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Anomalies of Water Temperature and Water-Mass Border Indices in the Northwest Atlantic Area in 1990 and 1991

by

I. K. Sigaev

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO)
5 Dm. Donskoy Str., 236000, Kaliningrad, Russia

ABSTRACT

The report presents anomalies of some hydrological features, averaged by months in the Labrador Sea, Great Newfoundland Bank and Scotian shelf areas in 1990 and 1991. Sea surface temperatures, hydrological fronts borders at sea surface and fall water column temperature within the layer of 0-200 m are considered. Based on anomalies comparison, the conclusion was made that the year of 1991 is the second relatively cold year with apparent trend of water temperature raising since 1989, according to hydrological conditions.

INTRODUCTION

Monitoring of inter-annual and seasonal water temperature variability was continued in some areas of the North-West Atlantic during 1991. As some early works (Sigaev, 1991) it was based on sea-surface temperature data (maps of the Hydrometeorological Center in Moscow) for 6 fixed points, borders of water masses of various origin at sea surface (faximil maps from Canada) and fall water column temperature at the Scotian shelf (young hake surveys). The conditions were compared in 1990 and 1991.

MATERIAL AND METHODS

The average monthly values for above mentioned anomalies are presented. Relatively new average long-termed values of sea-surface temperature and fall temperature anomalies within the layer of 0-200 m in the Scotian shelf were calculated for 1977 trough 1991. Water-mass borders were defined based on the average long-termed values available.for 1978 through 1987. The data are shown in Tables 1 to 3, where blanks mean the data lack.

It is necessary to mention that the distance in tens of miles of each water-mass border from 37°N may be considered as a border location index. This index is determined at each meridian and is averaged for the area, located between 59° and 65°W. The following is according to the text.

Recalculation of long-termed average values revealed insignificant variations in anomalies of SST and fall temperatures. As to the plots of water-mass border index anomalies in 1990, presented by the author in NAFO SCR Doc. 91/4, Fig. 3, the corrections are required for October, November and December estimates due to arroneous copying from faximil maps "Ocean Features analysis". Corrected anomalies in October through December 1990 are presented in Table 2. In would be noted the very high positive anomaly of cold shelf water border in September 1990.

RESULTS

Analysis of table data in 1991 revealed the lowered temperature background of the ocean upper layer in the Labrador Sea, Newfoundland Bank and Scotian shelf areas. In 1991 the number of months with negative SST anomalies constituted 6 in the first and third areas and reached 8 in the second area.(Table 1). In some months anomalies were amounted to 2.8°C. The comparison of SST anomalies in 1990 and 1991 showed that the number of months with negative anomalies in the first year was greater than in the second one, which suggested the trend of SST raising. This trend was the most apparent at the Scotian shelf (45°00N, 60°00W) and shelf slope (42°30N, 62°30W). In 1991 water mass borders between 59° and 65°W were not significantly differed from their location in 1990 (Table 2). In 1991 the border of the cold shelf water was almost the same as in 1990, except January and October. In January 1991 it was characterized by the greater negative anomaly, and in January 1990 by a positive anomaly of almost the same absolute value.

The outstanding positive anomaly of the border location in October 1990 was confirmed by the maximum positive SST anomaly during the same period (Table 1). In January, November and December the significant variations in slop water location

were observed in 1990 and 1991. Thus in January 1991 the border was significantly shifted southwards, and in 1990 - northwards. In November and December 1991 the border was shifted northwards, and in 1990 - southwards. In 1991 and 1990 seasonal shifts of the border of Golf Stream front northern edge were similar and revealed significant negative anomalies during summer and fall, i.e. they were located well southwards the long-termed position.

Analysis of fall temeperatures in the layer of 0-200 m over the Scotian shelf revealed positive anomalies in 1991 at the depth of 50 m, 75 m and near bottom over the entire survey area, and in spawning grounds and slope area, unlike the negative anomalies observed in 1990. As in 1990 the upper layer was characterized by the negative anomaly significantly exceeded in the absolute value that of 1990.

To summarize the results of temperature conditions in 1990 and 1991 it may be concluded that in general the year of 1991 is considered as a relatively cold one (the second one since 1989), when some evidence was revealed of the trend for water temperature raising. The advective precesses seemed to play the major role in this trend.

REFERENCES

Sigaev, I. K. MS 1991. Review of hydrographic conditions in some areas of the Northwest Atlantic, 1990. NAFO SCR Doc. 91/4, Serial No. N1876, 12 p.

Table 1 Sea-surface temperature anomalies

Labrador Sea

Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
						Months						
						57°30N, 57°30W						
1990	L*	L	L	L	-0.8	-0.9	-0.1	0.1	0.9	-0.9	-0.9	-1.0
1991	L	-0.3	-0.6	-1.0	0.8	-0.5	1.6	0.4	0.3	-1.0	-0.9	0.2
						52°30N, 52°30W						
1990	-0.5	L	L	L	L	1.7	0.0	0.9	0.7	0.2	-0.9	-0.9
1991	-0.7	-1.4	-0.8	-1.3	1.3	0.8	-0.2	0.2	-1.0	0.5	1.4	1.3
						Newfoundland Bank						
1990	-0.6	0.6	-0.9	-1.2	-1.8	-1.8	-1.2	0.6	1.2	-0.6	0.5	0.3
1991	0.2	-0.7	-1.5	-1.1	0.2	-1.3	-1.4	-1.7	-1.5	0.1	1.4	1.6
						45°00N, 50°00W						
1990	-0.2	-1.3	-1.3	-0.2	-1.2	-1.2	-0.6	0.0	1.7	1.6	0.3	-0.1
1991	-0.4	1.1	0.0	-0.2	-0.7	-2.1	-2.7	-2.0	-1.0	-0.2	0.6	0.8
						Scotian shelf						
						45°00N, 60°00W						
1990	-1.1	0.0	0.0	0.2	-0.6	-1.6	-0.3	0.3	1.7	2.2	-0.2	0.6
1991	-0.3	0.5	1.6	0.2	0.5	1.9	0.8	-0.2	0.1	0.0	1.5	0.1
						42°30N, 62°30W						
1990	-0.9	0.0	-0.9	-1.4	-2.3	-2.2	-0.7	-1.0	-0.5	0.2	-2.5	1.8
1991	0.6	-2.8	-2.2	-2.8	-0.4	0.9	0.2	-0.2	-0.7	0.2	0.6	0.3

* character "L" means that sea surface is coved with ice

Table 2 Anomalies of indices of water-mass border location

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
						Months						
						Cold shelf water masses						
1990	4.6	5.2	2.8	4.2	-3.5	-2.9	-1.3	-0.6	-2.3	7,5	-1.6	-3.8
1991	-5.4	-	-	3.4	-1.1	-1.9	-1.6	-0.2	-0.2	-0.8	1.6	0.5
						Slope water masses						
1990	2.2	4.4	2.8	3.5	-1.4	-6.1	0.2	-0.1	1.1	-0.6	-2.6	-2.7
1991	-9.6	-	-	4.1	2.5	-2.5	0.0	-0.5	-3.5	-0.4	1.6	2.2
						Golf-Stream						
1990	0.0	3.1	-0.6	1.3	-2.2	-7.6	-6.4	-9.3	-4.7	-8.5	-3.9	-1.9
1991	-4.2	-	-	0.0	-1.8	-3.0	-4.8	-8.7	-7.5	-8.2	-2.7	-5.7

Table 3 Anomalies of fall water temperatures over the Scotian shelf

	Total survey area				Spawning ground				Slope			
	0m	50 m	75m	bottom	0m	50 m	75 m	bottom	0 m	50 m	75 m	bottom
1990	-1.2	-1.6	-0.5	-0.8	-1.8	-2.1	-1.6	-1.6	-1.8	-3.8	-2.6	-2.3
1991	-3.0	1.2	0.6	0.5	-3.1	0.5	0.9	0.8	-2.8	2.1	0.6	0.7