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Biomass Estimates from Two Hydroacoustic Surveys for Capelin
(Mallotus villosus) in NAFO Divisions 3L and 3N

by

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Introduction

Two acoustic surveys were carried out from June 25 to July 6, 1987 in NAFO Div. 3N (GADUS 139) and from May 13 to May 31, 1988 in NAFO Div. 3L (GADUS 151). These surveys are part of an ongoing program of capelin acoustic surveys conducted by Canada since 1977.

Methodology

Data were collected using the hydroacoustic data acquisition system described by Stevens (1986). A target strength value of -34 dB/kg was used as in previous surveys (Miller 1985). Fishing sets were conducted throughout the surveys on an opportunistic basis and a random sample of 200 capelin was taken from each set for length, sex, and maturity determination. A stratified age sample was also taken to provide an age/length key. Sampling data were combined from each survey block to provide an estimate of age and length composition of the biomass estimate.

The 1988 survey was broken into two distinct parts which used two different configurations of the HYDAS system. This was necessitated by an equipment malfunction during the first part of the cruise. The calibration parameters used during each part of the survey are listed in the Appendix I

Results

Figures 1 and 2 show the location of the survey blocks, acoustic transects, and fishing sets for each survey. Tables 1 and 2 give the acoustic

survey results for each survey. Biomass was estimated at 229,406 metric tons for the Div. 3N0 stock and at 4,550,475 metric tons for the Div. 3L stock. Tables 3 and 4 give the breakdown of the current and historical biomass estimates into age classes by both weight and numbers. Mature four-year-old capelin of the 1983 year-class were predominant in the 1987 Div. 3N0 estimate and two-year-old capelin of the 1986 year-class were predominant in the 1988 Div. 3L estimate. The 1986 year-class appears to be the strongest on record since 1983.

References

- Miller, D. S. 1985. Capelin (Mallotus villosus) hydroacoustic surveys in NAFO Division 3L and 3LNO in 1984. NAFO SCR Doc. 85/73.
- 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 from GADUS ATLANTICA Cruise No. 139 in NAFO Div. 3N, June-July 1987.

Mean density	10.4
Area (sq. km)	21968.
Total biomass	229406.
# of transects	18
# of estimates	901
Delta	.97
Lw limit delta	-.02
C of variance	17.0
Min. density	.4
Max. density	32.8

T#	Block E	
	#Ds	Mean D
1	50	8.3
2	51	8.0
3	50	5.9
4	50	9.3
5	50	11.3
6	50	32.8
7	48	15.7
8	50	14.5
9	50	6.3
10	51	.4
11	50	7.0
12	51	23.0
13	50	15.0
14	50	9.5
15	50	9.9
16	50	6.3
17	50	3.4
18	50	1.6

Combined total biomass is 229406.

Table 2. Acoustic survey results from GADUS ATLANTICA Cruise No. 151 in NAFO Div. 3L, May 1988.

	Block A	Block B	Block C	Block D
Mean density	55.7	121.7	49.4	36.4
Area (sq km)	10715	19686	10897	28029
Total biomass	596302	2396305	538517	1019350
# of transects	31	17	11	14
# of estimates	372	662	209	518
Delta	.90	.97	.95	.97
Lw limit delta	-.09	-.03	-.06	-.03
C of variance	31.6	18.6	34.8	22.9
Min. density	1.9	14.0	10.3	1.5
Max. density	551.0	379.8	228.8	94.6

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	24.5	1	39	82.4	1	19	37.7	1	37	58.3
2	12	104.0	2	39	91.1	2	19	20.1	2	37	79.1
3	12	551.0	3	39	20.5	3	19	11.2	3	37	94.6
4	12	211.5	4	39	379.8	4	19	23.6	4	37	40.5
5	12	27.5	5	39	239.8	5	19	31.3	5	37	78.9
6	12	121.7	6	38	243.2	6	19	35.1	6	37	60.1
7	12	66.4	7	39	63.5	7	19	35.9	7	37	16.2
8	12	3.2	8	39	14.0	8	19	49.7	8	37	8.0
9	12	2.3	9	39	227.8	9	19	59.9	9	37	1.5
10	12	10.4	10	39	116.6	10	19	228.8	10	37	2.8
11	12	1.9	11	39	96.4	11	19	10.3	11	37	3.8
12	12	2.9	12	39	97.5				12	37	21.9
13	12	5.2	13	39	133.9				13	37	39.1
14	12	32.2	14	39	45.3				14	37	4.2
15	12	29.6	15	39	33.5						
16	12	14.5	16	39	75.4						
17	12	92.3	17	39	111.9						
18	12	39.2									
19	12	6.3									
20	12	2.5									
21	12	3.2									
22	12	102.7									
23	12	86.5									
24	12	18.7									
25	12	6.8									
26	12	11.7									
27	12	19.5									
28	12	55.1									
29	12	47.7									
30	12	16.3									
31	12	7.4									

Combined total biomass is 4550475.

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
<u>Numbers (billions)</u>						
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
1987	2.1	0.7	2.4	4.5	0.4	<0.1
<u>Weights ('000s tons)</u>						
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
1987	3	12	63	139	12	<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
<u>Numbers (billions)</u>						
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	4.4	<0.1
1988	13.5	380.4	65.7	9.7	15.3	1.5
<u>Weights ('000s tons)</u>						
1982	<1	50	327	61	21	6
1983	<1	27	36	21	2	6
1984	<1	128	117	93	15	<1
1985	<1	1975	1225	136	59	<1
1986	0	392	2649	618	24	14
1987	<1	637	442	1344	149	4
1988	10	1953	1604	308	546	57

1988

	Age					
	1	2	3	4	5	6
(Nos. - billions)						
immature	13.5	373.0	15.6	0.1	0.1	0
mature	0	7.4	50.1	9.6	15.2	1.5

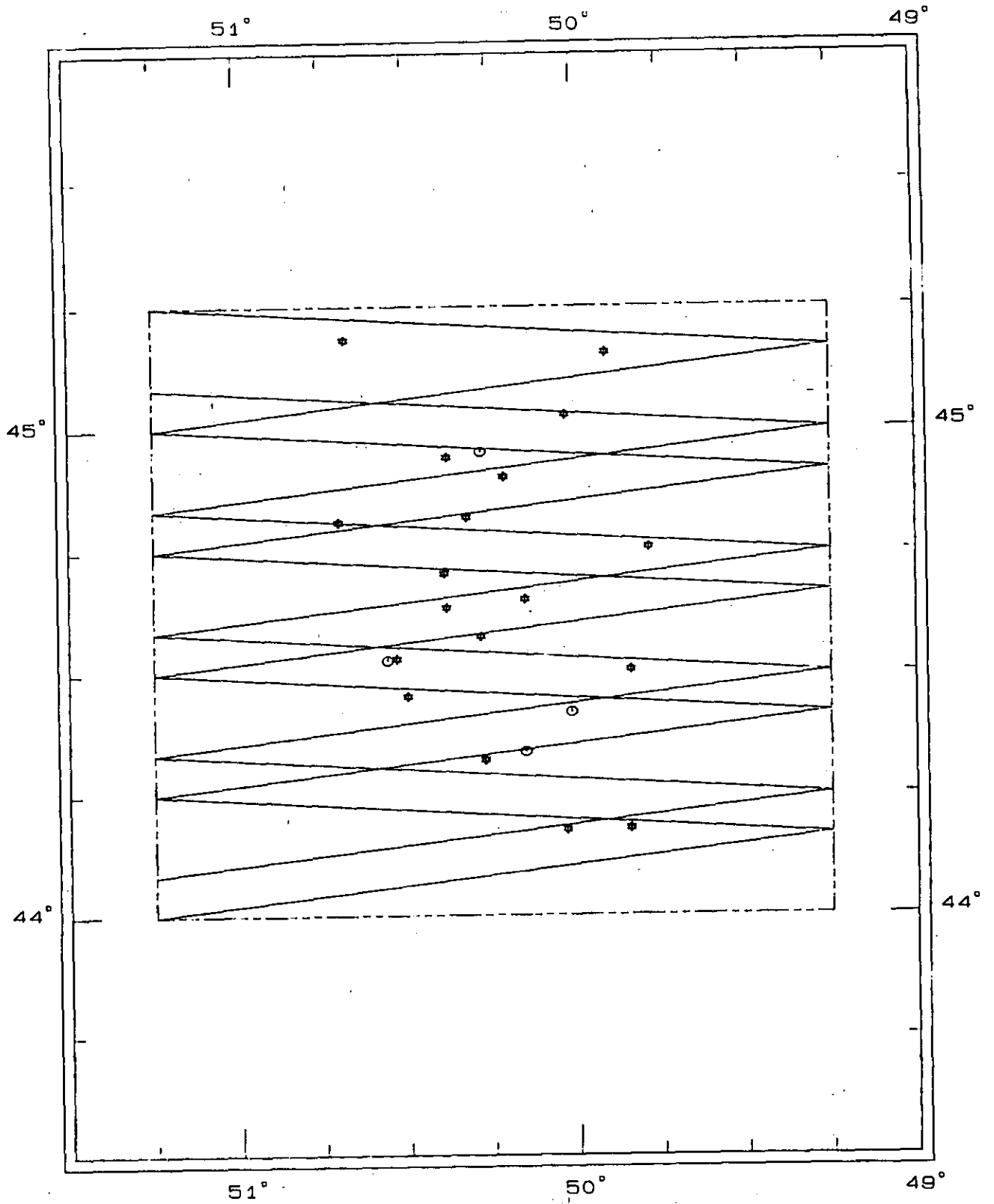


Fig. 1. Acoustic survey track and fishing set locations for GADUS ATLANTICA Cruise No. 139, NAFO Div. 3NO capelin.

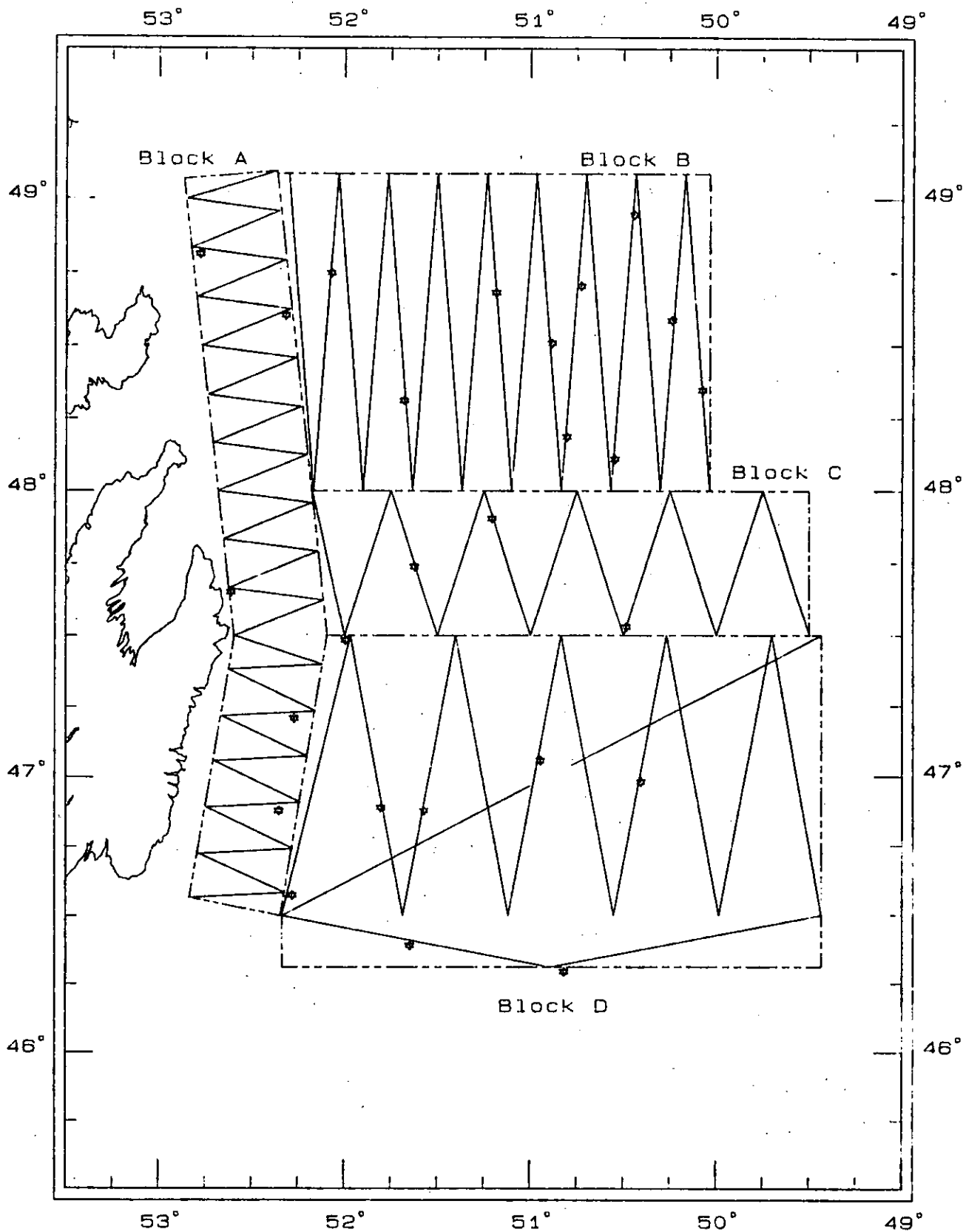


Fig. 2. Acoustic survey track and fishing set locations for *GADUS ATLANTICA* Cruise No. 151, NAFO Div. 3L capelin.

Appendix I

The calibration parameters for the acoustic data acquisition system for each survey are:

Parameter	Gadus 139	Gadus 151	
		Part 1	Part 2
Source level	120.9dB	124.4dB	125.5dB
Receive sensitivity	-52.3dB	-69.6dB	-68.4dB
Fixed gain	-12.7dB	5.6dB	5.5dB
Beam pattern	-29.42dB	-29.42dB	-29.36dB
Attenuation coeff.	.0120dB/meter	.0120dB/meter	.0120dB/meter
Target strength	-34dB/kg	-34dB/kg	-34dB/kg