



Serial No. 2185
(D. c. 1)

ANNUAL MEETING - JUNE 1969

TEMPERATURE CONDITIONS IN
THE GULF OF MAINE AND ADJACENT WATERS
DURING 1968

by

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A cooling trend in sea surface temperatures has been observed at Boothbay Harbor, Maine and at other locations along the coast of New England and the Maritime Provinces since 1953 (Lauzier, 1965; Stearns, 1965; Welch, 1967). Professor H. C. Willet of M. I. T. (personal communication) has predicted on a basis of long-term solar-climatic relations that this coastal cooling trend should terminate in the late 1960's. Mr. W. R. Welch of the BCF Biological Laboratory, Boothbay Harbor, Maine has now informed me that the surface water temperatures at Boothbay Harbor during 1968 were appreciably higher than in 1967.

The annual deviations from the 1940-59 mean sea surface temperature at Boothbay Harbor for the period 1940-68 are plotted in Figure 1. In Figure 2 the seasonal sea surface temperature curve for 1968 is compared to the 1967 and 1940-59 mean seasonal temperature curves. The base period 1940-59 was chosen for the number of years were approximately equal in both periods of warming and cooling.

It has previously been shown that surface temperatures at Boothbay Harbor are a good index to offshore surface and subsurface temperature conditions in the Gulf of Maine and contiguous waters (Colton, 1968a). In addition, both inshore and offshore temperature conditions appear to depend in large measure on the relative position and degree of mixing of coastal and oceanic water masses along the edge of the Continental Shelf. Warm years occur when Slope Water borders upon the 200-m isobath and cold years when Slope Water is displaced or modified by Coastal Water of Labrador origin (Colton, 1968b).

Offshore hydrographic conditions during September 1968 are compared with conditions during September 1965 and 1966 to determine if they reflect those observed at Boothbay Harbor. The distribution of Coastal and Slope Water along the edge of the Continental Shelf is also examined to see if the previous correlation still exists. The data were collected during Albatross IV Cruise 65-12, 4-16 September 1965, Albatross IV Cruise 66-12, 8-23 September 1966, and Evergreen ICNAF Cruise 68-2, 8-17 September 1968. The Evergreen data were made available by Mr. M. Light of the U. S. Coast Guard Oceanographic Unit.

The distribution of temperature at the surface, 50 m., and 100 m. during September 1968 and of temperature anomalies at these depths relative to the September 1940-59 and 1965-66 means are shown in Figure 3. The anomalies are the differences between the 1968 mean temperature and the 1940-59 and 1965-66 mean temperatures within 30-minute quadrangles. With but few exceptions, the 1968 temperature anomalies were positive relative to the 1965-66 means in all three depth strata. These anomalies tended to increase with distance from shore and in a south-easterly direction. The 1968 temperatures were lower than the 1940-59 mean temperatures at all depths in the western Gulf of Maine and south

of Cape Cod and at 50 m. and 100 m. in the southeast portion of the sampling area. The greatest positive anomalies occurred south of Nova Scotia and Georges Bank.

The distribution of temperature and salinity at 200 m. along the edge of the Continental Shelf and the distribution of temperature, salinity, and dissolved oxygen on sections made along meridian 68°30'W during September 1965, 1966, and 1968 are shown in Figures 4 and 5. If we consider a temperature of 9 degrees C. and a salinity of 35 ‰ as roughly defining the northern limit of Slope Water (Worthington, 1964; Colton, 1968b), the Slope Water boundary coincided with the 200-m isobath in 1968 and extended appreciably north and east of its position in 1965 and 1966. The subsurface dissolved oxygen concentrations corresponded to those typical of Coastal Water in 1965 and 1966 and to those typical of Slope Water in 1968 (McLellan, 1957).

Temperature-salinity data at 150, 200, and 250 m. for Evergreen stations 11-14 are plotted in Figure 6. The temperature-salinity curves for Slope Water off the Scotian Shelf and Coastal Water in the Cabot Strait (McLellan, 1957) are also shown. The approximate depths of various temperature-salinity characteristics are indicated by numbers adjacent to the curves. The temperature-salinity values were adjacent to the Slope Water curve in September 1968 while the values in this same area in September 1965 and 1966 were characteristic of Coastal Water (Colton, 1968b, Figure 7).

Hydrographic conditions in September 1968 confirm previous conclusions in that the offshore temperature anomalies paralleled those observed at Boothbay Harbor and that the presence of Slope Water along the edge of the Continental Shelf coincided with a warming of surface and subsurface waters in the Gulf of Maine area.

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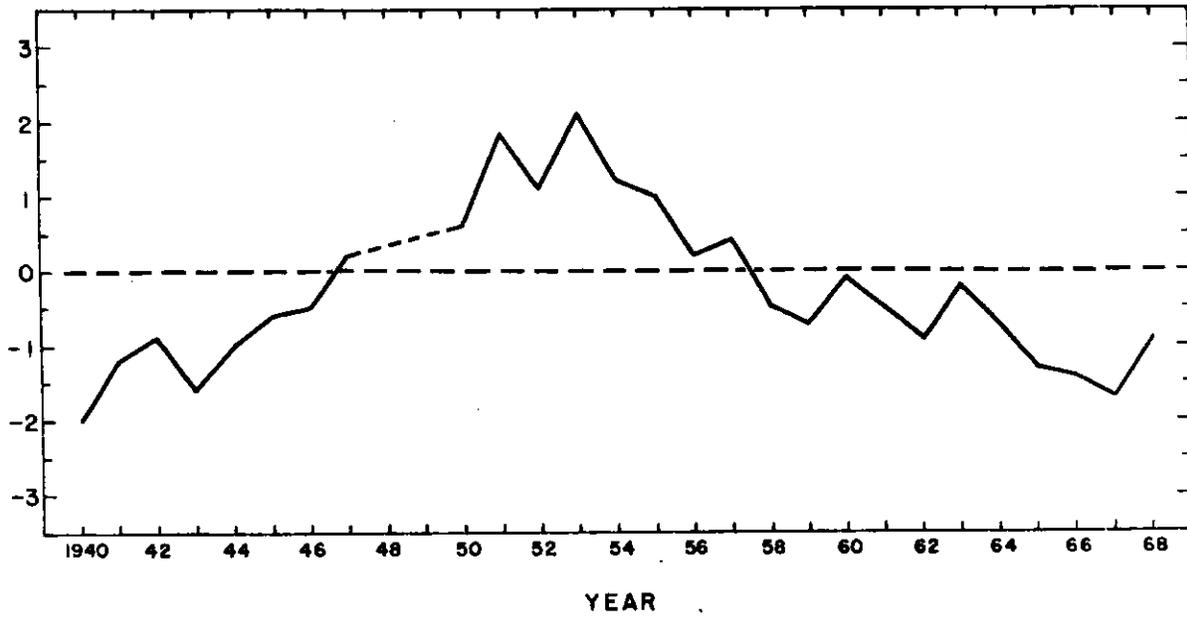


Figure 1. Annual deviations from the 1940-59 mean sea surface temperature at Boothbay Harbor, Maine.

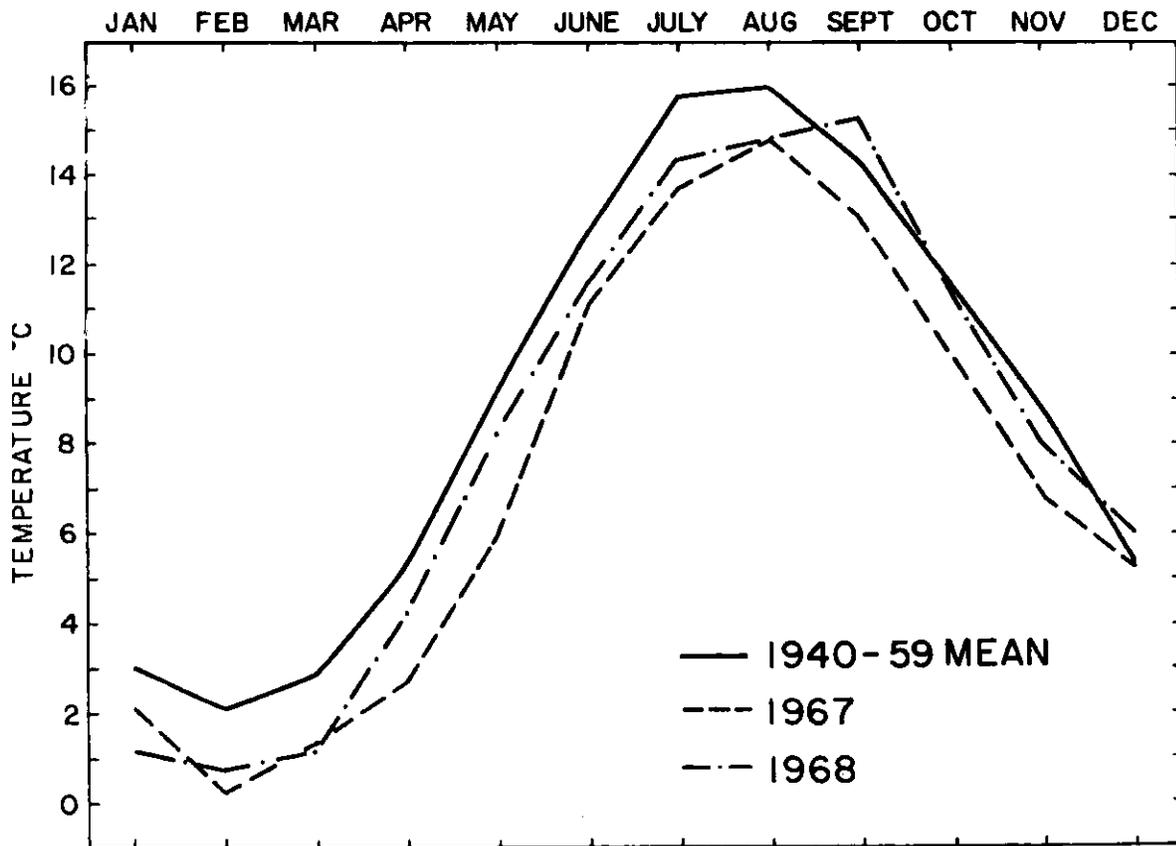


Figure 2. Seasonal temperature curves, Boothbay Harbor, Maine, 1940-59, 1967, and 1968.

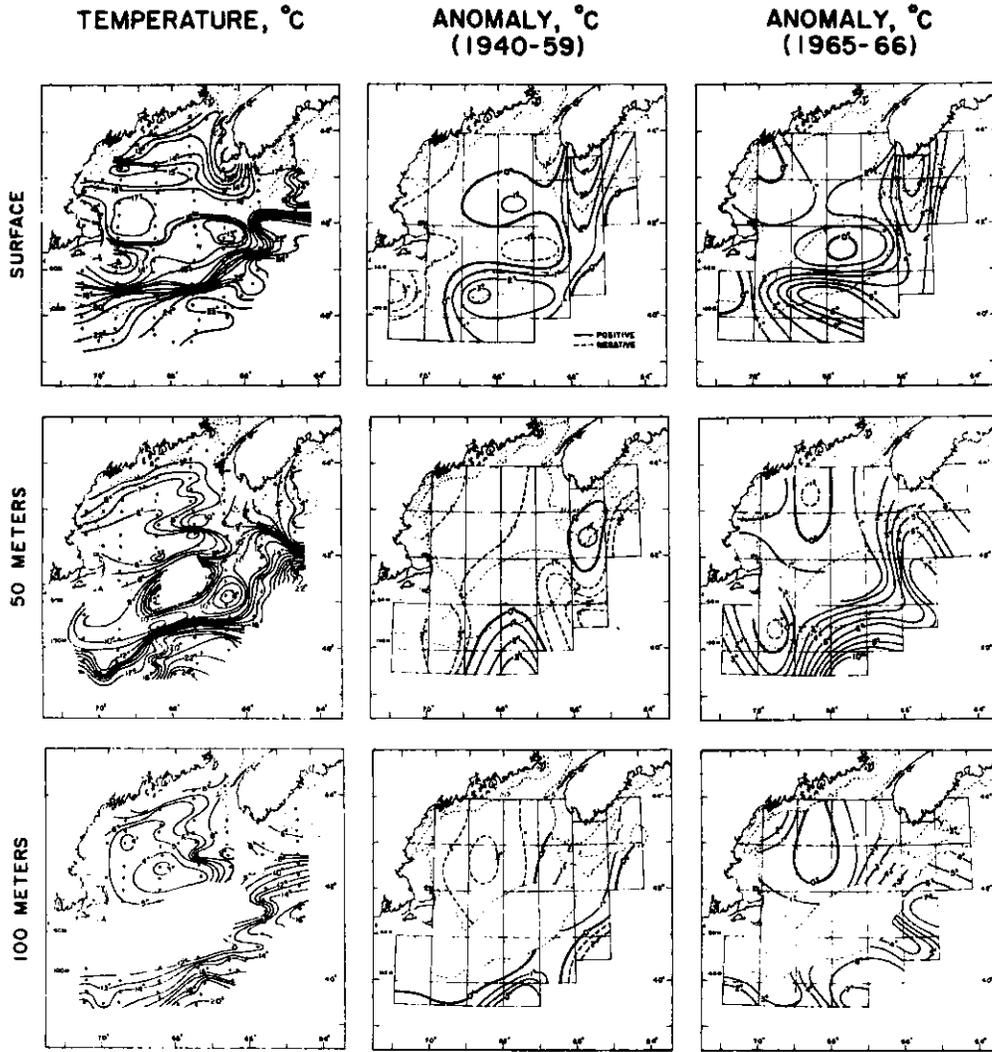


Figure 3. Temperature distribution and temperature anomalies relative to the September 1940-59 and 1965-66 means during September 1968.

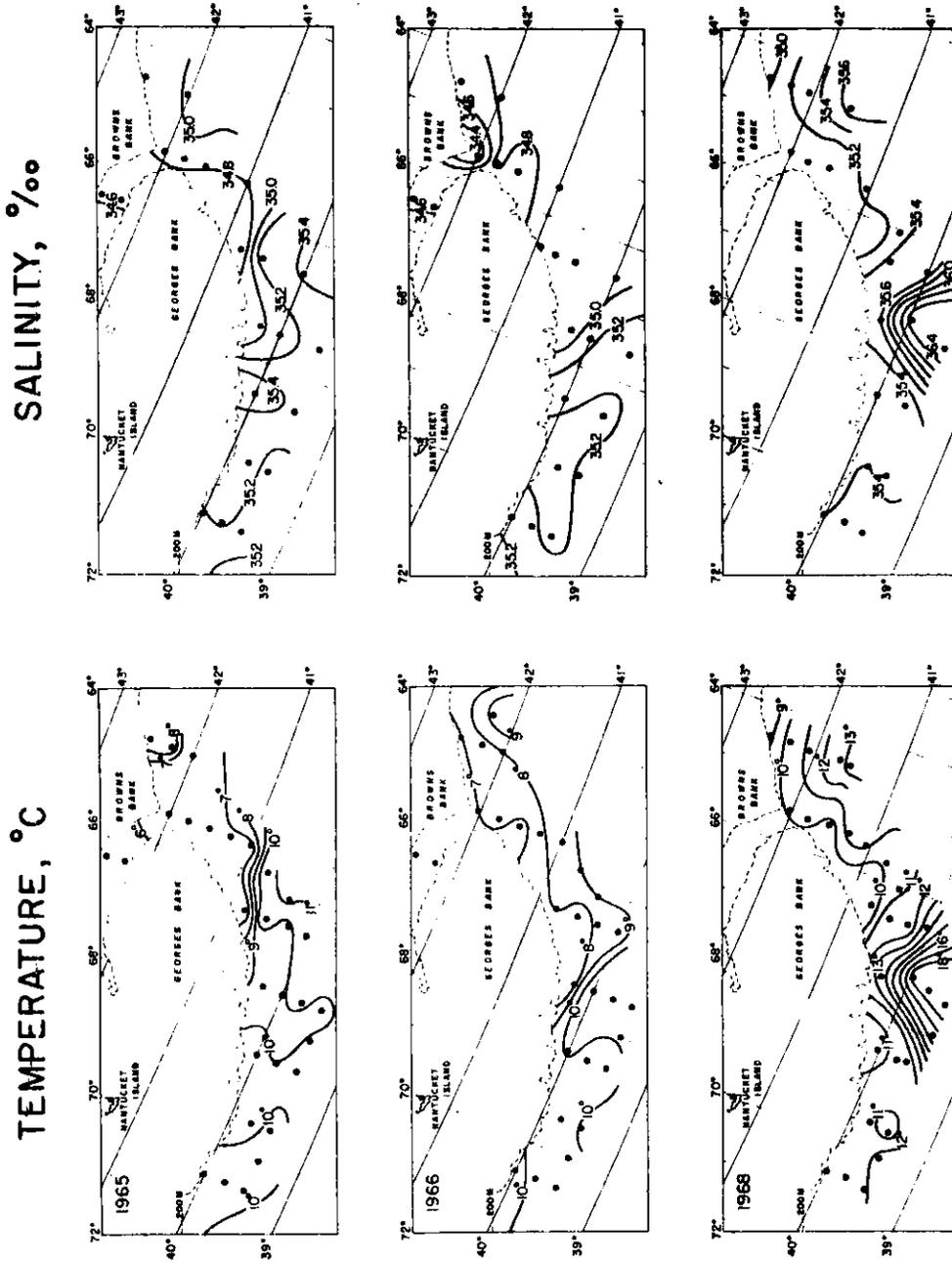


Figure 4. Temperature and salinity at 200 m. during September 1965, 1966, and 1968.

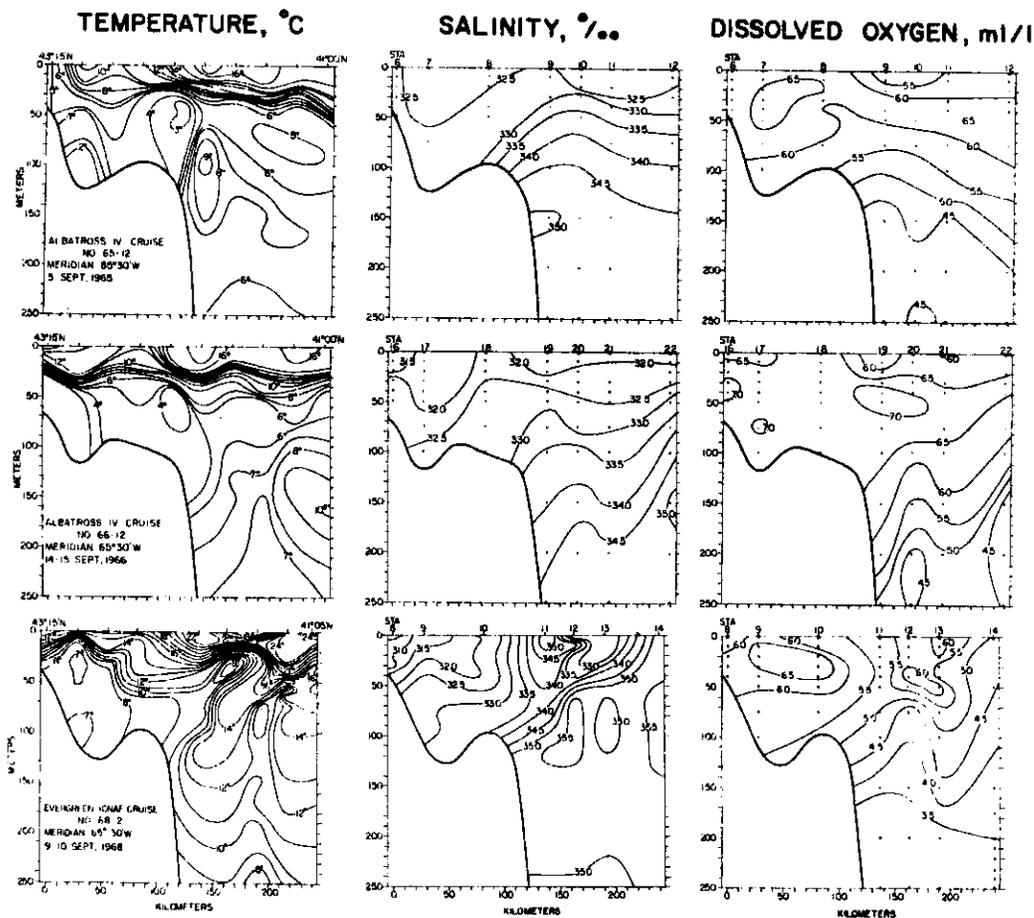


Figure 5. Temperature, salinity, and dissolved oxygen profiles, September 1965, 1966, and 1968.

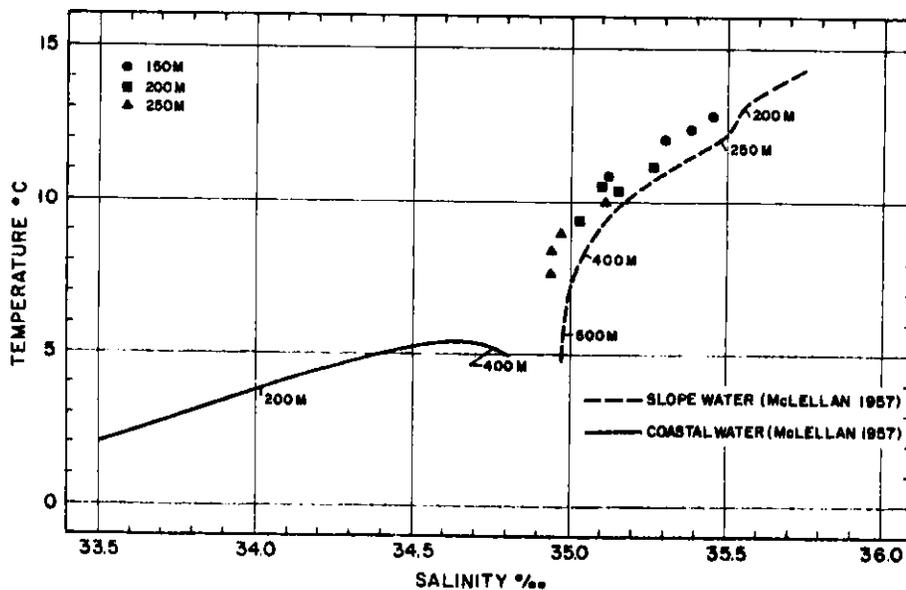


Figure 6. Temperature-salinity relations at Evergreen stations 11-14, September 1968.