RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No.1820
(D.c.1)

ICNAF Res.Doc.67/37

ANNUAL MEETING - JUNE 1967

TRENDS OF MEAN MONTHLY SEA WATER TEMPERATURES, 1950-1966, AT BOOTHBAY HARBOR, MAINE

by
Walter R. Welch

A marked change in the trend of surface sea water temperature has taken place along the Maine Coast. The warming trend in progress during the early 1950's reached its peak in 1953 and since then the temperature has shown a general decline. The changes have been documented by the U.S. Bureau of Commercial Fisheries Biological Laboratory at Boothbay Harbor, Maine. The temperature records, beginning in 1905, were obtained several times daily by bucket and thermometer, and since 1950 have been tabulated as hourly readings from a continuously recording thermograph with its bulb fixed at 5.5 feet below mean low water.

Monthly and annual means and deviations of means are used here to demonstrate changes. A base period, 1950-59, was first selected. This 10-year period cannot be regarded as a normal period since it includes the highest temperatures of a warming trend; but precedence has been set for its use in comparing oceanographic data.

Ten-year means for each month of the base period were determined from individual monthly means (Table 1). The deviation of each monthly mean from the corresponding monthly mean of the base period was calculated and used to construct Figure 1A. The annual mean for the base period was likewise determined and the deviation of each annual mean from the annual mean of the base period was used to plot the solid line in Figure 1B, each point of which is at the midpoint of the year. The temperatures for the three warmest months of the years of the base period were averaged to obtain a base period mean. Then the deviation of the mean for the warm period of each year from the base period mean was used to plot the broken line in Figure 1B, each point of which is at the mid-point of the 3-month warm period. The deviations of the 3-month cold periods of each year were obtained in the same way and plotted as the short-dashed line in Figure 1B.

Deviations of monthly means (Figure 1A) show the end of the warming trend in 1953 and the subsequent cooling trend. This figure also shows that the month-to-month deviations have been more erratic since the temporary check in the downward trend occurred between 1959 and 1963. The deviations of annual means (Figure 1B) illustrate the same trends. Their comparisons with the deviations of the warm and cold periods of each year are made to show that, while both summer and winter temperatures have followed the same downward trend as the annual means, greater decreases have taken place during the winters. This figure also shows that the deviations of the cold periods have become more extreme since the temporary check in the downward trend. Other investigators have noted that the greatest increases in both air and water temperatures during the upward trend also occurred during the colder part of the year.

Environmental changes, particularly trends such as those discussed here, are well recognized as being vitally important to ecosystems. The Boothbay Harbor Laboratory will continue its program of recording environmental variables and analyses of such changes and trends.

Table 1. Mean sea water temperatures, Boothbay Harbor, Maine. °C.

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	Base Period Mean 1950-59
Jan.	5.1	6.1	5.2	4.7	4.2	5.5	3.4	3.7	4.3	2.2	3.9	3.3	3.3	2.8	3.3	1.3	3.0	4.4
Feb.	3.0	4.1	4.2	5.5	3.5	3.5	3.2	3.8	2.8	1.9	2.2	1.7	0.6	2.4	2.8	0.1	1.6	3.6
March	3.4	4.7	4.2	6.1	5.0	4.2	3.2	4.1	3.0	1.7	2.2	2.5	1.8	3.5	2.5	1.9	1.8	4.0
April	4.3	7.0	6.4	7.5	7.0	6.8	5.3	6.3	5.4	5.1	4.3	5.1	5.0	5.2	4.8	4.4	4.2	6.1
May	8.7	10.7	9.8	11.2	10.2	10.4	8.2	10.2	8.8	8.2	10.0	7.9	7.8	9.3	9.0	9.3	7.4	9.6
June	13.2	14.3	13.5	14.3	13.9	13.6	12.3	14.4	11.3	11.4	13.0	12.8	12.4	13.3	11.8	11.7	11.9	13.2
July	17.1	17.3	17.2	17.2	15.9	16.8	14.8	15.2	14.1	15.0	14.7	15.0	14.2	15.8	15.3	14.5	13.7	16.1
August	17.1	17.6	17.0	17.1	15.4	17.0	16.0	15.2	15.0	15.5	15.9	15.4	15.9	15.4	14.7	15.0	14.6	16.3
Sept.	13.6	16.6	15.9	16.1	14.8	15.0	14.6	14.2	13.4	14.4	13.8	15.4	14.0	13.7	13.4	13.0	12.7	14.9
Oct.	12.3	12.8	12.4	13.0	13.2	12.7	11.8	10.5	10.4	11.0	10.7	10.6	11.1	11.5	10.6	9.1	8.8	12.0
Nov.	10.3	10.6	8.3	10.7	10.4	10.0	10.0	8.6	8.5	8.1	9.2	8.0	8.2	9.0	7.6	6.4	6.6	9.6
Dec.	7.7	8.0	6.5	9.1	8.1	4.9	7.1	6.0	4.9	5.5	5.6	5.1	5.3	4.8	3.7	4.5	4.8	6.8
Annual Mean	9.6	10.8	10.1	11.1	10.2	10.0	9.2	9.4	8.5	8.3	8.9	8.5	8.1	8.8	8.3	7.7	7.6	9.7
Mean for 3 warm months	15.9	17.2	16.7	16.8	15.4	16.3	15.1	14.9	14.2	15.0	14.8	15.3	14.7	15.0	14.5	14.2	13.7	15.8
Mean for 3 cold months	3.6	5.0	4.5	5.4	4.2	4.4	3.3	3.9	3.4	1.9	2.8	2.5	1.9	2.9	2.9	1.1	2.1	4.0

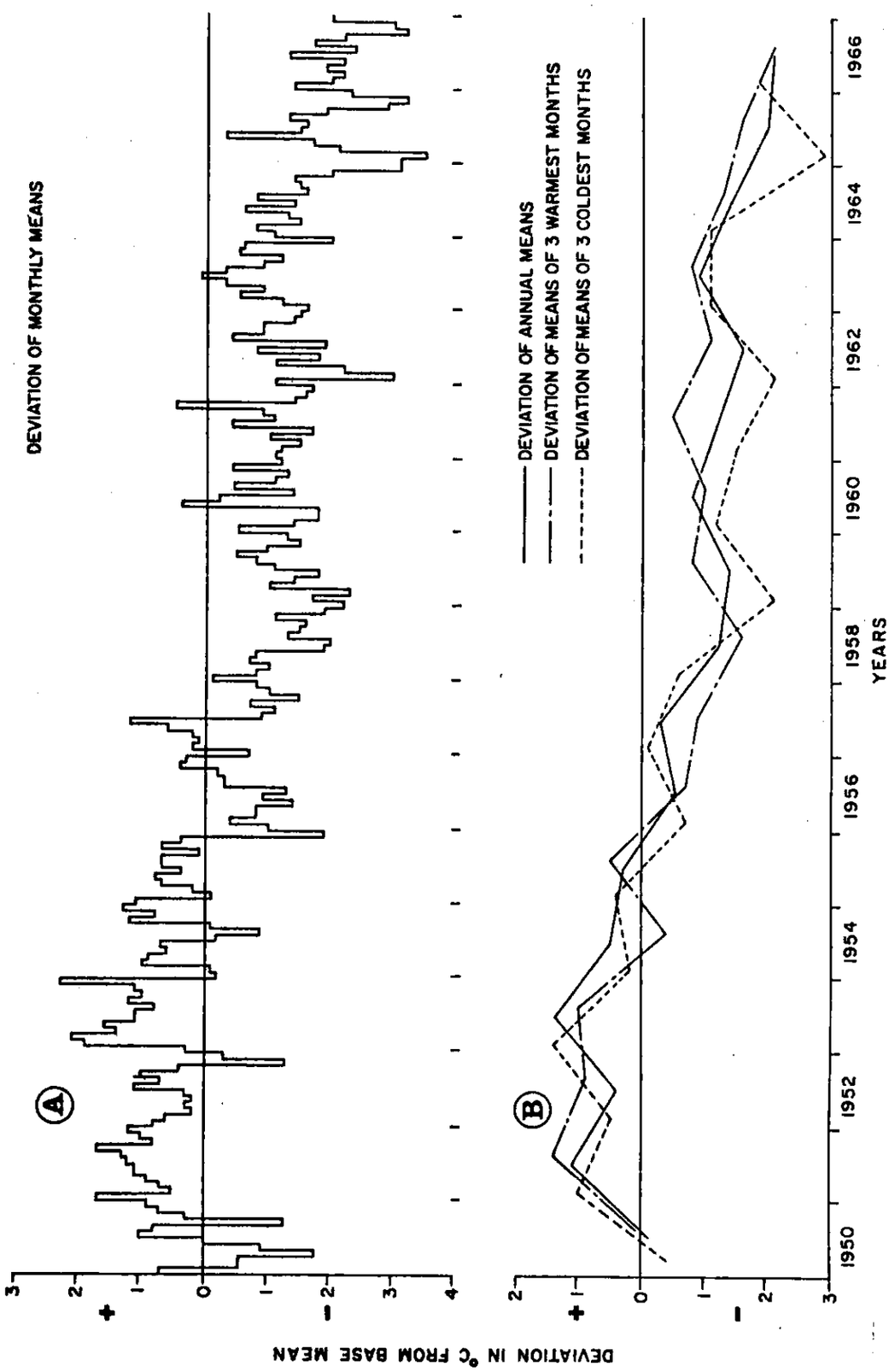

Fig. 1. Deviations in surface water temperature from base mean, Boothbay Harbour, Maine, 1950-1966.