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Water Column Thermal Structure Across the Shelf and Slope Southeast of Sandy Hook, New Jersey in 1985

by

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Monitoring of water temperatures across the continental shelf and upper slope in the New York Bight continued in 1985 for the tenth year. Temperature-depth profiles were constructed from 16 expendable bathythermograph (XBT) transects extending from the entrance of New York Harbor through the 106-mile Dumpsite (Fig. 1). The XBT cruises conducted and the oceanic features monitored in the New York Bight are presented in Table 1.

A "station-through-time" diagram (Fig. 2) and a bottom temperature diagram (Fig. 3) depict the major oceanographic/climatological events occurring in the New York Bight in 1985. The "station-through-time" diagram was constructed by plotting the temperatures in the water column above the 65 m isobath from each cruise at the date of the cruise and contouring the temperatures, at 1°C intervals, through time for the year. The 65 m isobath was selected for its mid-shelf location, a position in the cold pool not influenced by the Hudson Canyon. The bottom temperature diagram was constructed following the method of Chamberlin (1977), by deriving bottom water temperatures from each contoured section, plotting the temperatures against depth and date and contouring at 1°C intervals.

Two distinct water masses, shelf water and slope water, reside in the New York Bight. A thermal transition zone, the shelf/slope front (SSF) separates the inshore shelf water from the offshore slope water and is visible at the surface on satellite imagery for most of the year. The surface position of the SSF usually is over the 200 m isobath, while the bottom indicator, the intersection of the 10°C isotherm with the bottom, lies between 80-120 m depths (Wright, 1976). Based on the analyses of Gulf Stream warm core rings in 1985 by Price and Barton (MS 1986), four rings were present along this

transect during the year. For the years 1977-1983, four rings were usually present each year with a maximum of five in 1982 and minimum of three in 1978 and 1981. The year 1984 was unusual in that no warm core rings migrated far enough to the south and west to enter the transect envelope (Fig. 1).

Shelf Water Events

In 1985, sea surface temperatures nearshore (top of Fig. 3) ranged from a minimum of about 1°C in mid-February to a maximum of over 22°C in mid-August. Sea surface temperatures at mid-shelf ranged from less than 6°C in late February to greater than 24°C in late August (Fig.2), reflecting the normal timing lag and temperature increase from nearshore to offshore.

Thermocline development began in April, as usual, and reached maximum intensity of about 1°C per meter of depth through the thermocline in mid-August. In general, normal deepening of the thermocline took place through the summer until fall overturn was completed in early November. The thermocline was somewhat deeper than normal in June and shoaled abruptly in August (Fig.2).

In early November, water column cooling was interrupted by the apparent intrusion of warm (>22°C) water onto the shelf associated with the passage of warm core ring 85-C (Fig.2).

Bottom Temperature Events (Fig. 3)

In 1985 cold pool water (water $<$ 10°C) was present on the bottom on the shelf until mid-September, as was the case in 1984. Normally, cold pool water persists until October. Water on the bottom cooler than 5°C (a subjective way of estimating winter intensity) lasted until the end of March, which is typical, and was about two weeks earlier than in 1984.

With fall overturn, temperatures on the bottom exceeded 16°C in November at mid-shelf depths (50-75 m). The November bottom temperatures were about 1-2°C warmer than normal, based on the compilations of Cook (1985), but were similar to temperatures encountered in 1984. On the upper slope, at depths of 100 m to 200 m, water temperatures exceeding 12°C persisted throughout the year. This is the first time since 1977 that 12°C, or warmer, water has remained on the upper slope for the entire year.

Summary

Cold pool temperatures in 1985 were about 1° to 2°C warmer than normal and bottom waters at mid- and outer shelf depths during fall overturn were

about 1° to 2°C warmer than normal. Water 10°C or colder was present on the bottom until mid-September, dissipating about two weeks earlier than normal. Fall overturn was completed, as usual, in early November. A distinct temperature increase in the water column at mid-shelf occurred in November, apparently resulting from the intrusion of slope or warm core ring water associated with the passage of ring 85-C. For the first time since 1977, temperatures of 12°C or warmer persisted on the bottom at upper slope depths for the entire year.

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Table 1. Water Column Thermal Structure in 1985

Vessel	Cruise No.	Date	Minimum-maximum depths (m) of cold pool (10°C or less)	Bottom depth (m) of 10°C isotherm SSF indicator	Rings present along transect
Oleander	85-02	Jan 30-31	-	69	
Oleander	85-03	Feb 15-16	-	102	
Oleander	85-04	Feb 20-21	-	108	
Oleander	85-05	Mar 23	-	107	
Oleander	85-06	Apr 26-27	-	87	
Oleander	85-07	May 01-02	-	83	
Oleander	85-08	May 17	4-92	92	84-G
Oleander	85-09	Jun 07	23-90	90	84-G
Oleander	85-11	Jul 12	23-105	105	84-G
Oleander	85-12	Aug 09-10	22-105	105	85-B
Oleander	85-13	Aug 14-15	19-99	99	
Oleander	85-14	Sep 06	22-94	94	85-F
Oleander	85-15	Sep 11-12	29-99	99	85-F
Oleander	85-18	Oct 16-17	-	-	85-F
Oleander	85-19	Nov 08-09	-	-	85-C
Oleander	85-21	Dec 07-08	-	-	85-C

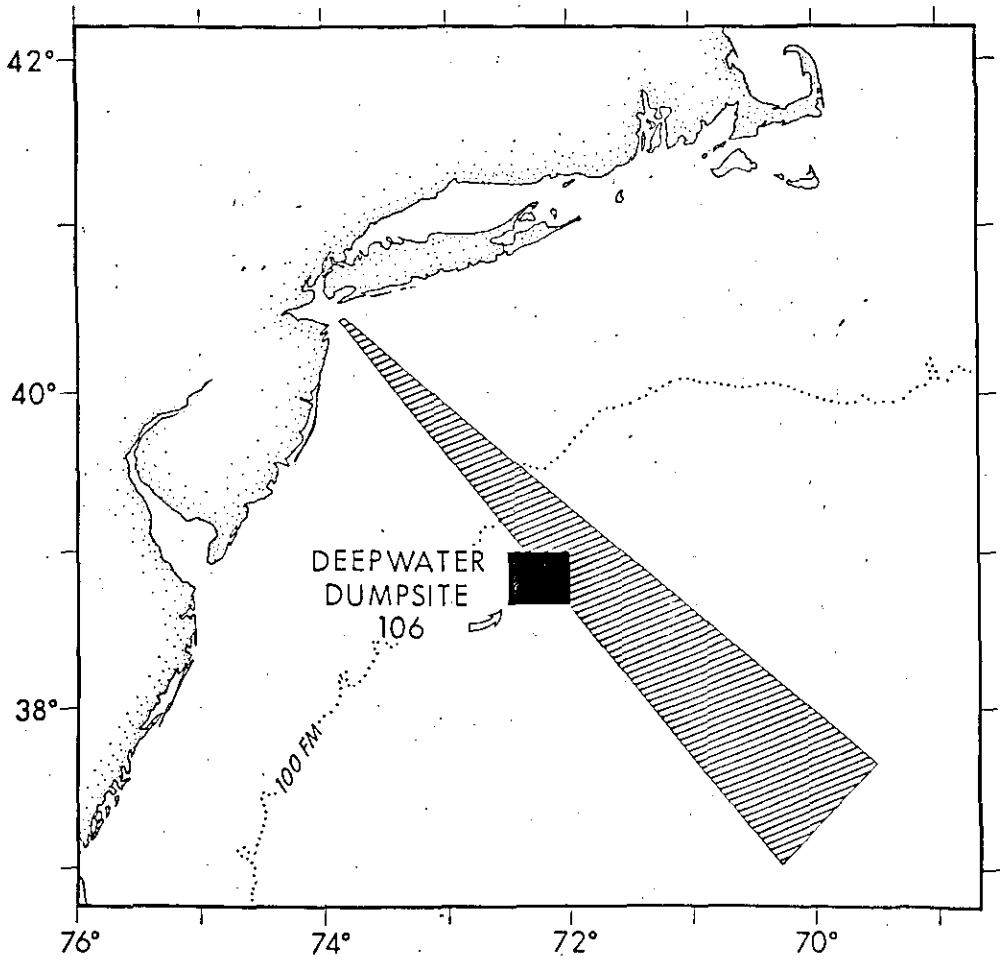

Figure 1. Envelope of 1985 transects in the New York Bight from the entance of New York Harbor to beyond the 106 Dumpsite.

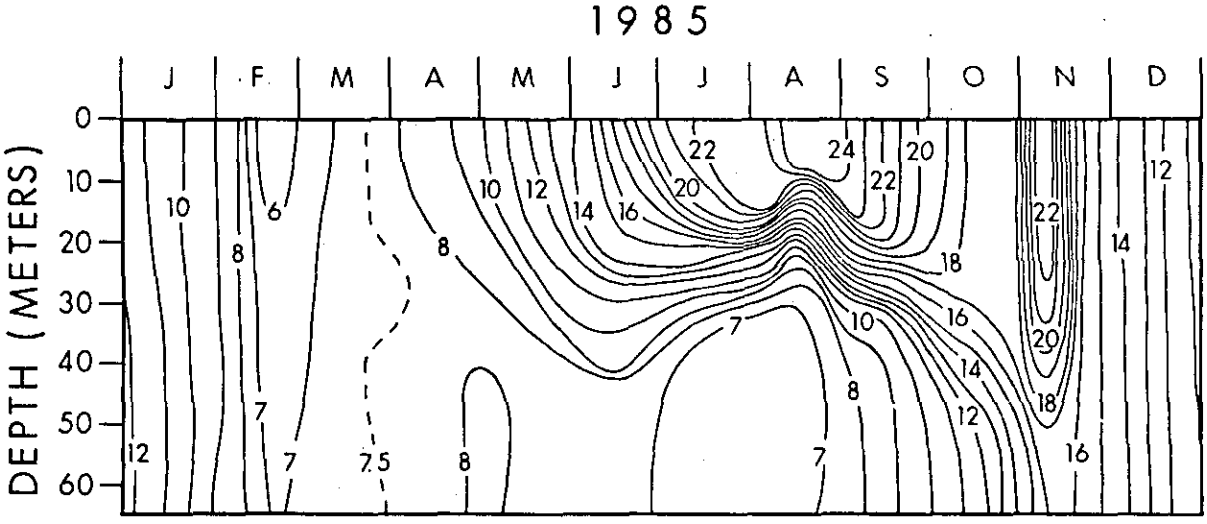

Figure 2. Station through time depicting seasonal water column temperatures at 65 m.

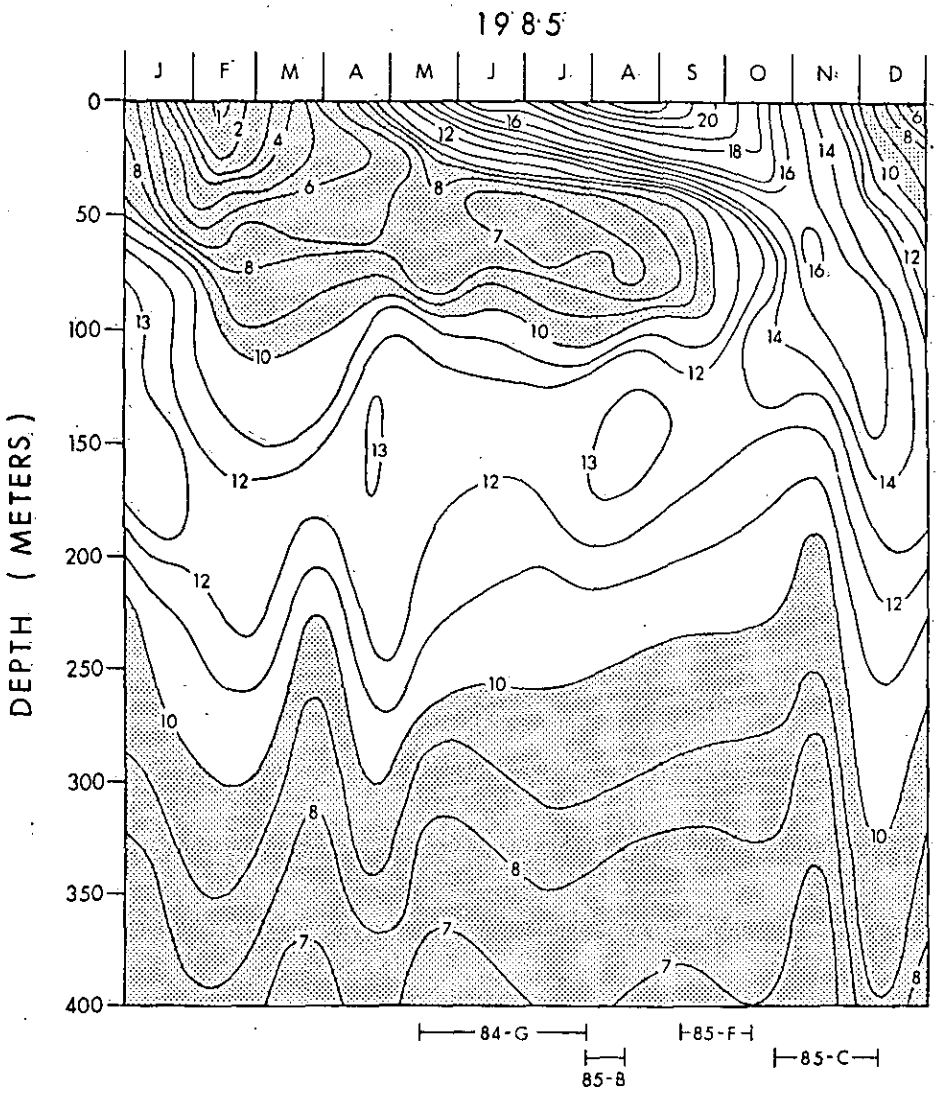

Figure 3. Bottom temperature diagram of the continental shelf and slope waters from New York Harbor to the 106 Dumpsite. Shaded areas are waters of 10°C or less. Lines at the bottom of the diagram indicate the duration of warm core Gulf Stream rings in the New York Bight area.