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Distribution and Abundance of Cod on the Flemish Cap, July 1988 and 1989

by

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INTRODUCTION

The population of cod on the Flemish Cap has declined during the last decades.

Sampling from commercial cod fishery in this area has not been adequate for a long time, since 1963 (WELLS, 1980). Information from research vessel surveys has therefore been particularly valuable in supplementing data from the commercial fishery. With a moratorium fishing for cod in 1988 reported catches were taken as by-catch in the redfish and flatfish fisheries.

A project on groundfish survey is being carried out by EEC-Spain since 1988 (VAZQUEZ, 1989).

The distribution and abundance of cod (as measured by availability to the trawl) may well influence the size of subsequent year-classes.

MATERIAL AND METHODS

In July 1988 and 1989 survey cruise was conducted on the Flemish Cap using the random-stratified sampling design.

The sampling grid was described by Doubleday (1982). The method and conditions have been those described by VAZQUEZ, (1989 and 1990). The figures 1 and 2 show the situation of trawls carried out in both years.

Cod were caught were weighed and counted in total or by means of sufficiently large samples so that totals could be

estimated with confidence. The otoliths for age determination were dissected.

These operations were taken on board. Fork length was measured to the nearest cm.. The total cod number sampling was 10453 in the year 1988 and 16214 in the year 1989. The cod length frequency is shown in figure 3. Otoliths readings were 2469 and 4301 respectively.

Abundance and biomass estimations were made following the usual expansion by area method.

After each tow temperature and salinity were measured by CTD SBE-139 sounder. Only 1989 data can be used.

RESULTS

The number of tows per stratum and the sampling intensity are shown in Table 1.

The temperature and salinity ranges were narrow, with similar values to those reported in others studies (TEMPLEMAN, 1976; MANKEVICK E.M. and V.S. PROKHOROV, 1963). The temperature range was 2.96-3.72 °C and the salinity ranged between 34.4047‰ and 34.845‰.

The isotherms of bottom temperatures and isolines of salinity over the Bank are given in Figures 4 and 5.

The estimated cod abundance (biomass) by stratum are shown in table 2. Biomass was three times higher in 1989. It might be attributed to the variable pelagic cod distribution. However this question deserves further investigated. Besides this the cod distribution was more extensive in 1989, in 1988 there was less stratum with cod catches. Cod catches in stratum 9 to 19 were minimal or nules. The catch isolines are shown in Figures 6 and 7.

The frequency of age-classes are presented in Tables 3 and 4. The year-classes more abundant were those of 1985 and 1986. In 1989 the 1984 cod year-class was more abundant in relative and absolute values than previous year. In spite of this cod age-group supported a high fishing intensity. The different cod distribution and availability could explain it.

No correlation was found between the cod catch (biomass or number) and the salinity and temperature. This suggests that the

summer cod distribution are not related with these two physical factors .

In 1989 the cod catches were minimal in depths of 550 m. or deeper. No cod was caught in the stratum 18, and very poor catches were obtained in the strata 16, 17 and 19. Catch of cod was more abundant in the eastern part of the Bank, mainly in the stratum 7 and 8 (Figure 7).

In both years the cod catches were more abundant in strata 2 and 8.

In 1988 the 72.6% of cod (ranged 16-30 cm) was caught in the depths from 150 to 250 m and the 40.3% between 200 and 250 m. This cod range constituted the 70.5% of total catch in number.

In 1989 the 70% of cod (ranged 16-30 cm) was caught in the depths from 200 to 250 m, comprising the 30.31% of total catch in number. The 62.2% of cod (ranged 45-59 cm) was caught in the depths from 300 to 350 m.

Some length ranges frequencies were correlated with the deepest depths (Table 5). The calculated correlation between the median length by trawl and the depth was positive and high: $N=87$, $R=0.736$, $p<0.001$ (Figure 8). In 1988 no length range were correlated with depth but the median length and the depth yielded a poorer correlation (Fig. 9)

In previous paper (Paz et al., 1988) we found a high cod predation upon redfish. Cod longer than 30 cm usually preys on redfish. We studied the relationships between redfish (16-25 cm) abundance distribution and 3 years old cod abundance or more in both years. No correlation was detected. The abundance and distribution of redfish seemed have no influence on the summer cod distribution.

CONCLUSIONS

1.- The salinity and temperature have little influence, if any, in the distribution of cod in Summer in the Flemish Cap.

2.- Mean estimates of abundance and biomass of cod on the Flemish Cap in Summer 1988 were 20.5 millions individuals and 36.7 thousand tones, and in 1989 were 18.9 millions individuals and 103.6 thousand tons.

3.- The cod distribution was very different in both years, being more expanded in 1989.

4.- At this time most of cod were in a 250-350 m depth, (strata 7 and 8).

5.- The relationship between mean length cod and the depth was high and positive. This correlation was higher in 1989.

6.- The 1985 and 1986 year-classes were more abundants in number, yielding 30.8% and 55.9% in 1988 and 27.2% and 44.9% respectively in 1989 of the total catches.

7.- The redfish distribution does not seem to have any influence in the summer cod distribution in Flemish Cap.

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Table 1. Number of tows per stratum and by depth zone completed on the Flemish Cap in July, 1988 and 1989. Sampling intensity is equal to number of tows per 350 square nautical miles.

STRATUM	DEPTH RANGE	AREA OF STRATUM	NUMBER OF TOWS		SAMPLING INTENSITY	
			88	89	88	89
1	130-150	341.8	4	4	4.1	4.1
2	150-180	837.9	10	10	4.2	4.2
3	180-250	627.8	7	7	3.9	3.9
4	180-250	347.8	4	4	4.0	4.0
5	180-250	703.4	8	7	3.98	3.5
6	180-250	496.1	6	6	4.2	4.2
7	250-370	821.8	9	9	3.8	3.8
8	250-370	646.1	7	7	3.8	3.8
9	250-370	314.3	3	3	3.3	3.3
10	250-370	951.3	9	12	3.3	4.4
11	250-370	806.1	9	8	3.9	3.5
12	370-550	670.4	8	8	4.2	4.2
13	370-550	248.6	3	3	4.2	4.2
14	370-550	602.0	6	6	3.5	3.5
15	370-550	665.7	6	6	3.2	3.2
16	550-730	634.1	7	7	3.9	3.9
17	550-730	215.7	2	2	3.2	3.2
18	550-730	209.7	2	2	3.3	3.3
19	550-730	413.9	5	5	4.2	4.2
TOTAL		10554.5	116	115	3.81	3.84

Table 2. Abundance and biomass estimates of cod by stratum on the Flemish Cap in July, 1988 and 1989.

STRATUM	ABUNDANCE (000'S)		BIOMASS (TONS)	
	88	89	88	89
1	483	150	1225	590
2	6453	2013	9230	9386
3	2121	1927	4066	9344
4	1906	871	2417	4404
5	2893	4282	1885	9730
6	3100	1768	2933	6173
7	793	1495	2021	14571
8	1261	1906	7757	14943
9	39	619	167	4784
10	296	738	1217	4454
11	1093	1524	2278	12020
12	73	472	307	2245
13	3	441	8	2304
14	4	81	97	868
15	7	608	679	7671
16	-	29	-	54
17	-	3	-	5
18	1	-	2	-
19	-	15	-	92
TOTAL	20526	18942	36675	103640
STRATA				
1-2	6936	2163	10455	9976
3-6	10020	8848	11302	29652
7-11	3482	6282	13441	50773
12-15	87	1602	1091	13089
16-19	1	47	1960	150
TOTAL	20526	18942	36675	103640

Table 3. Cod Age frequency ('000) per stratum on the Flemish Cap in July, 1988.

AGE	STRATUM																	TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18		
1	1	349	50	59	177	62	8		1	3	8							718
2	72	3393	1263	851	2443	2270	344	112	22	118	594	2						11484
3	310	2168	542	858	232	701	319	678	12	120	362	27	2	1	1	1		6334
4	94	529	194	132	34	58	93	446	2	38	81	37	1	1	3			1743
5	6	12	64	5	5	7	22	23	1	9	34	7				1		196
6		1	7	1	2	1	3	1	1	3	7			1	1			29
7			4	1	1			5	2	2	4	8		1	4			32
8								1			2	2						9
TOTAL	483	6452	2124	1907	2894	3099	795	1262	41	297	1096	73	3	4	14	1		20545

Table 4. Cod Age frequency ('000) per stratum on the Flemish Cap in July, 1989.

AGE	STRATUM																			TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19		
1	12	168	309	66	920	401	32	1	3	111	59				1		2		2082	
2	10	114	127	21	474	226	17	4	4	57	45		1		1				1100	
3	97	1244	929	524	2508	856	390	669	162	287	549	80	148	8	53		1	1	8510	
4	25	390	438	229	319	212	667	918	302	179	599	276	226	41	301	15		7	5147	
5	5	81	110	39	56	65	356	302	140	90	250	108	64	29	234	13		6	1947	
6		7	12	1	4	6	26	11	7	11	19	7	2	2	16			1	131	
7		4	2		1	1	2			2	2				1				15	
8		5	1					4	1						1				14	
9																			1	
10							1												1	
TOTAL	158	2003	1928	860	4282	1767	1485	1906	618	737	1523	471	441	80	608	28	3	15	18948	

Table 5. Correlation between length range Cod classes and depth. Flemish Cap in July, 1989.

LENGTH RANGE (cm)	NUMBER OF CASES	R (Reg. coef.)	P (Prob.)
10-20	54	0.830	0.553
21-30	72	-0.493	<0.001
31-40	87	-0.243	0.023
41-50	96	0.740	<0.001
51-60	91	0.693	<0.001
61-70	48	0.502	<0.001
71-80	20	0.190	0.936

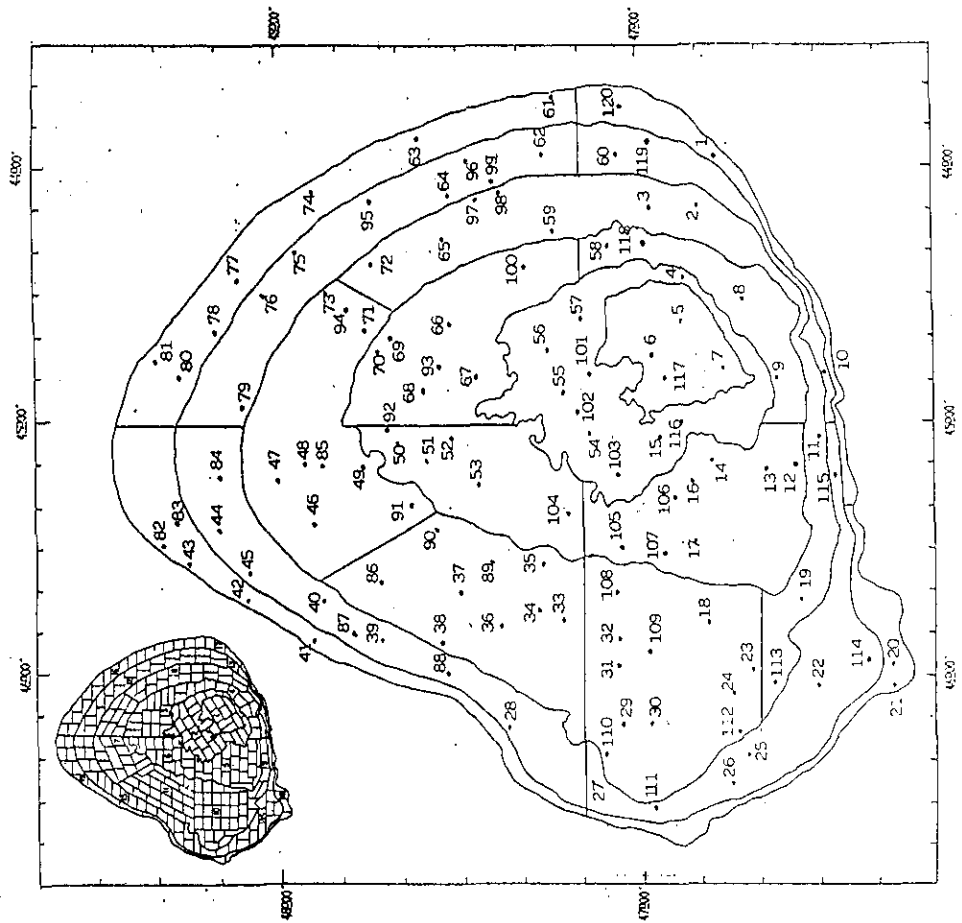


Figure 1. Flemish Cap bank with the tows situation carried out in July, 1988.

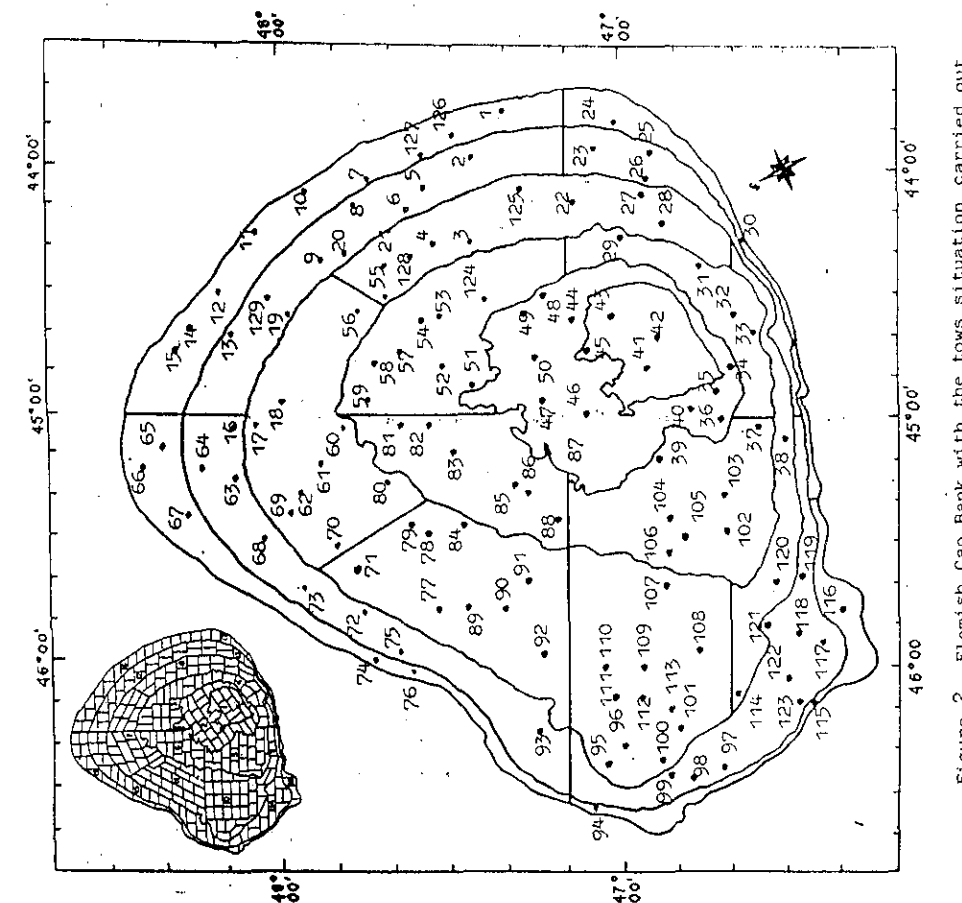


Figure 2. Flemish Cap Bank with the tows situation carried out in July, 1989.

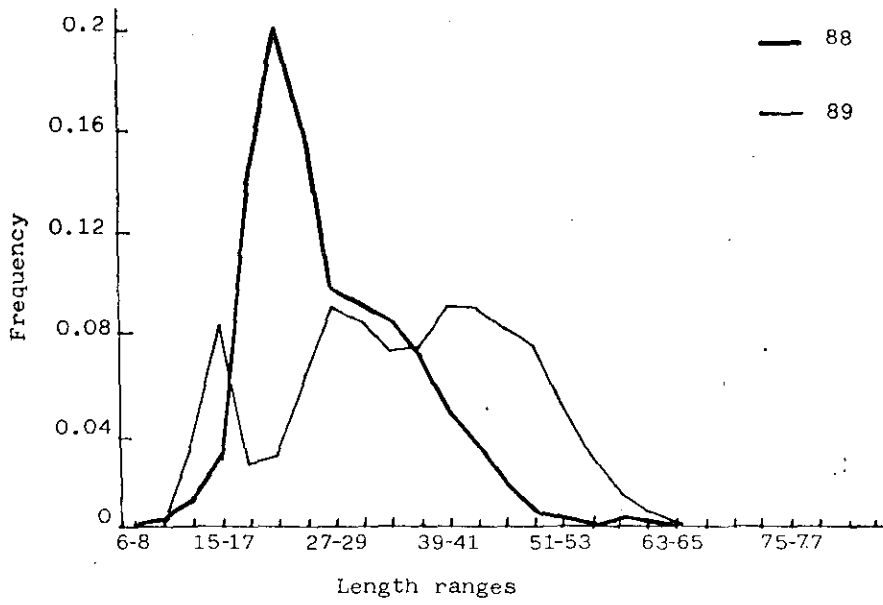


Figure 3. Length frequency of Cod on the Flemish Cap, in July 1988 and 1989.

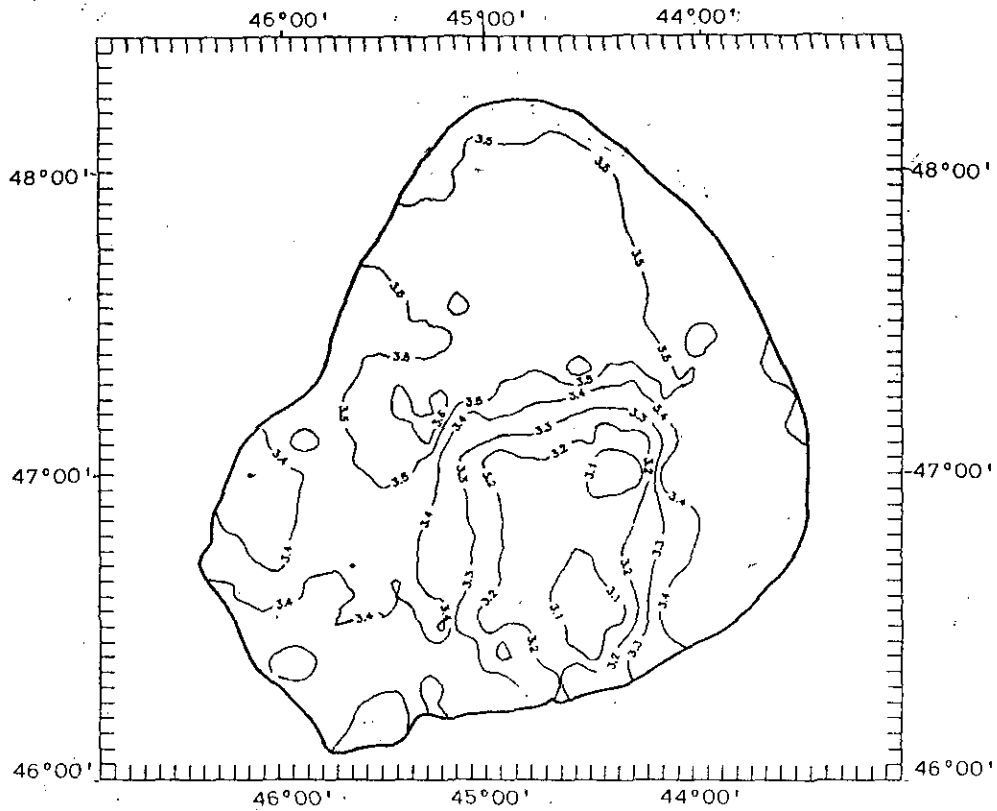


Figure 4. Isolines bottom temperature on the Flemish Cap in July, 1989.

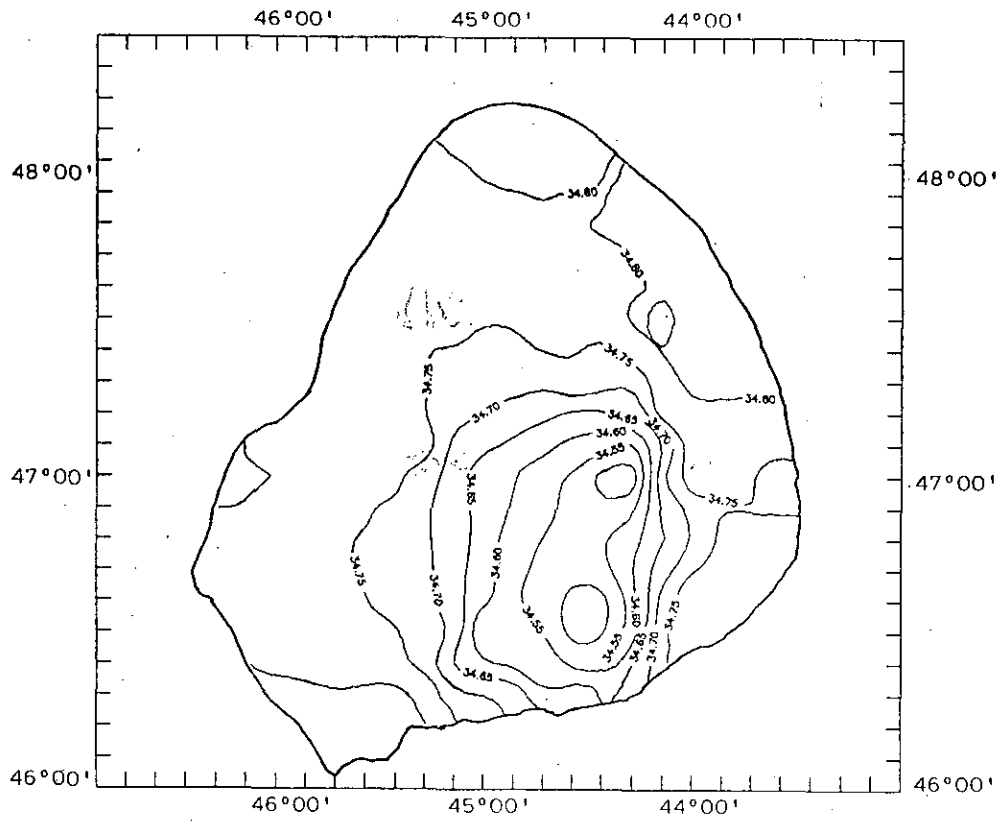


Figure 5. Isolines bottom salinity on the Flemish Cap in July, 1989.

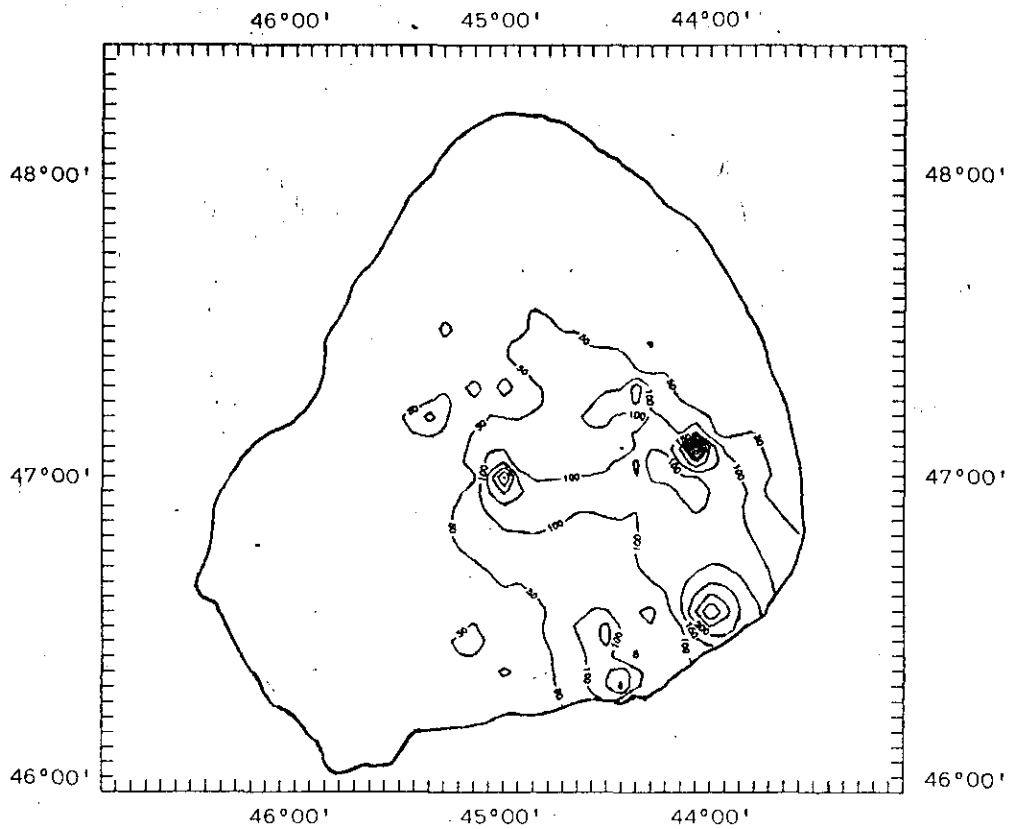


Figure 6. Distribution and abundance of Cod on the Flemish Cap in the July, 1988.



Figure 7. Distribution and abundance of Cod on the Flemish in the July, 1989.

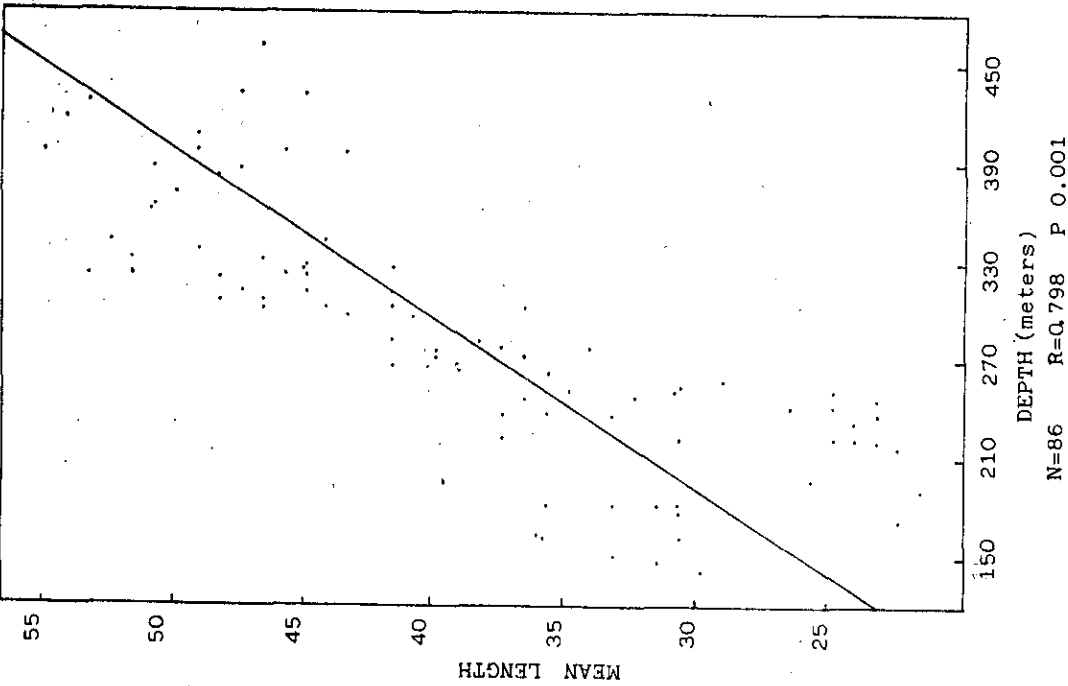


Figure 9. Relationship between Cod mean total length (cm) and depth in July, 1989.

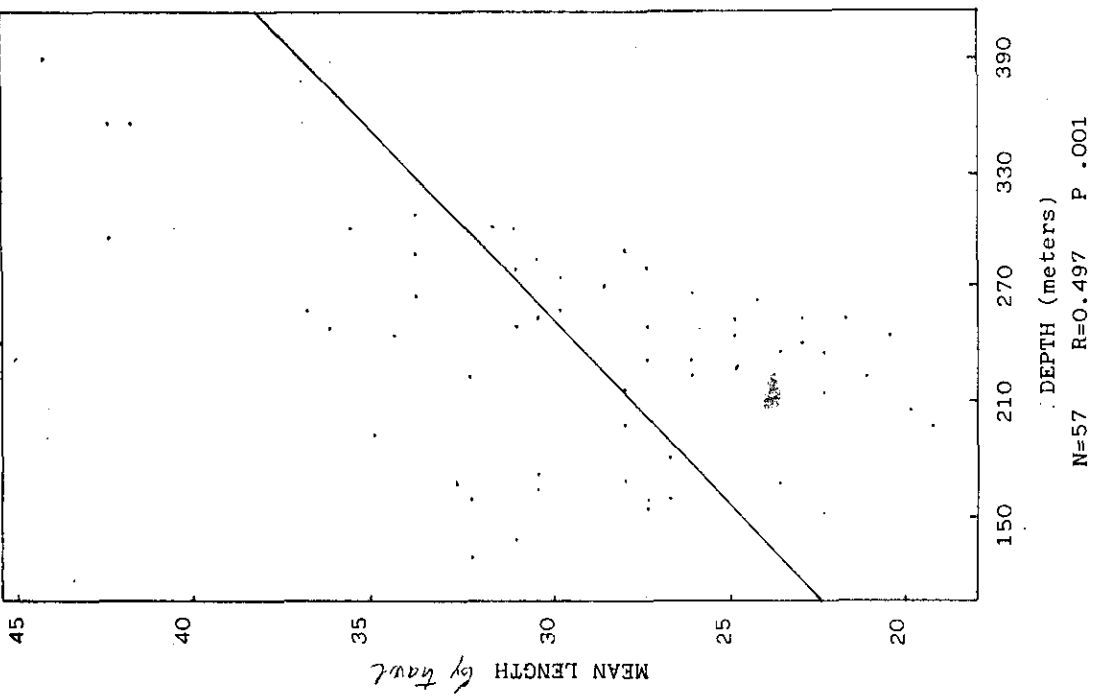


Figure 8. Relationship between Cod mean total length (cm) and depth in July, 1988.