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Capelin (*Mallotus villosus*) Catch, Effort, and Biological Characteristics  
in the Romanian Fishery in Division 2J, September-October 1979

by

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Abstract

Observations made in the autumn of 1979 indicate different catch composition in the directed capelin fishery from that of previous years, with Arctic cod appearing together with capelin in most of the tows. The capelin catches consisted mostly of age-groups 1 and 2 for both males and females, indicating a significant change in the population structure from that of previous years. Thus the 1978 and 1977 year-classes were well represented in the catches in 1979, while the strong 1973 year-class had nearly disappeared, and the 1976, 1975 and 1974 year-classes were not well represented.

Introduction

Observations on species composition of catches, length frequency distributions of capelin by sex, as well as weights, stages of maturity, ages, etc. were made on Romanian vessels engaged in a directed fishery for capelin in 1979. The fishing activity took place from 6 September to 16 October 1979, mainly off southern Labrador in Div. 2J, and both catches and catch rates were very low.

Materials and Methods

Biological data on capelin were collected from otter trawl hauls with catches greater than 500 kg. As soon as the catch was taken on board, a random sample of 200 capelin was collected for analysis. Fork length measurements were taken to the nearest 0.5 cm, and weights recorded to the nearest gram for each length class and sex. Otolith were selected from each length group (5 males, 5 females) represented in the catch length composition.

The length-weight relationships for each sex and sexes combined were calculated using the standard equation  $W = aL^b$ , where  $W$  is weight in gm,  $L$  is the length in cm, and  $a$  and  $b$  are constants derived from the least squares regression. The von Bertalanffy equation was used to calculate the growth curves by sex from the age-length keys.

Results

Catch and fishing effort

The Romanian directed fishery for capelin began on 6 September 1979 with a 3600 GRT trawler searching for capelin schools in Div. 2H, 2J and 3K for 5 days after which the first catches were made off southern Labrador. Most of the tows were made in Div. 2J (Table 1) along the continental shelf between 53°44' and 52°15' N latitude in depths ranging from 130 to 305 m (majority at about 150 m) at distances of 14-36 nautical miles from the coast. The gear used was the otter trawl which worked both near the bottom (especially during daytime) and in midwater up to 12 m below the surface (especially at night).

Low catches were realized, as the scattered schools consisted of small capelin mixed with small Arctic cod (*Boreogadus saida*). Under these conditions and with no extension of the capelin fishing licence, Romanian vessels caught only 846 tons (48%) from the 1750 tons allocated.

The catches in the fall of 1979 were not "clean" but contained a mixture of capelin and small

Arctic cod. In both September and October, capelin constituted 79.1% and 91.1% of the total catches respectively, whereas in 1977 and 1978 in Div. 2J (Table 2) 98.2 to 100% of the catches consisted of capelin (Panait, 1979; Maxim *et al.*, 1979).

In September-October 1979, it was considered unusual to find massive schools of small Arctic cod, which was recorded by echo-sounder extending from the surface to the bottom but which could not be distinguished from capelin on the sounder paper. Because of the mixed capelin and young cod catches mainly in the daytime fishery and the mixed capelin, American plaice, small cod and lumpfish catch at night, considerable quantities were discarded (Table 3). All of the American plaice were taken during nighttime hauls when the trawl operated at depths of 12-20 m below the surface, where the plaice were feeding on capelin, cod fry and pink shrimp.

During September, analysis of 3 samples of small cod (625 specimens) revealed 618 Arctic cod (98.9%), 4 Atlantic cod (0.6%) and 3 Greenland cod (0.5%). During October, 2 samples of small cod (414 specimens) consisted entirely of Arctic cod. Small Arctic cod consistently appeared in the catches during the whole fishing period, but their abundance appeared to decline toward the end of September and early October.

The catch per unit effort values in Div. 2J in September and October 1978 were 1.004 and 1.554 tons per trawling hour respectively, significantly lower than values for the same months in 1977 and 1978 (Table 4). In fact, the rapid decline in CPUE from 1977 to 1979 confirms the generally accepted conclusion that the capelin stock in Div. 2J and 3K has decreased.

#### Population analyses

The main feature of the capelin length frequencies from Div. 2J in the fall of 1979 was the small size of the capelin in the catches (46% being less than 15 cm). The size range was 8.5-23.0 cm in September and 8.5-22.0 cm in October, most being in the range of 12.5-17.5 cm in both months (Fig. 1; Table 5). There was a significant reduction in the average length and weight of both males and females between 1978 and 1979 (Table 6).

The length-weight relationships determined for 7,677 males and 9,305 females are shown in Fig. 2 together with the relationship for sexes combined. The correlation coefficients for all three relationships were about 0.98.

Age samples collected during the course of the investigation (Tables 7 and 8) showed a distinct dominance of age-groups 1 and 2 in both months for both sexes. These age compositions are distinctly different from those of previous years when the representation of age-group 1 in the catches was very small, usually less than 5% (ICNAF, 1979; Panait, 1979; Seliverstov and Serebrov, MS 1979). The significant increase in the number of age-group 1 relative to the number of age-groups 2 and 3 in the catches supports the conclusion that the stock has decreased in abundance. Considering that the 1974 year-class was weak and those of 1975 and 1976 medium to weak, it seems that the 1978 and 1977 year-classes can be considered as medium on the basis of the 1979 age compositions.

Growth curves calculated by the von Bertalanffy equation (Fig. 3) resulted in the following parameters:

Sex	K	$t_0$	$L_\infty$	$W_\infty^1$
Male	0.252	-2.368	23.061	95.36
Female	0.204	-2.845	23.236	88.04

<sup>1</sup> Calculated from the length-weight relationships.

Analysis of 2,315 specimens by maturity stages (Table 9) showed that most of the capelin caught in September and October 1979 were post-spawners. It was noted that the length of post-spawning females were observed as small as 12.5 cm and post-spawning males as small as 14.5 cm, suggesting the earlier maturation of females, even at the end of the first year.

#### Conclusions

In 1979, the catch composition in the directed capelin fishery was different from previous years, in that small Arctic cod (*Boreogadus saida*) regularly occurred (percentages ranged from 10 to 90%) with capelin in the Div. 2J fishery.

Catch rates of 1.004 and 1.554 tons/hour in September and October 1979 respectively were considerably lower than experienced in the preceding years.

Length frequencies showed smaller capelin in the catches, 46% being less than 15 cm in length. Age composition data indicated a dominance of age-groups 1 and 2 for both sexes and in both months. The significant presence of these age-groups support the conclusion of declining stock abundance on the one hand but indicates the medium-sized year-classes in 1978 and 1977 on the other. Prospects are not very good for a successful capelin fishery in 1980.

The male:female sex ratio over the whole period of studies was 45:55. Growth was faster for males than for females after age 1, as indicated by the mean length-at-age and weight-at-age data. Practically all capelin in the September-October 1979 samples were in the post-spawning condition.

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Table 1. Romanian catch and effort data for directed capelin fishery in Div. 2H, 2J and 3K, September-October 1979.

	September		October	
	Div. 2J	Div. 3K	Div. 2H	Div. 2J
No. of vessels	2	1	1	2
Days on ground	41	1	1	24
Fishing days	38	1	1	24
No. of tows	176	1	1	113
Fishing hours	499	2	2	318
Capelin	396,075	-	-	449,940
Arctic cod	99,859	-	3,000	42,730
Atlantic cod	646	30	-	-
Greenland cod	485	-	-	-
American plaice	225	-	-	1,116
Halibut	2	-	-	2
Lumpfish	2,365	30	100	475
Spiny lumpfish	1	-	-	-
Atlantic herring	-	-	-	1
Short barracudina	3	-	2	-
Arctic eelpout	1	-	-	-
Squid- <i>Illex</i>	27	-	-	2
Pink shrimp	872	-	-	8
Total catch (kg)	500,561	60	3,102	494,274
Catch/day (kg)	13,173	60	3,102	20,595
Catch/tow (kg)	2,844	60	3,102	4,374
catch/hour (kg)	1,004	30	1,551	1,554

Table 2. Romanian catches in directed capelin fishery in Div. 2J in 1977 and 1978.

Div.	Month	Year	Catch (tons)	Percent capelin
2J	August	1977	-	-
		1978	199	100.0
	September	1977	256	100.0
		1978	389	100.0
	October	1977	1197	98.2
		1978	-	-

Table 3. Romanian discards by species in directed capelin fishery in Div. 2H, 2J and 3K in September-October 1979.

Species	September		October	
	2J	3K	2H	3K
Capelin	53,000	-	-	4,000
Arctic cod	99,859	30	3,000	42,730
Atlantic cod	646	-	-	-
Greenland cod	485	-	-	-
American plaice	115	-	-	-
Lumpfish	2,365	30	100	475
Short barracudina	-	-	2	-
Pink shrimp	872	-	-	8
Total discards (kg)	157,342	60	3,102	47,213

Table 4. Romanian catch and effort data for directed capelin fishery in Div. 2J in September-October 1977-1979.

Div.	Month	Year	Total catch (ton)	Effort		CPUE	
				Days fished	Hours fished	Tons/day	Tons/hour
2J	Sep	1977	256	5	51	51.2	5.01
		1978	389	24	193	16.2	2.02
		1979	396	38	499	13.2	1.00
	Oct	1977	1197	33	318	36.3	3.76
		1978	-	-	-	-	-
		1979	450	24	318	20.6	1.55

Table 5. Length frequencies and mean weights (g) of capelin sampled from Div. 2J in September-October 1979.

Length (cm)	September				October			
	Male		Female		Male		Female	
	%	$\bar{w}$	%	$\bar{w}$	%	$\bar{w}$	%	$\bar{w}$
8.5			+	3			1	4
9	1	4			1	3	2	4
9.5	2	4	5	4	2	4	2	4
10	5	5	6	5	5	5	3	5
10.5	5	6	12	6	4	5	5	6
11	3	7	7	7	4	6	6	6
11.5	6	8	12	8	11	7	18	7
12	9	10	16	9	23	8	34	8
12.5	28	11	45	11	51	10	60	10
13	37	12	58	13	53	11	65	12
13.5	76	14	105	15	66	13	92	13
14	78	17	99	16	80	15	113	16
14.5	134	19	145	19	106	18	121	18
15	119	21	117	21	110	21	134	21
15.5	139	24	97	23	105	25	90	23
16	128	27	64	25	137	28	69	26
16.5	122	30	56	27	124	32	45	28
17	63	33	39	30	77	34	43	31
17.5	30	36	43	32	31	38	33	34
18	10	40	30	36	9	41	32	38
18.5	2	42	23	38	1	47	21	41
19	1	46	10	41	+	48	7	43
19.5	+	55	4	46			2	44
20	-	-	1	49			1	54
20.5	-	-	1	57			1	58
21	-	-	+	63			-	-
21.5	+	70	+	68			+	90
22			1	77			+	85
22.5			+	71				
23			+	94				
Total	998		998		1000		1000	
No. meas.	4650		5477		3027		3828	
$\bar{L}$ (cm)	15.09		14.83		14.99		14.75	
$\bar{w}$ (g)	22.7		20.6		22.4		19.9	

Table 6. Mean capelin length and weight by sex in Div. 2J, September-October 1978 and 1979.

Div.	Month	Year	Mean length (cm)		Mean weight (g)	
			F	M	F	M
2J	Sep	1978	16.45	15.61	29.6	28.1
		1979	14.83	15.09	20.6	22.7
	Oct	1978	-	-	-	-
		1979	14.75	14.99	19.9	22.4

Table 7. Age-length keys by sex for capelin sampled in Div. 2J, September-October 1979.

Length (cm)	September												October												
	1+		2+		3+		4+		5+		6+		1+		2+		3+		4+		5+		6+		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
8.5		1																							
9		1											1	1											
9.5	1	-											-	2											
10	1	12											1	2											
10.5	3	17											-	2											
11	5	16											1	2											
11.5	14	19											1	14											
12	22	36											3	19											
12.5	34	59		2									7	15		1									
13	55	64		9									21	15		2									
13.5	69	63	2	17									28	9	2	7									
14	58	52	7	48									19	5	-	10									
14.5	26	17	19	73		1							6		2	12									
15	15	2	48	75		12									9	24		1							
15.5	3		68	69	4	31									14	23	2	5							
16			72	21	16	52		3							26	4	1	14							
16.5			71	1	25	21		18							18		3	12		4			1		
17			37		35	14	2	34							8		11	2	2	12			-		
17.5			8		38	11	11	36		1							13	2	2	10			4		
18					14	2	33	21		19							3		-	4			2		
18.5					2		10	9		23							1		7	2			4		
19					1		3	4		7		1							-	1	7		1		
19.5							1			2		1							-		-		-		1
20										3		2							-		-		3		
20.5										1		1							1		1		1		
21												1													
21.5												-													
22												1													
Aged	306	359	332	315	135	144	60	125	-	56	-	7	88	88	79	83	34	36	11	33	1	22	-	2	

Table 8. Age composition of capelin in samples from Div. 2J. in September-October 1979.

Div.	Month	Sex	Age composition (‰)						Total aged
			1+	2+	3+	4+	5+	6+	
2J	Sep	M	166	181	73	33	-	-	833
		F	195	171	78	68	30	4	1006
	Oct	M	185	166	71	23	20	-	213
		F	185	174	76	69	46	2	263

Table 9. Stages of maturity of capelin in samples from Div. 2J in September-October 1979.

Div.	Month	Sex	Maturity distribution (‰)					Total spec.
			I	II	II-III	III	VI-II	
2J	Sep	M	11	176	83	72	107	833
		F	3	76	55	10	407	1006
	Oct	M	2	219	60	49	105	213
		F	-	96	74	4	391	263

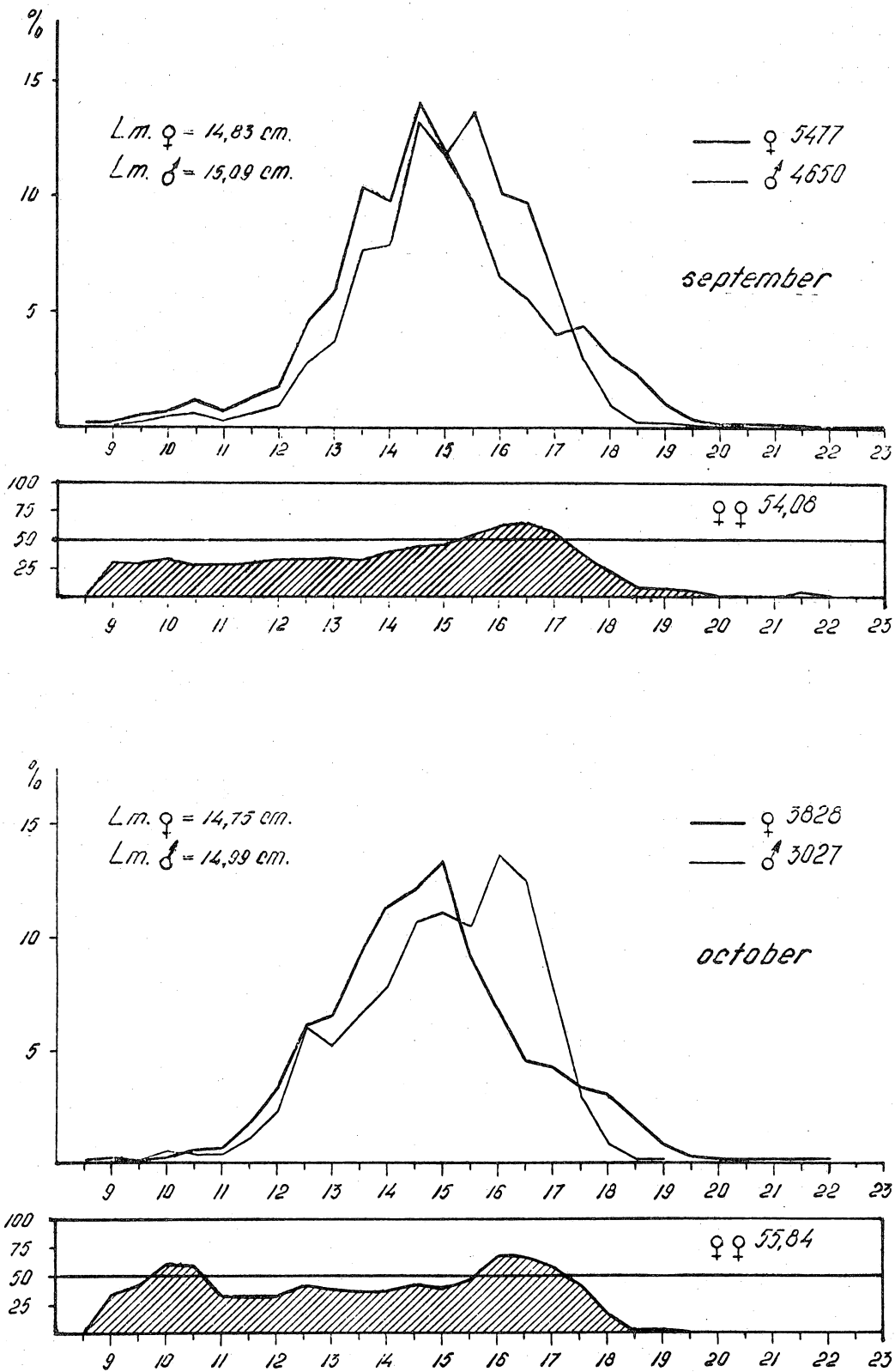


Fig. 1. Length composition and sex ratio of capelin in Division 2J, September-October 1979.



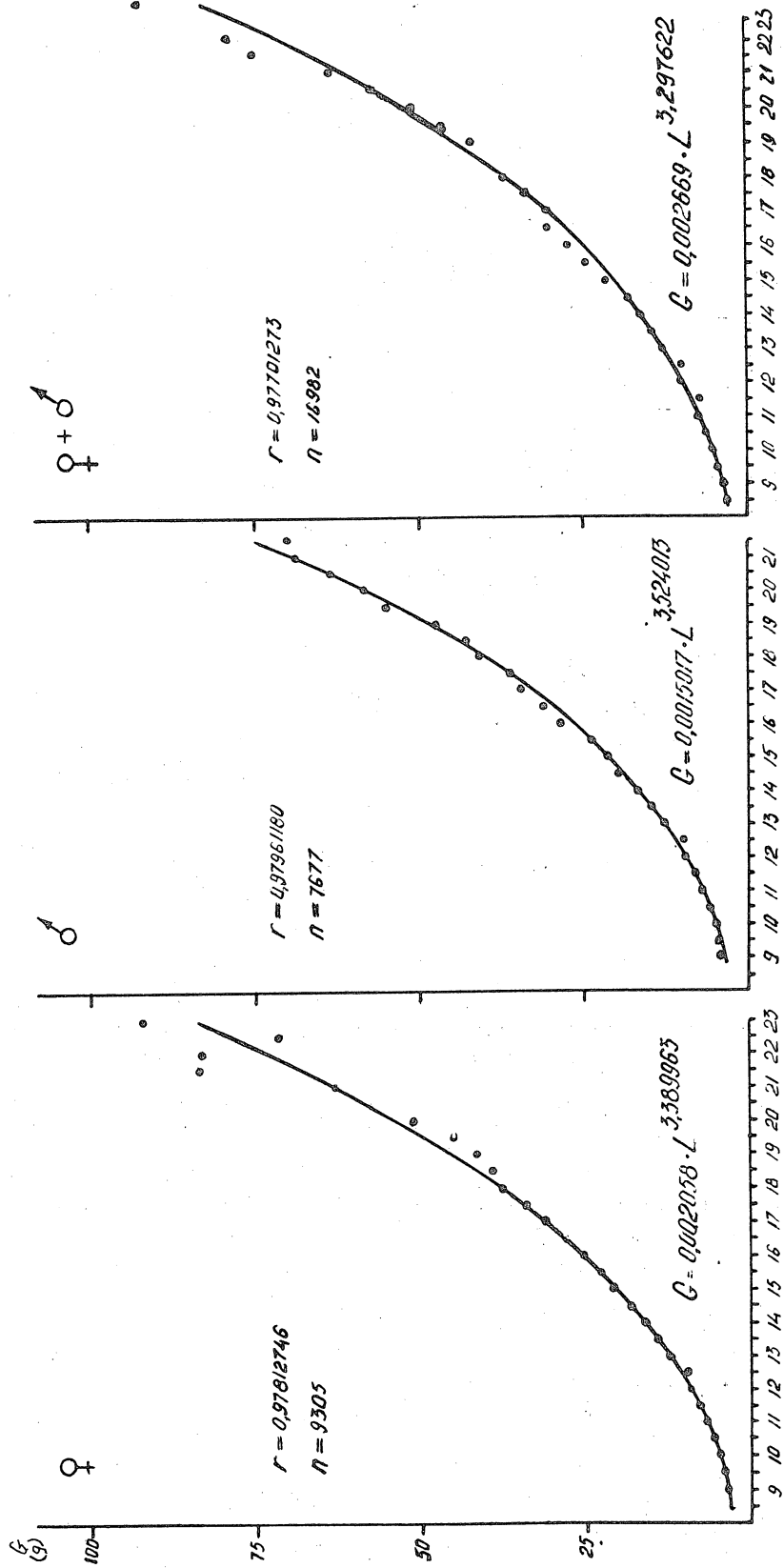


Fig. 2. Length-weight relationships for capelin in Division 2J, September-October 1979.

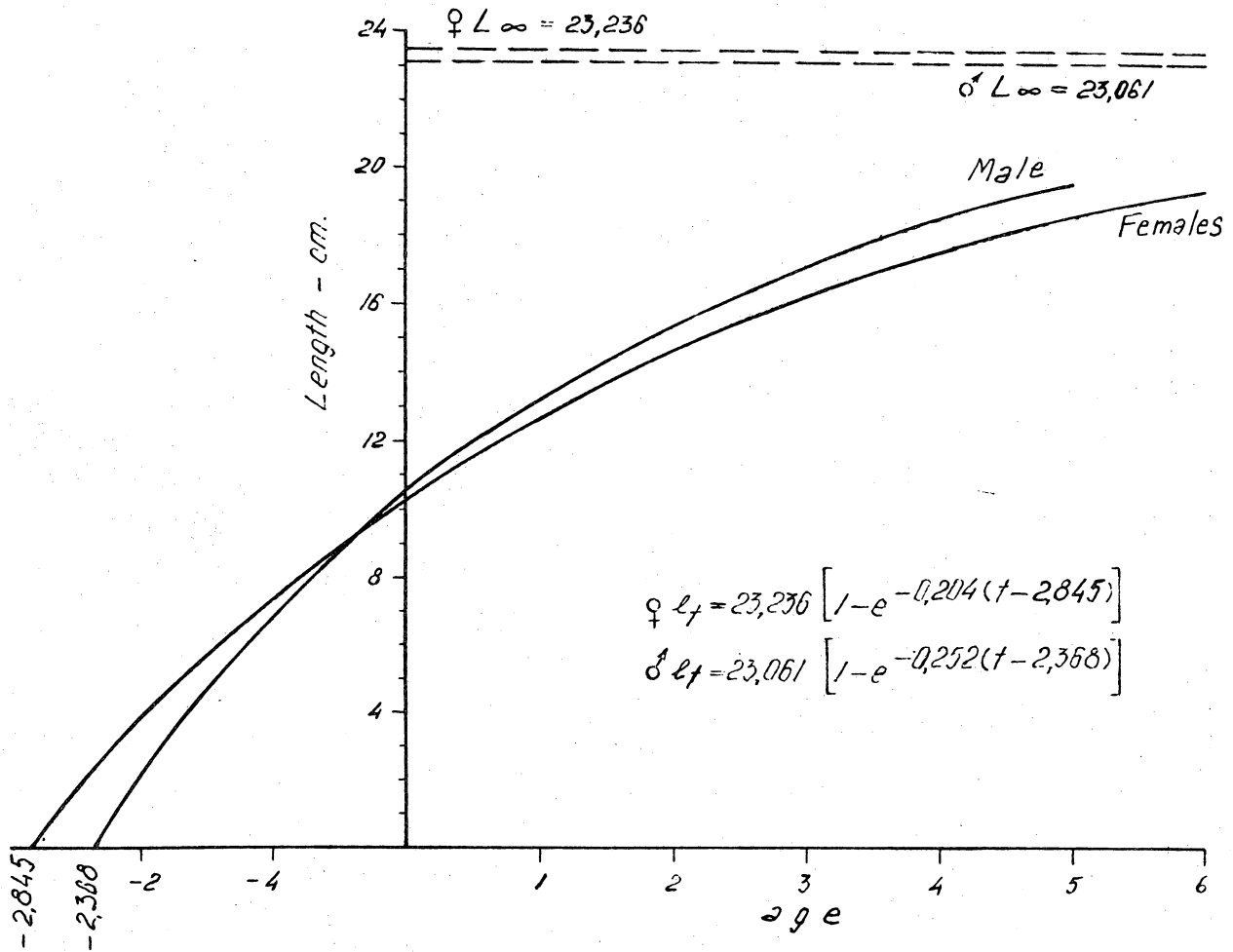


Fig. 3. Bertalanffy growth curves for male and female capelin in Division 2J, September-October 1979.