Northwest Atlantic Fisheries Organization

Serial No. N4073 **NAFO SCR Doc. 99/22**

SCIENTIFIC COUNCIL MEETING – JUNE 1999

Results from Bottom Trawl Survey of Flemish Cap in July 1998

by

A. Vázquez

Instituto de Investigaciones Marinas
Eduardo Cabello 6, Vigo, Spain
e-mail: avazquez@iim.csic.es

ABSTRACT

A stratified random bottom trawl survey of Flemish Cap was carried out in July 1998 up to a depth of 730 metres. Survey results are presented and compared with results of previous surveys in the series since 1988. Abundance at age indices are presented for cod, American plaice, redfish (*Sebastes mentella* and *S. fasciatus*) and Greenland halibut.

KEYWORDS: Survey, Flemish Cap, Cod, American plaice, Redfish, Greenland halibut.

INTRODUCTION

The survey of Flemish Cap was carried out in 1998 on board R/V Cornide de Saavedra. A total of 119 valid bottom trawls were made up to a depth of 730 metres (400 fathoms) (Figure 1). The survey adequately covered all strata of the bank. A synoptic sheet of the survey with ship and gear characteristics is shown in Table 1. This was the 11th survey of the series initiated by the EU in 1988. All survey had a stratified random design following NAFO specifications (Doubleday, 1981). 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
196	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

Total biomass of all species was calculated by the swept area method. The results are presented in Table 2, as well as in the table below. Those amounts are assumed to underestimate real values to various degrees, as a consequence of each species having a particular catchability and accessibility to bottom gears. In this framework, the total biomass estimated for 1998 has the minimum value along the series. Redfish shows the highest annual variability probably due to its pelagic habitat, making accessibility to bottom gears more variable than for demersal or benthic species. Cod, witch flounder and redfish reached a biomass minimum in 1998. Greenland halibut reached a maximum in

1998. Shrimp also reached a maximum in 1998, but the use of a 25 mm liner in the cod-end in 1998 produced a noticeable increase of small size shrimp catches.

RESULTS

For total biomass of main species on the bank, survey estimates by the swept area method were:

Species	survey: 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
cod	37127	103644	55360	36597	24295	55642	24062	8815	8196	9063	4532
American plaice	11886	10533	9101	7565	6492	5949	6173	5087	3073	2268	2577
redfish	158417	136658	104194	63845	104477	62589	126010	73640	100543	139241	59316
Greenland halibut	6818	4391	5649	8038	8588	7210	7904	10705	11409	15846	23849
roughhead grenadier	2390	1024	996	1587	1817	3757	2350	1855	1619	1425	2014
shrimp	2164	1923	2139	8211	16531	9163	3337	5413	6502	5096	16620

tons

Cod

Mean catch by strata and whole bank data and their standard error are presented in Table 3. Total biomass estimates by the swept area method by strata and its comparison with the 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	2,490	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	-	-

tons

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

The calculated abundance at age is shown in the table of the following page. The 1990 year-class was the most abundant observed at age 1, but its importance 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. Among the most recent year-classes, those of 1993 and 1994 (ages 5 and 4 in 1998) were among the weakest ones observed in the previous period. The 1995 and 1996 year-classes (ages 3 and 2 in 1998) failed almost completely and, according to the results of the present survey, the same failure appears to have occurred for the 1997 year-class (age 1 in 1998).

Tables 5, 6 and 7 show length frequency, age-length key and estimated age composition of the stock in 1998 respectively. Catch per tow distribution is presented in Figure 2.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
1	458	2418	237	13780	7118	438	315	155	4	4	3	
2	7196	6062	1179	2560	3706	13274	385	1137	297	14	8	
3	4037	6964	467	1538	475	2852	2459	123	613	315	9	
4	1085	2819	1588	193	203	102	456	361	82	436	114	
5	128	227	1453	628	33	127	12	90	225	36	145	
6	22	33	394	168	127	17	6	1	19	90	7	
7	28	12	32	31	21	50		2	1	2	14	
8	11	7	13	7	1	10	12		1			
9		1	8	4				1			1	
10			3	1			1	1				
11				2	1							
12										1		
Total	12965	18543	5374	18906	11685	16870	3646	1873	1240	898	300	
Biomass	37127	103644	55360	36597	24295	55642	24062	8815	8296	9063	4532	tons
SOP *	33474	100217	51388	37231	22734	54945	22867	8841	8138	8873	4502	tons

abundance (x 10000)

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

American plaice

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		Tons

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

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 shown in the above table:

The abundance by age-groups is presented in the table of the following page. The 1984, 1986 and 1990 year-classes, ages 14, 12 and 8 in 1998, were the most abundant cohort since 1989. Their growth can be easily followed in the above table, confirming the suitability of the ageing criterion. It is interesting to note that good year-classes can be recognised at age 2 and 3 years, long before recruitment is completed at age 4 to 7 years. Fish aged 6 or more years roughly corresponds with fisheable biomass. Its abundance (N 6+) decreased along the period except in 1992, when an increase was recorded as a consequence of the income of the abundant 1986 year-class.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1	-	-	-	-	-	-	-	-	-	7	-
2	2284	454	359	309	736	9	34	19	28	14	22
3	625	6847	775	911	679	1365	40	99	103	96	29
4	3034	1500	7083	1877	910	969	1789	627	222	22	42
5	1975	3238	897	4461	1471	643	782	1620	465	99	62
6	3020	3006	2475	1836	3423	320	651	990	1236	311	202
7	4154	2868	1717	2009	913	3110	703	988	656	901	457
8	4258	1691	1657	1566	1090	339	2487	665	411	200	654
9	1492	587	1030	675	624	592	243	1132	308	312	388
10	207	261	485	232	289	296	480	128	470	223	267
11	109	34	90	8	138	198	166	143	113	372	235
12	61	14	15	48	74	229	164	119	63	103	228
13	-	-	31	-	16	280	195	119	67	19	73
14	-	-	17	-	-	865	398	241	90	77	94
15	-	-	-	-	-	28	397	183	62	38	47
16	-	-	-	-	-	35	9	27	20	92	89
Total	21219	20500	16631	13932	10363	9268	8538	7100	4321	2886	2889
Biomass (t)	11868	10533	9101	7565	6492	5949	6173	5087	3073	2268	2577
SOP (t)		9726	8827	7682	6111	5856	5966	5041	3031	2229	2533
N 6+	13301	8461	7517	6374	6567	6282	5893	4735	3496	2648	2734

abundance (x 1000)

The stock has recorded a steady decline since 1988. Global indices in table above, such as total abundance, biomass, SOP and N6+, have tended to decrease over the period: their levels in 1997 and 1998 are around 5 times lower than in 1988. 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 should be the first weak cohort. Neither do the results indicate a possible change in future years: the six youngest year-classes, those with less than 8 years old in 1998, were among the weakest observed in this survey. The 1990 year-class (age 8 in 1998), the most abundant cohort of recent years, is less abundant than the 1986 year-class at the same age.

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 for which classification was not possible. The 15 cm maximum length is a good reference for the 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 an uniform defined group, but it is maintained for practical reasons.

Mean catch by strata and whole bank data are presented in Tables 13, 15, 19 and 23 for *Sebastes marinus, S. mentella, S. fasciatus* and the *juvenile* group respectively. Total biomass estimates by the swept area method are summarised in the table below.

	Sebastes:	spp.				Russia	
Year	*marinus*	*mentella*	*fasciatus*	juvenile	EU total	bottom (1)	total (2)
1983						154,900	
1984						132,300	
1985						51,900	
1986						309,500	
1987						110,700	
1988	15,397		143,022		158,419	61,400	379,000
1989	22,962		113,696		136,658	90,100	365,900
1990	14,699	72,893		16,601	104,193	20,700	246,400
1991	4,093	50,071	5,680	4,001	63,846	45,500	107,700
1992	4,130	71,810	5,308	23,229	104,477	18,500	99,500
1993	4,173	25,056	4,425	28,935	62,589	72,600	147,100
1994	33,240	35,710	7,829	49,233	126,011	-	-
1995	9,042	59,332	5,032	235	73,641	21,600	-
1996	11,293	77,897	11,025	329	100,544	15,900	-
1997	64,847	56,093	17,471	830	139,241	-	-
1998	6,422	45,358	6,436	1,100	59,316	-	-

tons

1) Trawlable biomass.
2) Trawlable plus pelagic biomass (Vaskov 1994, Vaskov and Karsakov 1996, Vaskov 1997)

Tables 14, 16, 20 and 24 show length frequency for the four groups. Age-length keys were made for *S. mentella* and *S. fasciatus* (Tables 17 and 21). Age composition for these two species are presented in Tables 18 and 22. Catch per tow distribution of the three species is presented in Figures 4, 5 and 6; their age composition are given together in the table below.

	S. mentella			S. fasciatus		
Age	frequence	m.weight	m.length	frequence	m.weight	m.length
1		11	9			
2	15	31	13	115	33	13
3	213	57	16	416	53	15
4	137	78	18	922	75	17
5	153	128	21	1475	111	19
6	393	166	23	549	147	21
7	272	212	24	472	186	23
8	1126	202	24	697	195	23
9	46	339	29	96	276	26
10	6	386	30	38	324	27
11	4	452	32	16	310	27
12	28	508	33	39	404	29
13	2	567	34			
14	2	641	35			
15	2	661	36			
16	3	760	37	3	343	28
17	6	725	37			
18		674	36			
19		751	37			
20						
21						
22		859	39			
23						
24		1154	43			
25+		1154	43			

frequence (×10000), mean weight in grams, mean length in cm

Frequencies (x 10000) at age of redfish stocks are presented in the table below.

	S. marinus							S. mentella							S. fasciatus						
Age	1991	1992	1993	1994	1995	1996	1997	1992	1993	1994	1995	1996	1997	1998	1992	1993	1994	1995	1996	1997	1998
1										10	6						2				
2				20	122	51				49	259	280	59	15			12	81	235	89	115
3	12	11	65	231	765	139		132		1074	3040	1620	480	213	5	82	264	400	486	1483	416
4	225	74	125	770	1342	791	612	2673	173	5249	19700	11726	3190	137	469	265	1284	875	1407	2340	922
5	357	234	228	808	1529	2120	1523	9884	550	2273	11900	30498	17631	153	1131	634	1777	1108	2620	1867	1475
6	179	197	254	885	406	1168	4227	3829	1420	1285	490	4765	10163	393	417	485	885	422	1064	1714	549
7	175	149	157	1087	281	438	3480	3048	1013	1915	870	850	794	272	140	204	353	238	533	784	472
8	73	100	119	755	146	170	2062	2181	637	1178	980	826	331	1126	83	99	118	105	200	300	697
9	53	65	50	578	76	121	452	1361	228	778	570	641	217	46	54	47	40	31	127	202	96
10	72	56	59	431	61	87	897	862	317	605	550	374	251	6	16	26	23	11	23	79	38
11	46	56	39	448	57	63	856	631	335	519	610	281	133	4	19	12	15	17	27	211	16
12	44	35	37	324	32	72	915	465	410	330	280	284	134	28	13	2		8	34		39
13	39	32	11	420	48	34	611	446	259	253	220	168	72	2	3	5	4	7	4		
14	9	14	14	145	26	25	420	321	260	161	250	188	121	2	9	3		2	13		
15	18	14	6	222	23	28	315	174	297	172	260	147	34	2		1	5	1	7		
16	9	2	4	22	14	14	70	172	69	85	160	106	48	3		3					3
17	18	1	4	83	17	10	56	107	95	59	102	69	44	6					3		
18		3	1	24	6	3	18	69	44	84	87	67	11		2						
19	6	3	5	50	3		26	72	34	38	46	32	14		2				2		
20	7	1			7	3	121	19	26	22	38	41	16								
21	3	2		23			13	13	31	13	25	18	6								
22		1		10	1	1	3			13	11	5	2						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 were aged 4 and 3 years respectively. The decline of juvenile biomass since 1995 reflects the weakness of younger year-classes.

Greenland halibut

Mean catch by strata and whole bank estimates are presented in Table 25. Total biomass estimates by the swept area method by strata and its comparison with results of previous surveys are presented in Table 26 and summarised 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	
1997	15.846	
1998	23.849	tons

Length frequency, age-length keys and age composition of the population were calculated (Tables 27, 28 and 29). Catch per tow distribution is presented in Figure 7. Age composition of the stock was calculated in surveys as follows:

Age	1991	1992	1993	1994	1995	1996	1997	1998
1	349	922	937	832	6165	2874	1597	1434
2		800	933	706	1394	4613	2113	1268
3	235	286	599	1082	1369	1527	4396	5149
4	993	861	566	1224	1249	2066	5157	7835
5	1956	1600	960	1365	1709	3070	5216	9168
6	1253	1996	1574	2233	3793	4394	6045	8821
7	2283	1793	1732	2096	3026	2020	3885	6334
8	545	991	1388	1213	1729	1378	1709	2339
9	464	473	905	689	1134	392	593	703
10	388	266	257	264	254	75	200	201
11	122	139	141	95	68	31	33	27
12		67	51	54	26	35	22	6
13		18	19	19			23	22
14		13	10		7			
15						8	8	
16							14	
total	8588	10225	10072	11860	21925	22483	31091	43217
Biomass (t)	8038	8588	7210	7904	10705	11409	15846	23849 t
SOP (t)	8329	8084	7136	7406	9782	11005	15367	23627 t
N 10+	510	503	478	432	355	149	300	256

abundance × 1000

Shrimp

Detailed results were presented by del Rio (1998).

Roughhead grenadier (*Macrourus berglax*)

Total biomass estimated by swept 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
1997	1,425
1998	2,014 Tons

Ageing of fish was started in 1994 survey. Detailed results were presented by Sarasua et al. (1999).

ACKNOWLEDGEMENTS

This study was supported by the European Commission (DG XIV, Study 96-030), CSIC, IEO, IPIMAR and the Basque Government.

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Table 1 - Technical data of the 1998 survey.

Procedure	Specification
Vessel	R/V Cornide de Saavedra
GT	1.200 t
Power	1.500 + 750 HP
Mean trawling speed	3.43 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	3.4 – 3.5 m (SCANMAR in 8 hauls)
warps	100 meters, 45 mm, 200 Kg/100m
trawl doors	polyvalent, 850 Kg
wire length	2.75 times the depth
mesh size in codend	40 mm (with 25 mm liner)
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* y *S. fasciatus*), Greenland halibut and roughhead grenadier (*Macrourus berglax*).

Table 2 - Total biomass swept area method estimates for several species or groups of species in 1988-1998 surveys (tons).

	survey:										
species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Rajidae	4495	1908	2824	4064	3765	6279	3462	2267	2052	1839	1981
Synaphobranchus sp.	219	88	42	77	70	70	8	16	3	11	37
Urophycis sp. (brótolas)	654	167	169	261	69	161	214	83	81	32	229
Antimora sp.	392	302	284	560	720	594	799	195	186	235	488
Macrouridae	3088	1438	1223	2249	2592	6183	3230	2604	2342	2289	2833
Notacanthus sp.	501	408	65	478	449	705	455	346	180	287	169
Illex sp.	5	8	1647	1159	66	1	210	1	87	64	71
Anarhichadidae	7973	7478	8120	10097	9095	14304	15516	19217	20559	14036	10987
witch flounder	909	335	420	769	823	1048	776	705	509	319	240
Greenland halibut	6818	4391	5649	8038	8588	7210	7904	10705	11409	15846	23849
Zoarcidae	559	923	1202	1978	1356	3277	1869	2182	1702	1730	2055
cod	37127	103644	55360	36597	24295	55642	24062	8815	8196	9063	4532
American plaice	11886	10533	9101	7565	6492	5949	6173	5087	3073	2268	2577
redfish	158417	136658	104194	63845	104477	62589	126010	73640	100543	139241	59316
shrimp	2164	1923	2139	8211	16531	8940	3338	5413	6502	5096	16620
others	624	206	1138	664	439	779	503	395	692	584	1109
Total	235833	270410	193575	146611	179828	173731	194529	131671	158114	192943	127093

Table 3 - Cod catches (Kg) by strata in the 1998 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	4.46	3.61	2.50	2.04
2 -	838	10	27.01	16.65	15.46	9.71
3 -	628	7	13.74	19.25	7.63	10.60
4 -	348	4	4.87	6.96	2.73	3.84
5 -	703	8	16.85	10.02	9.46	5.59
6 -	496	6	14.60	15.62	8.43	8.82
7 -	822	9	1.12	1.50	0.65	0.87
8 -	646	7	1.34	1.46	0.81	0.88
9 -	314	3	-	-	-	-
10 -	951	11	2.53	3.99	1.43	2.25
11 -	806	9	2.60	2.36	1.49	1.36
12 -	670	7	-	-	-	-
13 -	249	3	-	-	-	-
14 -	602	7	-	-	-	-
15 -	666	8	-	-	-	-
16 -	634	7	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	119	5.67			

	catch per tow	catch per mile towed
mean	5.67	3.22
standard error	0.74	0.42

(Kg)

Stock biomass estimated by swept area method = 4,532 tons

Table 4 - Cod biomass estimated by the swept area method (tons) 1988-1998.

Stratum	depth in fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1 -	70- 80	1223	590	751	5078	69	469	1969	1421	915	221	114
2 -	81-100	9229	9386	1876	4988	4683	8223	7443	2764	3629	1863	1727
3 -	101-140	4065	9344	1994	2236	7704	7670	5539	1042	958	1029	639
4 -	"	2846	4404	2355	2637	3131	12885	1714	678	971	779	127
5 -	"	1937	9731	7738	9685	4155	6205	840	1158	851	1045	887
6 -	"	2932	6173	3007	1392	866	3837	1284	1191	564	977	557
7 -	141-200	2022	14571	3582	2308	859	5595	779	111	50	970	71
8 -	"	8121	14943	15313	4644	2136	7241	3287	317	85	1464	70
9 -	"	167	4784	5895	171	130	907	217	8	94	158	-
10 -	"	1217	4454	4255	1417	297	851	460	53	42	274	181
11 -	"	2278	12020	3706	1625	204	1526	529	71	37	282	160
12 -	201-300	305	2245	1478	115	-	22		-	-	-	-
13 -	"	8	2304	689	85	-	-		-	-	-	-
14 -	"	97	686	584	119	61	211		-	-	-	-
15 -	"	680	7671	2137	98	-	-		-	-	-	-
16 -	301-400	-	60	-	-	-	-		-	-	-	-
17 -	"	-	5	-	-	-	-		-	-	-	-
18 -	"	2	-	-	-	-	-		-	-	-	-
19 -	"	-	91	-	-	-	-		-	-	-	-
total		37127	103644	55360	36597	24295	55642	24062	8815	8196	9063	4532

Table 5 - Cod length frequency by strata (× 1000) in the 1998 survey.

length (cm)	stratum 1	2	3	4	5	6	7	8	10	11	total
18-20	13	6									19
21-23	6										6
24-26											
27-29											
30-32	6	13									19
33-35		44									44
36-38		6	7								13
39-41		19	7		7						32
42-44	6	44	14		7					7	78
45-47	13	101	34	13	26	26		15	7		235
48-50	6	260	55	46	66	52		15	7	7	513
51-53	25	253	89	13	106	52	14			7	559
54-56	25	222	102	26	99	129	14	15	39	34	706
57-59		165	75	7	60	52	7		13	20	398
60-62		38	41		66	19	7		13	7	191
63-65	6	13	20		20	13		7			79
66-68		19			7				7	7	39
69-71		6	7		7						20
72-74		6				6			7		19
75-77					13						13
78-80											
81-83		6									6
84-86											
87-89											
90-92					7						7

Table 6 - Cod age-length key in 1998.

length (cm)	age 1	2	3	4	5	6	7	8	9	10	no id	tot n.
12-14												
15-17												
18-20	3											3
21-23	1											1
24-26												
27-29												
30-32		3										3
33-35		7										7
36-38		2										2
39-41			4	1								5
42-44			5	7								12
45-47			4	30	1						1	36
48-50				67	11						1	79
51-53				40	45						1	86
54-56				24	78	3					3	108
57-59				3	54	4						61
60-62					24	1	4					29
63-65					5	3	4					12
66-68					1		5					6
69-71							3					3
72-74							3					3
75-77							2					2
78-80												
81-83							1					1
84-86												
87-89												
90-92									1			1
total:	4	12	13	172	219	11	22		1		6	460

Table 7 - Cod age composition by strata (× 1000) in the 1998 survey.

age	stratum 1	2	3	4	5	6	7	8	10	11	total	mean weight (g)	mean length (cm)
1 :	19	6									25	69	20
2 :	6	63	7								76	358	34
3 :	4	45	15	1	11	3		2	1	3	85	753	43
4 :	37	517	155	63	160	123	10	29	22	22	1138	1189	50
5 :	36	525	240	39	257	199	30	17	54	55	1452	1664	56
6 :	2	22	14	1	14	11	1	2	2	3	72	1990	59
7 :	2	43	19		42	13	1	2	15	7	144	3095	68
8 :													
9 :					7						7	7403	91
10 :													
11 :													
12 :													
13 :													
14 :													
15 :													
16+:													

Table 8 - American plaice catch (Kg) by strata in the 1998 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	4.75	3.27	2.56	1.68
2 -	838	10	18.66	20.08	10.65	11.52
3 -	628	7	4.59	9.30	2.55	5.12
4 -	348	4	9.79	7.32	5.54	4.01
5 -	703	8	10.26	16.90	5.95	9.88
6 -	496	6	0.68	0.73	0.40	0.43
7 -	822	9	0.53	0.68	0.32	0.41
8 -	646	7	2.36	3.52	1.44	2.08
9 -	314	3	-	-	-	-
10 -	951	11	0.38	0.47	0.21	0.26
11 -	806	9	0.37	0.59	0.21	0.33
12 -	670	7	-	-	-	-
13 -	249	3	-	-	-	-
14 -	602	7	0.07	0.19	0.04	0.11
15 -	666	8	0.10	0.28	0.06	0.16
16 -	634	7	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	119				

	catch per tow	catch per mile towed
mean	3.20	1.83
standard error	0.69	0.40

(Kg)

Stock biomass estimated by swept area method = 2,577 tons
" " " " " by sex (m f) = 694 1,884 tons
(m f) = male / female

Table 9 - American plaice biomass estimated by swept area method (tons) 1988-1998.

stratum	depth in fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1 -	70- 80	979	750	448	808	532	809	496	1672	1096	286	117
2 -	81-100	1990	2701	1040	1997	1285	950	899	1001	707	555	1190
3 -	101-140	1025	838	1207	935	473	333	244	189	126	371	213
4 -	"	1649	346	661	240	418	429	640	367	201	152	257
5 -	"	1949	2319	1406	1055	628	968	922	412	375	464	558
6 -	"	358	847	720	376	451	229	606	92	24	10	26
7 -	141-200	880	398	562	292	479	239	237	187	54	62	35
8 -	"	313	123	209	188	545	365	132	99	42	92	124
9 -	"	77	122	262	-	280	154	15	375	41	27	
10 -	"	1742	1118	1555	981	1054	1094	1677	531	311	215	27
11 -	"	889	876	973	301	279	219	227	82	51	24	22
12 -	201-300	7	14	35	13	8	11	25	9	24	5	
13 -	"	2	-	15	-	-	-	-	2	-	-	
14 -	"	6	6	6	292	22	53	18	11	3	-	3
15 -	"	17	74	2	73	28	82	30	51	17	5	5
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	2268	2577

Table 10 - American plaice length frequency by strata (× 1000) in the 1998 survey.

length (cm)	stratum 1	2	3	4	5	6	7	8	10	11	14	15	total
20-21				7			7						14
22-23							7	7					14
24-25			7										7
26-27				7									7
28-29		6		7	13				7	7			39
30-31					7				7				13
32-33	6		14	7	27	6	7						66
34-35	44	57	7	7	53		7	7	7				188
36-37	25	76	28	7	139			7		7			288
38-39	56	63	14	20	80	6	14	7	20				280
40-41	25	120	14	27	119	6	7	14	14		7		352
42-43	31	107	14	39	66	6			7				271
44-45	19	107	55	27	40	6	7			7		6	274
46-47		127	14	40	53	6		15					254
48-49		133	20	26	26		7	7					221
50-51		171	7	33	33			15		7			265
52-53		108	27	7	33			22					197
54-55		38		7	20			15					79
56-57		13	14	7	7								40
58-59		6											6

Table 11 - American plaice age-length key in the 1998 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.
18-19																		
20-21		1																1
22-23		1	1															2
24-25																		
26-27				1														1
28-29			2	1	1													4
30-31					1		1											2
32-33						3	1											4
34-35						7	10	3	4								1	25
36-37						7	12	13	4	1	2						1	40
38-39						3	8	12	9	3	1	1						37
40-41						2	6	16	9	4	1	1	1					40
42-43							3	11	5	2	1	1					1	24
44-45								2	2			2					1	7
total:		2	3	2	2	22	41	57	33	10	5	5	1				4	187

FEMALE

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	no id	tot n.
18-19																		
20-21		1																1
22-23																		
24-25			1															1
26-27																		
28-29				2														2
30-31																		
32-33				2	3	1												6
34-35					3	1												4
36-37						1	2										1	4
38-39					1	2	3											6
40-41						3	5	5		1								14
42-43							7	5	2	4								18
44-45							6	15	7	4	1						2	35
46-47							4	12	10	6	3	3	1				1	40
48-49								4	4	5	7	7	2	2	1	2		34
50-51									2	8	13	7	1	4	1	2	3	41
52-53										2	6	10	1	6	3	2		30
54-55												1	3	2	1	5		12
56-57												1	1		1	2	1	6
58-59													1					1
total:		1	1	4	7	8	27	41	25	30	30	29	10	14	7	13	8	255

Table 12 - American plaice age composition by strata (× 1000) in the 1998 survey.

age	stratum 1	2	3	4	5	6	7	8	10	11	14	15	total	mean weight (g)	mean length (cm)
1 :															
2 :				7			11	4					22	77	21
3 :		3	7	4	7		4	4					29	154	25
4 :		2	5	11	6	2	2		7	7			42	233	29
5 :		7	8	12	17	3	9	1	5				62	344	33
6 :	28	47	15	10	78	3	6	7	7	1			202	463	36
7 :	50	136	37	34	151	6	7	14	17	3	1	1	457	597	39
8 :	65	240	50	57	179	12	11	14	14	6	3	3	654	724	41
9 :	41	153	29	36	95	6	6	9	7	3	2	1	388	770	42
10 :	12	125	19	30	57	3	4	9	3	3	1	1	267	973	45
11 :	5	130	16	24	40	1	2	13	1	3			235	1176	48
12 :	5	125	21	23	35	1	2	14	1	1			228	1259	49
13 :	1	40	6	7	13			6					73	1452	51
14 :		54	7	8	15			9		1			94	1428	51
15 :		25	6	4	8			4					47	1523	52
16+:		45	9	9	17			9					89	1568	53

Table 13 - Redfish (*Sebastes marinus*) catch (Kg) by strata in the 1998 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	19.30	32.95	10.83	18.50
2 -	838	10	3.03	4.57	1.74	2.62
3 -	628	7	2.47	2.38	1.40	1.32
4 -	348	4	2.53	3.95	1.41	2.18
5 -	703	8	28.62	49.28	16.40	28.61
6 -	496	6	6.60	3.01	3.82	1.64
7 -	822	9	10.55	15.45	6.03	8.58
8 -	646	7	4.34	3.75	2.62	2.37
9 -	314	3	5.07	2.57	2.87	1.45
10 -	951	11	12.25	13.85	6.88	7.58
11 -	806	9	27.86	21.17	15.70	11.63
12 -	670	7	0.35	0.43	0.20	0.26
13 -	249	3	1.53	2.64	0.89	1.55
14 -	602	7	2.65	2.68	1.52	1.52
15 -	666	8	0.48	0.36	0.28	0.21
16 -	634	7	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	119	8.02			

	catch per tow	catch per mile towed
mean	8.02	4.56
standard error	1.50	0.86

(Kg)

Stock biomass estimated by swept area method = 6,422 tons
" " " " " by sex (i m f) = 2 3,365 3,055 tons
(i m f) = immature / male / female

Table 14 - Redfish (*Sebastes marinus*) length frequency by strata (× 1000) in 1998.

length (cm)	stratum 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	total
8-			14													14
9-																
10-																
11-																
12-		6	7			6				14						33
13-							14			27						41
14-		12	7		13	6				7						46
15-	6		7			6				13	7					40
16-	6	12	7		13		7	22	8	20						95
17-	50	19	7			6				7	7					96
18-	150	38	7		33	6				20						255
19-	231	45	28		83	84	42	7	16	27	48					609
20-	219	127	75		169	110	63	15		20	149					947
21-	351	139	61		167	96	105	15	16	118	251					1320
22-	181	101	48	7	360	109	163	44	46	137	435			14		1645
23-	219	102	47	7	300	142	289	22	40	341	537	7		20	6	2079
24-	231	57	47	7	633	116	317	37	24	381	605				13	2467
25-	138	82	21	7	607	84	254	58	93	334	720			33	18	2450
26-	137	69	34	20	827	78	268	59	56	348	625		13	46	6	2585
27-	106	38	48	47	645	52	289	94	86	374	612	7	19	30		2445
28-	88	19	14	13	447	32	184	44	8	289	510		6	66		1718
29-	82		7	26	325	38	141	81	46	204	455	22		65	12	1504
30-	19	6	7	20	138	19	120	80		124	244		19	17	12	826
31-	6	13	14	20	164	19	49	29	8	72	170	7		33		603
32-	12	6	7	14	43	19	21	14		53	95	7	12	23		327
33-	12	6	7		37	6	21	22		20	68			10		209
34-					7	19		22		26	34		6			115
35-					27	6	7			26	14					80
36-					13					7	14					33
37-					13		28				7					48
38-					10		7								6	23
39-			7		7		7									21
40-					7		7									14
41-										14	7					20
42-																
43-										7	7					13
44-																
45-																
46-																
47-																
48-																
49-																
50-																
51-											7					7

Table 15 - Redfish (*Sebastes mentella*) catch (Kg) by strata in the 1998 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	2.28	4.51	1.30	2.57
4 -	348	4	1.95	3.90	1.08	2.16
5 -	703	8	0.35	0.38	0.20	0.21
6 -	496	6	0.70	0.36	0.41	0.22
7 -	822	9	42.76	55.23	24.34	30.65
8 -	646	7	28.64	28.02	16.71	15.93
9 -	314	3	501.44	505.65	284.06	286.57
10 -	951	11	83.01	101.85	47.29	58.04
11 -	806	9	95.22	155.21	55.39	89.81
12 -	670	7	48.99	16.35	28.54	9.69
13 -	249	3	82.23	62.03	48.03	36.50
14 -	602	7	222.76	122.05	127.71	69.42
15 -	666	8	43.27	14.31	25.18	8.21
16 -	634	7	4.46	5.80	2.69	3.37
17 -	216	2	6.43	5.62	4.27	3.88
18 -	210	2	0.69	0.11	0.41	0.07
19 -	414	5	6.42	6.33	3.83	3.72
total	10555	119	56.16			

	catch per tow	catch per mile towed
mean	56.16	32.23
standard error	10.45	5.94

(Kg)

Stock biomass estimated by swept area method = 45,358 tons
" " " " " by sex (i m f) = 49 22,857 22,452 tons
(i m f) = immature / male / female

Table 16 - Redfish (*Sebastes mentella*) length frequency by strata (× 1000) in 1998.

length (cm)	stratum 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total
4-					1													1
5-																		
6-																		
7-																		
8-	1																	1
9-	2																	2
10-	2				2													4
11-	1				2	1							1					4
12-	4	1	2	8	13	2		1					1					32
13-	7	1	4	20	21	17	7	10	1				4					94
14-	3	2	5	13	28	17	41	30	10				2					153
15-	1		1	1	61	44	90	182	52				6					435
16-	1	4	4	2	92	113	405	491	131		1	9	16					1270
17-	1	4	2	2	65	64	360	344	99	2		7	7					954
18-	1	1	2		43	26	110	187	50	2	1		2					425
19-	4	2	2		28	34	118	145	81			2	4					420
20-	2	4	1	1	85	39	171	214	70	5		2	4				1	599
21-	6	2	1	1	93	75	266	361	177	5	7	73	26	1				1093
22-	4	2	2		220	101	784	552	296	37	21	346	72					2438
23-	12	4		1	347	149	1880	680	428	88	52	893	169					4702
24-	8	1	1	1	274	146	1861	533	548	185	94	1254	241	1			1	5149
25-	8	6		1	227	87	709	234	349	223	109	1027	223	3			1	3209
26-	6	1	1		91	24	207	93	281	122	96	425	124	1		1	2	1476
27-	2				14	9	11	25	223	61	44	136	60	4	2		5	593
28-		1		1	6	6		1	112	29	32	66	24	4			3	285
29-					2	1		2	44	16	10	39	13	3			4	134
30-		1			2	2		2	13	14	21	28	9	2	2		5	100
31-									12	28	10	49	12	4	3	1	3	121
32-									4	26	14	36	8	6	2		7	100
33-					1			3	1	18	18	26	9	5	4		4	88
34-					1			2	9	18	10	17	6	3	4		5	77
35-									6	14	5	13	2	1	1		3	45
36-						1			3	18	4	18	5	1			1	51
37-						1				9	3	14	6	1			1	34
38-								1	6	8	2	6	1		1			26
39-										4	3	9	1			1		17
40-										3		3						6
41-										1		5	1				1	7
42-										1				1	1			3
43-										2		3			1		1	6
44-												1		1	1			3
45-														1				1
46-														1				1

Table 17 - Redfish (*Sebastes mentella*) age-length key in the 1998 survey.

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.
11-																										1	1
12-		2																								5	7
13-		2																								22	24
14-			2																							27	29
15-			3																							20	23
16-			5	1																						25	31
17-			3	3																						24	30
18-			1	6																						17	24
19-				2																						19	21
20-					9	1																				17	27
21-					3	5	2	1										**MALE**								19	30
22-					1	6	1	5																		17	30
23-						7	1	17																		27	52
24-							1	25																		22	48
25-						2	3	26																		26	57
26-							6	14																		16	36
27-							3	3	2																	20	28
28-							2		3	1																12	18
29-									4																	13	17
30-									2	1		1														10	14
31-									3	1	1	1														15	21
32-										1	2	5	1	1												18	28
33-											1	7	1													15	24
34-												8														21	29
35-												1	1	2	1	1			1							9	16
36-															1		2									10	13
37-																	1									10	11
38-																1										5	6
39-																										5	5
40-																			1								1
41-																											
42-																										2	2
43-																										3	3
44-																										2	2
45-																											
46-																										1	1
total:		4	14	12	13	21	19	91	14	4	4	23	3	3	2	2	3		2							475	709

Table 17 – (continued) Redfish (*Sebastes mentella*) age-length key in the 1998 survey.

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-																											
12-																										3	3
13-		5																								10	15
14-		2	3																							19	24
15-			4																							24	28
16-			6	1																						29	36
17-			1	1																						20	22
18-				4																						23	27
19-				3	3	1																				19	26
20-					8																					15	23
21-					8	4	1																			14	27
22-					4	6	1	3																		17	31
23-						12	3	9								**FEMALE**										18	42
24-						5	7	17																		12	41
25-							4	20																		19	43
26-							10	14																		15	39
27-							5	11	2																	15	33
28-							3	3	2																	13	21
29-								1	3																	10	14
30-									7		1															15	23
31-									2	1	1	5														13	22
32-										1	1	4														11	17
33-												2														15	17
34-												5	1	1												11	18
35-												5	2													6	13
36-												1	2	1	1	1	1	1								11	19
37-														1												12	13
38-																2	1									6	9
39-																	3					1				4	8
40-																										3	3
41-																										5	5
42-																											
43-																								1	1	3	5
44-																										2	2

Table 18 - Redfish (*Sebastes mentella*) age composition (× 10,000) in the 1998 survey.

	stratum																	mean	mean
age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	weight (g)	length (cm)
1 :																			11	9
2 :	1		1	3	4	2	2	1					1					15	31	13
3 :		1	1	1	20	19	64	81	22			1	3					213	57	16
4 :		1			11	10	43	53	17			1	1					137	78	18
5 :	1	1			17	9	40	50	22	1		9	3					153	128	21
6 :	1				30	15	138	72	44	7	4	69	13					393	166	23
7 :	1				17	8	68	29	42	14	9	68	16					272	212	24
8 :	3	1			72	32	347	121	135	51	29	272	61	1			1	1126	202	24
9 :					1	1		1	14	6	5	12	4	1			1	46	339	29
10 :									1	1	1	2	1					6	386	30
11 :										1	1	2						4	452	32
12 :								1	2	6	4	9	2	1	1		2	28	508	33
13 :										1		1						2	567	34
14 :										1		1						2	641	35
15 :										1		1						2	661	36
16 :									1	1		1						3	760	37
17 :										2	1	2	1					6	725	37
18 :																			674	36
19 :																			751	37
20 :																				
21 :																				
22 :																			859	39
23 :																				
24 :																			1154	43
25+:																			1154	43

Table 19 - Redfish (*Sebastes fasciatus*) catch (Kg) by strata in the 1998 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	1.71	3.32	0.96	1.86
2 -	838	10	2.59	7.67	1.48	4.39
3 -	628	7	2.56	3.45	1.46	1.97
4 -	348	4	2.12	2.84	1.18	1.56
5 -	703	8	5.38	4.46	3.06	2.56
6 -	496	6	3.46	1.97	2.01	1.12
7 -	822	9	13.46	10.51	7.84	6.35
8 -	646	7	15.65	11.08	9.30	6.46
9 -	314	3	41.27	15.07	23.37	8.45
10 -	951	11	14.01	9.65	7.93	5.33
11 -	806	9	15.12	12.51	8.77	7.69
12 -	670	7	3.22	2.09	1.88	1.22
13 -	249	3	3.06	3.55	1.79	2.07
14 -	602	7	11.12	11.20	6.40	6.49
15 -	666	8	5.17	1.81	3.01	1.07
16 -	634	7	0.17	0.25	0.10	0.16
17 -	216	2	0.16	0.23	0.10	0.14
18 -	210	2	-	-	-	-
19 -	414	5	0.65	0.65	0.40	0.40
total	10555	119	7.93			

	catch per tow	catch per mile towed
mean	7.93	4.57
standard error	0.71	0.41

(Kg)

Stock biomass estimated by swept area method = 6,436 tons
" " " " " by sex (i m f) = 4 3,389 3,043 tons

Table 20 - Redfish (*Sebastes fasciatus*) length frequency by strata (× 1000) in the 1998 survey.

lenght (cm)	stratum																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	total
8-			14																14
9-	6		7				7												20
10-	6	12	34																53
11-		19	21		20	26	7			13									106
12-		25	28		119	71	28			33	54								357
13-		120	42		152	90	63	7	126	111	74								787
14-	12	165	47	7	185	116	77	14	331	381	279								1615
15-	19	108	14	7	297	142	98	73	1077	656	469			14					2972
16-	51	64	46	20	304	168	233	146	1301	964	631	7		39	26				4000
17-	87	215	67	7	271	90	339	190	677	932	624	15		39	38			14	3606
18-	101	279	129	20	357	245	620	554	701	813	1101	45	13	144	156	30		20	5325
19-	75	304	150	53	390	238	959	627	1207	872	1148	81	32	187	259	7	19	47	6656
20-	44	247	101	73	205	116	720	598	832	793	720	104	32	298	298		9	33	5223
21-	19	64	62	47	92	51	685	569	748	531	578	178	45	431	284			20	4402
22-		6	81	33	139	58	741	854	503	505	530	111	32	342	207			7	4149
23-	6	19	68	20	86	45	508	686	453	406	442	104	38	341	181			7	3409
24-			21	7	20	19	423	350	350	354	258	60	13	291	90			20	2274
25-			14	14	53	13	204	219	186	223	156	60	32	153	51				1377
26-			14	20	13	6	120	58	78	118	163	74	25	191	45				925
27-		6	14	7			63	44	24	144	61	37	19	104	6				529
28-			7				28	44		112	20	37	6	67	19				341
29-			14		7	6		7		46	27	7	6	77	19				217
30-							14	15		20				14					62
31-			7							20	7			29	6				69
32-								7		27	7			19	6				66
33-										7	7			7					20
34-										13			6		6				26
35-														10		7			17

Table 21 - Redfish (*Sebastes fasciatus*) age-length key in the 1998 survey.

MALE

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17+	no id	tot n.
11-																		5	5
12-		4																16	20
13-		2																18	20
14-			5															19	24
15-			4	3														21	28
16-			1	5	1													30	37
17-			1	9	1													34	45
18-				4	9	1												34	48
19-					21	2												28	51
20-					7	8	2											36	53
21-					6	10	1	6										21	44
22-					2	4	9	9										29	53
23-						2	6	8										28	44
24-							4	4										19	27
25-								2	2									23	27
26-								1	6	1	2	1						11	22
27-								2	2	3								14	21
28-									1	3						1		6	11
29-								1	1	1	1	2						3	9
30-												1						1	2
31-																			
32-												1						1	2
total:		6	11	21	47	27	22	33	12	8	3	5				1		399	595

FEMALE

length (cm)	age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17+	no id	tot n.
11-																		8	8
12-		1																12	13
13-		2																21	23
14-			6															22	28
15-			1	1														20	22
16-			1	2	1													26	30
17-				10	2													19	31
18-				7	4													32	43
19-					15													35	50
20-					8	2		1										34	45
21-					3	3	3	2										20	31
22-					1	4	4	4										21	34
23-						4	4	9										23	40
24-						3	6	16										25	50
25-							6	9	2									19	36
26-							3	5	3									20	31
27-								2	2	2	1							14	21
28-							1	1	1			2						16	21
29-										2	1	2						9	14
30-												2						3	5
31-												2						5	7
32-												3						1	4
33-																		1	1
34-																		3	3
35-																		2	2
36-																			
37-																		1	1
total:		3	8	20	34	16	27	49	8	4	2	11						414	596

Table 22 - Redfish (*Sebastes fasciatus*) age composition (× 10,000) in the 1998 survey.

	stratum																			
age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	total	mean weight (g)	mean length (cm)
1 :																					
2 :		15	7		27	16	9	1	13	14	13								115	33	13
3 :	4	25	7	1	41	23	19	9	119	96	69			2	1				416	53	15
4 :	15	39	15	3	72	36	75	53	218	202	162	4		13	12	1		2	922	75	17
5 :	18	64	31	12	80	47	196	148	256	221	247	20	7	56	60	2	2	8	1475	111	19
6 :	3	12	10	6	17	11	84	81	85	72	74	16	5	41	29			3	549	147	21
7 :	1	3	7	4	14	7	77	83	62	61	60	15	4	47	25			2	472	186	23
8 :	1	4	11	6	17	8	113	117	97	95	89	23	8	72	34			2	697	195	23
9 :			2	1	1		11	8	8	19	12	7	3	20	4				96	276	26
10 :			1				3	2	1	12	4	4	1	9	1				38	324	27
11 :			1				2	1	1	2	2	1	1	4	1				16	310	27
12 :			2				3	4		10	4	1		12	3				39	404	29
13 :																					
14 :																					
15 :																					
16 :										2		1							3	343	28
17 :																					
18 :																					
19 :																					
20 :																					
21 :																					
22 :																					
23 :																					
24 :																					
25+:																					

Table 23 - Juvenile redfish (*Sebastes sp.*) catch (Kg) by strata in the 1998 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	0.00	0.00	0.00	0.00
2 -	838	10	0.02	0.05	0.01	0.03
3 -	628	7	0.08	0.14	0.04	0.08
4 -	348	4	0.03	0.06	0.02	0.03
5 -	703	8	0.21	0.44	0.12	0.24
6 -	496	6	0.43	0.32	0.26	0.20
7 -	822	9	3.83	4.75	2.24	2.86
8 -	646	7	1.45	1.77	0.91	1.17
9 -	314	3	8.21	13.86	4.64	7.83
10 -	951	11	3.48	2.44	1.98	1.41
11 -	806	9	4.80	3.31	2.77	2.01
12 -	670	7	-	-	-	-
13 -	249	3	-	-	-	-
14 -	602	7	-	-	-	-
15 -	666	8	-	-	-	-
16 -	634	7	-	-	-	-
17 -	216	2	-	-	-	-
18 -	210	2	-	-	-	-
19 -	414	5	-	-	-	-
total	10555	119	1.35			

	catch per tow	catch per mile towed
mean	1.35	0.78
standard error	0.29	0.17

(Kg)

Stock biomass estimated by swept area method = 1,100 tons

Table 24 - Juvenile redfish (*Sebastes sp.*) length frequency by strata (× 1000) in the 1998 survey.

length (cm)	stratum 1	2	3	4	5	6	7	8	9	10	11	total
5-	1	3			3			1	8	5		20
6-		1			2		1				1	5
7-					3	1	1			1	5	11
8-			3	1	5	18	18	5		7	17	74
9-		2	12	5	17	43	10	39	8	12	17	165
10-		3	1	3	3	10	5	13		2	10	49
11-		2			2	2	20	12	17	19	41	114
12-			2		7	8	128	78	125	190	236	775
13-			5		13	20	246	106	302	405	422	1519
14-			1		3	3	101	22	118	115	162	523
15-							93	3	1	30	37	163
16-							69		8	7	4	89
17-							11				1	12
18-												
19-					1							1

Table 25 - Greenland halibut (*Reinhardtius hippoglossoides*) catch (Kg) by strata in the 1998 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	0.09	0.20	0.05	0.11
3 -	628	7	7.59	5.55	4.31	3.02
4 -	348	4	1.54	0.50	0.87	0.27
5 -	703	8	3.21	2.09	1.81	1.21
6 -	496	6	9.07	4.81	5.37	2.95
7 -	822	9	41.00	29.51	23.42	16.23
8 -	646	7	19.36	15.06	11.30	8.59
9 -	314	3	19.57	5.50	11.09	3.10
10 -	951	11	18.64	8.54	10.63	5.00
11 -	806	9	19.62	10.69	11.24	6.43
12 -	670	7	58.31	18.59	33.91	10.30
13 -	249	3	28.37	1.44	16.43	0.31
14 -	602	7	31.34	18.01	17.92	10.05
15 -	666	8	77.25	36.70	44.95	21.13
16 -	634	7	64.63	22.84	39.07	13.17
17 -	216	2	38.60	9.48	25.17	7.62
18 -	210	2	46.03	18.84	27.24	10.67
19 -	414	5	76.96	37.65	46.41	22.58
total	10555	119	28.93			

	catch per tow	catch per mile towed
mean	28.93	16.95
standard error	1.64	0.94

(Kg)

Stock biomass estimated by swept area method = 23,849 tons
" " " " " by sex (i m f) = 2 9,149 14,698 tons

Table 26 - Greenland halibut (*Reinhardtius hippoglossoides*) biomass estimated by swept area method (tons) 1988-1998.

stratum	depth in fathoms	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1 -	70- 80	-	-	-	-	-	-	-	-	-	-	-
2 -	81-100	-	3	6	-	-	-	-	119	-	2	6
3 -	101-140	26	31	8	8	18	3	-	21	106	89	361
4 -	"	142	20	-	15	27	10	-	5	0	23	40
5 -	"	73	96	-	28	41	1	2	21	35	96	170
6 -	"	31	18	15	12	8	15	-	31	104	224	355
7 -	141-200	84	62	63	186	242	93	211	890	1130	1401	2566
8 -	"	149	219	63	177	373	138	38	328	353	1048	973
9 -	"	177	162	53	75	318	30	42	175	157	250	464
10 -	"	106	81	48	169	356	31	231	518	705	848	1348
11 -	"	44	60	20	104	225	230	232	484	660	617	1208
12 -	201-300	399	637	290	749	609	918	1200	1129	2091	2213	3029
13 -	"	63	122	214	43	24	141	150	125	293	476	545
14 -	"	362	289	315	775	834	469	610	404	888	1564	1438
15 -	"	428	166	505	958	633	1356	1469	1740	1425	2647	3991
16 -	301-400	1352	1342	2492	2487	1798	2141	1500	1832	2065	1742	3303
17 -	"	262	118	130	408	39	105	730	730	254	517	725
18 -	"	104	49	449	348	57	208	380	943	188	548	763
19 -	"	3016	919	977	1498	2988	1321	1108	1211	956	1539	2562
total		6818	4391	5649	8038	8588	7210	7904	10705	11409	15846	23849

Table 27 - Greenland halibut (*Reinhardtius hippoglossoides*) length frequency by strata (× 1000) in the 1998 survey.

Length (cm)	stratum 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total
14-15		7				28	22												57
16-17		28	7			359	109		91	61	7			6					669
18-19		21		13	12	345	168		111	75					7				754
20-21						35	44		7	7									93
22-23						35			13		7								56
24-25		14			12	91	15	8	99	47	7			6					300
26-27		75			12	395	51	8	131	61	14		7	19					775
28-29		75	7		52	205	87	8	72	40	37		14	32	36			13	679
30-31		68			65	261	124	24	151	75	37	6	33	46	81	9		40	1020
32-33		129	14	46	148	430	197	40	171	143	75	13	99	124	169	37	8	93	1934
34-35		137	13	46	129	655	357	134	302	265	245	19	158	348	287	19	25	187	3327
36-37	6	177	13	106	180	896	386	134	478	421	446	57	264	793	390	84	75	347	5255
38-39	6	95	20	66	129	832	285	269	531	434	706	116	316	726	626	167	174	466	5965
40-41		88	13	53	84	875	256	150	439	299	870	115	362	1008	773	130	150	513	6177
42-43		47	7	40	64	493	183	55	322	272	765	129	362	868	737	121	166	533	5164
44-45		20	7	7	12	282	117	56	151	96	334	84	276	716	567	177	91	546	3538
46-47		14			6	190	73	8	53	81	394	64	152	531	538	74	109	340	2625
48-49		21				63	22	32	92	27	334	58	85	399	295	103	100	293	1923
50-51						42		8	13	34	230	45	86	245	243	28	109	200	1282
52-53						35	7	8	7	14	74	32	27	121	147	56	33	160	720
54-55						14	7			27	59	19	46	133	81	9	8	66	472
56-57						7					15	6	20	82	59	19	25	40	272
58-59										7	29	6		39	22			40	144
60-61								8				6	7	6	29	9		14	79
62-63										7		6			7				21
64-65																			
66-67																			
68-69							7						7						14

Table 28 - Greenland halibut (*Reinhardtius hippoglossoides*) age-length k
in the 1998 survey.

length	age																no	tot
(cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id	n.
14-15	1																	1
16-17	34	1																35
18-19	25	4																29
20-21	4	1																5
22-23		2	1															3
24-25		13	4															17
26-27		22	11	1													2	36
28-29		9	17														3	29
30-31		10	24	9													1	44
32-33		1	37	16	2						**MALE**						1	57
34-35			31	32	8	3											1	75
36-37			19	38	25	8												90
38-39			5	25	38	13											2	83
40-41				6	37	23	12										1	79
42-43				2	14	30	23	1									2	72
44-45					10	24	21	2										57
46-47					2	23	19	6										50
48-49					1	10	16	4	2	1							2	36
50-51						5	18	13	1		1							38
52-53						1	11	8	4									24
54-55							6	8	2									16
56-57							2	1	5									8
58-59								1	2									3
60-61										1								1
62-63										1								1
64-65																		
66-67																		
68-69										1								1
total:	64	63	149	129	137	140	128	44	16	4	1						15	890

length	age																no	tot
(cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id	n.
14-15	6																	6
16-17	26																1	27
18-19	29	3															2	34
20-21	2	3																5
22-23		2																2
24-25		12	4														2	18
26-27		13	13															26
28-29		12	18	3						**FEMALE**							3	36
30-31			23	3													3	29
32-33		1	23	28	5												3	60
34-35			23	31	8													62
36-37			12	35	28	5											4	84
38-39			5	38	33	9	3										1	89
40-41				14	32	33	14											93
42-43					21	35	18	2									2	78
44-45					13	32	29	3	1								1	79
46-47					6	29	24	14	2								2	77
48-49						20	18	23	3	1							1	66
50-51						1	21	18	4	2								46
52-53						2	13	22	11		1						1	50
54-55						1	10	18	8	6								43
56-57							5	8	10	2							1	26
58-59							1	8	6	1		1						17
60-61									5	3			1				1	10
62-63											1		1					2
64-65																		
66-67													1					1
68-69													1					1
.....																		
78-79																1		1
total:	63	46	121	152	146	167	156	116	50	15	2	1	4			1	28	1068

Table 29 - Greenland halibut (*Reinhardtius hippoglossoides*) age composition (x 1000) in the 1998 survey.

	stratum																			mean	mean
age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	weight (g)	length (cm)
1 :		53	7	11	11	706	304		191	132	7			6	6				1434	38	17
2 :		100	3	3	51	494	132	20	219	105	43		16	33	32	3		14	1268	138	26
3 :	1	277	20	67	246	1192	500	130	563	386	314	38	213	448	401	61	39	253	5149	283	33
4 :	5	259	27	116	277	1344	571	266	709	595	712	97	406	978	693	133	133	514	7835	380	36
5 :	4	168	23	101	182	1271	468	260	693	556	1095	167	530	1365	1060	224	220	781	9168	486	39
6 :	1	98	15	56	95	916	322	159	513	396	1179	200	548	1532	1272	265	275	979	8821	618	42
7 :		48	7	22	40	506	170	79	273	226	863	164	402	1196	1032	226	247	833	6334	743	45
8 :		10		1	3	111	35	23	61	67	355	75	139	490	405	85	115	364	2339	983	49
9 :		2				23	7	9	10	17	89	26	43	154	143	29	34	117	703	1194	52
10 :						4	8	4	2	12	24	7	15	39	33	15	8	30	201	1356	54
11 :						1					3	4	1	3	8	1	2	4	27	1302	54
12 :											1			2	1			2	6	1612	58
13 :								1				4	8	1	7			1	22	2131	63
14 :																					
15 :																					
16+:																					

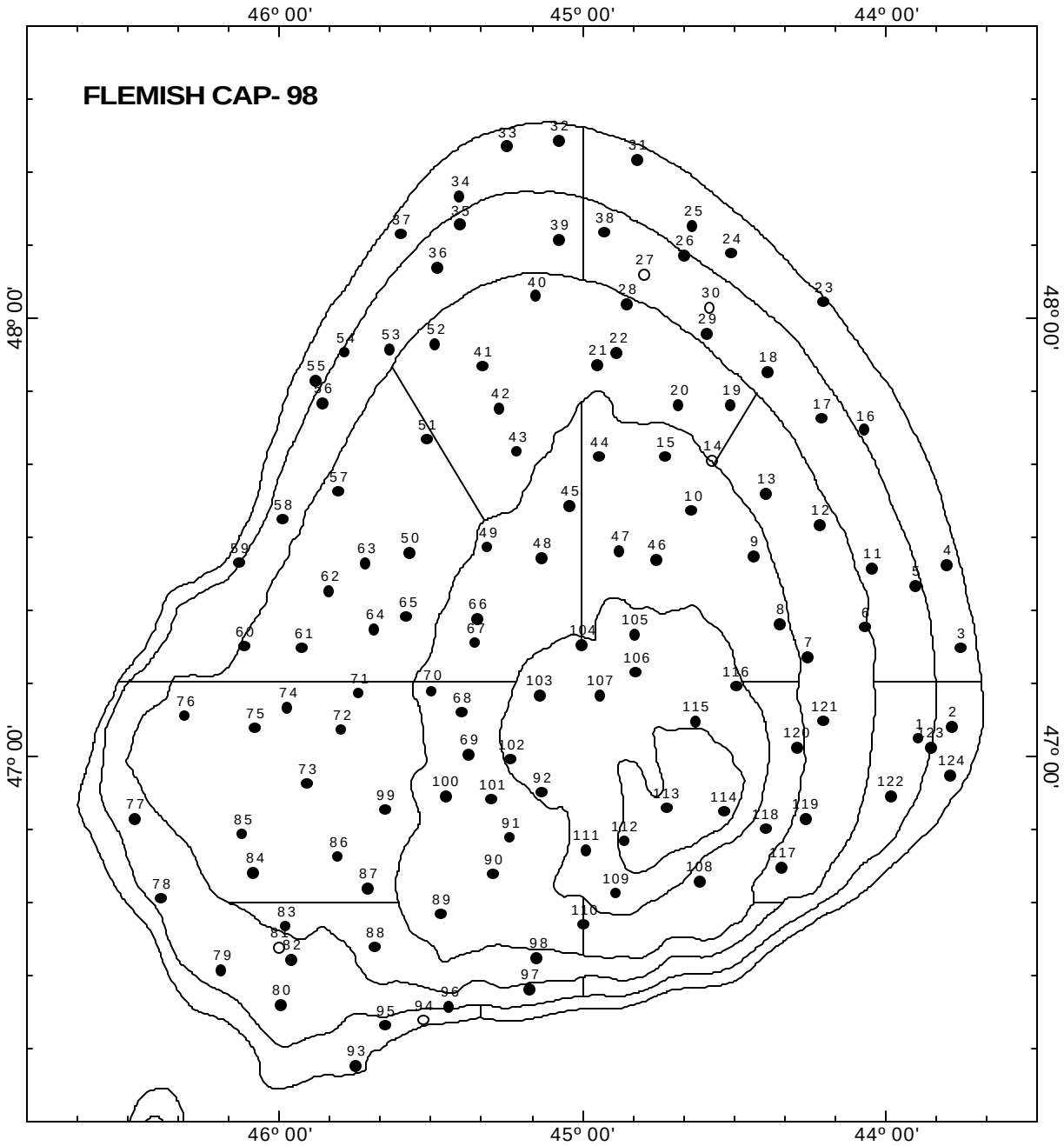

Figure 1 – Haul position of the Flemish Cap-98 survey.

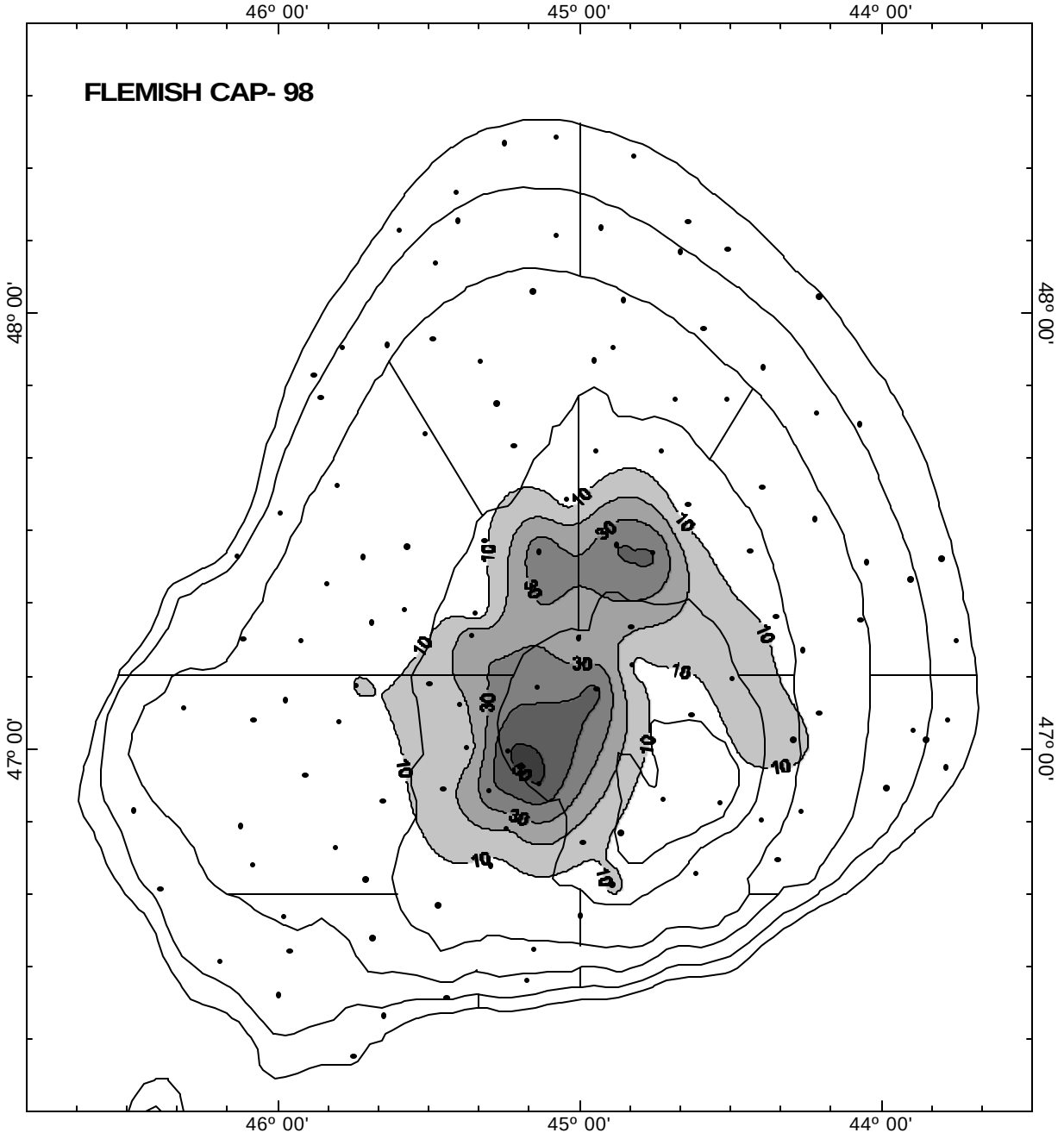

Figure 2 - Cod (*Gadus morhua*) catch distribution in Kg/tow

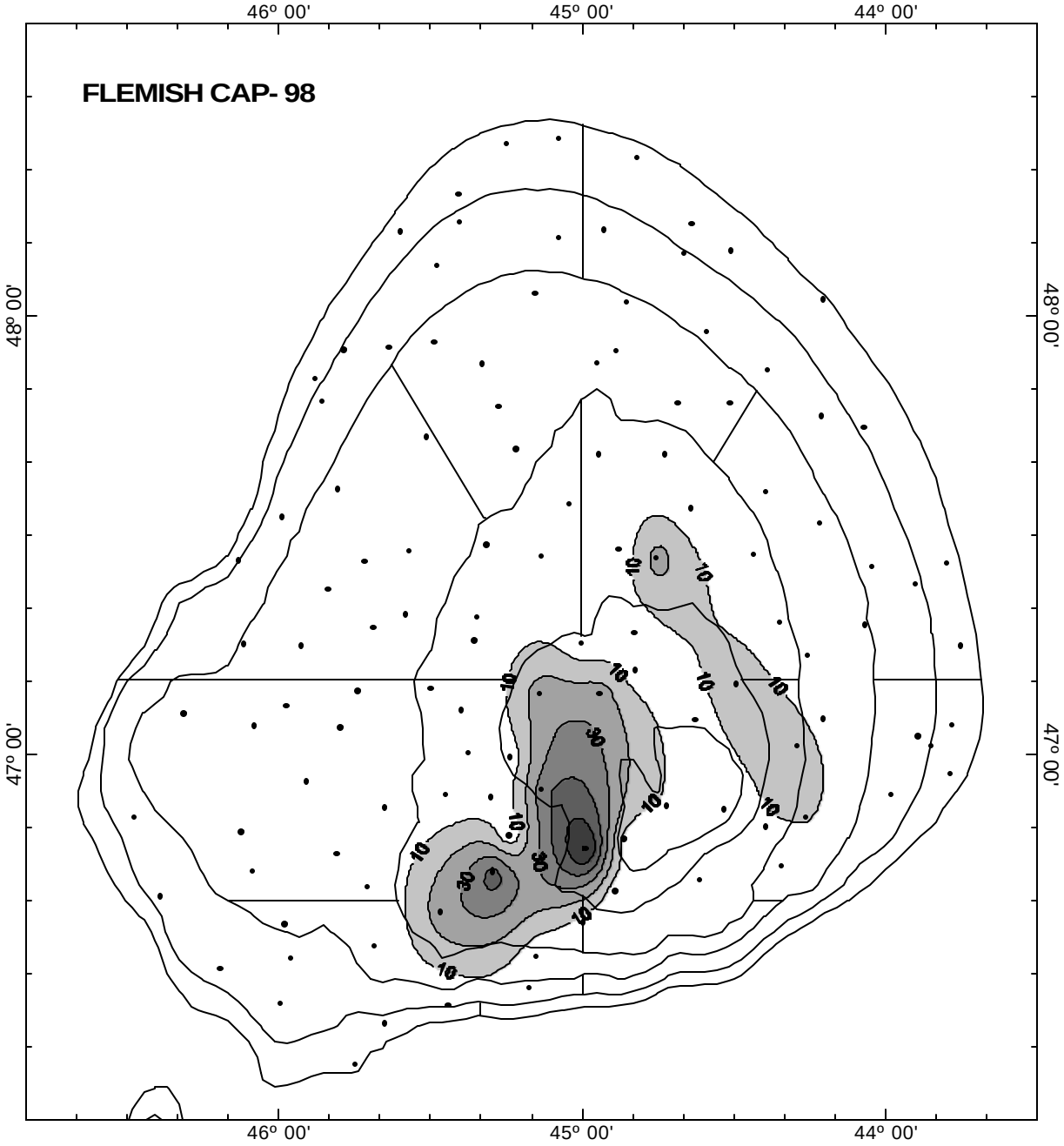

Figure 3 - American place (*Hippoglossoide platessoides*) catch distribution in Kg/tow

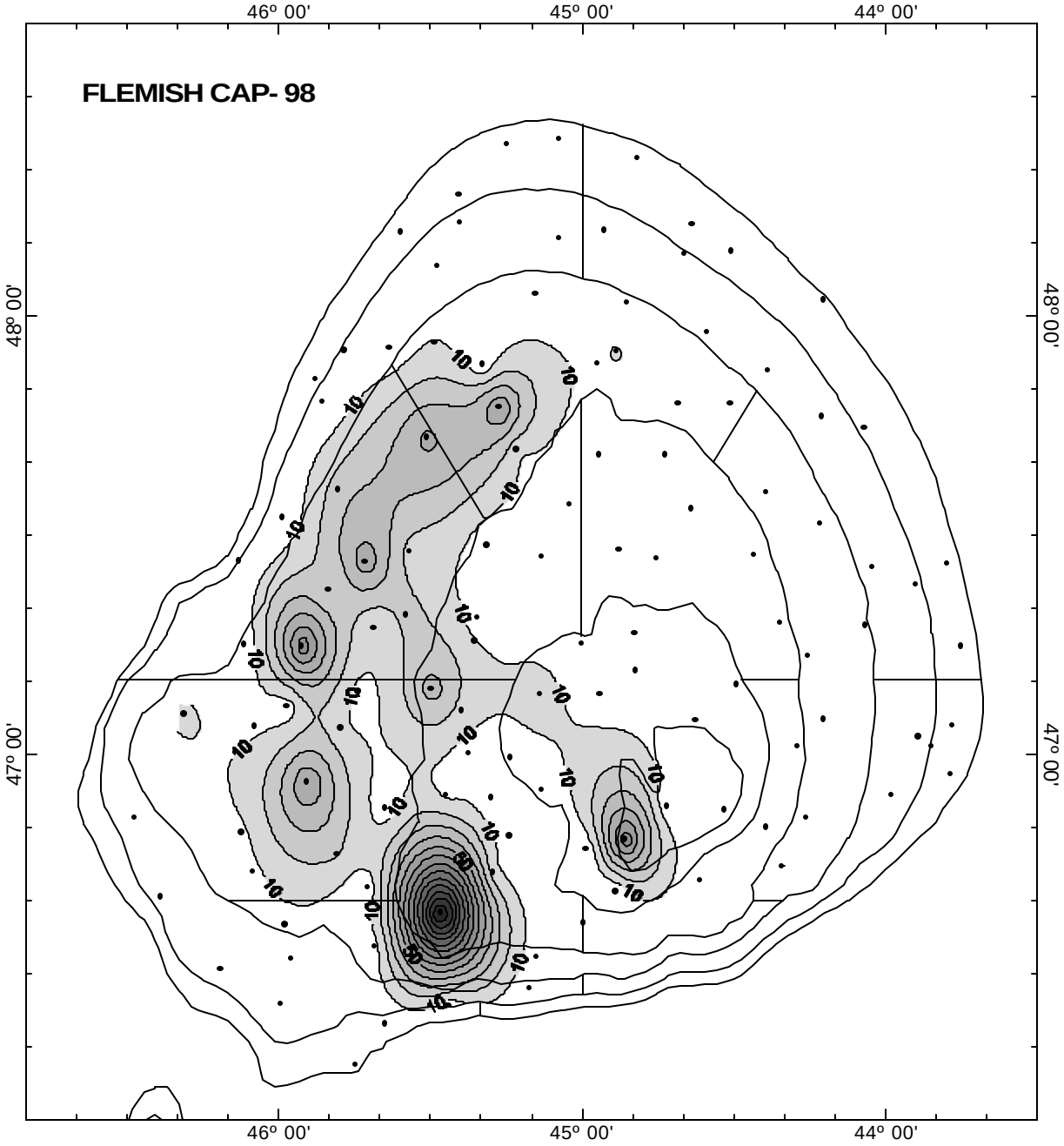

Figure 4 - Redfish (*Sebastes marinus*) catch distribution in Kg/tow

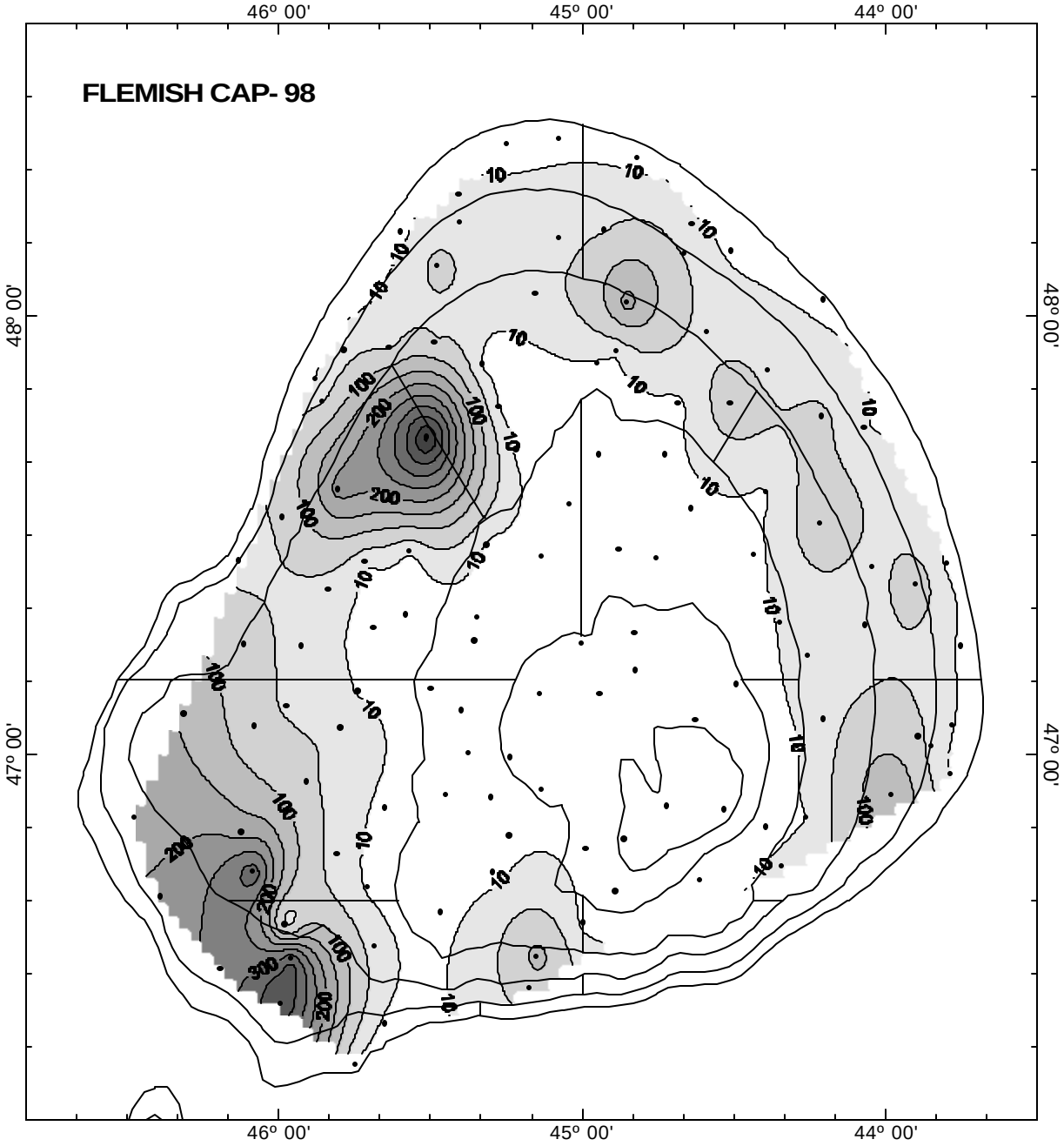

Figure 5 - Redfish (*Sebastes mentella*) catch distribution in Kg/tow

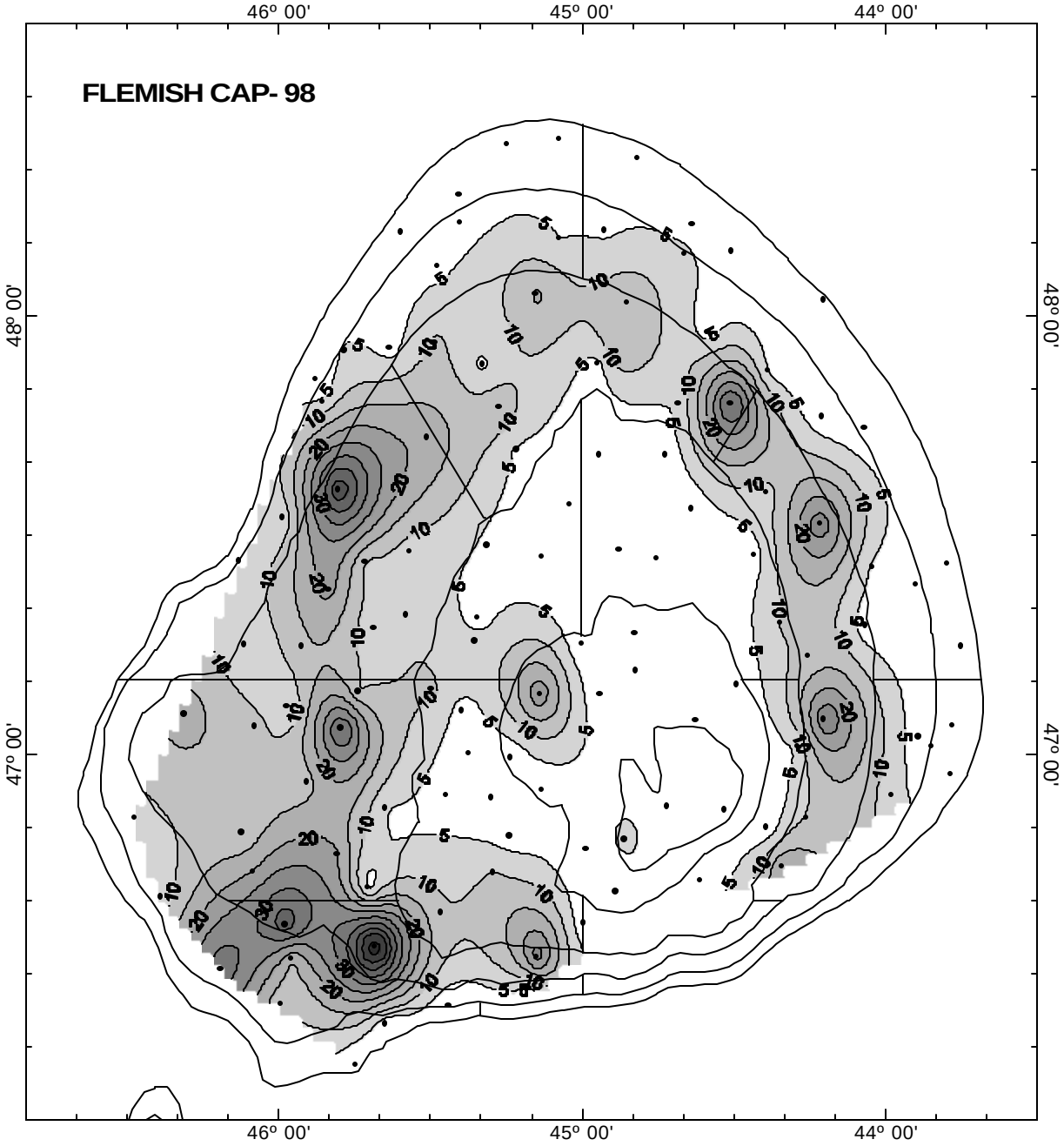

Figure 6 - Redfish (*Sebastes fasciatus*) catch distribution in Kg/tow

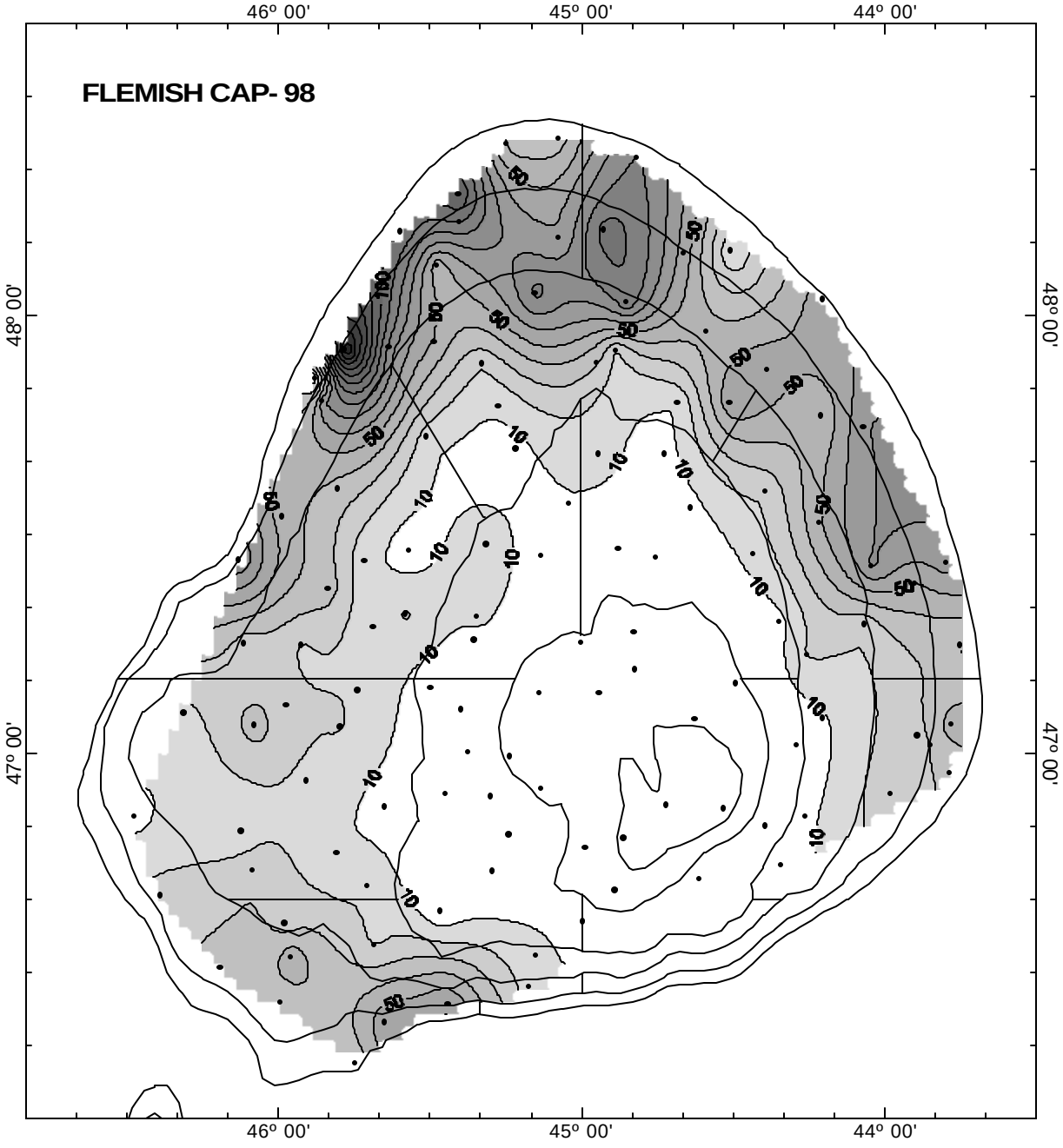

Figure 7 - Greenland halibut (*Reinhardtius hippoglossoides*) catch distribution in Kg/tow.