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An Examination of Age Compositions estimated for Cod of the
Flemish Cap in the period 1977-82.

by

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INTRODUCTION

At the June 1982 meeting of STACFIS it was apparent that age compositions of cod from the Flemish Cap as estimated by Soviet and Canadian researchers differed substantially. An exchange of otoliths has shown that the discrepancies arose from differences in the interpretation of ages from otoliths and were not merely the result of sampling variation.

The Canadian data are presented here in order to expose any internal inconsistencies and thus contribute to the definition and solution of the ageing problem.

MATERIALS AND METHODS

In January-February of each year in the period 1977-82, survey cruises were conducted on the Flemish Cap using the random-stratified sampling design. All cod caught were measured (fork length) except for 204 kg of a total catch of 1388 kg in one set made in 1978. The remaining cod from this set were measured and the length frequency was adjusted by the ratio of weight caught to weight measured (Table 1). During the course of each cruise a minimum collection of 25 pairs of otoliths at each 3 cm group was aimed for, and in some years the minimum was exceeded. The length compositions for these cruises were adjusted by the areal expansion method to approximate that of the population available to the gear.

In November 1978 all cod were measured and an otolith sample taken during a cruise in which the diurnal movements of redfish were studied. The length composition for this cruise has not been adjusted and presumably is less representative than those from the surveys. Age-length keys (Table 2) were constructed for each cruise and applied to the length compositions. The per mille age and length compositions are shown in Tables 3 and 4, while average lengths-at-age are shown in Table 5. All ages were interpreted from the otoliths by the author.

RESULTS

The length frequencies for 1977 and 1978 are strongly bimodal (Fig. 1). The length frequency for 1979 contains 3 or 4 modes. When the length frequencies by age group are superimposed, the progression of year-classes especially those identified as the 1973 and 1974 year-classes is clearly seen.

Since 1979 the year-class identified as that of 1977 predominated up to 1981. In 1982 cod of ages 1, 2, 4, and 5 were predominant whereas 3-yr-old cod (1979 year-class) were scarce.

From average length-at-age estimates (Table 5) for the 73, 74, and 77 year-classes, it is clear that the 1977 year-class is estimated to have been about one year's growth larger than the 73 and 74 year-classes at corresponding ages. This discrepancy in growth implies either a consistent ageing error or a substantial increase in growth for this year class. It is clear that the estimates for cod of ages 2-5 are higher in the 1980s than in the latter part of the 1970's.

The increases in length-at-age from 1977 to 1978, especially for the 1971-73 year-classes, are quite small. In fact, it appears that lengths-at-age for 1977 are high in relation to those of 1978-80.

Table 1. Sampling of cod on the Flemish Cap by Canadian research vessels in the period 1977-82. ATC 257 means cruise # 257 of the research vessel A.T. Cameron. Gadus 5 means cruise #5 of the research vessel Gadus Atlantica.

Date	Ship and cruise	# successful sets	Sets with cod	# of cod measured ¹	# of otoliths collected
Feb.77	ATC 257	35	35	3,124	533
Jan-Feb/78	Gadus 5	134	129	13,534	1,883
Nov.78	ATC 284	34	33	1,237	444
Jan-Feb/79	Gadus 17	95	81	3,194	992
Jan.80	Gadus 30	130	102	5,209	691
Jan.81	Gadus 45	142	105	4,778	723
Jan-Feb/82	Gadus 61	109	94	1,019	466

¹ All cod were measured except for Gadus 5 where 13,619 cod were caught and 13,534 measured.

Table 2. Age length keys for each of 7 research vessel cruises, all of which were conducted in January - February of the year specified except for ATC 284 which was conducted in November.

Table 2. continued

COD 3M 1978
ORIGINAL AGE/LENGTH KEY

Table 2. continued

LENGTH	AGES													TOTAL									
	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30
7.0	2																						2
10.0	6																						6
13.0	1	2																					3
16.0	0	15																					15
19.0		25																					25
22.0		1																					25
25.0		24																					25
28.0		21	3	1																			25
31.0			16	1																			25
34.0			21	4																			25
37.0			3	23																			26
40.0				21	6	1																	26
43.0				11	14	1																	26
46.0				4	21	2																	27
49.0				5	15	8																	27
52.0				7	17	2																	27
55.0				1	20	2																	27
58.0					19	6																	27
61.0					13	9																	27
64.0					11	9																	27
67.0					6	5	1																27
70.0					4	8																	27
73.0					1	11																	27
76.0					2	1																	27
79.0					2																		27
82.0					1																		27
85.0						1																	27
88.0							1																27
91.0							1																27
97.0								1															27
100.0								1															27
103.0								1															27
106.0									1														27
109.0									1														27
130.0										1													27
	9	87	44	65	66	108	55	5	0	0	4	0	0	1	0	0	0	0	0	0	0	0	444

AGES

Table 2. continued

COD 3M 1981 GADUS 45
ORIGINAL AGE/LENGTH KEY

Table 2. continued

LENGTH	AGES																											TOTAL	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
10.0	1																												1
13.0		2																											2
16.0	2																												2
28.0	0																												2
31.0																													24
34.0																													35
37.0																													36
40.0																													36
43.0																													35
46.0																													35
49.0																													35
52.0																													35
55.0																													36
58.0																													35
61.0																													35
64.0																													35
67.0																													35
70.0																													35
73.0																													37
76.0																													35
79.0																													29
82.0																													31
85.0																													27
88.0																													19
91.0																													17
94.0																													20
97.0																													6
100.0																													7
103.0																													2
106.0																													3
109.0																													1
115.0																													1
0	5	0	1	2	1	6	4	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	723

COD 3M 1982 GADUS
ORIGINAL AGE/LENGTH KEY

Table 2. continued

1410:

AGES

LENGTH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	TOTAL
7.0	2																														2	
10.0	6																														6	
12.0	10																														10	
22.0		4																													4	
25.0			10																												10	
28.0				34																											34	
31.0					46																										46	
34.0						34																									34	
37.0							3																								3	
40.0								4																							4	
43.0									5																						5	
46.0										10																					10	
49.0											29																				29	
52.0												27																			27	
55.0													3																		3	
58.0														13																	13	
61.0															16																16	
64.0																2															2	
67.0																	27														27	
70.0																		1													1	
73.0																			5												5	
76.0																				4											4	
79.0																					1										1	
82.0																						8									8	
85.0																							3								3	
88.0																								1							1	
91.0																									2						2	
94.0																										2					2	
97.0																											6				6	
100.0																												4			4	
103.0																													1		1	
106.0																																1
109.0																																1
112.0																																1
115.0																																1
	0	18131	4116102	4	24	23	40	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	466

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Table 3. Length compositions of cod taken on the Flemish Cap by Canadian research vessel in 1977-82

Length 3cm gp.	Feb. 1977	Jan-Feb. 1978	Nov. 1978	Jan-Feb. 1979	Jan. 1980	Jan. 1981	Jan-Feb. 1982
6-8			1.6				1.9
9-11	.3		4.9			.4	68.8
12-14	0		2.4			.4	40.6
15-17	7.4	.1	12.1	1.0	.7	.4	0
18-20	25.8	.9	95.4	4.1	5.5	0	0
21-23	39.9	1.6	270.8	45.8	11.8	0	4.0
24-26	97.8	17.0	99.4	116.7	13.4	0	9.9
27-29	80.2	36.6	15.4	35.5	10.5	.4	58.8
30-32	30.9	53.2	23.4	12.2	44.2	6.1	159.4
33-35	23.3	72.9	45.3	16.8	186.8	42.5	81.4
36-38	47.3	65.2	111.6	50.1	271.3	84.5	2.9
39-41	176.5	47.7	75.2	121.2	115.6	61.4	7.5
42-44	124.4	84.2	46.9	102.7	23.0	72.3	5.0
45-47	25.6	141.4	29.9	90.0	13.4	167.2	17.2
48-50	99.5	149.7	33.1	82.9	20.6	199.1	64.7
51-53	69.4	113.5	28.3	63.4	31.5	129.5	100.0
54-56	49.3	74.7	25.1	73.5	46.5	39.5	105.4
57-59	34.6	47.3	19.4	54.5	43.2	22.9	56.1
60-62	22.5	30.1	16.2	37.7	34.8	31.8	47.5
63-65	13.5	22.3	11.3	22.5	33.1	35.6	55.7
66-68	4.9	13.1	9.7	20.7	25.5	24.5	19.5
69-71	2.5	9.4	10.5	13.6	15.2	23.5	9.7
72-74	3.2	5.0	2.4	7.6	15.2	13.3	6.9
75-77	5.1	2.7	0	5.4	9.4	8.4	10.9
78-80	4.3	1.6	1.6	3.6	9.6	6.5	17.9
81-83	1.4	1.5	.8	3.5	7.7	6.9	7.9
84-86	3.9	1.7	0	1.3	4.4	5.7	9.9
87-89	2.5	1.7	.8	1.4	2.5	4.2	3.9
90-92	1.0	1.0	1.6	.4	1.8	3.6	1.9
93-95	1.0	.6	0	1.5	.7	4.9	2.0
96-98	0	.4	.8	.8	.4	1.5	4.9
99-101	.6	.6	.8	1.4	0	1.4	5.8
102-104	.3	.9	.8	2.2	.4	.4	3.1
105-107	0	.3	.8	.3	.2	.6	4.9
108-110	0	.3	.8	.4	.2	.2	1.9
111-113	0	.5	0	1.2	.4	0	.9
114-116	.3	.2	0	.4	0	.2	.9
117-119	.3	.1	0	.4	.4		
120-122	.5	.1	0	1.2	.2		
123-125		.3	0	.8			
126-128			0	0			
129-131			.8	.8			
Total	1000.0	1000.4	999.9	999.5	1000.1	999.8	999.7

Table 4. Age compositions of cod on the Flemish Cap, 1977-82

Age	Feb. 1977	Jan-Feb. 1978	Nov. 1978	Jan-Feb. 1979	Jan. 1980	Jan. 1981	Jan-Feb. 1982
0	-	-	7.3	-	-	-	-
1	.3	-	452.7	-	-	1.2	111.4
2	45.6	1.2	62.2	182.5	31.4	-	316.4
3	219.5	60.0	165.7	41.6	594.8	191.4	3.7
4	581.4	196.0	136.6	219.0	72.6	572.9	295.4
5	127.3	576.5	118.8	212.3	91.3	36.1	173.8
6	16.4	153.1	48.5	262.0	83.6	78.0	5.7
7	3.5	6.0	4.0	66.6	119.5	38.5	26.6
8	.3	2.3	-	4.2	4.9	76.6	24.3
9	3.8	.8	-	2.1	.7	3.8	38.9
10	.8	1.9	3.2	.8	.2	.9	1.9
11	.3	.9	-	1.2	-	.2	.9
12	-	.2	-	.4	.5	-	-
13	.5	.4	.8	2.0	.2	.4	-
14	-	.5	-	1.1	-	-	-
15	-	.1	-	.4	-	-	-
>15	.3	.1	-	3.6	-	-	.9
Total	1000.0	1000.0	999.8	999.8	999.7	1000.0	999.9
Population Number Millions	46.8	79.2	-	25.6	32.7	27.0	5.6

Table 5. Average length-at-age of cod taken on the Flemish Cap, 1977-82 by Canadian research vessel. Average lengths based on at least 10 age determinations only are shown.

Age	1977	1978	1978 ¹	1979	1980	1981	1982
2	20.15	19.46	27.83	24.49	22.86	-	30.97
3	26.05	27.92	36.63	29.47	36.15	37.53	-
4	44.46	35.29	41.70	40.64	40.40	48.08	52.31
5	56.79	48.40	53.36	45.77	54.26	52.24	60.85
6	77.05	58.19	62.31	56.07	59.48	62.50	66.82
7	81.70	77.56	-	65.07	69.37	66.43	74.57
8	-	87.24	-	86.72	81.16	75.73	79.19

¹ These average lengths from November 1978. All other lengths were from cod collected in January-February of the year specified.

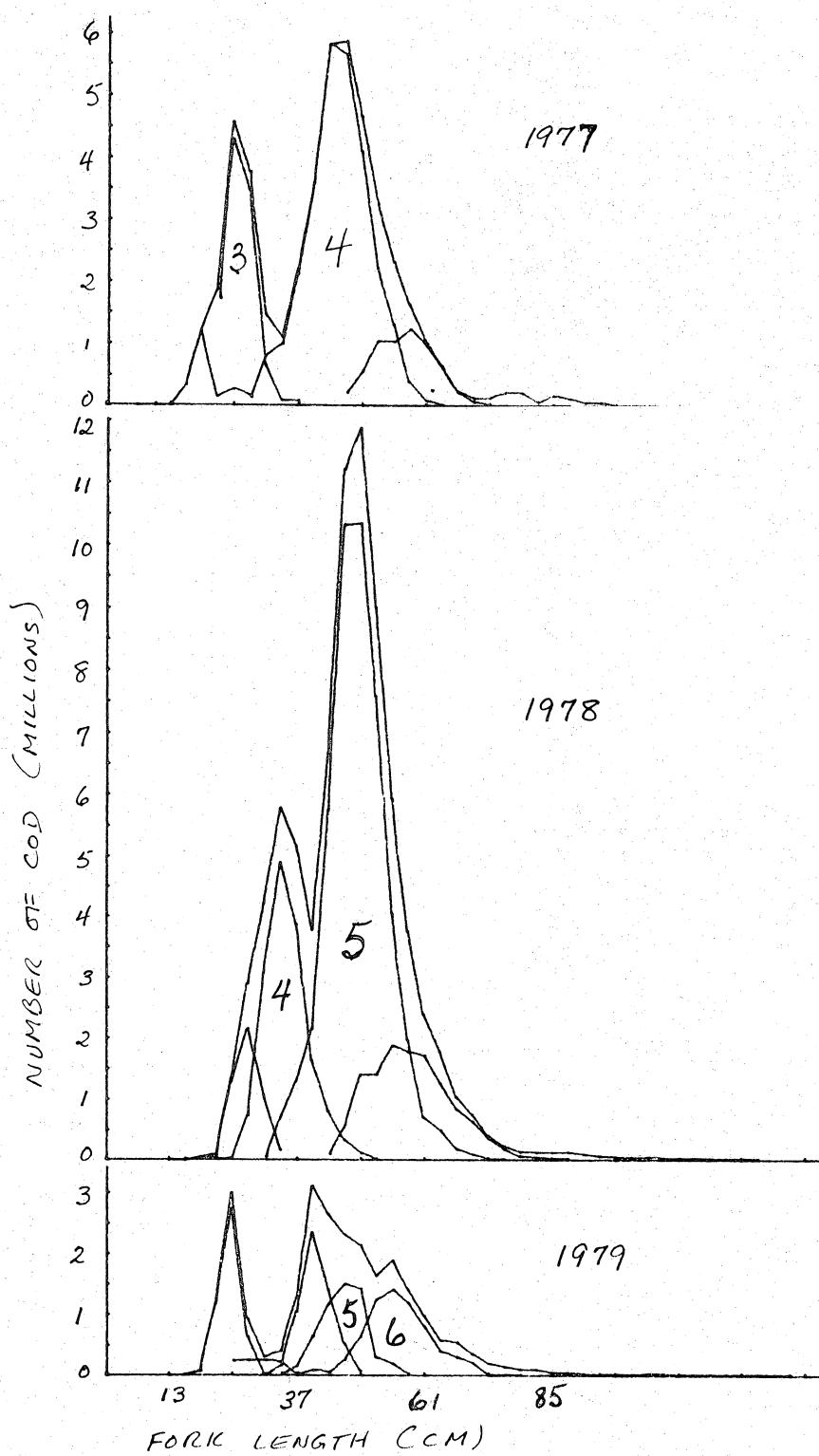


Fig. 1. Length compositions of cod (millions) on the Hemish Cap in the period 1977-1979. The 1973 and 1974 year-classes are identified as ages 4-6 and 3-5 respectively.

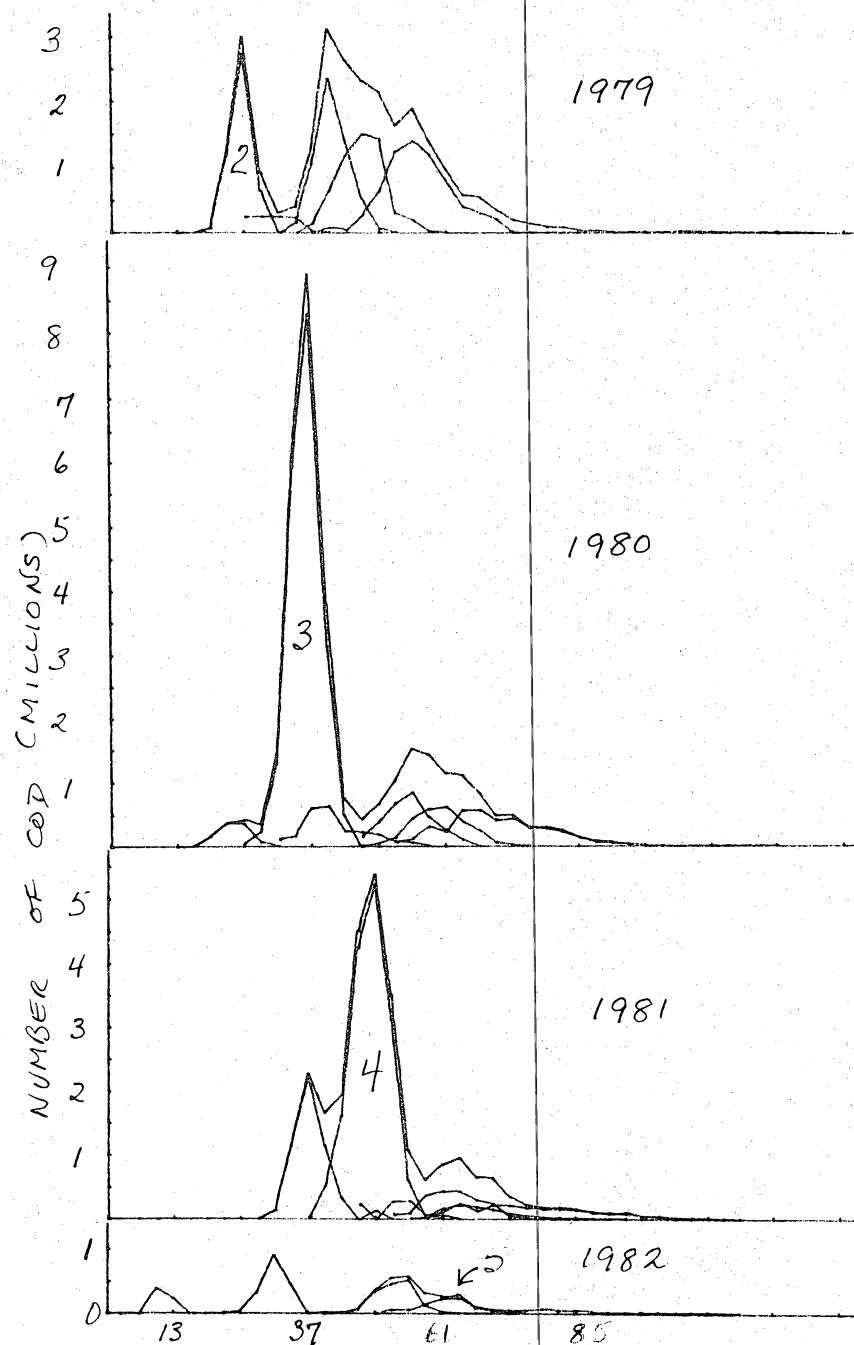


Fig. 2. Length compositions of cod (millions) on the Hemish Cap in the period 1979-82
The 1977 year-class is identified at ages 2-5

