of anglerfish in the area West of Scotland by gear, year and quarter, 2003-2004, each series standardised to its mean.

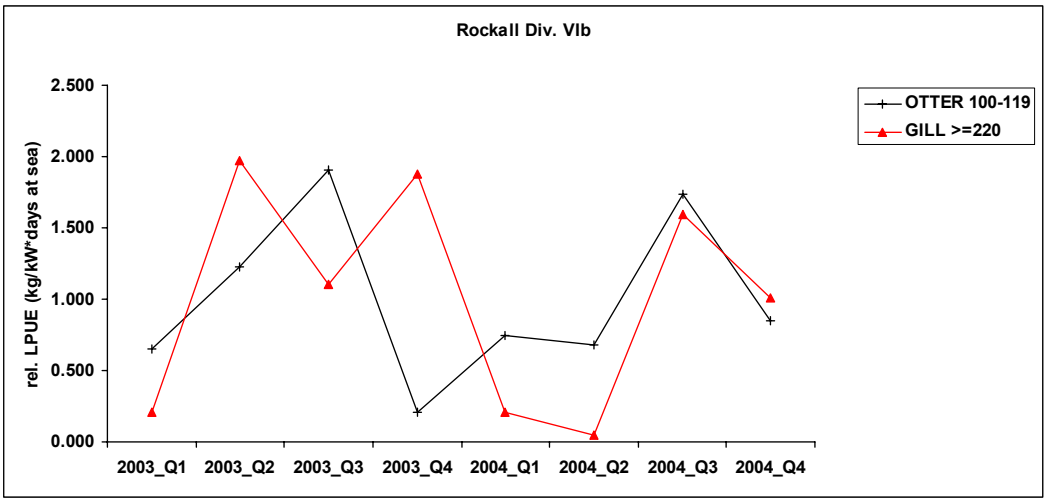


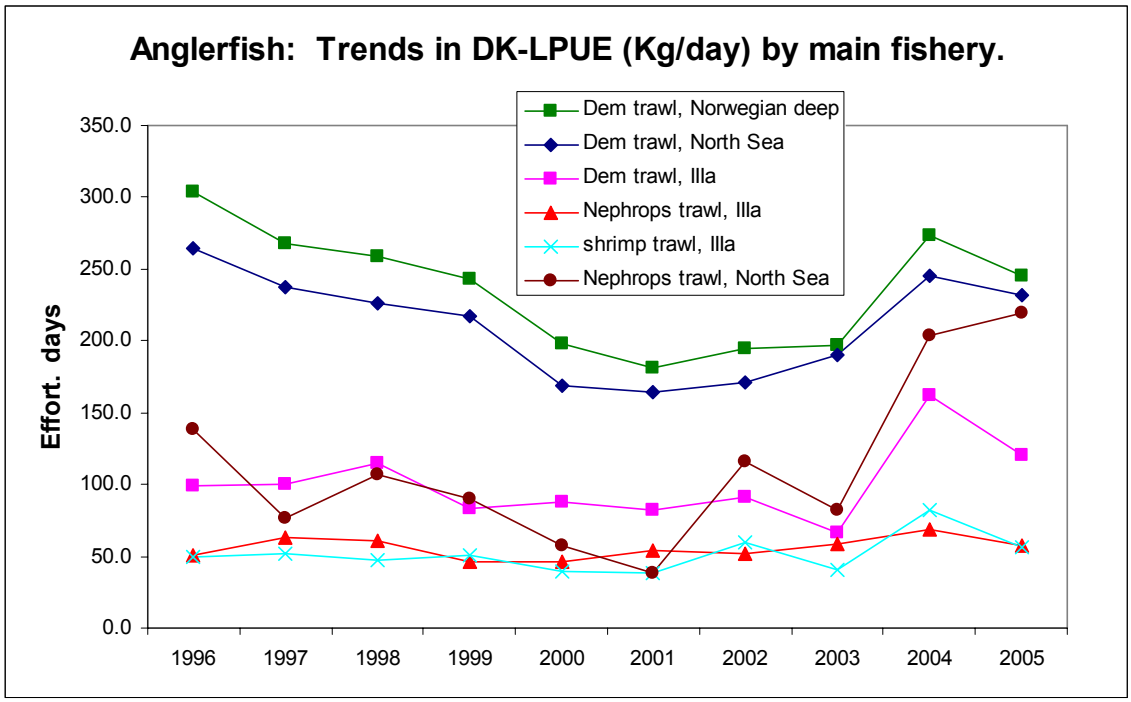
Figure 3.3.3 Relative landings per unit of effort of anglerfish in the Rock all area by gear, year and quarter, 2003-2004, each series standardised to its mean.

3.3.2. Danish data

The Danish LPUEs are based on logbook records. Figure 3.3.4 shows the trends in LPUEs for the main fisheries as mentioned in Sect. 2.2.2. Of relevance is the series for the demersal trawl fishery in the North Sea and in particular the series for this fishery in the Norwegian Deep as the fishery, where most anglerfish is taken. Note the upwards trend, especially from 2003 to 2004 for all fisheries and the subsequent stabilisation or even slight decline of the LPUE level in 2005. Similar patterns can be seen in time series for III A (Skagerrak).

The break observed for 2005, no longer increasing as in the previous years, could without any other information at hand be interpreted as a corresponding change in stock abundance in 2005. However, in view of other mainly qualitative indications of increasing stock abundance it is our opinion, that this discontinuation of the increase can at least to some extent be explained by the TAC constraint on the Danish fishery in the Norwegian EEZ from 2005. In the previous years the TAC for anglerfish in the North Sea had not been limiting the landings of this species, but in 2005 a TAC of 1800 t was negotiated for Danish landings from the Norwegian zone. According to the Danish fishing industry, this puts restrictions on the Danish catches of anglerfish in 2005. Note also the decline in North Sea landings from 2004 to 2005 reflecting the TAC for 2005. As a consequence it is highly probable that the observed decline in LPUE in 2005 based on logbook data merely reflects TAC constraints. The restrictions have continued in 2006, where a Danish TAC of 1750 t for the Norwegian EEZ has been agreed.

Figure 3.3.4. Logbook based estimates of LPUE by fishery.



Table

År	Danish LPUE in IV (Kg/day) dem trawl	Neph trawl	Shrimp trawl	Danish LPUE in Norwegian deeps (IVa)	Danish LPUE in IIIa (Kg/day) dem trawl	Neph trawl	Shrimp trawl
1996	264	139	99	304	99	51	49
1997	237	77	63	268	101	63	52
1998	226	107	61	259	115	61	48
1999	218	90	64	243	83	46	51
2000	169	57	51	198	88	46	40
2001	164	39	47	181	83	54	38
2002	171	116	54	195	91	52	59
2003	191	83	51	197	66	59	40
2004	245	204	82	273	162	69	82
2005	232	220	62	245	121	58	56

3.4. Size composition in the catch

3.4.1. Danish length composition data

Danish samples of landed catch in the port of Hirtshals for size (length) measurements are available for 2002-2005. It seems that the 2002 samples indicate more large individuals in the landings, However, sample size is small (anglerfish is an expensive species), and the samples do not indicate any significant changes in size composition of the landings during this period.

Data on the size composition in the catch are available for the 3 years 2003-2005 when including Norwegian data for 2003 and 2004 (available in ICES WGNSDS 2005 report). Note the recruiting size-(age-) group in 2003 and even more conspicuously in 2005. The size composition of the catch in these 2 years could indicate a large recruiting size (age) groups in the stock. This interpretation is qualitatively confirmed by the fishing industry's information of large amounts of small specimens in the catches in 2005 and 2006.

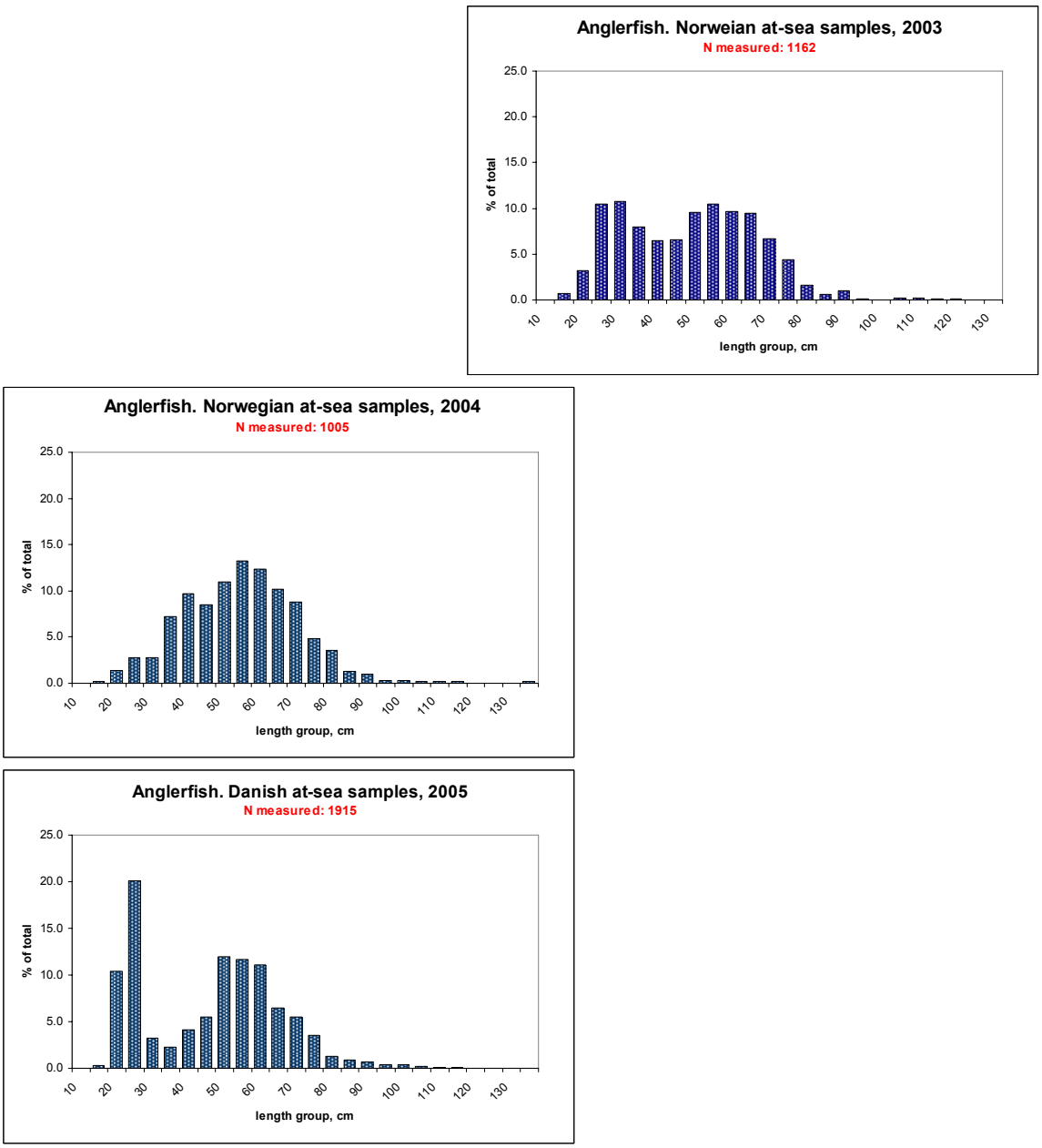


Figure 3.4.1 At-sea samples from Norwegian Deep, 2003 – 2004, sampled at sea.

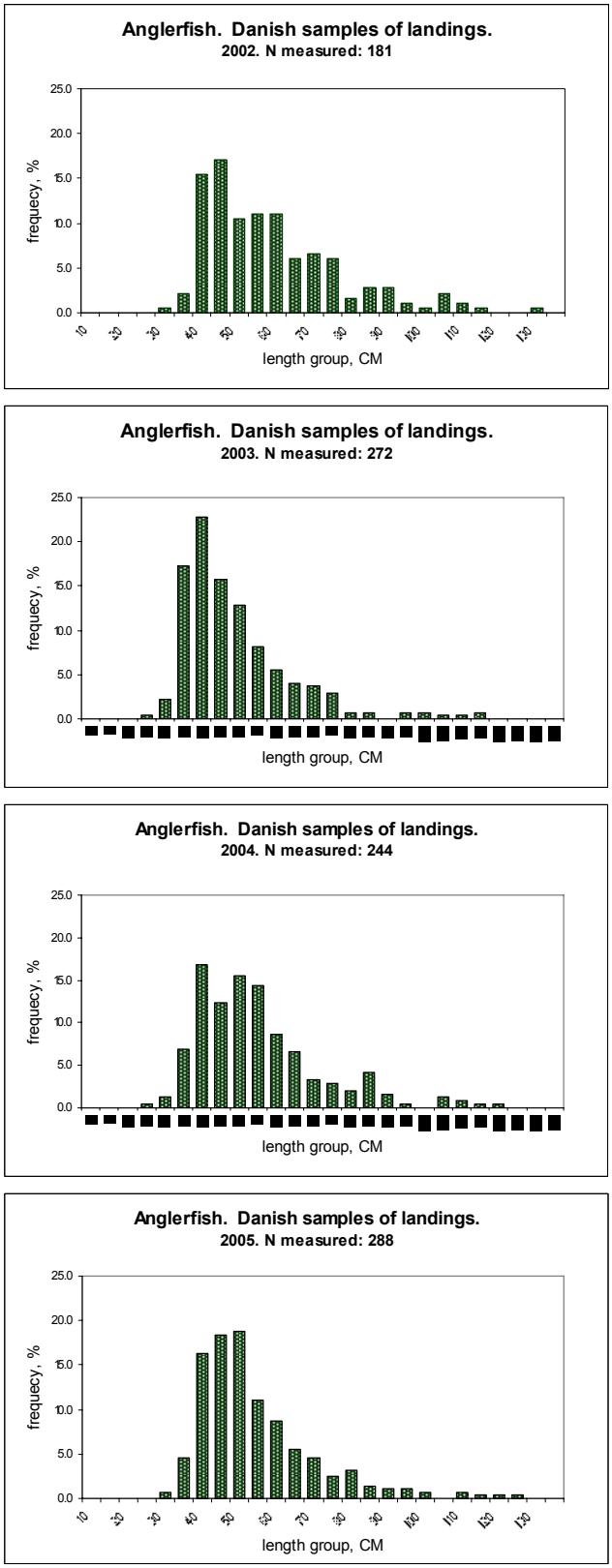


Figure 3.4.2. Length distribution in Danish landings, sampled at the market.

3.4.2. Scottish length composition data

Length composition data are available for the landed component of the Scottish catches. The sampling program is stratified by area (Scottish demersal sampling area), by gear type (heavy trawl, light trawl, Nephrops trawl, seine and pair trawl) and by quarter.
For the West of Scotland (Division VIa), the data were available by gear type and quarter for the years 2001-2004 and are illustrated in Figure 3.4.3 (for the most important gear types). Length distributions are also available for landings from the North Sea (Sub-area IV) and Rockall (Division VIb), but only aggregated over all gear types. These are illustrated in Figures 3.4.4 and Figures 3.4.5.
There is no clear evidence from these data as to whether there have been any particularly strong year classes in recent years. However, it is not known to what extent these landings length frequencies are representative of the length frequencies of the actual catch due to lack of discard information and possible mis-reporting by size category. Furthermore the coarse spatial resolution of these data may mean that if recruits congregate in particular locations then pulses of recruitment may not be picked up in the overall length frequency distribution.
Length frequency distributions are also available from a number of Scottish dedicated anglerfish surveys which have been carried out since 1999. Some have been carried out using commercial fishing boats while others have been carried out by FRV Scotia.
The Shelf Edge was surveyed in the years 1999 and 2000 by the MFV Endeavour as part of an EU funded contract (EU 98/096: Distribution and biology of anglerfish and megrim in the waters to the West of Scotland) and as part of the Scottish Industry/Science partnership by the MFV Enterprise in 2001. A new joint industry/science survey project in FRS began in 2005 and as part of this the MFV Endeavour III was chartered to survey the Shelf edge. The 3 surveys in 1999-2001 covered the same survey stations and the vessels involved used gear with the same mesh size (110 mm). The frequency distributions are shown in Figure 3.4.6 and over these years (1999-2001) look relatively similar. The vessel chartered in 2005 used a 120 mm mesh. There is an apparent lower proportion of large individuals in the catch in 2005, however this may just be a result of the difference in distribution of survey stations in this year.
Rockall has also been surveyed (in 2000, 2001 and 2005) as part of the same projects as described above. A reduction in the proportion of large individuals was observed in 2001 (Figure 3.4.7) and this is still the case in 2005. In addition in 2005, there also appears to be a rather lower proportion of individuals caught in the 30-50cm length range. Again it should be noted that the survey in 2005 was carried out by a different boat with larger mesh size and had a different design, so differences in length frequency distribution may be attributable to differences in spatial coverage of the survey.
The FRV Scotia has also been involved in these surveys, however the areas covered by the research vessel in 1999/2000 (Shelf Edge) and 2005 (North Sea) were quite different so no comparative frequency distributions are shown.

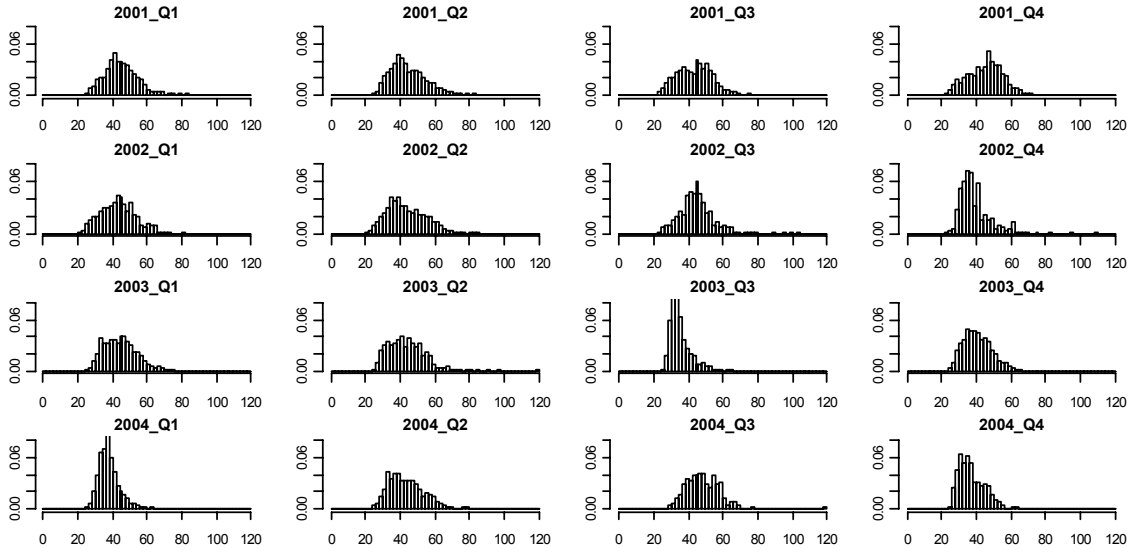


Figure 3.4.3a. Length distributions of the Scottish light trawl landings in Division VIa.

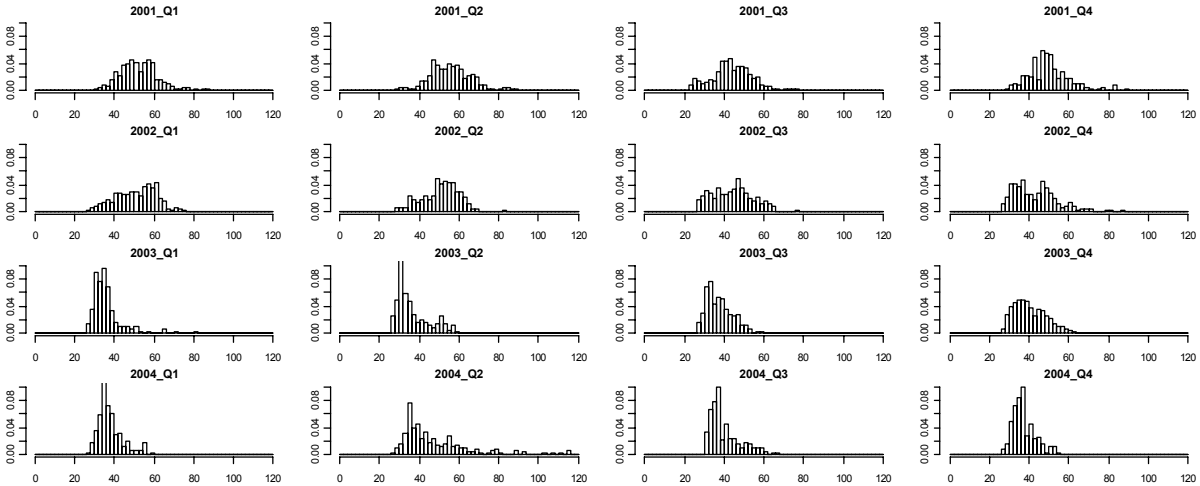


Figure 3.4.3.b. Length distributions of the Scottish 'heavy trawl' landings in Division VIa.

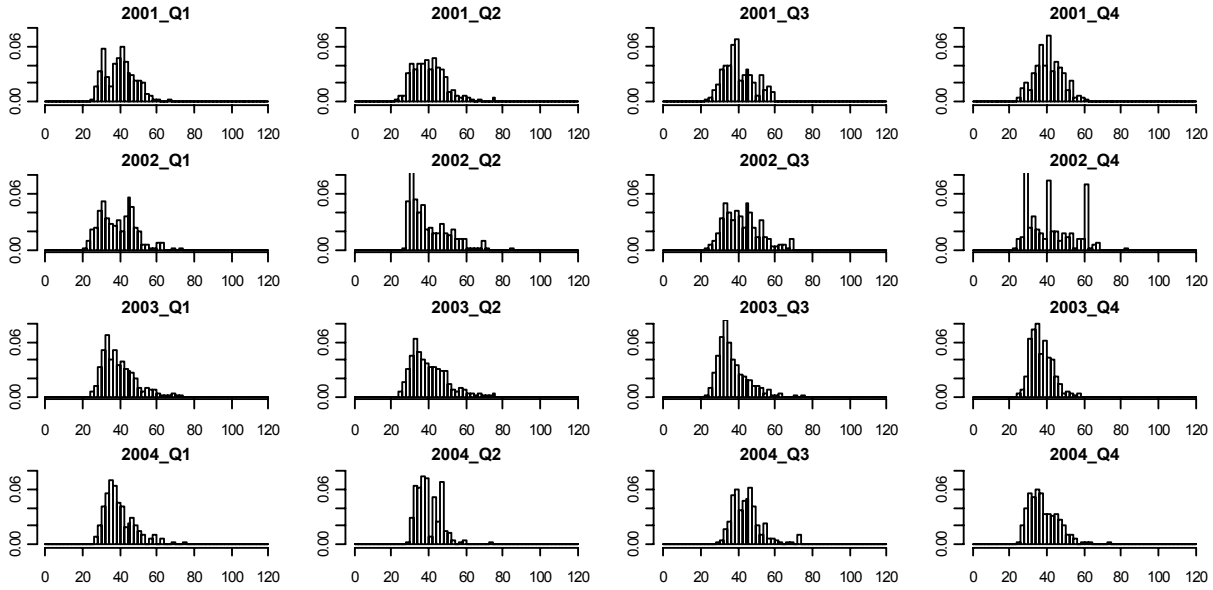


Figure 3.4.3c. Length distributions of the Scottish Nephrops trawl landings in Division VIa.

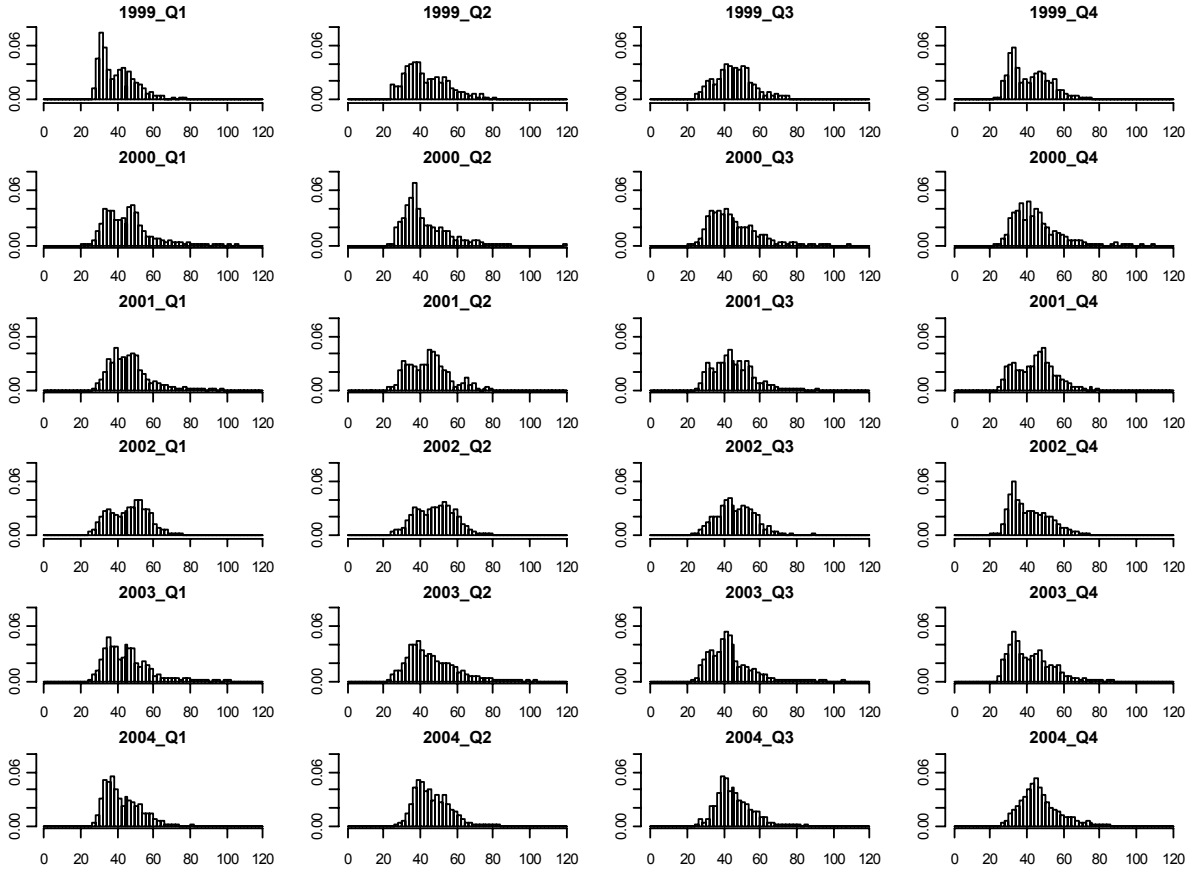


Figure 3.4.4. Length distributions of the Scottish landings (all gears) in Sub-area IV.

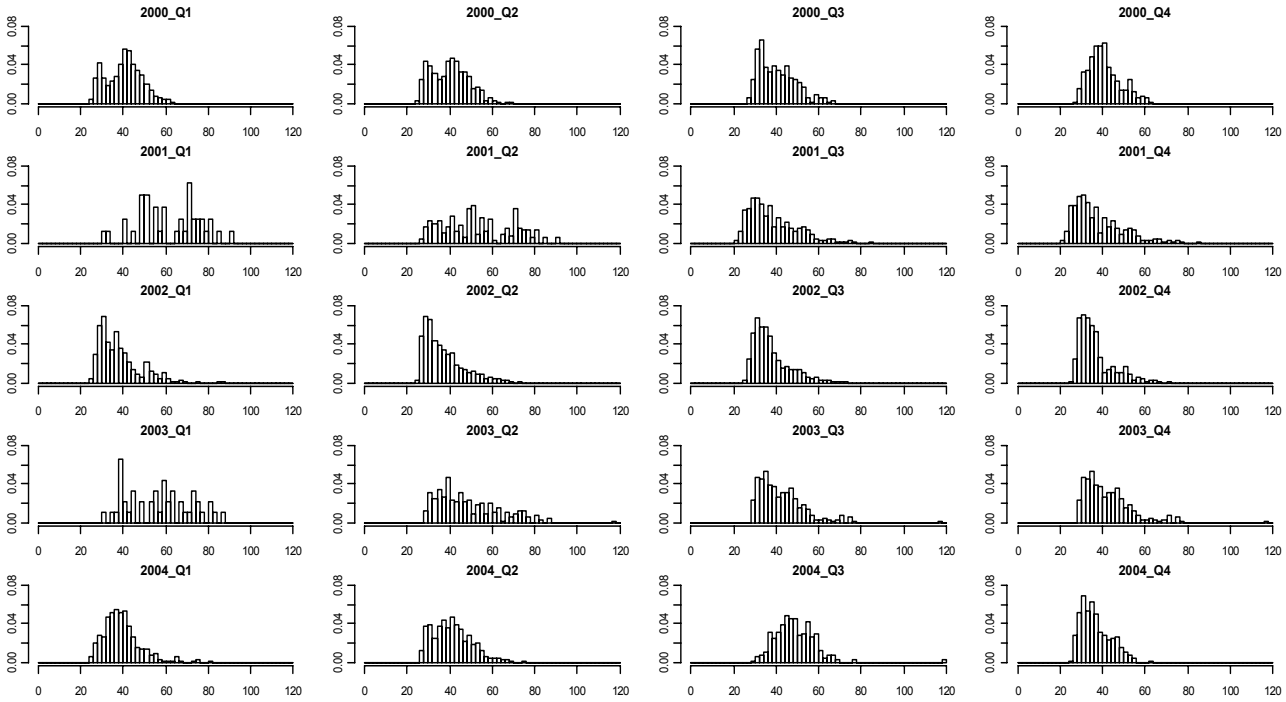


Figure 3.4.5. Length distributions of the Scottish landings (all gears) in Division VIb (Rockall).

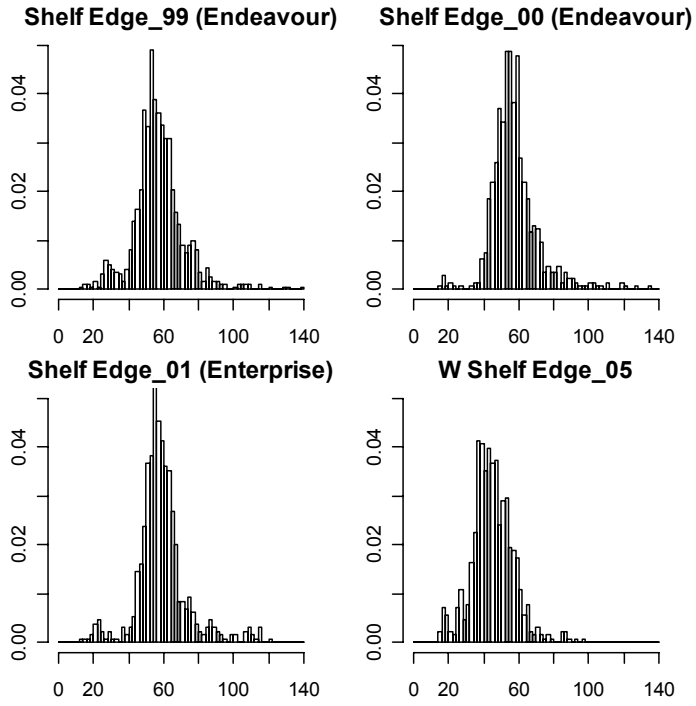


Figure 3.4.6. Length frequencies from surveys conducted on the Shelf Edge by commercial fishing vessels chartered by FRS.

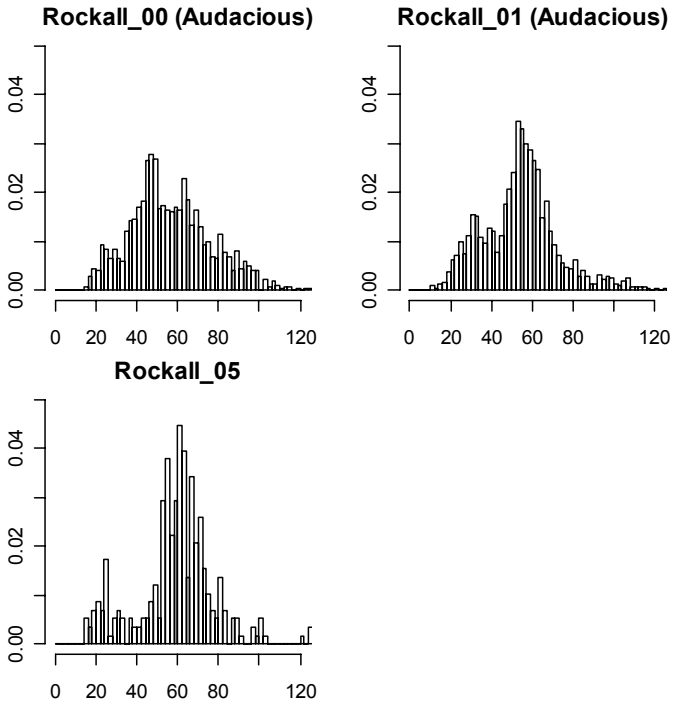


Figure 3.4.7. Length frequency distributions collected on various Scottish surveys at Rockall.

3.4.3. UK (EW) length composition data

Length frequency distributions for anglerfish from the UK (EW) observer programme are shown in Figures 3.4.8-3.4.10 for demersal, Nephrops and beam trawls respectively, for data aggregated over quarters and ICES Divisions IV and VI. There is some indication of increased numbers of small anglerfish (20-25cm) caught in 2005 for the demersal and Nephrops trawls.

Figure 3.4.8. Length frequency distributions of anglerfish numbers caught, based on UK (EW) observer data for demersal trawls, aggregated over all quarters and ICES Divisions IV and VI. The number of fish measured (n) is indicated in the top right corner of each plot.

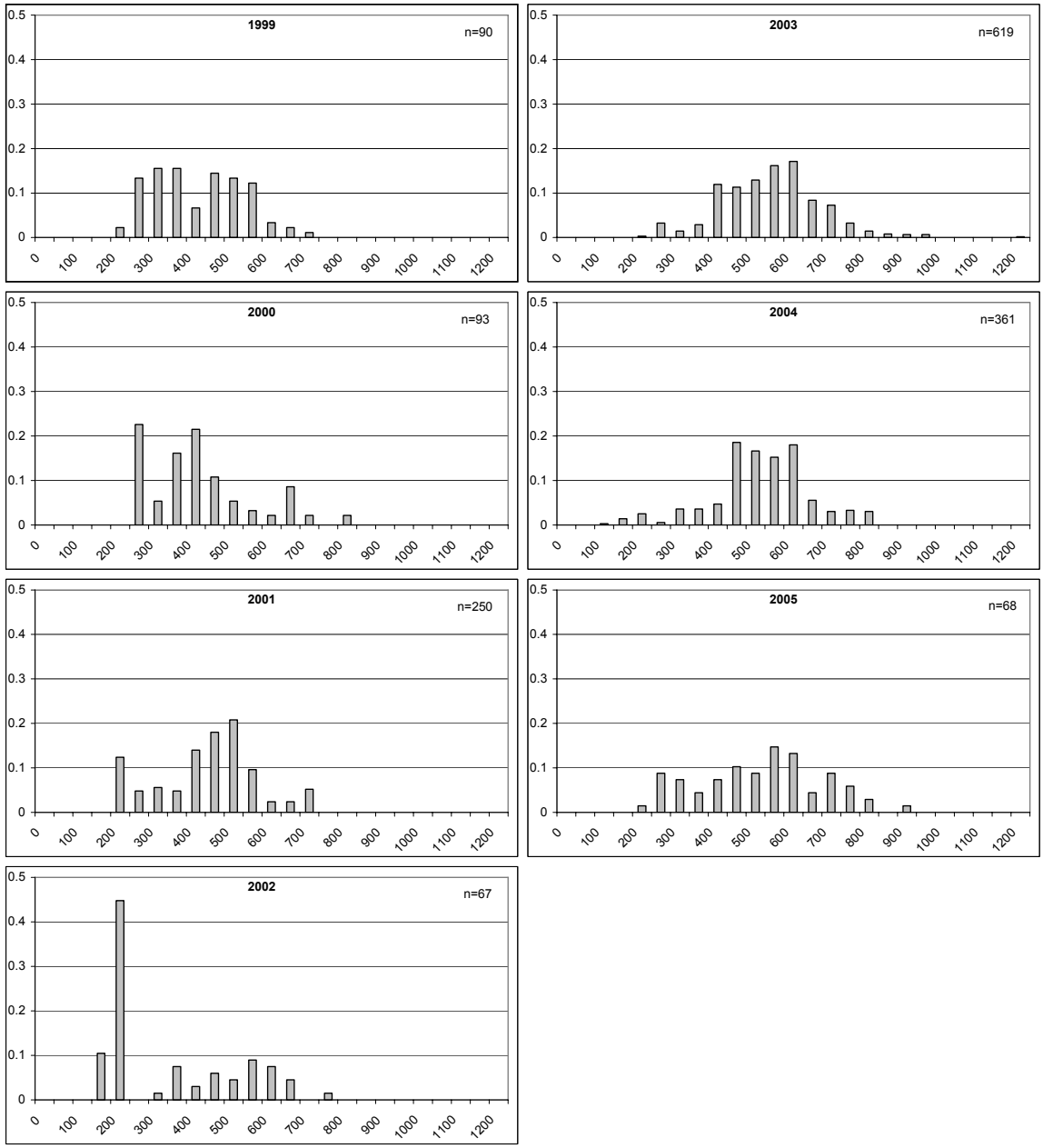


Figure 3.4.9. Length frequency distributions of anglerfish numbers caught, based on UK (EW) observer data for Nephrops trawls, aggregated over all quarters and ICES Divisions IV and VI. The number of fish measured (n) is indicated in the top right corner of each plot. The 2006 data are for quarter 1 only.

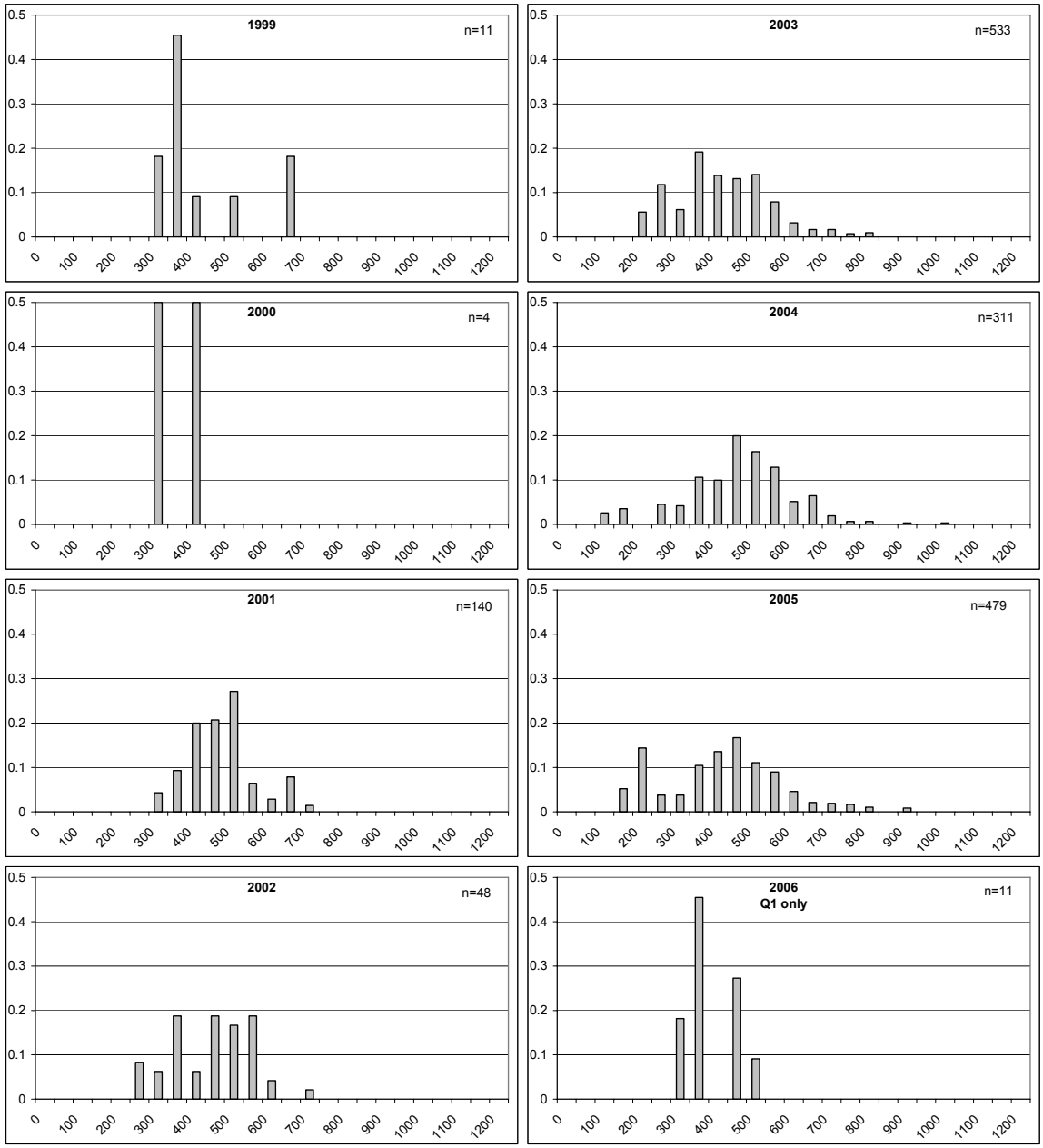
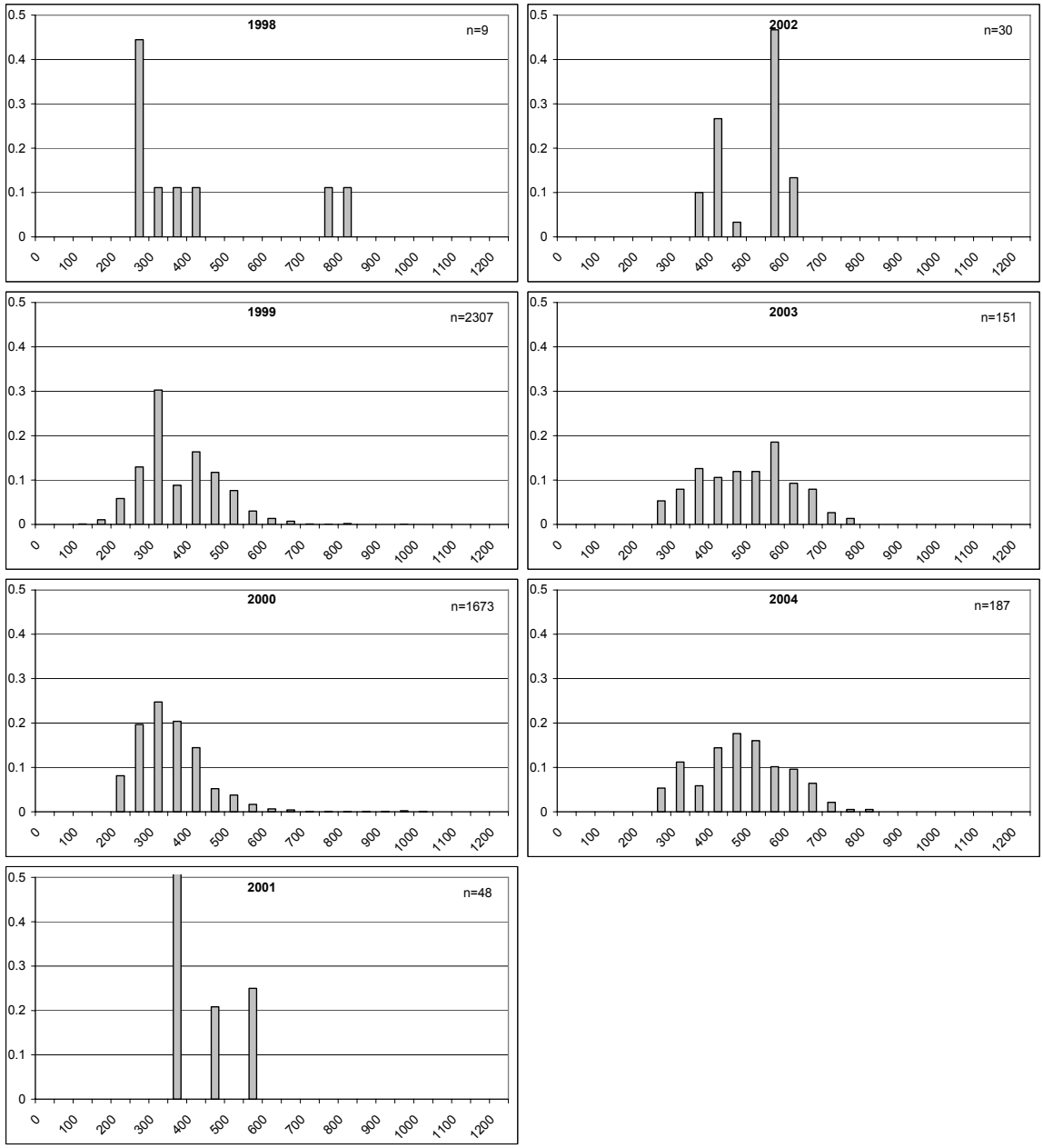


Figure 3.4.10. Length frequency distributions of anglerfish numbers caught, based on UK (EW) observer data for beam trawls, aggregated over all quarters and ICES Divisions IV and VI. The number of fish measured (n) is indicated in the top right corner of each plot.



4. Recommendations

Summarising the above findings on trends in the stock, all data sources indicate an increase in abundance from 2003 to 2004, and a levelling off thereafter. However, the sources differ in the magnitude of the abundance shift. Whereas the statistical analysis of the Scottish observer data indicate a full doubling in catch rates in 2004, the logbook and diary data come to an increase by approx. 40%. As already noted by ICES (2005), the logbook data might be less reliable as an indicator of stock abundance, because of the TAC restriction on landings. On the other hand, the abundance shift detected in the Scottish observer data is only just statistically significant. At the bottom line, the currently available information does not allow a final judgement on the magnitude of the abundance shift in 2004. Consequently, there is no realistic opportunity for an accurate catch prediction. However, the reported rise in catch rate is real, and remains qualitatively undisputed by the analyses presented above. Consequently, if both effort and TAC are kept constant, a further deterioration of the quality of fishery-dependent data is foreseen. This will weaken the current efforts to collect more and more reliable information on the anglerfish and its fishery.

The vast majority of the catch of anglerfish stems from mixed fisheries, catching sole, saithe, plaice, megrim, Nephrops, haddock and cod, amongst others. Optional effort restrictions aiming at a recovery of these other species will have a side-effect for the anglerfish too, but a shift from anglerfish-poor areas to anglerfish-rich areas might annihilate this effect. However, the statistical analysis of Scottish observer data did not show evidence for such shifts in the recent past.

In the present situation, no analytical assessment of the anglerfish stock is available and further information on the biology of anglerfish and on the status of the stock is required to improve the quality of the scientific advice. There are several indications of an increase in stock abundance, but these indications are either qualitative or rather uncertain. Although these claims are essentially corroborated by the analyses presented in this report, the uncertainty in the data is yet too high, to give a definite advice on higher catch limits. While the rising trend in catch rates is not debated, there is insufficient ground to specify an exact figure for an update of catch limits. It is therefore recommended to raise the current TAC (2006) conditional on a re-evaluation of the upward trend in the abundance of the stock in one year from now (spring 2007). An initial modest increment of 10% is considered adequate by this group of experts. If and when the higher catch rates, observed in the post-2003 period in comparison to the preceding years, are discontinued or there is inadequate evidence to prove this beyond reasonable doubt (statistical significance), the raise in TAC should be discontinued. When a comprehensive assessment of the stock becomes available, this should of course override the current advice.

References

Mandel, J., 1959, The analysis of Latin squares with a certain type of row-column interaction. Technometrics 1, 379-387.

Milliken, G.A. & Johnson, D.E., 1989, Analysis of messy data, Vol. 2 : nonreplicated experiments. Van Nostrand Reinhold, New York, 199 pp.

Clarke, E (2004) A brief report defining fisheries using Scottish demersal reported landings data for the North Sea. Working Document presented to ICES SGDFF January 2004

ICES 2006. Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks (WGNSDS), 10-19 May 2005, Murmansk, Russia. ACFM:13. 757pp.

Bailey, N., Tuck, I. & Dobby, H. 2004. New information on the stock trends and abundance of Northern Shelf anglerfish. Supplementary working paper provide to ICES Review Group on the assessment of the Northern Shelf Demersal Stocks (RGNSDS) 2004.

Annex 1: List of participants

Invited experts

Willem Dekker (chair), the Netherlands
Nicholas Bailey, UK-Scotland
Helen Dobby, UK-Scotland
Sten Munch-Petersen, Denmark
Macdara Ó Cuaig, Ireland
José de Oliveira, UK-England
Hans-Joachim Rätz, Germany

European Commission staff

Kenneth Patterson
Sarunas Zableckis

Annex 2: List of Working Documents and Presentations

Working documents

- Munch-Petersen S. Data on the Danish fishery for anglerfish in the North Sea and Skagerrak (IIIa).
- Rätz H.J. Recent German landings and effort of anglerfish by fleets in the Skagerrak, North Sea and West of Scotland.

Presentations

- Campbell, N and Bailey N. Defining the “monk fishery”, and those which take significant by-catch of monk.
- Bailey N. Update on data available for Northern Shelf anglerfish TAC review by STECF.
- Dobby H. Anglerfish tally book data - The story so far…
- Fernandes P. Anglerfish distributions & observed catch rates based on the 2005 survey and FRS observer data. Fisheries Research Services, Aberdeen.

Annex 3 Coding used for fleet aggregation.

Areas
North Sea, Skagerrak
4

Northern Shelf
6a
6b

FISHING TECHNIQUES			**Gear code**
Mobile gears	Beam trawl		LARGE_BEAM SMALL_BEAM
	Demersal trawl & demersal seine	Bottom trawl	OTTER
		Danish & Scottish seiners	DEM_SEINE
	Pelagic trawl & Seiners	Pelagic Trawl	PEL_TRAWL
		Pelagic seiner & purse seiner	PEL_SEINE
	Dredges		DREDGE
Passive gears	Longlines		LONGLINE
	Drift & fixed Nets except Trammel Nets		GILL
	Trammel Nets		TRAMMEL
	Pots & traps		POTS

Gear type	Mesh size range
Mobile gears	<16
	16-31
	32-54
	55-69
	70-79
	80-89
	90-99
	100-119
	>=120
Passive gears	10-30
	50-59
	60-69
	70-79
	80-89
	90-99
	100-109
	110-119
	120-219
	>=220