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Assessment of Cod Stock in NAFO Subarea 3 by the Data
From 1990 Trawl-Acoustic Survey

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ABSTRACT

Trawl-acoustic survey in NAFO Divs. 3M, 3NO and 3KL has been conducted in April-July 1990.

As a result of fishery in 1989-1990 the cod stock in Div. 3M has considerably reduced. According to estimate obtained by trawl-acoustic method fish abundance made up 19.0×10^6 spec., biomass - 15.2×10^3 t in 1990 against 159.1×10^6 spec. and 78.3×10^3 t in 1989.

Cod stock in Divs. 3NO is reducing ; it constituted 7.8×10^6 spec., biomass - 60.3×10^3 t in 1990.

The abundance and biomass of the Labrador cod (Divs. 3KL) are close to the estimates for 1989 and make up 646.8×10^6 spec. and 774.2×10^3 t.

INTRODUCTION

Long-term observations over cod stock status in NAFO Subarea 3 have been continued during the trawl-acoustic survey carried out by MB-1202 "Persey-III" in April-July 1990. The results obtained are analyzed in the paper and the estimate for abundance and biomass of cod in Divs. 3NO, 3K, 3L and 3M in 1990 against the data for 1977-89 is considered.

MATERIAL AND METHODS

Stratified-random (Doubleday, 1981) trawl survey has been conducted in combination with acoustic survey to estimate the abundance and biomass of cod distributed above fishing zone using a bottom trawl (Mamylov, 1988).

To characterize year-to-year variations in the stock status the results from 1990 survey were compared to retrospective

data from trawl and trawl-acoustic surveys (Bulatova et al., 1990; Kuzmin, 1990). Mean catches are presented per 0.5 trawling hour.

RESULTS

Div. 3M. In June-July 1990 main aggregations of cod on the Flemish Cap Bank were found on the eastern slope at 210-290 m depths. Catches per half-hour valid trawlings were minor (Fig.1) and did not exceed 55 kg. Pelagic cod aggregations were heavier in Strata 7 and 4 (Fig.2). Cod from 1986 year class were predominant in catches as by the results from the 1987-89 surveys.

Compared to 1989 the survey of 1990 indicated a reduction in both the abundance and biomass of cod (Table 1). Trawl surveys carried out by EEC (Vazquer, 1990) also confirm much reduction in cod biomass in 1990 compared to 1989 (Fig.3)*, which is related to the intensive cod fishery in 1989 (Rep. of Sci.Coun., 1990) in the presence of the 1988-1990 moratorium. Thus, the prognosis for recruitment of cod populational spawning portion on the Flemish Cap Bank were not confirmed (Fig.4). Growth in mature fish portion of the stock has been registered under the reduction of fish total abundance (Table 2). In 1991 the fishery will be less effective and continue to deteriorate the populational spawning stock.

Divs. 3NO. In April 1990 mean cod catches constituted 1-3 spec. by strata at 55-270 m depth and 6-10 spec. - deeper. Large cod at 75-140 cm length occurred to 100 m depth.

By the data from the 1990 trawl survey the abundance of cod reduced by 2.6 and biomass - by 1.4 times, compared to 1989 (Tables 3, 4 and 5).

According to the estimate obtained by trawl-acoustic method cod abundance made up 7.8×10^6 spec. and biomass - 60.3×10^3 t, what is lower than the data from the 1987-89 trawl-acoustic surveys (Table 6).

Results from Canadian trawl surveys (Bishop et al., 1990) indicated a minor growth in abundance (1.04 times) and biomass (1.13 times).

No essential recruitment to the southern Newfoundland cod has been registered in 1990 (Table 7), as well as in 1983-89, which was the main reason for prolonged reduction in the stock. Mean

* Data on 1990 stock have been presented to Dr.Chumakov by Dr.Vazquer.

length and mean age of cod increased in catches for 1990 (Tables 8 and 9). Specimens of 33-41 and 105-116 cm long at age 3-5 and 10 years from the 1987, 1986, 1985 and 1980 year classes constituted the bulk of catches. Mature fish in the stock made up 33%, which is higher compared to 1989 (28%).

Divs. 3KL. In April-May main cod aggregations were found at 150-330 m depth on the northeastern slope of the Grand Bank in Div. 3L (Fig.5). Maximum catch at 190 m depth made up 600 kg. In Div. 3K water temperature was anomalously low over the most part of shelf in June 1990 and only along the eastern slope of the Funk Island Bank it was by 0.1-0.4°C higher in a bottom layer compared to the long-term mean values. The highest catches per 30-minute valid haul were registered in the southern part of the Funk Island Bank eastern slope and constituted 1.7-7.1 t (Fig.6).

Length and age compositions of the Labrador cod indicate a stable status of the population (Tables 8 and 9). Fish of 36-44 cm long at age 4-5 were predominant in catches in Div. 3L. In Div. 3K specimens of 51-59 cm long at age 5-7 from the 1985-83 year classes made up the bulk of catches.

Comparison of the estimates for stocks by the results from the 1989 and 1990 trawl surveys indicated the abundance to increase (from 353.2×10^6 to 375.9×10^6 spec.) and biomass to reduce (from 547.7×10^3 to 459.4×10^3 t) in Divs. 3KL in 1990. On the whole, according to the assessment by trawl survey method in 1990 the stock remained to be close to the level of 1988-89 (Tables 10 and 11). The abundance and biomass estimated by the trawl-acoustic method made up 646.8×10^6 spec. and 774.2×10^3 t, i.e. lower than the values for 1988-89 (Table 6).

CONCLUSION

The 1986 cod year class on the Flemish Cap Bank ^{has} essentially withdrawn by the fishery in 1989-90. The Flemish Cap cod stock has reduced nearly by 10 times in 1990. Fishery in 1991 will be less effective and continue to deteriorate the populational spawning stock.

The reduction of the southern Newfoundland cod stock (Divs. 3NO) resulted from poor recruitment to the stock for a period 1983-90.

The Labrador cod stock (Divs. 3KL) in 1990 has remained on a high level, while in Div. 3L a reduction in the abundance and biomass observed in 1989 was continuing.

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TABLE 1. Mean catches per trawling, abundance and biomass of cod in Div. 3M by the data from the 1977-1990 trawl surveys

Year	Area, mile ²	Number of hauls	Mean catch		Abundance, 10 ⁶ spec.		Biomass, 10 ³ T			
			Number, spec.	Weight, kg	Maximum	Mean	Maximum	Mean	Maximum	Mean
1977	908I	24	234.30	201.30	262.88	157.61	52.33	262.58	135.40	8.23
1978	7467	30	42.35	39.90	38.24	23.42	8.60	30.79	22.07	13.36
1979	908I	64	80.60	60.95	102.73	54.22	5.70	71.78	40.99	10.21
1980	908I	76	14.60	17.90	12.64	9.82	7.00	16.31	12.02	7.74
1981	7745	29	28.35	43.45	24.58	16.28	7.98	34.83	24.93	15.02
1982	908I	62	15.35	20.55	14.03	10.34	6.66	23.87	13.83	3.79
1983	908I	103	97.40	34.30	100.39	65.53	30.67	31.07	23.07	15.06
1984	908I	103	90.20	46.40	75.40	60.68	45.96	39.29	31.21	23.13
1985	908I	106	55.09	41.70	44.64	37.06	29.48	34.66	28.07	21.48
1986	908I	108	55.30	38.70	53.29	37.20	21.11	36.76	26.06	15.36
1987	8479	104	58.60	16.20	50.96	36.82	22.68	13.28	10.15	7.02
1988	8411	97	42.90	12.40	37.90	26.73	15.50	10.45	7.72	4.99
1989	908I	109	104.72	54.30	107.91	70.44	32.98	53.89	36.52	19.14
1990	7813	85	7.40	6.80	5.86	4.31	2.76	5.42	3.92	2.42

TABLE 2. Number of mature and immature fish in mean catch per trawling by the data from the 1983-1990 trawl surveys on the Flemish Cap Bank

Year	No. of imma- : ture fish, : spec.	No. of : mature fish, : spec.	No. of : mature fish, : %	Total, : spec.
1983	83.05	11.30	11.6	97.40
1984	76.50	13.71	15.2	90.20
1985	40.72	14.38	26.1	55.09
1986	44.66	8.64	15.6	55.30
1987	56.28	2.32	4.0	58.60
1988	42.14	0.79	1.8	42.90
1989	100.61	4.12	3.9	104.72
1990	6.20	1.20	16.3	7.40

TABLE 3. Mean catches per trawling, abundance and biomass of cod in Div. 2N by the data from the 1977-1990 trawl surveys

Year	Area, : mile ²	Number : of hauls	Mean catch		Abundance, 10 ⁵ spec.			Biomass, 10 ³ t		
			Number, : spec.	Weight, : kg	Maximum	Mean	Minimum	Maximum	Mean	Minimum
1977	16455	43	91.26	80.87	136.00	109.48	82.95	119.39	97.80	76.17
1978	15240	42	87.27	70.56	212.71	98.52	-15.66	151.67	79.66	7.76
1979	16276	45	20.74	18.44	28.03	25.01	21.99	24.48	22.23	19.99
1980	15902	51	23.44	29.43	38.58	27.61	16.65	47.79	34.67	21.55
1981	15203	42	21.53	34.97	33.35	24.25	15.15	55.74	39.39	23.03
1982	16428	52	62.89	69.21	123.09	76.52	29.96	119.47	84.21	48.96
1983	16997	69	61.30	96.10	106.31	77.16	48.00	179.11	121.00	62.90
1984	16142	71	82.40	99.80	131.58	98.57	65.55	178.30	119.28	60.26
1985	17102	76	223.80	224.50	445.14	282.17	119.20	459.73	283.23	106.73
1986	16300	67	81.42	132.01	156.50	98.30	40.11	229.69	159.39	89.10
1987	16455	72	12.11	23.26	27.26	14.76	2.26	39.49	28.35	17.22
1988	14856	59	34.20	36.30	86.65	37.61	-11.42	62.00	39.95	17.90
1989	15503	94	5.53	47.20	8.57	6.35	4.13	85.05	54.18	23.30
1990	15260	63	2.00	22.00	3.61	2.25	0.89	46.17	24.90	3.63

TABLE 4. Mean catches per trawling, abundance and biomass of cod in Div. 30 by the data from the 1977-1990 trawl surveys

Year	Area, 2 mile	Number of hauls	Mean catch		Abundance, 10 ⁶ spec.		Biomass, 10 ³ T			
			Number, spec.	Weight, kg	Maximum	Mean	Maximum	Mean	Maximum	Mean
1977	16743	42	41.73	42.57	69.98	51.75	33.53	70.64	52.80	34.96
1978	13501	37	21.62	21.78	28.87	21.63	14.38	32.00	21.78	11.57
1979	17259	42	15.13	20.91	29.67	19.35	9.03	48.15	26.74	5.33
1980	16734	48	14.65	29.52	25.24	18.17	11.09	50.78	36.61	22.44
1981	14918	29	12.29	16.07	16.31	13.58	10.86	23.15	17.76	12.37
1982	16775	40	48.17	67.40	102.82	59.86	16.89	130.51	83.74	36.98
1983	17586	45	47.45	46.20	92.11	60.18	28.25	87.45	61.85	36.24
1984	17752	59	112.20	122.20	250.00	160.70	71.37	195.75	147.49	99.24
1985	17648	55	182.48	133.47	503.06	238.54	-25.97	297.95	174.47	51.00
1986	18287	78	128.10	198.70	277.20	171.50	65.80	405.31	266.02	126.73
1987	17875	66	29.77	197.46	71.74	39.42	7.10	575.18	261.47	-52.23
1988	18147	79	13.24	52.30	26.28	17.80	9.32	131.45	70.27	9.09
1989	18240	93	5.24	20.24	10.29	7.08	3.87	37.02	27.35	17.69
1990	13052	52	3.20	33.70	4.40	3.05	1.70	48.34	32.57	16.80

TABLE 5. Mean catches per trawling, abundance and biomass of cod in Div. 3NO by the data from the 1977-1990 trawl surveys

Year	Area, mile ²	Mean catch		Abundance, 10 ⁶ spec.	Biomass, 10 ³ t
		Number, spec.	Weight, kg		
1977	33198	65.6	61.2	161.2	150.6
1978	28741	56.4	47.6	120.2	101.4
1979	33535	17.9	19.7	44.4	49.0
1980	32636	18.9	29.4	45.8	71.3
1981	30121	17.0	25.6	37.8	57.2
1982	33203	55.5	68.3	136.4	168.0
1983	34583	53.6	71.4	137.3	182.8
1984	33894	103.3	106.3	259.3	266.8
1985	34748	202.3	177.8	520.7	457.7
1986	34371	106.0	167.1	269.8	425.4
1987	34330	21.3	113.9	54.2	289.8
1988	33003	22.6	45.1	55.4	110.2
1989	33743	5.4	32.6	13.4	81.5
1990	28312	2.5	27.4	5.2	57.5

TABLE 6. Estimation of abundance (10⁶spec.) and biomass (10³) of cod by the data from trawl and acoustic surveys for 1987-1990

Year	Survey	3K		3L		3NO		3M	
		Abundance	Biomass	Abundance	Biomass	Abundance	Biomass	Abundance	Biomass
1987	Trawl-	132.9	130.5	73.4	131.9	54.2	289.8	36.8	10.2
	Acoustic	136.0	134.8	29.4	45.3	6.7	36.9	40.2	9.3
	Total	268.9	265.3	102.8	177.2	60.9	326.7	77.0	21.6
1988	Trawl-	306.2	331.2	89.4	159.4	55.4	110.2	26.7	7.7
	Acoustic	228.8	143.3	194.9	223.8	135.2	149.8	123.8	26.5
	Total	535.0	474.5	284.3	383.2	190.6	260.0	150.5	34.2
1989	Trawl-	230.0	352.2	123.2	195.5	13.4	81.5	70.4	36.5
	Acoustic	235.6	308.7	62.9	88.3	4.9	26.0	88.7	41.8
	Total	465.6	660.9	186.1	283.8	18.3	107.5	159.1	78.3
1990	Trawl-	276.2	335.6	99.6	123.7	5.2	57.5	4.3	3.9
	Acoustic	193.2	213.4	77.8	101.5	2.6	2.8	14.7	11.3
	Total	469.4	549.0	177.4	225.2	7.8	60.3	19.0	15.2

TABLE 7. Mean number of cod at age 1-18 in catch per half-hour trawling in Divs. 3NO by the data from the 1977-1990 trawl surveys, spec.

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Mean number by age for 1977-1990
1	0.3	0.2	1.5	0.1	0.5	0.8	3.1	1.2	3.4	0.2	0.8	1.9	0.1	-	1.0
2	14.8	3.7	2.1	5.4	0.9	13.4	4.7	17.6	18.0	4.4	11.2	10.0	0.7	0.2	7.6
3	23.0	18.4	3.8	3.6	6.6	10.0	12.4	33.4	64.3	12.4	2.1	7.2	1.7	0.4	14.2
4	13.1	16.8	3.8	2.4	4.2	10.3	9.4	25.1	50.4	41.7	1.0	0.5	1.0	0.6	12.9
5	7.5	10.8	3.4	2.6	1.9	10.2	7.7	12.5	40.3	23.2	1.0	0.2	0.2	0.4	8.7
6	3.7	4.0	1.4	2.2	1.2	3.8	7.6	5.9	12.7	10.2	1.0	0.5	0.2	0.2	3.9
7	1.8	1.6	0.8	1.2	0.8	2.5	3.3	3.5	6.7	4.6	0.8	0.4	0.4	0.1	2.0
8	0.8	0.6	0.4	0.7	0.4	2.0	2.0	1.8	2.8	4.2	0.8	0.4	0.5	0.1	1.2
9	0.3	0.2	0.2	0.3	0.2	1.2	1.9	1.1	1.2	2.5	0.8	0.5	0.2	0.1	0.8
10	0.1	0.1	0.2	0.2	0.1	0.7	0.9	0.8	1.2	1.3	0.7	0.5	0.1	0.2	0.5
11	0.1	+	0.1	0.1	0.1	0.3	0.4	0.2	0.6	0.6	0.5	0.3	0.1	0.1	0.2
12	0.1	+	0.1	+	0.1	0.2	0.1	0.1	0.4	0.4	0.4	0.2	0.1	0.1	0.2
13	+	+	+	+	+	0.1	+	+	0.2	0.2	0.1	0.1	0.1	+	0.1
14	+	-	+	+	+	+	+	0.1	-	+	0.1	-	+	+	+
15	+	-	+	+	+	+	+	0.1	+	+	+	-	+	+	+
16	+	-	+	-	+	+	-	-	+	-	+	-	+	-	+
17	-	-	+	-	-	-	-	-	-	-	-	-	+	+	+
18	-	-	-	-	-	-	-	-	-	+	-	-	+	-	+

Mean number for period 65.6 56.4 17.9 18.9 17.0 55.5 53.6 103.3 202.3 106.0 21.3 22.7 5.4 2.5 53.5 surveyed

TABLE 8. Length composition of cod in NAFO Subarea 3
by the data from the 1989 and 1990 trawl surveys, %.

Length, cm	2K		2L		2N		30		3M	
	1989	1990	1989	1990	1989	1990	1989	1990	1989	1990
9-11	-	-	+	-	2	-	6	-	-	-
12-14	-	-	1	+	3	-	12	-	2	1
15-17	+	-	4	+	19	-	2	-	15	4
18-20	1	1	9	5	55	18	17	9	6	1
21-23	4	1	13	17	77	57	35	14	17	12
24-26	5	5	18	30	67	84	22	41	41	43
27-29	4	12	32	47	133	57	19	27	93	61
30-32	13	21	52	75	127	48	52	55	105	36
33-35	24	18	65	81	110	97	83	50	151	56
36-38	23	32	79	112	84	106	63	58	175	75
39-41	24	52	74	99	58	79	44	55	130	99
42-44	42	79	71	113	33	40	26	73	106	136
45-47	55	62	49	86	25	84	26	64	64	102
48-50	96	98	41	67	17	35	18	59	43	110
51-53	147	139	58	54	16	9	12	64	25	99
54-56	144	136	63	36	14	13	14	45	15	46
57-59	161	159	82	35	5	-	14	27	8	59
60-62	106	89	75	30	9	9	28	18	1	28
63-65	56	47	63	26	10	13	48	5	1	15
66-68	30	22	47	22	5	13	66	14	1	10
69-71	20	10	31	17	12	18	73	9	+	1
72-74	11	7	24	13	10	9	54	18	-	-
75-77	7	3	12	10	6	-	52	5	-	-
78-80	7	4	11	6	5	13	37	23	-	-
81-83	6	1	4	3	2	-	29	18	+	3
84-86	4	-	2	3	-	-	34	5	-	-
87-89	5	-	2	2	-	4	29	9	-	1
90-92	2	-	1	2	6	-	16	14	-	1
93-95	3	-	1	1	5	13	17	5	+	-
96-98	1	-	2	+	4	9	5	18	-	1
99-101	-	-	2	1	2	9	12	23	+	-
102-104	-	-	2	-	6	9	7	23	-	-
105-107	-	-	1	+	7	9	5	37	-	-
108-110	-	-	2	1	5	26	2	5	-	-
111-113	-	-	2	2	4	22	1	23	-	-
114-116	-	-	+	1	18	26	6	23	-	-
117-119	-	-	1	1	13	18	-	9	-	-
120-122	-	-	1	+	7	9	1	9	-	-
123-125	-	-	+	+	6	18	5	9	-	-
126-128	-	-	-	-	6	22	2	18	-	-
129-131	-	-	-	-	6	-	4	5	-	-
132-134	-	-	-	+	-	-	-	5	-	-
135-137	-	-	-	-	-	-	-	-	-	-
138-140	-	-	-	+	-	-	1	9	-	-
No. of fish, %.	1001	998	999	998	999	1000	999	1000	1000	1000
No. of spec.	17513	13183	5670	5248	999	227	832	219	10875	675
Mean length, cm	54.46	51.83	50.09	44.71	41.74	53.30	58.03	61.36	36.92	43.95

TABLE 9. Age composition of cod in NAFO Subarea 3 by the data from the 1988-1990 trawl-surveys, %/oo

Age	3K			3L			3MO			3M		
	1988	1989	1990	1988	1989	1990	1988	1989	1990	1988	1989	1990
1	1	4	2	17	36	1	83	15	62	2	23	6
2	31	48	36	50	181	32	444	130	176	630	13	19
3	45	91	181	176	289	147	319	309	231	315	771	186
4	131	300	289	105	134	358	217	179	162	43	188	707
5	453	321	148	126	148	234	7	35	162	4	4	68
6	253	178	98	242	198	66	20	35	64	4	1	7
7	62	31	80	176	80	76	19	82	33	3	+	4
8	18	15	17	68	17	61	18	92	38	4	+	1
9	3	8	3	23	3	12	20	38	44	-	+	1
10	1	3	3	88	3	6	21	15	82	-	-	-
11	1	3	4	5	4	2	15	15	44	-	-	-
12	1	+	2	4	2	3	9	18	47	+	-	-
13	-	-	2	1	1	2	4	11	4	-	-	-
14	-	-	1	1	1	1	-	11	7	-	-	-
15	-	-	1	-	1	1	-	3	2	-	-	-
16	-	-	1	+	1	+	-	3	2	-	-	-
17	-	-	1	-	1	+	-	2	2	-	-	-
18	-	-	1	-	1	+	-	1	2	-	-	-
Fish number, 999	375	375	375	639	498	415	579	540	277	355	294	238
No. of fish in age sample	511	511	511	315	315	315	316	316	316	316	316	316
Mean age	5.14	5.70	4.98	5.32	4.98	4.79	3.16	5.01	5.80	2.44	3.14	3.87

TABLE 10. Mean catches per trawling, abundance and biomass of cod in Div. 3L by the data from the 1977-1990 trawl surveys

Year	Area, mile ²	Number of hauls	Mean catch		Abundance, 10 ⁶ spec.			Biomass, 10 ³ T		
			Number, spec.	Weight, KG	Maximum	Mean	Minimum	Maximum	Mean	Minimum
1977	28008	58	49.60	38.40	141.96	102.89	63.82	110.24	79.66	49.08
1978	25664	47	19.44	24.58	45.69	36.96	28.22	63.62	46.73	29.85
1979	28956	55	48.72	72.76	139.42	104.51	69.60	196.02	156.07	116.12
1980	30327	62	34.25	58.87	95.33	76.95	58.57	166.57	132.26	97.94
1981	27840	49	31.61	50.09	88.58	65.20	41.83	141.21	103.31	65.40
1982	29079	52	32.57	56.74	82.13	70.18	58.29	145.60	122.22	98.84
1983	31599	83	51.93	86.53	152.32	121.54	90.76	254.13	202.54	150.95
1984	33243	92	126.64	155.66	388.29	311.85	235.42	476.47	383.30	290.13
1985	31509	85	77.41	75.86	246.50	180.70	114.90	236.56	177.06	117.56
1986	33333	108	120.30	177.08	384.13	297.03	209.93	544.53	437.23	329.93
1987	33333	115	29.73	53.83	91.47	73.41	55.34	167.84	132.91	97.97
1988	33333	114	36.20	64.50	119.62	89.43	59.25	224.25	159.37	94.48
1989	33243	122	50.03	79.40	156.84	123.20	89.55	246.98	195.51	144.04
1990	32283	105	41.60	51.70	141.03	99.57	58.11	168.95	123.67	78.40

TABLE 11. Mean catches per trawling, abundance and biomass of cod in Div. 3K by the data from the 1977-1990 trawl surveys

Year	Area, mile ²	Number of hauls	Mean catch		Abundance, 10 ⁶ spec.			Biomass, 10 ³ T		
			Number, spec.	Weight, kg	Maximum	Mean	Minimum	Maximum	Mean	Minimum
1977	24329	50	16.73	14.80	38.09	30.15	22.22	33.99	26.68	19.37
1978	24260	51	6.78	7.58	17.01	12.19	7.37	18.11	13.63	9.14
1979	22963	51	32.53	44.03	88.01	55.34	22.67	109.54	74.89	40.25
1980	23410	57	26.74	39.19	59.31	46.38	33.45	84.28	67.96	51.64
1981	20719	46	12.57	20.05	22.49	19.30	16.11	35.32	30.78	26.23
1982	23614	55	12.56	24.59	25.65	21.96	18.26	50.30	43.01	35.73
1983	26015	75	18.25	28.98	44.90	35.18	25.46	70.87	55.85	40.83
1984	26213	88	152.41	182.98	421.84	295.94	170.03	522.67	355.30	187.92
1985	17947	47	220.65	187.94	420.99	285.99	150.99	348.79	243.59	138.39
1986	26546	97	139.28	139.72	329.71	270.43	211.15	335.45	271.30	207.15
1987	25581	93	70.12	68.88	214.76	132.86	50.96	206.27	130.52	54.76
1988	26546	95	157.70	170.60	530.50	306.15	81.81	563.61	331.21	98.81
1989	26009	96	119.33	182.80	436.46	229.90	23.34	700.57	352.16	3.75
1990	24008	95	154.90	188.20	503.45	276.31	49.17	639.48	335.73	31.99

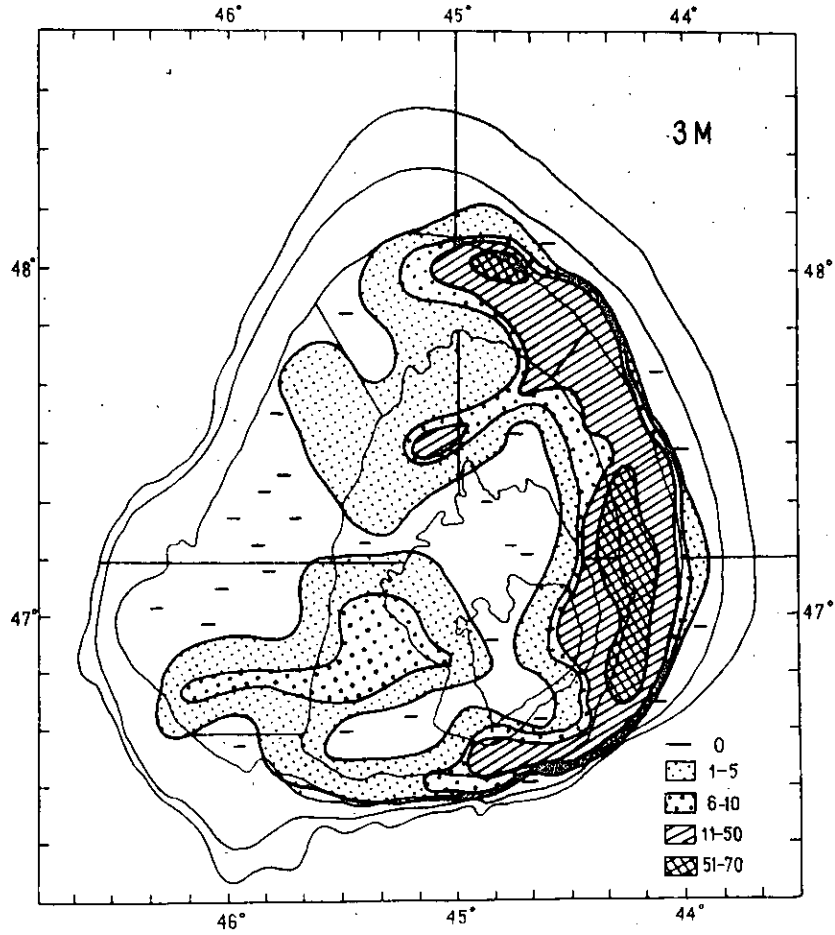


Fig. 1. Distribution of cod on the Flemish Cap Bank by catches (spec.) per trawling

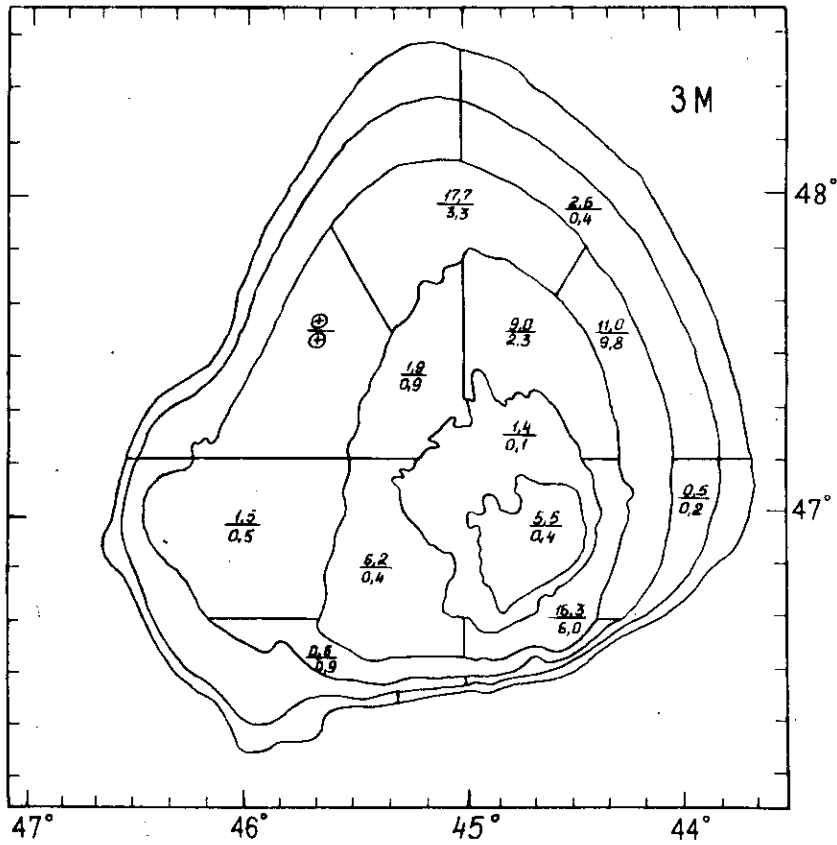


Fig.2. Distribution of cod on the Flemish Cap Bank by the data from acoustic survey in June-July 1990. Density of fish aggregations, expressed in mean units of echointensity by strata is shown by figures: in pelagial (over line), in a bottom layer (below line)

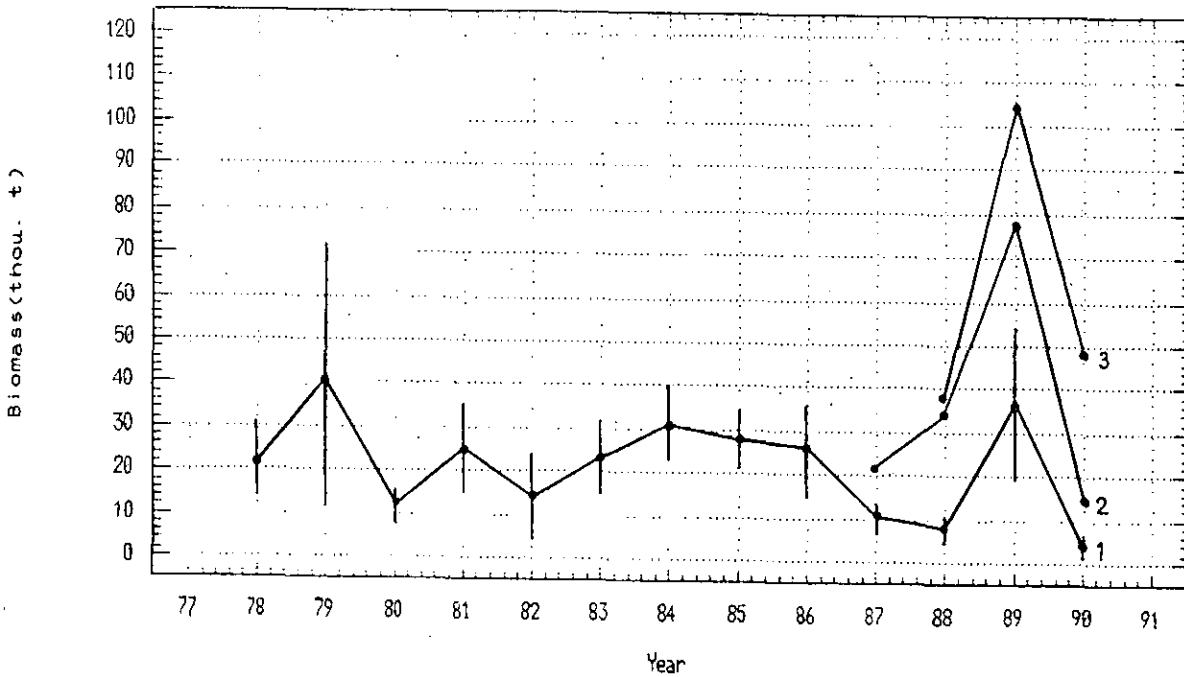
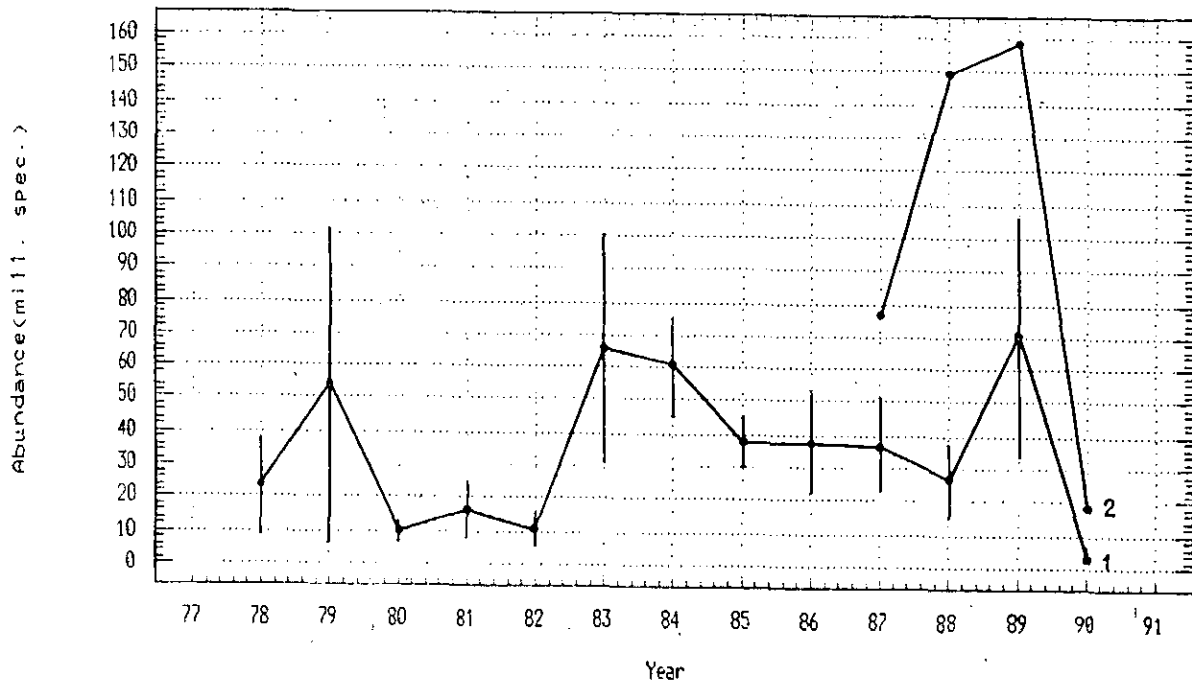


Fig.3. Abundance and biomass of cod on the Flemish Cap Bank.
1 - by estimates from the Soviet trawl surveys.
Vertical lines - maximum and minimum values for stock.
2 - the Soviet trawl-acoustic surveys
3 - EEC trawl surveys

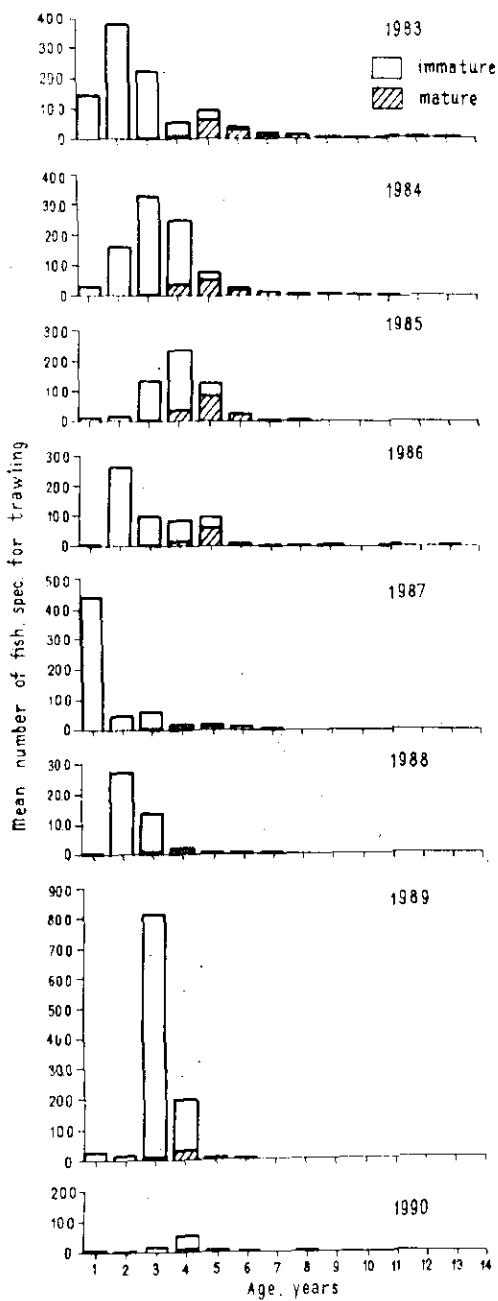


Fig.4. Number of immature and mature cod (spec.) at different age in mean catch per trawling by the data from trawl surveys on the Flemish Cap Bank

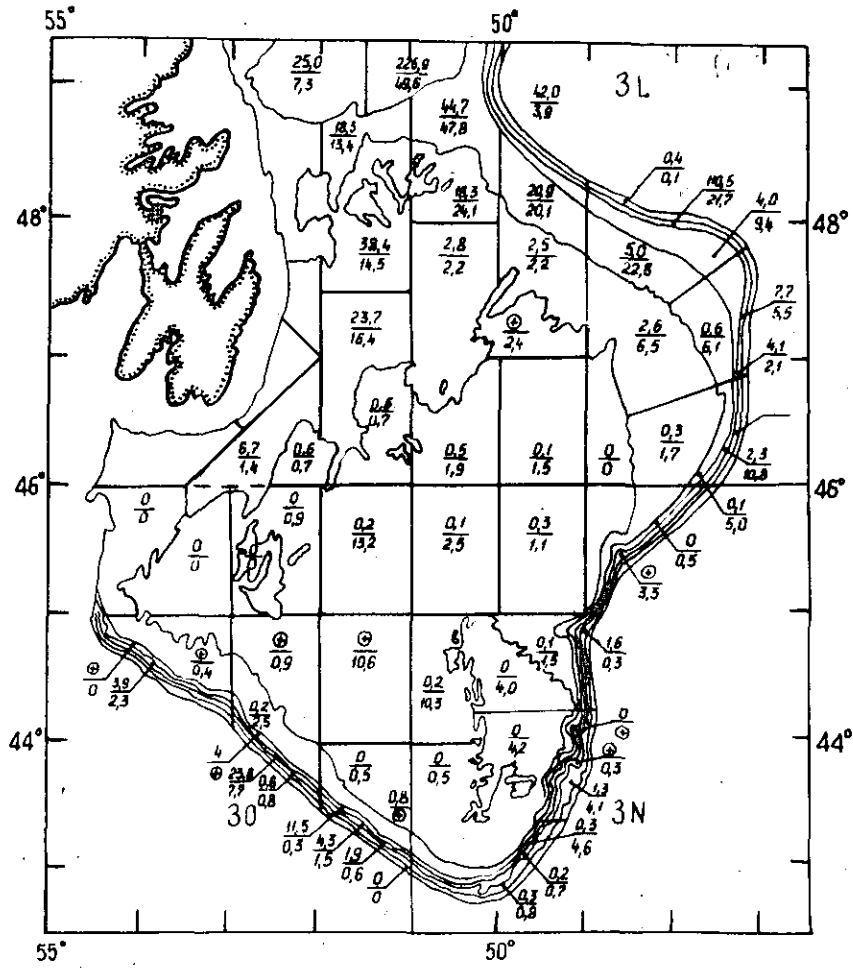


Fig.5. Distribution of cod on the Grand Bank in April-May 1990. See Fig.2 legend.

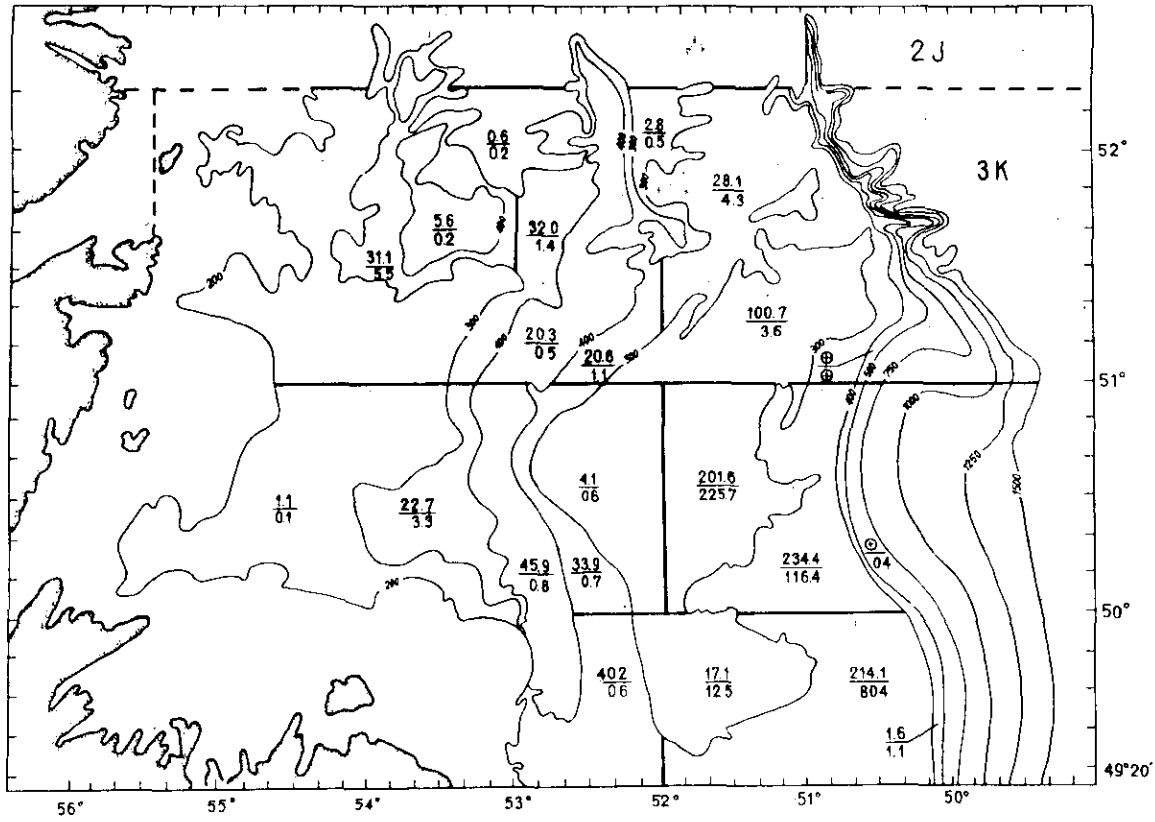


Fig.6. Distribution of cod in Div.3K in June 1990.
See Fig.2 legend.