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Results from Bottom Trawl Survey on Flemish Cap of July-August 2005

by

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Abstract

A stratified random bottom trawl survey on Flemish Cap was carried out from July 1st to August 21th 2005. The area surveyed was extended up to depths of 800 fathoms (1 400 meters) following the same procedures as in previous years and increasing the number of hauls planned (195). The survey was carried out by the *R/V Vizconde de Eza* with the usual survey gear (Lofoten). A total of 176 valid hauls were made by the vessel *R/V Vizconde de Eza*, 117 up to 730 meters depth and 59 up to 1 400 meters. Survey results including abundance indices of the main commercial species and age distributions for cod, redfish, American plaice, Greenland halibut and Shrimp are presented. The general indexes for this year are estimated taken into account the traditional swept area (strata 1-19, up to depths of 730 m) and the total area surveyed (strata 1-34, up to depths of 1 400 m).

Introduction

The survey on Flemish Cap was carried out on board *R/V Vizconde de Eza* in 2005. A total of 176 valid bottom trawls were made up to a depth of 1 400 m (800 fathoms) (Fig. 1). The survey covered all strata of the bank adequately with the exception of the strata corresponding with the Beothuk knoll (35-39 strata) in the southwest of the bank. A synoptic sheet of the survey with vessel and gear characteristics is shown in Table 1. This was the 18th survey of the series initiated by the EU in 1988. All surveys had a stratified random design following NAFO specifications (Doubleday, 1981). Dates of the previous surveys were:

Year	Vessel	Valid		111		Valid	
		tows	Dates	Year	Vessel	tows	Dates
1988	Cornide de Saavedra	115	8/7 – 22/7	1997	Cornide de Saavedra	117	16/7 – 1/8
1989	Cryos	116	12/7 – 1/8	1998	Cornide de Saavedra	119	17/7 – 2/8
1990	Ignat Pavlyuchenkov	113	18/7 – 6/8	1999	Cornide de Saavedra	117	2/7 – 20/7
1991	Cornide de Saavedra	117	24/6 – 11/7	2000	Cornide de Saavedra	120	10/7 – 28/7
1992	Cornide de Saavedra	117	29/6 – 18/7	2001	Cornide de Saavedra	120	3/7 – 20/7
1993	Cornide de Saavedra	101	23/6 – 8/7	2002	Cornide de Saavedra	120	30/6 – 17/7
1994	Cornide de Saavedra	116	6/7 – 23/7	2003	Vizconde de Eza	114	2/6 – 27/7
1995	Cornide de Saavedra	121	2/7 – 19/7	2004	Vizconde de Eza	177 ¹	25/6 – 2/8
1996	Cornide de Saavedra	117	28/6 – 14/7	2005	Vizconde de Eza	176 ²	1/7 – 21/8

¹ 124 valid tows were carried out in depths lesser than 400 fathoms.² 117 valid tows were carried out in depths lesser than 400 fathoms.

Material and Methods

As the last year, the *R/V Vizconde de Eza* carried out the survey following the same procedures as in previous years, the same bottom trawl net Loføten, with a cod-end mesh size of 35 mm, as well as all other details of its use (Saborido-Rey and Vazquez, 2003).

Results

Following the agreement of the NAFO Standing Committee on Fisheries Science (STACFIS), on preferring mean number or weight per tow over other survey indices, most tables in the report are presented in that way. Details on changes were presented in last year report (Saborido-Rey and Vazquez, 2003)

Mean catch per tow (Kg) of main species in past surveys are:

Survey	Cod	American plaice	Redfish	Greenland halibut	Roughhead grenadier	Shrimp
1988	50.78	19.95	234.19	8.61	2.50	7.14
1989	141.82	17.47	202.11	5.56	1.08	2.86
1990	73.82	14.90	157.62	7.21	1.06	4.34
1991	50.05	12.54	95.69	10.16	1.66	14.50
1992	33.22	10.76	161.91	10.85	1.96	31.28
1993	75.81	9.78	90.29	8.12	3.76	15.03
1994	32.91	10.23	202.10	9.99	2.46	4.95
1995	12.06	8.44	108.98	13.52	1.94	9.33
1996	11.21	5.10	148.80	14.42	1.69	13.56
1997	12.39	3.76	206.19	20.02	1.49	9.58
1998	6.20	4.27	88.08	30.13	2.10	52.19
1999	3.55	3.21	122.67	26.37	1.55	32.00
2000	3.81	2.00	221.33	21.09	1.30	24.52
2001	3.35	2.99	96.18	17.25	2.59	35.21
2002	3.10	2.55	150.85	15.05	1.51	49.96
2003	1.98	2.84	116.66	7.73	2.92	26.75
2004* ₍₁₋₁₉₎	5.06	4.38	311.62	15.28	4.47	25.03
2005* ₍₁₋₁₉₎	6.52	3.43	563.35	14.55	2.97	38.14
2004 ₍₁₋₃₄₎	3.32	2.88	204.71	23.15	14.03	16.49
2005 ₍₁₋₃₄₎	4.19	2.21	362.21	17.20	11.39	24.93

*Mean catch per tow for the comparable area and depths in the historical series.

These survey indices are also presented in Table 2, and even they belong to different species and pelagic vs. demersal character and the transformation to the new scale only was carried out for the main species, a global index is presented for each year, which minimum occurred in 2001. Redfish shows the highest annual variability probably due to its pelagic habitat, making accessibility to bottom gears more changeable than in the case of demersal or benthic species. Cod reached its biomass minimum in 2003, increasing in the last two years. The relative high values founded in 2004 for American plaice and grenadiers decreasing in 2005. These changes were probably due to the occasional increasing of catchability in 2004. Greenland halibut biomass maintained a continuous biomass increase to reach a maximum in 1998, since then the biomass decreased up to minimum historical value in 2003. In 2005 the biomass decreased a 5% compared from 2004. Shrimp catches in 2005 were between the highest of the historical series.

Excluding red fish, the whole period could be divided in two in regards to species composition: Cod, American plaice and skates dominating the first half, prior to 1995, and Greenland halibut, the second half. For cod, 1995 was the spawning year for the first extremely weak recruitment; it had been 1991 for American plaice. In 2005 the high cod indexes at age 1 could indicate the presence of the relative strong year-class in 2004.

Cod

Mean catch per tow by strata and its standard error are presented in Table 3. These indices are compared with results of previous surveys in Table 5. Total biomass calculated by the swept area method and compared with Russian survey results are:

Year	EU (1)	Russia: (2)	(3)	Year	EU (1)	Russia: (2)	(3)
1983		23,070		1995	9,695	8,260	-
1984		31,210		1996	9,013	730	-
1985		28,070		1997	9,966	-	-
1986		26,060		1998	4,986	-	-
1987		10,150	21,600	1999	2,854	-	-
1988	40,839	7,720	34,200	2000	3,062		-
1989	114,050	36,520	78,300	2001	2,695	784	-
1990	59,362	3,920	15,200	2002	2,496	694	-
1991	40,248	6,740	8,200	2003	1,593		-
1992	26,719	2,490	2,400	2004	4,071		
1993	60,963	8,990	9,700	2005	5,242		tons
1994	26,463	-	-				

1) Biomass estimated from bottom trawl survey. 2) Biomass estimated from bottom trawl survey (Kiseleva and Vaskov 1994; Kiseleva 1996, 1997; Vaskov and Igashov, 2003). 3) Biomass estimated of bottom trawlable plus pelagic biomass (Borovkov *et al.* 1993; Kiseleva and Vaskov 1994).

The mean frequency at age per tow ('000) is shown in the table below.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	6.05	24.38	2.86	160.45	88.95	5.07	3.75	1.77	0.04	0.05	0.03	0.01	0.22	0.59		0.85		10.03
2	99.36	13.43	15.35	32.60	52.13	172.05	5.14	14.80	3.88	0.19	0.10	0.10	0.02	2.48	1.65	0.07	4.18	0.02
3	61.55	113.53	6.37	21.02	6.94	38.67	34.51	1.66	8.28	4.32	0.12	0.14	0.41	0.02	0.80	0.78	0.03	1.39
4	16.72	67.91	21.08	2.64	2.97	1.37	6.34	4.84	1.11	5.97	1.56	0.15	0.25	0.15	0.04	0.17	0.72	0.1
5	1.81	25.40	19.69	8.40	0.48	1.64	0.16	1.15	2.99	0.49	1.95	0.89	0.12	0.10	0.09	0.03	0.18	0.88
6	0.26	1.66	5.59	2.15	1.74	0.21	0.08	0.04	0.24	1.18	0.10	0.55	0.55	0.02	0.04	0.05	0.01	0.17
7	0.28	0.18	0.42	0.37	0.30	0.61	0.01	0.03	0.01	0.03	0.18	0.02	0.21	0.18	0.03	0.01	0.01	
8	0.09	0.16	0.18	0.08	0.02	0.11	0.14		0.01			0.01	0.01	0.12	0.12	0.01	0.00	0.02
9		0.01	0.10	0.04				0.03			0.01		0.02	0.01	0.04	0.05	0.01	0.01
10		0.01	0.03	0.00			0.01	0.01						0.01		0.03	0.02	0.01
11				0.01	0.01									0.01	0.01			
12									0.01				0.01					
13																		
14													0.01					
total	186.13	246.66	71.67	227.78	153.53	219.72	50.14	24.33	16.56	12.23	4.05	1.87	1.83	3.67	2.81	2.04	5.16	12.63

The 1990 year-class was the most abundant observed at age 1, but its level was not maintained in the following years, after recruitment. This may indicate that its abundance was overestimated in the 1991 survey. The abundance of the 1991 year-class, although recording a maximum at age 2, decreased quickly as a consequence of the intense fishery on ages 2 and 3 during 1993 and 1994. Later year-classes, from 1992 onwards (ages 13 or less in 2005), were weak, weaker than the ones observed in the previous period. The 1995 to 1999 year-classes (ages 10 to 6 in 2005) failed almost completely and, according to the results of the last surveys, the same failure appears to have

occurred to the 2001 and 2003 year-classes (age 4 and 2 respectively in 2005). The 2000 and 2002 year-classes abundance, although low in the historical series, was estimated to above average in the last 10 years. The 2004 year-class abundance is the highest in the 12 years.

Tables 6, 7 and 4 show mean length frequency per tow, the age-length key and mean frequency at age per tow and stratum respectively. Catch per mile distribution is presented in Fig. 2.

American plaice

Mean catch per tow by strata is presented in Table 8. These indices are compared with results of previous surveys in Table 10. Total biomass calculated by the swept area method and compared with Russian survey results is shown in the following table:

Year	EU	Russia (1)	Year	EU	Russia (1)
1983		8,900	1995	6,785	
1984		7,500	1996	4,098	
1985		7,800	1997	3,026	
1986		20,200	1998	3,437	
1987		9,300	1999	2,585	
1988	16,046	6,500	2000	1,606	
1989	14,047	5,000	2001	2,404	
1990	11,983	1,200	2002	2,049	548
1991	10,087	14,400	2003	2,286	1,398
1992	8,656	1,200	2004	3,525	
1993	7,861	2,700	2005	2,760	
1994	8,227				

1) Rikhter *et al.*, 1991; Borovkov *et al.*, 1992, 1993, 1994; Vasikov and Igashov, 2003.

The mean frequency at age per tow is presented in the following table. The 1986 and 1990 year-classes, ages >13 in 2005, were between the most abundant cohorts in the period, but no good recruitment was observed since then. Fish aged 6 or more roughly correspond with fishable biomass. The abundance of this group (f 6+) decreased along the period except in 1992, when an increase was recorded as the consequence of the income of the abundant 1986 year-class. In the last years fluctuate in low levels without trends.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1		0.05	0.01	0.05					0.01	0.01		0.01	0.02			0.01		
2	0.50	0.70	0.53	0.44	1.06	0.01	0.05	0.04	0.04	0.02	0.03		0.03	0.05		0.01	0.14	0.04
3	2.34	10.40	1.14	1.50	0.99	1.92	0.06	0.14	0.15	0.14	0.04	0.03	0.01	0.06	0.04	0.04	0.35	0.14
4	1.63	2.33	10.41	2.70	1.33	1.35	2.65	0.92	0.32	0.03	0.06	0.08	0.10	0.07	0.08	0.12	0.09	0.36
5	5.26	5.43	1.40	6.65	2.41	0.97	1.29	2.65	0.73	0.15	0.09	0.10	0.13	0.13	0.02	0.10	0.10	0.13
6	7.94	5.42	4.19	3.04	5.93	0.52	1.09	1.70	2.07	0.52	0.33	0.10	0.19	0.07	0.11	0.07	0.13	0.13
7	6.23	5.15	2.91	3.34	1.59	5.14	1.21	1.71	1.11	1.50	0.77	0.30	0.15	0.14	0.08	0.06	0.13	0.16
8	6.79	3.02	2.77	2.57	1.87	0.56	4.26	1.13	0.68	0.34	1.12	0.59	0.19	0.33	0.16	0.17	0.16	0.13
9	2.18	1.00	1.68	1.06	1.03	0.97	0.40	1.91	0.50	0.51	0.65	0.63	0.49	0.54	0.20	0.36	0.31	0.28
10	0.57	0.43	0.78	0.37	0.47	0.46	0.81	0.20	0.78	0.36	0.44	0.32	0.53	0.72	0.24	0.29	0.39	0.25
11	0.12	0.05	0.14	0.01	0.22	0.32	0.28	0.22	0.18	0.61	0.37	0.42	0.28	0.60	0.37	0.53	0.35	0.28
12	0.20	0.02	0.02	0.07	0.12	0.38	0.28	0.18	0.10	0.16	0.36	0.26	0.23	0.52	0.28	0.60	0.74	0.31
13	0.16		0.04		0.02	0.45	0.31	0.18	0.10	0.03	0.11	0.15	0.09	0.24	0.31	0.35	0.53	0.44
14	0.06		0.02			1.33	0.65	0.36	0.13	0.12	0.14	0.15	0.07	0.20	0.18	0.33	0.50	0.49
15	0.07					0.04	0.61	0.27	0.09	0.06	0.07	0.07	0.06	0.14	0.16	0.18	0.41	0.32
16+	0.05					0.05	0.01	0.04	0.03	0.14	0.13	0.12	0.07	0.12	0.23	0.20	0.65	0.68
Total	34.09	34.01	26.05	21.79	17.05	14.47	13.96	11.66	7.02	4.69	4.73	3.32	2.65	3.94	2.45	3.44	4.99	4.14
freq. 6+	24.37	15.09	12.55	10.46	11.25	10.22	9.91	7.90	5.77	4.35	4.49	3.11	2.35	3.62	2.32	3.14	4.30	3.47

Global indices of the table, such as total number by tow and frequency 6+, have declined over the whole period, reaching their lowest level in 2002: more than 10 times lower than in 1988-1990. Data in the table above indicates two periods for recruitment, and a change from an upper abundance level to a lower one. The 1991 year-class was the first weak cohort. The relative high values founded in 2003, 2004 and 2005 for American plaice, mainly in the ages older than 13 years old, are probably due to the relative strong year classes previous to 1991.

Tables 11, 12 and 9 show mean length frequency per tow, the age-length key and mean frequency at age per tow and stratum, respectively. Catch per mile distribution is presented in Fig. 3.

Redfish

All redfish catches were classified by species. The group name *juvenile* contains those individuals of small size for which routine classification was not possible. The 15 cm maximum length is a good reference for this group, but it was never used as a criterion. The skill required to identify the species increased over time, so the group *juvenile* is not a uniform defined group, but it is maintained for practical reasons.

Mean catch per tow by strata are presented in Tables 13, 15, 19 and 21 for *Sebastes marinus*, *S. mentella*, *S. fasciatus* and the *juvenile* group, respectively. The following table shows the total biomass by year.

Year	<i>Sebastes:</i>		<i>Sebastes spp.</i>		total
	<i>marinus</i>	<i>mentella</i>	<i>fasciatus</i>	<i>juvenile</i>	
1988	22.67		211.52		234.19
1989	33.96		168.15		202.11
1990	20.83	107.80		28.99	157.62
1991	6.05	74.05	8.40	7.19	95.69
1992	6.10	106.20	7.85	41.75	161.91
1993	5.96	26.41	6.44	51.49	90.29
1994	49.14	52.84	11.57	88.55	202.10
1995	13.37	87.75	7.44	0.42	108.98
1996	16.70	115.21	16.30	0.59	148.80
1997	95.90	82.95	25.84	1.49	206.19
1998	9.50	67.08	9.52	1.98	88.08
1999	13.95	96.51	11.76	0.46	122.67
2000	66.39	132.16	19.10	3.67	221.33
2001	12.74	57.11	17.05	9.27	96.18
2002	14.49	60.63	34.27	41.46	150.85
2003	49.88	35.79	18.69	12.30	116.66
2004	106.17	57.24	94.71	53.54	311.62
2005	147.69	105.20	123.45	76.70	453.04

Numbers in thousand of tons

Tables 14, 16, 20 and 22 show mean length frequency by tow for the four groups. Age-length keys and mean frequency at age by tow and stratum for *S. mentella* are presented in Tables 18 and 17, respectively. Catches per mile distributions of the three species are presented in Fig. 4, 5 and 6.

Greenland halibut

Mean catch per tow by strata and its standard error are presented in Table 23. These indices are compared with results of previous surveys in Table 27 and summarised as follow:

Year	EU	Year	EU	
1988	8.62	1997	20.02	
1989	5.56	1998	30.13	
1990	7.21	1999	26.37	
1991	10.16	2000	21.09	
1992	10.85	2001	17.25	
1993	8.93	2002	15.05	
1994	9.99	2003	7.73	
1995	13.52	2004	15.28	
1996	14.42	2005	14.55	Kg/tow

Mean length frequency by tow, age-length keys and mean frequency at age per tow are presented in Tables 24, 26 and 25, respectively. Catch per mile distribution is presented in Fig. 7. Mean frequency at age per tow ('000) in the historical series was calculated as follows:

age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	1.62	2.09	1.77	1.78	12.41	5.84	3.33	2.74	1.06	3.75	8.03	4.08	2.20	2.19	0.54
2	0.26	1.57	1.55	1.24	2.54	7.97	3.78	2.13	0.70	0.29	1.43	2.94	1.00	3.29	0.81
3	0.43	0.56	0.97	1.70	2.23	2.41	6.00	7.68	3.01	0.60	1.81	2.79	0.61	4.37	3.18
4	1.31	1.27	0.86	1.78	1.91	3.04	6.50	11.00	10.47	2.16	0.99	1.67	1.51	1.97	2.50
5	2.87	2.30	1.27	1.92	2.66	4.20	7.11	12.33	13.41	7.09	2.79	3.79	2.48	6.96	6.89
6	1.60	2.80	1.92	2.97	5.10	5.82	8.46	11.30	12.58	14.10	7.79	5.59	2.94	7.80	7.59
7	2.75	2.42	2.02	2.66	3.77	2.49	4.99	7.84	5.55	5.40	6.63	5.73	1.93	2.54	2.92
8	0.66	1.31	1.57	1.47	2.12	1.62	2.15	2.62	1.82	2.32	3.21	1.28	0.47	0.64	0.61
9	0.57	0.58	0.96	0.78	1.31	0.42	0.66	0.75	0.35	0.45	0.18	0.13	0.13	0.29	0.11
10	0.44	0.34	0.26	0.27	0.26	0.09	0.22	0.20	0.10	0.11	0.04	0.06	0.10	0.13	0.12
11	0.18	0.17	0.13	0.11	0.07	0.03	0.03	0.03	0.01	0.05	0.01	0.02	0.02	0.08	0.06
12	0.01	0.08	0.05	0.06	0.02	0.04	0.02	0.01	0.00			0.01	0.00	0.05	0.02
13		0.03	0.03	0.02			0.02	0.02	0.00					0.01	
14		0.01	0.01		0.01	0.00			0.01					0.00	
15	0.02					0.01	0.01							0.00	
16+	0.01						0.01								
total	12.74	15.53	13.38	16.76	34.39	33.98	43.26	58.64	49.08	36.33	32.92	28.09	13.38	30.33	25.33
freq. 10+	0.66	0.64	0.48	0.47	0.35	0.16	0.31	0.26	0.12	0.17	0.05	0.09	0.12	0.28	0.19

The Tables 28 and 29 also show the abundance and biomass by age, corresponding at age greater or equal than five years in order to compare with XSA results.

Shrimp

Some errors were found in the catches recorded in the EU survey last year 2005 and corrected. Because of that the indexes presented in the Scientific Council Meeting of October-November (Casas *et al.*, 2005), have been changed, and in this paper the corrected shrimp indexes are presented.

Mean catch per tow by strata and its standard error are presented in Table 30. These indices are compared with results of previous surveys and summarised as follow:

Year	Mean catch per tow (kg)	Total Biomass (tons)	Biomass CL>20mm (tons)	Female Biomass (tons)	Female Meancatch per tow (kg)
1988	6.98	5615	5255	4525	5.63
1989	2.80	2252	2082	1359	1.69
1990	4.23	3405	2756	1363	1.69
1991	14.12	11352	10306	6365	7.91
1992	30.48	24508	23214	15472	19.24
1993	14.52	11673	8596	6923	8.61
1994 ¹	4.82	3879	3702	2945	3.66
1995	9.05	7276	6379	4857	6.04
1996	13.01	10461	8083	5132	6.38
1997	9.26	7449	6344	4885	6.07
1998 ²	48.95	39367	15562	11444	14.23
1999	30.70	24692	15073	13669	17.00
2000	23.63	19003	10649	10172	12.65
2001	33.83	27204	17462	13336	16.58
2002	45.40	36510	17319	17091	21.25
2003	26.22	21087	13070	11589	14.41
2004	25.10	20182	12027	12081	15.02
2005	38.14	30675	12915	14253	17.72

Mean length frequency by tow by sex and strata are presented in Tables 31 and 32. The results of the modal analysis (MIX) are also shown in the Table 33 and the mean catch at age per tow in the table 34. Catch per mile distribution is presented in Fig. 8.

Mean frequency at age per tow (10^5) in the historical series was:

Age	1988	1989	1990	1991	1992	1993	1994 ¹	1995	1996	1997	1998 ²	1999	2000	2001	2002	2003	2004	2005
1											1.17	0.02	0.11	0.03	2.25	0.18		
2	0.16	0.01		0.59					4.26	0.78	68.35	5.89	1.33	4.13	13.68	15.63	34.09	2.23
3	1.53	1.02	5.02	3.23	1.97	9.80	0.53	3.02	10.66	3.60	52.66	29.75	21.19	23.34	59.53	22.06	11.94	85.83
4	2.90	1.01	1.14	5.79	1.81	4.68	1.09	3.44	1.90	3.00	8.80	18.60	13.36	25.05	14.02	6.82	7.99	6.52
5	2.03	1.03	0.41	4.83	5.47	2.55	0.90	1.50	3.39	4.00	9.81	7.47	7.11	14.73	13.02	11.28	9.74	13.06
6	0.19	0.13	0.02	1.27	14.04	5.54	2.25	2.67	0.81	1.43	5.14	2.54	4.34	4.02	3.87	3.02	1.65	9.42
7				0.41	4.94	0.61	0.09	1.51	0.54	0.20	0.19	0.10	0.75	0.19	0.68	0.11	0.26	1.75
8																		
total	6.82	3.21	6.60	16.12	28.23	23.18	4.86	12.14	21.56	13.01	146.13	64.37	48.19	71.50	107.04	59.10	65.67	118.80

¹Codend mesh-size 40 mm.

²Codend mesh-size 25 mm.

Roughhead grenadier (*Macrourus berglax*)

Mean catch per tow (kg) along the EU survey series was:

year	EU	year	EU
1988	2.50	1997	1.49
1989	1.08	1998	2.10
1990	1.06	1999	1.55
1991	1.66	2000	1.30
1992	1.96	2001	2.59
1993	3.76	2002	1.51
1994	2.46	2003	2.92
1995	1.94	2004	4.47
1996	1.69	2005	2.97

Detailed results are presented by (Murua and González, 2006).

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Table 1 – Technical data of the 2005 survey.

Procedure	Specification
Vessel	R/V Vizconde de Eza
GT	1 400 t
Power	1 800 HP
Mean trawling speed	3.5 knots
Trawling time	30 minutes effective time
Fishing gear	type Lofoten
footrope / handrope	31.20 / 17.70 m
footgear	27 steel bobbins of 35 cm
vertical opening	3.0 m (SCANMAR)
warps	100 meters, 45 mm, 200 Kg/100m
trawl doors	polyvalent, 850 Kg
wire length	1.6 × depth echo sounder + 430 m
mesh size in cod-end	35 mm
Type of survey	Stratified sampling
Station selection procedure	Random
Criterion to change position of a selected tow	- unsuitable bottom for trawling according to ecosounder register. - Information on gear damage from previous surveys.
Criterion to reject data from tow	- tears in cod-end - severe tears in the gear - less than 20 minutes tow - bad behaviour of the gear
Daily period for fishing	6.00 to 22.00 hours
Species for sampling	All fish, squid and shrimp
Species for age determination	Cod, American plaice, redfish (<i>Sebastes mentella</i>), Greenland halibut and Roughhead grenadier (<i>Macrourus berglax</i>).

Table 2 – Mean catch per tow for several species or groups of species in 1988-2005 surveys (Kg) in depths lesser than 400 fathoms.

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Rajidae	5.59	2.41	3.51	5.05	4.7	7.76	4.36	2.82	2.55	2.29	2.46	2	1.43	2.78	1.92	5.73	7.76	5.27
<i>Synphobranchus sp.</i>	0.27	0.11	0.05	0.1	0.09	0.13	0.01	0.02	0	0.01	0.05	0	0	0.03	0.01	0.03	0.11	0.09
<i>Urophycis sp.</i>	0.8	0.21	0.21	0.32	0.09	0.21	0.27	0.1	0.1	0.04	0.28	0.31	0.21	0.49	0.16	0.68	0.83	0.92
<i>Antimora sp.</i>	0.49	0.38	0.35	0.7	0.9	1.02	0.99	0.24	0.23	0.29	0.61	0.36	0.33	0.83	0.43	0.38	1.44	1.38
Macrouiidae	3.84	1.81	1.52	2.8	3.22	8.08	4.02	3.24	2.91	2.85	3.52	2.9	2.25	3.83	2.54	4.59	6.11	4.17
<i>Notacanthus sp.</i>	0.62	0.51	0.08	0.59	0.56	0.92	0.57	0.43	0.22	0.36	0.21	0.08	0.12	0.13	0.08	0.03	0.18	0.08
<i>Illex sp.</i>	0.01	0.01	2.05	1.44	0.08	0	0.26	0	0.11	0.08	0.09	0.02	0	0.01	0.01	0.28	0.59	0.10
Anahichadidae	9.94	9.31	10.1	12.56	11.31	17.85	19.45	23.9	25.57	17.45	13.66	6.94	5.56	7.29	6.5	7.44	13.17	11.90
Witch flounder	1.13	0.42	0.52	0.96	1.02	1.3	0.98	0.88	0.63	0.4	0.3	0.47	0.51	0.57	0.26	1.05	1.95	2.21
Greenland halibut	8.61	5.56	7.21	10.16	10.85	8.12	9.99	13.52	14.42	20.02	30.13	26.37	21.09	17.25	15.05	7.73	15.28	14.55
Zoarcidae	0.7	1.42	1.5	2.46	1.69	4.32	2.33	2.71	2.12	2.15	2.56	1.11	0.97	1.55	1.01	2.57	4.58	3.83
Cod	50.78	141.82	73.82	50.05	33.22	75.81	32.91	12.06	11.21	12.39	6.20	3.55	3.81	3.35	3.10	1.98	5.06	6.52
American plaice	19.95	17.47	14.90	12.54	10.76	9.78	10.23	8.44	5.10	3.76	4.27	3.21	2.00	2.99	2.55	2.84	4.38	3.43
Redfish	234.19	202.11	157.62	95.69	161.91	90.29	202.10	108.98	148.80	206.19	88.08	122.67	221.33	96.18	150.85	116.66	311.62	563.35
Shrimp*	7.14	2.86	4.34	14.50	31.28	15.03	4.95	9.33	13.56	9.58	52.19	32.00	24.52	35.21	49.96	26.75	25.03	38.14
Others	0.79	0.26	1.42	0.83	0.53	0	0.59	0.49	0.86	0.73	1.38	0.77	1.98	1.8	1.16	7.03	3.39	2.09
Total	344.07	386.41	277.78	209.92	271.69	240.61	293.42	186.67	227.52	277.86	204.61	202.00	284.12	172.49	234.43	178.74	398.10	658.04

*) Values affected by mesh size cod-end: 40 mm in 1994, 25 mm in 1998 and 30 mm in 1999.

Table 5 – Cod mean catch per tow (Kg) by strata in 1988-2005 surveys.

depth in		year																	
stratum	fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	70- 80	51.62	24.91	31.67	214.33	2.9	19.79	83.11	59.97	38.62	9.32	4.81	3.81	9.57	3.31	18.31	6.64	72.16	41.87
2	81-100	158.97	161.67	32.32	85.91	80.67	141.64	128.21	47.61	62.5	32.08	29.75	23.52	11.6	7.68	11.53	1.6	24.89	29.57
3	101-140	93.43	214.78	45.84	51.39	177.06	176.28	127.32	23.96	22.01	23.66	14.67	3.05	7.51	4.82	9.41	1.88	0.19	37.43
4	"	118.03	182.67	97.7	109.36	129.88	534.46	71.11	28.12	40.26	32.32	5.26	0.97	16.72	18.43	2.5	5.13	5.51	5.72
5	"	39.78	199.81	158.89	198.86	85.31	127.41	17.26	23.78	17.49	21.47	18.2	4.77	7.92	4.85	2.74	5.66	0.28	0.56
6	"	85.49	179.66	87.5	40.5	25.21	111.67	37.36	34.64	16.42	28.44	16.22	9.93	13.53	19.83	13.88	0.64	3.86	5.44
7	141-200	35.5	255.88	62.9	40.53	15.09	98.24	13.67	1.95	0.87	17.05	1.24	0.82	0.09	0.2	0.38	1.71	0.29	
8	"	181.45	333.89	342.16	103.75	47.72	161.79	73.45	7.08	1.9	32.71	1.56	0.47	1.48	2.5	0.76	2.26	0.09	
9	"	7.68	219.91	270.98	7.87	5.98	41.69	10	0.37	4.3	7.28		0.8	1.72		0.58	15.72		
10	"	18.47	67.6	64.58	21.51	4.51	12.92	6.98	0.8	0.64	4.16	2.74	1.41	1.47	1.11	0.03	0.33		0.38
11	"	40.8	215.27	66.37	29.1	3.66	27.33	9.47	1.28	0.67	5.06	2.86	4.16	1.72	2.84	0.3	0.93	0.46	0.92
12	201-300	6.57	48.37	31.84	2.47			0.47									1.39		
13	"	0.44	133.59	39.93	4.94														
14	"	2.33	24.43	14	2.85	1.46	4.81											0	
15		14.74	166.25	46.32	2.13													0.35	
16	301-400		1.35																
17			0.31				0.14												
18		0.13					0.18												
19			3.19																
total		50.78	141.95	75.71	50.05	33.22	76.08	32.91	12.05	11.21	12.39	6.2	3.55	3.81	3.35	3.1	1.98	5.06	6.52
s.e.		7.19	15.18	10.23	8.34	7.26	21.63	9.16	2.57	1.81	2.14	0.8	0.56	0.74	0.47	0.49	0.34	0.97	2.02

s.e.: standard error

Table 8 – American plaice mean catch pertow by strata and its standard error in the 2005 survey.

stratum	area sq. miles	tow number	catch pertow (Kg)	
			mean	st. error
1	342	4	39.83	47.59
2	838	10	12.47	11.81
3	628	7	2.11	3.26
4	348	4	13.55	7.48
5	703	8	0.85	0.84
6	496	6	1.88	2.77
7	822	9	0.49	1.03
8	646	7	3.56	5.19
9	314	3	0.74	1.29
10	951	11	1.20	1.56
11	806	9	0.57	0.83
12	670	8		
13	249	3		
14	602	7		
15	666	5	0.09	0.19
16	634	7		
17	216	2		
18	210	2		
19	414	5		
total	10555	117	3.43	
s.error			0.85	

Table 9 – American plaice mean frequency at age per tow in the 2005 survey.

age	stratum												total	mean weight g	mean length cm	
	1	2	3	4	5	6	7	8	9	10	11	15				
1																
2		0.12	0.22		0.20						0.05		0.04	88	21	
3	0.21	0.33	0.30	0.74	0.36	0.04	0.04			0.24	0.15		0.14	170	26	
4	1.32	0.98	0.19	2.10	0.59	0.35	0.25	0.08		0.56	0.25	0.12	0.36	280	31	
5	0.74	0.46	0.10	0.71	0.18	0.04	0.06	0.04		0.14	0.06	0.06	0.13	378	34	
6	1.78	0.39	0.05	0.17	0.10	0.12	0.03	0.09		0.06	0.08	0.06	0.13	505	37	
7	2.16	0.50	0.07	0.26	0.10	0.18	0.02	0.10		0.07	0.07	0.03	0.16	621	39	
8	2.34	0.35	0.04	0.13	0.02	0.05	0.02			0.10	0.02		0.13	596	39	
9	5.16	0.90	0.05	0.43	0.07	0.15	0.01	0.07		0.05	0.04		0.28	721	41	
10	4.51	0.87	0.05	0.33	0.05	0.14	0.01	0.07		0.04	0.03		0.25	752	42	
11	5.11	0.98	0.06	0.40	0.06	0.14	0.01	0.06	0.01	0.04	0.03		0.28	767	42	
12	5.93	1.02	0.09	0.57	0.02	0.08	0.02	0.08	0.03	0.04	0.02		0.31	798	43	
13	7.46	1.52	0.16	1.10	0.04	0.17	0.03	0.17	0.05	0.08	0.02		0.44	856	44	
14	8.51	1.57	0.17	1.21	0.06	0.12	0.08	0.26	0.08	0.07	0.05		0.49	885	44	
15	4.28	1.11	0.19	1.21	0.04	0.13	0.01	0.31	0.05	0.07	0.02		0.32	1014	45	
16+	5.08	2.78	0.71	3.73	0.07	0.28	0.08	1.13	0.20	0.24	0.07		0.68	1368	51	

Table 10 – American plaice mean catch per tow (Kg) by strata in 1988-2005 surveys.

stratum	depth in		year																	
	fathoms		1988	1989	1990	1991	1992	1993	1984	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	70- 80		50.09	38.38	19.4	41.37	27.24	41.42	25.4	85.58	56.1	14.64	5.99	14.3	13.24	40.02	5.41	49.58	52.62	39.83
2	81-100		44.54	56.42	21.52	41.71	26.84	19.84	18.76	20.91	14.78	11.6	24.86	28.34	15.3	13.07	19.76	11.36	11.52	12.47
3	101-140		28.57	23.35	34.86	26.06	13.18	9.27	6.8	5.27	3.52	10.34	5.95	2.04	0.44	1.93	1.55	0.36	8.9	2.11
4	"		82.92	17.43	30.81	12.07	21	21.56	32.19	18.46	10.12	7.65	12.92	2.03	3.77	3.24	4.85		13.21	13.55
5	"		48.53	57.74	34.15	26.26	15.64	24.1	22.95	10.26	9.32	11.55	13.88	1.37	1.05	2.08	3.55	1.53	1.27	0.85
6	"		12.68	29.9	25.22	13.28	15.91	8.07	21.39	3.24	0.84	0.36	0.93	1.05	0.65	0.97	1.65	0.77	0.61	1.88
7	141-200		18.74	8.47	13.38	6.21	10.2	5.09	5.04	3.97	1.15	1.32	0.75	0.29	0.23	0.45	0.84	0.48	1.24	0.49
8	"		8.49	3.33	5.35	5.08	14.78	9.9	3.47	2.67	1.15	2.49	3.35	0.04		0.93	0.87	0.28	1.08	3.56
9	"		4.29	6.83	14.34		15.59	8.57	0.81	20.91	2.31	1.48					0.05	0.38	2.99	0.74
10	"		32.07	20.56	27.62	18.06	19.4	20.14	30.86	9.78	5.72	3.96	0.49	1	0.61	1.31	0.49	0.75	0.58	1.20
11	"		19.3	19.02	21.44	6.53	6.07	4.75	4.93	1.79	1.09	0.52	0.48	0.61	0.36	0.44	0.95	0.47	1.03	0.57
12	201-300		0.17	0.36	0.88	0.33	0.21	0.29	0.65	0.23	0.63	0.13				0.08			0.22	
13	"		0.11		1.08					0.13										
14	"		0.16	0.19	0.13	8.49	0.63	0.12	0.52	0.31	0.09		0.09	0.21						
15	"		0.44	1.95	0.05	1.91	0.75	2.16	0.79	1.35	0.44	0.13	0.13					0.12		0.09
16	301-400		0.12			0.07	0.19	0.27	0.12											
17	"																			
18	"																			
19	"					0.47	0.11	0.17	0.08	0.32										
total			19.95	17.47	14.9	12.55	10.76	9.79	10.23	8.44	5.09	3.76	4.27	3.21	2	2.99	2.55	2.86	4.38	3.43
s.e.			2.29	2.55	1.59	1.47	1.19	1.29	1.71	1.35	1.13	0.88	0.93	1.08	0.41	0.53	0.91	0.93	0.92	0.85

Table 11 – American plaice mean length frequency per tow in the 2005 survey.

length	male	female	length	male	female	length	male	female	length	male	female
12-13		0.01	24-25		0.03	36-37	0.30	0.01	48-49	0.04	0.18
14-15	0.01		26-27	0.02	0.03	38-39	0.50	0.02	50-51		0.25
16-17	0.01	0.04	28-29	0.06		40-41	0.50	0.02	52-53		0.32
18-19		0.01	30-31	0.14	0.04	42-43	0.39	0.07	54-55		0.14
20-21	0.01		32-33	0.12	0.10	44-45	0.19	0.10	56-57		0.13
22-23	0.01	0.04	34-35	0.13	0.04	46-47	0.03	0.14	58-59		0.02

Table 12 – American plaice age-length key in 2005.**MALE**

Length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
18-19																		1
20-21		1																1
22-23		1																1
24-25																		0
26-27			2															2
28-29			2	3														5
30-31			1	8														9
32-33				4	2	2	1											9
34-35					2	2	2		1		1		1		1			10
36-37						2	2	3	3	2	1	1	1	4	1			20
38-39						1	1	3	2	2	3	4	3	5	3	2		29
40-41									3	4	1	3	7	7	4	2		31
42-43									2	3	5	7	8	4	1	2		32
44-45									2		2	1		1		1		7
46-47										1	1						1	3
48-49										1			1				1	3
50-51																		
52-53																		
54-55																		
56-57																		
58-59																		
total		2	5	15	4	7	6	6	13	13	14	16	21	21	10	9		162

FEMALE

Length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
18-19		1																1
20-21																		
22-23			4															4
24-25		1	2															3
26-27			1	2														3
28-29																		
30-31				3	1													4
32-33			1	6	3													10
34-35				2	2													4
36-37				1														1
38-39					1		1											2
40-41					1			1										2
42-43						2	2		1	1	1							7
44-45						1	2		2	2	2							10
46-47							1	2	1	1	1	2	3	1	1	2		15
48-49							1		1	1	1	1	2	3	2	6		18
50-51									1	1		2	5	3	5	9		26
52-53											1	2	4	6	4	16		33
54-55														1	2	11		14
56-57														1	2	9		13
58-59															1	1		2
Total		2	8	14	8	3	7	3	6	6	6	7	14	16	16	54		172

Table 13 – Redfish (*Sebastes marinus*) mean catch per tow by strata and its standard error in the 2005 survey.

stratum	area sq. miles	tow number	catch pertow (Kg)	
			mean	st. error
1	342	4	12.11	10.41
2	838	10	92.32	236.19
3	628	7	219.13	154.89
4	348	4	28.20	25.20
5	703	8	1725.19	3358.75
6	496	6	173.12	331.81
7	822	9	92.62	92.02
8	646	7	40.36	71.52
9	314	3	84.61	108.71
10	951	11	237.02	621.20
11	806	9	63.16	54.86
12	670	8	1.66	2.56
13	249	3	3.87	5.51
14	602	7	3.98	3.46
15	666	5	1.47	0.78
16	634	7	0.03	0.08
17	216	2		
18	210	2		
19	414	5	0.54	1.22
total	10555	117	183.65	
s.error			81.50	

Table 14 – Redfish (*Sebastes marinus*) mean length frequency pertow ('000) in the 2005 survey.

length	male	female	length	male	female
11	0.00	0.00	27	7.35	8.31
12	0.04	0.00	28	1.87	5.09
13	0.30	0.19	29	2.03	1.72
14	0.80	0.20	30	1.44	0.88
15	3.23	1.02	31	1.31	0.39
16	6.63	6.04	32	2.06	0.40
17	13.62	11.91	33	2.04	0.63
18	17.58	16.63	34	1.36	0.35
19	21.08	22.43	35	0.76	1.18
20	42.28	28.05	36	0.87	0.86
21	52.59	50.56	37	0.44	1.21
22	68.75	71.99	38	0.39	0.01
23	94.52	99.80	39	0.05	1.18
24	81.73	68.22	40	0.00	0.24
25	47.35	51.51	41	0.00	0.34
26	19.90	16.09	42	0.00	1.18

Table 15 – Redfish (*Sebastes mentella*) mean catch pertow and its standard error by in the 2005 survey.

stratum	area sq. miles	tow number	catch pertow (Kg)	
			mean	st. error
1	342	4		
2	838	10	0.02	0.05
3	628	7	3.99	4.11
4	348	4	22.22	36.15
5	703	8	52.22	92.52
6	496	6	6.63	7.04
7	822	9	74.35	42.91
8	646	7	132.12	235.39
9	314	3	2193.29	2063.52
10	951	11	191.20	122.48
11	806	9	121.30	75.42
12	670	8	38.89	37.44
13	249	3	76.94	53.71
14	602	7	241.58	116.95
15	666	5	26.50	14.93
16	634	7	2.65	1.81
17	216	2	2.79	1.16
18	210	2	17.53	21.09
19	414	5	3.65	4.50
total	10555	117	130.82	
s.error			36.26	

Table 16 – Redfish (*Sebastes mentella*) mean length frequency per tow ('000) in the 2005 survey.

length	male	female	length	male	female	length	male	female
13	0.10	0.29	24	33.74	31.39	35	0.14	0.26
14	1.55	0.70	25	12.39	16.63	36	0.12	0.10
15	4.31	2.42	26	10.66	13.16	37	0.04	
16	20.08	13.33	27	7.88	5.52	38	0.01	0.02
17	26.40	19.90	28	8.23	1.42	39	0.02	
18	43.51	31.29	29	5.66	1.27	40		
19	44.32	38.21	30	3.92	2.88	41		
20	38.24	45.92	31	1.03	1.60	42		
21	59.63	45.79	32	0.31	2.44	43		
22	89.21	55.20	33	0.09	1.21	44		
23	60.20	58.92	34	0.06	0.75	45		

Table 17 – Redfish (*Sebastes mentella*) mean frequency ('000) at age pertow in the 2005 survey.

Age	Strata																		Total (1-19)	Mean length cm.	Mean weight g.	
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20				
2			38		18	2	19		18	16									6	15	44	
3		2	62	124	19	41	175	139	257	128	1	1		1					1	62	17	66
4		8	47	209	17	115	269	1073	457	235	4	6	6	10	1				5	135	19	92
5		5	33	127	7	131	223	1766	397	227	10	15	25	27	1			1	7	144	20	114
6		8	32	71	14	240	333	6558	540	395	55	91	206	94	2				9	344	22	154
7		1	5	4	2	34	52	2276	75	53	29	62	125	22	1				1	97	24	191
8		1	1			3	4	815	5	2	21	51	143	5	1			1		37	26	243
9						2	1	116		3	16	31	134	2	1			4	1	14	28	303
10						1		45		1	10	19	105	1	1			4	1	9	29	337
11						1		23			5	8	38	1	1			5		4	31	406
12								17			4	9	46	1				4		4	31	435
13											2	4	29	1				2		2	31	418
14											1	3	7				1	4		1	34	552
15											4	7	38	1	1		2	8		3	31	436
16																		1			35	625
17													1					1			35	628
18																						
19																						
20																						
21																						
22																						
25+																						
Total		26	219	536	77	571	1076	12827	1750	1059	162	311	903	166	9	4	35	26	860	21.3	147	

Table 18 – Redfish (*Sebastes mentella*) age-length key applied to length data in 2005 survey.

length cm	ages																				Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
12	1																				1
13	5																				5
14	7	1																			8
15	7	5																			12
16		8	2																		10
17		6	7	1																	14
18		2	9	4	1																16
19			6	5	1																12
20			3	6	4																13
21			1	6	9																16
22				1	12	2															15
23					9	3															12
24					7	4	1														12
25					1	5	2														8
26						3	5	1													9
27						1	4	2	1												8
28							2	6	1												9
29								3	6	1		1		1							12
30								3	4	4	3										14
31									1	1	2	1		2							7
32										4	2	1	1	3							11
33										3	4		1								8
34											1	1	1	2							5
35												1	1	4	1	1					8
36													2	4	1						7
37														2				1			3
38													1				1				2
39																1	1			1	3
Total	20	22	28	23	44	18	14	15	13	13	12	5	7	18	2	2	2	1	1	20	260

Table 19 – Redfish (*Sebastes fasciatus*) mean catch per tow by strata in the 2005 survey.

stratum	area	tow	catch pertow (Kg)	
	sq. miles	number	mean	st. error
1	342	4	0.46	0.57
2	838	10	99.72	283.10
3	628	7	117.72	66.53
4	348	4	79.25	74.93
5	703	8	583.42	426.51
6	496	6	170.20	279.53
7	822	9	156.84	79.73
8	646	7	118.31	63.32
9	314	3	186.85	202.72
10	951	11	501.99	1067.23
11	806	9	180.52	163.23
12	670	8	24.31	35.75
13	249	3	24.35	16.28
14	602	7	21.57	10.74
15	666	5	24.82	16.28
16	634	7	0.63	0.47
17	216	2		
18	210	2	1.10	0.25
19	414	5	2.57	1.76
total	10555	117	153.51	
s.error			32.58	

Table 20 – Redfish (*Sebastes fasciatus*) mean length frequency per tow ('000) in the 2005 survey.

length	male	female	length	male	female	length	male	female	length	male	female
13	0.40	0.91	20	66.68	67.04	27	0.45	9.89	34	0.00	0.14
14	9.77	7.39	21	55.93	48.26	28	0.19	6.32	35		
15	51.73	50.88	22	50.65	35.13	29	0.05	4.40	36		
16	118.11	90.76	23	30.22	21.34	30	0.04	3.27	37		
17	105.15	98.45	24	15.33	24.67	31	0.00	1.58	38		
18	90.49	89.31	25	4.17	20.17	32	0.00	1.04	39		
19	79.98	71.77	26	1.96	15.64	33	0.02	0.07	40		

Table 21 – Juvenile redfish (*Sebastes sp.*) mean catch per tow by strata and its standard error in the 2005 survey.

stratum	area sq. miles	tow number	catch pertow (Kg)	
			mean	st. error
1	342	4	5.47	6.15
2	838	10	92.35	237.31
3	628	7	264.87	484.61
4	348	4	82.07	110.52
5	703	8	832.75	1722.67
6	496	6	133.24	162.93
7	822	9	13.51	11.07
8	646	7	9.42	15.11
9	314	3	25.61	20.32
10	951	11	36.42	39.02
11	806	9	26.14	25.33
12	670	8		
13	249	3		
14	602	7	0.08	0.22
15	666	5		
16	634	7		
17	216	2		
18	210	2		
19	414	5		
total	10555	117	95.37	
s.error			42.60	

Table 22– Juvenile redfish (*Sebastes sp.*) mean length frequency per tow ('000) in the 2005 survey.

length		length	
7	0.62	13	385.61
8	7.09	14	689.14
9	10.94	15	518.53
10	14.18	16	166.88
11	58.44	17	27.73
12	138.77	18	1.37

Table 23 – Greenland halibut (*Reinhardtius hippoglossoides*) mean catch per tow by strata and its standard error in the 2005 survey.

stratum	Area sq. miles	tow number	catch pertow (Kg)	
			mean	st. error
1	342	4		
2	838	10	0.11	0.36
3	628	7	8.69	8.77
4	348	4	3.42	2.46
5	703	8	5.22	6.15
6	496	6	8.79	7.94
7	822	9	9.52	2.29
8	646	7	18.97	9.94
9	314	3	3.81	1.94
10	951	11	14.61	5.85
11	806	9	17.31	5.85
12	670	8	19.99	8.79
13	249	3	16.37	1.70
14	602	7	13.48	4.10
15	666	5	34.43	15.66
16	634	7	28.09	11.40
17	216	2	26.05	0.52
18	210	2	27.11	12.38
19	414	5	29.00	16.60
total	10555	117	14.55	
s. error			0.78	

Table 24 – Greenland halibut (*Reinhardtius hippoglossoides*) mean length frequency ('000) per tow in the 2005 survey.

length	male	female	length	male	female	length	male	female	length	male	female
10-11			30-31	0.38	0.70	50-51	0.27	0.77	70-71		
12-13			32-33	0.29	0.35	52-53	0.14	0.43	72-73		
14-15	0.05	0.02	34-35	0.69	0.49	54-55	0.09	0.23	74-75		
16-17	0.17	0.25	36-37	0.90	0.92	56-57	0.03	0.15	76-77		
18-19	0.08	0.28	38-39	0.97	1.29	58-59	0.04	0.13	78-79		
20-21		0.03	40-41	1.07	1.59	60-61	0.02	0.04	80-81		
22-23	0.02	0.04	42-43	1.06	2.01	62-63	0.02	0.02	82-83		
24-25	0.12	0.11	44-45	0.87	1.66	64-65		0.06	84-85		
26-27	0.54	0.44	46-47	0.71	1.55	66-67					
28-29	0.92	0.97	48-49	0.42	0.94	68-69		0.03			

Table 26 - Greenland halibut (*Reinhardtius hippoglossoides*) age-length key in the 2005 survey.**MALE**

Length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
12-13																		
14-15		2																2
16-17	9	2																11
18-19	1	2																3
20-21																		
22-23			1															1
24-25		2	5	1														8
26-27		4	23	2														29
28-29		6	23	1														30
30-31			9	8														17
32-33				12	6													18
34-35			1	15	13	1												30
36-37				4	23	3												30
38-39				5	23	4												32
40-41					17	12												29
42-43					11	19												30
44-45					9	17	3											29
46-47					3	22	7											32
48-49						16	14											30
50-51						4	22	5										31
52-53							18	4										22
54-55							10	8										18
56-57							5	8										13
58-59								5	3	3								11
60-61									3	5								8
62-63										2								2
64-65											1							1
66-67											1							1
total	10	18	62	48	105	98	79	30	6	10	2							468

Table 26 – (continued)

FEMALE

length cm	age																total		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+			
12-13																			
14-15	2																	2	
16-17	12	3																15	
18-19	11	10																21	
20-21		3																3	
22-23		1	2															3	
24-25		1	6															7	
26-27		3	21	1														25	
28-29		3	25	3														31	
30-31			16	13														29	
32-33			4	12	6													22	
34-35				8	17													25	
36-37				5	23	1												29	
38-39				9	18	3												30	
40-41				1	15	12	1											29	
42-43				1	12	23	1											37	
44-45					6	33	2											41	
46-47					1	21	9											31	
48-49					1	15	15	1										32	
50-51					1	4	22	3										30	
52-53							22	9										31	
54-55								14	15	1								30	
56-57								8	18	4								30	
58-59								4	8	14	4							30	
60-61										6	14	5						25	
62-63											18	6						24	
64-65											8	10	1					19	
66-67												7	2	1				10	
68-69												4	6					10	
70-71													3	1				4	
72-73												1	7	3				11	
74-75													2	3	1			6	
76-77													1	1				2	
78-79													1	2	1			4	
80-81														1				2	
82-83															2			2	
80-81															1	1		2	
82-83															2			2	
84-85																1		1	
86-87																	1	1	
88-89																			
90-91																		1	1
total	25	24	74	53	100	112	98	54	25	44	33	24	11	8	2	2		689	

Table 27 – Greenland halibut (*Reinhardtius hippoglossoides*) mean catch pertow (Kg) by strata in 1988-2005 surveys.

strata	depth in fathoms	year																	
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	70- 80																0	0.08	
2	81-100		0.04	0.1					1.89		0.04	0.09	0.05		0.24	0.16	0	0.16	0.11
3	101-140	0.55	0.66	0.16	0.17	0.38	0.06		0.46	2.25	1.9	7.67	7.27	5.09	8.03	2.93	1.15	17.58	8.69
4	"	5.45	0.76		0.57	1.04	0.39		0.2	0.02	0.87	1.55	7.46	7.81	5.92	2.19	3.96	11.91	3.42
5	"	1.39	1.81		0.53	0.77	0.01	0.03	0.4	0.67	1.82	3.22	7.65	5.72	5.01	1.24	1.72	4.19	5.22
6	"	0.84	0.48	0.4	0.34	0.22	0.42		0.84	2.8	6.02	9.54	7.94	4.69	7.02	2.74	0.56	11.58	8.79
7	141-200	1.36	1.01	0.92	3.01	3.92	1.5	3.42	14.44	18.33	22.74	41.63	37.61	25.06	15.68	6.85	6.61	15.46	9.52
8	"	3.07	4.51	1.25	3.65	7.7	2.84	0.92	6.77	7.28	21.64	20.09	40.51	26.74	22.84	17.83	10.3	15.69	18.97
9	"	7.53	6.86	2.21	3.17	13.48	1.29	1.8	7.45	6.66	10.63	19.72	14.79	10.22	14.84	5.8	5.85	18.07	3.81
10	"	1.48	1.14	0.8	2.37	4.99	0.44	3.23	7.25	9.89	11.89	18.9	21.08	22.11	24.06	10.26	3.95	9.1	14.61
11	"	0.73	0.99	0.37	1.72	3.72	3.81	3.84	8.01	10.91	10.21	19.99	21.5	17.73	16.63	5.52	4.51	9.33	17.31
12	201-300	7.94	12.68	5.64	14.9	12.12	18.27	23.88	22.46	41.6	44.04	60.3	71.74	42.59	31	21.27	13.18	14.73	19.99
13	"	3.38	6.51	11.49	2.29	1.26	7.53	8.06	6.7	15.69	25.47	29.21	51.59	20.15	15.29	27.47	3.22	18.2	16.37
14	"	8.01	6.58	6.2	17.16	18.48	7.12	13.51	8.95	19.67	34.64	31.86	23.54	10.7	19.11	23.57	19.3	29.46	13.48
15	"	8.57	3.32	10.35	19.18	12.67	27.15	29.41	34.84	28.52	53	79.91	58.86	52.95	31.86	24.31	11.96	19.57	34.43
16	301-400	28.43	28.22	52.65	52.31	37.8	45.03	31.55	38.53	43.43	36.65	69.46	23.65	41.72	27.48	45.17	13.1	19.09	28.09
17	"	16.18	7.26	7.71	25.16	2.44	12.01	45.1	45.07	15.66	31.93	44.75	36.7	30.28	10.29	12.42	8.99	11.8	26.05
18	"	6.58	3.08	31.63	22.08	3.65	8.15	24.13	59.86	11.95	34.78	48.43	58.21	11.21	35.9	43.36	66.38	34.4	27.11
19	"	97.13	29.6	32.52	48.26	96.24	42.54	35.69	38.99	30.78	49.58	82.51	32.19	56.24	35.48	69.55	7.86	16.27	29.00
total		8.62	5.56	7.21	10.16	10.85	8.93	10	13.52	14.42	20.01	30.13	26.37	21.08	17.25	15.05	7.73	15.28	14.55
s.e.		0.95	0.49	1.01	1.02	1.73	1.19	0.84	1.52	1.1	1.41	1.68	1.89	1.15	0.97	0.82	0.76	0.99	0.78

Table 28 – Greenland halibut (*Reinhardtius hippoglossoides*) abundance ('000) by age in 1991-2005 surveys.

AGE	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	1302	1677	1423	1429	9978	4699	2674	2200	852	3014	6459	3282	1768	1762	437
2	207	1260	1245	996	2045	6408	3036	1716	563	235	1153	2364	804	2644	652
3	348	447	777	1365	1793	1942	4822	6180	2419	479	1456	2248	489	3517	2554
4	1054	1023	692	1435	1535	2442	5225	8843	8419	1741	799	1342	1217	1585	2007
5	2307	1852	1021	1545	2136	3380	5714	9919	10787	5703	2242	3045	1991	5601	5537
6	1291	2249	1545	2385	4099	4680	6800	9085	10119	11336	6262	4498	2362	6271	6105
7	2212	1947	1627	2139	3029	2001	4014	6304	4467	4346	5328	4610	1552	2040	2345
8	534	1054	1266	1180	1706	1299	1731	2108	1466	1865	2584	1025	375	518	491
9	462	468	776	631	1052	341	528	600	280	361	147	104	105	233	89
10	352	273	213	219	209	70	177	157	82	92	36	48	79	107	97
11	141	138	104	90	53	21	23	27	6	44	5	16	15	63	44
12	12	67	38	47	18	31	17	6	3	0	0	6	4	38	15
13	0	25	21	18	0	0	17	16	3	0	0	0	0	5	3
14	0	12	9	0	5	4	0	0	5	0	0	0	0	3	3
15	15	0	0	0	0	5	6	0	0	0	0	0	0	3	3
16+	8	0	0	0	0	0	9	0	0	0	0	0	0	3	3
TOTAL ('000)	10245	12490	10757	13479	27659	27323	34792	47160	39470	29216	26471	22587	10762	24390	20374
N5+('000)	7334	8084	6620	8254	12307	11832	19035	28221	27217	23747	16605	13352	6483	14884	14734

Table 29 – Greenland halibut (*Reinhardtius hippoglossoides*) biomass (ton.) by age in 1991-2005 surveys.

AGE	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	37	65	43	50	376	161	87	91	29	107	270	105	49	71	16
2	20	170	136	114	249	961	386	246	76	26	176	315	85	138	72
3	256	134	160	374	386	466	1200	1802	596	93	337	404	116	560	455
4	609	640	204	602	530	1006	1821	3472	3302	633	326	506	456	487	676
5	1619	1403	510	845	984	1872	2653	4960	5338	2709	1149	1649	1116	2634	2818
6	1231	1930	1085	1631	2490	3233	4057	5746	6274	7162	4200	3202	1877	4179	4390
7	2502	1895	1418	1782	2299	1748	3101	4763	3576	3539	4470	4427	1745	2118	2408
8	666	1169	1344	1231	1683	1415	1727	2109	1481	1977	2570	1222	511	725	657
9	471	590	979	811	1341	473	714	726	376	437	222	161	178	385	153
10	446	358	314	344	348	113	280	214	148	150	66	93	157	211	199
11	221	202	185	157	104	57	64	36	11	88	13	32	37	134	106
12	33	108	71	60	41	57	32	9	8	0	0	15	11	86	43
13	0	46	48	35	0	0	36	34	8	0	0	0	0	20	0
14	0	16	36	0	15	20	0	0	14	0	0	0	0	13	0
15	51	0	0	0	0	19	13	0	0	0	0	0	0	0	0
16+	34	0	0	0	0	0	30	0	0	0	0	0	0	13	0
TOTAL (ton.)	8157	8722	6520	8033	10857	11574	16088	24218	21200	16945	13855	12084	6338	11719	12021
Biomass 5+	7274	7716	5990	6896	9307	9007	12708	18596	17233	16062	12691	10802	5632	10519	10774

Table 30 – Shrimp (*Pandalus borealis*) mean catch per tow by strata and its standard error in the 2005 survey.

stratum	Area sq. miles	tow number	catch per tow (Kg)	
			mean	st. error
1	342	4		
2	838	10	3.02	4.34
3	628	7	25.22	28.45
4	348	4	103.30	130.44
5	703	8	15.81	17.50
6	496	6	28.58	23.56
7	822	9	51.12	16.34
8	646	7	116.76	48.28
9	314	3	33.78	17.75
10	951	11	40.50	21.39
11	806	9	44.42	6.95
12	670	8	38.79	29.54
13	249	3	47.62	15.34
14	602	7	59.96	19.26
15	666	5	27.07	9.83
16	634	7	32.86	44.01
17	216	2	0.60	0.84
18	210	2	3.48	1.53
19	414	5	16.80	6.30
total	10555	117	38.14	
s. error			3.01	

Table 31. Shrimp mean length frequencies ($\times 10^5$) per tow and percentages by sex and maturity stage on Flemish Cap 2005.

LENGTH (mmCL)	MALES	FEMALES		
		Primiparous	Multiparous	Ovigerous
7.5	0.01			
8	0.03			
8.5	0.01			
9	0.03			
9.5	0.04			
10	0.01			
10.5	0.03			
11	0.10			
11.5	0.10			
12	0.29			
12.5	0.50			
13	0.85			
13.5	1.34			
14	2.27			
14.5	3.79			
15	7.13	0.03		
15.5	11.04	0.01		
16	15.40	0.09		
16.5	14.28	0.07		
17	12.81	0.17		
17.5	8.08	0.35		
18	4.70	0.41		
18.5	2.16	0.68		
19	1.23	0.79	0.05	
19.5	0.39	1.26	0.10	
20	0.35	1.41	0.21	
20.5	0.29	1.48	0.37	
21	0.25	1.90	0.58	
21.5	0.18	1.95	0.76	
22	0.07	1.93	1.06	
22.5	0.03	1.47	1.01	
23	0.01	1.21	1.35	
23.5		0.63	1.28	0.01
24		0.45	1.44	0.01
24.5		0.29	1.26	
25		0.20	0.93	
25.5		0.08	0.79	
26		0.05	0.50	
26.5		0.01	0.31	
27			0.22	
27.5			0.17	
28			0.08	
28.5			0.05	
29			0.01	
29.5			0.01	
30				
30.5			0.01	
31				
Total	87.80	16.90	12.56	0.03
Percentage	74.86	14.41	10.71	0.02

Table 32. Shrimp mean length frequencies ($\times 10^5$) per tow by strata in 2005 on Flemish Cap survey.

mm (CL)	STRATA																			Total
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
7.5		0.01																		0.01
8		0.01	0.01																	0.03
8.5		0.01																		0.01
9			0.02																	0.03
9.5		0.01					0.03													0.04
10		0.01																		0.01
10.5	0.01	0.01																		0.03
11	0.01		0.04		0.01		0.04													0.11
11.5	0.03	0.03	0.01		0.01		0.01													0.09
12	0.05	0.07	0.02	0.01	0.03		0.05		0.03				0.01							0.28
12.5	0.08	0.11	0.02	0.04	0.04		0.14		0.04	0.01	0.01		0.01							0.51
13	0.23	0.11	0.10	0.01	0.08	0.04	0.09	0.01	0.09	0.04	0.01		0.04							0.85
13.5	0.29	0.16	0.21	0.08	0.12	0.04	0.12		0.14	0.08	0.03		0.06							1.34
14	0.35	0.22	0.23	0.13	0.17	0.09	0.51	0.03	0.26	0.09	0.03		0.16							2.28
14.5	0.20	0.40	0.65	0.35	0.22	0.15	0.77	0.03	0.40	0.18	0.10	0.01	0.29							3.81
15	0.15	0.76	1.22	0.38	0.38	0.42	1.69	0.10	0.86	0.31	0.25	0.03	0.48	0.03						7.15
15.5	0.07	0.76	2.22	0.62	0.47	0.71	2.85	0.09	1.20	0.69	0.60	0.10	0.47	0.03	0.01					11.08
16	0.07	0.97	3.18	0.38	0.53	1.37	4.57	0.21	1.44	0.94	0.59	0.12	0.73	0.15	0.01					15.52
16.5	0.03	0.85	2.54	0.27	0.39	1.46	3.95	0.15	1.32	1.11	0.84	0.30	0.64	0.25	0.05			0.01		14.36
17	0.03	0.46	1.92	0.12	0.33	1.90	3.57	0.13	1.07	1.08	0.67	0.42	0.60	0.47	0.05			0.03		13.00
17.5	0.03	0.18	1.11	0.06	0.17	1.35	2.10	0.15	0.58	0.81	0.71	0.29	0.32	0.44	0.04			0.06		8.45
18	0.01	0.11	0.25	0.05	0.09	0.80	1.42	0.13	0.33	0.45	0.50	0.22	0.26	0.39	0.05			0.07		5.13
18.5		0.05	0.27	0.01	0.04	0.48	0.47	0.10	0.21	0.25	0.27	0.15	0.16	0.27	0.07			0.06		2.85
19		0.03	0.17	0.04	0.04	0.31	0.42	0.04	0.14	0.16	0.14	0.11	0.17	0.21	0.07			0.06		2.10
19.5		0.03	0.06	0.10	0.05	0.23	0.39	0.07	0.21	0.13	0.14	0.10	0.08	0.12	0.04			0.03		1.77
20		0.08	0.04	0.10	0.07	0.20	0.31	0.16	0.20	0.15	0.14	0.08	0.22	0.12	0.05			0.04		1.96
20.5		0.08	0.05	0.09	0.09	0.21	0.33	0.13	0.21	0.16	0.25	0.10	0.17	0.12	0.11			0.06		2.14
21		0.11	0.06	0.09	0.09	0.24	0.39	0.21	0.40	0.24	0.15	0.21	0.25	0.15	0.15			0.06		2.77
21.5		0.07	0.10	0.10	0.09	0.31	0.51	0.15	0.24	0.28	0.25	0.15	0.29	0.17	0.14			0.06		2.87
22		0.07	0.06	0.10	0.08	0.28	0.43	0.22	0.35	0.30	0.21	0.14	0.35	0.27	0.18			0.04		3.06
22.5		0.08	0.01	0.08	0.09	0.28	0.18	0.07	0.26	0.30	0.21	0.14	0.32	0.23	0.19			0.03		2.47
23		0.04	0.07	0.12	0.08	0.24	0.33	0.06	0.25	0.30	0.18	0.08	0.34	0.20	0.22			0.07		2.57
23.5		0.03		0.06	0.12	0.17	0.13	0.03	0.26	0.26	0.14	0.07	0.34	0.12	0.12			0.07		1.93
24		0.05		0.05	0.11	0.19	0.12	0.07	0.24	0.28	0.11	0.05	0.31	0.07	0.18			0.07		1.89
24.5		0.04		0.01	0.07	0.16	0.12	0.03	0.13	0.20	0.11	0.03	0.32	0.11	0.14			0.07		1.52
25		0.01			0.03	0.08	0.07	0.03	0.11	0.14	0.08	0.01	0.25	0.07	0.18			0.07		1.12
25.5				0.01	0.04	0.11	0.03	0.01	0.05	0.09	0.07		0.18	0.01	0.22			0.06		0.87
26		0.01		0.01	0.03	0.01	0.01	0.01	0.03	0.06	0.03	0.01	0.12	0.01	0.15			0.06		0.55
26.5		0.01		0.01	0.01	0.01			0.04	0.04	0.01		0.03	0.01	0.14		0.03	0.01	0.34	
27				0.03	0.01				0.04	0.01			0.01		0.10		0.03	0.01	0.22	
27.5				0.01	0.03				0.01	0.01			0.03	0.01	0.07			0.01	0.18	
28													0.01		0.04			0.01	0.07	
28.5															0.04				0.04	
29															0.01				0.01	
29.5																			0.00	
30																			0.00	
30.5													0.01						0.01	
Total	1.62	6.08	14.66	3.52	4.21	11.91	26.15	2.47	11.14	9.16	6.88	2.91	8.00	4.02	2.84	0.00	0.07	1.09	117.43	

Table 33. Results from the modal analysis (MIX) for each sex/maturity group on EU Flemish Cap survey 2005.

Sex and maturity group	Males		Primiparous females		Multiparous females	
<i>Age</i>	<i>Prop.</i>	<i>St. Dev.</i>	<i>Prop.</i>	<i>St. Dev.</i>	<i>Prop.</i>	<i>St. Dev.</i>
1						
2	0.025	0.003				
3	0.954	0.004	0.049	0.011		
4	0.021	0.003	0.273	0.027		
5			0.569	0.029	0.266	0.033
6			0.109	0.027	0.596	0.033
7					0.138	0.033
<i>Age</i>	<i>Mean CL</i>	<i>St. Dev.</i>	<i>Mean CL</i>	<i>St. Dev.</i>	<i>Mean CL</i>	<i>St. Dev.</i>
1						
2	12.85	0.121				
3	16.54	0.017	17.52	0.200		
4	20.15	0.210	19.75	0.145		
5			21.92	0.112	21.78	0.130
6			23.98	0.225	24.10	0.132
7					26.39	0.243
<i>Age</i>	<i>Sigma</i>	<i>St. Dev.</i>	<i>Sigma</i>	<i>St. Dev.</i>	<i>Sigma</i>	<i>St. Dev.</i>
1						
2	0.887	Cons. CV				
3	1.142	Cons. CV	0.788	Fixed CV		
4	1.391	Cons. CV	0.889	Fixed CV		
5			0.986	Fixed CV	0.980	Fixed CV
6			1.079	Fixed CV	1.085	Fixed CV
7					1.188	Fixed CV

Table 34. Mean catch per tow(kg) at age by years on EU Flemish Cap surveys.

Year Age-class	1988	1989	1990	1991	1992	1993	1994 ¹	1995	1996	1997	1998 ²	1999	2000	2001	2002	2003	2004	2005
1					0.00						0.07	0.00	0.01	0.00	0.14	0.01	0.00	
2	0.06	0.00		0.21	0.00				0.76	0.17	11.24	1.03	0.23	0.71	2.71	3.16	5.79	0.23
3	0.71	0.48	2.55	1.51	0.76	2.67	0.18	0.85	5.66	1.58	20.15	9.71	7.37	6.24	20.78	8.87	4.64	19.62
4	2.96	0.78	1.10	4.78	0.88	2.59	0.69	2.06	1.33	2.12	5.10	11.21	6.51	12.42	8.00	3.43	4.94	2.62
5	2.90	1.31	0.54	5.09	4.58	2.27	0.85	1.11	3.36	3.55	7.11	5.95	4.77	10.35	9.65	7.71	7.72	7.09
6	0.35	0.23	0.03	1.84	16.96	6.15	2.95	2.88	1.03	1.55	5.02	2.66	3.87	3.84	3.35	2.91	1.78	6.88
7				0.69	7.21	0.84	0.15	2.15	0.87	0.29	0.26	0.14	0.88	0.27	0.77	0.13	0.32	1.70
8					0.00													
total (ton.)	6.98	2.80	4.23	14.12	30.39	14.52	4.82	9.05	13.01	9.26	48.95	30.71	23.63	33.83	45.40	26.22	25.18	38.14

¹Codend mesh-size 40 mm.²Codend mesh-size 25 mm.

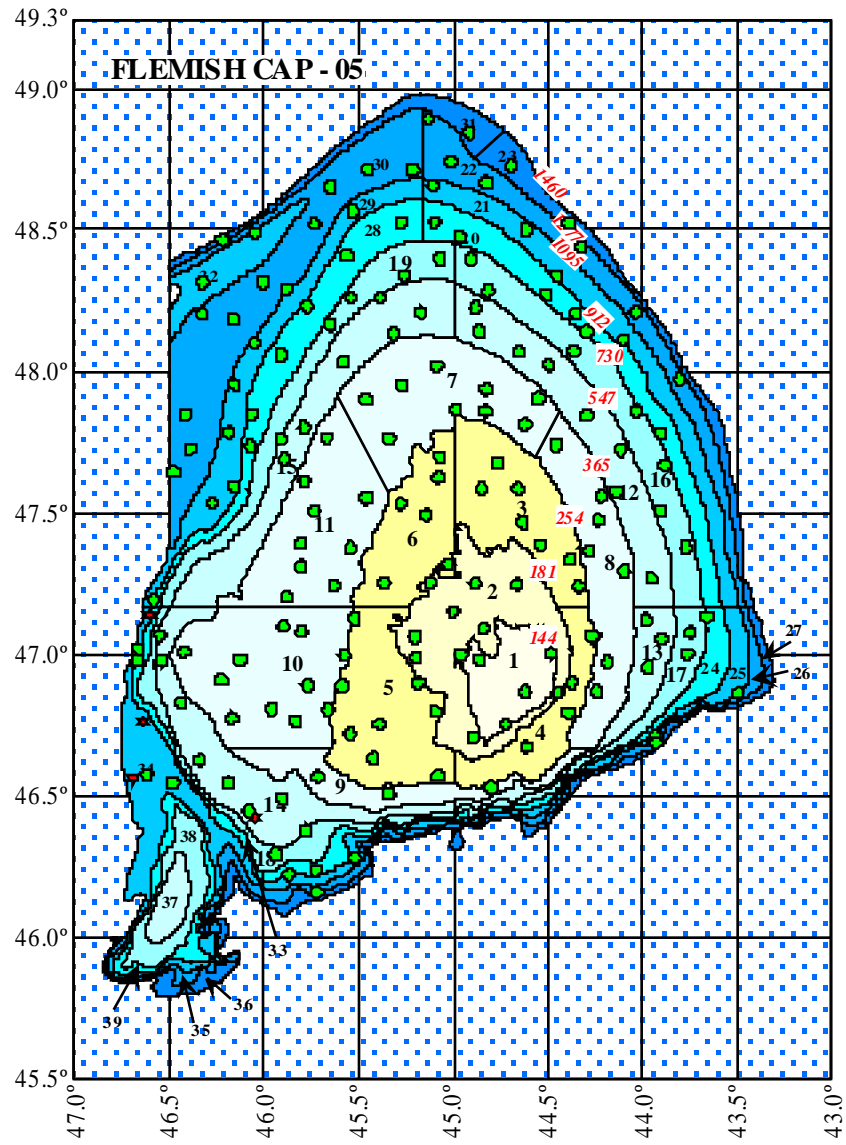


Figure 1 - Haul positions for the Flemish Cap 2005 survey.

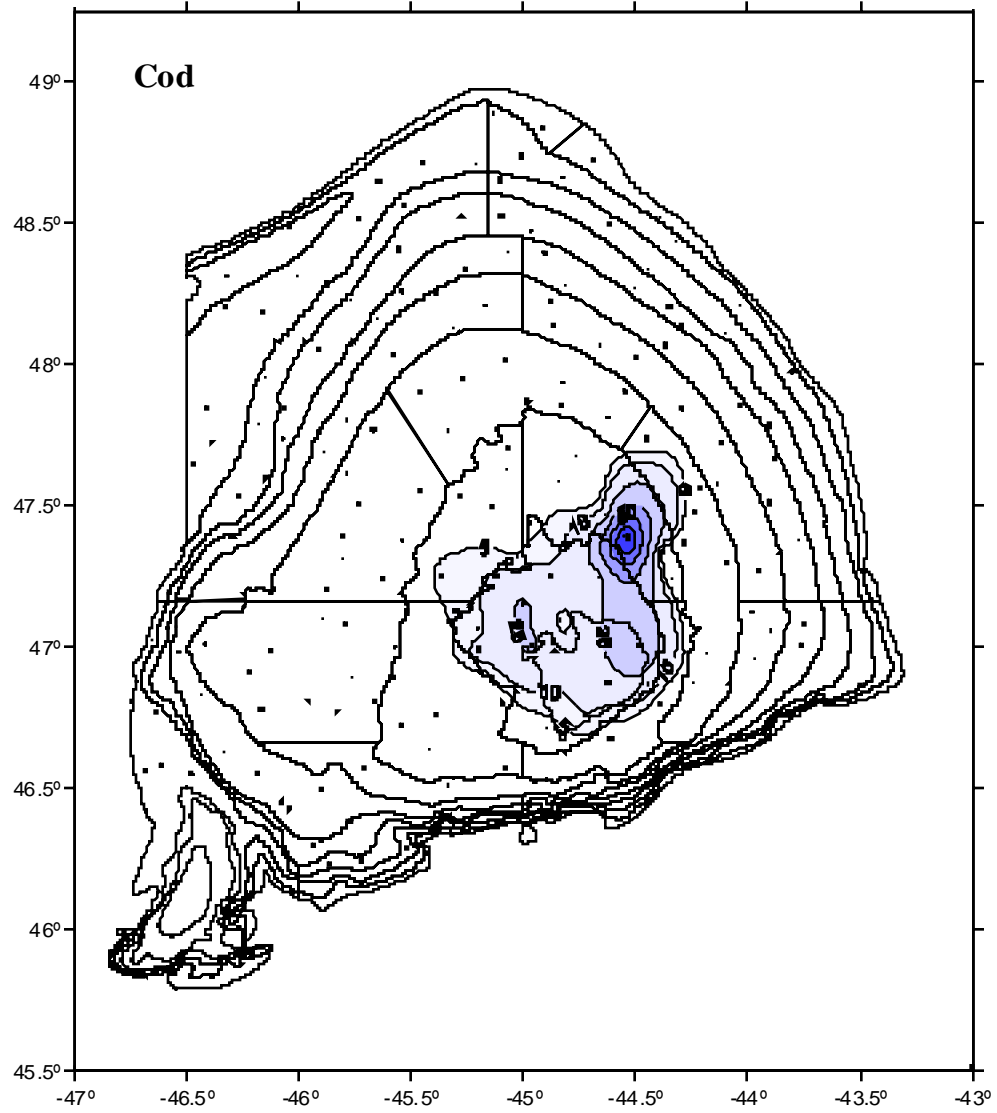


Figure 2 - Cod (*Gadus morhua*) catch distribution in the 2005 survey in Kg/mile.

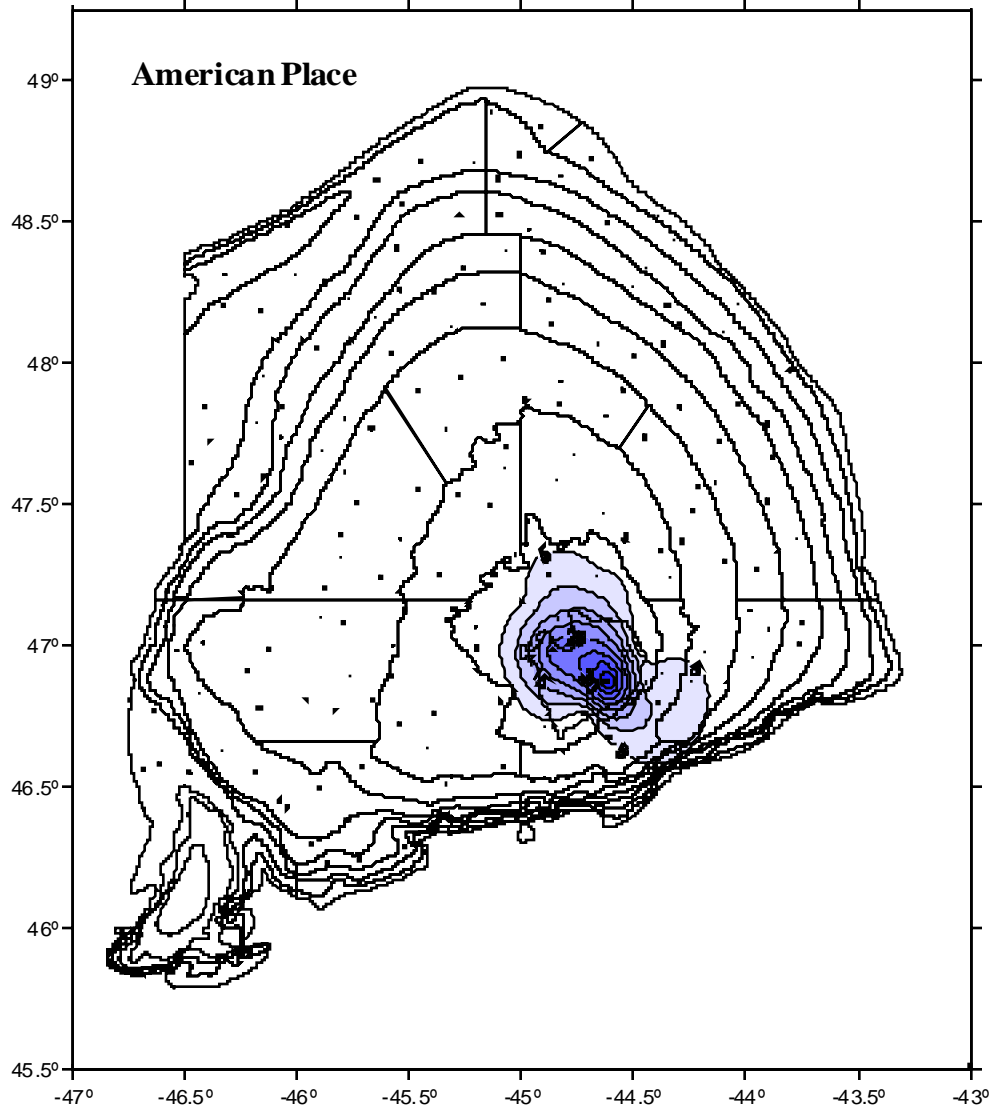


Figure 3 - American plaice (*Hippoglossoides platessoides*) catch distribution in the 2004 survey in Kg/mile

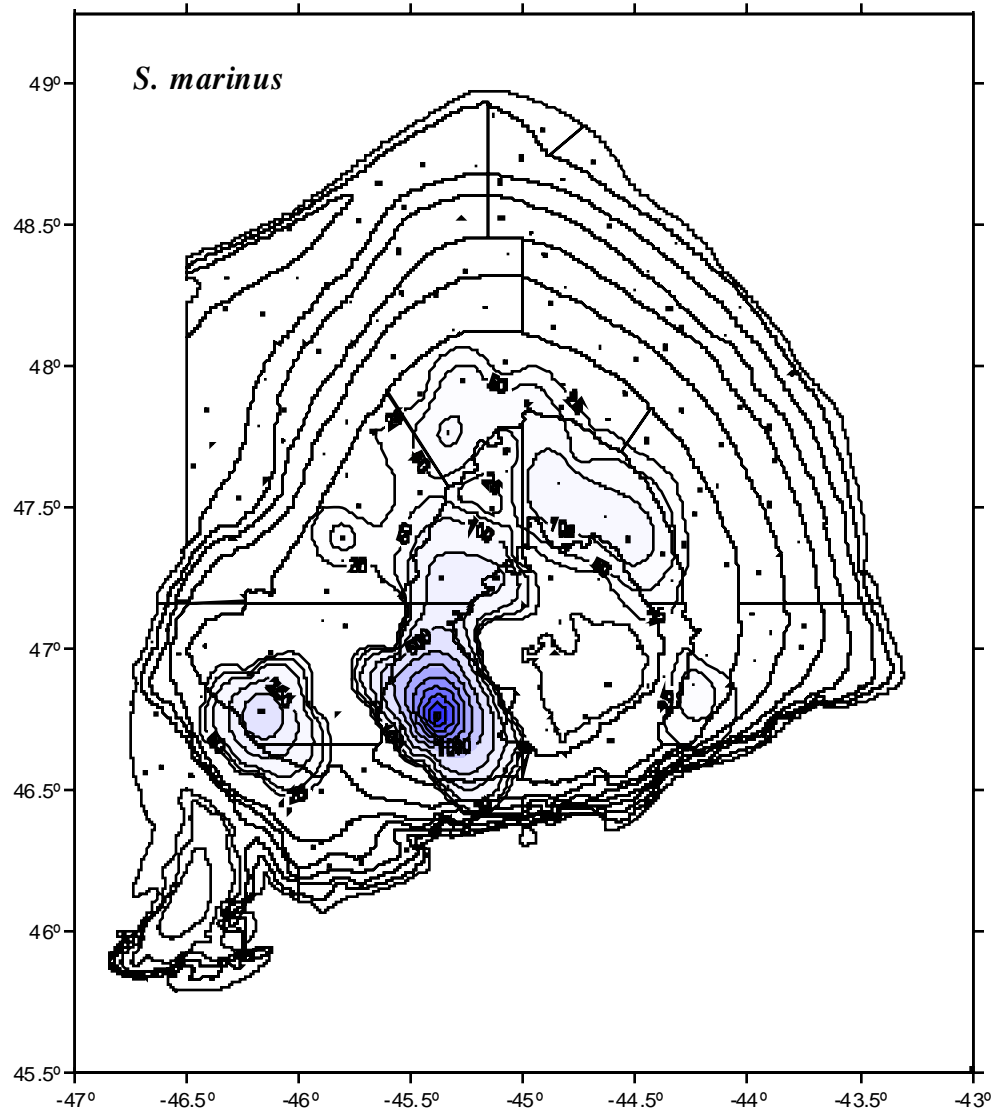


Figure 4 - Redfish (*Sebastes marinus*) catch distribution in the 2005 survey in Kg/mile

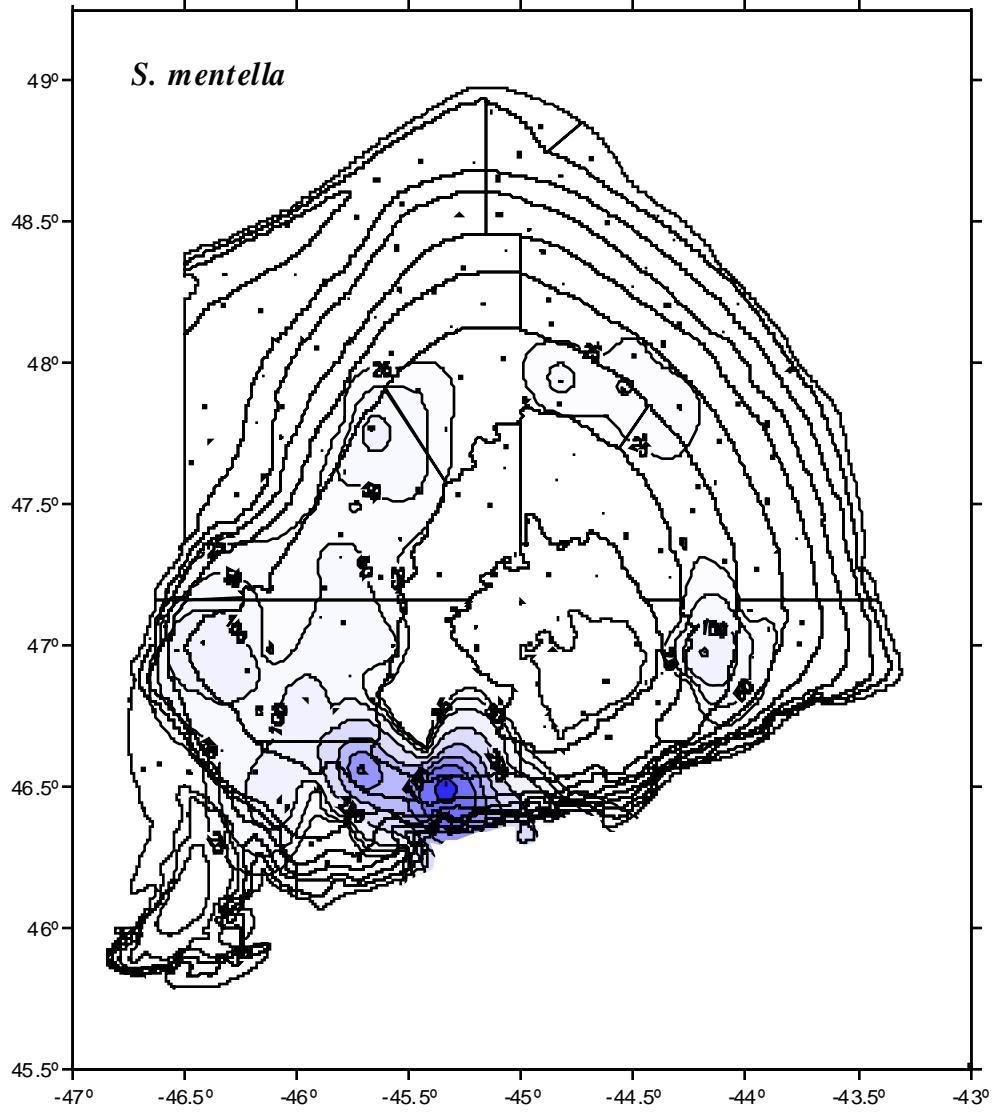


Figure 5 - Redfish (*Sebastes mentella*) catch distribution in the 2005 survey in Kg/mile

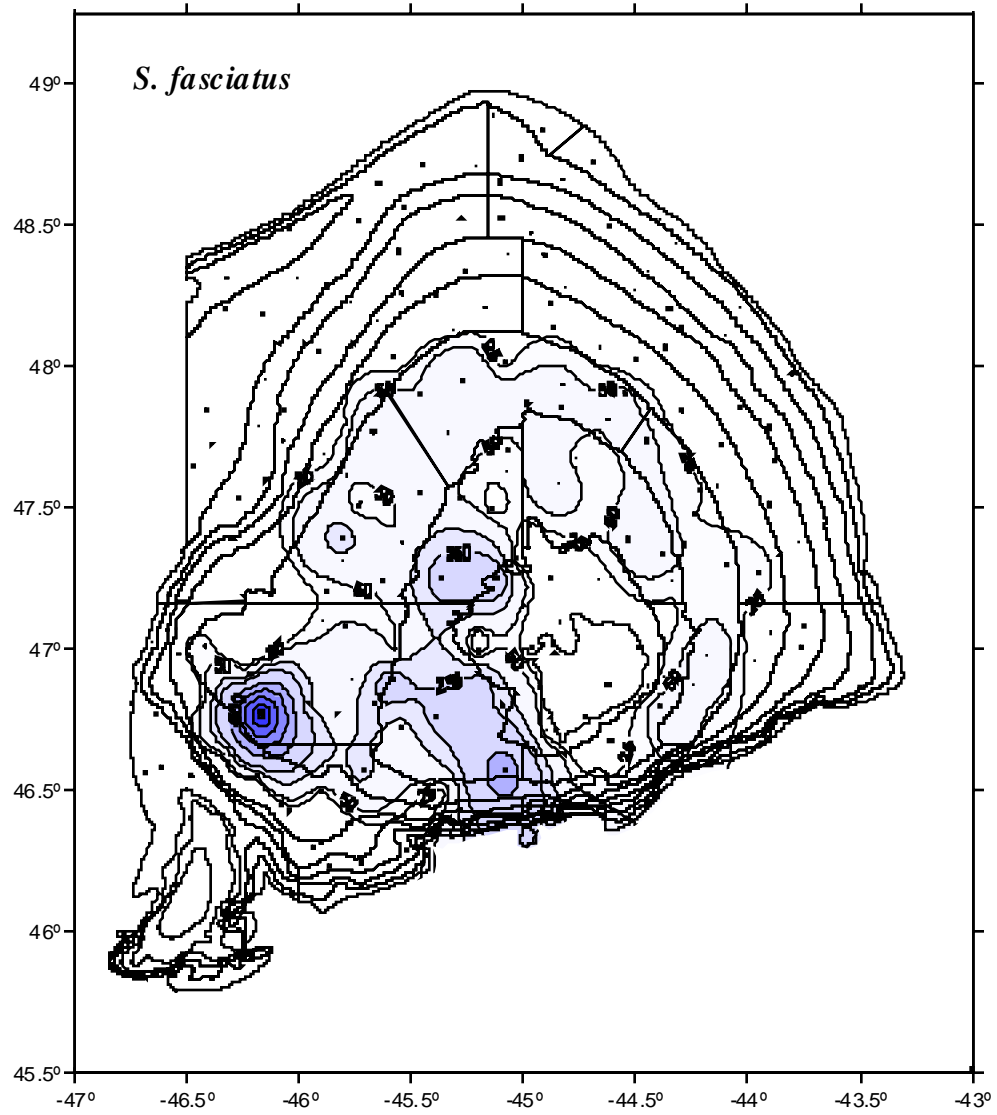


Figure 6 - Redfish (*Sebastes fasciatus*) catch distribution in the 2005 survey in Kg/mile

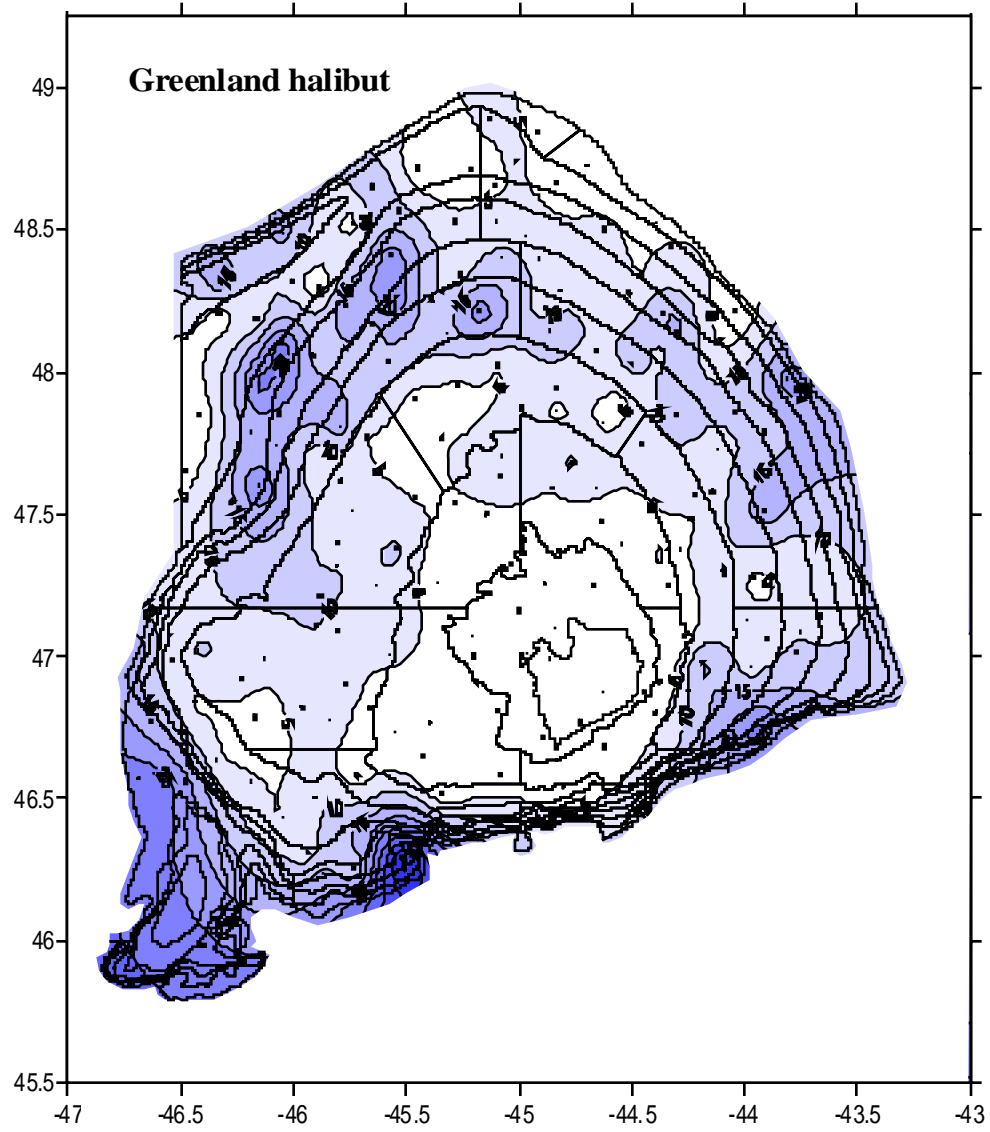


Figure 7 - Greenland halibut (*Reinhardtius hippoglossoides*) catch distribution in the 205 survey in Kg/mile.

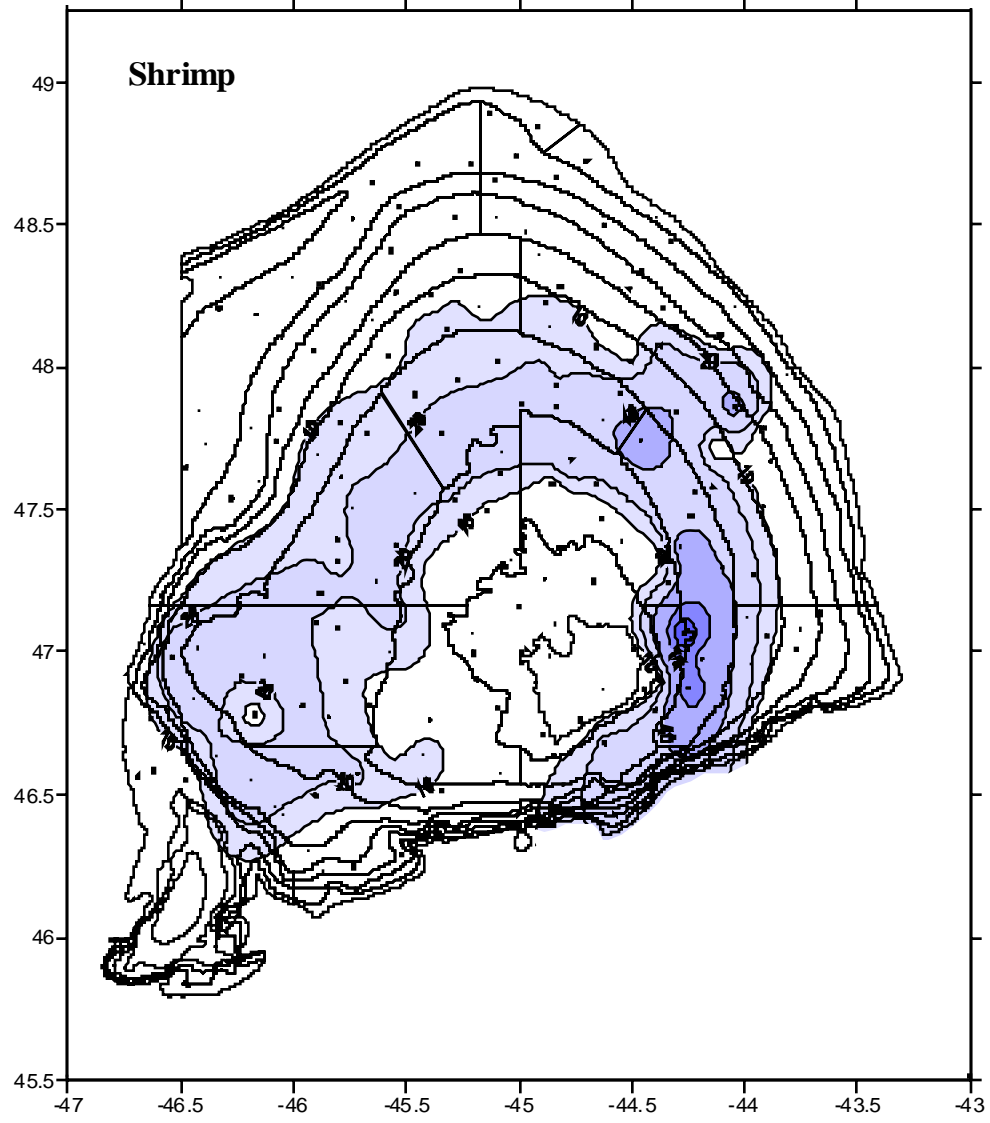


Figure 8 - Shrimp (*Pandalus borealis*) catch distribution in the 2005 survey in Kg/mile.