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Northern Shrimp (*Pandalus borealis*) on Flemish Cap in July 1995

by

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A stratified random bottom-trawl surveys on Flemish Cap was carried out in July 1995 following the same method used since 1988. Results of shrimp population (*Pandalus borealis*) are presented in this paper and compared with those previously observed.

Material and methods

The survey was conducted following the same procedures as in previous years (Vázquez, 1995). Samples of approximately one Kilogram shrimpwere taken in each tow this specie was present. Samples were frozen for posterior analysis. Males and females was separated according to the characteristics of the endopod of the first pleopod (Rasmussen, 1953). Individuals in the changing sex phase were included with males. Females were further separated as inmatures (first time spawners) and matures (spawned previously) based on the condition of the sternal spines (McCrary, 1971). Few ovigerous females were found this year as well as in previous ones: the spawning period in Flemish Cap begins between the end of July and the beginning of August (Mena, 1991). Oblique carapace length (CL). The distance from the base of the eye to the posterior dorsal edge of the carapace (Shumway et al, 1985) were measured to the lower 0.5 mm. 3018 individuals were weighed to the nearest 0.1 gr to calculate the length-weight relationship.

Results

Total biomass estimated by swept area method and average catch per mile from 1988 to 1995 are presented in Table 1 . An increase was observed in 1995 with regard to 1994. Length frequencies by sex from 1995 survey are shown in Table 2. Males presented a CL between 13 and 27.5 mm. Females presented one between 18.5 and 32.5 mm. The 23 mm length modal group is mainly made by individuals which had become female in 1995. Upper length females modal groups tended to be overlapped and indistinct (Savard et al, 1994).

Length frequencies by strata in 1995 (Table 3) indicate that the presence of shrimp is scarce in depths lower than 140 fathoms (252 m) or higher than 301 fathoms (554 m) . The shrimp mainly occupy those strata between 141 and 300 fathoms. Small size shrimp are scarce in depth greater than 300 fathoms, were the minimum length (CL) measured was 19 mm.

Total biomass estimated by strata in 1995 survey (Table 4) shows a distribution pattern similar to that observed in previous surveys, although shrimp appeared in estratum 2 (81-100 fathoms) for first time in this year. The increase of biomass from 1994 to 1995 (Table 5) is not explain by change in small length shrimp (<17 mm) which represent the annual recruitment, but was mainly due to increase of abundance of modal group 20-22.5 mm (named E in Figure 1). The modal class with largest shrimp sizes which constitutes the bulk of fisheable stock has 28 mm CL in 1994 and 26.5 mm in 1995, but its abundance decreased not only due to the natural mortality but also presumable as a consequence of the shrimp fishing in this zone.

The cod-end mesh-size was 40 mm in 1994 survey but it was 35 mm in all other surveys. The apparent increase in shrimp abundance from 1994 to 1995 is a consequence of a underestimation of the 1994 value mainly due to a low efficiency of the 40 mm mesh-size to catch medium size shrimp.

Reference

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Table 1- Total biomass estimated by swept area method and average catch per mile

Year	Biomass (t)	Average catch per mile (Kg)
1988	2164	1.54 ± 0.28
1989	1923	1.37 ± 0.24
1990	2139	1.53 ± 0.21
1991	8211	5.83 ± 0.71
1992	16531	11.75 ± 1.86
1993	9256	6.57 ± 1.04
1994	3337	2.37 ± 0.35
1995	5413	3.85 ± 0.44

Table 2- Length frequencies by sex

Length (mm)	Males	Immature Females	Mature Females	Ovigerous Female
13.0	3			
13.5	25			
14.0	48			
14.5	140			
15.0	361			
15.5	540			
16.0	867			
16.5	1242			
17.0	1160			
17.5	707			
18.0	375			
18.5	170	5		
19.0	182	16	2	
19.5	694	6	2	
20.0	1206	17		
20.5	2002	89	7	
21.0	2917	266	18	
21.5	3257	657	77	7
22.0	2437	1069	181	
22.5	1214	1119	176	
23.0	404	1191	492	
23.5	310	889	402	
24.0	283	601	587	6
24.5	381	874	776	90
25.0	306	1359	1177	84
25.5	70	1450	1846	
26.0	55	1377	2210	22
26.5	5	1261	2297	7
27.0	1	687	2279	18
27.5		428	2113	
28.0		209	2215	40
28.5		69	2042	18
29.0		29	1998	
29.5		32	1696	
30.0		9	918	
30.5			583	
31.0			234	
31.5			85	
32.0			16	
32.5			10	

Table 3 - Length frequencies by strata

	STRATA													
Length	2	6	7	8	9	10	11	12	13	14	15	16	19	Total
13.0		3												3
13.5			8			17								25
14.0		2	12			24	6			4				48
14.5		3	26	3		61	24	17		4				140
15.0		5	106		16	129	39	32		33	1			361
15.5		3	117	3		222	64	125		4	1			540
16.0	29	5	158	14	87	301	135	138			1			867
16.5	116		220	25	64	385	148	179		49	54			1242
17.0	58	2	145	21	87	239	136	173		109	186		4	1160
17.5	43	3	87	33	87	124	84	81		36	128			707
18.0	58	2	23	1	19	40	61	58		32	82			375
18.5	29		15			14	6	57		16	39			175
19.0	14	2	17			74	29	41		18	5			200
19.5	29		41	7		203	66	75		41	221		18	702
20.0	101	2	64	12	53	200	86	224		61	362		57	1223
20.5	72		117	13	91	419	195	241		361	512	14	61	2098
21.0	86	2	167	32	231	822	217	431		365	705	7	132	3201
21.5	115	12	333	75	254	586	324	668		513	919	18	174	3998
22.0	29	26	382	102	261	581	333	659	7	441	626	24	212	3687
22.5	101	25	352	71	87	397	276	374	2	284	392	15	129	2509
23.0		27	322	231	69	474	315	309		139	156	13	29	2087
23.5	29	9	222	95	102	379	266	221	7	74	131	16	47	1601
24.0	43	9	131	63	147	360	227	166	7	64	174	18	67	1477
24.5	86	8	163	129	184	407	283	274		190	247	21	126	2121
25.0	101	8	217	245	199	627	262	389	2	260	448	31	134	2926
25.5	188	2	189	221	256	567	302	628	2	228	573	43	163	3366
26.0	115	2	165	233	295	647	289	559	7	255	801	40	248	3664
26.5	203	2	129	195	411	407	261	482	7	336	781	28	322	3570
27.0	43	2	94	99	460	410	212	574		160	657	27	243	2985
27.5	14	2	63	48	261	432	202	455	9	171	601	30	249	2541
28.0	43		64	34	259	382	165	420	18	309	478	11	276	2464
28.5	58		30	13	187	305	175	287	23	361	407	23	258	2129
29.0	14		30	1	247	239	66	229	39	427	450	18	266	2027
29.5	43		23	12	166	228	66	131	21	395	452	16	173	1728
30.0	58		1	3	166	60	16	51	14	142	270	20	124	927
30.5	14				77	4		70	14	213	91	6	94	583
31.0					19	9	13	31	5	101	47	5	4	234
31.5						6			14	49	5	3	8	85
32.0							6		2			1	5	16
32.5			2						2	4			4	10

frequency $x10^4$

Table 4- Total biomass estimated by strata (tonnes)

Stratum	Depth (fathoms)	1988	1989	1990	1991	1992	1993	1994	1995
1	70-80	0	0	0	0	0	0	0	0
2	81-100	0	0	0	0	0	0	0	162
3	101-140	0	0	0	5	0	1	0	2
4	101-140	0	0	0	0	0	0	0	0
5	101-140	0	0	0	4	8	0	0	6
6	101-140	0	0	2	19	3	3	0	11
7	141-200	18	20	212	713	2134	1404	93	299
8	141-200	9	51	46	158	1130	545	3	183
9	141-200	57	47	24	150	88	109	0	506
10	141-200	115	44	188	1499	2278	972	658	873
11	141-200	89	0	105	733	2714	794	358	452
12	201-300	786	582	313	1733	3329	1786	599	778
13	201-300	64	58	42	63	28	120	0	28
14	201-300	255	218	407	814	1640	(1161)	556	632
15	201-300	404	328	558	1485	2522	2029	916	1021
16	301-400	308	234	239	171	303	133	44	47
17	301-400	2	10	0	0	0	0	0	0
18	301-400	0	0	0	0	0	0	0	1
19	301-400	56	331	4	663	354	163	111	412
Total		2164	1923	2139	8211	16531	9256	3337	5413

Table 5.- Estimated biomass by length classes for the years 1994 and 1995.

Length (mm)	specimen number 1995	mean weight at length	weight by length classes	specimen number 1994	mean weight at length	weight by length classes
13.0	30	1.3	39			
13.5	250	1.5	375			
14.0	480	1.7	816			
14.5	1400	1.9	2660	20	2.0	40
15.0	3610	2.1	7581	60	2.2	132
15.5	5400	2.3	12420	750	2.4	1800
16.0	8670	2.5	21675	770	2.6	2002
16.5	12420	2.7	33534	1610	2.9	4669
17.0	11600	3.0	34800	1880	3.1	5828
17.5	7070	3.2	22624	3900	3.4	13260
18.0	3750	3.5	13125	2670	3.7	9879
18.5	1750	3.8	6650	1410	4.0	5640
19.0	2000	4.1	8200	440	4.3	1892
19.5	7020	4.5	31590	900	4.7	4230
20.0	12230	4.8	58704	2360	5.0	11800
20.5	20980	5.2	109096	6940	5.4	37476
21.0	32010	5.6	179256	11520	5.8	66816
21.5	39980	6.0	239880	13440	6.2	83328
22.0	36870	6.4	235968	13790	6.6	91014
22.5	25090	6.8	170612	8410	7.1	59711
23.0	20870	7.3	152351	6240	7.5	46800
23.5	16010	7.8	124878	6510	8.0	52080
24.0	14770	8.3	122591	9760	8.5	82960
24.5	21210	8.8	186648	11020	9.0	99180
25.0	29260	9.3	272118	10420	9.6	100032
25.5	33660	9.9	333234	14860	10.1	150086
26.0	36640	10.5	384720	13170	10.7	140919
26.5	35700	11.1	396270	22080	11.3	249504
27.0	29850	11.7	349245	34170	12.0	410040
27.5	25410	12.3	312543	43070	12.6	542682
28.0	24640	13.0	320320	37970	13.3	505001
28.5	21290	13.7	291673	33390	14.0	467460
29.0	20270	14.4	291888	23200	14.7	341040
29.5	17280	15.2	262656	9650	15.4	148610
30.0	9270	15.9	147393	7640	16.2	123768
30.5	5830	16.7	97361	2270	17.0	38590
31.0	2340	17.6	41184	1700	17.8	30260
31.5	850	18.4	15640	1750	18.6	32550
32.0	160	19.3	3088	10	19.5	195
32.5	100	20.2	2020	280	20.4	5712
33.0				30	21.3	639

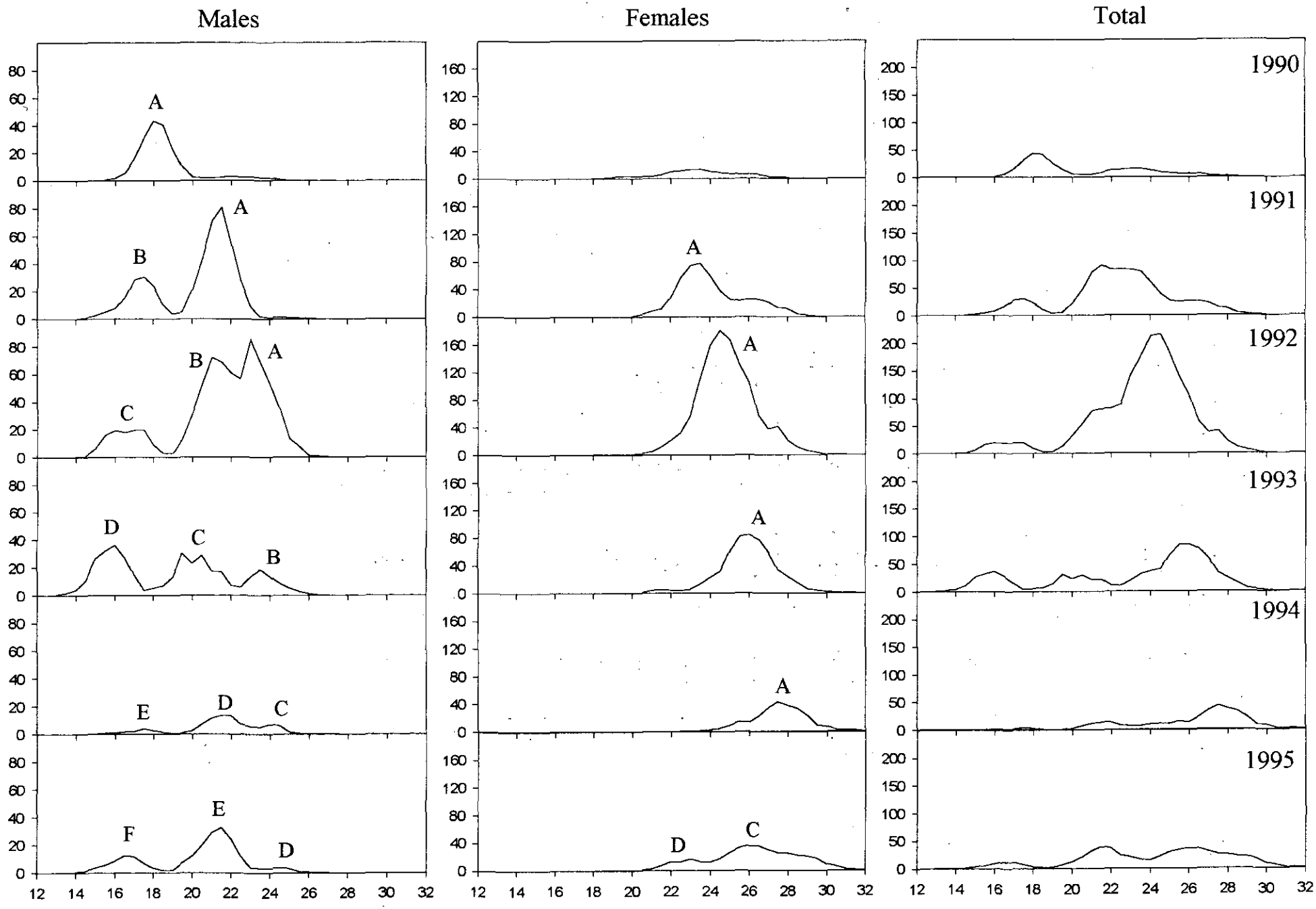

Figure 1. Shrimp length distribution on Flemish Cap, 1990-1995. Y-Axis = Frequency (10^4) X-Axis = Length (mm)

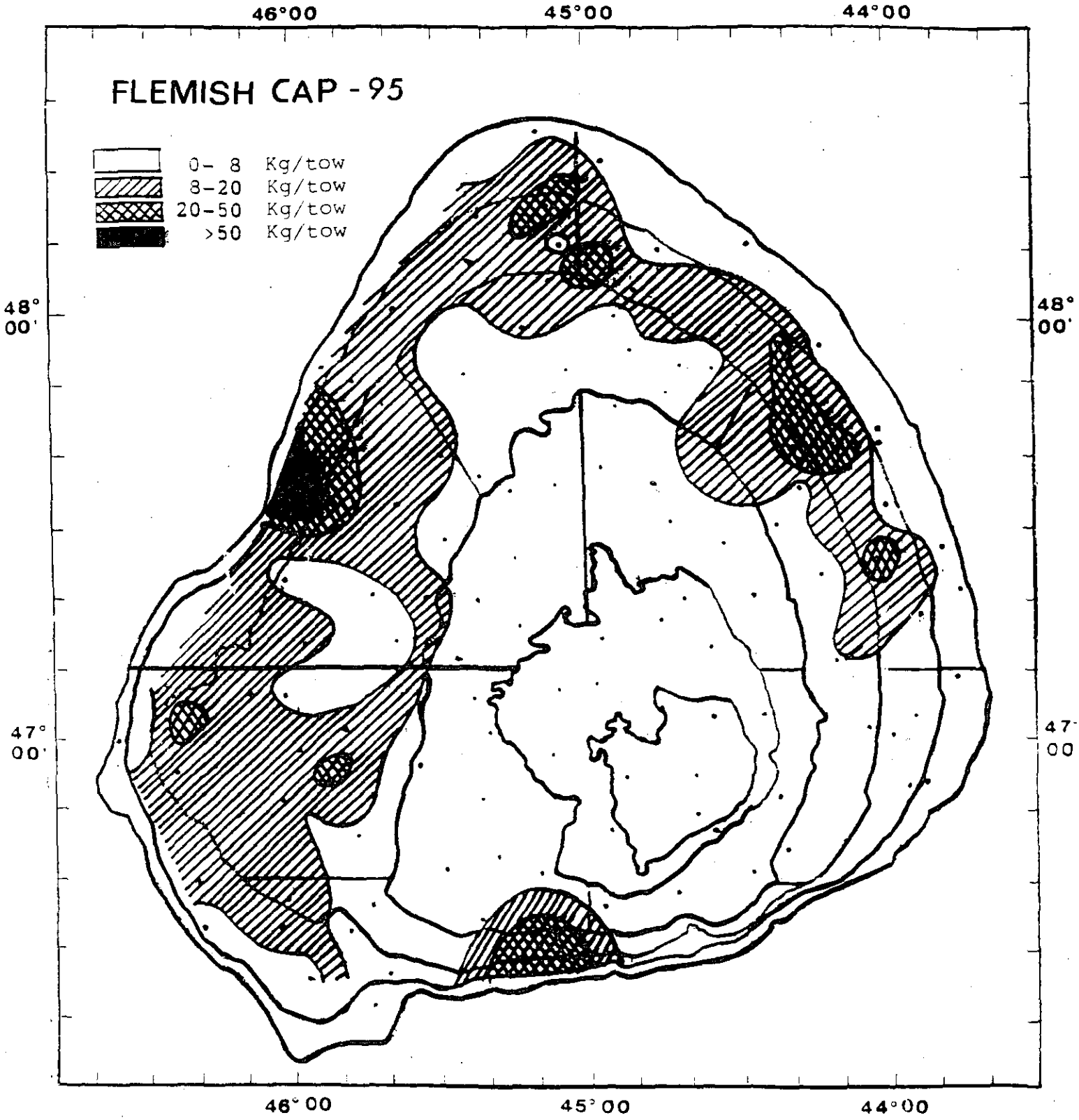

Fig 2 - Shrimp (*Pandalus borealis*) Catch Distribution in July 1995 on Flemish Cap