Northwest Atlantic Fisheries Organization

Serial No. N295

NAFO SCR Doc. 81/ VI/19

SCIENTIFIC COUNCIL MEETING - JUNE 1981

Water Temperature in the Labrador and Newfoundland Areas in 1980

by

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Abstract

Insignificant negative anomalies of water temperature were prevailent on the main oceanological sections in the Newfoundland and Labrador area from May to November 1980. They were registered on the south-east slope of the Grand Bank in May, and also east and north-east of the Bank in October. Negative anomalies in the 200-500 m layer were distributed in the larger area than those in the 0-200 m layer.

In November 1980 water temperature in three branches of the Labrador Current was approaching normal after a warm three-year period from 1977 to 1979. Small positive anomalies were observed in the coastal branch of the Current, negative ones - in the main and Atlantic branches.

As compared with 1979, water temperature fell almost in all layers and branches of the Labrador Current in May-June and November 1980. The greatest decrease in temperature was registered in the 50-200 m and 200-500 m layers of the main and Atlantic branches of the Labrador Current (to 0.6-0.8°).

Mean water temperature of various layers and branches of the Labrador Current in the Newfoundland and Labrador area in 1980 is analysed in the paper. It was estimated by the accepted method (Elizarov, 1962; Burmakin, 1972) for standard oceanological sections.

Material and methods

In 1980 observations were performed in Cruise 20 of the RV "Protsion" at 263 hydrological stations of standard sections (May-June), 344 trawl stations in Cruise 2/80 of the FRV "Nikolai Kononov" (March-June) and 410 stations of standard sections in Cruise 21 of the RV "Protsion" (August-November).

Mean weighted water temperature was calculated for the 0-50, 50-200, 0-200 and 200-500 m layers on separate parts of oceanological sections.

Temperature anomalies for the 0-200 and 200-500 m layers per date of observations were calculated on the basis of normal (mean) annual curves drawn earlier (Burmakin, 1972; 1976). Besides, mean temperature reduced to certain dates was analysed in relation to some sections(Burmakin, 1969). In this case deviations from the mean long-term norm and difference of temperature changes as compared with 1979 were calculated.

Results

As consistent with four-year quasi-periodicity in year-to-year fluctuations of water temperature in the 0-200 m layer of the Newfoundland and Labrador area which was determined earlier (Burmakin, 1972), in 1981 there should occur the decrease of water temperature to the level of moderately cold years after a warm three-year period from 1977-1979.

From May to October 1980 positive anomalies of temperature turned into negative ones almost on all sections of the 0-200 m layer (Table 1). Alongside with this negative anomalies were registered first south-east of the Grand Bank and also to the north-east (sections 4-A - 7-A). The greatest negative anomalies were observed in the Flemish Pass in August (-2.3° on the section 6-A), the greatest positive ones - south of the Grand Bank (1.0° on the section 3-A).

In November negative anomalies in the 0-200 m layer were observed in the South Labrador area (section 8-A).

Negative anomalies in the 200-500 m layer were distributed on a greater number of sections than those in the 0-200 m layer (Table 2). In May-June anomalies from -0.1° to -0.4° were observed in the areas of the Southeast and Northeast slopes of the Grand Bank and they grew to -0.5° by August (sections 4-A, 6-A, 7-A). In August anomalies were positive on the Southeast slope (to 0.8° on the section 4-A).

In November negative anomalies of the 200-500 m layer on the section 8-A in the South Labrador area were -0.33°.

As compared with 1979, in 1980 temperature in the core of the Labrador Current (50-200 m layer) and in deep layers (200-500 m) decreased by 0.05-0.86°, and rose by 0.13 - 1.25° in the 0-50 m layer (Table 3). The predominant fall of temperature was recorded on almost all sections excluding section 3-A where temperature rose in all layers.

It may be supposed that the cold Labrador Current activized and at the same time radiational heating occurred as compared with last year.

In November 1980 on the reference section 8-A (observations of 1964) of the Labrador area temperature fell as compared with 1979 in all layers and branches of the Labrador Current (Table 4). Insignificant rise (by 0.03 - 0.13°) was registered only in the coastal branch (A). The decrease was 0.64° in the 50-200 and 200-500 m layers of the main branch (B) and 0.82° - in the 50-200 m layer of the warm Atlantic branch (C).

Thus, cold advection by the Labrador Current increased simultaneously with the decrease of heat advection by the Atlantic waters.

Notwithstanding the predominant decrease of temperature in the Labrador Current, as compared with last year, mean temperature in all layers of the stream on the whole (ABC) was at the level of the mean long-term norm after a warm period from 1977 to 1979 (Burmakin, 1980). The greatest negative anomalies were observed in the front zone (200-500 m layer) of the main branch

of the Labrador Current (-0.33°) and in the 50-200 m and 200-500 m layers of the warm Atlantic component (-Q29° and -0.33°).

Conclusions

Small negative anomalies of water temperature were observed (mainly from -0.2° to -0.5°) on standard oceanological sections in the Newfoundland and Labrador area for the period of observations from May to November 1980.

Areas with waters having negative anomalies extended from the Southeast to Northeast slopes of the Grand Bank, being greater in the 200-500 m layer than in the 0-200 m layer.

Water temperature in all layers of all branches of the Labrador Current approached the mean long-term norm in November 1980 after a warm three-year period from 1977 to 1979. In the coastal branch positive anomalies to 0.2° were observed in the 0-50 m layer, in the main and Atlantic branches - negative to -0.3° in the 50-200 and 200-500 m layers.

As compared with 1979 water temperature decreased in all layers and branches of the Labrador Current in May-June and November 1980. The greatest decrease was observed in the 50-200 and 200-500 m layers (to 0.6°-0.8°), i.e. in the core of the Labrador Current and in the deep front zone, which was caused by the increase of transfer of Arctic cold waters.

References

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Table 1 Temperature anomalies in the 0-200 m layer in 1980

Section and date	May	Jun	Aug	Oct	Nov
8-A(B) 4 October, 3 and 4 November				0.4	-0.05;-0.27
Triangle (NW) 27 May, 13 October	0.3			0.4	
Triangle (SW) 25 May, 14 October	0.2			0.8	
Triangle (SE) 26 May, 15 October	0.7			0.3	
7-A 21 May, 31 August, 19 October	0.2		-0.3	-0.2	
6-A (H) 23 May, 31 August, 18 October	0.3		0.0	0.0	
6-A (G) 5 June, 29 August, 22 October		0.5	-2.3	-0.7	
6-A (H_2) 5 June, 29 August, 22 October		-0.8	-0.3	-0.5	
4-A 17 May, 22 August	-0.6		1.1		
3-A 15 May, 21 August	1.0		0.3		

Table 2 Temperature anomalies in the 200-500m in 1980

Section and date	May	Jun	Aug	Oct	Nov
8-A(B) 4 October 3 and 4 November				0.1	-0.33;-0.24
Triangle (NW) 27 May	0.3				
Triangle (SE) 26 May	0.1				
7-A 21 May, 31 August, 19 October	-0.2		-0.3	-0.5	
6-A (G) 5 June, 29 August, 22 October		-0.2	-0.4	-0.3	
6-A (H_2) 5 June, 29 August, 22 October		-0.1	0.3	-0.5	
4-A 17 May, 22 August	-0.4		0.8		
3-A 15 May, 21 August	0.6		0.0		

Table 3 Changes of water temperature in 1980 as compared with 1979 on standard sections in the Newfoundland area in May-June

Standard sections	Date	Δ t (1980-1979) for layers, m			
		0-50	50-200	0-200	200-500
Triangle (NW)	May	0,3I	-0,I5	0,0I	-0,56
Triangle (SW)	May	0,29	-0,I9	-0,I6	-
Triangle (SE)	May	0,6I	0,25	0,39	-0,05
7-A	15 May	0,I3	-0,49	-0,3I	-0,48
6-A (H_1)	June	-0,7I	-0,44	-0,62	-
6-A (G)	June	0,24	-0,03	0,04	-0,22
6-A (H_2)	May	I,25	0,I6	0,44	-0,04
4-A	15 May	0,43	-0,86	-0,82	-0,57
3-A	15 May	0,64	I,I8	0,9I	0,96

Table 4 Mean temperature (t), changes of water temperature in 1980 as compared with 1979 (Δ t) and deviations from mean long-term norm of 1964–1980 (A) in the Labrador area on the section 8-A by the data reduced to 1 November

Parts of section 8-A	layers, m											
	0-50			50-200			0-200			200-500		
	t	Δ t	A	t	Δ t	A	t	Δ t	A	t	Δ t	A
A	I,5I	0,03	0,25	0,I3	0,I3	-0,07	0,54	0,05	0,03	-	-	-
B	I,24	-0,33	-0,07	I,I8	-0,63	-0,05	I,20	-0,55	-0,05	I,70	-0,64	-0,33
C	3,96	-0,49	0,25	3,36	-0,82	-0,29	3,5I	-0,73	-0,I9	3,65	-0,I7	-0,33
ABC	I,98	-0,23	0,I5	I,3I	-0,37	0,0I	I,50	-0,35	0,06	-	-	-