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Results from Bottom Trawl Survey of Flemish Cap in July 1996

by

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The survey of Flemish Cap was carried out in 1996 on board R/V Cornide de Saavedra. A synoptic sheet of the survey with ship and gear characteristics is shown in Table 1. This was the ninth survey of the series initiated by the EU in 1988. Dates of the previous survey 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	28/0 -14/7

All survey had a stratified random design following NAFO specifications (Doubleday, 1981).

A total of 117 valid bottom trawl were made up to a depth of 720 metres (400 fathoms) (Figure 1). The survey covered adequately all strata of the bank.

Total biomass of all species was calculated by the swept area method. The results are presented in Table 2, where some species are grouped to balance possible identification error in former surveys. Those amounts are assumed to underestimate real values but in different degrees, as a consequence of each species having a peculiar catchability and accesibility to bottom gears. In this framework, the total biomass estimated for 1995 has the minimum value of all the series. Redfish shows the highest annual variability due to probably its pelagic habitat, making accessibility to bottom gears to change more often than demersal or bentic species. Cod, American plaice, Synaphobranchus and Antimora reached a biomass minimum in 1996. Meanwhile, dogfish and Greenland halibut reached a maximum.

RESULTS

Weighted (by stratum area) mean catches in half-hour tows of main species on the bank were:

	1988	1989	1990	1991	1992	1993	1994	1995	1996
cod	46.7	146.0	70.8	47.1	30.3	67.1	54.4	11.6	10.3
American plaice	15.0	14.3	11.6	9.7	8.0	7.1	7.6	6.6	3.9
redfish	207.5	194.4	133.3	81.5	126.9	70.9	95.6	94.7	123.5
Greenland halibut	7.9	5.9	7.2	7.9	10.3	7.3	9.2	13.4	13.8
shrimp	2.5	2.7	2.7	10.2	20.3	9.5	3.8	6.9	8.0

Kg

Cod

Mean catch by strata and whole bank data and their standard error are presented in Table 3. Biomass estimated by the swept area method by strata and its comparison with results of previous surveys are presented in Table 4. Global data 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	37,127	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	2,400	2,400
1993	55,642	8,900	9,700
1994	42,767	-	-
1995	8,815	8,260	-
1996	8,196	-	-

tons

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

The calculated abundance (x 10000) by age-groups is shown in the following table. Values for 1989, as presented in previous reports, were modified because a systematic error was detected in that year ageing criterion; so ages were reviewed.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	
1 -	458	2418	237	13780	7118	438	314	155	4	
2 -	7196	6062	1179	2560	3706	13274	385	1137	297	
3 -	4037	6964	467	1548	475	2852	4710	123	613	
4 -	1085	2819	1588	192	203	102	844	361	82	
5 -	128	227	1453	622	33	127	18	90	225	
6 -	22	33	394	173	127	17	9	1	19	
7 -	28	12	32	25	21	50		2	1	
8 -	11	7	13	1	1	10	18		1	
9 -		1	8	4				1		
10 -			3				1	1		
11 -				1	1					
12 -										
total	12965	18543	5374	18906	11685	16870	6270	1873	1240	
Biomass	37127	103644	55360	36597	24295	55642	42767	8815	8296	tons
SOP*	33474	100217	51388	37231	22734	54945	42153	8841	8138	tons

*) SOP = Sum of products: back calculation of biomass as sum of products of frequencies and mean weight at age.

Recruitment is believed to be completed before age 2 with the 35 mm mesh size used in the cod-end. The 1990 year-class was the more abundant one observed at age 1, but its importance did not maintained in the following years, after recruitment; it seems indicate that its abundance was overestimated in 1991 survey. The 1991 year-class, the more abundant one at age 2, was the more important of last years, but its abundance decreased quickly as a consequence of an intense fishery on ages 2 and 3 during year 1993 and 1994. Most recent year-classes, those of 1993, 1994 and 1995, were among weaker ones observed in the period.

Approximately the half part of the cod catch of the 1994 survey was token in one tow; if this tow is not considered, the total biomass swept area estimate is only 24,062 tons. So the sharp decline of cod biomass from 1994 to 1995, as shows the above table, could start one year before and be a progressive event more than a so radical change.

Tables 5, 6 and 7 show length frequency, age-length key and estimated age composition of the stock respectively. Catch per tow distribution is presented in Figure 2.

American plaice

Mean catch by strata and whole bank data and its standard error are presented in Table 8. Biomass estimated by swept area method by strata and its comparison with results of previous surveys are presented in Table 9. Total biomass in comparison with Russian survey results is:

year	EU	Russia (1)
1983 -		8,900
1984 -		7,500
1985 -		7,800
1986 -		20,200
1987 -		9,300
1988 -	11,868	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	-

tons

1) Rikhter et al. 1991; Borovkov et al. 1992, 1993, 1994

The abundance (x 1000) by age-groups is presented in the following table. Data from 1995 were reviewed.

age	year: 1988	1989	1990	1991	1992	1993	1994	1995	1996
2 -	2284	454	359	309	736	9	34	19	28
3 -	625	6847	775	911	679	1365	40	99	103
4 -	3034	1500	7083	1877	910	969	1789	627	222
5 -	1975	3238	897	4461	1471	643	782	1620	465
6 -	3020	3006	2475	1836	3423	320	651	990	1236
7 -	4154	2868	1717	2009	913	3110	703	988	656
8 -	4258	1691	1657	1566	1090	339	2487	665	411
9 -	1492	587	1030	675	624	592	243	1132	308
10 -	207	261	485	232	289	296	480	128	470
11 -	109	34	90	8	138	198	166	143	113
12 -	61	14	15	48	74	229	164	119	63
13 -	-	-	31	-	16	280	195	119	67
14 -	-	-	17	-	-	865	398	241	90
15 -	-	-	-	-	-	28	397	183	62
16 -	-	-	-	-	-	35	9	27	20
total	21219	20500	16631	13932	10363	9268	8538	7100	4321
Biomass	11868	10533	9101	7565	6492	5949	6173	5087	3073
SOP		9726	8827	7682	6111	5856	5966	5041	3031
N 6+	13301	8461	7517	6374	6567	6282	5893	4735	3496

The 1984, 1986 and 1990 year-classes, ages 12, 10 and 6 in 1996, were the most abundant cohort since 1989. Their growth can be easily followed in the above table, what is a test in favour of the appropriateness of the ageing criterion. It is to note that good year-classes can be recognised as such when aged 2 and 3 years, long time before the recruitment is completed at ages 4 to 7 years.

Fish having 6 or more years roughly corresponds with fisheable biomass. Its abundance (N 6+) decreased along the period except in 1992, when a increase was produced by the income of the abundant 1986 year-class.

The stock has a steady decline since 1988. Global indices in the above table, such as total abundance, biomass, SOP and N6+, had a decreasing tendency over the period: their levels in 1996 are more than 3 times lower than in 1988. The 1990 year-class (age 6 in 1996), the most abundant cohort of recent years, is less abundant that 1986 year-class at the same age. These results neither show some signal that could indicate a change in the tendency for the next years: the four youngest year-classes, those with less than 6 years old, were the weaker observed in this survey.

Tables 10, 11 and 12 show length frequency, age-length key and estimated age composition of the stock 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 which classification was not possible. The skill to identify the species increased over the time, so the group *juvenile* is not an uniform defined group, but it is mantained for practical reasons.

Mean catch by strata and whole bank data are presented in Tables 13, 17, 21 and 25 for *Sebastes marinus, S. mentella, S. fasciatus* and "juvenile" respectively. Total biomass estimates by the swept area method are summarised in the next table:

year	*Sebastes*: *marinus*	*spp.* *mentella*	*fasciatus*	juvenile	UE total	Russia bottom(1)	Russia total(2)
1983						154,900	
1984						132,300	
1985						51,900	
1986						309,500	
1987						106,400	
1988	15,289		142,933		158,222	47,000	379,000
1989	22,958		113,675		136,633	83,300	365,900
1990	14,699	72,893		16,601	104,193	17,700	246,400
1991	4,093	50,071	5,680	4,001	63,846	45,400	107,700
1992	4,130	71,810	5,308	23,229	104,477	18,200	99,500
1993	4,173	25,056	4,425	28,935	62,589	69,800	147,100
1994	33,240	35,710	7,829	49,233	126,011	-	-
1995	9,042	59,332	5,032	235	73,641	20,700	-
1996	11,293	77,897	11,025	329	100,544	-	-

1) Trawlable biomass.
2) Trawlable plus pelagic biomass (Vaskov 1994, Vaskov and Karsakov 1996).

Tables 14, 18, 22 and 26 show length frequency for the four groups. Age-length keys were made for three species (Tables 15, 19 and 23). Age composition for each of the three species are presented in tables 16, 20 and 24. Catch per tow distribution of the three species are presented in Figures 4, 5 and 6; their age composition are given together in the following table.

age	*S. marinus* freq.	mw	ml	*S. mentella* freq.	mw	ml	*S. fasciatus* freq.	mw	ml
2 :	51	37	13	280	33	13	235	38	13
3 :	139	59	15	1620	54	15	486	60	15
4 :	791	96	18	11726	95	19	1407	100	18
5 :	2120	155	21	30498	129	21	2620	150	21
6 :	1168	217	24	4765	177	23	1064	208	24
7 :	438	288	26	850	250	26	533	288	26
8 :	170	359	28	826	303	28	200	340	28
9 :	121	434	30	641	358	29	127	404	30
10 :	87	477	31	374	414	31	23	473	31
11 :	63	530	32	281	448	32	27	509	32
12 :	72	597	34	284	497	33	34	556	33
13 :	34	653	35	168	544	34	4	583	34
14 :	25	761	37	188	562	34	13	717	36
15 :	28	788	37	147	615	35	7	680	36
16 :	14	885	39	106	657	36		-	
17 :	10	939	39	69	715	37	3	729	36
18 :	3	1086	41	67	735	38		-	
19 :		-		32	760	38	2	760	37
20 :	3	1052	41	41	854	40		-	
21 :		-		18	913	41		-	
22 :	1	1212	43	5	897	40	1	885	39
23 :		-		13	963	41		-	
24 :		-		5	1007	42		-	
25+:	4	2247	53	17	1046	42		-	

frequency x 10000
mw - mean weight in grams
ml - mean length in cm

Frequencies (x 10000) at age of redfish stocks are presented in the following table. The ageing criterion used was the one described by Saborido-Rey (1995), which imply that fish are one year younger than it would result from previous routine. Fish ages from past surveys were transformed in accordance with the new ageing criterion in the following table.

age	*S. marinus* 1991	1992	1993	1994	1995	1996	*S. mentella* 1992	1993	1994	1995	1996	*S. fasciatus* 1992	1993	1994	1995	1996
1 :									10	6					2	
2 :				20	122	51			49	259	280			12	81	235
3 :	12	11	65	231	765	139	132		1074	3040	1620	5	82	264	400	486
4 :	225	74	125	770	1342	791	2673	173	5249	19700	11726	469	265	1284	875	1407
5 :	357	234	228	808	1529	2120	9884	550	2273	11900	30498	1131	634	1777	1108	2620
6 :	179	197	254	885	406	1168	3829	1420	1285	490	4765	417	485	885	422	1064
7 :	175	149	157	1087	281	438	3048	1013	1915	870	850	140	204	353	238	533
8 :	73	100	119	755	146	170	2181	637	1178	980	826	83	99	118	105	200
9 :	53	65	50	578	76	121	1361	228	778	570	641	54	47	40	31	127
10 :	72	56	59	431	61	87	862	317	605	550	374	16	26	23	11	23
11 :	46	56	39	448	57	63	631	335	519	610	281	19	12	15	17	27
12 :	44	35	37	324	32	72	465	410	330	280	284	13	2		8	34
13 :	39	32	11	420	48	34	446	259	253	220	168	3	5	4	7	4
14 :	9	14	14	145	26	25	321	260	161	250	188	9	3		2	13
15 :	18	14	6	222	23	28	174	297	172	260	147		1	5	1	7
16 :	9	2	4	22	14	14	172	69	85	160	106		3			
17 :	18	1	4	83	17	10	107	95	59	102	69					3
18 :		3	1	24	6	3	69	44	84	87	67	2				
19 :	6	3	5	50	3		72	34	38	46	32	2				2
20 :	7	1			7	3	19	26	22	38	41					
21 :	3	2		23			13	31	13	25	18					
22 :		1		10	1	1			13	11	5					1
23 :	1			9	1		5	10	7	5	13					
24 :											5					
25+:	5	1		51	9	4	16	3	2	31	17		2			

The 1990 and 1991 year-classes of the whole species were abundant, causing the juvenile biomass to peak in 1994, when those year-classes aged 4 and 3 years respectively. The decline of juvenile biomass since 1995 reflects the weakness of youngest year-classes.

Greenland halibut

Mean catch by strata and whole bank estimates are presented in table 27. Total biomass estimates by the swept area method by strata and its comparison with results of previous surveys are presented in Table 28 and resumed as follow:

1988	-	6,818
1989	-	4,391
1990	-	5,649
1991	-	8,038
1992	-	8,588
1993	-	7,210
1994	-	7,904
1995	-	10,705
1996	-	11,409 tons

Length frequency, age-length keys and age composition of the population were calculated (Tables 29, 30 and 31). Catch per tow distribution is presented in Figure 7. Age composition of the stock was calculated as follows:

age		1991	1992	1993	1994	1995	1996	
1	-	349	922	937	832	6165	2874	
2	-		800	933	706	1394	4613	
3	-	235	286	599	1082	1369	1527	
4	-	993	861	566	1224	1249	2066	
5	-	1956	1600	960	1365	1709	3070	
6	-	1253	1996	1574	2233	3793	4394	
7	-	2283	1793	1732	2096	3026	2020	
8	-	545	991	1388	1213	1729	1378	
9	-	464	473	905	689	1134	392	
10	-	388	266	257	264	254	75	
11	-	122	139	141	95	68	31	
12	-		67	51	54	26	35	
13	-		18	19	19			
14	-		13	10		7		
15	-						8	
16	-							
total		8588	10225	10072	11860	21925	22483	(x 1000)
Biomass		8038	8588	7210	7904	10705	11409	tons
SOP		8329	8084	7136	7406	9782	11005	tons
N 10+		*510*	*503*	*478*	*432*	*355*	*149*	

The apparent increase of cohort abundance up to ages 6 or 7 is a consequence of the recruitment of young fish to the area. Compared with the age composition of commercial trawling catches in the deepest strata (de Cárdenas et al. 1995), oldest fish on Flemish Cap are relatively scarce, indicating that fish older than 7 years presumably migrates to deepest areas where adults spawn. By the same reason, all Greenland halibut caught in the survey was immature: length of first maturation in the area occurs at 65 centimetres (Junquera and Saborido-Rey, 1995) and few fish on Flemish Cap overpass that length.

Abundance of cohorts aged 2 to 6 years in 1996, as shown in previous table, are the highest recorded in the time series. This seems not to be the effect of a year factor because abundance of fish older than 6 years decreased, as it is expected and observed in previous years, and because abundance at all ages of cohorts from 1990 to 1995 were greater than all previous cohorts at the same age, with only two exceptions of little importance: 1993 cohort at age 1 and 1992 cohort at age 2. These cohorts from 1990 to 1995 seems to be progressively more abundant. In the same time period, abundance of oldest fish, those with 10 or more years,

N10+ in the above table, had a steady decrease, which is consistent with the fishery initiated in those years. In summary, the stock on Flemish Cap semms to be in an steady growth in both fisheable biomass and abundance since 1993 produced by consecutive strongest year-classes.

Shrimp

Detailed results were presented by Del Rio (1996).

Roughhead grenadier (*Macrourus berglax*)

Total biomass estimated by sweept area method in this survey was:

1989	-	1,024
1990	-	996
1991	-	1,587
1992	-	1,817
1993	-	3,757
1994	-	2,350
1995	-	1,855
1996	-	1,619 tons

Ageing of fish started in 1994 survey. Detailed results were presented by Alpoim (1997).

Oceanographic records

A CTD sounder was used after each fishing haul. Temperature reaches a minimum of 1°C to 3°C at 50 to 100 metres depth, ant it increases up to an almost uniform value of 3,5°C in deepest zones. Detailed results were presented by Cerviño and Prego (1997).

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Table 1 - Technical data of the survey.

Procedure	specification
Vessel	R/V CORNIDE DE SAAVEDRA
GT	1,200 t
power	1,500 + 750 HP
Mean trawling speed	3.50 knots
Trawling time	30 minutes effective time
Trawl gear	type "Lofoten"
footrope / handrope	31.20 / 17.70 m
footgear	27 steel bobbins of 35 cm
vertical opening	2.5 - 2.8 m
warps	100 meters, 45 mm, 200 Kg/100 m
trawl doors	polyvalent, 850 Kg
wire length	2.75 times the depth
mesh size in codend	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 from previous surveys.
Criterion to reject data from tow	- tears in codend - 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 fishes, squid and shrimp
Species for age determination	cod, American plaice, redfish (*Sebastes marinus, S. mentella* and *S. fasciatus*) Greenland halibut and roughhead grenadier).

Table 2 - Total biomass swept area method estimates for several species or groups of species in 1988-1996 surveys (tons).

	survey								
specie	1988	1989	1990	1991	1992	1993	1994	1995	1996
Rajidae	4495	1908	2824	4064	3765	6279	3462	2267	2052
Synaphobranchus sp.	219	88	42	77	70	70	8	16	3
Urophycis sp.	654	167	169	261	69	161	214	83	81
Antimora sp.	392	302	284	560	720	594	799	195	186
Macrouridae	3088	1438	1223	2249	2592	6183	3230	2604	2342
Notacanthus sp.	501	408	65	478	449	705	455	346	180
Illex sp.	5	8	1647	1159	66	1	210	1	87
Anarhichadidae	7973	7478	8120	10097	9095	14304	15516	19217	20559
witch flounder	909	335	420	769	823	1048	776	705	509
Greenland flounder	6818	4391	5649	8038	8588	7210	7904	10705	11409
Zoarcidae	559	923	1202	1978	1356	3277	1869	2182	1702
cod	37127	103644	55360	36597	24295	55642	42767	8815	8196
American plaice	11886	10533	9101	7565	6492	5949	6173	5087	3073
redfish	158417	136658	104194	63845	104477	62589	126010	73640	100544
shrimp	2164	1923	2139	8211	16531	9163	3337	5389	6502
others	624	206	1138	664	439	779	503	395	692
Total	235833	270410	193575	146611	179828	173954	213234	131647	158114

Table 3 - Cod catches (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	36.59	53.60	20.07	29.42
2 -	838	10	57.80	40.54	32.47	23.62
3 -	628	7	20.86	30.25	11.44	16.51
4 -	348	4	36.67	19.09	20.92	10.59
5 -	703	8	15.93	23.69	9.08	13.66
6 -	496	6	13.70	14.98	8.53	9.80
7 -	822	9	0.83	0.95	0.45	0.53
8 -	646	7	1.77	2.36	0.99	1.31
9 -	314	3	3.92	4.75	2.23	2.52
10 -	951	11	0.61	1.51	0.33	0.82
11 -	806	9	0.44	0.94	0.35	0.79
12 -	670	8	-	-	-	-
13 -	249	3	-	-	-	-
14 -	602	6	-	-	-	-
15 -	666	7	-	-	-	-
16 -	634	6	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	117				

	catch per tow	catch per mile towed
mean	10.31	5.82
standard error	1.66	0.94

(Kg)

Stock biomass estimated by swept area method = 8,196 tons

Table 4 - Cod biomass estimated by the swept area method (tons) 1988-1996.

Stratum	depth in fathoms	survey 1988	1989	1990	1991	1992	1993	1994	1995	1996
1 -	70- 80	1223	590	697	5078	69	469	1969	1421	915
2 -	81-100	9229	9386	1878	4988	4683	8223	7443	2764	3629
3 -	101-140	4065	9344	2174	2236	7704	7670	5539	1042	958
4 -	"	2846	4404	2242	2637	3131	12885	1714	678	971
5 -	"	1937	9731	7681	9685	4155	6205	840	1158	851
6 -	"	2932	6173	2988	1392	866	3837	1284	1191	564
7 -	141-200	2022	14571	3987	2308	859	5595	779	111	50
8 -	"	8121	14943	14524	4644	2136	7241	21992	317	85
9 -	"	167	4784	5765	171	130	907	217	8	94
10 -	"	1217	4454	3813	1417	297	851	460	53	42
11 -	"	2278	12020	3509	1625	204	1526	529	71	37
12 -	201-300	305	2245	1443	115	-	22	-	-	-
13 -	"	8	2304	667	85	-	-	-	-	-
14 -	"	97	686	496	119	61	211	-	-	-
15 -	"	680	7671	2131	98	-	-	-	-	-
16 -	301-400	-	60	-	-	-	-	-	-	-
17 -	"	-	5	-	-	-	-	-	-	-
18 -	"	2	-	-	-	-	-	-	-	-
19 -	"	-	91	-	-	-	-	-	-	-
total		37127	103644	53977	36597	24295	55642	42767	8815	8196

Table 5 - Cod length frequency by strata (x 1000) in 1996 survey.

length (cm)	stratum 1	2	3	4	5	6	7	8	9	10	11	total
15-17	12			20								33
18-20		6										6
21-23												
24-26	6	62		60	7	6						142
27-29	44	312	122	442	59	32		7				1017
30-32	62	530	203	455	86	84	34	14			7	1474
33-35	106	430	54	261	39	13	20			6		930
36-38	417	1277	135	509	178	26		7				2549
39-41	442	1165	244	328	158	32	7					2375
42-44	187	536	142	80	79	39						1063
45-47	50	249	54	27	46		7	7				440
48-50	75	318	68	54	105	13						632
51-53	56	293	101	54	125	64		7		6	21	728
54-56	31	168	81	13	99	64	7	14				478
57-59	25	87	68	7	33	71			8			299
60-62		25	20	7	7	39		7		6		110
63-65		19	7				7	14	8	6		61
66-68		12			7	13			8			40
69-71												
72-74		6										6
75-77									8			8
78-80		6										6
81-83		6										6

Table 6 - Cod age-length key in 1996.

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	no id	tot n.
9-11													
12-14													
15-17	4												4
18-20	1												1
21-23													
24-26		24											24
27-29		159											159
30-32		207	4									2	213
33-35		34	59									2	95
36-38		2	252	5								3	262
39-41			226	15	3								244
42-44			86	29	6							10	131
45-47			9	27	26							3	65
48-50			2	21	68								91
51-53				5	106	1							112
54-56					72	3							75
57-59					42	3							45
60-62					9	9							18
63-65					3	6							9
66-68					1	5							6
69-71													
72-74						1							1
75-77							1						1
78-80						1							1
81-83								1					1
total:	5	426	638	102	336	29	1	1				20	1558

Table 7 - Cod age composition by strata (x 1000) in 1996 survey.

age	stratum 1	2	3	4	5	6	7	8	9	10	11	total	mean weight (g)	mean length (cm)
1 :	12	6		20								38	41	16
2 :	153	1061	342	1048	166	125	41	21		2	7	2966	251	30
3 :	1025	3028	506	1035	411	93	21	8		4		6131	531	39
4 :	122	420	95	76	82	18	3	3			1	820	804	44
5 :	198	924	333	133	352	222	12	31	11	11	20	2247	1324	52
6 :	3	62	23	5	17	38	5	13	13	7		186	2267	62
7 :									8			8	4000	76
8 :		6										6	5025	82
9 :														
10 :														
11 :														
12 :														
13 :														
14 :														
15 :														
16+:														

Table 8 - American plaice catch (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	43.42	43.97	24.04	24.99
2 -	838	10	11.29	16.65	6.33	9.27
3 -	628	7	2.66	2.59	1.51	1.43
4 -	348	4	7.32	6.64	4.34	4.01
5 -	703	8	7.15	4.75	4.00	2.61
6 -	496	6	0.63	0.68	0.36	0.39
7 -	822	9	0.88	0.88	0.49	0.49
8 -	646	7	0.90	1.25	0.49	0.67
9 -	314	3	1.63	2.83	0.99	1.71
10 -	951	11	4.45	4.87	2.45	2.63
11 -	806	9	0.79	0.48	0.47	0.28
12 -	670	8	0.48	0.75	0.27	0.41
13 -	249	3	-	-	-	-
14 -	602	6	0.06	0.16	0.04	0.10
15 -	666	7	0.32	0.56	0.19	0.34
16 -	634	6	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	117				

	catch per tow	catch per mile towed
mean	3.90	2.18
standard error	0.86	0.48

(Kg)

Stock biomass estimated by swept area method = 3,073 tons

Table 9 - American plaice biomass estimated by swept area method (tons) 1988-1996.

stratum	depth in fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996
1 -	70- 80	979	750	448	808	532	809	496	1672	1096
2 -	81-100	1990	2701	1040	1997	1285	950	899	1001	707
3 -	101-140	1025	838	1207	935	473	333	244	189	126
4 -	"	1649	346	661	240	418	429	640	367	201
5 -	"	1949	2319	1406	1055	628	968	922	412	375
6 -	"	358	847	720	376	451	229	606	92	24
7 -	141-200	880	398	562	292	479	239	237	187	54
8 -	"	313	123	209	188	545	365	132	99	42
9 -	"	77	122	262	-	280	154	15	375	41
10 -	"	1742	1118	1555	981	1054	1094	1677	531	311
11 -	"	889	876	973	301	279	219	227	82	51
12 -	201-300	7	14	35	13	8	11	25	9	24
13 -	"	2	-	15	-	-	-	-	2	-
14 -	"	6	6	6	292	22	53	18	11	3
15 -	"	17	74	2	73	28	82	30	51	17
16 -	301-400	4	-	-	3	7	9	4	-	-
17 -	"	-	-	-	-	-	-	-	-	-
18 -	"	-	-	-	-	-	-	-	-	-
19 -	"	-	-	-	11	3	4	2	8	-
total		11886	10533	9101	7565	6492	5949	6173	5087	3073

Table 10 - American plaice length frequency by strata (x 1000) in 1996 survey.

length (cm)	stratum 1	2	3	4	5	6	7	8	9	10	11	12	14	15	total
12-13								7							7
14-15															
16-17						6									6
18-19			7	7			7				7				28
20-21															
22-23										6	7				13
24-25				7		6	7			13					33
26-27					7				8	6					21
28-29	12			7	13				8	13	7				60
30-31	31	12	7		13	6	14			6	7				98
32-33	149	50			20					19	14				252
34-35	137	69	7	7	20		14	7		45	7				311
36-37	218	93	7	13	39			14	8	128	7	6	8		543
38-39	360	112	7	14	40	6	20		17	129	35	6			747
40-41	298	181	34	27	78	19	7		25	32	7				709
42-43	205	50		40	39		21		17	51	7	6			437
44-45	118	24		13	53	6	7			32		6		7	268
46-47	37	62	14		33					26	7				179
48-49	31	106	7	20	53		7			19		6			249
50-51	62	44	14	20	26			28							193
52-53	6	31	14	7	20					13					90
54-55	12	6	7	20	7									7	59
56-57		19		7	7										32
58-59	6														6
60-61	6														6

Table 11 - American plaice age-length key in 1996 survey.

MALE

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	no id	tot n.
14-15																		
16-17																		
18-19		1																1
20-21																		
22-23			1															1
24-25			3															3
26-27			2															2
28-29			1	3														4
30-31			1	8	1	1												11
32-33			1	3	10	8	2										3	27
34-35				7	13	11		3									1	35
36-37				2	10	28	7	3	2	1							3	56
38-39					4	29	15	7	6	6							5	72
40-41					2	11	19	4	5	15	3						4	63
42-43						4	10	2	2	7	2						4	31
44-45						1	2	3	1	6							1	14
46-47							1	1									1	3
48-49									1									1
total:		1	9	23	40	93	56	23	17	35	5						22	324

FEMALE

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	no id	tot n.
14-15																		
16-17																	1	1
18-19		3																3
20-21																		
22-23			1															1
24-25			2															2
26-27			1															1
28-29			1	2														3
30-31				2														2
32-33																		
34-35					4													4
36-37					4	8											1	13
38-39					4	11	1			1							2	19
40-41					3	21	1	4									1	30
42-43						14	6	3	1									24
44-45						3	8	6	1	1			1					20
46-47						1	1	8	5	3		1	1				3	23
48-49							2	5	7	9	4	2	2	3	1	1	3	39
50-51								2	6	5	3	3	4	4			3	30
52-53									2	2	2	2		2	5			15
54-55											1	2	2	4	1			10
56-57														1	3	1		5
58-59																		
60-61																1		1
total:		3	5	4	15	58	19	28	22	21	10	10	10	14	10	3	14	246

Table 12 - American plaice age composition by strata (x 1000) in 1996 survey.

age	stratum 1	2	3	4	5	6	7	8	9	10	11	12	14	15	total	mean weight (g)	mean length (cm)
1 :								7							7	13	12
2 :			7	7			7				7				28	49	18
3 :	13	3	1	9	12	7	8		10	30	10				103	169	26
4 :	86	32	7	5	27	4	13	2	6	25	15				222	298	31
5 :	193	86	9	16	36	2	12	5	3	84	16	1	2		465	421	35
6 :	483	227	33	55	124	15	34	10	19	189	32	10	4	1	1236	538	38
7 :	327	115	6	21	60	6	11	2	19	69	12	6	1	1	656	657	40
8 :	153	91	13	17	56	5	8	3	5	47	7	4		2	411	769	42
9 :	110	76	11	13	44	1	3	7	5	30	5	2		1	308	883	44
10 :	220	104	11	15	43	2	5	5	12	41	7	2		3	470	816	43
11 :	40	30	5	8	13		1	3	3	7	1	1		1	113	1033	46
12 :	11	19	6	8	11			3		4				1	63	1315	50
13 :	14	17	5	9	12		1	4		3		1		1	67	1238	49
14 :	15	26	7	15	15		1	4		3		1		3	90	1406	51
15 :	3	25	6	9	13					5				1	62	1567	53
16+:	7	7		2	3					1					20	1746	54

Table 13 - Redfish (*Sebastes marinus*) catch (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	3.77	7.42	2.02	3.98
2 -	838	10	6.48	9.42	3.61	5.29
3 -	628	7	5.08	5.62	2.83	3.06
4 -	348	4	4.46	3.95	2.66	2.42
5 -	703	8	9.79	9.30	5.53	5.29
6 -	496	6	17.26	27.03	11.32	19.10
7 -	822	9	22.04	23.88	12.27	13.16
8 -	646	7	24.81	49.55	13.86	27.69
9 -	314	3	78.61	122.79	43.19	65.83
10 -	951	11	36.62	39.67	20.67	23.00
11 -	806	9	32.87	43.08	19.51	24.99
12 -	670	8	0.50	0.43	0.28	0.24
13 -	249	3	0.08	0.14	0.05	0.08
14 -	602	6	0.82	0.76	0.51	0.48
15 -	666	7	0.71	1.15	0.42	0.70
16 -	634	6	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	117				

	catch per tow	catch per mile towed
mean	14.06	8.02
standard error	2.99	1.67

(Kg)

Stock biomass estimated by swept area method = 11,293 tons

Table 14 - Redfish (*Sebastes marinus*) length frequency by strata (x 1000) in 1996.

length (cm)	stratum 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	total
10-	6										7					13
11-	18	6									7					32
12-	12	12		7	7	9				6	21					75
13-	75	100	7		7	18					7					213
14-	94	124	14	7	26	48					28					342
15-	124	181	54		46	81	42	14		28	38					607
16-	187	312	48	13	33	162	48			64	111					979
17-	131	361	34	20	125	276	162	14	122	151	325					1719
18-	130	355	149	7	99	327	371	76	408	350	652				7	2933
19-	93	293	101	33	257	393	508	62	530	534	771					3577
20-	50	355	149	60	165	431	628	132	1217	1084	1216				7	5492
21-	62	231	162	40	243	362	760	166	652	1447	1421			16		5562
22-	19	212	109	74	276	452	763	375	1025	1414	1342				15	6075
23-	25	187	115	73	237	413	867	464	1512	1107	1005	38		33	22	6099
24-	12	125	88	33	204	259	736	575	1112	856	792				15	4807
25-		94	61	40	112	226	584	465	895	635	670	13		16	15	3823
26-		56	48	13	92	143	261	514	652	398	270		6	16	7	2475
27-		44	34	13	59	100	162	236	365	428	291			8	7	1746
28-		31	7	13	7	59	154	222	122	270	309				15	1208
29-		12	14	7	26	55	103	180	122	207	240			16	7	990
30-		6	14	7	20	57	126	152	243	214	133	13				984
31-		6	7	14	33	57	42	90		325	220				7	799
32-			28		33	18	72	104		149	92	6		8	7	517
33-			20		33	15	31	118	243	170	109	6		8	7	762
34-					20		27	111		68	93			8		326
35-			7		20		38	42		135	29					269
36-				7	7	9	31	49		74	60	6				241
37-			14	14	20		24	21		94	62					247
38-					26	9	24	14		64	24					160
39-				7	7		20	21		51	47					152
40-					7		10	7		40	7					72
41-										10						10
42-								7		34						41
43-					7						16					23
44-								7			14					21
45-										17						17
46-					7					6						13
47-																
48-																
49-																
50-																
51-																
52-																
53-																
54-																
55-										17						17
56-					7											7
57-								7								7

Table 15 - Redfish (Sebastes marinus) age-length key in1996 survey.

MALES

length (cm)	age 2	3	4	5	6	7	8	9	19	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	no id	tot n.
10-	2																									2
11-	2																									2
12-	7	1																								8
13-	13																								1	14
14-	11	12																								23
15-	2	28	1																						1	32
16-		12	13																						1	26
17-		1	24																						2	27
18-			19	1																					2	22
19-			15	5																					1	21
20-				26	1																				2	29
21-			2	18																					1	21
22-				19	1																				1	21
23-				8	12																				3	23
24-				4	19	1																			1	25
25-				2	18	3																			1	24
26-				2	7	12																			1	22
27-					1	21	4																		2	28
28-						17	9																		1	27
29-					1	1	17	3	1																	23
30-							2	14	4																1	21
31-								6	10	2	1														2	21
32-								1	7	9	2															19
33-									1	6	9	2													2	20
34-										1	5	3	1	1											3	14
35-										1	2	8	2	3											3	19
36-								1		1	1	1	4	3	2										3	16
37-											1		4	5	3											13
38-													2	2		3									3	10
39-												1			2	2	1								1	7
40-															1	1			2							4
41-																										
42-														1												1
43-																					1					1
44-																										
45-																										
46-																								2		2
total:	37	54	74	85	60	55	32	25	23	20	21	15	13	15	8	6	1		2		1			2	39	588

FEMALES

length (cm)	age 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	no id	tot n.
10-																										
11-	1																									1
12-	3																									3
13-	16	1																								17
14-	4	11																								15
15-	1	17	1																						1	20
16-	1	17	16																							34
17-		3	19																						1	23
18-			23	4																					2	29
19-			22	6																						28
20-			1	29																					2	32
21-				23																						23
22-				22	2																				4	28
23-				8	16																				5	29
24-				6	15	1																			2	24
25-				3	14	5																			1	23
26-				1	9	14																			2	26
27-					4	18	4																		2	28
28-						8	10																		5	23
29-							14	3																		17
30-						1	3	15	2																2	23
31-							1	7	10	2																20
32-								1	5	9	1														1	17
33-								1	2	3	4	1														11
34-								1		1	5	1													2	10
35-									1		1	2													2	6
36-									1		4	1	1													7
37-											3	1	1													5
38-													1	1											1	3
39-												1	1	2											1	5
40-											1			1	1											3
41-																										
42-																1			1							2
43-															1	1										2
44-															1		1									2
45-																										
46-																			1							1
47-																										
48-																										
49-																							1			1
50-																										
51-																										
52-																										
53-																										
54-																										
55-																								1		1
56-																								1		1
57-																								1		1
total:	26	49	82	102	60	47	32	28	21	15	19	7	4	4	3	2	1		2				1	3	36	544

Table 16 - Redfish (*Sebastes marinus*) age composition (x 10000) in 1996 survey.

	stratum																mean	mean
age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	total	weight (g)	length (cm)
1 :																	-	
2 :	16	18	2	1	3	5				1	5					51	37	13
3 :	27	42	8	2	9	21	7	1	2	7	13					139	58	15
4 :	41	106	28	6	43	96	95	14	97	100	164				1	791	95	18
5 :	17	98	51	21	87	154	276	104	382	457	465	2		3	3	2120	155	21
6 :	3	32	22	11	44	72	167	128	277	208	193	3		4	4	1168	217	24
7 :		11	7	3	13	25	50	72	95	88	70			2	2	438	288	26
8 :		3	2	2	4	9	19	29	23	37	39			1	2	170	359	28
9 :		1	2	1	3	7	13	18	22	31	22	1				121	434	30
10 :			2	1	3	5	8	13	7	28	19				1	87	477	31
11 :			2		3	2	6	11	7	18	12			1	1	63	530	32
12 :			2	1	4	2	6	15	9	18	14			1		72	597	34
13 :			1		2		4	7	2	12	6					34	654	35
14 :				1	2		3	3		10	6					25	762	37
15 :					2		4	4		11	7					28	789	37
16 :				1	1		1	2		5	4					14	887	39
17 :					2			1		5	2					10	941	39
18 :								1		1	1					3	1089	41
19 :																	-	
20 :										3						3	1054	41
21 :																	-	
22 :					1											1	1216	43
23 :																	-	
24 :																	-	
25+:					1			1		2						4	2283	53

Table 17 - Redfish (*Sebastes mentella*) catch (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	-	-	-	-
2 -	838	10	-	-	-	-
3 -	628	7	0.70	1.09	0.40	0.61
4 -	348	4	0.60	1.20	0.37	0.74
5 -	703	8	1.53	1.95	0.86	1.09
6 -	496	6	0.75	0.61	0.42	0.34
7 -	822	9	72.85	85.71	41.71	49.13
8 -	646	7	135.06	155.02	75.86	86.28
9 -	314	3	842.24	683.75	500.36	382.47
10 -	951	11	299.87	245.17	168.21	139.34
11 -	806	9	73.54	54.38	42.29	29.70
12 -	670	8	44.81	13.81	25.71	7.97
13 -	249	3	137.67	66.45	79.79	41.18
14 -	602	6	219.55	139.91	135.78	88.63
15 -	666	7	60.77	66.58	36.02	41.62
16 -	634	6	5.99	5.59	3.51	3.57
17 -	216	2	2.78	2.58	1.60	1.58
18 -	210	2	10.80	9.33	6.17	5.18
19 -	414	5	7.75	12.53	4.57	7.38
total	10555	117				

	catch per tow	catch per mile towed
mean	95.21	55.35
standard error	14.70	8.32

(Kg)

Stock biomass estimated by swept area method = 77,897 tons

Table 18 - Redfish (*Sebastes mentella*) length frequency by strata (x 10000) in 1996.

length (cm)	stratum 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total
11-				2		4												7
12-	2		1	13	12	6		35	14									81
13-	2		1	5	17	15		38	17									95
14-	1		4	1	4	21	40	120	64									253
15-			14	1	54	90	24	444	162	1			5					795
16-	2		10	5	80	57		347	165	1		9	5					682
17-	2		10	3	99	85	58	798	229	2		4	6	1				1296
18-	1		8		330	165	176	2077	492	6	3	23	53					3334
19-	5		9	3	811	429	587	4620	970	37	5	99	199					7772
20-	7	2	11	6	1010	835	1409	6175	1182	139	30	494	473				1	11774
21-	6	4	8	3	878	734	3245	3476	825	299	102	821	586	1				10987
22-	2	1	1	2	445	726	2941	963	324	407	150	589	400		1		2	6955
23-	2		1	2	142	341	1826	146	40	256	120	181	130		2			3187
24-	1				37	126	1030	39	12	69	53	81	36				1	1485
25-					7	35	357	21	2	31	30	44	15	1			1	542
26-					5	27	95		2	25	19	34	32	1			4	244
27-					10	45	280	12	4	26	37	94	24	5			6	541
28-			1		3	56	111	2	1	29	38	98	28	8	1		8	384
29-			1		2	66	99	2	1	25	71	135	32	16			13	460
30-						63	37	15		24	62	111	20	8	1	1	12	354
31-					2	39	58	2	1	16	41	155	12	10		3	10	347
32-		2	1	1	5	38	37	19	1	6	47	138	11	6	2	4	2	318
33-						32	95		2	3	26	129	11	4	1	2	3	306
34-					5	16	74		1	3	26	94	5	1		1	1	228
35-						15			1	3	20	108	6	4		2	2	160
36-						5				1	11	99	6			4		126
37-						8		2		2	10	75	3			1		102
38-						1				1	12	56	5	2	1			77
39-										3	3	39	2	1		3		49
40-						3				1	5	17	2	1		2		29
41-						1					1	22	2					26
42-										1	1	11	1		2	2	1	18
43-												4	1	1		1		7
44-												2						2
45-												2						2
46-																		
47-																		
48-														1				1

Table 19 - Redfish (*Sebastes mentella*) age-length key.

MALE

length (cm)	age 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	no id	tot n.
10-																										
11-	2																									2
12-	28																								5	33
13-	16	1																							4	21
14-	4	10																							5	19
15-		18																							8	26
16-		16	5																						5	26
17-		5	13																						5	23
18-			25	1																					2	28
19-			21	8																					5	34
20-			4	22																						26
21-			1	42	1																				12	56
22-				47	7																				3	57
23-				12	31																					43
24-				5	16																					21
25-					8	13																			3	24
26-					1	14		1																	4	20
27-						8	13	1																	2	24
28-						8	17	7	1																4	37
29-							16	15																	3	34
30-								22	4	1																27
31-						1		7	13	6																27
32-								1	6	12	2														4	25
33-									1	4	7	2	2	1											4	21
34-											7	4	2	2	2	1									2	20
35-												3	4	4	4		1								4	20
36-													4	4	3	3									1	15
37-														2	2	2	1	3							2	12
38-													1		3	2	2	2								10
39-																1	1	1	1						1	5
40-																			2	1				1		4
41-																			1					1		2
42-																			1	1		3			1	6
43-																							1			1
...																										
48-																								1		1
total:	50	50	69	137	64	44	46	54	25	23	16	9	13	13	14	9	5	6	5	2		3	1	3	89	750

FEMALE

length (cm)	age 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	no id	tot n.
10-																										
11-	1																									1
12-	7	1																								8
13-	11																								5	16
14-	11	7																							3	21
15-		27																							10	37
16-		10	11																						5	26
17-		1	16																						6	23
18-			15																						12	27
19-			12	8																					5	25
20-			3	23																					2	28
21-			2	38																					6	46
22-				36	4																				6	46
23-				5	17																				2	24
24-				2	20	1																				23
25-					7	10	2																		1	20
26-					1	18	1																		2	22
27-					1	8	11																		2	22
28-						4	15	4																	5	28
29-							17	10	2																4	33
30-							1	14	4	1															3	23
31-								2	15	3																20
32-									3	9	6	1													1	20
33-											12	2	3	1											3	21
34-											3	8	8												1	20
35-												4	4	5	1										1	15
36-													2	5	4	1										12
37-												1		4	1	1	6	1	2						1	17
38-														1	4	7	4								3	19
39-															2	3	5	2	3	1						16
40-																		1	2	2	2	2	1			10
41-																	1	1	4	4	1	1			2	14
42-																			1	1		3		4	1	10
43-																			1				1	2		4
44-																									1	1
45-																								1		1
total:	30	46	59	112	50	41	47	30	24	13	21	16	17	16	12	12	16	5	13	8	3	6	2	7	93	699

Table 20 - Redfish (*Sebastes mentella*) age composition (x 100000) in 1996 survey.

age	stratum 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	mean weight (g)	mean length (cm)
1 :																			-	
2 :				2	3	3	1	12	6									27	33	13
3 :			2	1	13	15	6	88	35			1	1					162	54	15
4 :	1		3	1	114	68	93	684	156	6	1	19	27					1173	95	19
5 :	2	1	2	1	243	232	771	1113	245	85	30	183	143					3051	129	21
6 :					20	46	274	31	9	31	16	30	19					476	177	23
7 :					1	8	44	2	1	6	6	12	5	1			1	87	250	26
8 :					1	9	32	1		5	8	19	5	2			2	84	303	28
9 :						10	10	1		4	10	20	4	2			2	63	358	29
10 :						4	7	1		1	5	16	1	1			1	37	414	31
11 :						3	5	1		1	4	12	1	1				28	448	32
12 :						3	7	1			3	12	1					27	497	33
13 :						1	4				2	8						15	544	34
14 :						1	4				2	10	1					18	562	34
15 :						1	1				1	10	1					14	615	35
16 :											1	8	1					10	657	36
17 :											1	5						6	715	37
18 :											1	5						6	735	38
19 :												2						2	760	38
20 :												3						3	854	40
21 :												1						1	913	41
22 :																			897	40
23 :												1						1	963	41
24 :																			1007	42
25+:												1						1	1046	42

Table 21 - Redfish (*Sebastes fasciatus*) catch (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	0.06	0.11	0.03	0.06
2 -	838	10	0.10	0.22	0.05	0.12
3 -	628	7	1.57	0.52	0.88	0.28
4 -	348	4	4.32	6.64	2.65	4.13
5 -	703	8	3.82	2.60	2.16	1.46
6 -	496	6	6.62	8.89	4.29	6.36
7 -	822	9	14.56	19.82	8.13	11.01
8 -	646	7	23.63	38.53	13.20	21.43
9 -	314	3	216.84	271.15	122.81	143.77
10 -	951	11	30.15	62.56	16.60	33.97
11 -	806	9	9.57	3.69	5.85	2.37
12 -	670	8	1.73	1.02	1.01	0.67
13 -	249	3	1.74	1.28	1.02	0.80
14 -	602	6	3.71	4.19	2.31	2.67
15 -	666	7	2.17	1.70	1.28	1.05
16 -	634	6	0.11	0.12	0.06	0.06
17 -	216	2	0.04	0.05	0.02	0.03
18 -	210	2	0.07	0.09	0.04	0.05
19 -	414	5	0.04	0.06	0.02	0.03
total	10555	117				

	catch per tow	catch per mile towed
mean	13.80	7.83
standard error	5.07	2.70

(Kg)

Stock biomass estimated by swept area method = 11,025 tons

Table 22 - Redfish (*Sebastes fasciatus*) length frequency by strata (x 1000) in 1996 survey.

lenght (cm)	stratum 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total
9-				7																7
10-						12														12
11-			7			25					42									75
12-		12	27	7	13	122	54	7	122	25	72									462
13-			115	20	125	302	205	14	8	112	279									1181
14-		6	176	27	217	373	398	51		127	394									1768
15-		31	81	33	178	180	248	95	217	220	308									1590
16-			88	60	158	102	233	42	833	285	286			8	7					2104
17-		6	34	100	138	58	342	220	990	664	372	12		8	66	8	8			3028
18-			54	107	98	77	552	543	2431	1064	572	19	6	82	29	8			7	5651
19-			68	120	250	90	786	683	2292	1192	494	70	6	24	51					6127
20-		6	27	127	165	122	784	1401	3133	1397	658	57	32	66	131	16		8	7	8135
21-		12	34	134	145	90	787	1678	3673	1169	536	57	38	106	116					8576
22-			68	67	112	122	739	1235	4185	942	294	95	32	91	80	8				8069
23-			41	27	72	64	414	559	3491	489	215	71	44	66	58	8				5617
24-	6		21	34	39	90	293	305	1623	513	114	51	19	115	58					3284
25-			14	7	14	90	212	158	2024	452	171	25	12	106	30					3315
26-			7	7	13	52	160	74	1338	513	65	12	6	107	22					2374
27-				7	13	38	67	148	816	497	72	6		73	15					1753
28-			7		7	45	103	74	851	363	43	13		16						1521
29-				7		39	64	23	895	207	14			8	7					1264
30-						6	33	30	452	141	21	13		8	7					711
31-										199	14	6			7					227
32-							14	30	122	169	14	6		8						363
33-									122	138				8						268
34-						6	14			74										94
35-						6	7			46										59
36-									122	15										137
37-						6				61										68
38-										15										15
39-					7					15										22

Table 23 - Redfish (*Sebastes fasciatus*) age-length key.

MALES

length (cm)	age 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+	no id	tot n.
10-																											
11-		2																									2
12-		19																								1	20
13-		20	2																							5	27
14-		9	17																							4	30
15-		4	26																							2	32
16-			14	7																							21
17-			2	20																						2	24
18-				23	1																					6	30
19-				13	8																					3	24
20-				3	20																					5	28
21-				1	27	3																				4	35
22-					21	3																				5	29
23-					7	15																				2	24
24-					2	16	1																			3	22
25-						15	6																			1	22
26-							17	1																		2	20
27-							15	6																		2	23
28-							13	4	1																	2	20
29-								6	4																		10
30-									11	1																1	13
31-										5	2	2															9
32-										2	2															1	5
33-											1	1	1													4	7
34-												1			1												2
35-															1												1
total:		54	61	67	86	52	52	17	16	8	5	4	1		2											55	480

FEMALES

length (cm)	age 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+	no id	tot n.
10-		1																									1
11-		4																									4
12-		16																									16
13-		21	1																								22
14-		5	15																								20
15-		1	18																							3	22
16-			21	3																							24
17-			5	15																						1	21
18-			1	17	2																					1	21
19-				23	3																					1	27
20-				4	24																					5	33
21-					24																					6	30
22-					34	2																				7	43
23-					2	19																				4	25
24-					4	16																				1	21
25-					1	14	5																			1	21
26-						2	23	1																			26
27-							16	8																			24
28-							11	13																		1	25
29-							1	6	4																		11
30-									5																	1	6
31-									2	1																2	5
32-									2	2	4	1															9
33-											1	5															6
34-											1	3		1													5
35-												1	2		1		1										5
36-														2	1												3
37-												1					1		1							1	4
38-														1													1
39-														1								1					2
total:		48	61	62	94	53	56	28	13	3	6	11	2	5	2		2		1			1			35	483

Table 24 - Redfish (*Sebastes fasciatus*) age composition (x 10000) in 1996 survey.

age	stratum 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	mean weight (g)	mean length (cm)
1 :																					-	
2 :		2	21	4	21	57	39	5	15	19	52									235	38	13
3 :		3	27	11	47	53	76	19	95	64	89			1	1					486	60	15
4 :		1	16	30	45	23	155	142	549	271	135	9	1	11	15	2	1		1	1407	100	18
5 :		2	14	35	47	36	245	428	1188	371	157	23	10	28	32	2		1	1	2620	150	21
6 :	1		7	7	12	21	84	102	601	128	43	13	7	24	13	1				1064	208	24
7 :			2	1	3	13	33	25	291	119	18	3	1	20	4					533	288	26
8 :				1	1	5	10	10	120	42	5	1		4	1					200	340	28
9 :						2	6	5	82	25	3	2		1	1					127	404	30
10 :								1	3	18	1									23	473	31
11 :							1	1	7	17	1									27	509	32
12 :						1	1		12	19				1						34	556	33
13 :										4										4	583	34
14 :									8	5										13	717	36
15 :									4	3										7	680	36
16 :																					-	
17 :										3										3	729	36
18 :																					-	
19 :										2										2	760	37
20 :																					-	
21 :																					-	
22 :										1										1	885	39
23 :																					-	
24 :																					-	
25+:																					-	

Table 25 - Juvenile redfish (*Sebastes sp.*) catch (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	-	-	-	-
2 -	838	10	0.06	0.17	0.03	0.09
3 -	628	7	0.09	0.16	0.05	0.10
4 -	348	4	0.01	0.02	0.01	0.01
5 -	703	8	0.39	0.34	0.22	0.19
6 -	496	6	1.09	1.57	0.70	1.10
7 -	822	9	1.54	1.45	0.85	0.80
8 -	646	7	0.37	0.27	0.20	0.14
9 -	314	3	-	-	-	-
10 -	951	11	0.71	1.02	0.39	0.55
11 -	806	9	1.36	1.66	0.87	1.05
12 -	670	8	-	-	-	-
13 -	249	3	-	-	-	-
14 -	602	6	-	-	-	-
15 -	666	7	-	-	-	-
16 -	634	6	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	117				

	catch per tow	catch per mile towed
mean	0.40	0.23
standard error	0.07	0.04

(Kg)

Stock biomass estimated by swept area method = 329 tons

Table 26 - Juvenile redfish (*Sebastes sp.*) length frequency by strata (x 1000) in 1996 survey.

length (cm)	stratum 2	3	4	5	6	7	8	10	11	total
6-						20	7		21	49
7-		20			13	369	49	26	193	669
8-	6	20	7	46	344	2303	388	308	1488	4910
9-	12	88	7	217	538	1013	423	391	837	3527
10-	25	14		158	110	123	55	58	93	636
11-	12	7	7	99	143	461	7	116	458	1309
12-	56	41		204	272	1320	90	558	1001	3544
13-	19	41		118	357	676	21	507	665	2403
14-	19	7		72	162	113	55	257	250	935
15-				13	39	10	90	32	72	256
16-							21		21	42

Table 27 - Greenland halibut (*Reinhardtius hippoglossoides*) catch (Kg) by strata in 1996 survey.

stratum	area squa. miles	tow number	catch per tow mean	catch per tow s.deviat.	catch per mile towed mean	catch per mile towed s.deviat.
1 -	342	4	-	-	-	-
2 -	838	10	-	-	-	-
3 -	628	7	2.08	3.36	1.27	2.13
4 -	348	4	0.02	0.02	0.01	0.01
5 -	703	8	0.67	0.76	0.38	0.43
6 -	496	6	2.82	3.36	1.58	1.86
7 -	822	9	18.24	10.59	10.31	6.13
8 -	646	7	7.29	5.47	4.10	3.13
9 -	314	3	5.93	3.33	3.75	2.47
10 -	951	11	9.87	6.02	5.56	3.54
11 -	806	9	10.38	9.42	6.14	5.20
12 -	670	8	41.19	18.62	23.40	10.57
13 -	249	3	15.43	7.67	8.82	4.24
14 -	602	6	17.82	12.26	11.06	7.88
15 -	666	7	27.81	10.45	16.04	6.12
16 -	634	6	42.92	29.26	24.43	16.60
17 -	216	2	14.90	21.07	8.80	12.45
18 -	210	2	11.55	0.07	6.72	0.31
19 -	414	5	29.21	8.74	17.31	5.18
total	10555	117				

	catch per tow	catch per mile towed
mean	14.03	8.11
standard error	1.07	0.62

(Kg)

Stock biomass estimated by swept area method = 11,409 tons

Table 28 - Greenland halibut (*Reinhardtius hippoglossoides*) biomass stimated by swept area method (tons) 1988-1996.

stratum	depth in fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996
1 -	70- 80	-	-	-	-	-	-	-	-	-
2 -	81-100	-	3	6	-	-	-	-	119	-
3 -	101-140	26	31	8	8	18	3	-	21	106
4 -	"	142	20	-	15	27	10	-	5	-
5 -	"	73	96	-	28	41	1	2	21	35
6 -	"	31	18	15	12	8	15	-	31	104
7 -	141-200	84	62	63	186	242	93	211	890	1130
8 -	"	149	219	63	177	373	138	38	328	353
9 -	"	177	162	53	75	318	30	42	175	157
10 -	"	106	81	48	169	356	31	231	518	705
11 -	"	44	60	20	104	225	230	232	484	660
12 -	201-300	399	637	290	749	609	918	1200	1129	2091
13 -	"	63	122	214	43	24	141	150	125	293
14 -	"	362	289	315	775	834	469	610	404	888
15 -	"	428	166	505	958	633	1356	1469	1740	1425
16 -	301-400	1352	1342	2492	2487	1798	2141	1500	1832	2065
17 -	"	262	118	130	408	39	105	730	730	254
18 -	"	104	49	449	348	57	208	380	943	188
19 -	"	3016	919	977	1498	2988	1321	1108	1211	956
total		6818	4391	5649	8038	8588	7210	7904	10705	11409

Table 29 - Greenland halibut (*Reinhardtius hippoglossoides*) length frequency by strata (x 1000) in 1996 survey.

length	stratum																	
(cm)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total
10-11					7													7
12-13					7	14		12	7									41
14-15	47	20	20		319	284	25	45	136	6						8		912
16-17	82		7	51	599	381	34	141	286									1580
18-19	14			25	129	56	8	51	64									348
20-21					7	7			7									21
22-23					54	14		45	7									121
24-25	14		7	32	435	118	8	301	258			33	22					1227
26-27	88		59	78	973	215	17	519	422	25	6	8	15	8				2432
28-29	95		7	161	626	125		84	165	6	12	8	22					1310
30-31	34		7	32	88	21		58	57	26		16	29	8		8	20	403
32-33	7			32	204	42		58	28	38	6	33	102	16	8		33	607
34-35	28		7	19	251	42	17	77	93	95	6	8	73	40		8	33	797
36-37	34		7	19	184	76	8	64	79	185	13	33	160	160	16	8	98	1143
38-39	7			13	129	49		58	93	300	25	50	197	223	56	16	124	1339
40-41	14		7		142	35	8	103	115	390	45	115	342	342	8		255	1920
42-43	21		7	6	156	69	25	122	136	530	63	74	234	326	64	8	203	2043
44-45			7	13	123	49	42	51	86	505	57	164	379	318	40	24	177	2034
46-47	7		7	6	54	28	17	90	50	326	31	131	153	318	24	41	157	1440
48-49	7				61	21	17	19	28	186	25	74	139	310	24	24	98	1033
50-51					14		8	25	36	128	50	25	87	208	40	16	78	715
52-53						7	8	26	28	108	13	33	43	160	16	16	7	465
54-55							8	38		39	6	16	15	64	8		26	220
56-57					7		8	13		12	6	8		72		16	20	163
58-59						7	8			19		8	22	16				81
60-61										6		24				8	7	45
62-63									7	6		8	7					29
64-65														8				8
66-67																		
68-69																		
70-71																		
72-73																		
74-75												16		8				24
76-77																		
78-79																		
80-81																		
82-83												8						8

Table 30 - Greenland halibut (*Reinhardtius hippoglossoides*) age-length key.

MALES

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	no id	tot n.
10-11																		
12-13																		
14-15	12																1	13
16-17	13																	13
18-19	8																	8
20-21	1	1																2
22-23		8																8
24-25		10	1														1	12
26-27		21	2														1	24
28-29		23	4															27
30-31		2	11	2														15
32-33			15	8	2													25
34-35			3	9	4													16
36-37			1	11	4													16
38-39				6	8												1	15
40-41				1	11	6											1	19
42-43				1	8	15	3											27
44-45				1	5	16	5											27
46-47						11	7	6									1	25
48-49						6	7	4										17
50-51							4	9	1									14
52-53						1		8	3	2								14
54-55							2	4	2	1								9
56-57								4	3	1								8
58-59									1	1								2
60-61												3						3
62-63									1									1
64-65									1									1
total:	34	65	37	39	42	55	28	35	12	5		3					6	361

FEMALES

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	no id	tot n.
10-11	1																	1
12-13																		
14-15	15																	15
16-17	22																	22
18-19	11	1																12
20-21																		
22-23		7																7
24-25		9																9
26-27		23	3															26
28-29		18	5															23
30-31		1	6	1														8
32-33	1		9	4													1	15
34-35			6	9	2												1	18
36-37			1	10	6	3												20
38-39				9	13	5											1	28
40-41				4	15	23	1											43
42-43				1	12	26	4										3	46
44-45					10	24	10	2									2	48
46-47					2	14	16	4										36
48-49						5	10	5	1									21
50-51						3	14	16	3									36
52-53							5	21	3									29
54-55							1	6	8									15
56-57								5	9									14
58-59								1	3	2		1					1	8
60-61									1		1	1						3
62-63										3	1							4
64-65																		
66-67																		
68-69																		
70-71																		
72-73																		
74-75											2				1			3
76-77																		
78-79																		
80-81																		
82-83														1				1
total:	50	59	30	38	60	103	61	60	28	5	4	2		1	1		9	511

Table 31 - Greenland halibut (*Reinhardtius hippoglossoides*) age composition (x 1000) in 1996 survey.

age	stratum 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	mean weight (g)	mean length (cm)
1 :	143	20	27	76	1059	736	67	235	488	7		2	5			8	1	2874	32	16
2 :	174		66	236	1872	431	24	872	778	30	15	48	55	8		1	3	4613	142	26
3 :	67		15	90	513	106	8	194	177	82	8	40	124	36	6	9	52	1527	232	30
4 :	45		11	43	376	102	15	139	161	344	27	65	277	247	36	16	162	2066	399	36
5 :	31		9	22	311	102	26	160	195	671	69	148	448	485	65	20	308	3070	538	40
6 :	28		15	12	292	118	54	199	236	1002	117	273	658	802	87	45	456	4394	673	43
7 :	8		4	6	96	38	30	85	80	448	65	145	270	450	55	43	197	2020	853	46
8 :	2		2	1	37	19	23	70	51	261	49	90	152	420	46	36	119	1378	1066	50
9 :					5	5	14	34	8	64	14	25	42	124	10	17	30	392	1365	54
10 :					1	2	4		7	19		9	9	21			3	75	1597	57
11 :									2	4		15		5		3	2	31	2772	68
12 :						1	1			4		20	2	2		3	2	35	1818	59
13 :																		-		
14 :												8						8	4777	82
15 :												5		3				8	3560	74
16+:																		-		

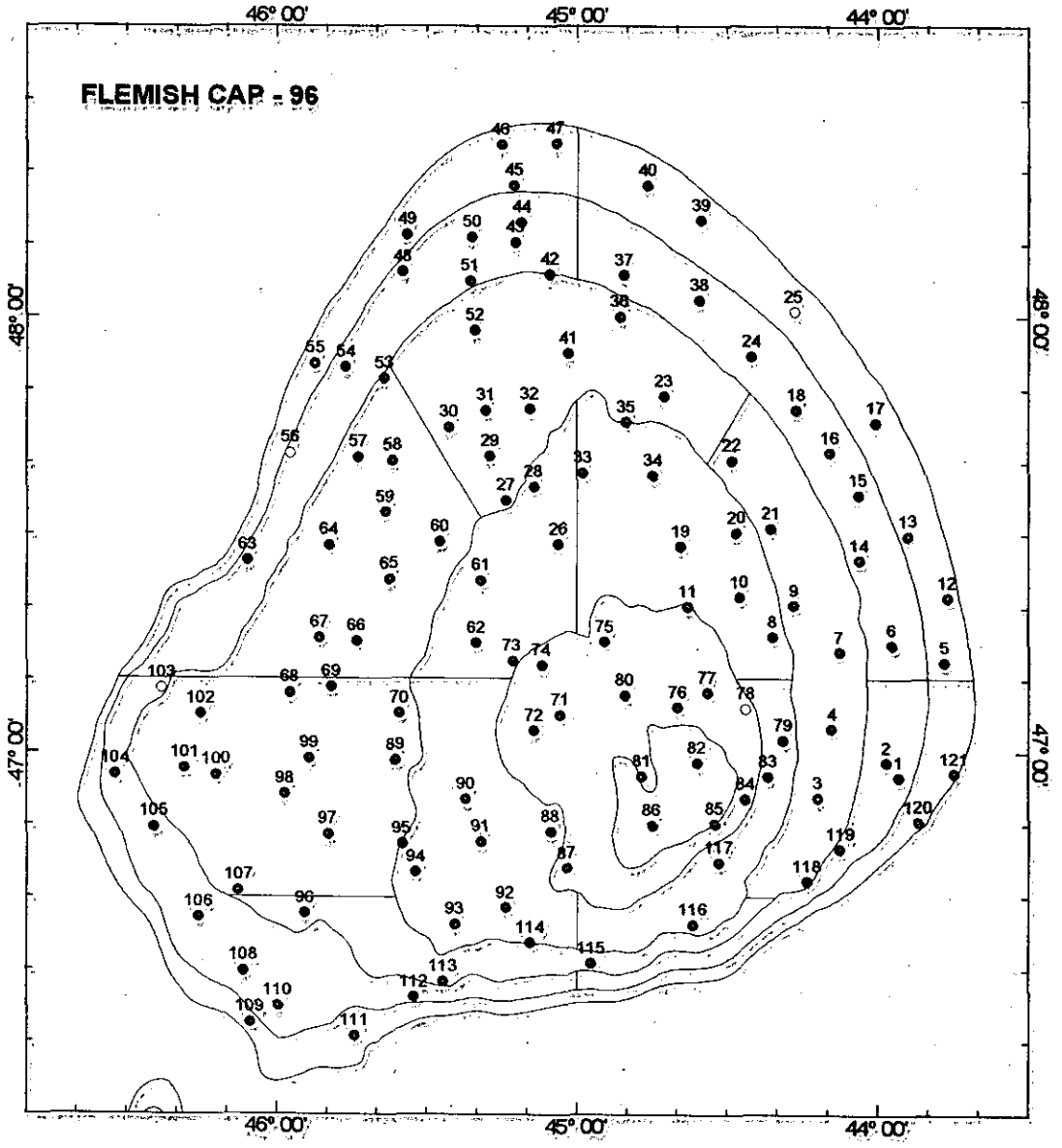

Figure 1 - Haul position of Flemish Cap-96 survey

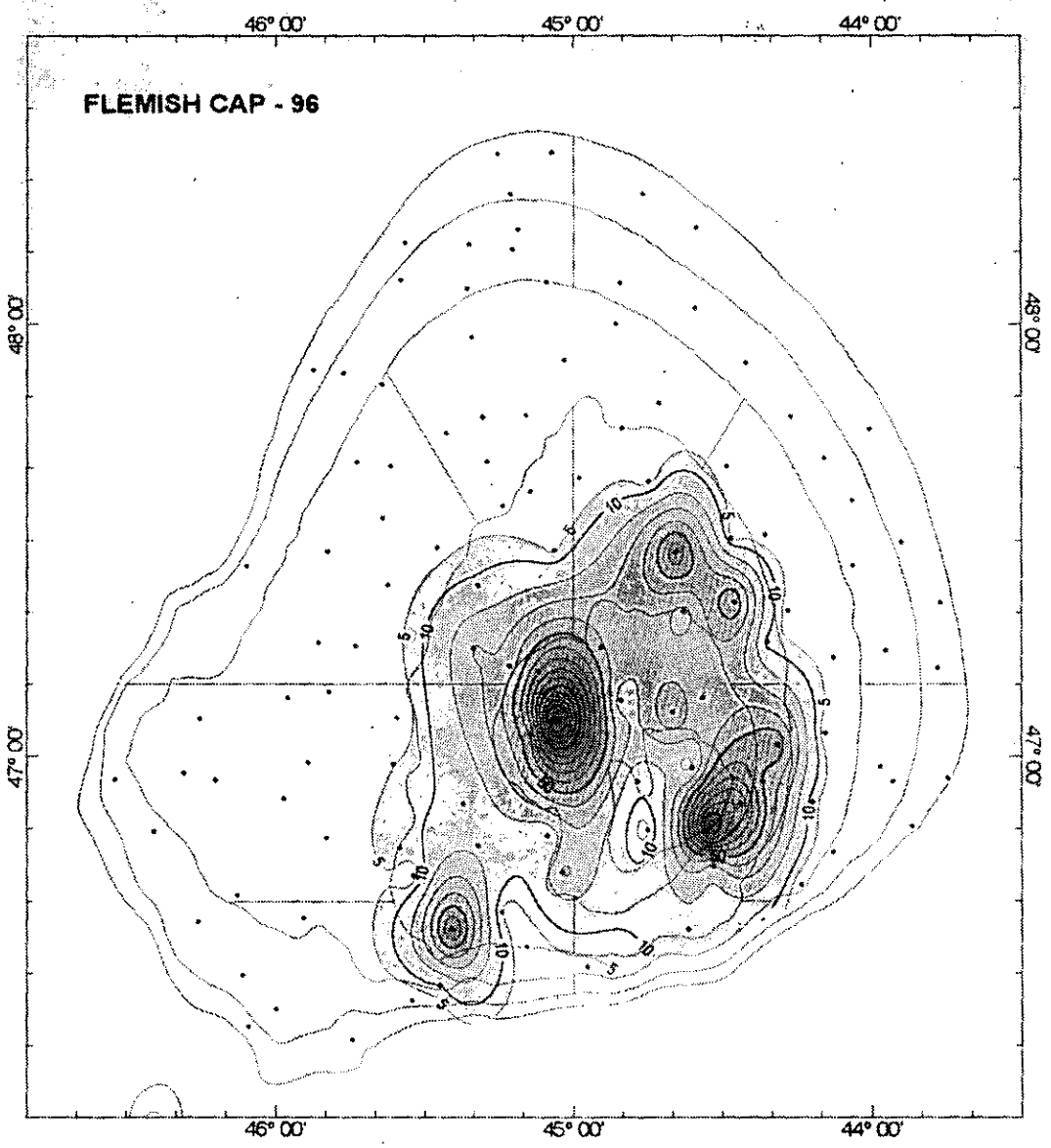

Figure 2 - Cod (Gadus morhua) catch distribution in Kg/tow.

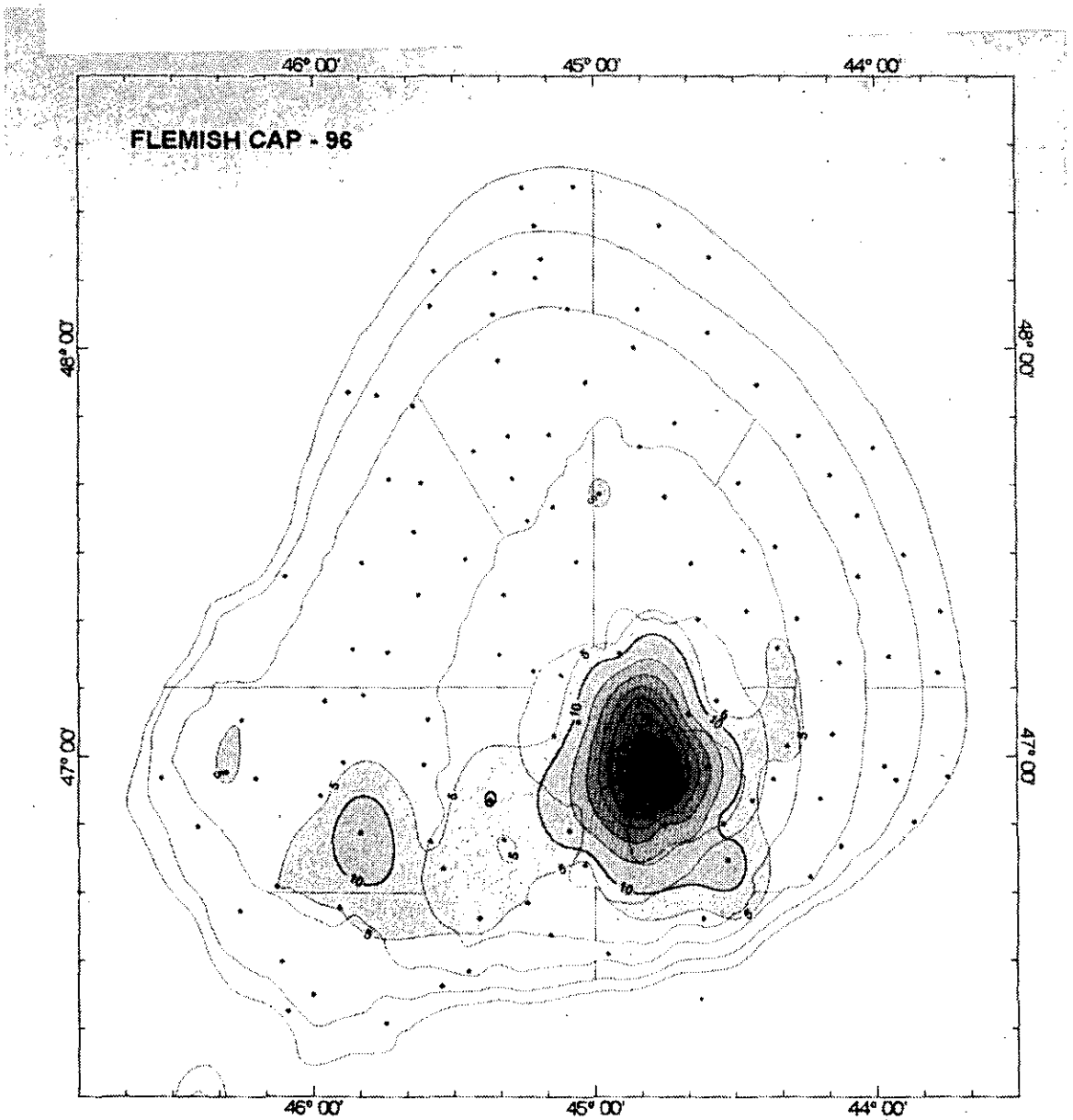

Figure 3 - American plaice (Hippoglossoides platessoides) catch distribution in Kg/tow.

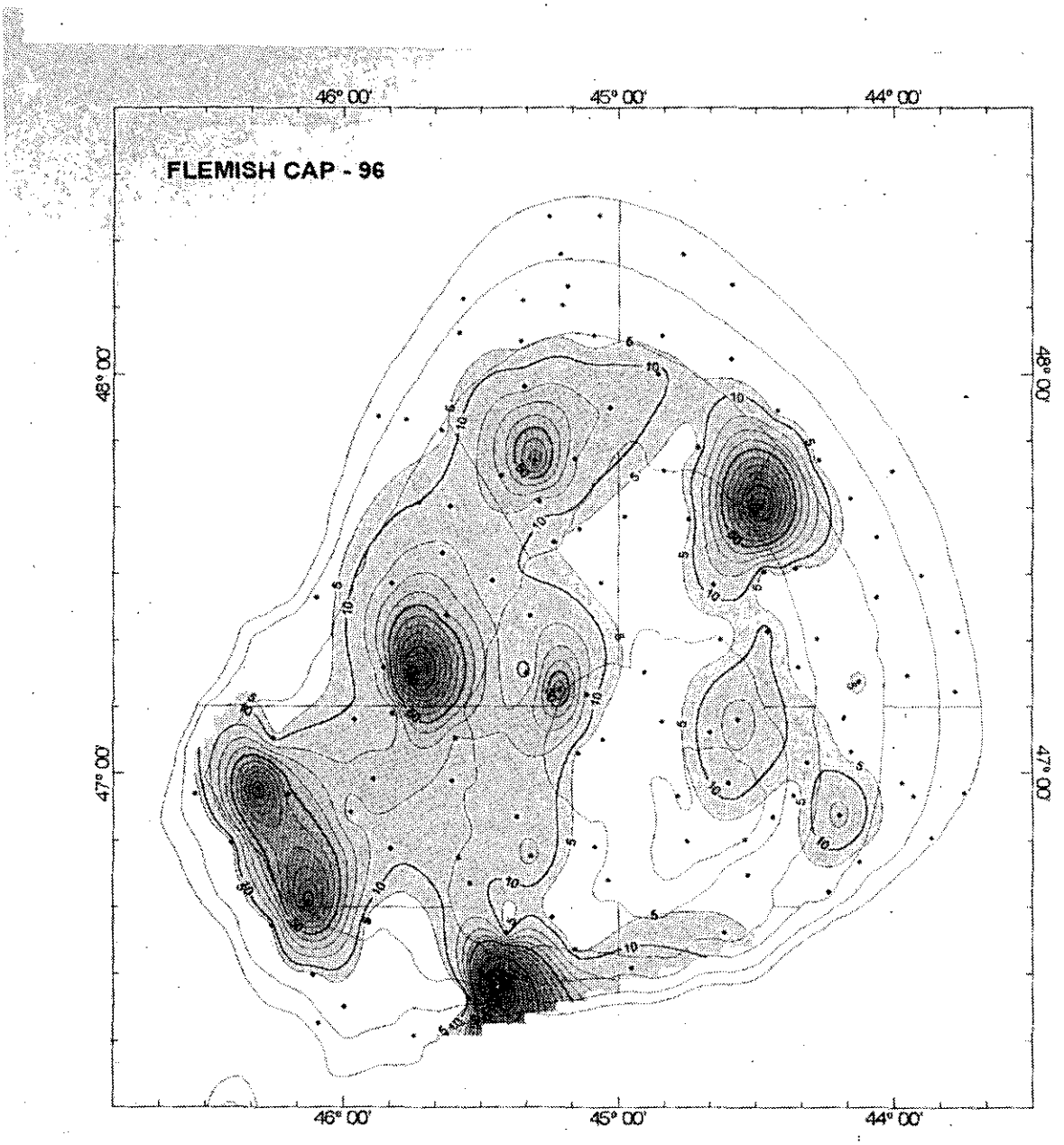

Figure 4 - Redfish (Sebastes marinus) catch distribution in Kg/tow.

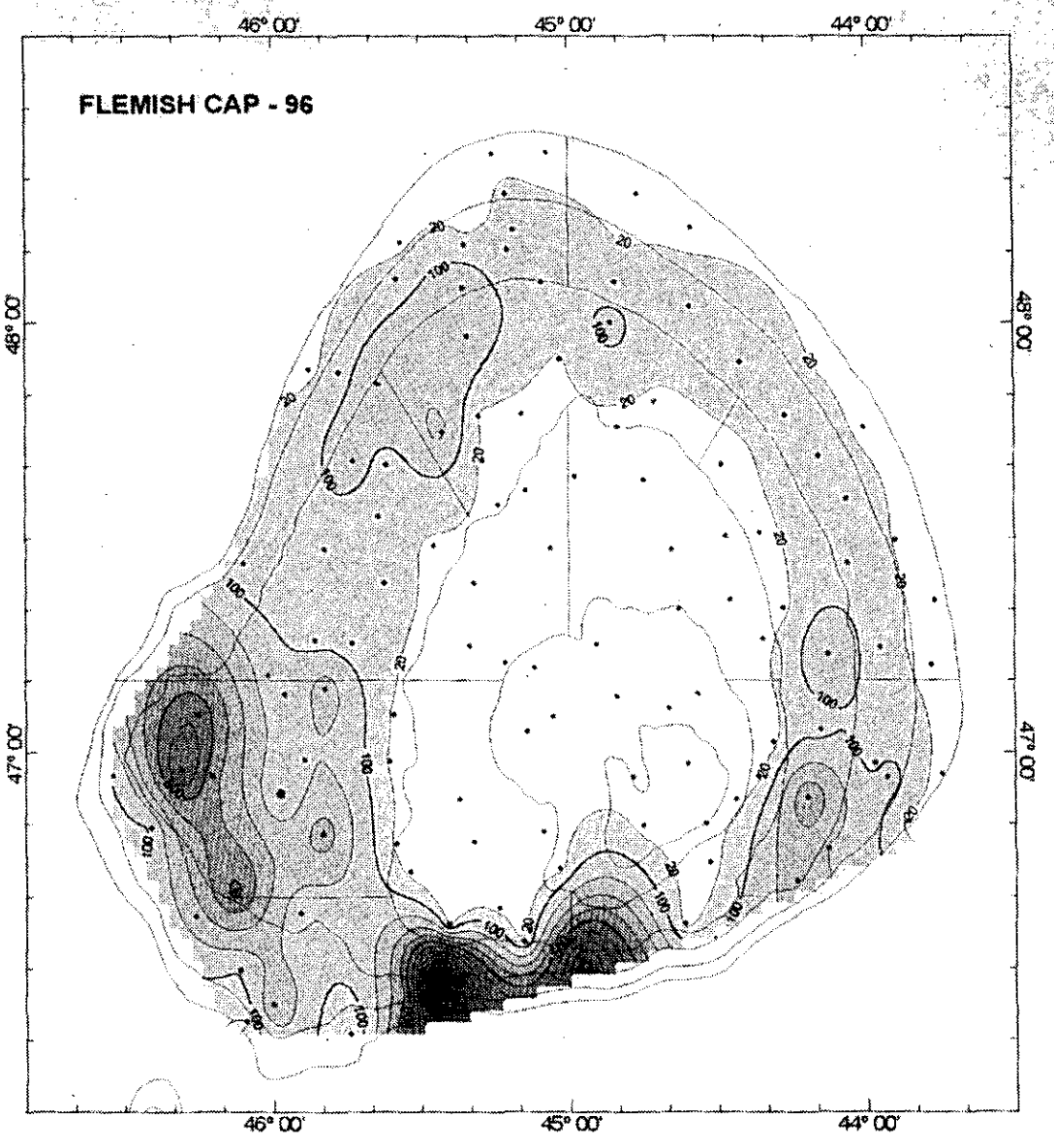

Figure 5 - Redfish (Sebastes mentella) catch distribution in Kr/tow.

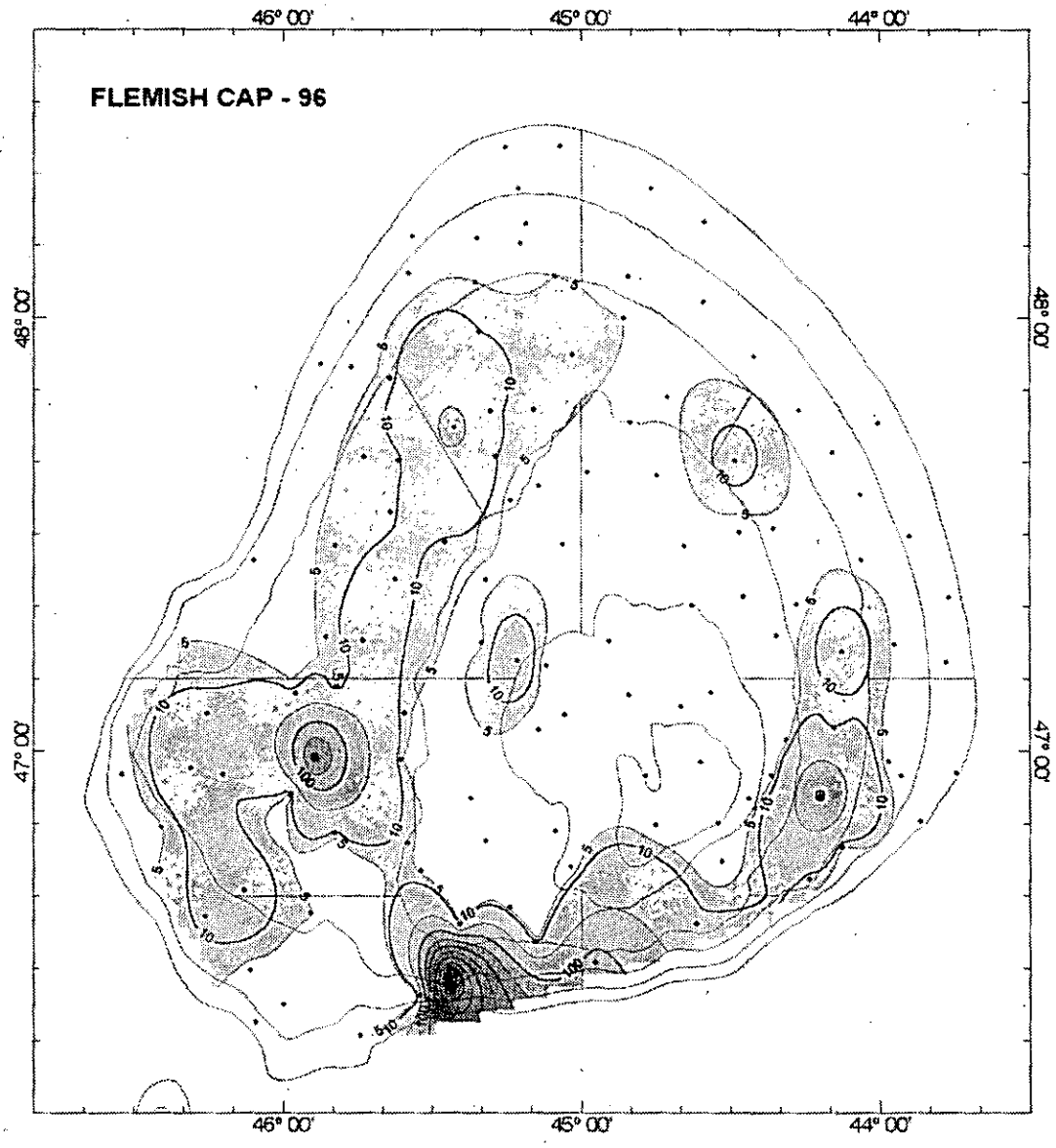

Figure 6 - Redfish (Sebastes fasciatus) catch distribution in Kg/tow.

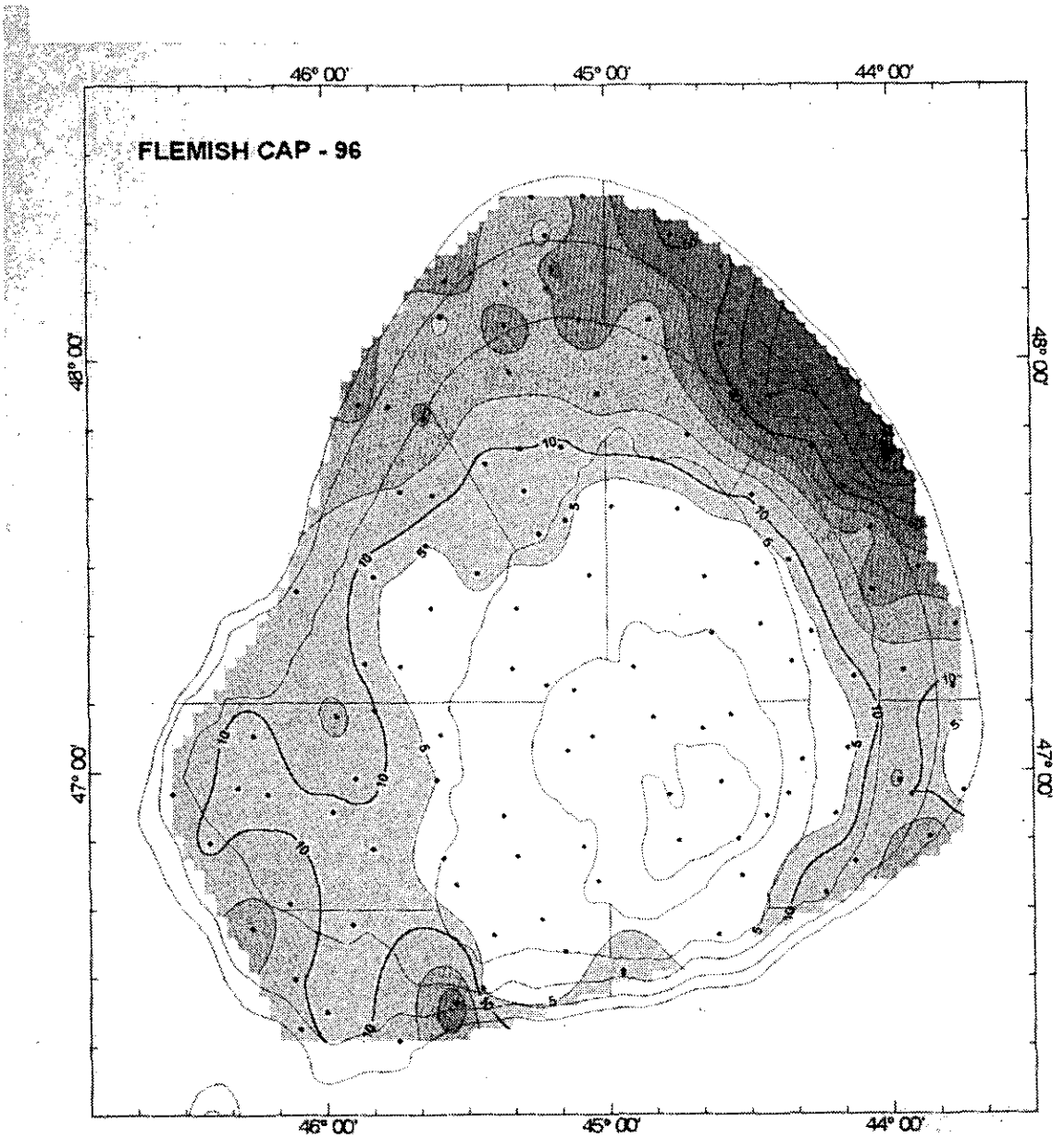

Figure 7 - Greenland halibut (Reinhardtius hippoglossoides) catch distribution in Kg/tow.