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Review of Hydrological Observations in the Northwest Atlantic in 1970-1979

by

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Introduction

The review of hydrological observations in the North-West Atlantic in 1970-1979 was made using an analysis of water temperature fluctuations in Labrador and Newfoundland areas. Data we had at our disposal on other areas and also on salinity and water discharge were unmatched and scarce, and so were not used. In addition, salinity and water discharge are rather conservative characteristics and change little by years.

Observations of the Soviet research vessels on standard hydrological sections in Labrador and Newfoundland areas in 1970-1979 analysed by the author in the Reports at the Annual NAFO Sessions are used in the paper (Burmakin and Kudlo, 1971; Burmakin, 1973-1976; Burmakin, Sterkhov and Svetlov, 1977; Burmakin and Sterkhov, 1978; Burmakin, 1979-1980; Kudlo and Burmakin, 1972).

Methods

Calculation of the mean water temperature on standard sections in Labrador and Newfoundland areas was made using N.N.Zubov's methods (1926). Parts of sections earlier proposed by A.A.Elizarov (1962) and also by the author (Burmakin, 1972) for calculation of the mean temperature of different water layers are shown by square brackets in Fig.1.

Temperature anomalies from the long-term mean norm per date of observations were determined for the 0-200 m layer by the diagrams of normal (average) annual variations (Burmakin, 1972; 1976).

Results

Table I lists the time of carrying out hydrological observations by the Soviet research vessels on standard sections in Labrador and Newfoundland areas in 1970-1979. As is seen from the Table regular observations were mainly made in the spring-summer period and also before winter. Therefore, we can judge of the thermal state of a year and of year-by-year fluctuations of water temperature just by these periods.

For convenience in analysing we divided a decade of 1970-1979 into two five-year periods. Temperature anomalies of the 0-200 m layer for all sections and months of 1970-1974 are given in Table 2, and for 1975-1979 in Table 3.

The analysis of these Tables shows that the first five years are characterized by a maximum cooling of water masses having reached the highest level in 1972 and 1973 for the whole period of investigations beginning from 1936 (Burmakin, 1975). The smallest anomalies were observed on the eastern slope of the Grand Bank in the main branch of the Labrador Current and reached values of -2.2 and -2.6° (sections 6-A and 4-A). It is interesting to note that in these years maximum positive anomalies up to +3.4° were also observed on the southern and south-western slopes of the Grand Bank in the North-Atlantic Current (sections 2-A and I-A). Judging by water temperature 1970 was moderately cold, 1971 and 1974 - cold.

The second five-year period (1975-1979) is characterized first of all by a smaller number of observations which is connected with economic and technical reasons. Nevertheless, according to the available body of evidence it may be quite exactly said of the increased level of water masses heat content (Table 3). The largest number of positive anomalies was observed for almost the whole period of 1977-1979, they being maximum in the north in the Hamilton Bank area in the main branch of the Labrador Current (section 8-A).

In 1975 temperature conditions of water masses were moderately warm and in 1976 - cold.

In September 1975 the maximum positive anomaly equal to +4.5° caused, in our opinion, by meandering of the Gulf Stream on the tail of the Grand Bank was observed on section 2-A (Burmakin and Sterkhov, 1978).

Conclusions

The analysis of the water temperature fluctuations of Labrador and Newfoundland areas in 1970-1979 showed that maximum negative anomalies with peaks in 1972 and 1973 prevailed in the first five years of this decade.

In the second five years there dominated positive anomalies, especially in the period from 1977 till 1979.

A contrary sign of anomalies was registered in the Labrador waters north and east of the Grand Bank and also in the Atlantic waters south and south-west of it, which occurred more often in abnormal years.

In abnormally cold 1972 and warm 1979 contrary in sign anomalies were observed for Labrador and Newfoundland in the Barents Sea which was registered in other years too. This phenomenon of antiphase needs careful investigation.

References

Burmakin, V.V. and B.P.Kudlo. 1971. Hydrographic conditions in the Northwest Atlantic in 1970. Int.Comm.Northw.Atlant. Fish.Redbook, 1971, Part III, p.49-56.

Burmakin, V.V. 1972. Seasonal and year-to-year variations in water temperatures in the Labrador and Newfoundland areas. Spec.Publ.Int.Comm.Northw.Atlant.Fish., 8:63-70.

1975a. MS. Water temperature in the Labrador and Newfoundland areas in 1974. Annu.Meet.Int.Comm.Northw. Atlant.Fish., Res.Doc. 75/76.

1975b. Water temperature in the Labrador and Newfoundland areas in 1972 compared with 1971 and 1973. Spec. Publ.Int.Comm.Northw.Atlant.Fish., 10:33-39.

1976. MS. Water temperature in the Labrador and Newfoundland areas in 1975. Annu.Meet.Int.Comm.Northw. Atlant.Fish., Res.Doc. 76/VI/72, p.23-35.

Burmakin, V.V., V.S.Sterkhov and I.I.Svetlov. 1977. MS. Water temperatures in the Labrador, Newfoundland and West Greenland areas in 1976. Ibid, Res.Doc. 77/VI/35.

Burmakin, V.V. and V.S.Sterkhov. 1978. MS. Water temperature in the Newfoundland, Labrador and Baffin Land in 1977. Ibid, Res.Doc. 78/VI/70, p.1-9.

Burmakin, V.V. 1979. MS. Water temperature in the Newfoundland and Labrador areas in 1977-1978. Annu.Meet.Int.Comm. Northw.Atlant.Fish., Res.Doc. 79/VI/106, p.1-7.

Burmakin, V.V. 1980. MS. Water temperature in the Labrador and Newfoundland areas in 1979. Serial No. N098 NAFO SCR Doc. 80/VI/59.

Elizarov, A.A. 1962. On the inter-annual fluctuations of intensity in the Labrador and West Greenland currents and on possibility of temperature prognosis in the commercial areas of the Northwestern section of the Atlantic Ocean. Okeanologiya, vol.2, No.5:796-809.

Kudlo, B.P. and V.V.Burmakin. 1972. Hydrological conditions in Labrador and Newfoundland areas in 1971. Int.Comm. Northw.Atlant.Fish.Redbook, 1971, Part III, p.11-18.

Zubov, N.N. 1926. On determination of temperatures. Zapisky po gidrographii, t.51.

Table 1. Time of carrying out hydrological observations in Labrador and Newfoundland areas in 1970-1979

Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
I970	—	—			—	—	—	—	—	—		
I97I			—	—	—	—	—	—			—	
I972	—	—		—	—	—				—		
I973				—	—	—	—	—			—	
I974				—	—	—	—	—		—	—	—
I975	—					—	—	—	—	—		
I976			—	—	—	—	—	—			—	—
I977				—	—	—					—	—
I978	—	—			—	—	—	—			—	
I979				—	—						—	

Table 2. Water temperature anomalies for the 0-200 m layer on standard hydrological sections in Labrador and Newfoundland areas in 1970-1974

Years	Months	NAFO Divisions and hydrological sections											
		2J	3L			3N				3O		3P	
		8A	NW	SW	SE	7A	6A	4A	3A	2A	1A	4A	
1970	January						0,2	0,8	0,1	-0,4	1,9	0,7	
	February								-0,5				
	May	0,2				-0,2	-0,2	0,0	-0,3				
	June											-0,3	
	July									-0,1	-0,2		
	August					-0,8	-1,3						
	September	0,5				-0,7					0,7	0,5	
	October	0,0					0,1	-0,8	-0,5	-0,1			
1971	March						-1,4					1,3	
	April						-0,7	0,9	0,0	-0,8	0,4		
	May					-0,8	-1,4	0,0	-0,1			1,2	
	June					-0,8			0,8		2,4		
	July	0,7				-1,2		0,6			-0,5	-0,5	
	November	-0,1											
	December					0,0	-0,9	-1,3	0,0	2,2			
1972	January										-0,1	-0,6	
	February					-0,8							
	April						-2,2	-0,8	-1,3	0,5			
	May					-1,5	-1,5	-0,9	-0,8		0,3	1,2	
	June									1,0	0,8	-1,0	
	October	-1,4											
1973	April						-1,0			3,4		0,5	
	May					-1,0	-0,1	-2,6	-0,8	-0,8			
	June	-1,2	-1,0	-1,1	-1,0							-1,0	
	July						-1,8			-0,5			
	August	-0,1	0,0	0,0	0,3								
	November	-0,2											
1974	May					-1,0	-0,6	-1,7	-0,9				
	July	0,0											
	August	0,1											
	November	-0,8	-0,5	-0,5									
	December				-0,5	-0,9	-1,2	-1,0	-0,9				

Table 3. Water temperature anomalies for the 0-200 m layer on standard hydrological sections in Labrador and Newfoundland areas in 1975-1979

Years	Months	NAFO Divisions and hydrological sections											
		2J	3L					3N			3O	3P	
		8-A	NW	SW	SE	7-A	6-A	4-A	3-A	2-A	I-A	44-A	
I975	January									0,5			
	June		0,I	0,0	0,4		-I,4						
	July												-I,I-0,9
	August	-0,7											
	September					0,2			3,0	4,5			
	October	-0,7											
I976	March						-2,5						
	April								-I,3	2,8	2,8		
	May					-0,5	-I,2	-I,0					
	June		-I,0	-0,2	-0,6				0,5				
	July	-0,6											
	November	-0,4											
	December	-0,6											
I977	April						-0,4						
	May					0,2		-0,3	-0,4	-0,9			
	June		0,7	0,2	0,6		-0,9				-I,6		
	November	I,6	0,6	-0,I	0,4								
	December					0,I	0,2	-0,8	0,0	I,6			
I978	January						-0,9						
	May						-0,6	0,7	0,I				
	June		0,I	0,I	0,4	-0,4	-0,8	0,2	I,0				
	July	I,9	0,9	0,3	0,7		-0,2			I,3			
	November	0,0											
I979	April							0,0	-0,I				
	May		0,4	0,4	0,5	0,5	0,7						
	November	0,4											

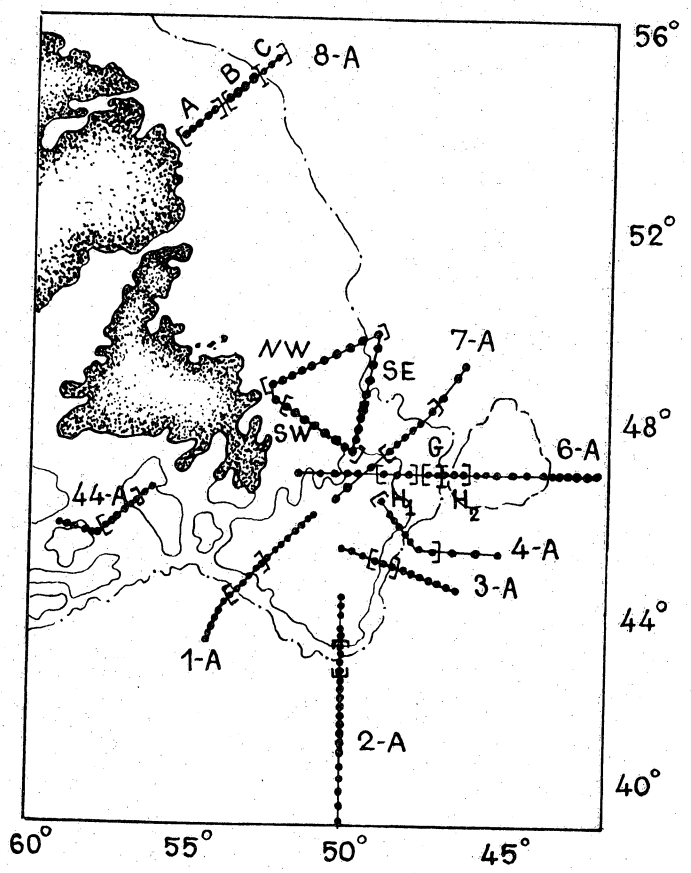

Fig. 1. Position of standard hydrological sections carried out by the Soviet research vessels in Labrador and Newfoundland areas.