

Northwest Atlantic



Fisheries Organization

Serial No. N818

NAFO SCR Doc. 84/VI/33

SCIENTIFIC COUNCIL MEETING - JUNE 1984

Distribution, Abundance and Biomass of Cod According to the Data
of Assessment Trawl Survey on the Newfoundland Shelf in 1983

by

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INTRODUCTION

Since 1971 regular observations on cod stock condition have been continued during an ordinary assessment trawl survey by R/V "Suloy" on the Newfoundland Shelf in May-July 1983. Data of the survey, estimates of cod abundance and biomass are presented in this paper.

MATERIAL AND METHODS

In 1983 the survey was carried out by a grid of random stations taking into account stratification of the areas, by the method accepted in NAFO (Doubleday, 1981), as opposed to previous years, when the valid hauls were carried out at the stations with relatively constant coordinates.

On the Flemish Cap where the strata were divided into small numbered area units, position of the next hauls was determined using the method of randomly selected stations. In other areas with no similar division the stations were regularly arranged with respect to the area of strata and regions on the whole. The position of stations was corrected in navigating charts.

On the Flemish Cap where most of hauls (122) were made, their quantity in each stratum was determined according to the area of stratum. In other areas 3 hauls in each stratum were scheduled in connection with a cruise time limitation.

A bottom trawl, with a small-meshed insertion in the bag (12 mm bar), of 1625 type, was used as a fishing gear. The vessel operated at 3.5 knots, and each haul lasted for one hour.

All fish were measured. In exceptional cases the unmeasured fish from large catches were counted. Cod weight was determined by length-weight keys.

In order to calculate the relative indices of abundance and biomass by the sum of hauls in each stratum a mean catch per 1 trawling hour was determined. Mean quantity and weight of fish (in kg) were multiplied by stratum area and quantity of possible hauls in 1 square mile. (During 1 trawling hour the fishing area constituted 0.027 square mile at a speed of 3.5 knots and trawl opening height of 14.3 m. 37.003 hauls could be made in one square mile). The estimates of abundance and biomass obtained for each stratum were summarized by a number of strata with a similar depth and by the area on the whole, and a mean-weighted catch per 1 trawling hour, respective to the area, was determined.

RESULTS

The data on cod mean catches per 1 trawling hour, the abundance and biomass by strata and areas are presented in Tables 1-5.

Figures show that cod were distributed mainly at depths of 500 m and rarely deeper than 550 m.

On the Flemish Cap maximum density of concentrations was observed in the strata 5, 2 and 4. On the Grand Bank shallow the concentrations of cod were observed in the eastern and northern areas. Cod were distributed relatively regularly, and the highest catches were in the stratum 375. Large concentrations of cod were found on the eastern slopes, at depths of 180-360 m and in the strata 378, 380, 368, 371 and 388. In the Notre Dame Bay (3K) the amount of fish in catches increased in the strata, located nearer to the coast.

Comparing the indices of cod abundance and biomass, obtained in 1983 with the data of previous years one may conclude that those indices were higher in almost all the areas compared to previous years (Table 6). Compared to 1982 insignificant reduction of biomass in Div. 30, that of abundance in Div. 3N and their notable increase

in Div. 3L might be due to the redistribution of fish (especially large ones) on the Grand Bank during summer feeding migration (Templeman, 1974, Postolaky, Maleev, 1973). Perhaps, in summer when the bulk of cod from the Labrador stock move to the coast, the cod of the South Newfoundland stock predominated in St. John's area (3L). Similarity of the length frequency curves of fish in three areas confirms this (Fig. 1). The only difference of the curves is that large fish predominated in the north of the bank (3L) and the young - in the south (3NO). In any case cod abundance and biomass, assessed on the Grand Bank on the whole, constituted 218 million spec. and 303.8 thou. t in 1982, and in 1983 - 259 million spec. and 386 thou. t, respectively.

On the Flemish Cap the abundance of cod increased essentially with insignificant increase of biomass. In the Notre Dame Bay those indices were somewhat higher compared to 1982, and lower than in 1980.

To judge by the total estimates of abundance and length-age composition of fish in catches by the areas, the abundance of cod by age groups was determined (Table 7). Mean catches of young fish aged 1-3 per 1 trawling hour in comparison with a long term mean are presented in Table 8.

As is seen from the Tables, the 1981 year class cod aged 2 constituted the bulk of catches on the Flemish Cap. Their abundance was higher than the long term mean, but lower than the abundance of a strong 1973 year class of the same age. Among other year classes the 1980 year class fish at age of 3 and the 1978 year class cod at age of 5 were somewhat more abundant.

In cod stock of the South Newfoundland (Div. 3NO) the specimens aged 3-6 of the 1980-1977 year classes were predominant. To judge by the young fish catches aged 1-2, the 1982 year class should be considered a rich one, and the 1981 year class - did not exceed the mean level.

In July 1983 the Labrador stock was formed by the 1978, 1977, 1975 and 1980 year classes, by the specimens aged 5-7 and 3. However, in spite of the fact that the fish at age of 3 years of the 1980 year class were more abundant than the fish at age of

3 years of the previous 5 year classes their abundance did not amount to the long term mean.

CONCLUSIONS

The total abundance of the Flemish Cap cod was essentially increased owing to rich recruitment in 1983. The abundance of the exploited part of the stock remains at a low level.

Throughout two last yearsb the abundance and biomass of the South Newfoundland cod were noticeably increased due to good and mean -abundant 1977-1980 year classes.

The abundance and biomass of the Labrador cod in 1983 were somewhat higher than in 1982, and, apparently, were close to the long term mean.

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Table I Abundance and biomass of cod on the Flemish Cap
(3M) in May 1983

Depths, m	Stra- tum, No.	Area, mile ²	Quantity of hauls	Mean catch per 1 trawling hour spec.! kg	Abundance, thou. spec.	Biomass, t
I27-I46	I	342	4	428	56,7	5416,3
I47-I82	2	838	10	564	137,7	17488,8
I84-255	3	628	6	129	66,2	2997,7
"	4	348	4	776	303,7	9992,6
"	5	703	7	823	135,9	21408,8
"	6	496	5	142	56,4	2606,2
A total for						
I84-255 m		2175	22	460	124,5	37005,3
257-364	7	822	7	20	34,3	608,3
"	8	646	7	23	19,1	549,8
"	9	314	3	58	32,0	673,9
"	10	951	8	20	40,6	703,8
"	II	806	9	63	75,7	1878,9
A total for						
257-364 m		3539	34	33	42,4	4414,7
366-546	I2	670	10	0,4	1,7	9,9
"	I3	249	3	107	242	985,9
"	I4	602	II	2	2,2	44,6
"	I5	666	9	2	5,0	49,3
A total for						
366-546 m		2187	33	13,4	30,2	1089,7
548-728	I6	684	7	0	0	0
"	I7	216	3	0	0	0
"	I8	210	4	0,5	6,0	3,9
"	I9	414	5	0	0	46,6
A total for						
548-728 m		1474	I9	0,05	0,85	3,9
A total for						
I27-546 m		908I	I03	I94,7	68,5	65414,8
						23008,9

Table 2 Abundance and biomass of cod on the South Newfoundland
(3N) in June 1983

Depths, m	Stra- tum No.	Area, mile ²	Quantity of hauls	Mean catch per 1 trawling hour spec.	Abundance thou. spec.	Biomass, t
55	375	I593	6	354,2	II66,3	20878,6
	376	I499	4	I3,2	I7,7	732,2
A total for						
55 m		3092	10	I88,9	609,5	21610,8
56-91	360	2992	5	71,2	20,6	7882,8
"	361	I853	3	I9,0	78,3	6239,6
"	362	2520	4	I79,0	249,7	I6691,3
"	373	2520	4	56,7	90,7	5287,1
"	374	931	3	I81,0	48,0	2790,4
"	383	674	3	30,0	64,7	748,2
A total for						
56-91 m		II490	22	93,2	I00,3	39639,4
93-I82	359	421	5	85,6	32,4	I333,5
"	377	I00	3	I77,3	35,0	656,I
"	382	647	4	I97,7	88,7	4733,I
A total for						
93-I82 m		II68	12	I55,5	63,8	6722,7
I84-273	358	225	2	I6,5	8,5	I37,4
"	378	I39	2	882,5	584,0	4589,0
"	381	I82	3	I00,3	I09,0	675,5
A total for						
I84-273 m		546	7	264,9	I88,5	535I,9
275-364	357	I64	4	7,2	I0,2	48,7
"	379	I06	4	2II,5	I25,5	829,6
"	380	II6	4	390,0	346,0	I674,0
A total for						
275-364 m		386	12	I78,3	I42,8	2547,3
366-546	723	I55	2	4,0	6,5	22,9
"	725	I05	3	0	0	0
"	727	I60	4	I99,7	I67,7	II82,3
A total for						
366-546 m		420	9	77,6	66,3	I205,2
548-728	724	I24	4	7,0	6,5	32,I
"	726	72	I	0	0	0
"	728	I56	3	0	0	0
A total for						
548-728 m		352	8	4,0	2,3	32,I
A total for						
the area						
55-546 m		I7102	72	I21,8	I92,8	77077,3
						I22024,I

Table 3 Abundance and biomass of cod on the South-western Newfoundland (30) in June 1983

Depths, m	Stra- tum No.	Area, mile ²	Quantity of hauls	Mean catch per trawling hour spec.	Abun- dance, thou. spec.	Biomass, t
56-91	330	2089	3	36	22,0	2782,8
"	331	456	3	124	44,3	2092,3
"	338	1898	3	86	57,6	6039,9
"	340	1716	2	70	90,0	4444,8
"	351	2520	3	318	323,6	29652,7
"	352	2580	4	95	167,6	9069,4
"	353	1282	2	41	2,0	1945,0
A total for						
56-91 m	I2541	20		120,7	126,0	56026,9
						58478,3
93-182	329	1721	3	19	25,7	1210,0
"	332	1047	5	45	6,2	1743,4
"	337	948	3	0,3	0,7	10,5
"	339	585	2	47	61,5	1017,4
"	354	474	3	1	0,3	17,5
A total for						
93-182 m	4775	16		22,6	18,3	3998,8
						3237,9
I84-273	333	151	2	3	6,0	16,8
"	336	121	1	0	0	0
"	355	103	1	0	0	0
A total for						
I84-273 m	375	4		1,2	2,4	16,8
						33,5
275-364	334	92	3	0	0	0
"	335	58	4	0,5	2,2	1,1
"	356	61	3	1	3,0	2,3
A total for						
275-364 m	211	10		0,4	1,5	3,4
						11,5
366-546	717	93	6	0	0	-
"	719	76	2	0	0	-
"	721	76	2	0	0	-
A total for						
366-546 m	245	10		0	0	-
						-
548-728	718	III	1	0	0	-
"	720	105	1	0	0	-
"	722	93	2	0,5	3,5	-
A total for						
548-728 m	309	4		0,3	1,7	-
A total for the area, m						
56-546	I8I47	60		89,4	92,0	60045,9
						61761,2

Table 4 Abundance and biomass of cod in St.John's area
(3L) in July 1983

Depth, m	Stra- tum No.	Area, mile ²	Quantity of hauls	Mean catch per trawling hour spec.	Abundance thou. kg	Biomass, spec. t
56-91	350	207I	3	III,7	204,0	8559,9
"	363	I780	3	IO9,3	I70,0	7199,I
"	371	II2I	2	247,5	433,0	I0266,4
"	372	2460	3	I23,0	208,7	II996,4
"	384	II20	2	203,5	378,5	8433,7
A total for		56-91 m	8552	I3	I47,0	46455,5
93-I82		2I20	2	54,0	II4,0	4236,I
"	348	2II4	2	IO3,0	242,5	8057,I
"	349	28I7	3	5I,7	I32,3	5389,I
"	364	I04I	2	25,5	45,0	982,3
"	365	I320	3	40,0	42,3	I733,4
"	370	2356	3	28,3	42,0	2066,I
"	385	I48I	3	26,0	24,7	366I,5
A total for		93-I82 m	I3249	I8	50,0	I03,0
I84-273		983	3	24,0	3I,7	873,0
"	347	I394	3	6I,0	I02,3	3I46,5
"	366	96I	3	47,7	7I,7	I696,2
"	369	983	3	I68,0	I70,3	6I10,8
"	386	82I	3	66,3	75,7	6I94,5
"	389	282	3	78,7	63,3	20I4,2
"	39I	282	3	78,7	82I,2	2299,7
A total for		I84-273 m	5424	I8	73,0	90,3
275-364		I432	3	42,0	73,3	2225,5
"	345	865	3	I06,3	I50,0	3402,4
"	346	334	6	666,0	II79,0	823I,I
"	368	7I8	4	55,2	77,0	I4575,0
"	387	36I	3	I4I5	I967,7	I890I,7
"	388	I45	3	74,3	85,0	26284,7
"	392	I60	3	0,0	398,6	456,I
A total for		275-364 m	3855	22	242,7	365,0
366-546		90	3	3,0	3,3	I0,0
"	729	II7	3	447,7	475,7	I938,2
"	73I	3I2	6	2,3	4,3	2059,5
"	733	I60	3	0,0	0,0	26,6
"	735	II4	2	0,0	0,0	49,6
A total for		366-546 m	679	I5	78,6	84,4
548-728		93	2	0,0	0,0	-
"	730	96	I	0,0	0,0	-
"	732	I60	3	0,7	I,7	-
"	734	II4	2	I,0	I,5	-
548-728		468	8	0,5	I,0	-
A total for		3I759	86	I04,0	I72,I	I22228,4
56-546 m						202293,6

Table 5 Abundance and biomass of cod in the Notre Dame Bay (3K) in July 1983

Depth, m	Stra- tum No.	Area, mile ²	Quanti- ty of hauls	Mean catch per trawling hour spec.	Abundance, thou. spec.	Biomass, t spec.
20I-300	620	2709	3	57,3	I06,0	I0625,6
"	621	2859	2	34,0	61,0	6453,3
"	624	668	2	36,5	42,0	I038,2
"	632	447	2	22,5	I7,5	289,5
"	634	I618	3	21,3	19,0	II37,5
"	635	I274	3	54,0	69,0	3252,8
"	636	I455	4	I7,7	42,0	2261,2
"	637	II32	4	59,7	86,0	3602,3
A total for						
	20I-300m	I2I62	23	39,8	63,7	I7889,6
						28660,4
30I-400	623	I027	3	58,0	II6,3	44I9,6
"	625	850	3	58,7	I0I,0	3I76,7
"	626	9I9	3	7I,0	I36,7	4648,6
"	628	I085	3	49,7	72,3	2902,7
"	629	495	3	40,3	I995,4	I007,4
"	630	544	3	36,7	55,0	738,I
"	633	2I79	II	II,0	I3,6	886,9
"	638	2059	4	30,7	4I,7	I096,6
"	639	I463	6	I7,3	28,2	I526,6
A total for						
	30I-400m	I062I	39	35,9	57,7	I4099,5
						22665,9
40I-500	622	632	3	I02,0	I9I,0	4466,7
"	627	II94	3	8,3	I3,7	605,3
"	63I	I202	3	I3,0	II,0	489,2
"	640	I98	3	0,0	0,0	0,0
"	645	204	4	I,0	5,2	39,2
A total for						
	40I-500m	3430	I6	26,3	44,I	3337,8
						5600,5
50I-750	64I	584	3	0,3	0,3	-
"	646	333	3	0	0	-
A total for						
	50I-750m	9I7	6	-	-	-
75I-I000	642	93I	4	0	0	-
"	647	409	4	0	0	-
I000-I250	648	232	I	0	0	-
A total for the area,						
	262I3	78	36,4	58,7	35326,9	56926,8
	200-500 m					

Table 6 Mean catches of cod (number of spec./trawling hour), mean weight (kg/trawling hour), indices of abundance (mill.spec.) and biomass (thou.t) according to the data of assessment surveys in 1980-1983

AREA	INDICES	1980	1981	1982	1983
3 K	Spec./hour	64,2	25,4	26,5	36,4
	kg/hour	89,9	39,2	49,3	58,7
	Abundance	60,I	19,2	23,9	35,3
	Biomass	84,2	29,7	44,4	56,9
3 L	Spec./hour	70,6	58,4	69,I	I04,0
	Kg/hour	I20,4	92,8	I2I,6	I72,I
	Abundance	75,7	65,6	74,6	I22,2
	Biomass	I29,2	I04,2	I3I,2	202,3
3 N	Spec./hour	40,0	44,7	I38,4	I2I,8
	Kg/hour	49,3	62,7	I46,9	I92,8
	Abundance	24,2	26,5	84,I	77,I
	Biomass	29,8	37,2	89,3	I22,0
30	Spec./hour	26,8	20,6	94,4	89,4
	Kg/hour	53,7	27,8	I32,7	92,0
	Abundance	I6,7	20,6	59,3	60,0
	Biomass	33,5	27,8	83,3	6I,7
3 M	Spec./hour	28,8	46,9	3I,I	I94,7
	Kg/hour	36,2	68,I	33,8	68,5
	Abundance	9,7	I5,2	I0,4	65,4
	Biomass	I2,2	22,0	II,4	23,0

Table 7 Abundance, mean length and mean weight of
I spec. of cod of different ages in 1983

AREA	AGE	YEAR CLASS	Abundance, thou. spec.	Mean length, cm	Mean weight of I spec., g
3 K	1	1982	28,3	13,00	20,0
	2	1981	2052,5	23,64	116,0
	3	1980	4578,4	33,96	255,7
	4	1979	1829,9	39,32	511,8
	5	1978	8280,6	46,40	859,4
	6	1977	4659,6	53,61	1307,8
	7	1976	2621,3	57,41	1642,1
	8	1975	4564,2	63,91	2122,6
	9	1974	2910,9	67,80	2532,8
	10	1973	1829,9	75,79	3638,3
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3 L	1	1982	1344,5	13,99	20,3
	2	1981	5060,3	25,93	160,5
	3	1980	17454,2	33,91	351,7
	4	1979	10377,2	39,10	515,9
	5	1978	18688,7	47,32	891,6
	6	1977	29567,0	54,34	1392,8
	7	1976	21646,6	60,34	1877,8
	8	1975	6331,4	67,49	2661,3
	9	1974	3031,3	73,60	3550,2
	10	1973	4388,0	77,24	3788,6
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3 N	1	1982	2875,0	14,84	23,6
	2	1981	8617,2	26,32	146,9
	3	1980	14922,2	34,70	362,0
	4	1979	10474,8	38,98	510,7
	5	1978	13041,5	48,14	1005,6
	6	1977	13149,4	57,47	1731,2
	7	1976	5618,9	65,55	2571,8
	8	1975	2350,9	77,96	4553,9
	9	1974	2774,8	86,57	6259,1
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30	1	1982	13456,3	14,54	22,9
	2	1981	7343,6	23,89	116,1
	3	1980	10712,2	32,73	320,1
	4	1979	7812,0	38,42	544,1
	5	1978	6094,7	47,23	926,5
	6	1977	6136,7	55,72	1509,7
	7	1976	2431,9	60,61	1976,7
	8	1975	2095,6	67,80	2778,3
	9	1974	780,6	76,94	3684,0
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3 M	1	1982	4252,0	13,00	14,5
	2	1981	34539,0	23,06	98,9
	3	1980	13017,5	29,27	208,8
	4	1979	2158,7	43,29	620,4
	5	1978	7784,4	49,5	1029,4
	6	1977	1962,4	58,08	1808,9
	7	1976	392,5	68,26	2705,7
	8	1975	785,0	74,84	3743,7
	9	1974	196,2	81,89	4972,6

Table 8 Mean number of young cod per 1 trawling hour of the 1971-1982 year classes aged 1-3

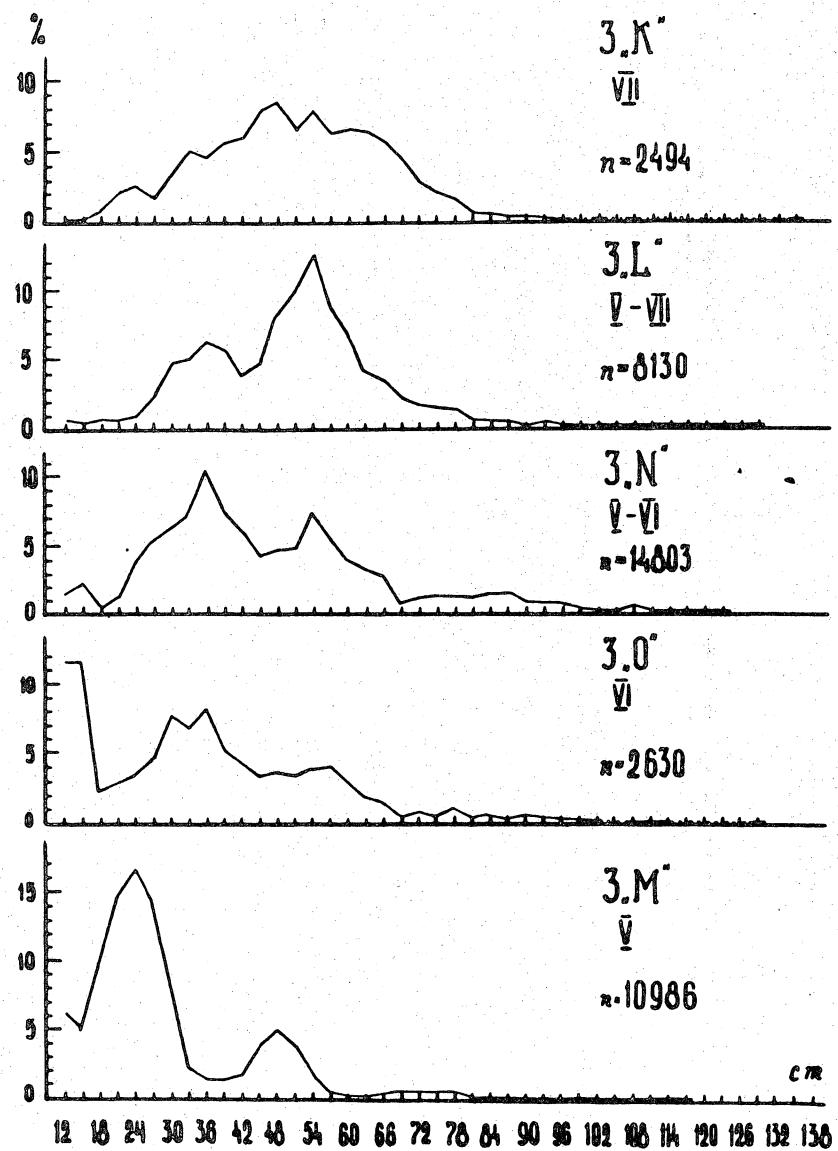


Fig. 1. Length composition of cod on the Newfoundland Shelf in May-July 1983

