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Results From an Acoustic Survey for Capelin in Divisions 3NO in 1992

by

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Introduction

An acoustic survey of capelin in NAFO Divisions 3NO was conducted during the period June 23 to July 3, 1992. Capelin detected acoustically in Divisions 3NO had an estimated biomass of 4,429 tons. This paper provides data pertaining to the distribution and age composition of the acoustic biomass estimate.

Methodology

The survey was conducted from the research vessel *Gadus Atlantica* during the period June 23-July 3, 1992. The configuration of the acoustic data acquisition system was the same as that used in recent surveys of this stock. The calibration parameters of the system were as follows:

Combined source level/receive sensitivity	53.90 dB
Fixed receiver gain	10.58 dB
TVG gain	20 log R
Attenuation coefficient	.012 dB/m
Pulse length	600 $\mu$ secs
Bandwidth	3.3 kHz
Average beam pattern	-28.79 dB
Target strength	-34 dB/kg

The survey design was random parallel transects with a minimum allowable spacing of 1 nautical mile as recommended by the CAFSAC Pelagic Subcommittee - O'Boyle and Atkinson (1989). Fishing sets were made on an opportunistic basis throughout the survey. It was attempted to have at least one set for each twelve hour watch and at least one set for each transect. For those midwater trawl sets that contained capelin, a random sample of 200 capelin was obtained for length, sex, and maturity observations and a stratified age sample was selected from each length/sex/maturity sample. Length composition and an age/length key was constructed for each stratum from the samples obtained in that stratum. Stratum outlines and transect locations and fishing set locations are shown in Figure 1.

Results and Conclusions

Table 1. gives estimates of acoustic backscatter and biomass for each stratum and for the total survey. Total biomass was estimated at 4,429 tons with a coefficient of variation of 0.116. Table 2. provides estimates of backscatter and biomass for each acoustic transect and shows the distribution of the biological sampling amongst the acoustic transects. Tables 3 and 4 give the total age composition by numbers and biomass for the historical period of Canadian acoustic biomass estimates. Table 5. provides

the percent at age by number, the mean length at age, total numbers and mean length and the number of samples used for each stratum. The 1990 yearclass was predominant in both strata. 1992 was the only year in the historical series of surveys that older capelin (3+ age group) did not comprise a significant proportion of the biomass estimate.

Table 6. gives bottom temperatures from XBT and CTD casts taken at fishing set locations. The listed observations were restricted to an area bounded by latitudinal parallels 44° 00' and 44° 50' and longitudinal meridians 49° 40' and 50° 40' where spawning capelin were most frequently observed on earlier surveys. The mean bottom temperature in 1988 at a time of relatively high capelin abundance was 3.3°C compared to 2.3°C in 1992. Carscadden et al. (1989) found that the densest spawning concentrations of SE shoal capelin were found when bottom temperatures exceeded 2.0°C. The cooler bottom water in 1992 may explain the absence of the normally higher proportion of older mature capelin in the biological samples obtained from the fishing sets.

Figure 2 shows the relative proportions of immature to mature capelin in the historical series of acoustic biomass estimates. Figure 3 shows the historical series of acoustic biomass estimates.

#### References

- Carscadden, J.E., K.T. Frank, and D. S. Miller. 1989. Capelin (*Mallotus villosus*) spawning on the southeast shoal: influence of physical factors past and present.  
CJFAS Vol. 46 No. 10: 1743-1754
- O'Boyle, R. N., and D. B. Atkinson. 1989. Hydroacoustic survey methodologies for pelagic fish as recommended by CAFSAC.  
CAFSAC Res. Doc. 89/72. 12 p.

Table 1. Statistics for each stratum and total survey

Strata	Transects sampled	Number of possible transects	Transect area (km <sup>2</sup> )	Transect area scattering coefficient (sr <sup>-1</sup> )		Strata total backscatter (m <sup>2</sup> /sr)	Biomass per transect (tons)		Total biomass (tons)
				Mean	S.E.		Mean	S.E.	
E	12	75	158.2	19.	2.8	1401.	46.9	7.2	3520.
F	11	75	217.4	5.	0.8	362.	12.1	2.1	909.
Total	23	150		12.	0.3	1763. .116	29.5	0.7	4429. .116

Table 2. Backscatter, biomass, and biological sampling for each acoustic transect

Strata	Transect Number	Transect Length	Transect area	Area scattering	Total Density backscattering	Density	Transect # of biomass sets	Lsms	Ages	
E	1	85.4	158.2	.10	16.	.25	40.	1	200	53
	2	85.4	158.2	.11	18.	.28	44.	1	200	47
	3	85.4	158.2	.21	33.	.52	82.	1	200	41
	4	85.4	158.2	.03	4.	.07	11.	1	200	39
	5	85.4	158.2	.19	30.	.47	74.	1	200	59
	6	85.4	158.2	.06	10.	.16	25.	1	200	56
	7	85.4	158.2	.07	11.	.18	28.	1	200	55
	8	85.4	158.2	.14	21.	.34	54.	1	200	42
	9	85.4	158.2	.21	34.	.54	85.	1	200	49
	10	85.4	158.2	.10	15.	.24	38.	1	200	58
	11	85.4	158.2	.16	25.	.39	62.	1	0	0
	12	85.4	158.2	.05	8.	.12	19.	0	0	0
F	1	60.5	112.0	.10	11.	.24	27.	1	0	0
	2	60.5	112.0	.03	4.	.08	9.	1	0	0
	3	60.5	112.0	.07	8.	.17	19.	1	0	0
	4	60.5	112.0	.06	7.	.16	18.	0	0	0
	5	60.5	112.0	.03	4.	.08	9.	1	200	42
	6	60.5	112.0	.05	5.	.12	13.	1	200	35
	7	60.5	112.0	.04	5.	.11	12.	1	200	41
	8	60.5	112.0	.02	2.	.05	6.	0	0	0
	9	60.5	112.0	.04	5.	.11	12.	0	0	0
	10	60.5	112.0	.02	2.	.04	4.	0	0	0
	11	60.5	112.0	.01	1.	.03	3.	1	200	43

Table 3. Numbers (billions) at age of capelin from NAFO Divisions 3NO hydroacoustic surveys.

Year	Cruise	Date/Age	1	2	3	4	5+	Total
1992	217	June 23-July 3	<0.1	0.4	<0.1	<0.1	<0.1	0.5
1989	169	June 24-July 3	<0.1	<0.1	1.1	0.1	<0.1	1.4
1988	153	June 21-July 3	2.6	11.9	11.2	1.6	2.2	29.5
1987	139	June 26-July 5	2.1	0.7	2.4	4.5	0.4	10.1
1986	126	June 26-July 5	1.1	0.6	15.0	5.9	0.2	22.8
1985	111	June 22-July 8	0.2	5.9	6.5	0.5	0.1	13.2
1984	96	June 16-July 2	1.6	0.3	2.2	0.8	0.2	5.1
1983	80	June 27-July 2	0.0	0.2	3.6	3.8	0.5	8.1
1982	66	June 30-July 4	0.0	0.1	16.8	0.6	0.1	17.6
1981	52	June 23-28	<0.1	0.6	7.8	1.8	0.4	10.6

Table 4. Biomass (thousands of tons) at age of capelin from NAFO Divisions 3NO hydroacoustic surveys.

Year	Cruise	Date/Age	1	2	3	4	5+	Total
1992	217	June 23-July 3	<1	3	1	<1	0	4
1989	169	June 24-July 3	<1	<1	24	4	<1	28
1988	153	June 21-July 3	12	166	250	56	76	560
1987	139	June 26-July 5	3	12	63	139	13	230
1986	126	June 26-July 5	2	9	319	160	5	495
1985	111	June 22-July 8	<1	59	135	16	2	212
1984	96	June 16-July 2	3	4	48	27	6	88
1983	80	June 27-July 2	0	2	85	115	17	219
1982	66	June 30-July 4	0	1	396	17	5	419
1981	52	June 23-28	<1	3	158	49	13	223

Table 5. Age composition and mean length at age, total number in billions, total mean length, and number of samples by survey stratum.

Stratum	Age	1	2	3	4	5+	Total Number of N/L	samples
E	%	6.1	75.4	17.3	1.2	0.1	0.4	10
	L	79	117	151	160	173	121	
F	%	0.7	96.8	2.6	0.0	0.0	0.1	4
	L	96	123	149	- 0	-	123	

Table 6. Bottom temperatures from acoustic surveys in 1988 and 1992 (between Lat 44 00 and 44 50 and Long 49 30 and 50 40)

Gadus 217 - 1992				Gadus 153 - 1988			
Station No.	Latitude	Longitude	Bottom Temp. (°C)	Station No.	Latitude	Longitude	Bottom Temp. (°C)
7	44° 33.4'	50° 39.8'	2.2	13	44° 46.8'	50° 16.0'	3.0
8	44° 22.5'	49° 59.6'	2.6	15	44° 40.8'	50° 15.0'	3.1
10	44° 10.0'	49° 45.5'	2.3	16	44° 40.2'	50° 04.1'	2.3
11	44° 10.0'	50° 25.2'	2.4	17	44° 36.1'	49° 54.0'	2.3
13	44° 01.0'	50° 25.3'	2.1	19	44° 28.5'	50° 18.0'	4.1
				20	44° 28.4'	49° 58.8'	3.6
				22	44° 23.8'	50° 02.0'	3.9
				24	44° 17.1'	50° 15.7'	3.9
				25	44° 12.4'	49° 45.7'	2.3
				26	44° 10.5'	50° 14.0'	3.2
				28	44° 03.4'	50° 16.7'	3.1
				31	44° 05.5'	49° 57.5'	3.6
				32	44° 09.1'	49° 58.4'	3.5
				35	44° 16.7'	49° 54.7'	3.2
				36	44° 24.2'	50° 04.1'	4.4
Mean Temp.			2.3	Mean Temp.			3.3

Figure 1. Survey track and set locations

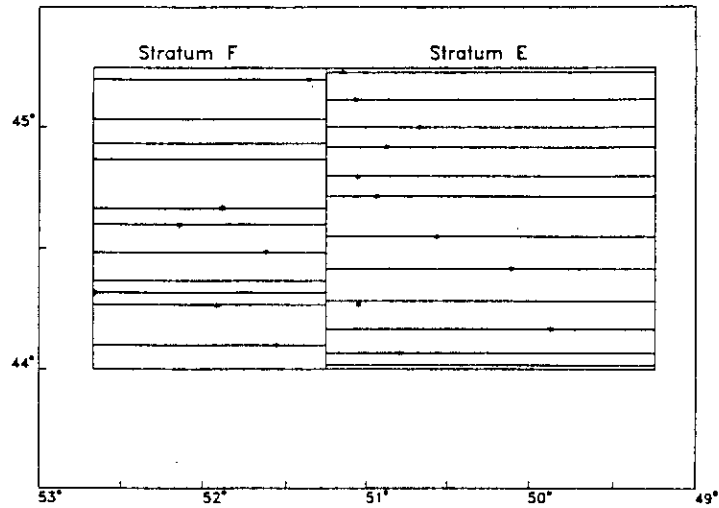


Figure 2. Relative proportions of immature to mature capelin

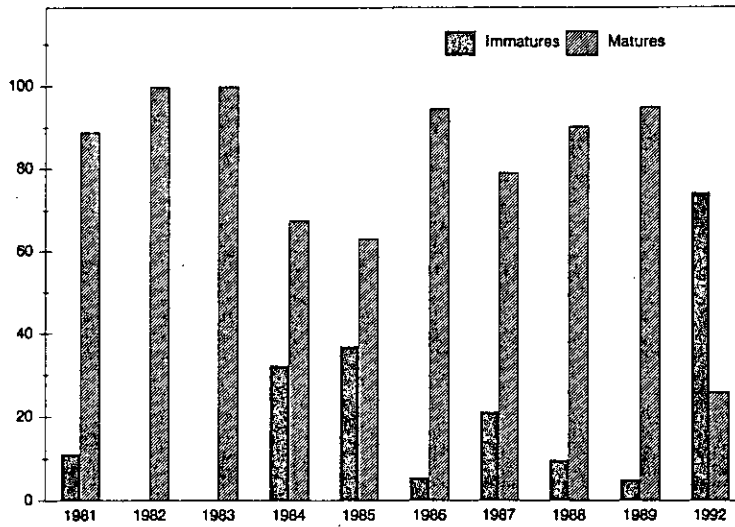


Figure 3. Division 3NO acoustic biomass estimates

