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Results of Acoustic Survey for Capelin (*Mallotus villosus*)
in NAFO Divisions 3LNO in 1993

by

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Abstract

Results of the acoustic survey for capelin conducted in June 1993 in Divs. 3LNO are presented. Some increase of capelin stock after its catastrophic reduction in 1990 was noted. Total capelin stock within the investigated area constituted 315 thou. t. 72.5% of the total investigated abundance were 1990 year class at the age of three.

Acoustic surveys on quantitative estimation of capelin stock are conducted regularly by PINRO vessels since 1974 two times a year: in summer for the prespawning concentrations in Divs. 3LNO and in autumn during the fattening migrations in Divs. 2J3K. Besides, the additional trawl ichthyoplankton survey for evaluation of abundance of 0-group capelin has been conducted in autumn.

Surveys for 0-group were ceased in 1991, and acoustic surveys are conducted during the trawl survey for demersal fish not more than once a year in one of the mentioned areas. Reduction of investigations is caused both by the problems of financing of the expeditions and by limits introduced by the Canadian authorities in recent years.

Materials and Methods

The acoustic survey for capelin was conducted in June, 8-25, 1993 by R/V MG-1362 "Vilnius" in Divs. 3LNO. The acoustic complex of EK-400 computer and SIORS echo integrator was used. The working regime of equipment is below:

frequency of echo sounder	- 38 kHz
width of the band	- 3.3 kHz
TVC	- 20 lgR - 0dB
duration of impulse	- 1 ms
diagram of the aerial direction	- 19.6 dB
target of strength (TS)	- 19.1 lgL - 74.4 (dB), where L - length of a fish.

Tracking, division of the area by strata and calculation of the biomass were done by the method accepted in CAFSAC (O'Boyle and Atkinson, 1989). Because of the introduction of the area in Div. 3L prohibited for every kind of fishery, data on length and weight of capelin obtained in stratum D were used in strata A, B and C.

Results

The route of the survey and division of the area by strata in sites of revealing of capelin are resented in Fig. 1. Tracking was conducted with the account of the distribution of capelin determined during the trawl survey for demersal fish (TAS) conducted in the area in April-May. However, great changes both in the distribution of fish and in their length composition took place between two surveys. Thus, during the TAS the largest number of capelin were registered in Div. 30 and along the land slope of the eastern part of the Grand Bank of Newfoundland (Fig. 2) due to data of acoustic devices and to catches and meshing of fish in a bottom trawl. Large mature capelin predominated there. Small number of mainly immature capelin was registered in Div. 30.

Results of calculations of capelin biomass are presented in Tables 1 and 2. Total biomass of capelin in the investigated area constituted about 315 thou.t that was 2.7 times more than biomass of capelin estimated in the similar survey of 1991 but lower than in 1990 survey (Table 3).

About 60% of the total biomass are in strata F and G in Div. 3N. The largest capelin are registered in this area as well. Total number of mature fish constituted 57.4%, at this 72.5% of total abundance are 1990 year class (at the age of 3) (Table 4).

Capelin yearlings (1992 year-class) were noted in large numbers during the acoustic survey and in meshing. Because of the absence of reliable data on target strength for these young, they were not accounted .

References

O'Boyle, R.N., and D.B. Atkinson. 1989. Hydroacoustic survey methodologies for pelagic fish as recommended by CAFSAC. Res. Doc. 89/72, 12p.

Table 1. Results from trawl-acoustic survey for capelin in Div.3LNO in June 1993

Stratum	Biomass, t	Number of tracks		Area of stratum, mile	Mean biomass by track, t	Standard deviation
h	(b_h)	actual	possible	A_h	Y_h	at track in stratum h, t
		n_h	N_h			σ_{yh}
A	11270	2	23	230	490	509
B	39840	4	60	3600	664	1182
C	3132	2	18	2430	174	69
D	69495	5	41	1845	1695	1297
E	1674	2	31	465	54	21
F	185400	7	90	9450	2060	3172
G	3705	2	15	750	247	135
Total	314516	24	278	18770	1131	402

Standard deviation 111707

σ_{yst} \bar{y}_{st} σ_{yst}

Table 2. Some parameters from acoustic survey for capelin in Divs. 3LNO in June 1993.

Stratum	Number of track	Length of track	Density, t/mile ²	Biomass by track, t	Number of hauls	Mass measurements, fish	Age samples, fish
A	1	100	8.50	850.2	-	-	-
	2	100	1.30	129.0	-	-	Area
B	1	60	40.61	2436.6	-	-	closed for fishery
	2	60	2.28	136.6	-	-	
	3	60	1.02	61.0	-	-	
	4	60	0.38	22.8	-	-	
C	1	135	1.65	223.4	-	-	-
	2	135	0.93	125.0	-	-	-
D	1	45	17.03	766.5	2	30	-
	2	45	36.27	1632.1	-	-	-
	4	45	52.66	2369.9	1	-	-
	5	45	4.80	215.9	2	237	50
E	1	15	2.56	38.3	1	62	39
	2	15	4.59	68.9	1	200	44
F	1	105	2.35	246.4	-	-	-
	2	105	34.33	3604.5	2	200	56
	3	105	82.97	8712.0	2	203	50
	4	105	0.91	95.7	-	-	-
	5	105	5.62	590.6	1	200	39
	6	105	7.74	812.5	1	200	74
	7	105	3.41	358.4	1	156	54
G	1	50	6.58	342.3	-	-	-
	2	50	3.02	151.3	1	104	63
Total	24				15	1592	469

Table 3. Capelin abundance (x10⁹ fish) and biomass (x10³ tons) from data of Soviet acoustic surveys in Div. 30.

Year	Abundance	Biomass	Year	Abundance	Biomass
1983	13.3	346.0	1988	310.9	3900
1984	191.7	2880.0	1989	187.6	2455
1985	289.3	2200.0	1990	299.9	3752
1986	95.2	1491.0	1991	8.2	118
1987	107.2	2161.0	1993	25.8	315

Table 4. Age composition (A, %), mean length (L, mm), weight (W, g) and maturity (μ , %) of capelin from 1993 acoustic survey data.

Div.	Parameter	Age				Total
		2	3	4	5	
3L	A	11.3	82.3	6.4	-	100.0
	L	9.9	13.0	15.1	-	12.8
	W	3.9	13.0	21.0	-	11.3
	μ	0	71.1	100.0	-	66.7
3O	A	30.9	39.1	29.3	0.7	100.0
	L	9.3	12.1	14.0	12.4	11.8
	W	3.4	9.7	15.7	11.2	9.5
	μ	0	44.7	79.2	100.0	49.6
3N	A	26.4	66.6	6.6	0.4	100.0
	L	11.0	13.6	15.4	16.8	13.0
	W	5.7	14.4	24.0	37.3	12.8
	μ	12.6	73.9	84.6	100.0	61.4
Total	A	20.5	72.5	6.6	0.4	100.0
	L	10.6	13.4	15.3	16.8	12.9
	W	5.0	13.3	21.4	37.1	12.2
	μ	7.8	68.2	81.3	100.0	57.4

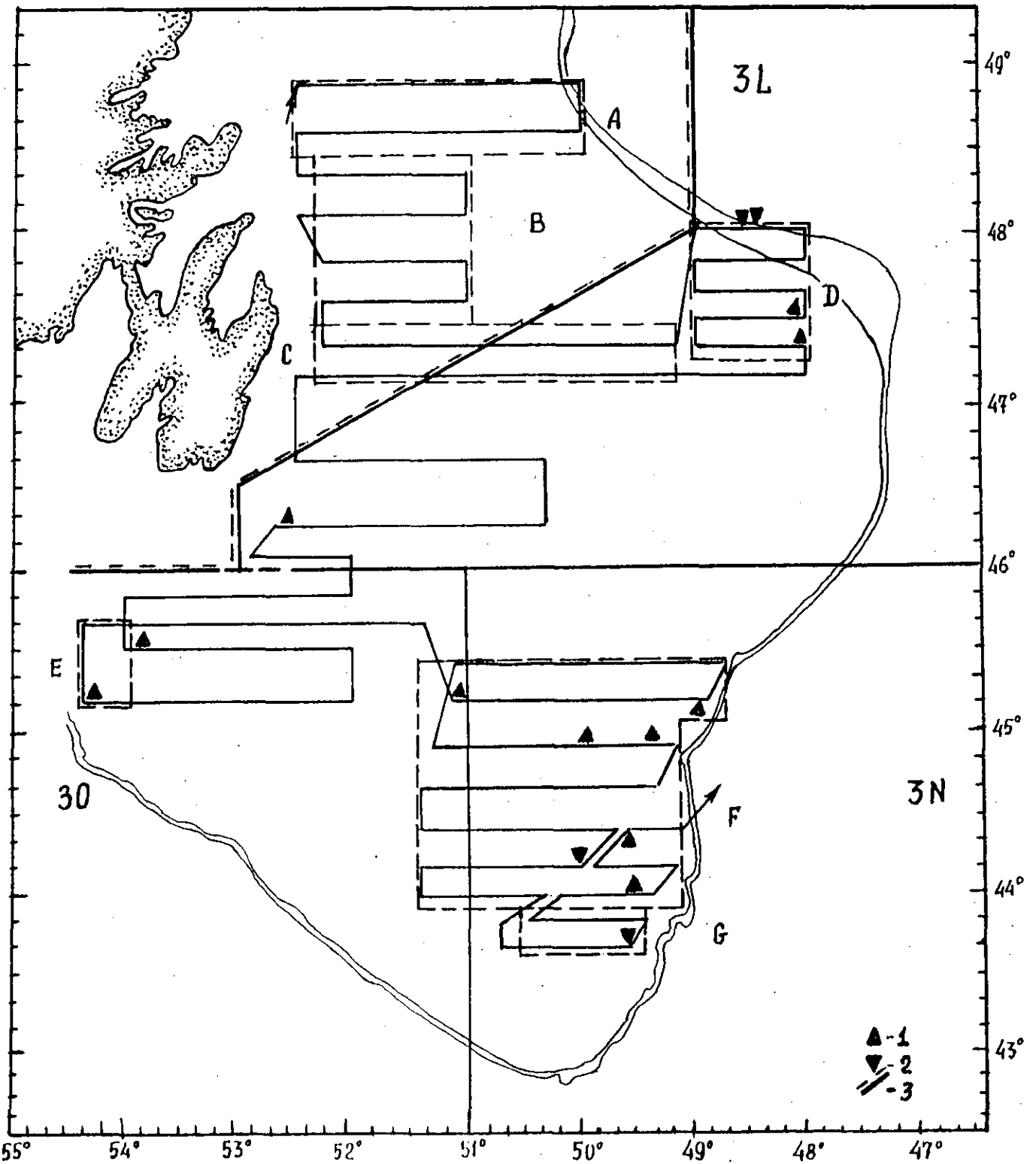


Fig. 1. Route of hydro-acoustic survey for capelin, strata and check hauls in June 1993 (08.06-25.06.1993)

- 1 - pelagic trawl;
- 2 - bottom trawl;
- 3 - area closed for fishery

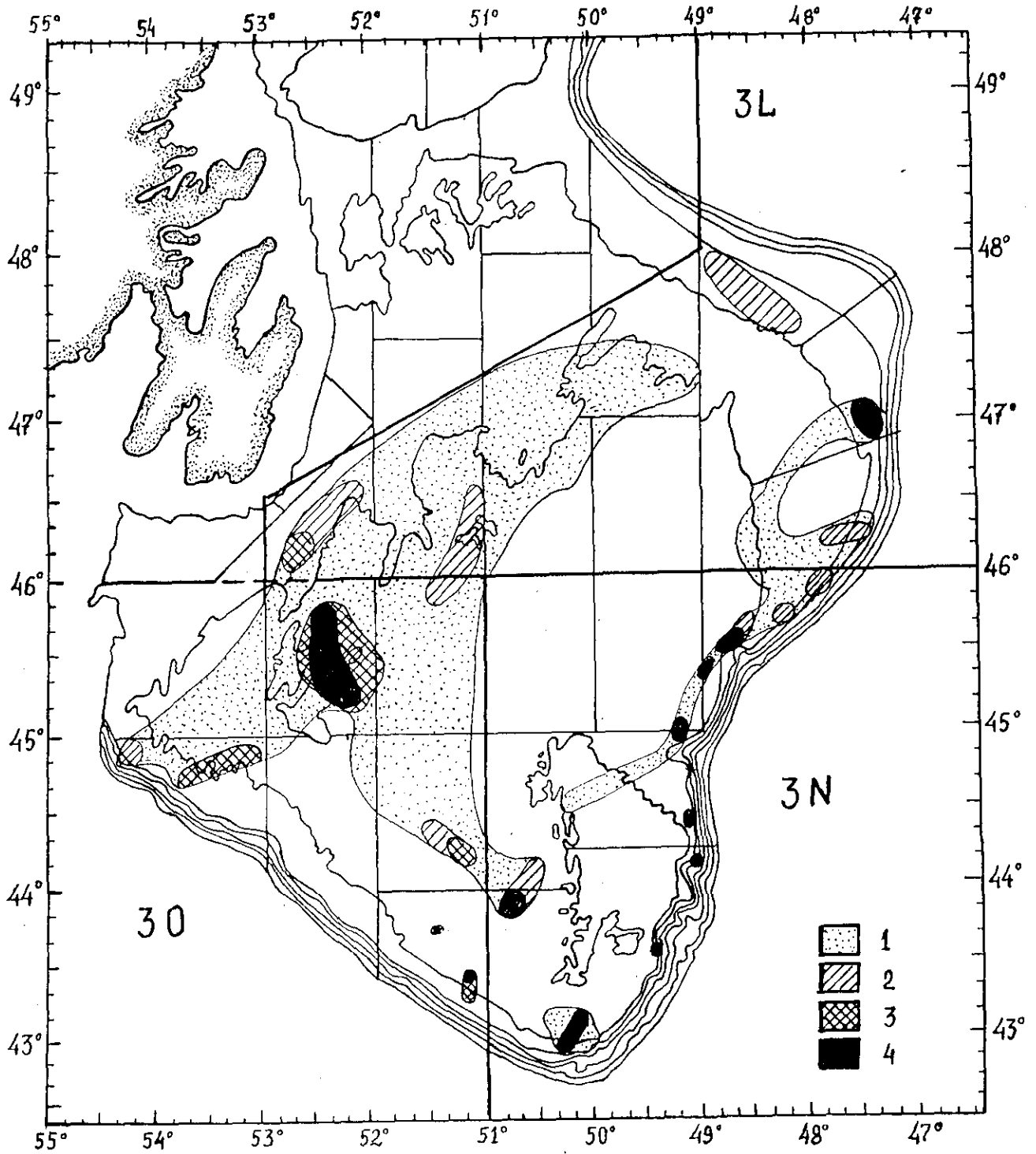


Fig. 2. Distribution of capelin from the results of trawl-acoustic survey (April-beginning of June 1993, catch; meshing)

- 1 - several fish;
- 2 - tens;
- 3 - hundreds;
- 4 - thousands, tens of thousands of fish