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Results from Bottom Trawl Survey on Flemish Cap of July 2002

by

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Abstract

A stratified random bottom trawl survey on Flemish Cap was carried out on July 2002 up to a depth of 730 m. Survey results are presented and compared with those of previous surveys in the series since 1988. Abundance at age indices was presented for cod, American plaice, redfish and Greenland halibut.

KEYWORDS: Survey, Flemish Cap, cod, American plaice, redfish, Greenland halibut.

Introduction

The survey on Flemish Cap was carried out in 2002 on board R/V *Cornide de Saavedra.* A total of 120 valid bottom trawls were made up to a depth of 730 m (400 fathoms) (Fig. 1). The survey adequately covered all strata of the bank. A synoptic sheet of the survey with vessel and gear characteristics is shown in Table 1. This was the 15th 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 tows	Dates
1988	Cornide de Saavedra	115	8/7 – 22/7
1989	Cryos	116	12/7 – 1/8
1990	Ignat Pavlyuchenkov	113	18/7 – 6/8
1991	Cornide de Saavedra	117	24/6 – 11/7
1992	Cornide de Saavedra	117	29/6 – 18/7
1993	Cornide de Saavedra	101	23/6 – 8/7
1994	Cornide de Saavedra	116	6/7 – 23/7
1995	Cornide de Saavedra	121	2/7 – 19/7
1996	Cornide de Saavedra	117	28/6 – 14/7
1997	Cornide de Saavedra	117	16/7 – 1/8
1998	Cornide de Saavedra	119	17/7 – 2/8
1999	Cornide de Saavedra	117	2/7 – 20/7
2000	Cornide de Saavedra	120	10/7 – 28/7
2001	Cornide de Saavedra	120	3/7 – 20/7
2002	Cornide de Saavedra	120	30/6 –17/7

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. Mean

catch per trawl were calculated weighting catch of each haul by its towered length and weighting mean value of each stratum to the stratum area; results are referred to a standard haul of half an hour time at 3.5 knots speed, that is: 1.75 miles towered distance. These indices may replace previous estimates of total biomass by the swept area method. The relationship between both indices is:

Mean-catch-per-tow = 1.75 * 0.0075 * 1000 / 10555 * Total-biomass

1.75	–	towered length for a standard tow, miles
0.0075	–	lateral opening of the gear in miles
1000	–	factor to change from tons to Kg
10555	–	Flemish Cap area down to 400 fathoms, square miles

However, catch per tow data presented in this paper were calculated from the original survey data files, instead of being calculated applying the above factor. Some discrepancies can be noted due to the latest corrections made on data files. Integer numbers also introduce errors in the rounding process. Catch per tow data are presented in Kg with two decimal places as a norm, even the associated error is higher than that level in all cases: 0.01 Kg *per* tow in mean catch per tow is approximately equivalent to a 1.2 Kg total catch in a 120 hauls survey, which is far beyond the accuracy for common species. For the same reasons, length frequencies and frequencies at age are presented in absolute numbers with two decimal places: 0.01 fish per tow roughly corresponds to one fish catch in a 120-haul survey. Some comparative tables are maintained as total biomass to avoid modify results from others authors.

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

Survey	cod	American plaice	redfish	Greenland halibut	roughhead grenadier	shrimp
1988	46.17	14.96	196.91	8.48	2.98	2.69
1989	129.07	13.10	170.27	5.47	1.29	2.45
1990	68.84	11.32	129.56	7.02	1.24	2.66
1991	45.51	9.41	79.39	10.00	1.97	10.21
1992	30.21	8.07	129.92	10.68	2.33	20.56
1993	69.18	7.34	70.12	8.79	7.88	10.83
1994	29.92	7.67	156.74	9.84	2.92	4.15
1995	10.96	6.33	91.57	13.31	2.31	6.73
1996	10.19	3.82	125.02	14.19	2.01	8.09
1997	11.27	2.82	173.14	19.70	1.77	6.34
1998	5.64	3.20	73.76	29.66	2.50	20.67
1999	3.23	2.41	103.08	25.96	1.85	15.46
2000	3.46	1.50	185.54	20.75	1.55	12.09
2001	3.05	2.24	79.48	16.98	3.08	17.54
2002	2.82	1.91	120.67	14.81	1.79	22.52

These survey indices are also presented in Table 2, and even they belong to different species and pelagic vs. demersal character, a global index was calculated 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. Both cod and witch flounder reached their biomass minimum in 2002. Greenland halibut maintained a continuous biomass increase to reach a maximum in 1998, but decreases since then. Shrimp catches were the highest in 2002, but interpretation of survey results needs to take into account changes occurred in cod-end mesh size.

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.

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)	
1983		23,070		
1984		31,210		
1985		28,070		
1986		26,060		
1987		10,150	21,600	
1988	37,133	7,720	34,200	
1989	103,644	36,520	78,300	
1990	55,360	3,920	15,200	
1991	36,597	6,740	8,200	
1992	24,295	2,490	2,400	
1993	55,642	8,990	9,700	
1994	24,062	-	-	
1995	8,815	8,260	-	
1996	8,196	730	-	
1997	9,063	-	-	
1998	4,532	-	-	
1999	2,596	-	-	
2000	2,782		-	
2001	2,451	784	-	
2002	2,270	694	-	tons

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 is shown in the table bellow.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	5.69	25.87	2.96	171.37	88.52	5.43	3.91	1.92	0.05	0.05	0.03	0.01	0.21	0.57	–
2	90.02	13.71	14.35	31.83	46.08	164.67	4.77	14.13	3.69	0.17	0.10	0.10	0.02	2.05	1.43
3	50.53	104.82	5.68	19.13	5.90	35.37	30.59	1.54	7.62	3.91	0.11	0.13	0.34	0.01	0.69
4	13.37	61.23	18.49	2.40	2.53	1.26	5.67	4.47	1.02	5.42	1.41	0.13	0.21	0.13	0.03
5	1.50	23.17	17.63	7.81	0.41	1.58	0.15	1.10	2.79	0.45	1.80	0.81	0.10	0.09	0.08
6	0.23	1.58	5.20	2.08	1.56	0.21	0.08	0.04	0.23	1.12	0.09	0.52	0.50	0.02	0.04
7	0.27	0.20	0.42	0.37	0.28	0.61	0.01	0.03	0.01	0.02	0.18	0.02	0.20	0.17	0.03
8	0.08	0.17	0.19	0.09	0.01	0.12	0.15	–	0.01	–	–	0.01	0.01	0.12	0.12
9	–	0.01	0.11	0.04	–	–	–	0.03	–	–	0.01	–	0.02	0.01	0.04
10	–	0.01	0.04	0.01	–	–	0.01	0.01	–	–	–	–	–	0.01	–
11	–	–	–	0.02	0.01	–	–	–	–	–	–	–	–	0.01	0.01
12	–	–	–	–	–	–	–	–	–	0.01	–	–	0.01	–	–
13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
14	–	–	–	–	–	–	–	–	–	–	–	–	0.01	–	–
total	161.69	230.77	65.07	235.15	145.30	209.25	45.34	23.27	15.42	11.15	3.73	1.73	1.63	3.19	2.47

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 10 or less in 2002), were weak, weaker than the ones observed in the previous period. The 1995 to 1999 year-classes (ages 7 to 3 in 2002) failed almost completely and, according to the results of the last survey, the same failure appears to have occurred to the 2000 year-class (age 2 in 2002).

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

American plaice

Mean catch per tow by strata and its standard error are 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)	
1983		8,900	
1984		7,500	
1985		7,800	
1986		20,200	
1987		9,300	
1988	11,887	6,500	
1989	10,533	5,000	
1990	9,101	1,200	
1991	7,565	14,400	
1992	6,492	1,200	
1993	5,949	2,700	
1994	6,173		
1995	5,087		
1996	3,073		
1997	2,268		
1998	2,577		
1999	1,940		
2000	1,204		
2001	1,803	548	
2002	1,536	1,398	tons

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

The mean frequency at age per tow is presented in the table of the following page. The 1984, 1986 and 1990 year-classes, ages 18, 16 and 12 in 2002, were 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.

There is no change in the perception on the condition of the stock relative to the last year views. The stock has recorded a steady decline since 1988. Global indices in the table of the following page, 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, and all year-classes with less than 12 years old in 2002, were among the weakest ones observed in this survey.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	–	–	–	–	–	–	–	–	0.01	0.01	–	0.01	0.02	–	–
2	2.84	0.57	0.44	0.39	0.91	0.01	0.04	0.03	0.03	0.02	0.03	–	0.03	0.04	–
3	0.78	8.52	0.95	1.13	0.84	1.70	0.05	0.12	0.13	0.12	0.03	0.03	0.01	0.06	0.03
4	3.77	1.87	8.68	2.33	1.13	1.20	2.23	0.78	0.28	0.03	0.05	0.07	0.09	0.06	0.07
5	2.46	4.03	1.08	5.54	1.83	0.80	0.97	2.01	0.58	0.12	0.07	0.07	0.11	0.10	0.02
6	3.76	3.74	2.96	2.28	4.26	0.40	0.81	1.23	1.54	0.39	0.25	0.07	0.15	0.06	0.08
7	5.17	3.57	2.04	2.50	1.13	3.86	0.87	1.23	0.82	1.12	0.57	0.22	0.11	0.10	0.06
8	5.29	2.10	1.97	1.95	1.36	0.42	3.08	0.83	0.51	0.25	0.81	0.42	0.14	0.24	0.11
9	1.86	0.73	1.23	0.84	0.78	0.74	0.30	1.41	0.38	0.39	0.48	0.46	0.36	0.39	0.13
10	0.26	0.33	0.58	0.29	0.36	0.35	0.59	0.16	0.59	0.28	0.33	0.23	0.39	0.52	0.17
11	0.14	0.04	0.11	0.01	0.17	0.24	0.21	0.18	0.14	0.46	0.29	0.32	0.21	0.43	0.27
12	0.08	0.02	0.02	0.06	0.09	0.29	0.20	0.15	0.08	0.13	0.28	0.20	0.17	0.39	0.20
13	–	–	0.04	–	0.02	0.35	0.24	0.15	0.08	0.02	0.09	0.12	0.07	0.18	0.23
14	–	–	0.02	–	–	1.07	0.50	0.30	0.11	0.10	0.12	0.13	0.05	0.16	0.14
15	–	–	–	–	–	0.04	0.50	0.23	0.08	0.05	0.06	0.06	0.05	0.11	0.13
16+	–	–	–	–	–	0.04	0.01	0.03	0.02	0.12	0.11	0.10	0.06	0.10	0.18
Total	26.39	25.52	20.12	17.32	12.88	11.51	10.60	8.84	5.38	3.61	3.57	2.51	2.02	2.94	1.82
freq. 6+	16.54	10.53	8.97	7.93	8.17	7.80	7.31	5.90	4.35	3.31	3.39	2.33	1.76	2.68	1.70

Tables 11, 12 and 9 show mean length frequency per tow, the age-length key and mean frequency at age per tow respectively. Catch per tow distribution is presented in Figure 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 and its standard error are presented in Tables 13, 17, 22 and 26 for *Sebastes marinus*, *S. mentella*, *S. fasciatus* and the *juvenile* group respectively. The following table summarize past results.

	Sebastes:	spp.			
Year	*marinus*	*mentella*	*fasciatus*	juvenile	total
1988	19.06		177.85		196.91
1989	28.55		141.72		170.27
1990	17.52	90.36		20.05	127.93
1991	5.09	62.26	7.06	4.98	79.39
1992	5.14	89.29	6.60	28.89	129.92
1993	5.02	23.91	5.50	35.69	70.12
1994	41.32	44.43	9.73	61.26	156.74
1995	11.24	73.78	6.26	0.29	91.57
1996	14.04	96.86	13.71	0.41	125.02
1997	80.64	69.75	21.72	1.03	173.14
1998	7.99	56.40	8.00	1.37	73.76
1999	11.73	81.14	9.89	0.32	103.08
2000	55.82	111.12	16.06	2.54	185.54
2001	10.71	48.02	14.34	6.41	79.48
2002	12.18	50.98	28.82	28.69	120.67

Tables 14, 18, 23 and 27 show mean length frequency by tow for the four groups. Age-length keys for *S. marinus*, *S. mentella* and *S. fasciatus* are presented in Tables 16, 20 and 24. Mean frequency at age by tow are presented in Tables 15, 19 and 25 for the three species, as well the values for *S. mentella* in all previous surveys (Table 21). Catches per tow distributions of the three species are presented in Figures 4, 5 and 6.

Greenland halibut

Mean catch per tow by strata and its standard error are presented in Table 28. These indices are compared with results of previous surveys in Table 32 and summarised as follow:

1988	8.48	
1989	5.47	
1990	7.10	
1991	10.00	
1992	10.68	
1993	8.79	
1994	9.84	
1995	13.31	
1996	14.19	
1997	19.70	
1998	29.66	
1999	25.96	
2000	20.75	
2001	16.98	
2002	14.81	Kg/tow

Mean length frequency by tow, age-length keys and mean frequency at age per tow are presented in Tables 29, 31 and 30, respectively. Catch per tow distribution is presented in Fig. 7. Mean frequency at age per tow was calculated as follows:

age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0.43	1.15	1.17	1.03	7.66	3.57	1.98	1.79	0.65	1.99	5.17	2.44
2		0.99	1.16	0.88	1.74	5.74	2.63	1.58	0.53	0.18	1.04	2.04
3	0.29	0.36	0.75	1.34	1.70	1.90	5.46	6.40	2.37	0.39	1.43	2.01
4	1.23	1.07	0.71	1.52	1.55	2.57	6.41	9.75	8.93	1.75	0.85	1.37
5	2.43	1.99	1.20	1.70	2.13	3.82	6.49	11.40	12.21	6.91	2.54	3.40
6	1.56	2.48	1.96	2.78	4.72	5.46	7.51	10.97	11.94	14.41	7.37	5.18
7	2.84	2.23	2.16	2.61	3.76	2.51	4.83	7.88	5.45	5.09	6.93	5.85
8	0.68	1.23	1.73	1.51	2.15	1.71	2.12	2.91	1.92	2.11	3.70	1.24
9	0.58	0.59	1.13	0.86	1.41	0.49	0.74	0.87	0.40	0.44	0.21	0.16
10	0.49	0.33	0.32	0.33	0.32	0.10	0.25	0.25	0.12	0.12	0.06	0.07
11	0.15	0.17	0.18	0.12	0.08	0.04	0.04	0.04	0.01	0.06	0.01	0.02
12		0.08	0.06	0.07	0.03	0.04	0.03	0.01				0.01
13		0.02	0.02	0.02			0.03	0.03				
14		0.02	0.01		0.01	0.01			0.01			
15						0.01	0.01					
16+							0.02					
total	10.68	12.71	12.56	14.77	27.26	27.97	38.55	53.88	44.54	33.45	29.31	23.79
freq. 10+	0.64	0.62	0.59	0.54	0.44	0.20	0.38	0.33	0.14	0.18	0.07	0.10

Shrimp

Del Río *et al.* (2002) presented detailed results.

Roughhead grenadier (*Macrourus berglax*)

Mean catch per tow this survey series was:

1989	1.29	
1990	1.26	
1991	1.97	
1992	2.33	
1993	7.88	
1994	2.92	
1995	2.31	
1996	2.01	
1997	1.77	
1998	2.50	
1999	1.85	
2000	1.55	
2001	3.08	
2002	1.79	Kg/tow

Detailed results were presented by Murua (2003).

Oceanographic conditions

A CTD station was made after each haul. Cabanas (2003) analysed the results.

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Table 1 – Technical data of the 2002 survey.

Procedure	Specification
Vessel	R/V Cornide de Saavedra
GT	1.200 t
Power	1.500 + 750 HP
Mean trawling speed	3.52 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	$6{,}45 \cdot \text{profundidad}^{0{,}858}$
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 ecosonder 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 (*Sebastes marinus, S. mentella* and *S. fasciatus*), Greenland halibut and roughhead grenadier (*Macrourus berglax*).

Table 2 – Mean catch per tow for several species or groups of species in 1988-2002 surveys (kg).

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Rajidae	5.59	2.41	3.51	5.05	4.70	7.76	4.36	2.82	2.55	2.29	2.46	2.00	1.43	2.78	1.92
Synaphobranchus sp.	0.27	0.11	0.05	0.10	0.09	0.13	0.01	0.02	0.00	0.01	0.05	0.00	0.00	0.03	0.01
Urophycis sp.	0.80	0.21	0.21	0.32	0.09	0.21	0.27	0.10	0.10	0.04	0.28	0.31	0.21	0.49	0.16
Antimora sp.	0.49	0.38	0.35	0.70	0.90	1.02	0.99	0.24	0.23	0.29	0.61	0.36	0.33	0.83	0.43
Macrouridae	3.84	1.81	1.52	2.80	3.22	8.08	4.02	3.24	2.91	2.85	3.52	2.90	2.25	3.83	2.54
Notacanthus sp.	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
Illex sp.	0.01	0.01	2.05	1.44	0.08	0.00	0.26	0.00	0.11	0.08	0.09	0.02	0.00	0.01	0.01
Anarhichadidae	9.94	9.31	10.10	12.56	11.31	17.85	19.45	23.90	25.57	17.45	13.66	6.94	5.56	7.29	6.50
Witch flounder	1.13	0.42	0.52	0.96	1.02	1.30	0.98	0.88	0.63	0.40	0.30	0.47	0.51	0.57	0.26
Greenland halibut	8.48	5.47	7.02	10.00	10.68	9.11	9.84	13.31	14.19	19.71	29.66	25.96	20.75	16.98	14.81
Zoarcidae	0.70	1.42	1.50	2.46	1.69	4.32	2.33	2.71	2.12	2.15	2.56	1.11	0.97	1.55	1.01
Cod	46.18	129.07	68.84	45.51	30.21	69.12	29.92	10.96	10.19	11.27	5.64	3.23	3.46	3.05	2.82
American plaice	14.96	13.10	11.32	9.41	8.07	7.38	7.67	6.33	3.82	2.82	3.21	2.41	1.50	2.24	1.91
Redfish	196.90	170.28	127.93	79.39	129.92	71.53	156.73	91.57	125.02	173.14	73.76	103.08	185.55	79.48	120.67
Shrimp*	2.69	2.45	2.66	10.21	20.56	11.36	4.15	6.73	8.09	6.34	20.67	15.46	12.09	17.54	22.52
Others	0.79	0.26	1.42	0.83	0.53	0.00	0.59	0.49	0.86	0.73	1.38	0.77	1.98	1.80	1.16
Total	293.38	337.20	238.71	182.31	223.61	211.51	242.12	163.73	196.61	239.92	158.04	165.10	236.69	138.60	176.80

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

Table 3 – Cod mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4	16.65	10.41
2	838	10	10.48	10.58
3	628	7	8.56	10.53
4	348	4	2.27	4.00
5	703	8	2.49	4.65
6	496	6	12.62	8.87
7	822	9	0.35	0.74
8	646	7	0.69	0.90
9	314	3	0.53	0.54
10	951	11	0.03	0.08
11	806	9	0.27	0.63
12	670	8	–	–
13	249	3	–	–
14	602	7	–	–
15	666	8	–	–
16	634	7	–	–
17	216	2	–	–
18	210	2	–	–
19	414	5	–	–
total	10555	120	2.82	0.45

Table 4 – Cod mean frequency at age per tow in the 2002 survey.

	stratum												mean weight	mean length
age	1	2	3	4	5	6	7	8	9	10	11	total	g	cm
1	–	–	–	–	–	–	–	–	–	–	–	–		
2	–	1.46	10.69	6.01	0.96	5.43	0.33	1.39	0.99	0.09	0.23	1.44	419	36
3	0.76	1.25	3.04	0.25	1.67	5.02	0.22	0.14	–	–	0.09	0.69	1118	50
4	0.01	0.08	0.12	–	0.12	0.18	–	–	–	–	0.03	0.03	1429	54
5	0.64	0.45	0.14	–	–	0.33	–	–	–	–	–	0.08	2470	65
6	0.51	0.30	–	–	–	–	–	–	–	–	–	0.04	3591	74
7	0.49	0.10	0.02	–	–	0.16	–	–	–	–	–	0.03	4858	81
8	1.53	0.56	0.10	–	–	0.45	–	–	–	–	–	0.12	4851	81
9	0.41	0.29	0.02	–	–	0.05	–	–	–	–	–	0.04	5846	86
10	–	–	–	–	–	–	–	–	–	–	–	–		
11	–	0.10	–	–	–	–	–	–	–	–	–	0.01	9938	103
12	–	–	–	–	–	–	–	–	–	–	–	–		

Table 5 – Cod mean catch per tow (kg) by strata in 1988-2002 surveys.

	depth in	year														
stratum	fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	70- 80	46.94	22.65	28.80	194.88	2.64	17.99	75.57	54.53	35.12	8.47	4.37	3.46	8.70	3.01	16.65
2	81-100	144.55	147.00	29.39	78.12	73.35	128.79	116.58	43.29	56.83	29.17	27.05	21.39	10.55	6.98	10.48
3	101-140	84.95	195.29	41.68	46.73	161.00	160.29	115.77	21.79	20.01	21.51	13.34	2.77	6.83	4.38	8.56
4	"	107.32	166.10	88.84	99.44	118.10	485.97	64.66	25.57	36.61	29.39	4.78	0.88	15.20	16.76	2.27
5	"	36.17	181.68	144.47	180.82	77.57	115.85	15.69	21.62	15.90	19.52	16.55	4.34	7.20	4.41	2.49
6	"	77.73	163.36	79.56	36.83	22.92	101.54	33.97	31.50	14.93	25.86	14.75	9.03	12.30	18.03	12.62
7	141-200	32.28	232.66	57.19	36.85	13.72	89.33	12.43	1.77	0.79	15.50	1.13	0.75	0.08	0.18	0.35
8	"	164.99	303.60	311.12	94.34	43.39	147.11	66.79	6.44	1.73	29.74	1.42	0.43	1.35	2.27	0.69
9	"	6.98	199.96	246.39	7.16	5.44	37.91	9.09	0.34	3.91	6.62	–	0.73	1.56	–	0.53
10	"	16.79	61.47	58.72	19.56	4.10	11.75	6.35	0.73	0.58	3.78	2.49	1.28	1.34	1.01	0.03
11	"	37.10	195.74	60.35	26.46	3.33	24.85	8.61	1.16	0.61	4.60	2.60	3.78	1.56	2.58	0.27
12	201-300	5.97	43.98	28.95	2.25	–	0.43	–	–	–	–	–	–	–	–	–
13	"	0.40	121.47	36.31	4.49	–	–	–	–	–	–	–	–	–	–	–
14	"	2.12	22.21	12.73	2.59	1.33	4.37	–	–	–	–	–	–	–	–	–
15		13.40	151.17	42.12	1.94	–	–	–	–	–	–	–	–	–	–	–
16	301-400	–	1.23	–	–	–	–	–	–	–	–	–	–	–	–	–
17		–	0.28	–	–	–	0.13	–	–	–	–	–	–	–	–	–
18		0.12	–	–	–	–	0.16	–	–	–	–	–	–	–	–	–
19		–	2.90	–	–	–	–	–	–	–	–	–	–	–	–	–
total		46.17	129.07	68.84	45.51	30.21	69.18	29.92	10.96	10.19	11.27	5.64	3.23	3.46	3.05	2.82
s.e.		6.54	13.80	9.30	7.58	6.60	19.67	8.33	2.34	1.65	1.95	0.73	0.51	0.67	0.43	0.45

s.e.: standard error

Table 6 – Cod mean length frequency per tow in the 2002 survey.

length		length		length	
30-32	0.13	57-59		84-86	0.03
33-35	0.48	60-62	0.02	87-89	0.01
36-38	0.58	63-65	0.02	90-92	0.02
39-41	0.23	66-68	0.03	93-95	
42-44	0.03	69-71	0.02	96-98	
45-47	0.12	72-74	0.03	99- 101	
48-50	0.30	75-77	0.02	102-104	0.01
51-53	0.19	78-80	0.05		
54-56	0.11	81-83	0.06		

Table 7 – Cod age-length key in 2002.

length	age															no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 16+	id.	total
30-32		16															16
33-35		58															58
36-38		70															70
39-41		27															27
42-44		2	1														3
45-47			14														14
48-50			36													1	37
51-53			24	1													25
54-56			10	3													13
57-59																	
60-62					2											1	3
63-65					2												2
66-68					4												4
69-71					1			1									2
72-74						4											4
75-77						1		2									3
78-80							2	3	1								6
81-83							1	5	1								7
84-86							1	3									4
87-89									1								1
90-92								1	2								3
93-95																	
96-98																	
99-101																	
102-104											1						1
total		173	85	4	9	5	4	15	5		1					2	303

no id.: no identified

Table 8 – American plaice mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4	4.06	4.63
2	838	10	14.82	26.60
3	628	7	1.16	0.88
4	348	4	3.64	3.89
5	703	8	2.66	2.33
6	496	6	1.24	1.01
7	822	9	0.63	0.91
8	646	7	0.65	1.50
9	314	3	0.04	0.07
10	951	11	0.37	0.44
11	806	9	0.71	0.58
12	670	8		
13	249	3		
14	602	7		
15	666	8		
16	634	7		
17	216	2		
18	210	2		
19	414	5		
total	10555	120	1.91	0.68

Table 9 – American plaice mean frequency at age per tow in the 2002 survey.

	stratum												mean weight	mean length
age	1	2	3	4	5	6	7	8	9	10	11	total	g	cm
1	–	–	–	–	–	–	–	–	–	–	–	–		
2	–	–	–	–	–	–	–	–	–	–	–	–		
3	–	0.10	–	–	0.13	0.17	–	–	0.33	–	–	0.03	181	27
4	–	0.10	0.07	–	0.06	0.33	–	–	–	0.18	0.23	0.07	273	31
5	–	–	0.07	–	0.06	0.08	–	–	–	–	0.06	0.02	380	35
6	0.59	0.19	–	–	0.16	0.13	0.14	–	–	0.12	0.13	0.08	416	35
7	0.41	0.21	0.09	0.04	0.03	0.05	0.02	–	–	0.13	0.05	0.06	638	40
8	0.81	0.49	0.05	0.14	0.27	0.05	0.06	0.01	–	0.07	0.05	0.11	729	42
9	1.35	0.78	–	0.11	0.17	0.09	0.03	0.05	–	0.01	0.05	0.13	687	41
10	1.32	1.02	0.02	0.23	0.25	0.06	0.09	0.04	–	0.01	0.06	0.17	848	43
11	0.91	1.99	0.11	0.54	0.44	0.17	0.12	0.02	–	0.03	0.10	0.27	1080	47
12	0.79	1.42	0.08	0.38	0.27	0.14	0.15	0.05	–	0.02	0.07	0.20	1138	47
13	0.36	1.89	0.14	0.41	0.39	0.16	0.08	0.02	–	0.02	0.10	0.23	1276	49
14	0.06	1.21	0.11	0.29	0.16	0.06	0.03	0.05	–	0.02	0.02	0.14	1382	51
15	0.04	1.07	0.08	0.32	0.15	0.05	0.03	0.14	–	0.01	0.03	0.13	1459	52
16+	0.04	1.67	0.16	0.28	0.21	0.12	0.03	0.05	–	0.01	0.07	0.18	1488	52

Table 10 – American plaice mean catch per tow (kg) by strata in 1988-2002 surveys.

	depth in	year														
stratum	fathoms	1988	1989	1990	1991	1992	1993	1984	1995	1996	1997	1998	1999	2000	2001	2002
1	70- 80	37.56	28.78	14.55	31.02	20.43	31.06	19.05	64.17	42.07	10.98	4.49	10.72	9.93	30.01	4.06
2	81-100	33.40	42.31	16.14	31.28	20.13	14.88	14.07	15.68	11.08	8.70	18.64	21.25	11.47	9.80	14.82
3	101-140	21.42	17.51	26.14	19.54	9.88	6.95	5.10	3.95	2.64	7.75	4.46	1.53	0.33	1.45	1.16
4	"	62.18	13.07	23.10	9.05	15.75	16.17	24.14	13.84	7.59	5.74	9.69	1.52	2.83	2.43	3.64
5	"	36.39	43.30	25.61	19.69	11.73	18.07	17.21	7.69	6.99	8.66	10.41	1.03	0.79	1.56	2.66
6	"	9.51	22.42	18.91	9.96	11.93	6.05	16.04	2.43	0.63	0.27	0.70	0.79	0.49	0.73	1.24
7	141-200	14.05	6.35	10.03	4.66	7.65	3.82	3.78	2.98	0.86	0.99	0.56	0.22	0.17	0.34	0.63
8	"	6.37	2.50	4.01	3.81	11.08	7.42	2.60	2.00	0.86	1.87	2.51	0.03	–	0.70	0.65
9	"	3.22	5.12	10.75	–	11.69	6.43	0.61	15.68	1.73	1.11	–	–	–	–	0.04
10	"	24.05	15.42	20.71	13.54	14.55	15.10	23.14	7.33	4.29	2.97	0.37	0.75	0.46	0.98	0.37
11	"	14.47	14.26	16.08	4.90	4.55	3.56	3.70	1.34	0.82	0.39	0.36	0.46	0.27	0.33	0.71
12	201-300	0.13	0.27	0.66	0.25	0.16	0.22	0.49	0.17	0.47	0.10	–	–	–	0.06	–
13	"	0.08	–	0.81	–	–	–	–	0.10	–	–	–	–	–	–	–
14	"	0.12	0.14	0.10	6.37	0.47	0.09	0.39	0.23	0.07	–	0.07	0.16	–	–	–
15	"	0.33	1.46	0.04	1.43	0.56	1.62	0.59	1.01	0.33	0.10	0.10	–	–	–	–
16	301-400	0.09	–	–	0.05	0.14	0.20	0.09	–	–	–	–	–	–	–	–
17	"	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
18	"	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
19	"	–	–	–	0.35	0.08	0.13	0.06	0.24	–	–	–	–	–	–	–
total		14.96	13.10	11.17	9.41	8.07	7.34	7.67	6.33	3.82	2.82	3.20	2.41	1.50	2.24	1.91
s.e.		1.72	1.91	1.19	1.10	0.89	0.97	1.28	1.01	0.85	0.66	0.70	0.81	0.31	0.40	0.68

Table 11 – American plaice mean length frequency per tow in the 2002 survey.

length	male	female	length	male	female	length	male	female
24-25	0.01		36-37	0.09		48-49		0.27
26-27		0.01	38-39	0.11	0.02	50-51		0.30
28-29	0.03	0.01	40-41	0.16	0.01	52-53		0.23
30-31	0.02	0.01	42-43	0.07	0.03	54-55		0.08
32-33	0.02	0.02	44-45	0.03	0.05	56-57		0.05
34-35	0.04	0.03	46-47	0.01	0.16	58-59		

Table 12 – American plaice age-length key in 2002.

MALE

length	age																no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id.	total
24-25			1															1
26-27																		
28-29				3														3
30-31				2														2
32-33						2												2
34-35						2	1	1		1								5
36-37						3	1	1	1	1	2	1	1					11
38-39							2	2	4	1	2	2						13
40-41								1	7	5	2	1	2				1	19
42-43								2	1	2	2						1	8
44-45										1		3						4
46-47										1								1
total			1	5		7	4	7	13	12	8	7	3				2	69

FEMALE

length	age																no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id.	total
24-25																		
26-27			1															1
28-29			1															1
30-31			1															1
32-33				1		1												2
34-35				2	2													4
36-37																		
38-39						1											1	2
40-41								1										1
42-43							2	1										3
44-45								2		1	1	1	1					6
46-47							1	1	3	3	5	3	2	1		1		20
48-49								1		3	8	3	6	4	5	3		33
50-51											7	6	6	8	5	5		37
52-53										1	4	4	9	1	2	8		29
54-55													2	2	1	5		10
56-57												1		1	3	1		6
total:			3	3	2	2	3	6	3	8	25	18	26	17	16	23	1	156

Table 13 – Redfish (*Sebastes marinus*) mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4	49.32	35.32
2	838	10	21.50	61.34
3	628	7	4.79	5.64
4	348	4	0.84	1.19
5	703	8	7.00	14.13
6	496	6	5.13	2.77
7	822	9	2.65	3.41
8	646	7	1.84	1.61
9	314	3	22.58	13.11
10	951	11	45.05	103.88
11	806	9	12.18	13.99
12	670	8	0.67	0.86
13	249	3	0.50	0.43
14	602	7	29.68	45.24
15	666	8	2.09	2.13
16	634	7		
17	216	2		
18	210	2		
19	414	5		
total	10555	120	12.18	3.45

Table 14 – Redfish (*Sebastes marinus*) mean length frequency per tow in the 2002 survey.

length	und.	male	female	length	und.	male	female	length	und.	male	female
13		0.06	0.03	27		0.88	0.56	41		0.05	0.07
14	0.01	0.20	0.31	28	0.02	1.15	0.54	42		0.08	0.05
15		0.82	0.75	29	0.01	1.40	0.44	43			
16		0.60	0.64	30		1.37	0.53	44		0.05	0.04
17		0.72	0.74	31	0.02	1.38	0.56	45		0.04	
18	0.01	0.63	0.64	32		1.12	0.84	46			0.02
19		0.53	0.43	33	0.01	1.35	0.47	47			0.07
20	0.01	0.73	0.43	34		1.13	0.82	48			
21		0.54	0.68	35	0.01	0.45	0.36	49			
22		0.79	0.59	36		0.65	0.22	50			
23		0.59	0.50	37		0.14	0.44	51			
24		0.63	0.51	38		0.25	0.23	52			
25		0.80	0.41	39		0.07	0.21	53			0.01
26		1.05	0.43	40		0.05	0.10	54			

und.: undetermined sex

Table 15 – Redfish (*Sebastes marinus*) mean frequency at age per tow in the 2002 survey.

	stratum																mean weight	mean length
age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	total	g	cm
1																		
2	0.46	0.03	0.28		0.12		0.07	0.09		1.15	0.22			1.63	0.08	0.27	608	34
3	14.48	2.04	2.50	0.08	1.42	9.26	0.91	0.07	6.93	1.77	1.16	0.12				1.85	68	16
4	31.49	8.71	4.05	0.50	2.43	9.34	2.28	0.30	20.35	2.64	4.78			0.64	0.12	4.02	102	19
5	10.61	2.69	1.71	0.17	0.42	3.58	0.59	0.05	8.49	0.71	1.17			0.29		1.33	102	18
6	42.39	19.94	2.48		1.93	2.02	2.07		8.57	3.31	2.36			2.36	0.12	4.37	190	23
7	22.45	9.40	1.18	0.21	1.04	0.97	0.82	0.17	4.12	7.28	1.66	0.06		6.70	0.23	3.05	340	27
8	14.16	6.63	0.98		1.13	0.81	0.30	0.31	2.14	3.28	1.37	0.17		5.02	0.38	1.98	334	28
9	16.72	8.37	1.35	0.17	1.13	0.79	0.68	0.29	2.65	4.47	2.39	0.13	0.16	8.85	0.40	2.68	356	28
10	6.55	3.38	0.71		0.52	0.75	0.26	0.24	2.25	3.73	1.77	0.27		4.68	0.40	1.47	437	30
11	0.84	0.60	0.05		0.20	0.03	0.08	0.07	1.18	0.31	0.37	0.04		1.22	0.11	0.27	517	32
12	19.75	10.42	2.61	0.38	3.23	1.84	1.48	1.20	12.61	26.64	7.87	0.53	0.49	25.71	1.70	7.12	495	32
13	0.51	0.33	0.42	0.25	0.87	0.17	0.11	0.42	2.39	9.91	1.57	0.12		1.23	0.12	1.35	656	35
14	1.56	0.87	0.19		1.64	0.33	0.26	0.12	2.75	7.78	0.97	0.04	0.32	2.68	0.31	1.32	736	36
15																		
16			0.14		0.12	0.33				0.33	0.34				0.12	0.10	985	40
17	0.26		0.14					0.14			0.11			0.35		0.05	1139	42
18	0.26				0.37		0.11			0.90				0.14	0.12	0.14	782	37
19																		
20+																		

Table 16 – Redfish (*Sebastes marinus*) age-length key in 2002.

MALE

length	age																	no	
cm	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	id.	total
13																			3	3
14	3																		6	9
15																			15	15
16	1																		18	19
17		3	1																16	20
18	1	3																	13	17
19		3	1																13	17
20		1	1	1															15	18
21			1	3															12	16
22				4															16	20
23				1															9	10
24				1	1														13	15
25				1	3														14	18
26				1	2		1												12	16
27						2													19	21
28						1	1			1									20	23
29							2			1									23	26
30						1	1	1		3									29	35
31						1		2		7									27	37
32					1					1									29	31
33					1					2									25	28
34											1								23	24
35										1									16	17
36												1							14	15
37																1			7	8
38																			5	5
39																			3	3
40																			2	2
41																			2	2
42																			2	2
43																				
44																			2	2
45																			1	1

no id.: unidentified

Table 16 – (continued)

FEMALE

length	age																		no	
cm	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	id.	total
13																			1	1
14	1																		6	7
15																			21	21
16		2																	20	22
17	1		2																16	19
18	1	1																	16	18
19		1																	13	14
20		2	1																13	16
21		1																	22	23
22				1															15	16
23				1	1														7	9
24				3															8	11
25				1	1														8	10
26						1	1												12	14
27					1	1	1			1									12	16
28							1			1									14	16
29								2											19	21
30							1	1		2									15	19
31							1	2	1	1									13	18
32										2									20	22
33								1	1	1									17	20
34										2									25	28
35										2		1							14	17
36										1		1							15	17
37												1							19	20
38																			11	11
39											1								14	15
40														2					9	11
41																			4	4
42															1				3	4
43																				
44																			1	1
45																				
46																			3	3
47																			2	2
48																				
49																				
50																				
51																				
52																				
53																			1	1

Table 17 – Redfish (*Sebastes mentella*) mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4	0.31	0.63
2	838	10	0.38	1.20
3	628	7	0.26	0.32
4	348	4	0.05	0.09
5	703	8	0.24	0.32
6	496	6	0.43	0.39
7	822	9	7.31	6.22
8	646	7	21.83	22.87
9	314	3	336.22	395.40
10	951	11	77.82	130.98
11	806	9	8.74	6.58
12	670	8	67.79	53.74
13	249	3	25.36	9.96
14	602	7	411.15	413.74
15	666	8	24.27	34.33
16	634	7	9.98	6.02
17	216	2	11.81	14.25
18	210	2	19.43	6.82
19	414	5	4.86	2.24
total	10555	120	50.98	11.87

Table 18 – Redfish (*Sebastes mentella*) mean length frequency per tow in the 2002 survey.

length	male	female	length	male	female	length	male	female
13	0.20	0.10	22	6.20	5.30	31	0.70	2.60
14	0.60	0.20	23	7.70	6.80	32	0.40	0.90
15	1.70	0.90	24	10.60	7.90	33	0.20	0.70
16	6.40	4.80	25	9.00	6.40	34	0.20	0.20
17	8.60	6.90	26	11.40	3.90	35	0.10	0.10
18	11.30	10.30	27	11.50	4.40	36	0.10	0.10
19	17.60	18.40	28	6.20	8.80	37	0.10	
20	17.60	15.00	29	2.30	10.40	38	0.10	0.10
21	8.30	6.40	30	1.40	6.70	39		

Table 19 – Redfish (*Sebastes mentella*) mean frequency at age per tow in the 2002 survey.

	stratum																			mean weight	mean length
age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	g	cm
1																						
2							0.3	0.7	2.0	0.7	0.2			1.1						0.3	43	15
3	0.2	0.5	0.3		0.3	0.8	14.3	23.1	143.0	53.5	13.7	1.3	0.3	34.0	4.6					15.1	59	16
4	1.7	2.4	0.1		0.5	1.2	38.9	126.2	666.3	367.5	41.1	15.0	1.0	296.6	32.1	0.2				87.1	94	19
5	0.6	0.5			0.1	0.2	8.9	41.0	231.0	127.3	9.5	11.3	2.9	169.4	15.1	0.5		0.2	0.1	33.8	119	20
6		0.4	0.1	0.1		0.1	4.7	14.7	175.1	53.2	3.9	34.9	11.6	251.2	20.4	1.8		1.6	0.8	29.9	172	23
7			0.1	0.1		0.2	2.4	5.1	144.1	24.2	2.0	38.9	11.5	242.2	13.2	2.5		1.1	1.1	24.7	204	24
8			0.2		0.1	0.2	1.0	2.5	113.1	12.1	1.4	35.1	10.6	197.2	1.0	3.1	0.4	4.0	1.6	19.5	260	26
9			0.2		0.1	0.3	0.5	1.0	105.0	7.1	1.2	30.8	10.3	178.3	9.0	3.4	1.0	5.4	1.8	17.3	295	27
10							0.1	0.2	31.4	1.8	0.5	9.6	3.5	51.0	2.5	1.5	1.3	2.7	0.8	5.1	346	29
11							0.1	0.3	14.0	0.9	0.3	9.7	4.8	34.0	2.0	2.4	3.8	3.8	0.8	3.7	372	29
12			0.2		0.2	0.1	0.8	2.6	188.4	12.2	2.6	54.9	19.4	298.3	12.9	6.5	6.2	14.9	3.4	29.9	331	28
13								0.1	2.3		0.1	2.5	3.2	4.5	0.7	1.7	3.2	4.9	0.6	0.9	541	33
14									0.9			1.0	0.9	1.0		0.3	1.1	1.1	0.1	0.2	528	33
15								0.1	0.4		0.1	1.4	1.1	1.7	0.3	1.2	2.0	0.9	0.3	0.4	603	35
16												0.5	0.4	0.1	0.1	0.3	0.9		0.3	0.1	643	35
17									1.4			1.2	0.6	2.8		0.4	0.5	0.7	0.2	0.4	427	31
18												0.2					0.2	0.2			158	8
19								0.1			0.1	0.2	0.4	0.7		0.2	0.4	0.1		0.1	597	35
20												0.6	0.2	0.1		0.6	0.8	1.1	0.6	0.1	744	37
21																						
22												0.2					0.2	0.2			158	8
23												0.3	0.2	0.1		0.1	0.3	0.1			213	14
24													0.3								83	3
25+													0.3								77	3

Table 20 – Redfish (*Sebastes mentella*) age-length key in the 2002 survey.

MALE

length	age																								no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	id.	total
12																										2	2
13																										5	5
14		1	4																							10	15
15			10																							10	20
16			4	3																						12	19
17			1	6																						8	15
18			1	5	1																					13	20
19				6	2																					11	19
20				3	3																					10	16
21				2	3	1						1														13	20
22				1	4	2		1																		14	22
23					1	5	3																			14	23
24					1	3	5																			17	26
25						3	4	1																		13	21
26							1	3	2		1	2														18	27
27								4	3			5														22	34
28								1	2	1		3														18	25
29									2	2		6														13	23
30										2	1	1					1									13	18
31									1	1	4	4	1													12	23
32											4	1	1		1								1			12	20
33												2	2	1												11	16
34													2	1	1		1			1						10	16
35															1	1										8	10
36													1													9	10
37															1											5	6
38																				1						5	6
39																				2						1	3
40																										2	2
41																											
42																											
43																										1	1

Table 20 – (continued)

FEMALE

length	age																							no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	id.	total
12																											
13																										5	5
14																										7	7
15		1	4	1																						5	11
16			9																							10	19
17			1	6																						9	16
18				7																						13	20
19				5	2																					9	16
20				6	1	2																				7	16
21				4	2																					15	21
22					1	7	2																			13	23
23					1	8	1																			17	27
24						2	4	2																		21	29
25						3	8	2																		13	26
26							2	4	2			1														17	26
27								2	4																	17	23
28								2	4	1		2														20	29
29								1	2	2		6														18	29
30												4														20	24
31										1	5	4														14	24
32											2	4	1	1												11	19
33											1	4	4		1											8	18
34											1		1		1				1							7	11
35												1		1			1		1							5	9
36															1	3			1							2	7
37													1	1	2											2	6
38																		1		1		1				1	4
39																										1	1
40																											
41																									1		1
42																								1			1

Table 21 – Mean frequency at age by tow of *Sebastes mentella*.

age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1			0.12	0.07			0.07	0.13			
2			0.61	3.25	3.49	0.73	1.89	2.95		0.70	0.27
3	0.82		13.33	38.01	20.16	5.96	26.60	28.49	4.35	55.70	15.09
4	15.87	2.28	65.25	245.15	145.82	39.67	17.04	49.37	15.55	44.65	87.10
5	112.89	5.20	28.27	148.12	379.24	219.25	19.07	27.64	31.90	30.98	33.79
6	63.47	18.32	15.93	5.86	59.24	126.37	49.11	30.29	25.38	28.60	29.89
7	34.42	15.67	23.81	10.88	10.57	9.88	33.73	50.86	40.94	23.98	24.74
8	30.99	11.08	14.67	12.34	10.28	4.11	139.86	47.68	72.13	24.79	19.51
9	21.65	4.29	9.68	7.35	7.97	2.71	5.53	177.77	38.27	9.90	17.33
10	13.59	5.09	7.54	6.93	4.65	3.12	0.85	7.41	203.99	6.82	5.11
11	8.97	5.19	6.49	7.71	3.50	1.66	0.59	0.29	3.63	37.43	3.66
12	6.59	6.15	4.10	3.67	3.54	1.66	3.42	0.52	0.34	1.29	29.87
13	6.49	4.10	3.16	3.01	2.08	0.89	0.36	1.23	0.28	0.58	0.91
14	4.83	4.36	2.01	3.27	2.34	1.51	0.46	0.16	2.47	0.30	0.24
15	4.34	5.35	2.11	3.36	1.83	0.42	0.21	0.34	0.13	0.42	0.39
16	3.05	1.59	1.08	2.09	1.32	0.60	0.35	0.37	0.11	0.22	0.10
17	1.95	1.86	0.73	1.29	0.85	0.55	0.64	0.24	0.18	0.17	0.36
18	1.36	1.32	1.04	1.10	0.83	0.13	0.03	0.65	0.10		0.02
19	1.25	0.95	0.45	0.58	0.40	0.17	0.09	0.09	0.63	0.03	0.10
20	0.44	0.79	0.28	0.48	0.50	0.19		0.13			0.15
21	0.33	0.38	0.17	0.32	0.21	0.07		0.14	0.05		
22	0.01		0.16	0.16	0.07	0.03	0.03	0.02	0.09		0.02
23	0.07	0.13	0.09	0.06	0.16			0.08	0.12	0.05	0.05
24	0.11	0.13	0.04	0.06	0.06		0.02	0.05	0.13		0.01
25+	0.19			0.32	0.20		0.02	0.13	0.16		0.01

Table 22 – Redfish (*Sebastes fasciatus*) mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4	133.42	199.55
2	838	10	16.10	44.85
3	628	7	10.06	10.83
4	348	4	1.28	1.43
5	703	8	8.79	13.77
6	496	6	6.54	4.77
7	822	9	13.28	12.10
8	646	7	24.18	12.61
9	314	3	319.38	418.96
10	951	11	41.65	39.92
11	806	9	25.96	21.70
12	670	8	8.64	10.53
13	249	3	5.25	6.50
14	602	7	44.27	37.42
15	666	8	10.57	9.58
16	634	7	0.58	0.68
17	216	2	0.11	0.04
18	210	2	0.71	0.07
19	414	5	0.38	0.19
total	10555	120	28.82	8.13

Table 23 – Redfish (*Sebastes fasciatus*) mean length frequency per tow in the 2002 survey.

length	male	female	length	male	female	length	male	female
13	0.10	0.10	20	9.10	11.90	27	0.90	1.80
14	1.50	1.10	21	9.00	5.90	28	0.70	1.40
15	7.00	7.40	22	9.70	6.10	29	0.20	0.60
16	14.20	12.60	23	5.70	2.70	30	0.10	0.30
17	15.70	15.00	24	3.90	2.70	31		0.20
18	23.10	21.20	25	2.40	2.50	32		0.10
19	14.90	17.90	26	1.10	2.70	33		

Table 24 – Redfish (*Sebastes fasciatus*) age-length key in the 2002 survey.

MALE

length	age																		no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18+	id.	total
10																			1	1
11		1																		1
12		1																		1
13		1	1																5	7
14			3	2															19	24
15			3	2															27	32
16			2	3															26	31
17			1	5															30	36
18				11															32	43
19				8															29	37
20				4	4	2													33	43
21				1	4	3		1											30	39
22					2	5	2	2											21	32
23						2		3											24	29
24						3	8												17	28
25						1	2	2				1							17	23
26								2		1									19	22
27							1	1						1					12	15
28																			5	5
29																			4	4
30																			3	3
31																			1	1
32																			2	2
33																			1	1

Table 24 – (continued)

FEMALE

length	age																		no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18+	id.	total
10																			1	1
11																				
12																			1	1
13																			6	6
14		1	1																25	27
15	1	1	6	2															23	33
16			3	6			1												23	33
17			2	6															27	35
18			1	8	1														24	34
19				8	2														31	41
20				3	5	1													24	33
21					6	3	1												22	32
22					3	7	2												19	31
23					1	3	3												19	26
24						3	2												20	25
25							6	1											20	27
26								4	1			1							19	25
27							1	4											16	21
28																			19	19
29								1	2	1									13	17
30											2								15	17
31																			12	12
32																			6	6
33																			4	4
34																			4	4
35																				
36																			2	2

Table 25 – Redfish (*Sebastes fasciatus*) mean frequency at age per tow in the 2002 survey.

	stratum																				mean weight	length
age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	g	cm
1	6.9	0.7	0.5	0.1	0.4	0.8	0.2	0.3	6.8	1.0	0.2			0.4						0.7	55	15
2	10.9	1.8	1.7	0.1	0.8	1.7	0.5	1.3	8.0	2.1	0.4		0.2	1.2		0.1		0.5		1.4	49	14
3	296.5	15.7	17.5	1.8	16.1	21.0	9.3	14.0	241.8	35.5	13.3	1.7	0.9	14.3	2.7	0.3		0.8	0.1	28.2	67	16
4	805.9	41.1	53.7	4.2	54.3	44.7	47.2	68.0	1625.5	155.2	74.1	14.4	4.8	107.7	22.2	3.6	0.8	3.9	1.9	123.2	92	18
5	78.1	11.3	9.9	0.8	8.6	4.4	12.5	20.3	403.1	34.9	21.4	5.6	2.7	40.6	8.5	0.9	0.2	1.3	0.6	27.2	134	20
6	42.4	12.3	6.0	1.2	4.6	2.2	12.8	24.7	263.5	35.3	23.1	7.3	4.9	47.6	10.3	0.4		0.9	0.3	22.5	169	22
7	32.3	11.3	3.9	0.7	2.6	1.6	8.0	16.0	100.1	23.8	18.0	5.2	4.5	32.1	6.9	0.2		0.1	0.1	13.3	198	23
8	9.5	13.9	2.7	1.0	0.9	1.2	7.3	18.0	75.9	24.0	16.0	7.5	4.8	27.6	7.6	0.1		0.1	0.2	11.7	226	24
9		0.5	0.2		0.1	0.1	0.6	1.6	1.7	1.7	1.2	0.8	0.5	2.0	0.9					0.7	314	27
10		1.9	0.1		0.1	0.1	0.3	0.7		1.0	0.7	0.4	0.4	0.9	0.6					0.5	304	27
11		0.4	0.1				0.1	0.6	2.1	0.2	0.5	0.5	1.0	1.0	0.4					0.3	418	30
12		0.7	0.1		0.1	0.1	0.4	1.5	6.0	2.2	1.2	0.6	0.5	1.8	0.6					0.8	261	26
13																						
14	0.4	2.0		0.1						0.6	0.1	0.1	0.2	0.5	0.1					0.3	307	27
15																						
16+																						

Table 26 – Juvenile redfish (*Sebastes sp.*) mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4	74.30	96.74
2	838	10	21.61	34.02
3	628	7	18.06	21.54
4	348	4	1.22	1.08
5	703	8	13.92	10.05
6	496	6	47.75	61.60
7	822	9	10.88	7.31
8	646	7	5.98	6.90
9	314	3	207.67	130.53
10	951	11	88.56	102.42
11	806	9	60.22	50.70
12	670	8	0.10	0.25
13	249	3		
14	602	7	3.44	4.90
15	666	8	1.68	3.16
16	634	7		
17	216	2		
18	210	2		
19	414	5		
total	10555	120	28.69	4.40

Table 27 – Juvenile redfish (*Sebastes sp*.) mean length frequency per tow in the 2002 survey.

length		length		length	
7	0.00	11	0.03	15	0.11
8	0.00	12	0.08	16	0.02
9	0.01	13	0.22	17	0.01
10	0.02	14	0.33	18	

Table 28 – Greenland halibut (*Reinhardtius hippoglossoides*) mean catch per tow by strata and its standard error in the 2002 survey.

	area	tow	catch per tow (Kg)	
stratum	sq. miles	number	mean	s. error
1	342	4		
2	838	10	0.16	0.37
3	628	7	2.88	2.71
4	348	4	2.16	2.60
5	703	8	1.22	1.15
6	496	6	2.70	2.43
7	822	9	6.74	4.49
8	646	7	17.55	8.46
9	314	3	5.71	5.65
10	951	11	10.10	7.28
11	806	9	5.43	4.44
12	670	8	20.94	6.46
13	249	3	27.04	7.28
14	602	7	23.20	7.33
15	666	8	23.93	18.28
16	634	7	44.46	14.26
17	216	2	12.23	4.91
18	210	2	42.68	22.98
19	414	5	68.46	18.28
total	10555	120	14.81	0.81

Table 29 – Greenland halibut (*Reinhardtius hippoglossoides*) mean length frequency per tow in the 2002 survey.

length	male	female	length	male	female	length	male	female
10-11		0.01	30-31	0.05	0.15	50-51	0.56	1.14
12-13	0.01	0.04	32-33	0.13	0.06	52-53	0.22	0.74
14-15	0.28	0.33	34-35	0.29	0.27	54-55	0.11	0.41
16-17	0.60	0.97	36-37	0.37	0.51	56-57	0.04	0.21
18-19	0.12	0.12	38-39	0.49	0.59	58-59		0.09
20-21	0.02		40-41	0.85	0.96	60-61		0.09
22-23	0.08	0.04	42-43	0.95	1.24	62-63		0.04
24-25	0.55	0.38	44-45	1.03	1.34	64-65		0.01
26-27	0.78	0.77	46-47	0.97	1.59	66-67		0.01
28-29	0.33	0.68	48-49	0.82	1.38	68-69		

Table 30 – Greenland halibut (*Reinhardtius hippoglossoides*) mean frequency at age per tow in the 2002 survey.

	stratum																			mean weight	mean length
age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	g	cm
1		1.98	0.75	0.96	4.42	2.21	1.96	0.33	14.17	4.75			0.72	0.62	0.14				2.44	32	16
2		6.67	0.45	0.59	4.49	4.71	6.03	0.67	3.05	4.39	0.06		0.03	0.09					2.04	134	26
3		5.59	1.05	0.58	3.80	6.00	6.47	0.71	2.07	3.37	0.22		0.30	0.69	0.11		0.20	0.41	2.01	182	28
4		0.75	0.05	0.09	0.91	2.61	2.81	0.61	1.32	1.56	1.00	0.06	1.32	3.68	1.24	0.29	2.01	3.72	1.37	379	36
5	0.08	0.54	0.42	0.17	0.65	2.04	4.23	2.10	2.27	1.12	3.93	3.90	5.66	7.56	6.60	2.51	12.59	17.78	3.40	545	41
6	0.02	0.27	0.64	0.36	0.17	1.11	5.41	2.50	3.14	1.04	8.30	9.84	7.67	9.10	14.97	3.31	19.83	28.57	5.18	717	44
7	0.08	0.04	0.97	0.56	0.17	0.93	6.00	2.28	3.48	1.50	9.49	12.59	9.76	8.97	20.84	4.37	17.74	28.33	5.85	968	49
8	0.02		0.16	0.05	0.15	0.10	1.24	0.32	0.97	0.48	1.76	2.52	2.56	1.72	5.19	1.08	2.91	4.78	1.24	1205	52
9			0.01	0.01	0.02	0.06	0.12	0.01	0.09	0.02	0.24	0.73	0.24	0.16	0.81	0.45	0.16	0.64	0.16	1563	57
10						0.07					0.08	0.68	0.14	0.02	0.33	0.31		0.29	0.07	1917	61
11												0.19		0.07	0.17			0.12	0.02	2046	63
12																0.49			0.01	2475	67
13																					
14																					
15																					
16+																					

Table 31 - Greenland halibut (*Reinhardtius hippoglossoides*) age-length key in the 2002 survey.

MALE

length	age																no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id.	total
10-11																		
12-13	1																	1
14-15	21																	21
16-17	23																	23
18-19	11	1																12
20-21		2																2
22-23		10																10
24-25		19	2															21
26-27		10	10															20
28-29		6	14															20
30-31			3	2														5
32-33			6	6														12
34-35			6	11	3													20
36-37				9	9												1	19
38-39				8	13													21
40-41					9	10	1										2	22
42-43					10	14	2											26
44-45					1	23	9	1										34
46-47						14	14	1									1	30
48-49						7	16	3										26
50-51						2	14	6										22
52-53							14	6										20
54-55							5	8										13
56-57								3	1									4

Table 31 – (continued)

FEMALE

length	age																no	
cm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	id.	total
10-11	1																	1
12-13	4																1	5
14-15	20																1	21
16-17	22																	22
18-19	11	3																14
20-21		1																1
22-23		2	1															3
24-25		14	6															20
26-27		10	6														4	20
28-29		4	17															21
30-31		2	15															17
32-33			2	3													1	6
34-35			1	15	3													19
36-37			1	15	3	1												20
38-39				4	12	4												20
40-41					16	4											1	21
42-43					13	11												24
44-45					3	16	3											22
46-47						12	15										2	29
48-49						4	20	1										25
50-51							25	6									1	32
52-53							20	2	1									23
54-55							10	11	1									22
56-57							2	17	2									21
58-59								6	5									11
60-61									4	7								11
62-63									1	1	3							5
64-65										1								1
66-67												1						1

Table 32 – Greenland halibut (*Reinhardtius hippoglossoides*) mean catch per tow (kg) by strata in 1988-2002 surveys.

	depth in	year														
stratum	fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	70- 80															
2	81-100		0.04	0.10					1.86		0.04	0.09	0.05		0.24	0.16
3	101-140	0.54	0.65	0.16	0.17	0.37	0.06		0.45	2.21	1.87	7.55	7.16	5.01	7.90	2.88
4	"	5.36	0.75		0.56	1.02	0.38		0.20	0.02	0.86	1.53	7.34	7.69	5.83	2.16
5	"	1.37	1.78		0.52	0.76	0.01	0.03	0.39	0.66	1.79	3.17	7.53	5.63	4.93	1.22
6	"	0.83	0.47	0.39	0.33	0.22	0.41		0.83	2.76	5.93	9.39	7.82	4.62	6.91	2.70
7	141-200	1.34	0.99	0.91	2.96	3.86	1.48	3.37	14.21	18.04	22.38	40.98	37.02	24.67	15.43	6.74
8	"	3.02	4.44	1.23	3.59	7.58	2.80	0.91	6.66	7.17	21.30	19.77	39.87	26.32	22.48	17.55
9	"	7.41	6.75	2.18	3.12	13.27	1.27	1.77	7.33	6.56	10.46	19.41	14.56	10.06	14.61	5.71
10	"	1.46	1.12	0.79	2.33	4.91	0.43	3.18	7.14	9.73	11.70	18.60	20.75	21.76	23.68	10.10
11	"	0.72	0.97	0.36	1.69	3.66	3.75	3.78	7.88	10.74	10.05	19.68	21.16	17.45	16.37	5.43
12	201-300	7.82	12.48	5.55	14.67	11.93	17.98	23.51	22.11	40.95	43.35	59.35	70.61	41.92	30.51	20.94
13	"	3.33	6.41	11.31	2.25	1.24	7.41	7.93	6.59	15.44	25.07	28.75	50.78	19.83	15.05	27.04
14	"	7.88	6.48	6.10	16.89	18.19	7.01	13.30	8.81	19.36	34.10	31.36	23.17	10.53	18.81	23.20
15	"	8.44	3.27	10.19	18.88	12.47	26.72	28.95	34.29	28.07	52.17	78.66	57.94	52.12	31.36	23.93
16	301-400	27.98	27.78	51.82	51.49	37.21	44.32	31.05	37.93	42.75	36.07	68.37	23.28	41.07	27.05	44.46
17	"	15.93	7.15	7.59	24.77	2.40	11.82	44.39	44.36	15.41	31.43	44.05	36.12	29.80	10.13	12.23
18	"	6.48	3.03	31.13	21.73	3.59	8.02	23.75	58.92	11.76	34.23	47.67	57.30	11.03	35.34	42.68
19	"	95.61	29.14	32.01	47.50	94.73	41.87	35.13	38.38	30.30	48.80	81.22	31.68	55.36	34.92	68.46
total		8.48	5.47	7.10	10.00	10.68	8.79	9.84	13.31	14.19	19.70	29.66	25.96	20.75	16.98	14.81
s.e.		0.94	0.48	0.99	1.00	1.70	1.17	0.83	1.50	1.08	1.39	1.65	1.86	1.13	0.95	0.81

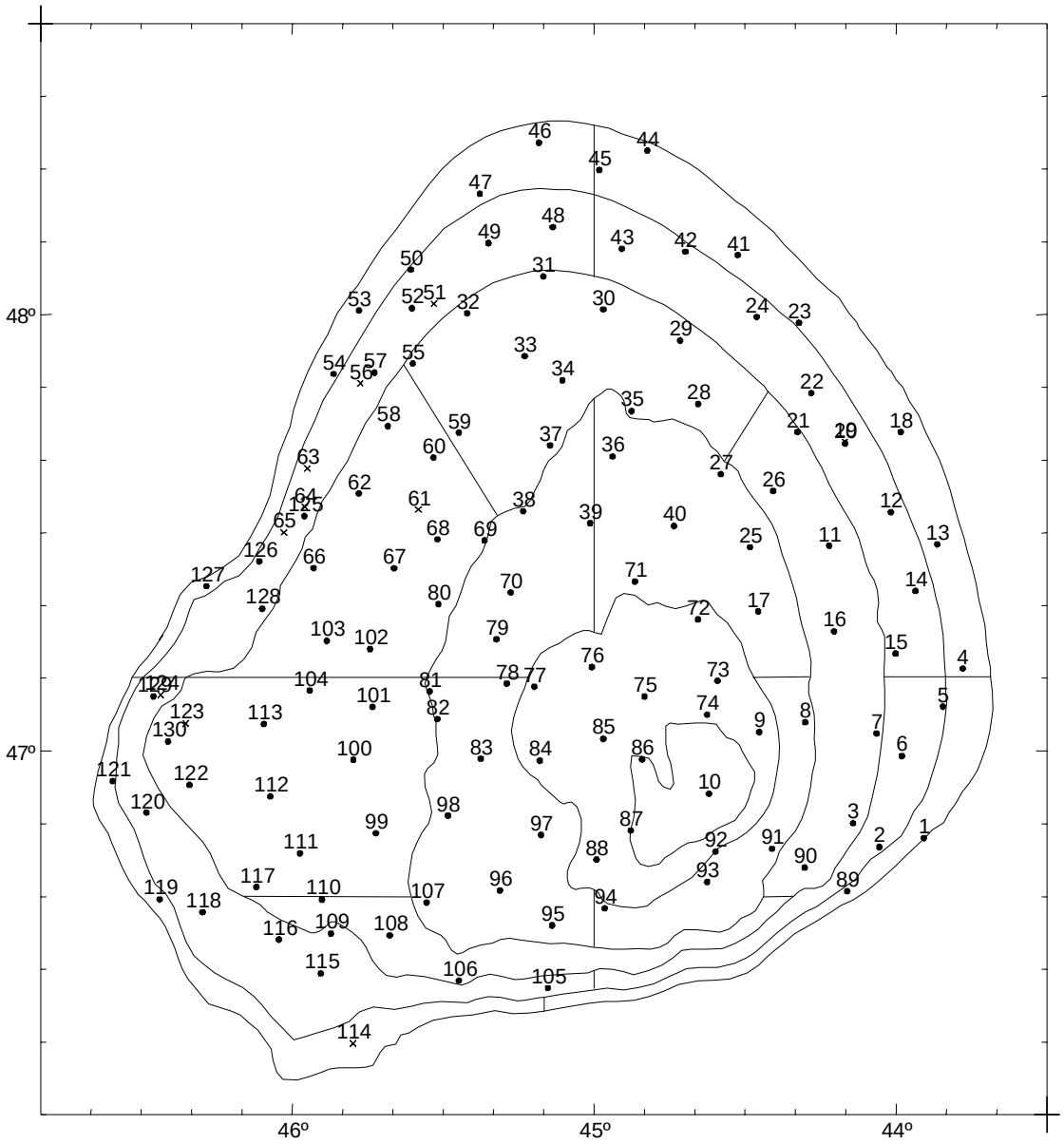

Fig. 1 - Haul positions for the Flemish Cap 2002 survey.

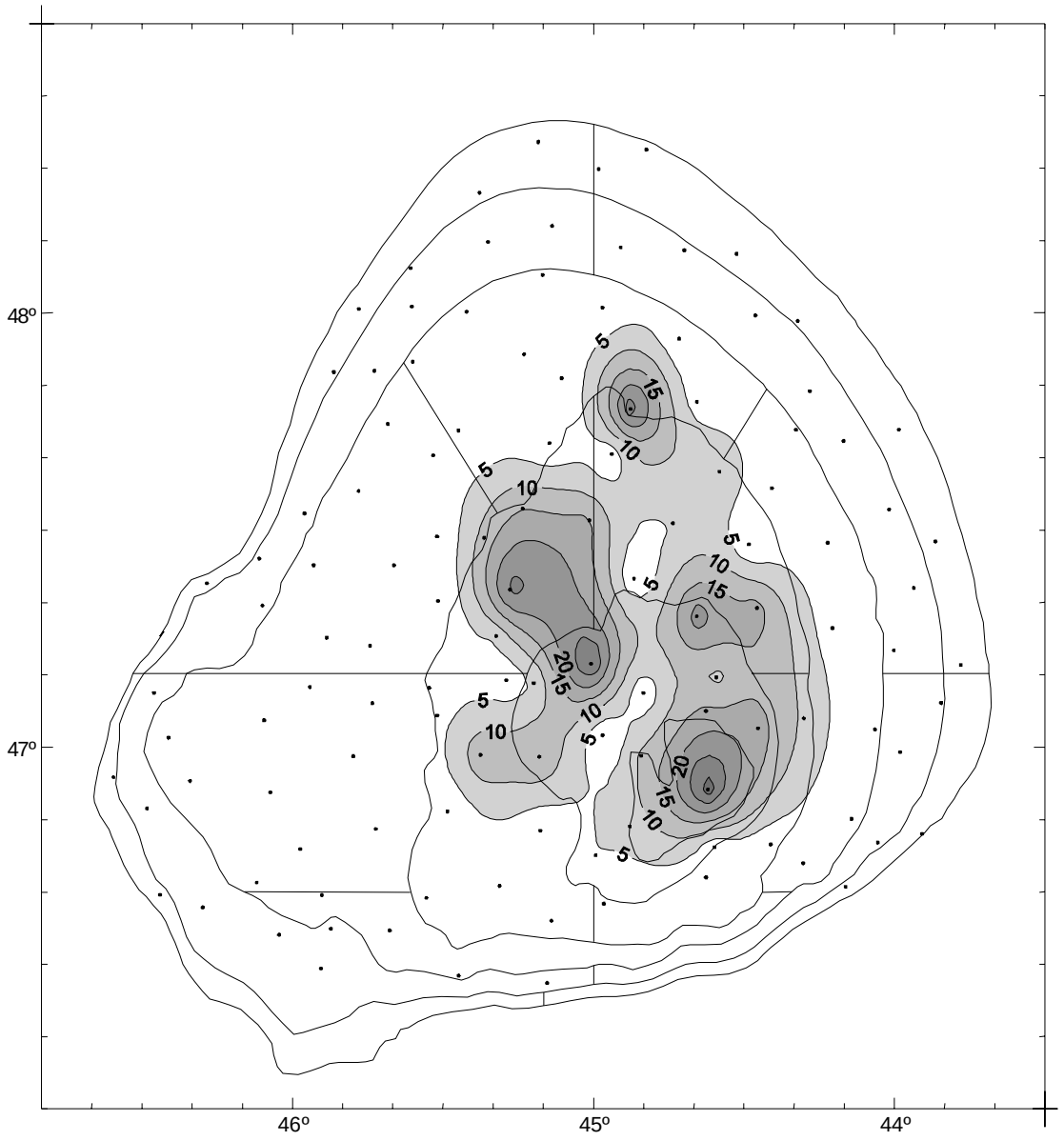

Fig. 2 - Cod (*Gadus morhua*) catch distribution in the 2002 survey in Kg/tow.

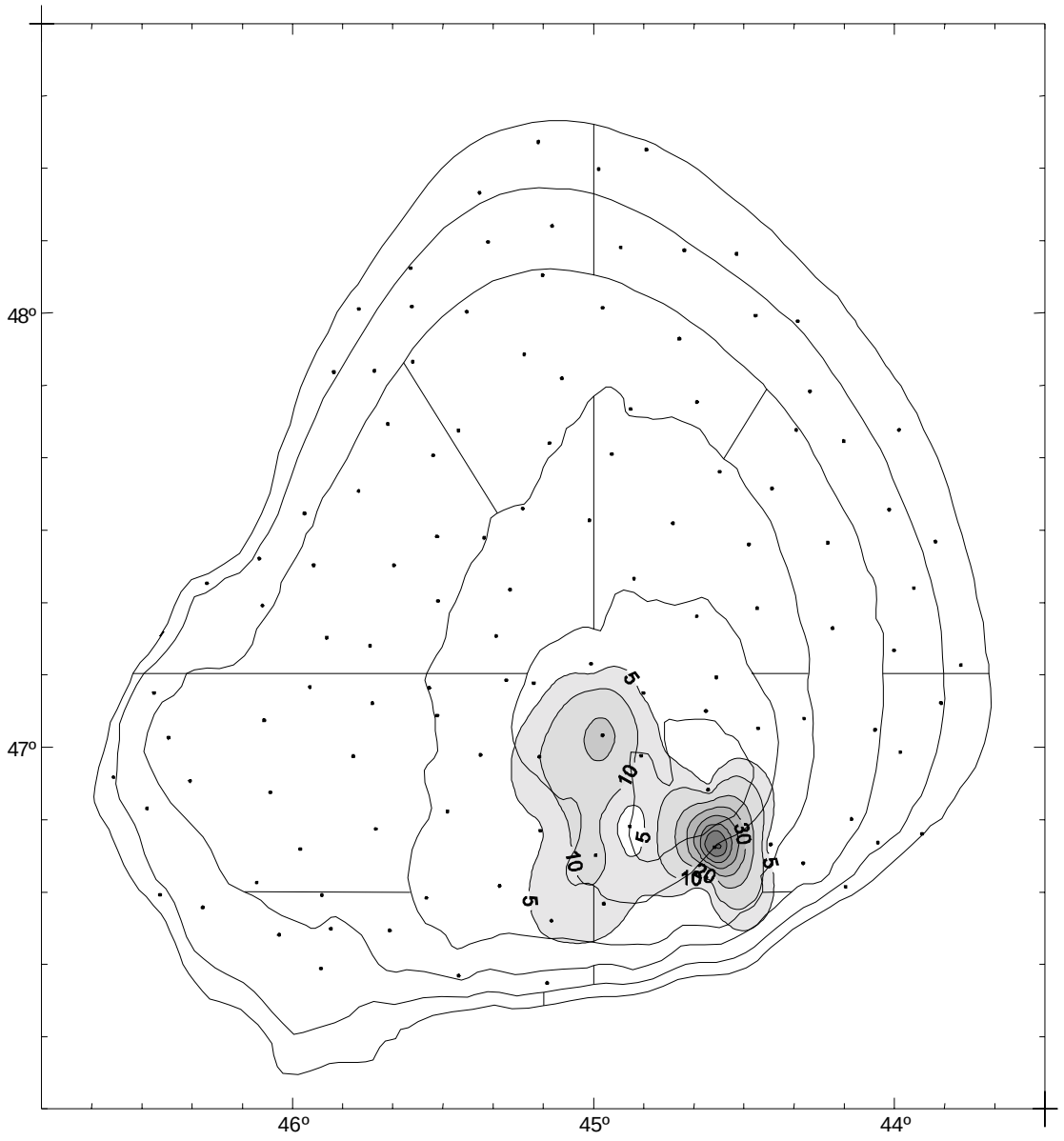

Fig. 3 - American plaice (*Hippoglossoide platessoides*) catch distribution in the 2002 survey in Kg/tow

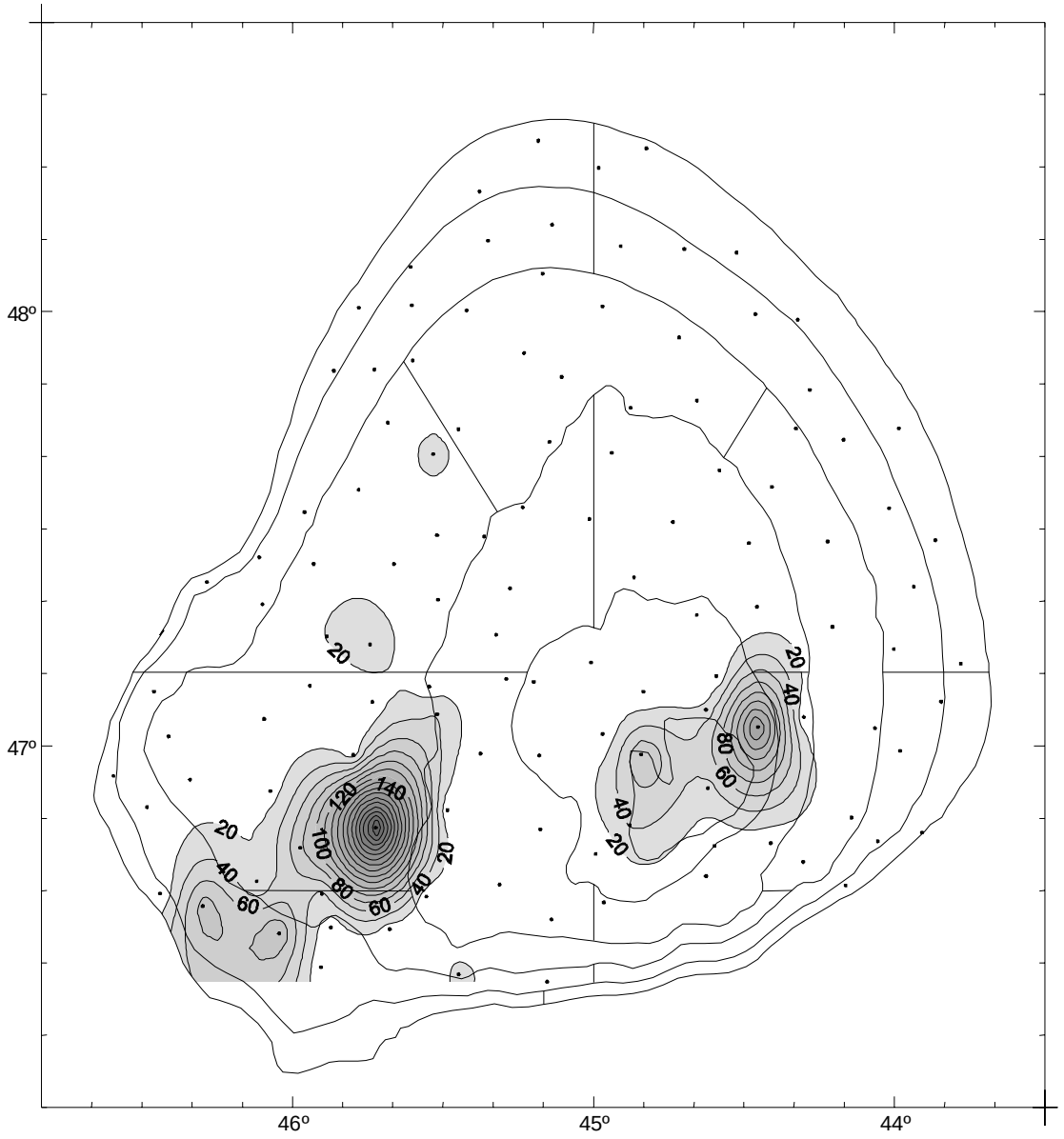

Fig. 4 - Redfish (*Sebastes marinus*) catch distribution in the 2002 survey in Kg/tow

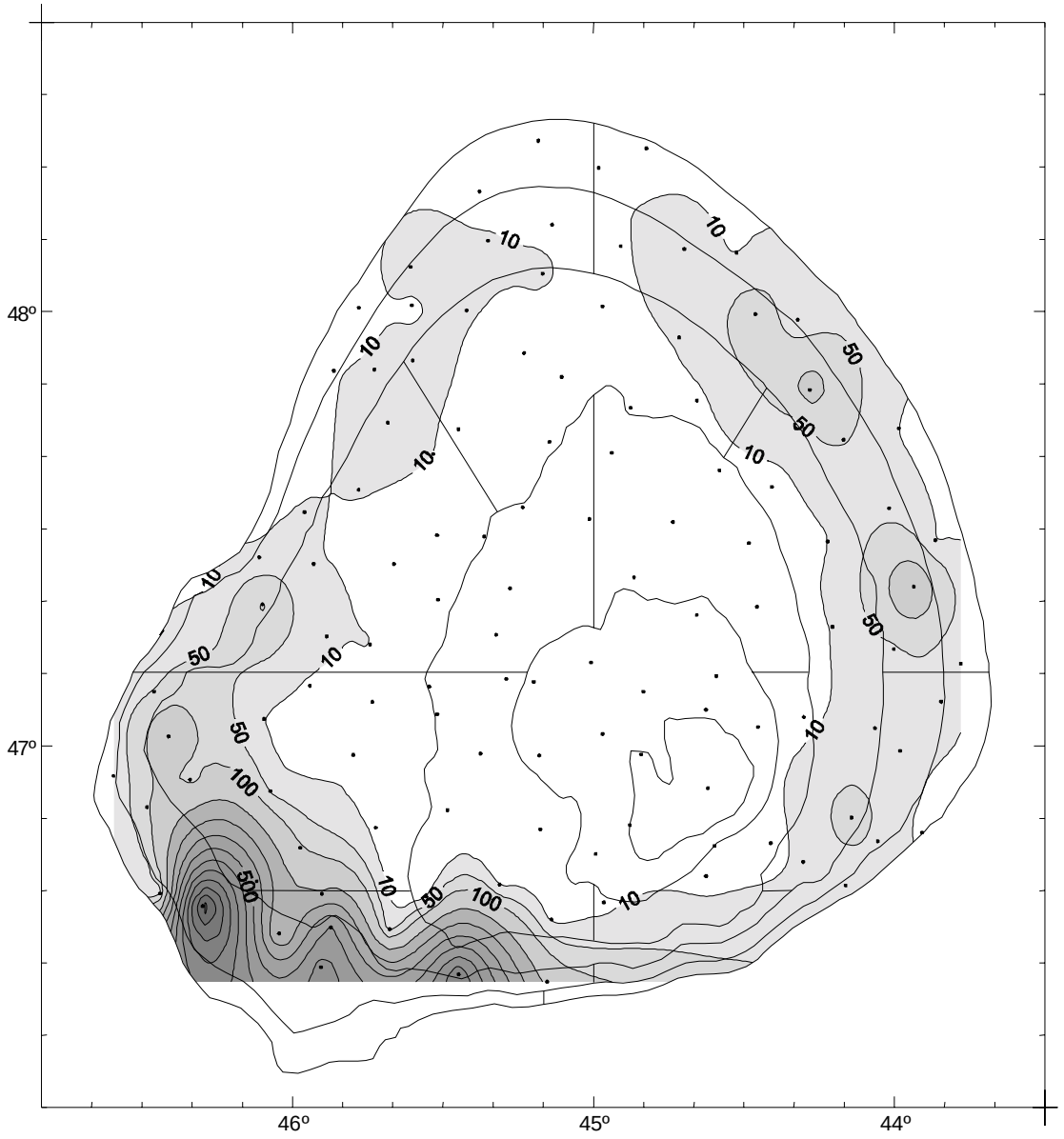

Fig. 5 - Redfish (*Sebastes mentella*) catch distribution in the 2002 survey in Kg/tow

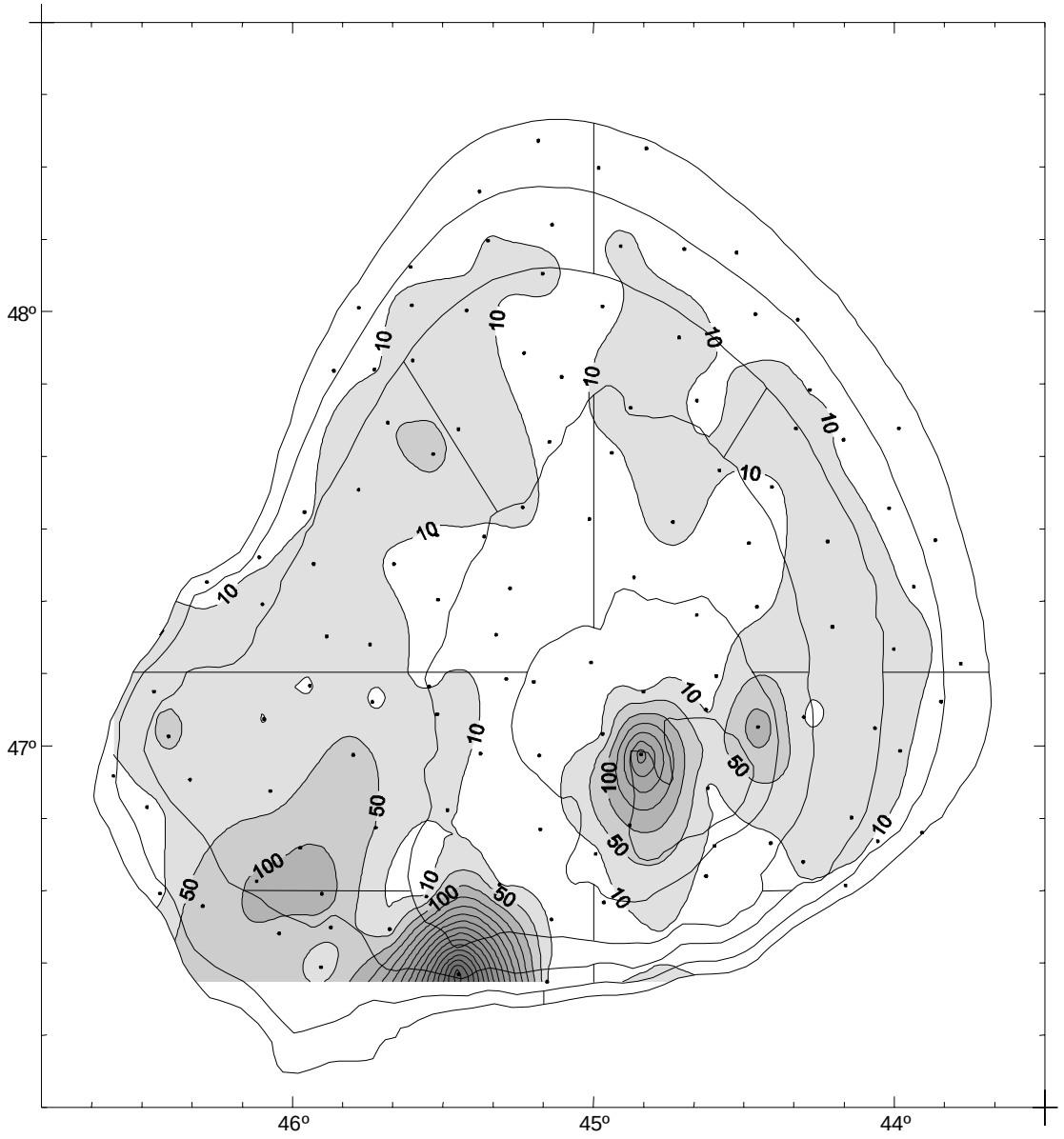

Fig. 6 - Redfish (*Sebastes fasciatus*) catch distribution in the 2002 survey in Kg/tow

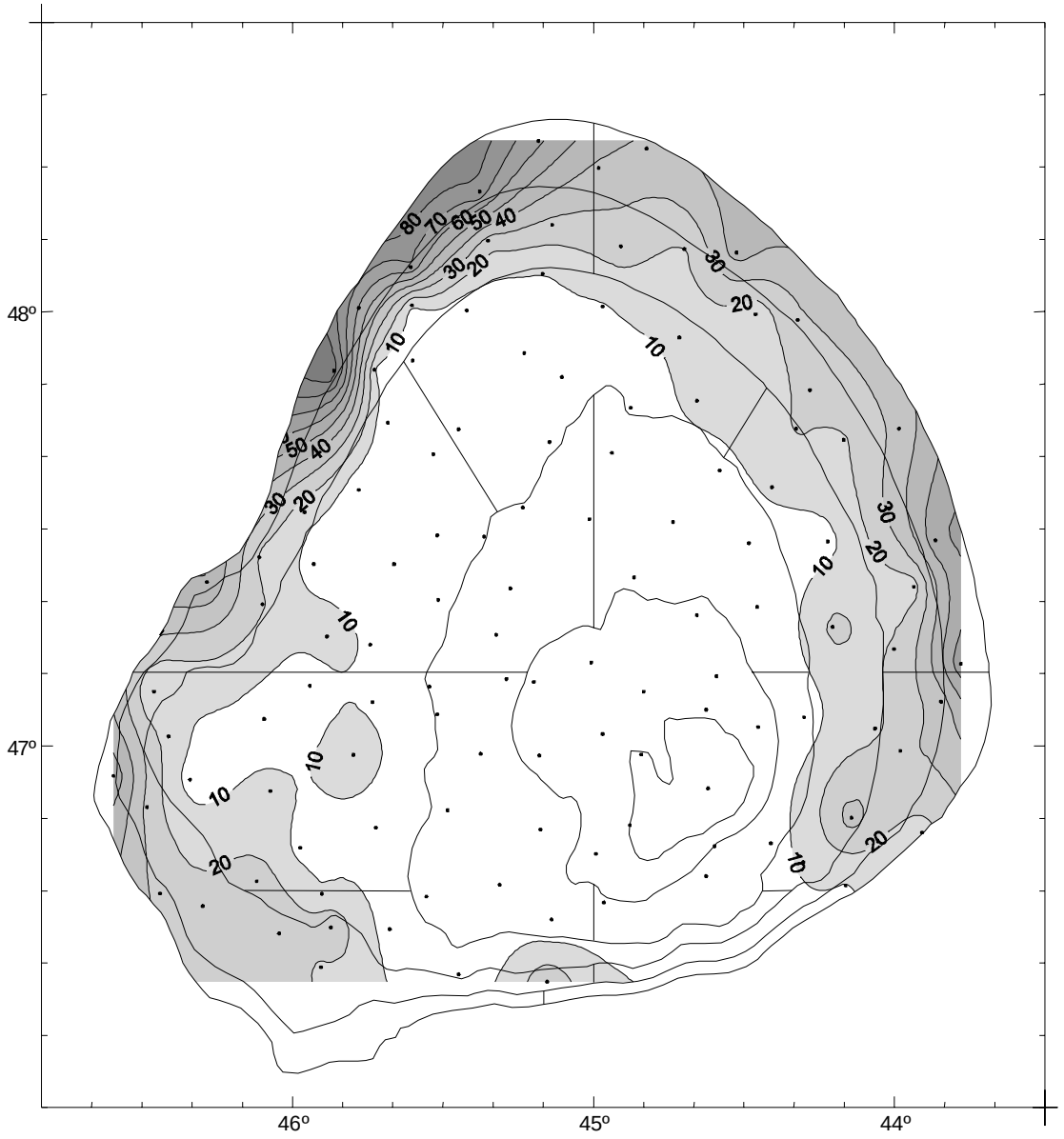

Fig. 7 - Greenland halibut (*Reinhardtius hippoglossoides*) catch distribution in the 2002 survey in Kg/tow.