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Estimate of Capelin Stocks in the South Labrador and Northern Newfoundland
Bank Areas in the Autumn of 1976 (Divisions 2J and 3K)

by

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Results of the echophotogrammetric survey of capelin stocks conducted by R/V PERSEUS III from 7 to 24 November 1976 in the South Labrador and Northern Newfoundland Bank areas are given in this paper.

It has been possible to evaluate only a part of the stock in the international waters, the other being distributed in the territorial waters of Canada.

The fish biomass in the international waters was found to be 1.05 mill. tons, the abundance being $46240.8 \cdot 10^6$ specimens. This makes it possible to propose a total allowable catch at not less than 0.3 mill. tons for the above areas. The surveys conducted for three years running show that the present (1974-1976) fishing intensity does not lead to a decline in stocks.

Introduction

Instrumental estimate of the capelin stocks in Division 3K (Northern Newfoundland Bank) and 2J (South Labrador) in 1976 was carried out from 7 to 24 November by R/V PERSEUS III.

In 1974-1975 instrumental estimate of the capelin stocks in those areas was conducted on completion of feeding migrations of capelin and formation of relatively stationary wintering concentrations (Serebrov, Bakanev and Kovalev, 1975; Bakanev, Seliverstov, Serebrov, 1976). In 1976 the formation of stationary winter-

ing concentrations was about one month late that was responsible for pursuance of survey in later terms. However, in November capelin concentrations continued to keep both inside the territorial waters of Canada and along their boundaries over a great area.

Material and methods

Estimate of the stocks and biomass of capelin in Divisions 2J and 3K was conducted over the area 50-54°N and 53-56°W (westwards as far as territorial waters of Canada). The survey route was worked out on the basis of information on the distribution of major commercial capelin concentrations obtained by scouting and fishing vessels. In the period of investigations a part of fish kept farther to the north and to the south of the surveyed area, but concentrations were very scattered which did not make it possible to follow a traditional echophotogrammetric method for the estimation of biomass and stocks of those concentrations. The extension of the route of the acoustic survey made up 1270 nautical miles in Divisions 2J and 3K. Simultaneously with these works, 4 dips of hydrostate "Sever-1" with observers, 33 dips of underwater photcamera and 33 control trawlings were made. 8164 specimens of capelin were measured, 779 specimens were taken for age determinations, 1175 specimens for gonad maturity stages and sex determinations, 1175 specimens for the intensity and components of feeding analyses.

In the autumn of 1976 estimation of the capelin stocks was performed by the methods used for this purpose in Divisions 2J and 3K in previous years (Bakanov, Seliverstov, Serebrov, 1976).

The methods are based on determination of three main indices of :

1. Specific volume occupied by capelin shoals per 1 mile.²
2. Average absolute density of shoals in the day time and at night.
3. Combined area occupied by concentrations of different density.

The parameters used for this purpose are shown on the table fragment of the first stage treatment of the echometrical survey materials (Table 1).

The density of capelin shoals was determined with the help of the underwater photcamera "Triton" as well as by the data of visual observations and photographs made from hydrostate "Sever-1". Photocameras "Triton" were lowered into the capelin concentrations from the drifting vessel and were also attached to the bottom line of the trawl or to weights-depressors. Photography of the same shoal under different ways of dipping and fixing of photocameras showed no difference in the shoal density relating to the way in which photographs were taken.

Photographs were interpreted according to the method used earlier (Bakanev, Seliverstov, Serebrov, 1976; Truskanov, Zaferman, 1973; Truskanov, Shcherbino, 1963, 1966), (Table 2).

Specific abundance of fish for each time interval of the survey was determined as a product of the specific volume of concentrations in $m^3/mile^2 \times 10^6$ (Table 1) and shoal density (S) defined from photographs for a given section of the route.

The values of specific abundance plotted on the map of echometric survey (according to the route of the vessel) were divided into four zones with the following gradations of the abundance :

1. $< 1 \cdot 10^6$ spec/mile²
2. $1.1 - 10 \cdot 10^6$ spec/mile²
3. $10.1 - 100 \cdot 10^6$ spec/mile²
4. $> 100 \cdot 10^6$ spec/mile²

The area of each zone outlined by isolines of equal specific abundance was measured, and the average specific abundance by zones was defined (Fig.1, Table 3).

The product of the average specific abundance by the zone area and average weight of fish in shoals of this zone (according to data of control trawlings) gives the value of capelin biomass in the zone (Table 3).

Discussion and conclusion

In November 1976 capelin kept in two separate concentrations: larger fish in the south-western Division 2J and north-western Division 3K (Fig. 1A), small fish to the south of 51°45'N in Division 3K (Fig. 1B). On the northern section (A) the average weight of one fish made up 28.3g, on the southern one^(B) it was 14.5g (Table 3). Even though we assume that fishes of the 1973 year class at the age of 3+ years (97.0%) prevailed on the northern section, and on the southern section fishes of this year class made up only 70.0% (27.8% accounted for the 1974 year class fishes), it remains inexplicable why the average weight of specimens was two times as high in the north. A more detailed analysis shows that specimens of the 1973 year class with a higher rate of growth and hence with a bigger weight kept in the north. The difference in the average weight of the 1973 year class specimens on the sections A and B (Fig. 1) made up 8.6g. The revealed difference refers to all other groups as well (Table 4).

Biomass and stocks of capelin in the autumn of 1976 proved to be almost similar to that in the autumn of 1975. Echophotogrammetric surveys conducted by the Polar Institute research vessels for three years running are indicative of the fact that the stocks and biomass of capelin in the South Labrador area (2J) and on the Northern Newfoundland Bank (3K) are at a rather stable level (Table 5). Recruitment of the 1973 year class to the commercial stock which lead to a considerable decrease in the average weight of one specimen in the stock in 1975 and 1976 (Fig. 2^x), resulted in the increase of the stock approximately by $2000 \cdot 10^6$ specimens under an insignificant decline in biomass.

As it has been repeatedly shown earlier (Serebrov, Bakanev, Kovalev, 1975; Bakanev, Seliverstov, Serebrov, 1976), one cannot identify the estimation of capelin stocks conducted by the Polar

^x) Fig. 2 shows age composition and average weight of capelin according to the ICNAF statistical zones (2J and 3K). In Table 4 average weight of specimens refers to the areas of distribution (Fig. 1).

Institute in Divisions 2J and 3K with the absolute size of the stocks in the mentioned areas. Only part of the capelin stocks found outside the territorial waters of Canada were covered by investigations. A considerable amount of fish always distributes in the territorial waters, as vividly seen in Fig.1 and on the plot of the 1975 survey (Serebrov, Bakanev, Kovalev, 1976). Therefore estimate of the capelin stocks in the South Labrador and Northern Newfoundland Bank areas is possible only at extension of investigations (on the international or other basis) into territorial waters. Consequently, estimate of the stocks outside the territorial waters only makes it possible to propose a total allowable catch of capelin in Divisions 2J and 3K at a level of 1975-1976, i.e. 0.3 mill.tons.

REFERENCES

- Bakanev, V.S., Seliverstov, A.S., Serebrov, L.I., 1976. Preliminary instrument estimate of abundance and biomass of capelin off South Labrador and the North Newfoundland Bank (div. 2 J and 3K). Intern. Comm. Northwest. Atlant. Fish. Res. Doc. 76/VI/54; 1-15.
- Serebrov, L.I., Bakanev, V.S., Kovalev, S.M., 1975. The state of Newfoundland capelin stock. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 75/7; 1-11.
- Truskanov, M.D., Shcherbino, M.N., 1963. Acoustic estimation of the abundance of fish concentrations. "Rybnoe khozyaistvo", No 6:52-58.
- Truskanov, M.D., Shcherbino, M.N., 1966. Acoustic estimation of the degree of concentration of fish. "Rybnoe khozyaistvo", No 8 : 38-42.
- Truskanov, M.D., Zaferman, M.L., 1973. Peculiarities of the procedure to determine fish abundance in the scattering layers by the hydroacoustic method. "Rybnoe khozyaistvo", No 10:1-44.

Table 1

Fragments of the first stage of data treatment

Date	Time	t	c	a	B	z	l	l ₁	l _{1-z}	D	d	(l-z)D	h	v	ZV	a.d.	α	ΣV	α.d.	Q _v	Q _{sp}
I7430	10 9,0	1,5	110	60	1,1	82,5	22,5	94	0,051	2115	10	21150	62100	0,07	0,9	10 ⁶	0,34				
I7440	80	50	0,9	67,5	17,5	78	0,042	1365	30	40950											
I7450	10 9,0	1,5	65	44	1,1	82,5	38,5	68	0,037	2618	30	78540	129710	0,06	2,1	10 ⁶	0,82				
I7450	75	48	0,9	67,5	19,5	75	0,040	1462	35	51170											
	65	44	0,9	37,5	-	68	0,037	-	20	-											

- Notes:
- t - running time, min.
 - c - speed, knots
 - a - distance, miles
 - B - average depth
 - z - zone extension
 - l - length, m
 - l₁ - true length, m
 - D - in meters
 - d - in miles

- (l-z)D - sectional area in m²
- h - vertical development, m
- v - volume in m³
- ZV - total volume in m³
- α.d. - total surveyed area in miles²
- Q_v - specific volume in m³/mile²·10⁶
- Q_{sp} - specific abundance spec/mile²·10⁶

Table 2

Density of capelin shoals according to the photosurvey data

Time of day	Hours	No. of observations	No. of dips	No. of trawls and drifts	Camera position	Total no. of pictures	No. of pictures in shoals	Average in m ³	Average in m ³	Total no. of fish on pictures	Density, spec/m ³ from	to	Average	
Day	11:20													
	11:50	33		84	trawl bottom line	60	7	3,7	5,1	67	0,15	4,4	2,12	
	13:00				trawl bottom line									
	13:15	39		93	weight-depr.	107	1	4,8	9,9	2	-	-	0,20	
	14:30				trawl bottom line	60	8	6,3	24,1	150	0,11	2,4	0,802	
	16:10				trawl bottom line	46	28	4,2	7,4	149	0,08	2,5	0,800	
	16:50	50		107	drift at 45° to horizon	38	10	4,3	10,4	84	0,23	1,3	0,862	
	17:00				trawl top line	112	19	4,07	6,4	232	0,24	10,8	2,43	
	17:40	49		116	hydrostate through porthole	20	1	8,7	53,1	84	-	-	2,12	
	18:05	54												
	18:50	19												
	Total for the day						443	74	339,05	760,10	768	-	-	-
	Average for the day						-	-	4,58	9,5	10,13	0,1008	10,8	1,320
Night	01:15				trawl bottom line	39	2	4,3	9,7	4	0,11	0,50	0,307	
	04:20	38		92	trawl bottom line	110	14	4,7	10,7	49	0,02	1,2	0,410	
	16:45				drift objective downwards	113	2	2,7	1,8	4	0,83	1,7	1,26	
	21:25	40		94	trawl weight-depress	82	1	3,2	2,9	2	-	-	0,70	
	18:10	41		2	trawl or bottom line	69	30	8,1	26,5	118	0,06	1,7	0,298	
	19:30	43		97										
	22:30	43		97										
17:30	45		102											
Total for the night						419	49	326,7	933,4	177	-	-	-	
Average for the night						-	-	6,6	19,0	3,6	0,02	1,7	0,380	

Table 3
Abundance and biomass of capelin (Divisions 2J-3K)

Fig.	Gradations of density, spec./mi ² x 10 ⁶	Average abundance, spec./mi ² x 10 ⁶ (Q _{av})	Area of concentration, mi ² (S)	Total abundance, spec. x 10 ⁶ (N)	Average weight of 1 specimen in grams	Total biomass in tons

Fig. 1A	1	0.51	759.0	387.09	28.3	10594.6
	1.1-10.0	5.85	2433.5	14235.97		402878.1
	10.1-100.0	34.41	346.2	11912.74		337130.6
	100.1	195.81	9.0	1762.29		49872.8
Total		7.97	3547.7	28298.09		800836.1

Fig. 1B	1	0.41	1798.2	736.26	14.5	10690.3
	1.1-10.0	4.43	506.5	2242.46		32515.7
	10.1-100.0	27.50	274.0	7535.00		109257.5
	100.1	164.40	39.1	6428.04		93206.6
Total		6.47	2617.8	16942.76		245670.1

Total for the two areas			6165.5	45240.85		1046506.2

Table 4

Average weight of capelin in Divisions 2J and 3K
in the autumn of 1976

Age	Weight of 1 specimen					
	Division 2J:			Division 3K		
	min	max	average	min	max	average
1+	-	-	-	8.5	9.3	8.9
2+	18.7	22.0	20.3	9.8	13.0	11.2
3+	20.3	34.2	28.6	15.2	33.5	20.0
4+	17.9	42.4	31.8	21.5	51.5	30.0
5+	28.5	44.7	39.5	-	-	-
6+	-	-	-	-	-	-
7+	-	-	38.5	-	-	-

Table 5

Stocks and biomass of capelin in Divisions 2J
and 3K in 1974-1976

Year	1974	1975	1976
Abundance			
specimens x 10 ⁶	43681.8	45665.7	45240.8
Biomass,			
mill.tons	1.33	0.98	1.05

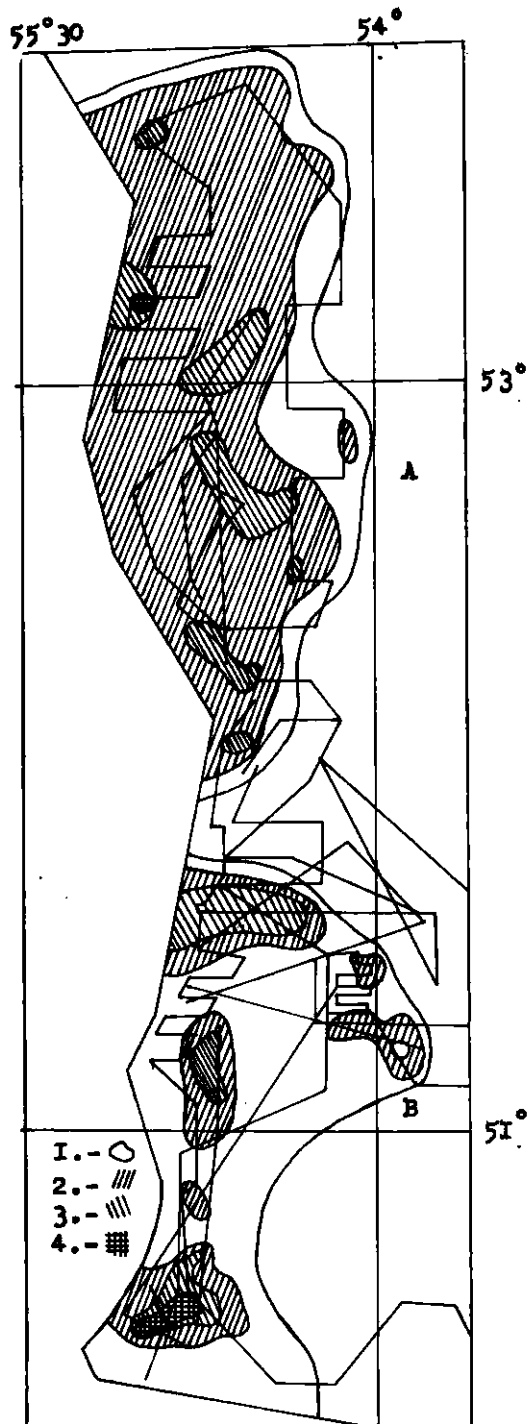


Fig.1. Plot of the capelin stocks survey in the South Labrador and Northern Newfoundland Bank areas from 7 to 24 November 1976.

Designations : specific density of concentrations
in specimens/mile²·10⁶
1. >100.1; 2. 10.1-100.0;
3. 1.1-10.1; 4. < 1.0.

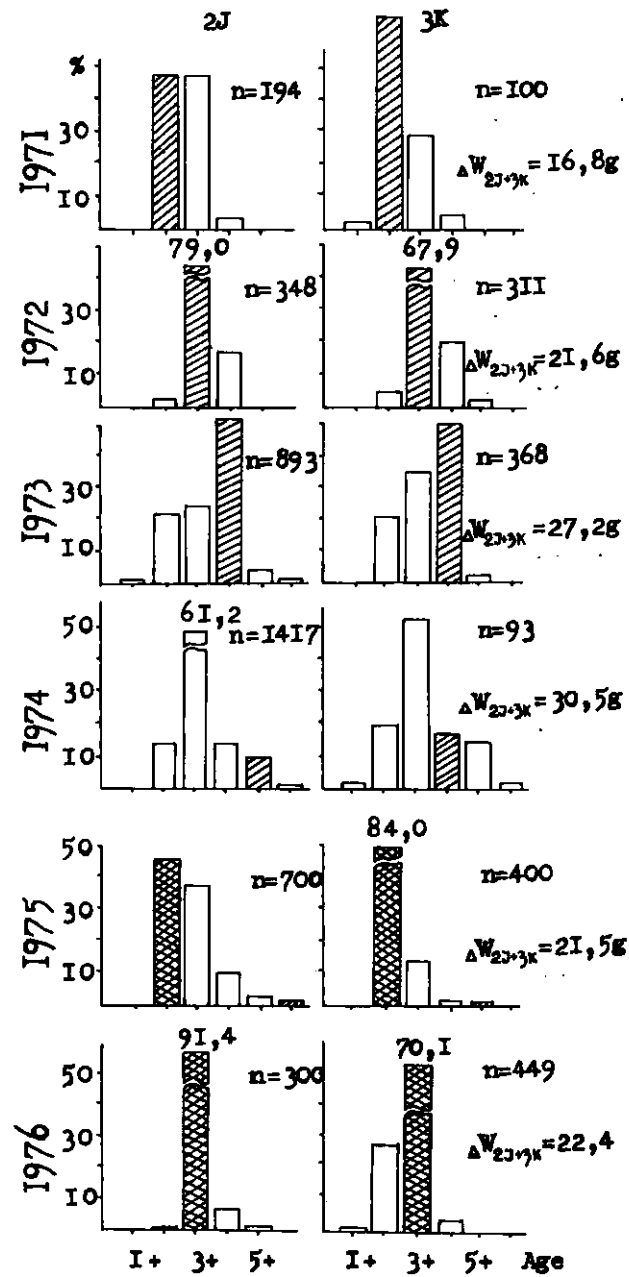


Fig.2. Age composition and average weight of capelin in the South Labrador and Northern Newfoundland Bank areas in the autumn of 1971-1976.

