Northwest Atlantic Fisheries Organization

Serial No. N1358

NAFO SCR Doc. 87/69

SCIENTIFIC COUNCIL MEETING - JUNE 1987

Capelin (Mallotus villosus) Biomass Estimates from Hydroacoustic Surveys in NAFO Div. 3NO (1986) and Div. 3L (1987)

by

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Introduction

Biomass estimates are presented for the NAFO Div. 3NO capelin stock from an acoustic survey carried out during the period June 26-July 5, 1986 and for the Div. 3L stock from a survey during the period May 15-June 1, 1987. These surveys are part of continuum of hydroacoustic surveys conducted by Canada on capelin stocks since 1977.

Materials and Methods

Data were collected using the HYDAS acoustic system (Stevens 1986). Collected raw acoustic data were corrected to an ideal TVG of 20 log R + 2α R (α = 0.0120dB/m) and were then analyzed by echo integration (Miller 1985). Fishing sets were conducted on an opportunistic basis throughout the survey and random length-sex-maturity samples of 200 capelin were taken from each set. A stratified age sample of 2 fish per half centimeter group for each sex was then taken from the length-sex-maturity sample to provide an age length key. Data were combined for each survey block to provide age and length compositions.

Results

Figures 1 and 2 show the survey blocks, acoustic cruise track, and fishing set locations for each of the two surveys. There were three transects in the gap in Block B (Fig. 1) that could not be analyzed due to problems with the data recording component of the hydroacoustic data acquisition system. Age and length compositions from each of the surveys are shown in Figures 3 and 4. Large mature 4-year-old capelin of the 1983 year-class were predominant in the southern half of Block A and in Block D. Immature 2-year-old capelin of the 1985 year-class were predominant in Blocks B and C.

Tables 1 and 2 give a summary of the hydroacoustic data used for the biomass estimates for each of the two surveys. The survey blocks for Div. 3L are identical in size and location to last years survey (Miller 1986) except for a 1.6% increase in size for Block D due to an adjustment in the location of survey transects.

Biomass for Div. 3L was estimated at 2,576,000 t and for Div. 3NO at 495,000 t. Coefficients of variation due to sampling and the relative contribution of inter-transect versus intra-transect variance (the delta parameter) were calculated using a cluster sampling model as with previous surveys (Nakashima 1981).

Tables 3 and 4 provide the historical biomass estimates from acoustic surveys in the same time periods for these two stocks.

References

Miller, D. S. 1985. The use of hydroacoustic surveys to estimate capelin biomass in NAFO Divisions 2J + 3KLNO. NAFO SCR Doc. 85/105, Ser. No. N1081.

1986. Estimates of capelin (Mallotus villosus) biomass from hydroacoustic surveys in Division 3LNO in 1985 and 1986. NAFO SCR Doc. 86/79, Ser. No. N1200.

Nakashima, B. S. 1981. Sampling variation and survey design for capelin, Mallotus villosus, from an acoustic survey in Division 3LNO, 1980. NAFO SCR Doc. 81/14, Ser. No. N278.

Stevens, C. R. 1986. A hydroacoustic data acquisition system (HYDAS) for the collection of acoustic data from fish stocks. Can. Tech. Rep. Fish. Aquat. Sci. No. 1520. 73 p.

Table 1. Acoustic survey results for NAFO Div. 3NO capelin, June-July 1986.

	Block E	Block F
Mean density	23.0	2.0
Area (sq. km.)	20524	11910
Total biomass	471429	23410
# of transects	16	15
# of estimates	713	417
Delta	.97	.95
Lw limit delta	-.02	-.04
C of variation	23.9	18.2
Minimum density	.5	.6
Maximum density	75.8	4.8

Block E			Block F		
T#	#Ds	Mean D	T#	#Ds	Mean D
1	44	5.0	1	28	.7
2	45	7.2	2	28	2.4
3	46	8.6	3	28	1.4
4	43	6.4	4	27	.6
5	43	7.5	5	28	4.6
6	44	12.4	6	29	2.6
7	45	19.3	7	29	.9
8	44	54.7	8	27	1.0
9	46	43.2	9	28	1.0
10	46	39.9	10	27	.6
11	43	75.8	11	28	.7
12	45	53.6	12	27	4.8
13	46	23.9	13	28	2.0
14	45	6.5	14	28	2.0
15	43	2.5	15	27	4.1
16	45	.5			

Combined total biomass is 494,838

Table 2. Acoustic survey results for NAFO Div. 3L capelin, May-June, 1987.

	Block A	Block B	Block C	Block D
Mean density	35.6	13.8	44.0	46.9
Area (sq. km.)	10715	19686	33812	9255
Total biomass	381623	271707	1488364	434365
# of transects	31	14	8	14
# of estimates	372	496	432	250
Delta	.91	.97	.98	.94
Lw limit delta	-.09	-.03	-.02	.06
C of variation	44.2	38.4	37.5	35.0
Minimum density	.2	.4	0.0	2.6
Maximum density	474.0	75.0	148.6	22.1

Block A			Block B			Block C			Block D		
T#	#Ds	Mean D	T#	#Ds	Mean D	T#	#Ds	Mean D	T#	#Ds	Mean D
1	12	.6	1	35	.8	1	54	0.0	1		29.1
2	12	.8	2	35	.4	2	54	0.0	2		68.9
3	12	.7	3	35	2.9	3	54	40.6	3		221.5
4	12	1.3	4	35	.9	4	54	33.3	4		78.4
5	12	1.2	5	35	14.3	5	54	148.6	5		131.8
6	12	.9	6	36	6.1	6	54	23.8	6		94.5
7	12	.7	7	37	11.3	7	54	86.6	7		21.8
8	12	1.0	11	35	3.3	8	54	19.2	8		9.9
9	12	.6	12	36	11.4				9		4.8
10	12	.5	13	35	41.5				10		14.3
11	12	.6	14	36	75.0				11		7.9
12	12	.8	15	36	18.5				12		6.0
13	12	.8	16	35	2.0				13		24.5
14	12	.5	17	35	3.3				14		2.6
15	12	.4									
16	12	.3									
17	12	.3									
18	12	.3									
19	12	.2									
20	12	23.2									
21	12	25.0									
22	12	26.4									
23	12	26.3									
24	12	36.4									
25	12	108.0									
26	12	89.4									
27	12	474.0									
28	12	215.6									
29	12	17.8									
30	12	45.6									
31	12	4.0									

Combined total biomass is 2576059.

Table 3. NAFO Div. 3NO acoustic survey biomass estimate broken down by year-class expressed in numbers and weights.

Survey year	Age 1	2	3	4	5	6
Numbers (billions)						
1981	≤0.1	0.6	8.3	1.4	0.3	≤0.1
1982	0	0.1	16.6	0.7	0.1	≤0.1
1983	0	0.2	3.6	3.8	0.5	≤0.1
1984	1.6	0.3	2.8	0.9	0.2	≤0.1
1985	0.2	5.9	6.5	0.5	≤0.1	0
1986	1.1	0.5	15.2	5.7	0.1	≤0.1
Weight ('000s tons)						
1981	≤0.1	4	165	43	11	1
1982	0	1	390	22	5	1
1983	0	2	85	115	17	≤1
1984	3	4	48	27	5	≤1
1985	≤1	59	135	16	2	0
1986	2	8	323	157	4	≤1

Table 4. Spring (April-May) NAFO Div. 3L acoustic survey biomass estimated by year-class.

Survey year	Age 1	2	3	4	5	6
Numbers (billions)						
1982	≤0.1	9.9	16.0	2.4	0.7	0.2
1983	≤0.1	3.5	1.9	0.7	≤0.1	≤0.1
1984	0.1	21.0	6.1	3.2	0.5	≤0.1
1985	≤0.1	367.4	82.0	4.8	1.8	≤0.1
1986	0	63.7	168.1	22.6	0.8	0.4
1987	0.3	87.6	18.6	38.4	9.4	≤0.1
Weight ('000s tons)						
1982	≤1	50	327	61	21	6
1983	≤1	27	36	21	2	6
1984	≤1	128	117	93	15	≤1
1985	≤1	1975	1255	136	59	≤1
1986	0	392	2649	618	24	14
1987	≤1	637	442	1344	149	4

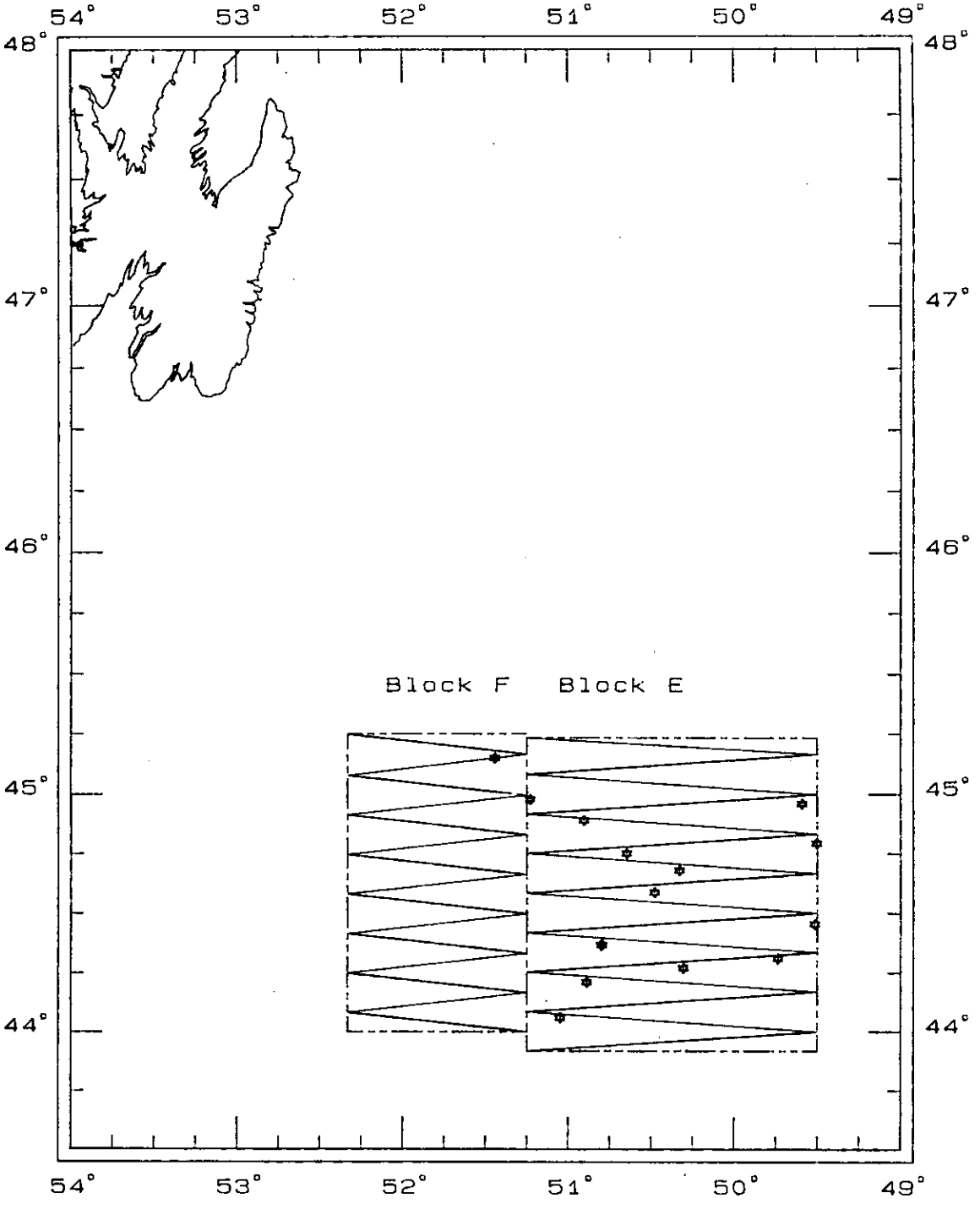

Figure 1. Acoustic cruise track for NAFO Division 3NO capelin June-July, 1986

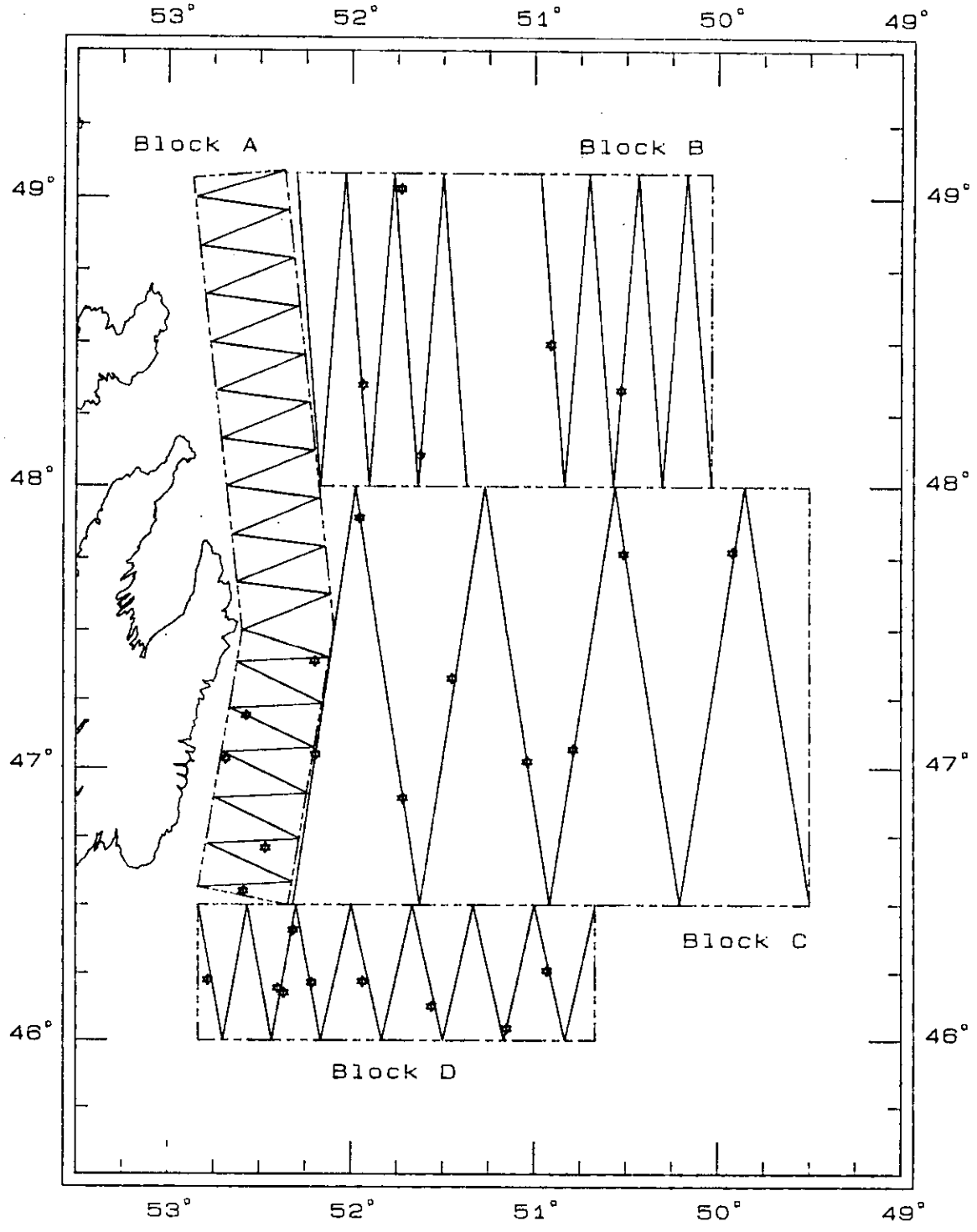

Figure 2. Acoustic cruise track for NAFO 3L capelin. May-June, 1987

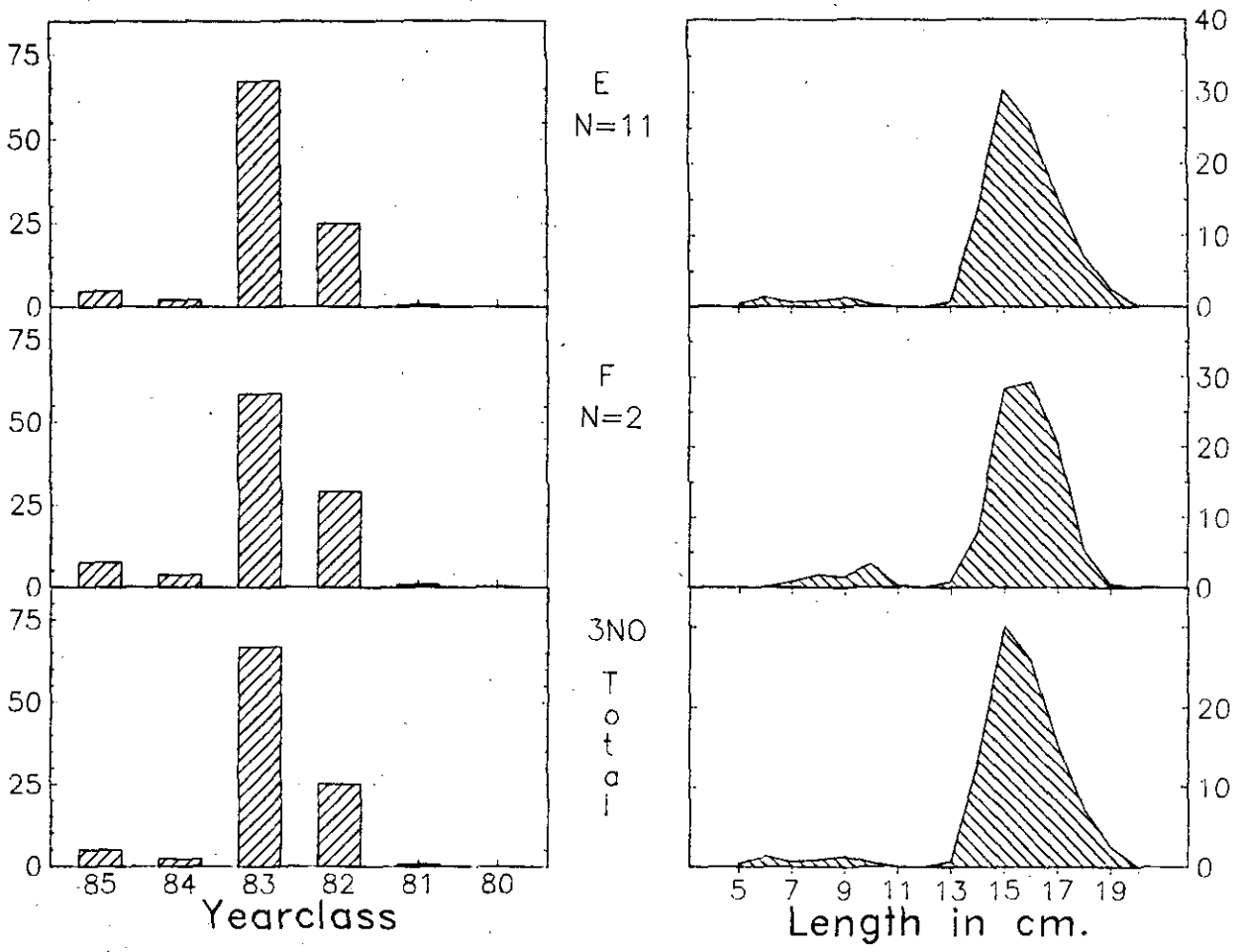

Figure 3. Age and length compositions from NAFO Division 3NO June–July, 1986

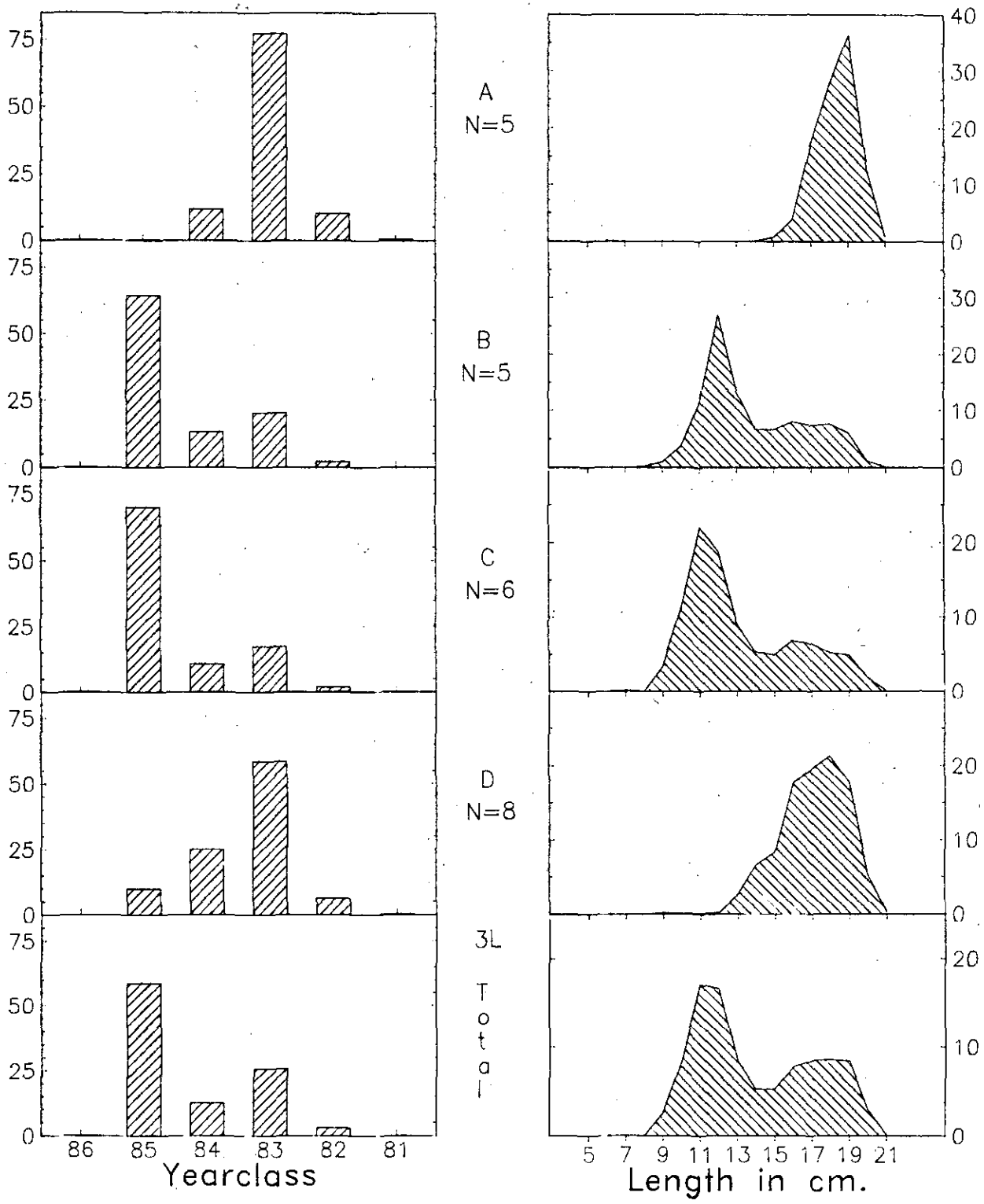

Figure 4. Age and length compositions from NAFO Division 3L. May–June, 1987