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Water Column Thermal Structure Across the Shelf and Slope Southeast of Sandy Hook, New Jersey in 1984

by

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Monitoring of the shelf water and upper continental slope water events in the New York Bight continued in 1984 for the ninth year. Temperature-depth profiles were constructed from 24 expendable bathythermograph (XBT) transects extending from the entrance of New York Harbor through the 106-Mile Dumpsite (Fig. 1). The transects collected 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 ocenographic/climatological events occurring in the New York Bight in 1984. The "station through time" diagram was constructed by plotting through time the temperatures in the water column above the 65-m isobath, using 1°C contour intervals. 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 Chamberlin's (1977) method, by deriving bottom water temperatures from each contoured section, plotting these tmeperatures 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. The surface position of the SSF usually occurs over the 200-m isobath,

while the bottom indicator, the intersection of the 10°C isotherm with the bottom, occurs between 80- and 120-m depths (Wright, 1976).

Based on the analysis of Gulf Stream warm core rings in 1984 by Price (MS 1985), no rings were present along this transect during the year. For the years 1977-1983, 4 rings were usually present each year, with a maximum of 5 in 1982 and minimum of 3 in 1978 and 1981.

Shelf Water Events

The sea surface temperatures near shore ranged from a minimum of 1.1°C in late January to a maximum of 24.8°C in mid-August (Fig. 3). Sea surface temperatures at mid-shelf ranged from 5°C in April to 23.5°C in August (Fig. 2), reflecting the normal timing lag and temperature increase from nearshore to offshore.

During late February and early March of 1984, the normal cooling of shelf waters along the bottom was interrupted by an intrusion of warmer water from offshore (Fig. 2 and 3). In June and July, at mid-shelf, the coldest water in the cold pool (<6°C) was located off the bottom at a depth of about 40m (Fig. 2).

Thermocline development began as usual in late April to early May and reached maximum intensity of about 1°C/meter in mid-August. Normal deepening of the thermocline occured throughout the summer until mid-October, when fall overturn was complete (Figure 2).

Bottom Temperature Events

This year cold pool water (water <10°C) lasted until mid-September, compared to 1983 when it lasted until mid-October. The extent of water on the bottom cooler than 5°C (a subjective way of estimating winter intensity) was greater than normal in 1984. Usually 5°C water lasts until the end of March with parcels of 5°C water occurring as late as the end of May. In 1984, 5°C water lasted until mid-April and occupied a slightly greater area than usual on the bottom of the continental shelf.

With fall overturn, temperature of water on the bottom at the outer shelf (80m to 100m) exceeded 16°C during November (Fig. 3). Since 1977, only in 1982 have waters that warm been detected on the outer shelf. On the upper slope, at depths of 100m to 200m depth, bottom temperatures in 1984 were greater than 12°C for all year, except in late March and early

April. Never, since 1977, has >12°C water persisted on the bottom of the upper slope for this much of the year.

Summary

Cold pool temperatures were warmer than usual early in 1984 and 10°C water remained on the bottom only until mid-September, about 2 weeks briefer than usual.

Fall overturn occurred about two weeks earlier than in 1983, and bottom temperatures across the shelf were about 2°C warmer.

On the upper slope, bottom water warmer than 12°C was present for about two months longer than in 1983.

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Price, C. A. MS 1985. Anticyclonic warm core Gulf Stream rings off northeastern United States during 1984. NAFO SCR Doc., No. 85/19, Serial No. N960, 12 p.

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Table 1. Water Column Thermal Structure in 1984.

Vessel	Cruise No.	Date	Depth Range of Cold Pool (10°C or less)	Rings Present Along Transect
"Oleander"	84-01	6-7 Jan	Isothermal	-
"Oleander"	84-02	11-12 Jan	Isothermal	-
"Oleander"	84-03	2-3 Feb	Isothermal	-
"Oleander"	84-04	9-9 Feb	Isothermal	-
"Oleander"	84-05	2-3 Mar	Isothermal	-
"Oleander"	84-06	7-8 Mar	Isothermal	-
"Oleander"	84-07	6-7 Apr	Isothermal	-
"Oleander"	84-08	11-12 Apr	Isothermal	-
"Oleander"	84-09	11-12 May	20 - 65m	-
"Oleander"	84-10	17-18 May	20 - 85m	-
"Oleander"	84-11	8-8 Jun	15 - 110m	-
"Oleander"	84-12	13-14 Jun	15 - 85m	-
"Oleander"	84-13	7-8 Jul	15 - 85m	-
Oleander"	84-14	11-12 Jul	15 - 65m	-
"Oleander"	84-15	10-11 Aug	Incomplete Data	-
"Oleander"	84-16	15-16 Aug	Incomplete Data	-
"Oleander"	84-17	7-8 Sep	55 - 80m	-
"Oleander"	84-18	11-12 Sep	40 - 90m	-
"Oleander"	84-19	21-21 Oct	Isothermal	-
"Oleander"	84-20	25-26 Oct	Isothermal	-
"Oleander"	84-21	2-3 Nov	Isothermal	-
"Oleander"	84-22	9-10 Nov	Isothermal	-
"Oleander"	84-23	7-7 Dec	Isothermal	-
"Oleander"	84-24	11-12 Dec	Isothermal	-

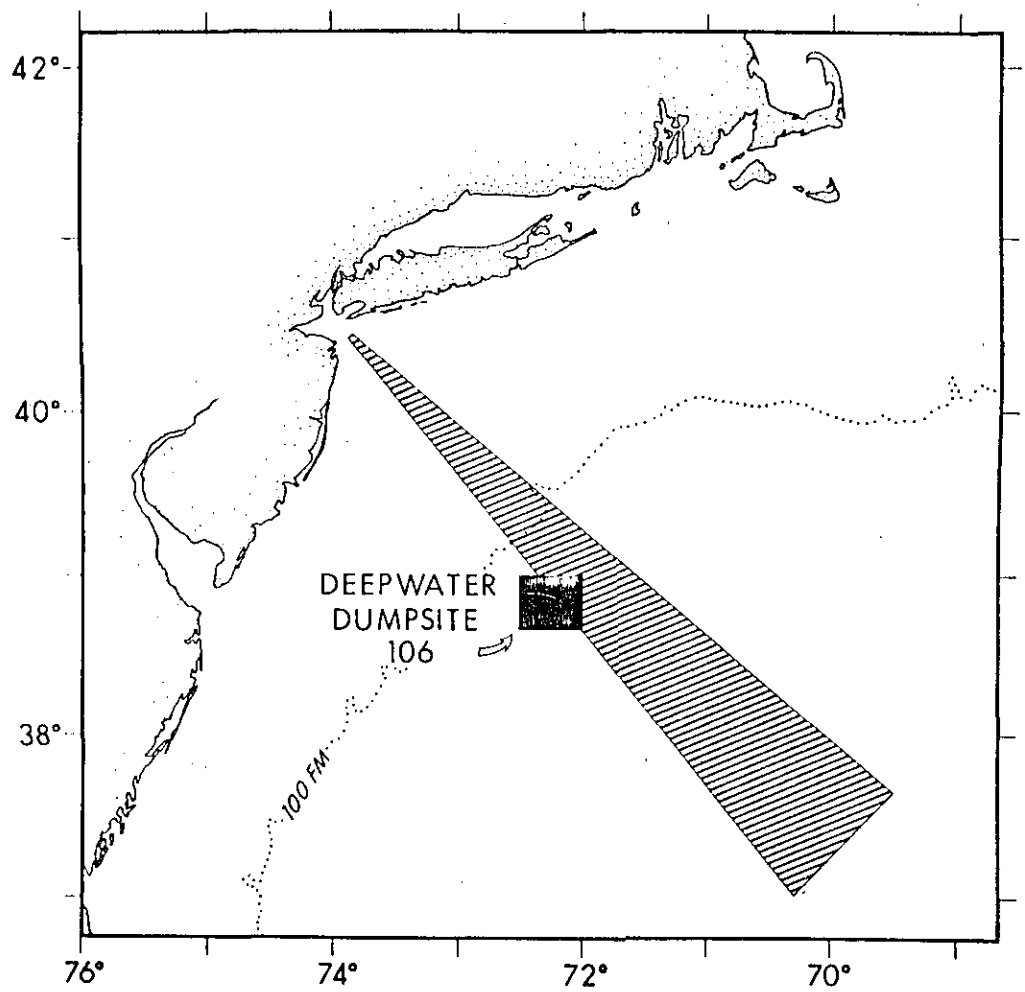

Figure 1. Envelope of 1984 transects in the New York Bight from the entrance of New York Harbor to the 106 Dumpsite.

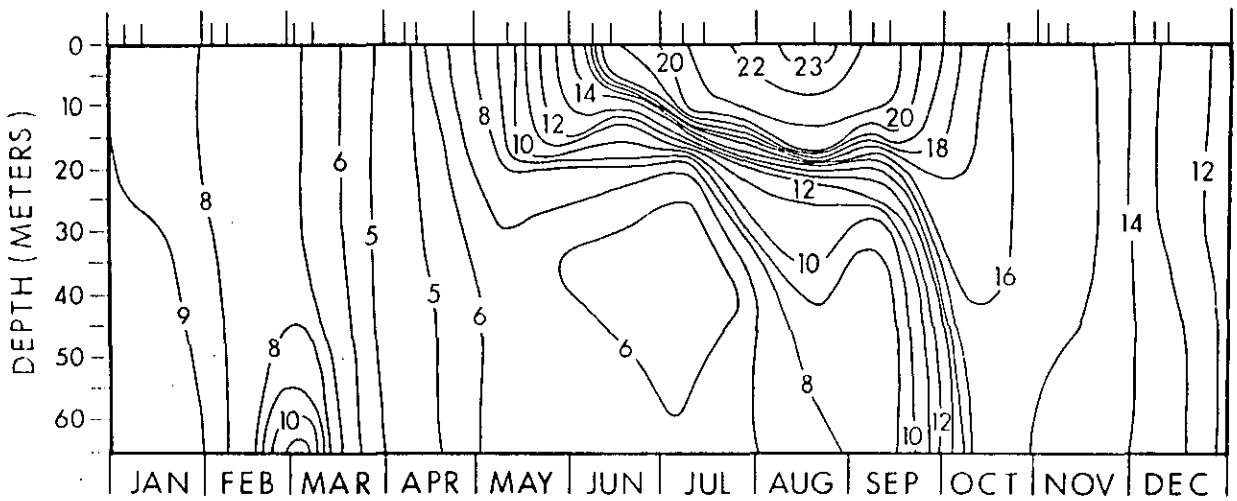

Figure 2. Station through time depicting seasonal water column temperatures at 65m.

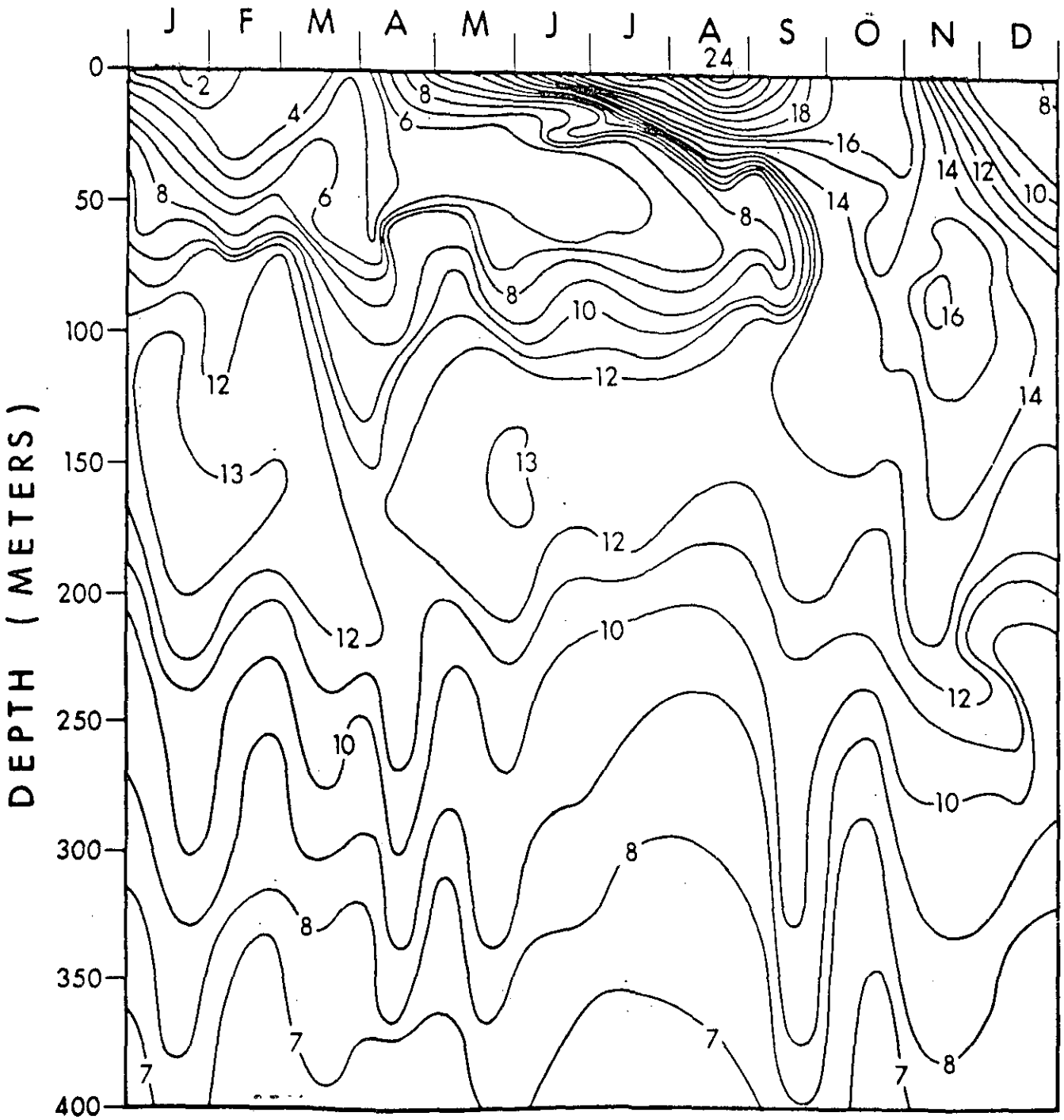

Figure 3. Bottom temperature diagram of the continental shelf and slope waters from New York Harbor to the 106 Dumpsite.