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Age Compositions of Cod in Longline Samples in 1984 and an Abundance Estimate
from a Research Vessel Survey in 1985 on the Flemish Cap

by

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Introduction

Catches of cod from the Flemish Cap in the period 1980-83 were in the range 10-14 thousand tons and were poorly sampled (Wells, Borges and Vazquez, 1984). Preliminary catches in 1984 totalled about 11,800 t (Table 1). Samples taken at sea in 1984 by Canadian observers were from the longline fleet only. Preliminary results are available from the Canadian research vessel survey conducted in February 1985.

Commercial Sampling

Samples were obtained at sea from longliners. About 12,000 fork length measurements to the nearest centimeter were taken and 229 pairs of otoliths returned to the laboratory for ageing. The length samples were as follows:

Denmark (Faroes)	August 1325
	September 8440
Norway	September 2178

The age-length key of 229 otoliths was applied to the length frequencies to arrive at the per mille age compositions shown in Table 2. The predominant year-class was that of 1981 as 3-year-old cod. Over 95% of the samples were of ages 3 and 4. Wells et al (1984) showed that the 1980 year-class at age 3 predominated in the commercial catch in 1983.

Research Vessel Survey in 1985

The survey conducted in February 1985 by means of *Gadus Atlantica* was the eighth in the winter series on Flemish Cap beginning in 1978. Tows were of half-hour duration and distributed proportionally to area over the grid of 19 strata by means of the random-stratified design. The catch per half-hour tow has been relatively stable since 1983 (Table 3).

All cod captured were measured. The catch included small specimens since the codend was lined as usual with 1 1/8 inch liner (Fig 1). Not all samples collected have been analyzed, but the age determinations available (704) were used to construct an age-length key. The resultant age composition and average lengths at age show that the population in February 1985 was composed largely of cod of ages 3 and 4 years and of average length less than 50 cm. (Table 4).

Estimates of total biomass and abundance were made by adjusting the catch per tow in the area swept by the trawl to the total area of the bank on a stratum to stratum basis (Fig 2). For the bank as a whole, there were about 28 million individuals. Cod were distributed over a wide range of depths up to 300 fm (Table 5), the greatest numbers occurring in strata 507 and 515. The estimated biomass for the bank as a whole was about

25,000 t, about 10,000 t of which was from strata 507 and 515. Best catch rates (kg/tow) were in strata 515, 509, 507 and 513 (Table 5). The occurrence of cod in relative abundance in deeper water is rather unusual.

Estimates of total mortality

Estimates of total mortality (Z) were obtained from the survival rates of groups of year-classes where abundances were estimated from research vessel surveys (Table 6). Z-values have been in the order of 1.0 on age-groups 4 years and older over the period 1978-1985.

Conclusions

Catches of longline in August and September 1984 were composed almost entirely of ages 3 and 4 fish. In February 1985, the population as indicated by research vessel survey consisted of about 25,000 t mostly of ages 4 and younger. Total mortality values have been in the order of 1.0 in the period 1978-85.

Reference

Wells, R., M. F. Borges, and A. Vazquez. 1984. Status of the Cod Stock in Division 3M. NAFO SCR Doc., No. 84/94, Serial No. N889, 9 p.

Table 1. Reported nominal catches by country of cod on Flemish Cap in 1984 (tons).

Country	Catch
Spain	4,745
Cuba	5
Deu	454
Japan	9
Norway	47
Portugal	3,474
Den(F)	3,058
Total	11,792

Table 2. Per mille age compositions and average length-at-age for cod taken in the longline fishery of Denmark (Faroes) and Norway on the Flemish Cap in 1984.

Age	August (Den F)		September Den (F)		September (Norw)	
	Number %	Average length cm	Number %	Average length cm	Number %	Average length cm
3	755	48.5	561	49.9	497	52.7
4	230	60.4	392	64.2	460	64.5
5	4	68.6	11	69.4	13	68.5
6	8	82.9	18	83.1	16	82.8
7	4	84.9	15	86.2	11	86.4
8						
9			3	84.4	2	85.1
10						
11			1	95.1	1	98.5
Total	1001		1001		1000	

Table 3. Catch per half-hour tow in Canadian surveys on the Flemish Cap, 1978-85 (kg).

Year	Kg/Half-hour Tow
1978	105
1979	39
1980	45
1981	52
1982	13
1983	37
1984	25
1985	32

Table 4. Age composition and average length at age of cod taken in February 1985 by Gadus Atlantica.

Age	per mille frequency	average length (cm)
1	2	13.0
2	35	21.4
3	233	30.6
4	682	45.3
5	35	66.6
6	2	76.0
7	4	88.9
8	3	91.4
9	+	(94)
10	1	104.5
11	1	106.8
12	1	106.7
13	1	110.5
14	+	(120)
Total	1000	

Table 5. Abundance estimates of cod on the Flemish Cap in February 1985 by stratum and in total.

GADUS 105 / 1985 / COD / 3M

ANALYSIS FOR TRIP 105 1985

VESSEL 20
ICNAF 3M

SPECIES 0438

NUMBERS

STRATUM	NO.SETS	TOTAL	AV./SET	UNITS	TOTAL NO	VAR.
501	4	14.10	3.52	25672.	90494.	6.77
502	10	189.00	18.90	62904.	1188881.	461.43
503	8	305.00	38.13	47140.	1797225.	1104.98
504	4	93.00	23.25	26122.	607345.	916.92
505	8	411.00	51.38	52770.	2711066.	5512.83
506	6	398.00	66.33	37232.	2469712.	5138.66
507	10	814.00	81.40	61703.	5022606.	4753.59
508	8	105.00	13.13	48491.	636451.	116.98
509	4	358.00	89.50	23570.	2109529.	4907.00
510	12	115.00	9.58	71386.	684116.	14.63
511	10	460.00	46.00	60502.	2783081.	1602.00
512	8	256.00	32.00	50293.	1609377.	841.43
513	3	28.00	9.33	18691.	174449.	129.33
514	7	236.77	33.82	45189.	1528469.	1464.09
515	8	706.00	88.25	49993.	4411862.	16394.78
516	8	0.0	0.0	47591.	0.	0.0
517	3	0.0	0.0	16214.	0.	0.0
518	3	0.0	0.0	15763.	0.	0.0
519	5	1.00	0.20	31077.	6215.	0.20

TOTAL	TOTAL	UPPER	LOWER	MEAN	AVERAGE	UPPER	LOWER
27830816.	35098928.		20562688.	35.13	44.30		25.95

EFFECTIVE DEGREES OF FREEDOM= 31
STUDENTS T-VALUE= 2.04 ALPHA=0.05

GADUS 105 / 1985 / COD / 3M

ANALYSIS FOR TRIP 105 1985

VESSEL 20
ICNAF 3M

SPECIES 0438

WEIGHTS

STRATUM	NO.SETS	TOTAL	AV./SET	UNITS	TOTAL NO	VAR.
501	4	33.02	8.26	25672.	211954.	201.28
502	10	107.40	10.74	62904.	675587.	131.09
503	8	159.00	19.88	47140.	936914.	653.12
504	4	21.75	5.44	26122.	142040.	35.68
505	8	167.50	20.94	52770.	1104874.	614.82
506	6	209.00	34.83	37232.	1296909.	2997.67
507	10	740.00	74.00	61703.	4566006.	5761.77
508	8	80.50	10.06	48491.	487946.	207.25
509	4	370.50	92.63	23570.	2183186.	2974.56
510	12	127.30	10.61	71386.	757287.	46.90
511	10	330.70	33.07	60502.	2000792.	1064.73
512	8	305.00	38.13	50293.	1917421.	1358.05
513	3	212.00	70.67	18691.	1320829.	13546.33
514	7	286.77	40.97	45189.	1851243.	1919.55
515	8	917.00	114.62	49993.	5730421.	38368.76
516	8	0.0	0.0	47591.	0.	0.0
517	3	0.0	0.0	16214.	0.	0.0
518	3	0.0	0.0	15763.	0.	0.0
519	5	1.00	0.20	31077.	6215.	0.20

TOTAL	TOTAL	UPPER	LOWER	MEAN	AVERAGE	UPPER	LOWER
25189584.	34433232.		15945929.	31.79	43.46		20.13

EFFECTIVE DEGREES OF FREEDOM= 15
STUDENTS T-VALUE= 2.13 ALPHA=0.05

Table 6. Catch at age of cod on the Flemish Cap by the research vessel Gadus Atlantica, 1978-85. Numbers are in 000's available to the research gear.

Age		1978	1979	1980	1981	1982	1983	1984	1985
1		-	-	-	32	628	293	43	56
2		95	4,675	1,030	-	1,781	71,001	1,526	974
3		4,757	1,067	19,475	5,172	21	7,824	15,833	6,485
4		15,531	5,610	2,377	15,479	1,663	319	1,897	18,981
5		45,688	5,437	2,990	975	978	2,357	73	974
6		12,135	6,712	2,737	2,108	32	958	645	56
7		476	1,706	3,912	1,041	150	45	426	111
8		181	108	160	2,069	137	84	12	83
9		65	55	23	102	219	68	44	+
10		154	20	6	23	11	237	63	28
>10		169	224	35	17	11	11	98	83
Total		79,251	25,614	32,745	27,018	5,631	83,197	20,660	27,831
Total	3+	79,156	20,939	31,715	26,986	3,222	11,903	19,091	26,801
	4+	74,399	19,872	12,240	21,814	3,201	4,079	3,258	20,316
	5+	58,868	14,262	9,863	6,335	1,538	3,760	1,361	1,335
	6+	13,180	8,825	6,873	5,360	560	1,403	1,288	361
\bar{x}	3+/4+		1.38	0.54	0.37	2.13	-0.24	1.30	-0.06
	4+/5+		1.65	0.70	0.66	2.65	-0.16	1.10	0.89
	5+/6+		1.90	0.73	0.61	2.43	0.09	1.07	1.33

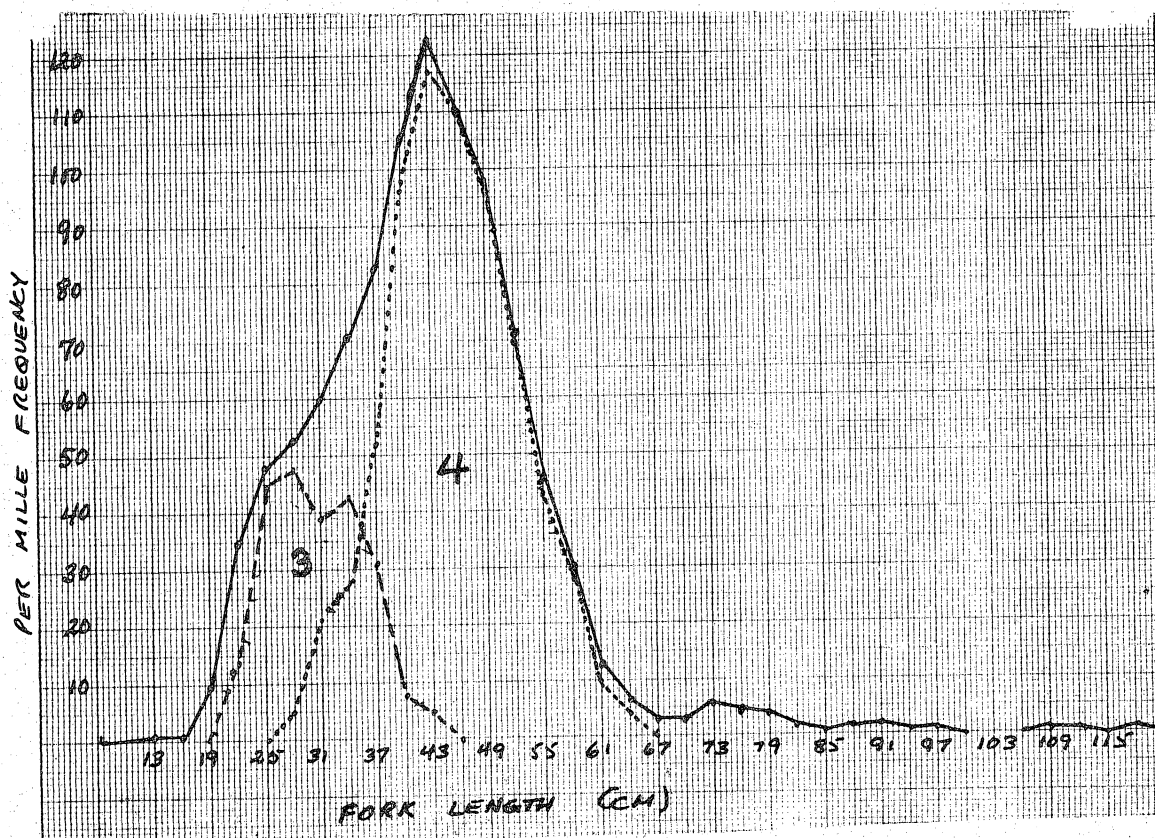


Figure 1. Length distribution of cod taken on the Flemish Cap in February 1985 by Gadus Atlantica. The length distributions of ages 3 and 4 (as determined by the use of an age-length key) are superimposed.

Stratum No.	Depth range (FM)	# rectangles	Total area (Sq. nautical miles)
1	70-80	10	341.8
2	80-100	25	837.9
3	100-140	18	627.8
4	"	10	347.8
5	"	20	703.4
6	"	15	496.1
7	140-200	24	821.8
8	"	19	646.1
9	"	9	314.3
10	"	28	951.3
11	"	24	806.1
12	200-300	20	670.4
13	"	7	248.6
14	"	17	602.0
15	"	20	665.7
16	300-400	19	634.1
17	"	6	621.7
18	"	7	604.3
19	"	12	413.9

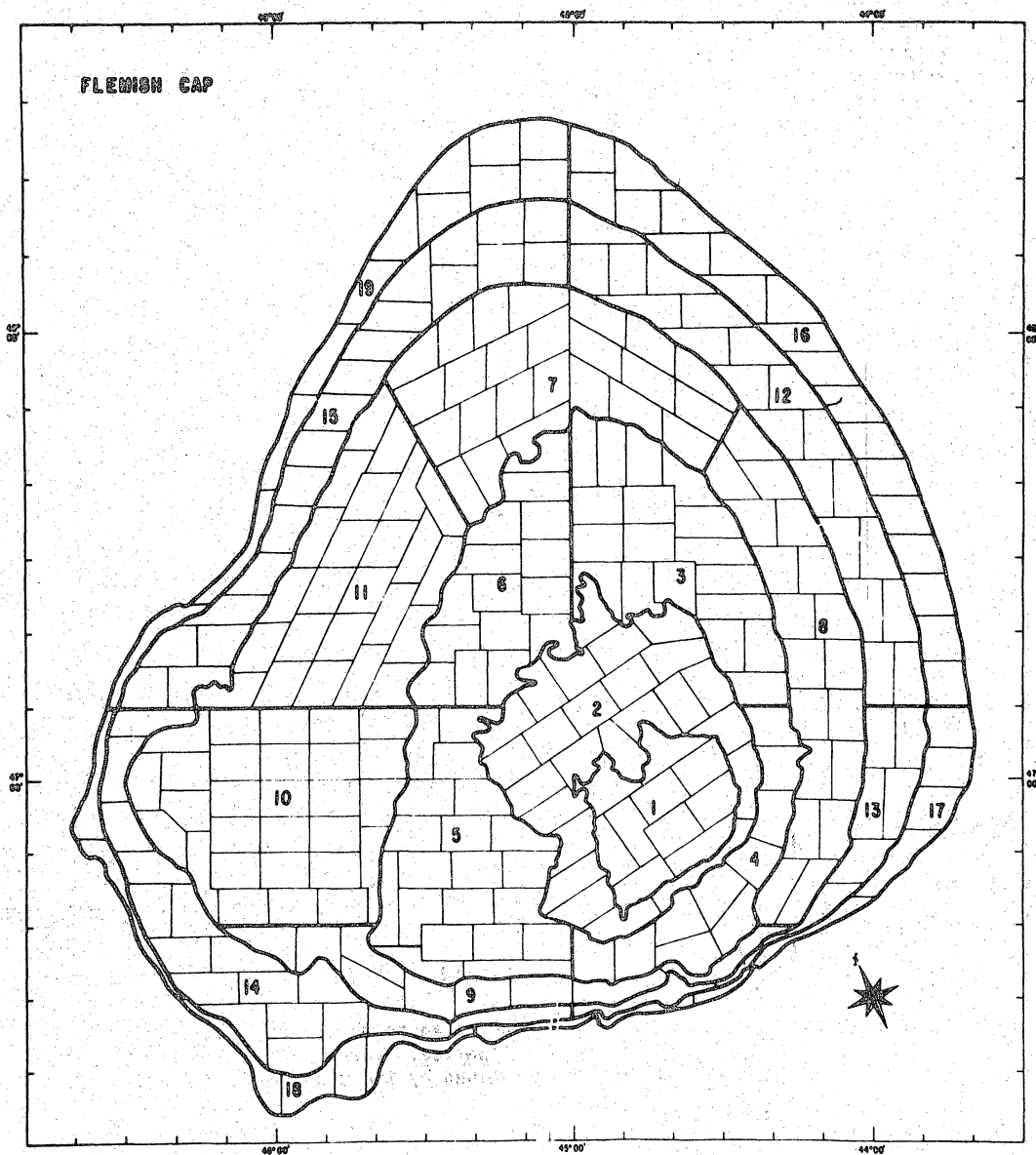


Fig. 2 Stratification chart showing the 19 strata used on Flemish Cap