

Northwest Atlantic



Fisheries Organization

Serial No. N1790

NAFO SCR Doc. 90/68

SCIENTIFIC COUNCIL MEETING - JUNE 1990

Results From Bottom Trawl Survey of Flemish Cap in July 1989

by

A. Vazquez

Instituto de Investigaciones Marinas
Muelle de Bouzas, Vigo, Spain

A fishing survey of Flemish Cap was carried out in July 1989 on board the French R/V CRYOS to estimate cod stock abundance, redfish and American plaice. The survey was conducted in the same way as the 1988 one (Vazquez, 1989); like that it had a bottom trawl stratified random design following NAFO specifications (Doubleday, 1981). A total of 129 bottom trawls were made up to a depth of 720 meters (400 f.). A synoptic sheet of the survey with ship and gear characteristics is presented in Table 1.

Although the research ship used was not the one of the 1988 survey, gear, fishing doars, warps and trawling speed remained the same. In such conditions the effect of using a different ship is reduced to a minimum. Both station election and course are chosen in a non personal proceedings.

RESULTS

A complete list of species occurrence in comparison with 1989's results is presented in Table 2.

Mean catch in half our tow of main species in the bank was:

	1988	1989	
cod	46.74	146.04	Kg
American plaice	15.01	14.25	"
<u>Sebastes marinus</u>	19.38	33.25	"
<u>Sebastes spp</u>	188.22	161.15	"
Shrimp	2.5	2.71	"

Cod

Mean catch by strata and whole bank data and its standard error are presented in Table 3.

Cod stock biomass, estimated by swept area method, was three times bigger than in 1988. This increase of biomass is not explained by individual growth in weight and recruitment. The abundances of year classes in the fishery were calculated as follow:

	year class abundance in:	
	1988	1989
1988 -		2085
1987 -	458	1100
1986 -	7196	8422
1985 -	4037	4922
1984 -	1085	1858
1983 -	128	127
1982 -	22	15
1981 -	28	12
1980 -	11	
1979 -		1

(x 10E-4)

The higher abundance observed in 1989 was not due to a few tows exceptionally abundant. The increase observed in the size of the 1987 year class in the 1989 survey may be explained by the increasing retention of longer fish by the gear. Full recruitment to the survey gear seems to occur before age 2. For 1986 to 1983 year classes, the bulk of the population, abundances calculated in 1989 have approximately the double size than in 1988, if the reduction by natural and fishing mortality is considered. The catches by species (Table 2) remained fairly constant from 1988 to 1989, pointing out that changes in the efficiency of the gear can be considered negligible. Statistical variability is not also sufficient to explain the higher cod catch.

Cod stock biomass estimates compare with USSR's survey results were:

Year	EEC ₁	USSR ₂
1983		23,000
1984		31,100
1985		28,100
1986		26,100
1987		12,300
1988	37,127	7,700 (34,200)
1989	103,644	36,500 (78,300) ₃

- 1) Biomass estimated from a bottom trawl survey
- 2) Biomass estimates from bottom trawl survey
(Chumakov, A.K. - 1989. PINRO Investigations in NAFO Convention Area in 1988. NAFO SCS Doc. 89/08)
- 3) USSR's estimates of bottom trawlable plus pelagic biomass
(Kuzmin, S.A. - 1990. Stock assessment, age-length composition and maturity stages of the Flemish Cap cod. NAFO SCR Doc. 90/53)

The more feasible explanation for the increase in cod abundance from 1988 to 1989, is that individuals of the strongest year classes in this stock became more accessible to bottom trawl gear in the late year. This would correspond to a less pelagic dispersion.

Tables 4, 5 and 6 show length frequency, age length key and estimated age composition of the stock respectively.

American plaice

Mean catch by strata and whole bank data and its standard error are presented in Table 7.

Total biomass calculated by swept area method was:

1988 -	11,868 t
1989 -	10,533

The abundance of year classes in the stock was:

	abundance in:	
	1988	1989
1987 -		454
1986 -	2284	6847
1985 -	625	1500
1984 -	3034	3238
1983 -	1975	3006
1982 -	3020	2868
1981 -	4154	1691
1980 -	4258	587
1979 -	1492	261
1978 -	207	34
1977 -	109	14
1976 -	61	

(x 10E-3)

Full recruitment seems not to occur before age 6. Among the prerecruited year classes, the one of 1986 seems to be very abundant.

Tables 8, 9 and 10 show length frequency, age length key and estimated age composition of the population respectively.

Redfish

Redfish catches were split into Sebaste marinus and Sebastes spp. Scales and otoliths were used for age determination of both species. Mean catch by strata and whole bank data and its standard error are presented in Tables 11 and 15.

Sebastes marinus is less abundant than the two other species together. Changes observed in stock biomass may partly arise from incorrect splitting of species in the beginning of 1988's survey.

Stock biomass estimated in:	1988	1989
<u>Sebastes marinus</u>	15,289	22,958
<u>Sebastes spp</u>	142,933	113,675
total	158,222	136,633 tons

These figures are well below of the respective absolute biomasses due to the pelagic behaviour of the redfish species.

Tables 12, 13 and 14 show length frequency, age length key and age composition of the population respectively for S. marinus, and tables 16, 17 and 18 for beaked redfish.

Greenland halibut (Reinhardtius hippoglossoides)

Mean catch by strata and whole bank estimates are presented in table 19. Table 20 shows the length composition of the population.

Shrimp (Pandalus borealis)

In Table 21 mean catch by strata and whole bank data are presented. Estimated length composition of the population is presented in Tables 22 and 23.

Pelagic hauls

Last three days of the survey were devoted to make pelagic trawl to identify organisms that are responsables for scattering layers in the echosonder, with special interest in identification of pelagic cod. The hauls were made in stations and depths with the most characteristic echo signals. Catches were from meduses, young Sebastes marinus, cod and mictophids. Meduses were present in all hauls.

The echo register of pelagic cod, once indentified, corresponded usually to quite large concentrations of fish.

REFERENCES

Doubleday, W.G.- 1981. Manual of Groundfish Surveys in the Northwest Atlantic. NAFO Sci. Counc. Stud. 2, 55 pp.
Vazquez, A.- 1989. Results from bottom-trawl survey of Flemish Cap in July 1988. NAFO SCR Doc. 89/60, 15 pp.

Table 1. Technical data of the survey.

Procedure	specification
Ship	B/O CRYOS
GT	800 t
power	2 x 690 HP
Trawling speed	3.5 - 4.0 knot
Trawling time	30 minutes
Trawl gear	type "Lofoten"
footrope / handrope	31.20 / 17.70 m
footgear	27 steel bobbins of 35 cm
vertical opening	3.20 m (according specifications)
warps	100 meters
trawl doors	polivalent, 850 Kg
wire length	2.5 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	- severe tears - less than 20 minutes tow
Daily period for fishing	6.00 to 22.00 hours
Species for sampling	all fishes and shrimp
Species for age determination	cod, American plaice and redfish (<u>Sebastes spp</u> and <u>S. marinus</u>)

Table 2. List of species caught in 1988 and 1989.

Family Species	1988's catch			1989's catch		
	tows	number	weight(gr)	tows	number	weight(gr)
PISCIS						
Squalidae						
Squalidae	2	2	3000			
Squalus acanthias	1	1	2450			
Etmopterus princeps	1	4	4700			
Rajidae						
Raja sp.	11	35	63700	6	8	30800
Raja spinicauda	25	30	265320	16	28	102700
Raja radiata	62	143	263590	46	94	165715
Raja senta	17	28	13860			
Nemichthyidae						
Nemichthys scolopaceus	1	1	15	1	1	200
Serrivomeridae						
Serrivomer beani	8	11	1760	13	15	2835
Synaphobranchidae						
Synaphobranchus kaupi	16	218	31510	13	117	13935
Notacanthidae						
Notacanthus chemnitzii (nasus)-17		95	66045	17	45	61950
Chauliodontidae						
Chauliodus sloani	11	99	3800	11	27	1450
Bathylagidae						
Bathylagus euryops	2	7	270			
Argentinidae						
Argentina silus	2	2	1040	1	0	300
Stomiidae						
Stomias boa				11	17	1015
Paralepididae						
Paralepis brevis brevis	11	88	5390			
Notolepis rissoi	1	2	30	20	45	2035
Alepisauridae						
Alepisaurus brevirostris				1	1	2400
Myctophidae						
Myctophidae	1	5	100	14	50	1200
Notoscopelus sp.	4	13	120			
Benthoosema glaciale	2	20	100			
Gadidae						
Gadus morhua	86	20350	5647907	99	30829	16687575
Melanogrammus aeglefinus	2	4	1150	5	6	4250
Merluccius bilinearis	2	2	404			
Urophycis sp.	3	2	1180			
Urophycis chus	29	187	32011			
Urophycis tenuis	12	29	34000	3	3	4650
Urophycis chesteri	19	204	25705	42	178	23120
Micromesistius poutassou	4	4	631	5	5	1390
Gaidropsarus ensis	15	27	6850	10	18	1965
Brosme brosme	3	3	16440	1	1	6500
Enchelyopus cimbrius	4	4	430	3	3	300
Moridae						
Antimora rostrata	13	564	51070	16	558	43975

TABLE 2. (Cont'd)

Macrouridae						
Coryphaenoides rupestris	50	1137	92291	9	160	14285
Macrourus berglax	39	613	316200	38	305	161615
Nezumia bairdi				44	840	48469
Coelorhynchus carminatus	3	24	961			
Trachyrhynchus murrayi	1	2	700			
Escomberesocidae						
Scomberesox saurus	2	2	360	1	1	70
Chiasmodontidae						
Chiasmodon niger	1	1	15			
Anarhichadidae						
Anarhichas sp.	1	16	15700			
Anarhichas lupus	81	1279	688390	87	1379	742685
Anarhichas minor	52	154	308105	61	151	221750
Anarhichas denticulatus	21	36	116390	20	30	205200
Zoarcidae						
Lycodes sp.	57	367	67226	11	61	11060
Lycodes esmarki				19	38	14425
Lycodes reticulatus	11	41	8861	53	900	145310
Stichaeidae						
Lumpenus lumpretaeformis				9	16	475
Escorpaenidae						
Sebastes sp.	82	87335	21054732	90	76906	18430160
Sebastes marinus	66	6690	2109025	53	11069	4052370
Cottidae						
Triglops murrayi	2	7	80	5	12	260
Cottunculus microps	9	12	1160	3	5	305
Cottunculus thomsoni				8	17	355
Agonidae						
Aspidophoroides monopterygius	6	9	96	5	18	120
Cyclopteridae						
Cyclopterus lumpus						
Pleuronectidae						
Hippoglossoides platessoides-	81	3165	1767930	81	3536	1691480
Glyptocephalus cynoglossus	64	270	133690	38	99	53570
Reinhardtius hippoglossoides-	75	663	940011	76	595	687860
Hippoglossus hippoglossus	2	2	28000			
CEPHALOPODAE						
Rossia macrosoma	2	2	100			
Illex illecebrosus	5	5	770	10	13	1280
Bathypolypus arcticus	5	7	1620			
Histioteuthis reversa	2	2	245			
Chiroteuthys picteti						
Cirromorpha	1	1	2100			
Onychoteuthis bauksii	1	1	20			
CRUSTACEAE						
Crustaceae se				1	0	1100
Pandalus borealis	54	14119	298373	38	20059	314670

Table 3. Cod catches (Kg) by strata.

stratum	area squa. miles	tow number	catch per tow		catch per mile towed	
			mean	s.deviat.	mean	s.deviat.
1 -	342	4	25.00	25.22	12.94	12.92
2 -	838	10	161.45	177.73	84.00	93.00
3 -	628	7	222.86	93.55	111.59	46.04
4 -	348	4	184.62	191.52	94.91	104.92
5 -	703	7	206.36	219.86	103.81	99.03
6 -	496	6	187.75	235.41	93.35	118.21
7 -	822	9	263.56	225.60	132.95	107.95
8 -	646	7	339.93	302.42	173.49	152.34
9 -	314	3	226.67	200.32	114.26	100.82
10 -	951	12	70.62	58.93	35.13	30.39
11 -	806	8	227.25	114.22	111.85	62.67
12 -	670	8	50.44	79.91	25.13	40.59
13 -	249	3	142.83	246.96	69.41	120.00
14 -	602	6	25.22	29.13	10.82	14.17
15 -	666	6	166.17	234.75	86.39	128.18
16 -	634	7	1.41	3.40	0.70	1.67
17 -	216	2	0.34	0.48	0.16	0.23
18 -	210	2	0.00	0.00	0.00	0.00
19 -	414	5	3.14	6.64	1.66	3.52

	catch per tow	catch per mile towed
general mean (Y)	146.04	73.65
standard error of Y	15.62	7.89

Table 5. Cod age length key.

length	age																no n.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id	tot
0- 2																		
3- 5																		
6- 8																		
9-11	2																	2
12-14	80	6															6	92
15-17	209	21															14	244
18-20	51	35	1														12	99
21-23	1	43	15														9	68
24-26	1	36	116	1													23	177
27-29		12	221	3	1												28	265
30-32		2	183	6	1												44	236
33-35			177	13													41	231
36-38			215	57	2												57	331
39-41			168	141													81	390
42-44	1	83	233	16													68	401
45-47		21	226	32													109	388
48-50		4	173	112	2												103	394
51-53		1	120	149	4												99	373
54-56			57	151	5												57	270
57-59			14	104	16												31	165
60-62				31	15												9	55
63-65				13	6	1												20
66-68				3	11	1											1	16
69-71				3	15	2											4	24
72-74					8	6												14
75-77					8	3	1										2	14
78-80					2	2	2											6
81-83						1												1
84-86						3	1											4
87-89							5										1	6
90-92							3	1										4
93-95							3	1										4
96-98							3										1	4
99- 1																	1	1
102- 4																		
105- 7																		
108-10																	1	1
111-13																		
114-16									1									1
total:	344	1561	2051	044	618	92	19	18	2	1							8024	301

Table 7. American plaice catch (Kg) by strata.

stratum	area squa. miles	tow number	catch per tow		catch per mile towed	
			mean	s.deviat.	mean	s.deviat.
1 -	342	4	31.88	18.96	16.45	9.96
2 -	838	10	44.80	44.11	24.18	25.40
3 -	628	7	19.75	14.95	10.01	8.00
4 -	348	4	14.62	7.63	7.47	4.27
5 -	703	7	44.18	53.04	24.74	29.93
6 -	496	6	25.83	12.21	12.81	6.11
7 -	822	9	7.09	4.16	3.63	2.08
8 -	646	7	2.57	4.68	1.43	2.71
9 -	314	3	5.92	5.22	2.92	2.49
10 -	951	12	17.76	21.73	8.81	11.04
11 -	806	8	16.16	14.43	8.15	7.68
12 -	670	8	0.34	0.97	0.16	0.44
13 -	249	3	0.00	0.00	0.00	0.00
14 -	602	6	0.15	0.36	0.08	0.20
15 -	666	6	1.57	1.69	0.84	0.95
16 -	634	7	0.00	0.00	0.00	0.00
17 -	216	2	0.00	0.00	0.00	0.00
18 -	210	2	0.00	0.00	0.00	0.00
19 -	414	5	0.00	0.00	0.00	0.00

	catch per tow	catch per mile towed
general mean (Y)	14.25	7.48
standard error of Y	1.95	1.09

Table 8. American plaice length frequency by strata (x 10E-3).

length (cm)	stratum															total
	1	2	3	4	5	6	7	8	9	10	11	12	14	15		
10-11		29								5					34	
12-13		6								5					11	
14-15		6													11	
16-17		34	30	6						10					85	
18-19		104	54		43	32	6		7	15	7				268	
20-21	6	328	238	28	101	87	49	32		83	33				987	
22-23	24	674	424	80	452	295	123	32	21	88	111				2324	
24-25	12	723	538	126	380	333	172	57		88	176			14	2621	
26-27	18	257	226	80	184	169	73	19	7	10	268				1313	
28-29	18	111	72	11	14	38	25	6		15	98				409	
30-31	53	172	36		93	43	12	26	7	26	46			7	522	
32-33	118	267	72	6	129	44	18			125	40				818	
34-35	236	540	72	17	219	54	43	12	28	349	85				1655	
36-37	413	548	84	6	386	153	80		7	422	190	6		37	2330	
38-39	278	498	66	12	314	120	56	6	28	239	131	6		7	1753	
40-41	147	234	72	23	311	98	37	6	49	214	105			22	1318	
42-43	54	242	54	58	295	65	55	13	35	145	118			15	1148	
44-45	42	192	84	81	360	153	68	19	14	192	190		6	7	1406	
46-47	12	243	90	29	184	76	31	31	14	47	72			7	836	
48-49	6	129	42	34	84	55	18	6		10	7				391	
50-51		16	12	11	70	5	12	6			13				147	
52-53		44	24	6	24	16				10	7				132	
54-55			6	6	16					5	7				40	
56-57		6			8										14	
58-59												6			6	

Table 10. American plaice age composition by strata (x 10E-3)

age	stratum														total	mean weight	
	1	2	3	4	5	6	7	8	9	10	11	12	14	15			
1 :																	0
2 :	2	163	115	12	52	40	11	6	7	36	10					454	74
3 :	64	1899	1341	282	1040	833	397	132	26	258	562			13	6847	144	
4 :	124	422	171	39	220	131	60	24	10	129	164			6	1500	314	
5 :	435	955	185	29	556	205	87	22	33	496	213	2		20	3238	485	
6 :	450	751	119	35	534	185	102	11	50	499	240	2		28	3006	624	
7 :	263	585	152	93	620	215	114	30	52	429	281	1	3	30	2868	823	
8 :	74	360	120	74	400	151	72	29	30	196	167		2	16	1691	969	
9 :	6	149	60	35	153	59	27	14	5	34	42			3	587	1236	
10 :	12	59	27	17	75	19	9	4	4	13	23				261	1411	
11 :		7	6	3	9	3				3	3				34	1765	
12 :		6			8										14	2125	
13 :																	
14 :																	
15 :																	
16+ :																	

Table 11. Redfish (Sebastes marinus) catch (Kg) by strata.

stratum	area squa. miles	tow number	catch per tow		catch per mile towed	
			mean	s.deviat.	mean	s.deviat.
1 -	342	4	41.00	27.47	21.29	14.26
2 -	838	10	1.18	2.31	0.61	1.17
3 -	628	7	35.51	57.96	17.22	27.44
4 -	348	4	0.47	0.59	0.25	0.31
5 -	703	7	25.11	35.35	12.57	16.82
6 -	496	6	18.47	19.69	9.17	9.86
7 -	822	9	12.34	12.59	6.41	6.28
8 -	646	7	1.96	3.16	1.05	1.69
9 -	314	3	2.10	2.67	1.08	1.39
10 -	951	12	203.32	673.06	97.45	322.40
11 -	806	8	100.64	185.01	50.99	96.00
12 -	670	8	0.00	0.00	0.00	0.00
13 -	249	3	0.00	0.00	0.00	0.00
14 -	602	6	0.00	0.00	0.00	0.00
15 -	666	6	0.00	0.00	0.00	0.00
16 -	634	7	0.00	0.00	0.00	0.00
17 -	216	2	0.00	0.00	0.00	0.00
18 -	210	2	0.00	0.00	0.00	0.00
19 -	414	5	0.40	0.89	0.19	0.43

	catch per tow	catch per mile towed
general mean (Y)	33.25	16.32
standard error of Y	18.29	8.82

Table 12. Redfish (*Sebastes marinus*) length frequency by strata.

(x 10E-3)

length (cm)	stratum											total
	1	2	3	4	5	6	7	8	9	10	11	
6-	6											6
7-		6	6			5						17
8-	12	29	24		7	5						78
9-	6	17	30		14	27			16			110
10-	6	52	36		63	38	25		108			328
11-	36	63	19		133	16	68		31			366
12-	6	75	66		266	76	86		52	203		830
13-	18	69	54		357	44	178		189	332		1241
14-	18	69	127		491	76	258		7	518	906	2469
15-	30	29	121		547	49	209			1371	464	2820
16-	54	12	36		315	49	98		7	3053	473	4098
17-	66	28	79		238	55	80		14	1214	134	1906
18-	30	29	48		189	60	18			26	40	441
19-	102	29	42		217	60	18			31	136	636
20-	138	40	42		210	110	30		14	238	123	945
21-	166	17	54		154	49	49	19		26	89	624
22-	198	28	84	9	175	71	43		14	168	224	1014
23-	228	17	108		126	77	43	6	7	471	46	1131
24-	347	17	72		161	72	56			342	136	1201
25-	304	22	102		112	105	55	19	28	1303	218	2270
26-	305	23	108		91	67	86		14	1926	143	2763
27-	281		96		168	94	80		14	1357	414	2505
28-	246	11	97		133	151	105	19	7	1814	800	3384
29-	150		93		105	66	62	45	7	2764	245	3536
30-	166	6	86	9	112	39	43		7	1936	627	3032
31-	54		88		21	44	86			2360	676	3330
32-	113		141	9	56	22	68		7	3378	952	4748
33-	42		137		63	17	92			3079	801	4230
34-	24		161		42	22	98	19		2021	564	2951
35-	18		174		21	5	49	6	7	1281	352	1913
36-	18		156		14	6	37			1208	299	1737
37-	42		161		42	5	37			412	330	1030
38-	18	6	143		14	11	24	12	7	418	584	1238
39-	6		96		28		25			522	235	911
40-			104		35	10	30			114	136	431
41-			84		7		18			114	86	311
42-	24		19		56		24			103	188	414
43-	18		45		35		25			211	126	460
44-	12		12		84		6			5	93	213
45-	6		7		49		6			5	86	159
46-			25		56					103	92	275
47-			7		49	6				315		376
48-	6				7					5	40	58
49-					7							13
50-												
51-					7	6						13
52-								6				6
53-					7							7
54-								6				6

Table 13. Redfish (Sebastos marinus) age length keys.

MALE

length	age																no id	n. tot	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+			
10-10																			
11-11																			
12-12																			
13-13																			
14-14																			
15-15																			
16-16				1															1
17-17					1														1
18-18					2														2
19-19				1	5	1													2
20-20					2	1													1
21-21						4	3												1
22-22					1	2		1											2
23-23						2	2	1	1										5
24-24						1	1	1	2										4
25-25						1	2		2										5
26-26								1	1		2								7
27-27								3				1							7
28-28								1	1	3	2								9
29-29								1	1	1	3								11
30-30										1		1	1	1					1
31-31										1									4
32-32											2	1							9
33-33									2			1	1		1				9
34-34												2		1					4
35-35												2	3						5
36-36													1						9
37-37													1	1	2				4
38-38												1		1	3	1			3
39-39																1			4
40-40																			2
41-41																1	3		1
42-42																1	2		3
43-43																	3		1
44-44																	3	7	10
45-45																	1		8
46-46																			5
47-47																			4
48-48																			1
49-49																			1
total:				2	11	12	8	9	10	6	7	11	8	4	8	14	142	252	

TABLE 13. (cont'd)

FEMALE

length	age															no		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id	tot
10-10																		
11-11																		
12-12																		
13-13																		
14-14																		
15-15																		
16-16				1	1												1	3
17-17				1													4	5
18-18																	1	1
19-19						1											2	3
20-20					1	2											4	7
21-21					3		4											7
22-22						1	1	1	1								6	10
23-23										1							5	6
24-24							3	1	1								4	9
25-25								2	3								6	11
26-26								2									5	7
27-27								1	2					1			11	15
28-28										1							9	10
29-29							1		2		2						8	13
30-30									1	4		1					5	11
31-31									2	1	1						5	9
32-32										5	1	1					2	9
33-33									1	1		1					2	5
34-34											1		2	1			2	6
35-35											2	1					4	7
36-36											2	1	1		1		8	12
37-37											1			1			4	6
38-38											1	1	1		3		1	6
39-39													1		1		3	5
40-40														1		4	2	7
41-41																2	2	4
42-42																3	3	6
43-43																2	2	4
44-44																	2	2
45-45																2	3	5
46-46																3	1	4
47-47																1	4	5
48-48																3	2	5
49-49																2		2
50-50																4		4
51-51																1	1	2
total:				2	5	4	8	8	8	6	12	7	8	6	3	32	124	233

Table 14. Redfish (Sebastes marinus) age composition (x 10E-3).

age	stratum											total	mean weight	
	1	2	3	4	5	6	7	8	9	10	11			
1 :														0
2 :														0
3 :														0
4 :	67	43	89		310	83	61		10	837	116		1616	93
5 :	313	55	133	2	434	187	92	9	10	654	180		2069	131
6 :	443	59	144	3	372	151	86	11	19	758	249		2295	200
7 :	344	36	131	4	194	122	75	13	22	1090	296		2327	245
8 :	537	17	212	2	296	200	167	20	25	3027	853		5356	332
9 :	587	33	250		253	168	172	20	22	3119	678		5302	343
10 :	160	2	158	8	87	43	87	17	6	3639	927		5134	492
11 :	259		147	2	167	112	148	23	12	4992	1145		7007	465
12 :	157	2	390	6	123	55	158	9	6	4777	1362		7045	565
13 :	71	2	370		86	28	118	9	2	2833	1167		4686	662
14 :	49	4	157		33	29	66	6	7	1502	566		2419	608
15 :	26	3	160		54	10	52	9	5	844	458		1621	798
16+ :	62		261		308	20	94			1183	710	6	2644	1181

Table 15. Redfish (Sebastes spp.) catch (Kg) by strata.

stratum	area squa. miles	tow number	catch per tow		catch per mile towed	
			mean	s.deviat.	mean	s.deviat.
1 -	342	4	0.00	0.00	0.00	0.00
2 -	838	10	0.00	0.00	0.00	0.00
3 -	628	7	66.86	162.48	32.36	78.20
4 -	348	4	5.83	8.81	3.08	4.75
5 -	703	7	1.80	2.91	1.01	1.66
6 -	496	6	36.67	80.57	16.91	36.76
7 -	822	9	231.05	293.03	110.87	138.38
8 -	646	7	345.93	586.96	174.86	295.30
9 -	314	3	118.67	9.29	59.61	6.85
10 -	951	12	196.03	198.85	101.43	107.03
11 -	806	8	508.31	459.50	245.20	209.20
12 -	670	8	224.50	134.97	113.90	62.26
13 -	249	3	467.00	225.10	246.39	133.30
14 -	602	6	139.25	97.88	67.68	54.39
15 -	666	6	152.67	86.28	77.72	47.69
16 -	634	7	109.17	100.44	60.07	55.44
17 -	216	2	170.59	239.59	92.93	130.64
18 -	210	2	28.50	10.61	14.85	6.14
19 -	414	5	63.90	43.49	33.53	23.08

	catch per tow	catch per mile towed
general mean (Y)	161.15	80.79
standard error of Y	22.03	10.79

Table 16. Redfish (Sebastes spp) length frequency by strata (x 10E-4).

length (cm)	stratum																	total
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
6-	1																	1
7-	1	1	1	1	1	1	1	10										3
8-	24	2	2	7	4	4	1	5	13									40
9-	3	12	2	7	7	3	21	4	8									49
10-	2	5	2	7	3	35	102	9	19	27					1			80
11-	1	5	4	9	9	142	227	13	104	48								262
12-	4	5	9	11	13	134	280	29	134	116	12	12	7					698
13-	3	12	11	13	13	173	940	85	184	121	21	23	48					821
14-	5	15	16	24	17	351	1661	163	694	154	52	181	96		3			1928
15-	4	16	12	16	30	674	195	1059	243	48	444	310	310	1	1			3963
16-	1	6	4	14	30	51	133	54	588	395	33	303	517	2				3508
17-				10	12	31	74	38	145	133	58	3	38					1175
18-	2	1	4	4	4	4	15	7	24	74	6	2	5					209
19-	2	4	4	4	4	16	2	3	24	76	6	2	5					133
20-	5	1	1	3	3	6	2	6	39	102	6	20	20			1		203
21-		1	1	1	1	62	34	9	83	75	6	10	29					312
22-	3	2	2	4	4	94	64	37	243	178	19	2	54	1		2		727
23-	2	2	2	3	3	194	87	89	278	431	53	8	112	1		1		1459
24-	5	3	4	1	3	325	216	150	530	762	122	12	266	1		1		2762
25-	3	2	3	6	5	562	332	209	838	1088	302	24	472	4		6		4448
26-	12	7	2	20	6	695	544	184	1020	1416	419	115	505	8	3	2	18	5592
27-	31	4	4	33	5	597	754	138	822	1262	445	148	268	3	3	1	6	4863
28-	60	1	4	60	5	513	660	80	427	793	168	159	94	10	11	4	4	3235
29-	95	2	1	31	18	571	44	190	381	105	151	32	63	14	6	1	6	1875
30-	146		2	23	125	269	26	53	274	86	98	15	22	27	25	2	14	1211
31-	77	1		22	97	176	6	25	307	77	53	25	33	40	20	1	12	972
32-	77	2		36	141	134	10	32	311	144	105	7	34	62	16	4	24	1138
33-	43			19	111	101	3	24	236	123	80	15	27	59	18	6	23	889
34-	30	1	1	19	128	116	5	9	185	110	91	21	18	80	33	5	28	878
35-	20	3	1	10	87	100	4	11	222	121	128	10	19	96	48	9	30	917
36-	17	1		8	49	43		19	141	131	141	9	18	110	58	6	37	789
37-	10		1	4	22	32	2	1	84	97	113	7	8	102	68	8	35	593
38-	7			2	14	12	2	1	27	60	90	3	6	88	56	4	26	396
39-	3	1		2	18	24		1	16	39	106	4	11	63	53	7	13	360
40-	1			1	3	20		6	24	34	59	1	1	42	43	3	16	253
41-	1			1	1	4		3	15	26	26		1	15	23	3	8	103
42-					4	3		8	7	10	10		1	19	5	2	7	65
43-									3	12	12			7	2	2	2	25
44-							3					1		1	1	1	2	7
45-									4	1				2	3	2	2	7
46-														1	1	1	2	5
47-														1	1	1	1	2
48-														1	1	1	1	1

Table 17. Redfish (Sabastes spp) age length keys.

MALE

length	age																no	n.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id	tot
10-10																		
11-11																		
12-12																		
13-13																		
14-14																		
15-15																		
16-16																	1	1
17-17																		
18-18			1	1			1											3
19-19						2												2
20-20																		
21-21					1	1												1 3
22-22					1			1										6 8
23-23					2	3	5	1										19 30
24-24					4	13	6	4	4	2	1	1						41 76
25-25					1	18	13	3	1	2	1							70 109
26-26						10	17	9	3	5								47 91
27-27					1	4	19	8	12	3				1				31 79
28-28						3	6	5	5	6	2	1	1					20 49
29-29							4	3	5	4	6							11 33
30-30							1	2	6	5	1	3	2					12 32
31-31								1	4	9	5	3	1					18 41
32-32									3	5	6	7	4	1				19 45
33-33									1	2	7	4	6	3				23 46
34-34								2	2	3	7	2	3	1				16 36
35-35									2	3	7	5	3	3				16 39
36-36								1		1	1	5	2	8	5			17 40
37-37									2	1	1	4	4	3	8	15		38
38-38												2	7	2	7	17		28
39-39												1	2	1	6	7		17
40-40														1	4	2		7
41-41															2	2		4
42-42																1		1
43-43																1		1
44-44																1		1
45-45																		
46-46																1		1
47-47																		
48-48																		
49-49																	1	1
total:				1	5	12	54	68	36	48	49	37	45	30	25	38	414	862

TABLE 17. (Cont'd)

FEMALE

length	age																no. n.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	id	tot
10-10																		
11-11																		
12-12																		
13-13																		
14-14																		
15-15																		
16-16																		
17-17																		
18-18				2														2
19-19			1															1
20-20						2												2
21-21						2											6	8
22-22						4		3	1								5	13
23-23						3	4	1	1								16	25
24-24						5	5	1		1							23	35
25-25						1	10	6	8	2	2				1		47	77
26-26						2	11	9	6	6	3	1					60	98
27-27						1	9	12	11	2	1	2	1			1	43	83
28-28						1	3	1	6	9	5	1	1				30	57
29-29								2	6	5	3	4					8	28
30-30									1	5	5	3	1				5	20
31-31									1	1	2		3				5	12
32-32									4	4	4	7	8			1	10	34
33-33									1	2	2	2	5	2			6	18
34-34									1	3	11	5	4	3	2		12	41
35-35											2		6	2	4	2	17	33
36-36												2	6	6	4	21	39	
37-37												4	4	2	3	4	22	39
38-38												1	2	2	1	8	17	31
39-39												1	2	4	3	5	13	28
40-40																8	8	16
41-41												1		1	1	8	10	21
42-42																	2	2
43-43																2	3	5
44-44																1		1
45-45																1		1
total:				3		21	42	35	41	37	32	38	40	24	23	45	389	770

Table 18. Redfish (Sebastes spp) age composition (x 10E-4).

age	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	total	mean weight
1 :																			0
2 :																			0
3 :																			0
4 :	4		1	5	12	16	7	48	161	40	2	1	22					277	112
5 :	2	1	2	3	134	55	50	146	180	146	31	71	95	1		1	2	785	180
6 :	9	3	5	9	447	279	164	804	966	146	140	264	396	3			7	3533	202
7 :	31	7	5	29	910	797	279	1280	1822	494	140	599	783	9	4	2	15	7206	247
8 :	90	6	4	54	770	864	211	988	1567	433	182	405	558	14	11	2	15	6174	264
9 :	68	3	2	36	489	615	114	576	950	270	145	206	288	22	14	2	13	3813	289
10 :	112	2	2	47	381	545	78	356	816	247	171	139	194	59	27	4	22	3202	335
11 :	118	3	1	45	320	457	54	256	700	262	185	101	143	87	37	6	33	2808	374
12 :	93	2	1	27	200	260	25	90	429	189	171	41	67	111	59	8	38	1811	460
13 :	64	2	1	36	191	202	13	59	396	238	234	36	53	171	88	12	58	1854	537
14 :	33	1	1	11	89	108	6	37	197	133	143	21	29	112	70	7	38	1036	566
15 :	14	1		7	52	57	3	15	120	111	131	9	16	105	66	8	35	750	641
16+ :	11	1		5	38	49	1	10	87	120	190	8	15	155	115	15	52	872	776

Table 19. Greenland halibut (Reinhardtius hippoglossoides)
catch (Kg) by strata.

stratum	area squa. miles	tow number	catch per tow		catch per mile towed	
			mean	s.deviat.	mean	s.deviat.
1 -	342	4	0.00	0.00	0.00	0.00
2 -	838	10	0.05	0.17	0.02	0.08
3 -	628	7	0.74	0.87	0.37	0.42
4 -	348	4	0.80	1.60	0.43	0.86
5 -	703	7	1.89	2.75	1.02	1.55
6 -	496	6	0.53	0.83	0.27	0.41
7 -	822	9	1.18	1.20	0.57	0.56
8 -	646	7	4.95	3.04	2.54	1.54
9 -	314	3	7.62	6.95	3.86	3.50
10 -	951	12	1.27	1.22	0.64	0.62
11 -	806	8	1.15	1.11	0.56	0.54
12 -	670	8	13.31	9.59	7.13	5.26
13 -	249	3	6.97	2.45	3.66	1.51
14 -	602	6	7.20	7.67	3.60	4.13
15 -	666	6	3.55	3.62	1.87	2.06
16 -	634	7	27.93	6.33	15.88	4.96
17 -	216	2	7.50	10.61	4.09	5.78
18 -	210	2	3.25	4.60	1.73	2.45
19 -	414	5	32.20	16.66	16.65	8.08

	catch per tow	catch per mile towed
general mean (Y)	5.85	3.12
standard error of Y	0.50	0.27

Table 20. Greenland halibut (Reinhardtius hippoglossoides)
length frequency in the bank (x 10E-3).

Sex	I	M	H	Sex	I	M	H
length				length			
24 -		6		54		23	138
25 -				55			94
26 -		6		56		6	161
27 -	6			57			74
28 -		7	5	58			88
29 -		6	6	59	12	21	33
30 -	6		13	60 -		6	60
31 -				61 -			34
32 -			6	62 -	6	6	19
33 -			15	63 -			12
34 -		12	12	64 -	7		13
35 -		12	14	65 -	7		13
36 -			19	66 -	7		12
37 -		12	7	67 -			6
38 -		12	26	68 -			12
39 -		24	44	69 -			6
40 -	6	12	21	70 -			
41 -		36	47	71 -			7
42 -	6	7	72	72 -			
43 -		47	113	73 -			8
44 -	5	83	77	74 -			7
45 -	11	55	88	75 -	6		
46 -		49	92	76 -			7
47 -		43	104	77 -			6
48 -	11	42	164	78 -	6		
49 -	11	57	210	79 -			7
50 -	7	70	216	80 -			
51 -	5	55	214	81 -			
52 -	17	45	137	82 -			6
53 -		39	162	83 -			

Table 21. Shrimp catch (Kg) by strata.

stratum	area squa. miles	tow number	mctch per tow		catch per mile towed	
			mean	s.deviat.	mean	s.deviat.
1 -	342	4	0.00	0.00	0.00	0.00
2 -	838	10	0.00	0.00	0.00	0.00
3 -	628	7	0.00	0.00	0.00	0.00
4 -	348	4	0.00	0.00	0.00	0.00
5 -	703	7	0.00	0.00	0.00	0.00
6 -	496	6	0.00	0.00	0.00	0.00
7 -	822	9	0.37	0.70	0.19	0.35
8 -	646	7	1.24	3.29	0.59	1.56
9 -	314	3	2.25	1.10	1.12	0.52
10 -	951	12	0.70	0.98	0.34	0.47
11 -	806	8	0.00	0.00	0.00	0.00
12 -	670	8	12.27	12.35	6.51	6.59
13 -	249	3	3.33	5.77	1.73	3.00
14 -	602	6	6.76	6.99	2.72	3.04
15 -	666	6	7.32	4.25	3.70	2.28
16 -	634	7	5.07	5.29	2.77	3.10
17 -	216	2	0.63	0.88	0.34	0.48
18 -	210	2	0.00	0.00	0.00	0.00
19 -	414	5	11.60	14.72	5.99	7.81

	catch per tow	catch per mile towed
general mean (Y)	2.71	1.37
standard error of Y	0.46	0.24

Table 22. Shrimp length frequency by strata (x 10E-4).

length (cm)	stratum								total	
	7	9	10	12	13	14	15	16		19
14.0-	3									3
14.5-	3		2							5
15.0-	3									3
15.5-										
16.0-	3		2							5
16.5-	3									3
17.0-	6	6								12
17.5-	3	6	4				12			25
18.0-	6	5	10	8	6	19	37	4		97
18.5-	6	9	31				12			59
19.0-	9	23	67	8	6	61	110			292
19.5-	9	39	73	8		55	184			378
20.0-	32	41	119	8		115	391		3	731
20.5-	9	66	67	39	6	148	464	17		842
21.0-	23	48	65	16	17	162	354	4		711
21.5-	12	27	29	16	6	112	160	4	3	380
22.0-	6	9	8	81		41	50	13	19	233
22.5-	3	8	2	96	11	6	200	28	123	493
23.0-	11	9	10	278	11	26	126	21	145	658
23.5-	14	10	8	162	6	94	200	88	215	822
24.0-	11	23	31	268	23	157	237	79	325	1192
24.5-	23	31	44	182	12	233	86	38	149	822
25.0-	26	35	28	208	29	128	136	26	48	684
25.5-	20	38	28	99	6	124	50	69	53	501
26.0-	9	49	19	65	6	65	38	37	79	377
26.5-	6	41	19	47	17	78	86	60	45	411
27.0-	6	26	10	224	46	28	161	72	155	751
27.5-	9	29	4	346	52	51	175	109	187	993
28.0-	3	24	5	270	29	155	186	206	187	1099
28.5-		15	5	583	34	123	125	197	214	1339
29.0-		3	8	559	52	113	123	247	236	1385
29.5-	3	12	6	284	63	88	174	212	239	1116
30.0-		2	4	211	17	84	111	84	233	770
30.5-		3		57	29	54	12	97	69	333
31.0-		2	2	31	6	84	25	116	19	294
31.5-				8	23	97	24	63	157	384
32.0-					11	47	36	47	50	198
32.5-				42	6	29	12	38		130
33.0-				34	6	33		47	53	178
33.5-					6	11		13	3	34
34.0-				34			12	4		52
34.5-						3				3

Table 23. Shrimp length frequency by sex (x 10E-4).

Sex	I	M	F
length			
14.0 -		3	
14.5 -		5	
15.0 -		3	
15.5 -			
16.0 -		5	
16.5 -		3	
17.0 -		12	
17.5 -		25	
18.0 -		97	
18.5 -		59	
19.0 -	6	286	
19.5 -	6	372	
20.0 -	3	722	6
20.5 -	15	822	5
21.0 -	6	696	9
21.5 -	3	361	16
22.0 -		221	12
22.5 -		424	69
23.0 -	6	615	37
23.5 -		781	41
24.0 -	11	1058	123
24.5 -		481	341
25.0 -	2	419	263
25.5 -		201	300
26.0 -	6	84	287
26.5 -	6	97	308
27.0 -	13	78	660
27.5 -	3	93	897
28.0 -	17	58	1024
28.5 -	15	12	1312
29.0 -	6	6	1373
29.5 -	11		1105
30.0 -	6		764
30.5 -			333
31.0 -			294
31.5 -			384
32.0 -			198
32.5 -			130
33.0 -			178
33.5 -			34
34.0 -			52
34.5 -			3