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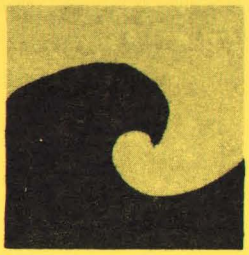
TECHNICAL
REPORT
SERIES # 13



HYDROGRAPHIC DATA REPORT: LONG ISLAND SOUND - 1970 PART II

BY

CHARLES D. HARDY

PREPARED WITH
SUPPORT
FROM THE
NASSAU - SUFFOLK
REGIONAL
PLANNING
BOARD

Technical Report No. 13

HYDROGRAPHIC DATA REPORT:
LONG ISLAND SOUND - 1970
PART II

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Prepared by the
Marine Sciences Research Center
with support from the
Nassau-Suffolk Regional Planning Board

January 1972

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ABSTRACT

Wind mixing of the water column resulted in an absence of vertical differences in physical parameters during this October 1970 cruise. A dramatic improvement was noted in the vertical distribution of dissolved oxygen since the August 1970 minimum. Ammonia formed the largest measured fraction of the dissolved forms of nitrogen in almost all areas of Long Island Sound. An inverse relation between chlorophyll-a concentration and nutrient concentration existed west of Execution Rock.

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LIST OF ILLUSTRATIONS

CRUISE 7014, October 5-7, 1970

This data report consists of a single survey of Long Island Sound in October 1970 (Fig. 1). Hydrographic data for the period January to April 1970 have been published in Technical Report No. 6. Cruise 7014 was conducted aboard the R/V ATLANTIC TWIN which was made available by the City University of New York. The three-day survey (Fig. 2) extended eastward from Rikers Island, East River, through Long Island Sound to Cerberus Shoals in Block Island Sound. Systematic north-south transects were made throughout Long Island Sound to insure adequate hydrographic coverage.

A submersible pump and water analysis system was installed aboard R/V ATLANTIC TWIN. This system (Hardy, 1970; Hardy and Weyl, 1971) permitted continuous monitoring on station of salinity, temperature and dissolved oxygen to a maximum depth of 56 meters. Water samples for chemical analyses were drawn from the pump flow, filtered through a Gelman Type A glass filter and immediately frozen. Nutrients were analyzed according to the methods of Strickland and Parsons (1968).

The water temperature of Long Island Sound was essentially the same from surface to bottom (Fig. 3). In other words, the thermocline, a prominent feature in August 1970 (Hardy and Weyl, 1971), was not found. The surface temperature difference (Fig. 4) between the East River and the Race was 3°C, with the maximum temperature (20.8°C) occurring off Rikers Island in the East River.

Salinity and density profiles (Figs. 5 and 7) resemble the temperature structure in that vertical gradients are virtually absent. Surface salinity values (Fig. 6) indicate a horizontal east-west difference of 6°/oo with a minimum value (24.8°/oo) in the East River and a maximum value (30.9°/oo) in Block Island Sound. An area of low surface salinity (26.1 to 26.6°/oo) was found west of the Connecticut River, indicating admixture of river discharge between Long Sand Shoal and the Connecticut shore.

The absence of vertical structure in the physical parameters is attributed to wind mixing of the water in conjunction with seasonal cooling and the convective mixing of surface waters.

A marked increase in dissolved oxygen concentration compared to the August survey of western Long Island Sound (Hardy and Weyl, 1971) was evident. Vertical and surface oxygen profiles (Figs. 8 and 9) demonstrate that all levels of the water column, in both Long Island and Block Island sounds, had oxygen levels close to or exceeding saturation values. Only the East River and the western end of Long Island Sound exhibited depressed oxygen levels, with a minimum of 2.9 parts per million (ppm) present near Rikers Island. However, the dissolved oxygen levels measured in the East River during Cruise 7014 represented an improvement in water quality over the dissolved oxygen found in August.

The concentration of dissolved nutrients follows a pattern similar to that observed in previous cruises (Hardy, 1970; Hardy and Weyl, 1970). High concentrations of the dissolved inorganic forms of NH_3, NO_2, NO_3 and PO_4 were present in the East River, with a steep decrease in nutrient concentrations in the western end of Long Island Sound and low values elsewhere.

Ammonia plus labile amino acids formed the largest measured fraction of the dissolved forms of nitrogen in almost all areas surveyed during the cruise (Figs. 10, 11, 12). Nitrate was found to exceed ammonia levels only in an area in the west central portion of Long Island Sound (Figs. 10 and 11).

A comparison of the total dissolved inorganic nitrogen forms ($NH_3 + NO_2 + NO_3$) with orthophosphate and chlorophyll-a concentrations (Fig. 13) demonstrates that the chlorophyll-a maximum is not obviously correlated with a continued increase in the nutrient concentration. As shown in Fig. 13, the chlorophyll-a peak occurs at nutrient levels significantly below the maximum nutrient levels in the East River. This phenomenon has been observed repeatedly (Hardy and Weyl, 1971) and suggests a reduction in the standing crop of phytoplankton.

The chlorophyll-a concentrations (Fig. 14) were considerably reduced from the high concentrations during August, and were somewhat lower than those found in October 1969 (Hardy, 1970). A chlorophyll-a maximum of 10 mg/m^3 was measured during Cruise 7014 at a station east of the entrance to Hempstead Harbor. A similar maximum concentration (10.6 mg/m^3) was found in approximately the same area during the October 1969 cruise.

Acknowledgements

The R/V ATLANTIC TWIN was made available for Cruise 7014 by the City University of New York through the good offices of Dr. Gerald Posner, Executive Director for Oceanography. Appreciation is extended to Captain Walter Van Horn and the crew of the ATLANTIC TWIN for their interest and assistance.

The scientific party was composed of the staff and students of the Marine Sciences Research Center who contributed their time and effort toward making the cruise successful.

M. Grant Gross and Peter K. Weyl, MSRC, provided advice and helpful criticism throughout the progress of the cruise and the report.

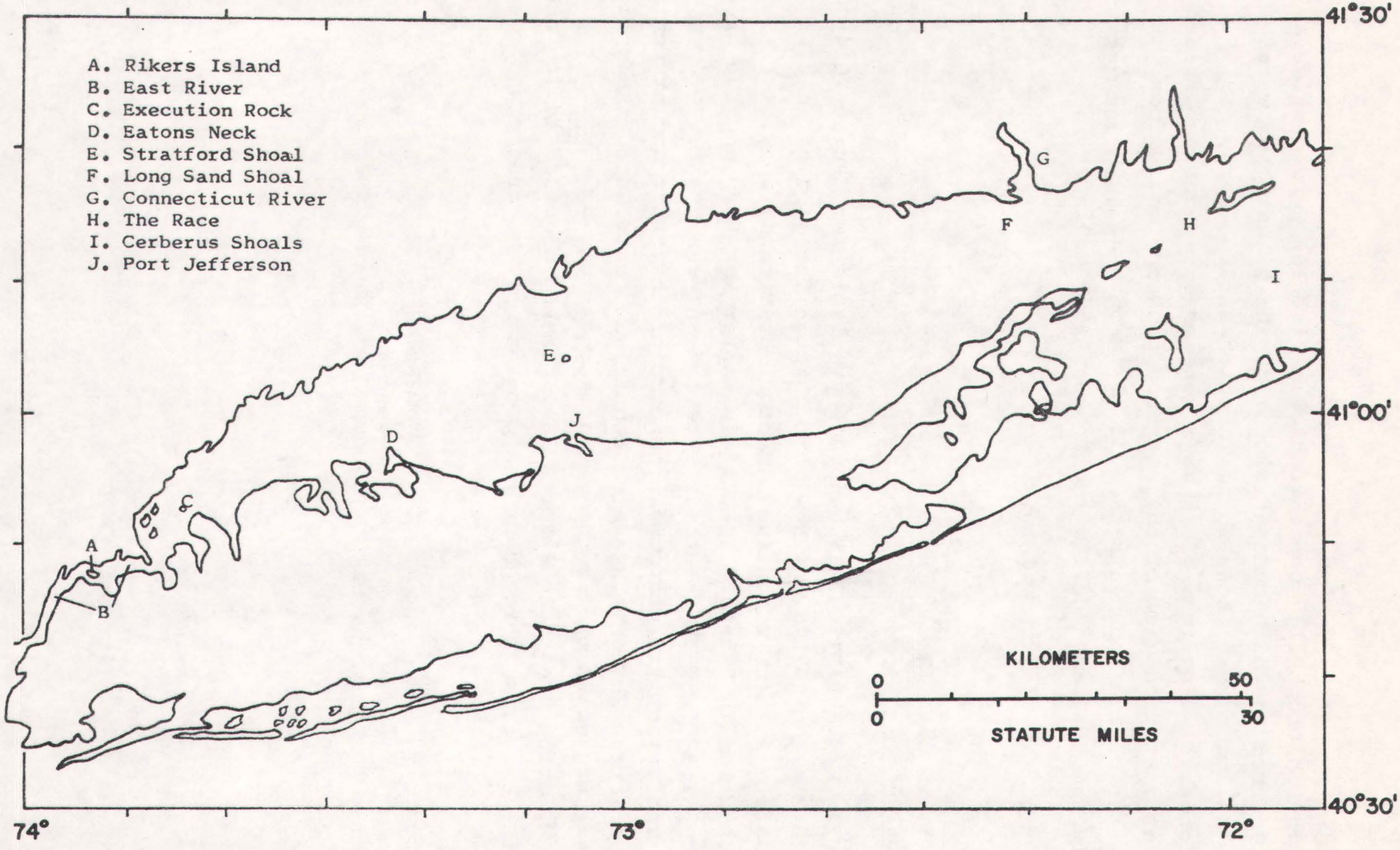

FIGURE I. GEOGRAPHIC FEATURES OF LONG ISLAND SOUND

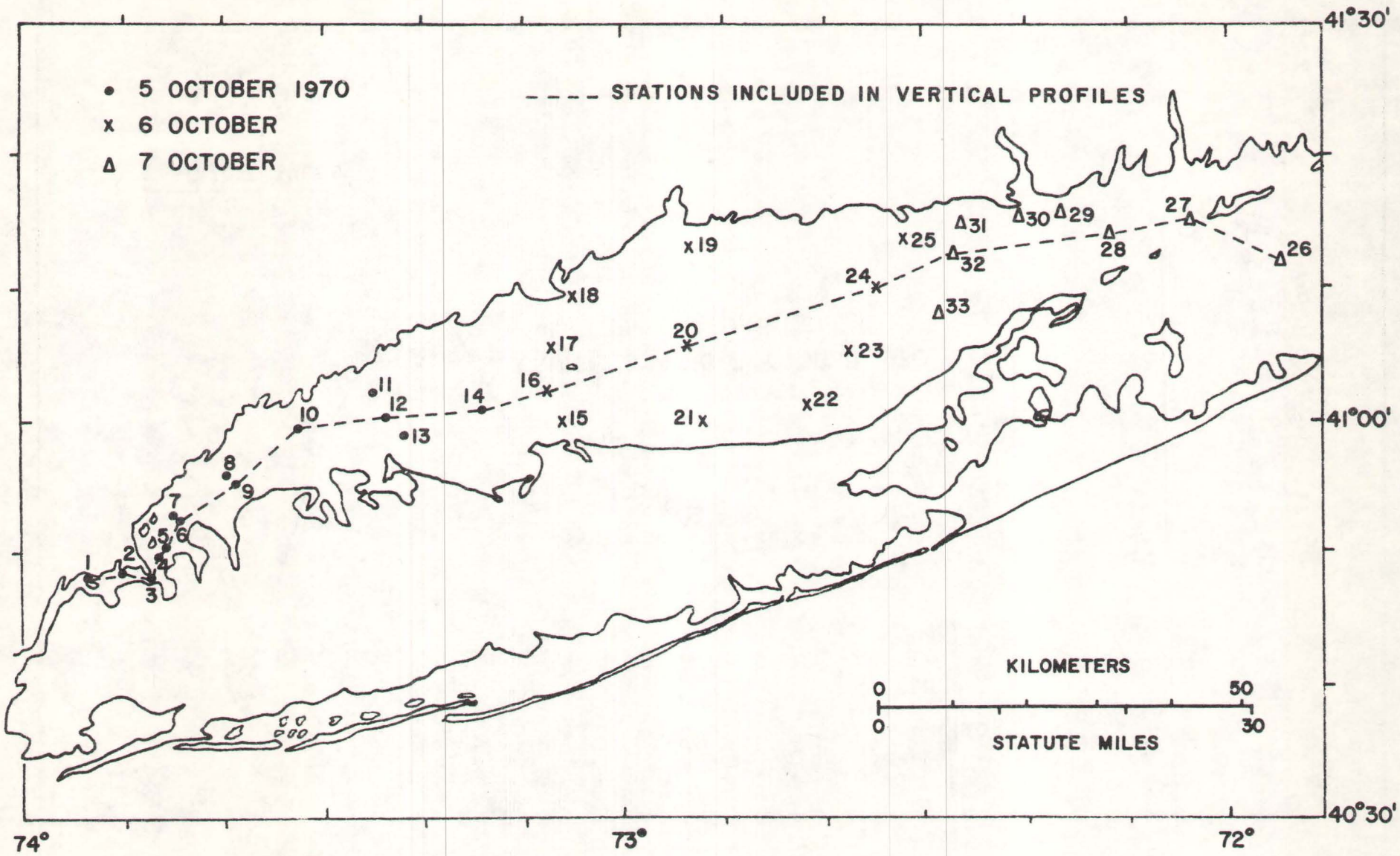

FIGURE 2. STATION LOCATIONS FOR CRUISE 7014

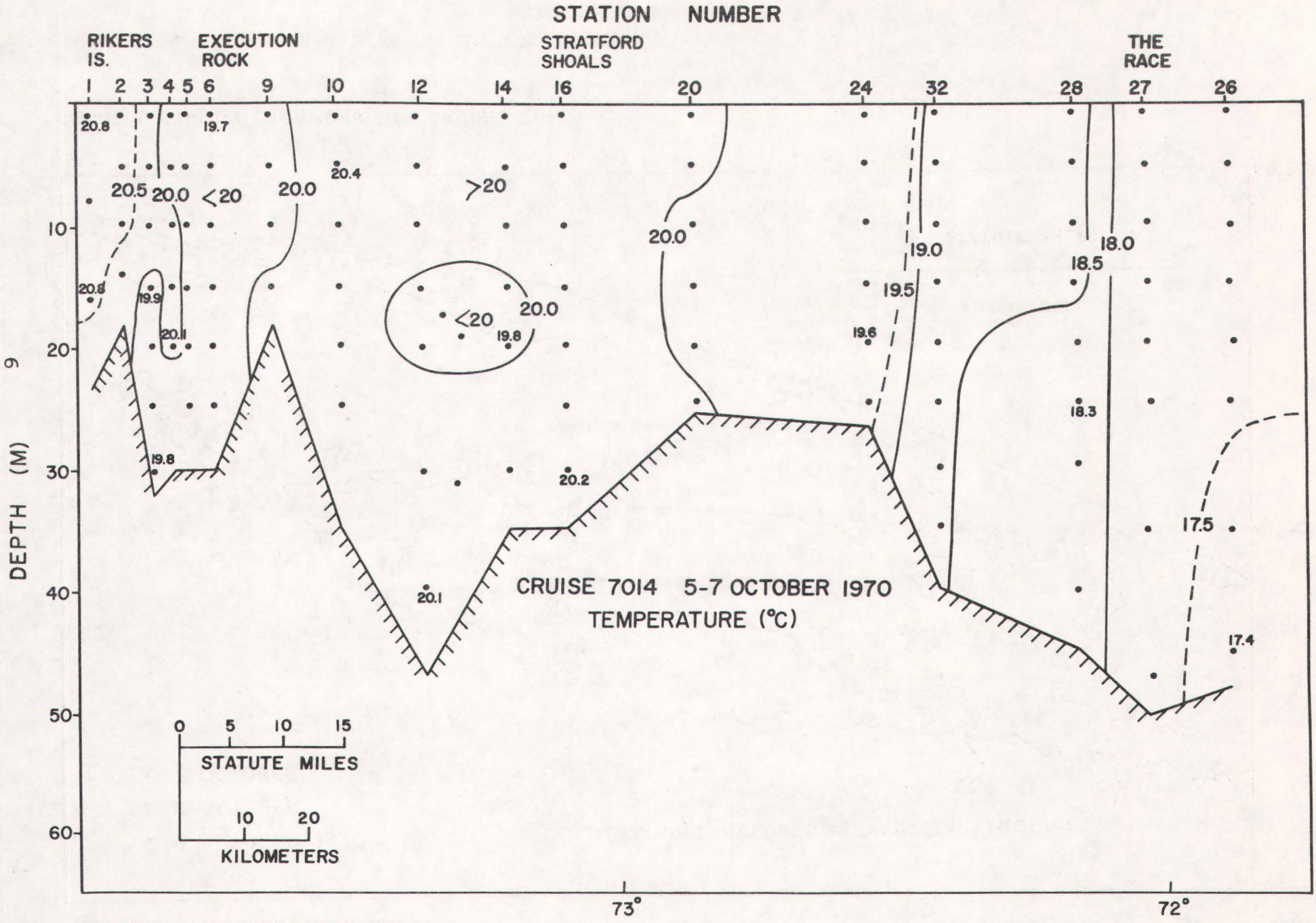

FIGURE 3. TEMPERATURE PROFILE

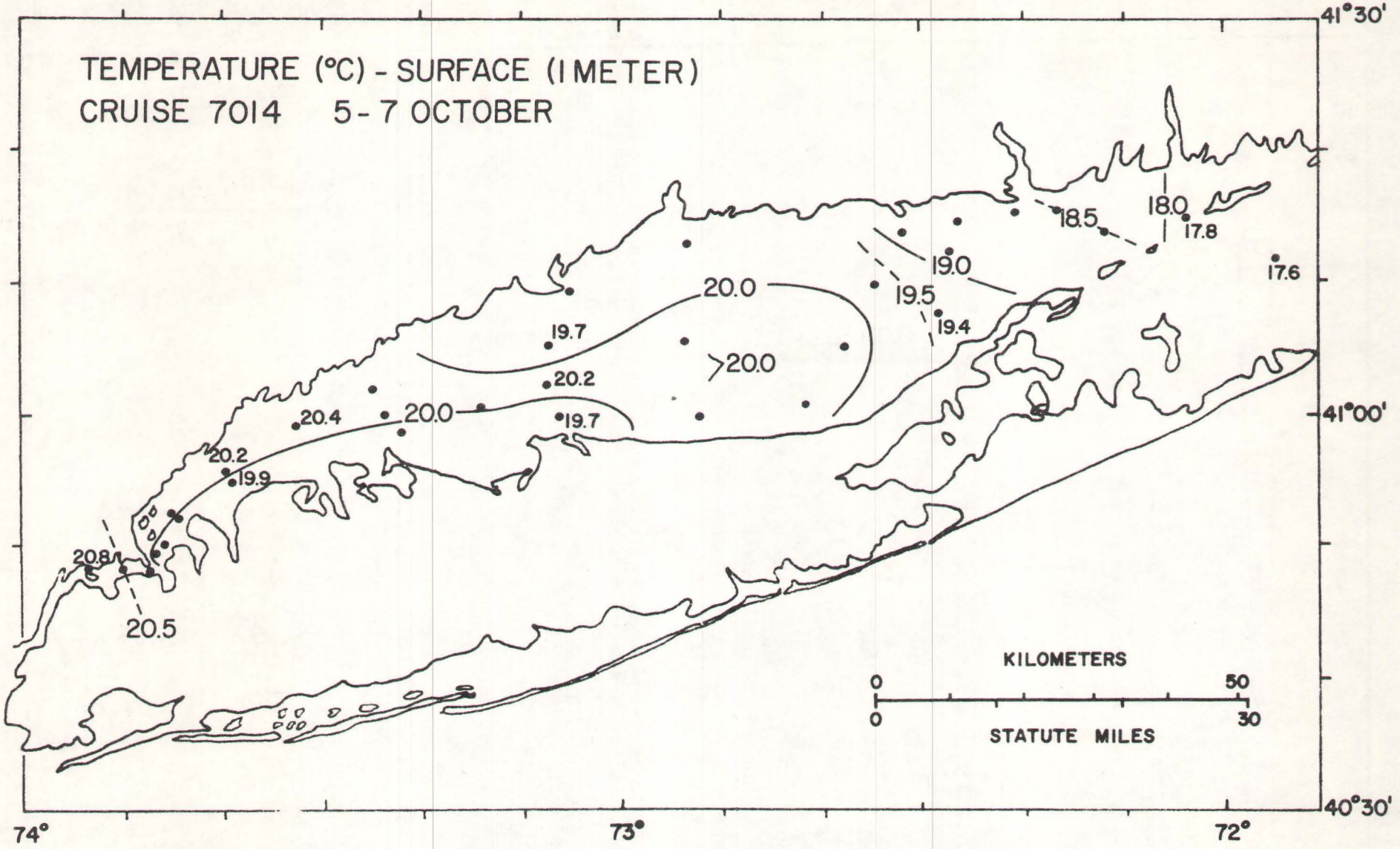

FIGURE 4. SURFACE TEMPERATURE

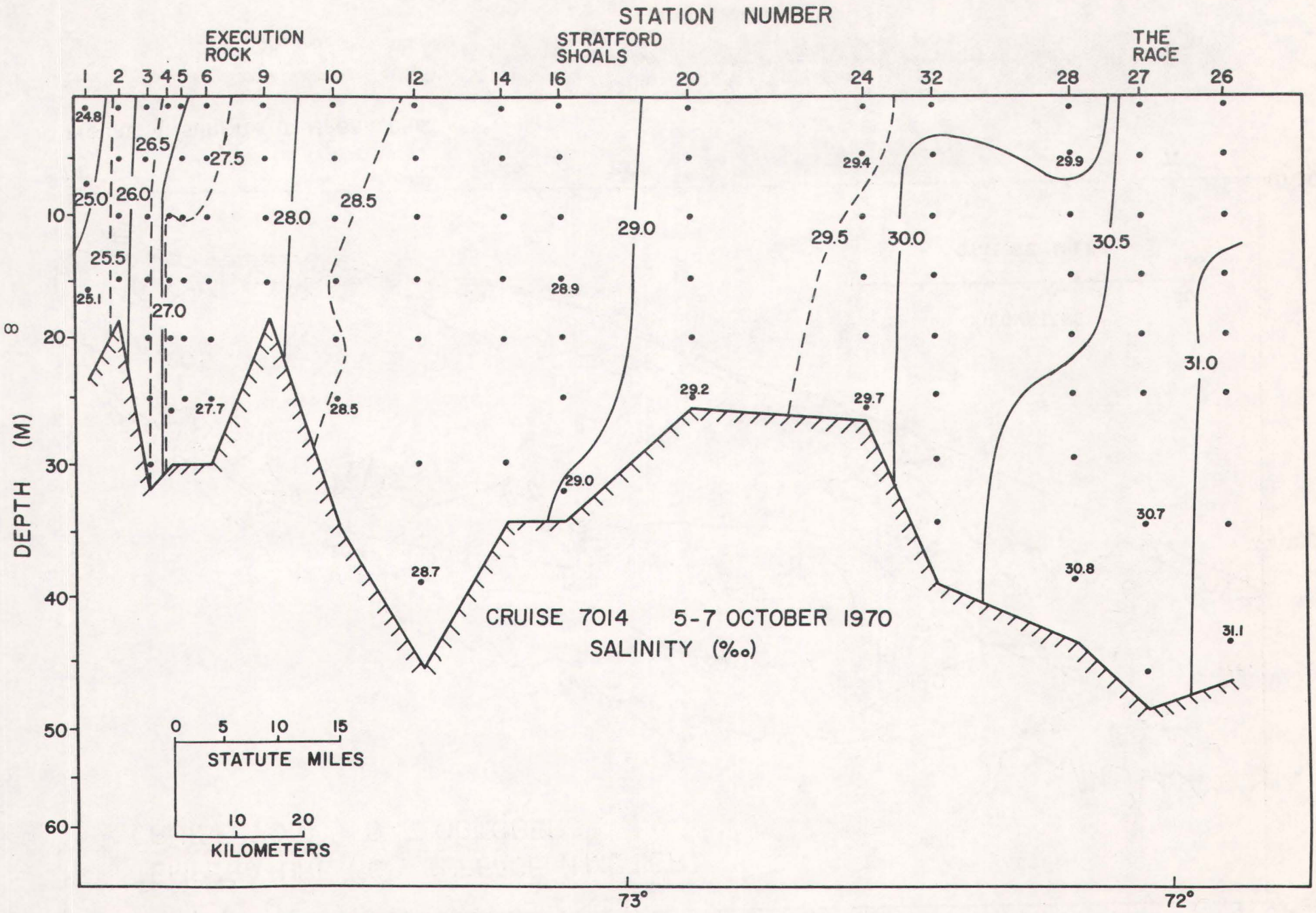

FIGURE 5. SALINITY PROFILE

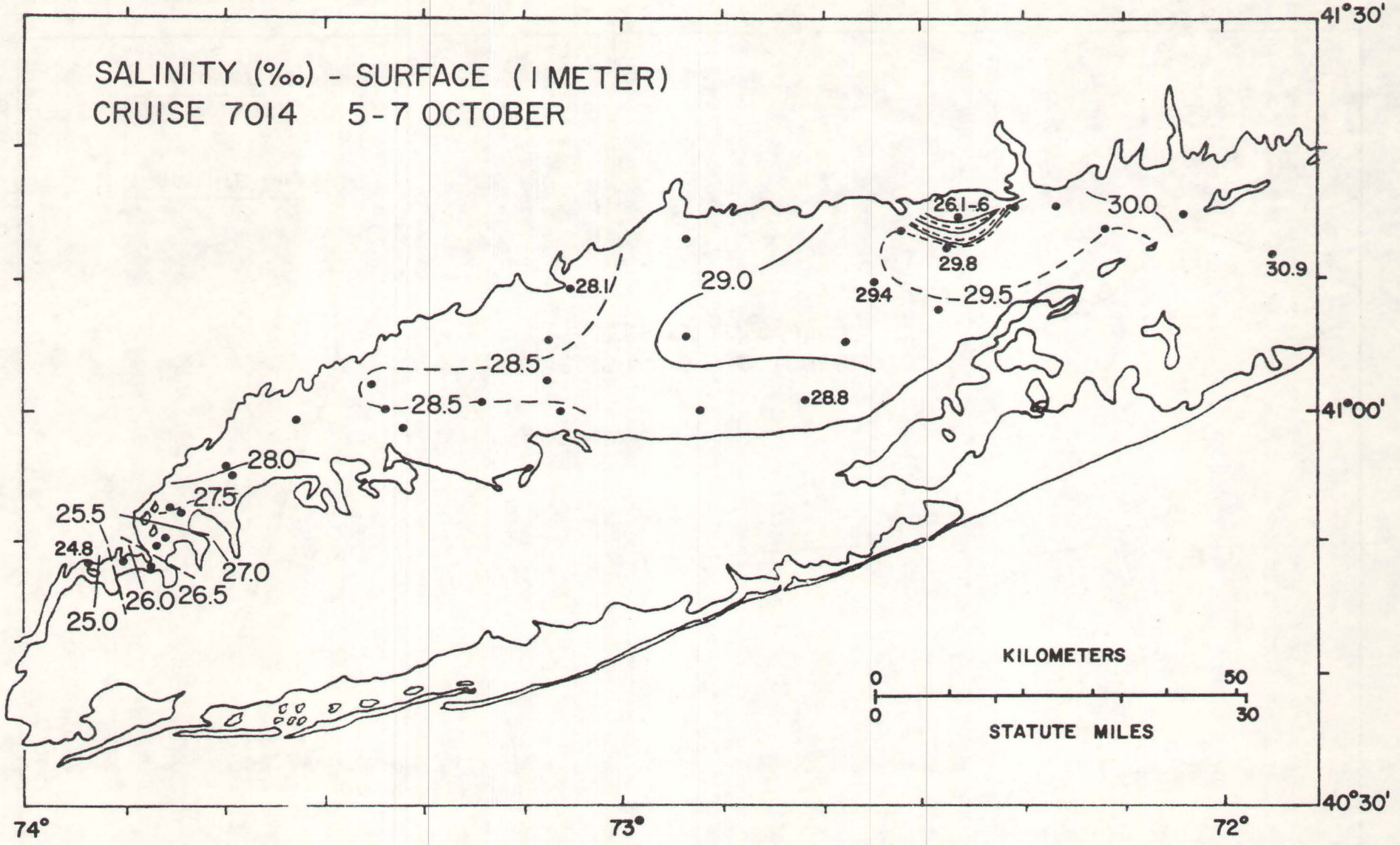

FIGURE 6. SURFACE SALINITY

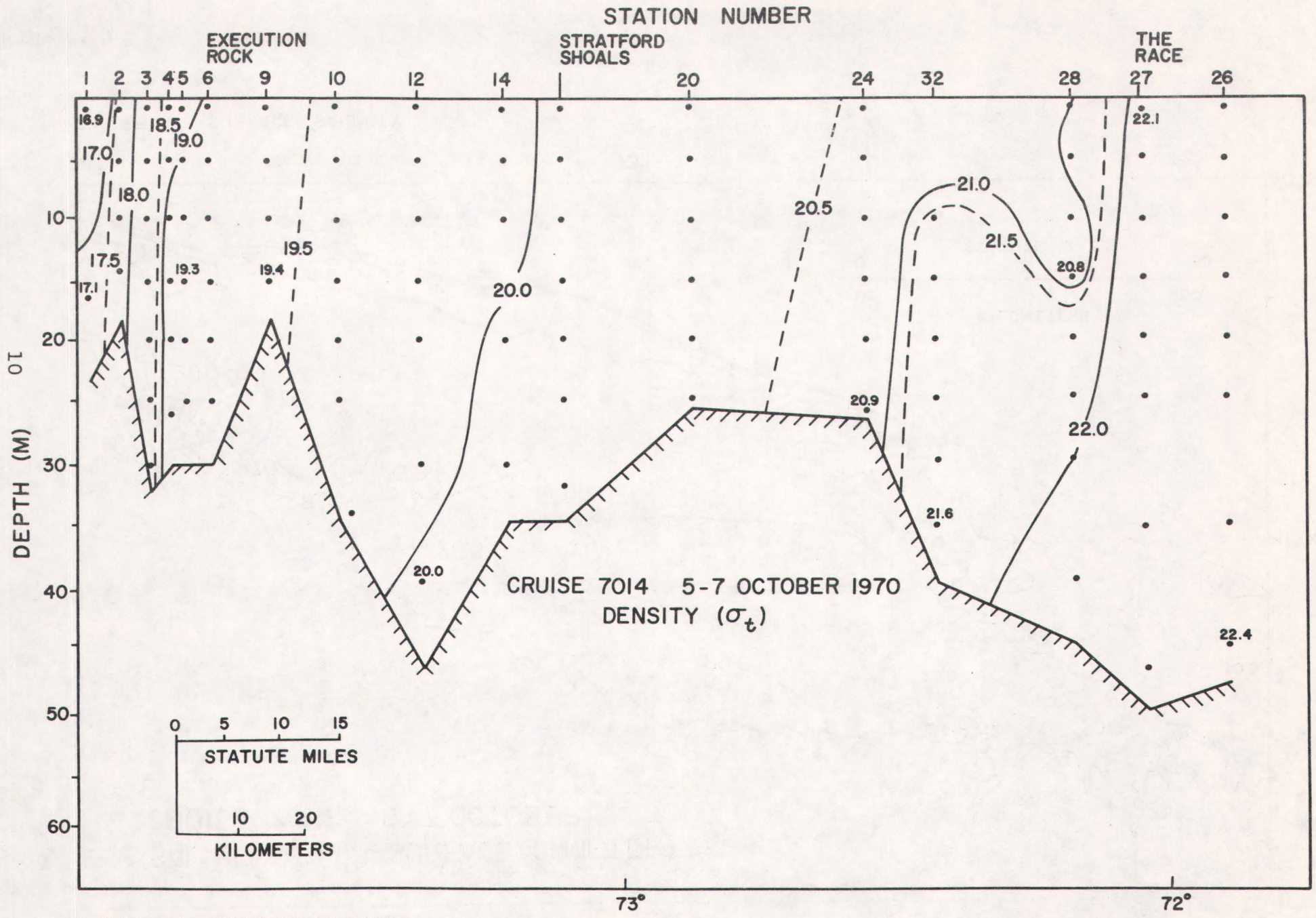

FIGURE 7. DENSITY PROFILE

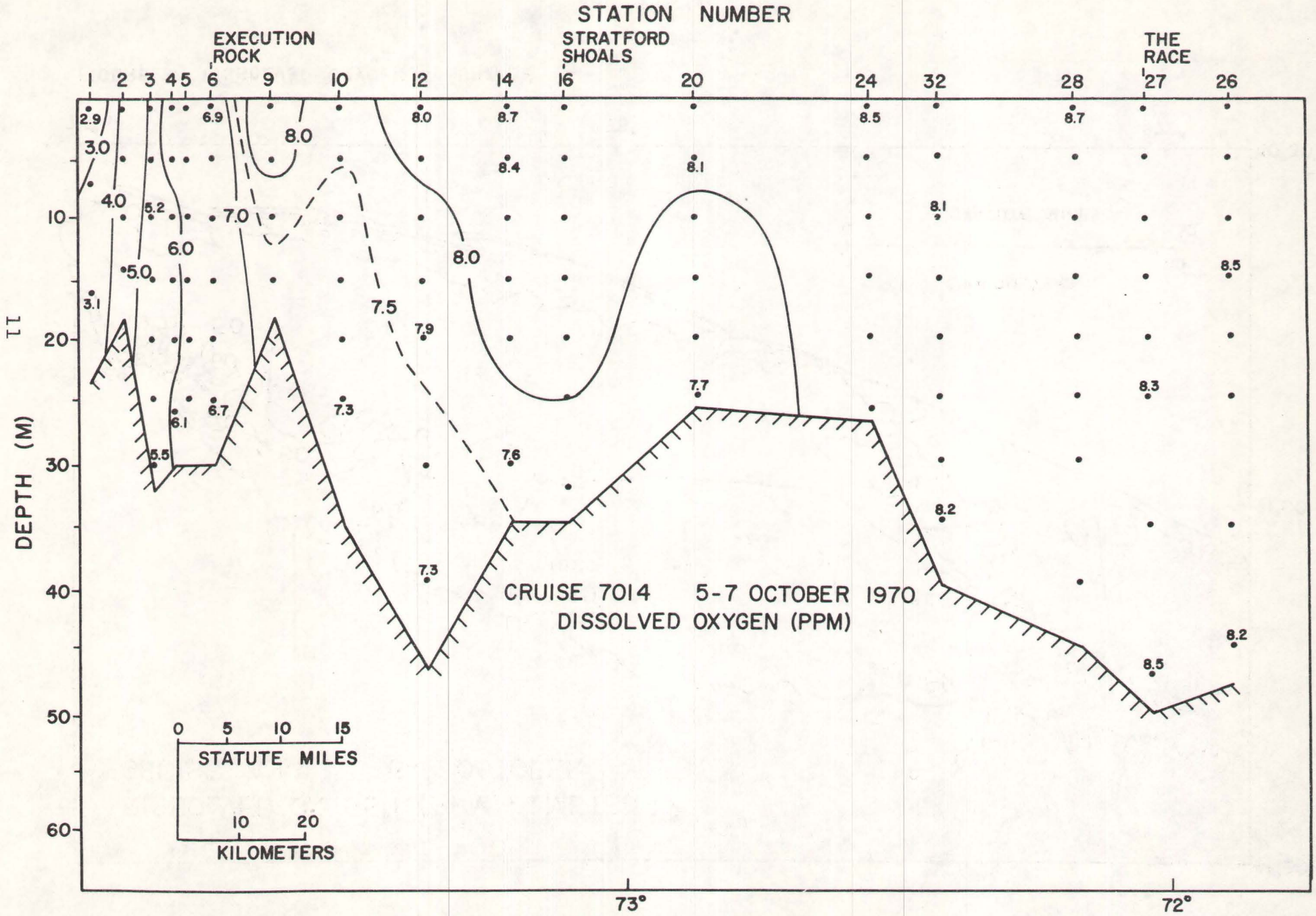

FIGURE 8. DISSOLVED OXYGEN PROFILE

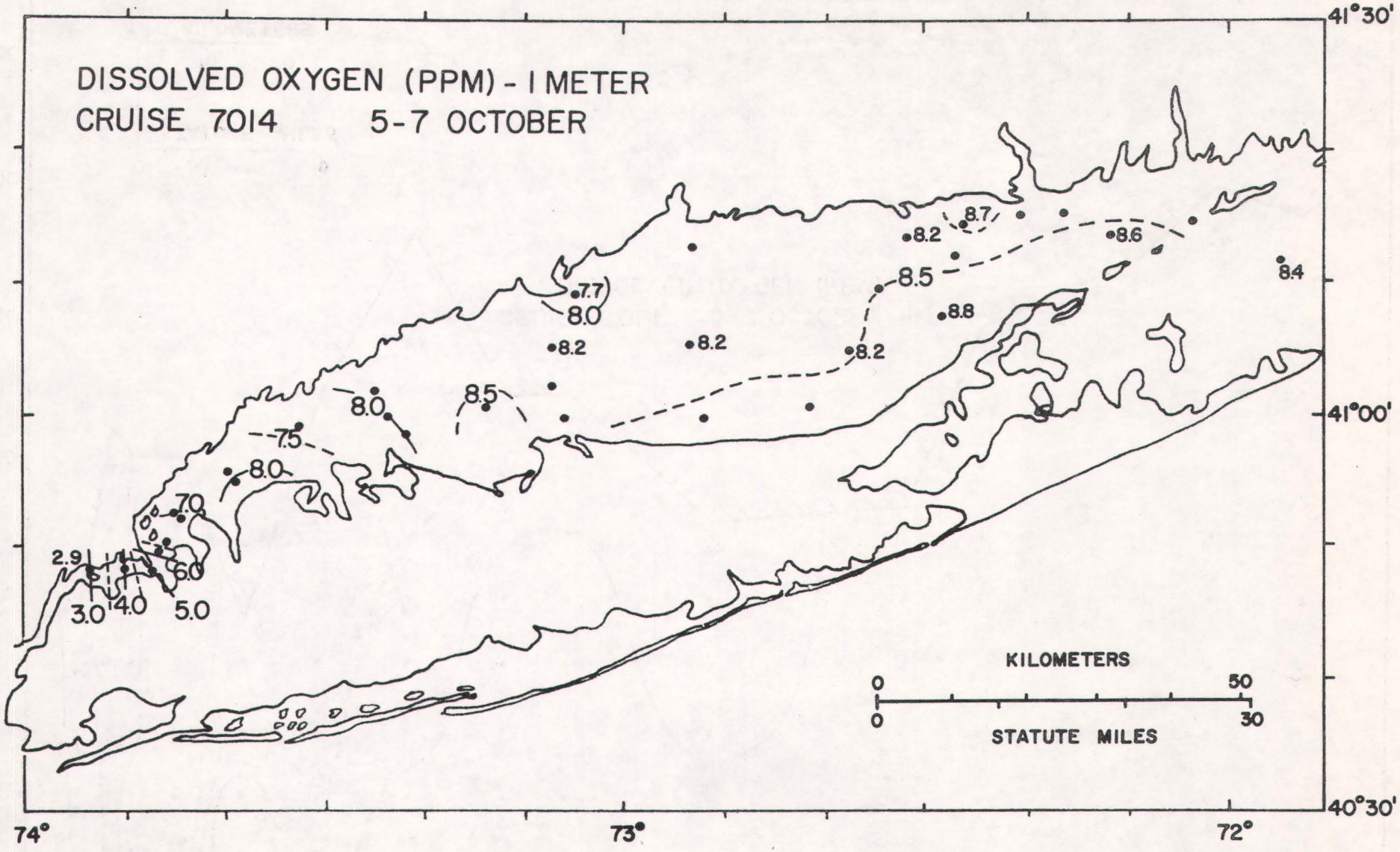

FIGURE 9. DISSOLVED OXYGEN – SURFACE

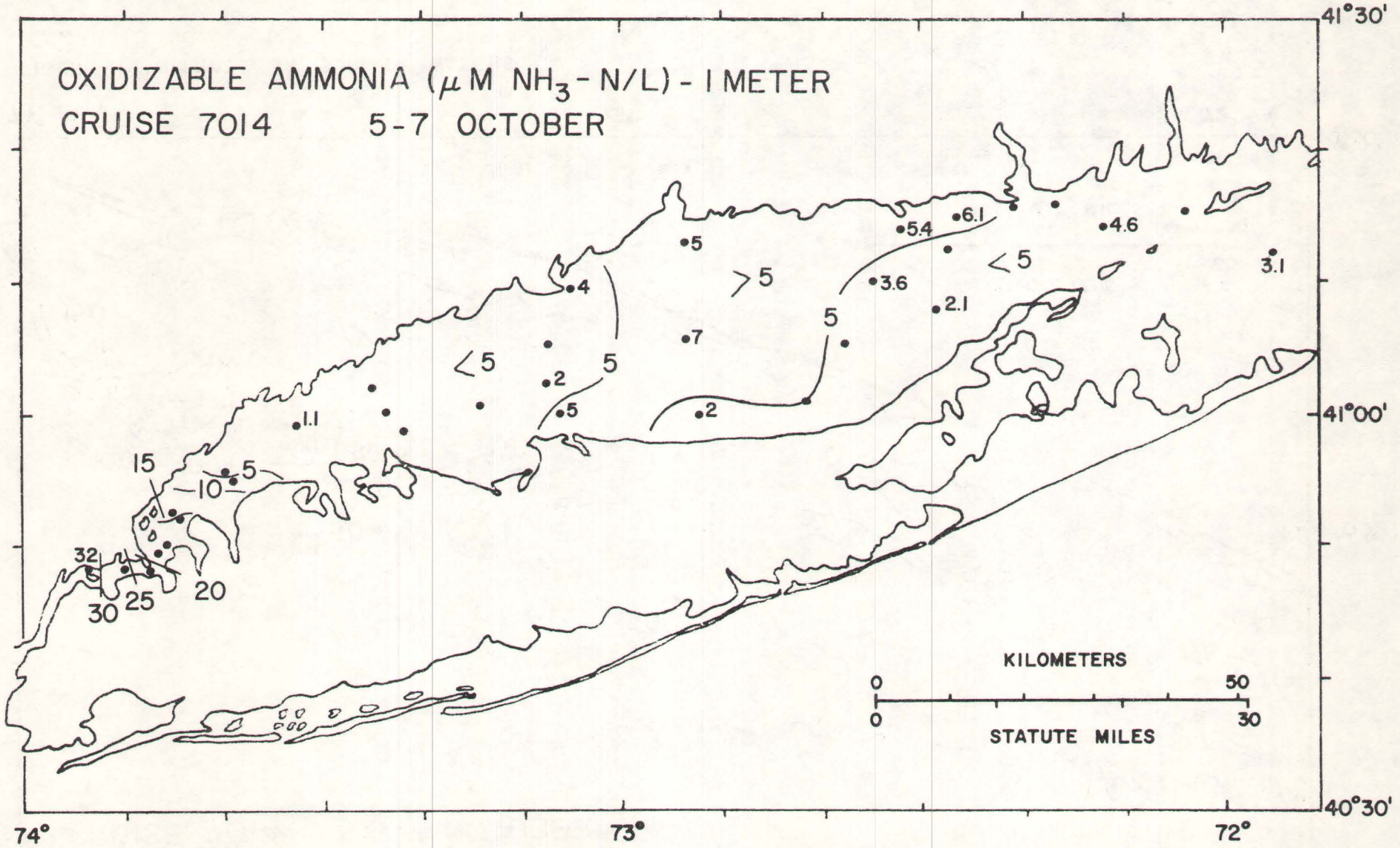

FIGURE 10. OXIDIZABLE AMMONIA IN SURFACE WATERS

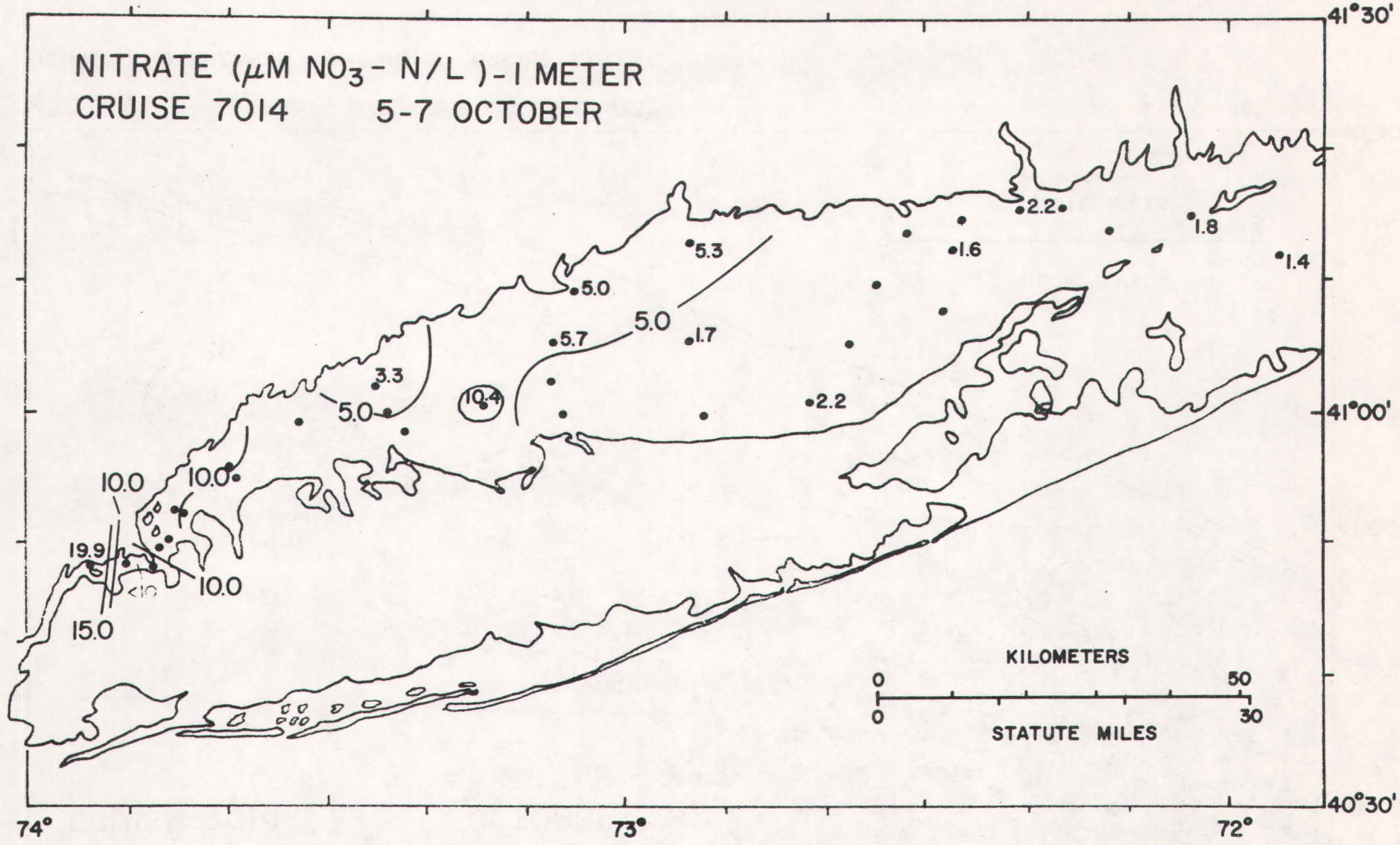

FIGURE II. NITRATE IN SURFACE WATERS

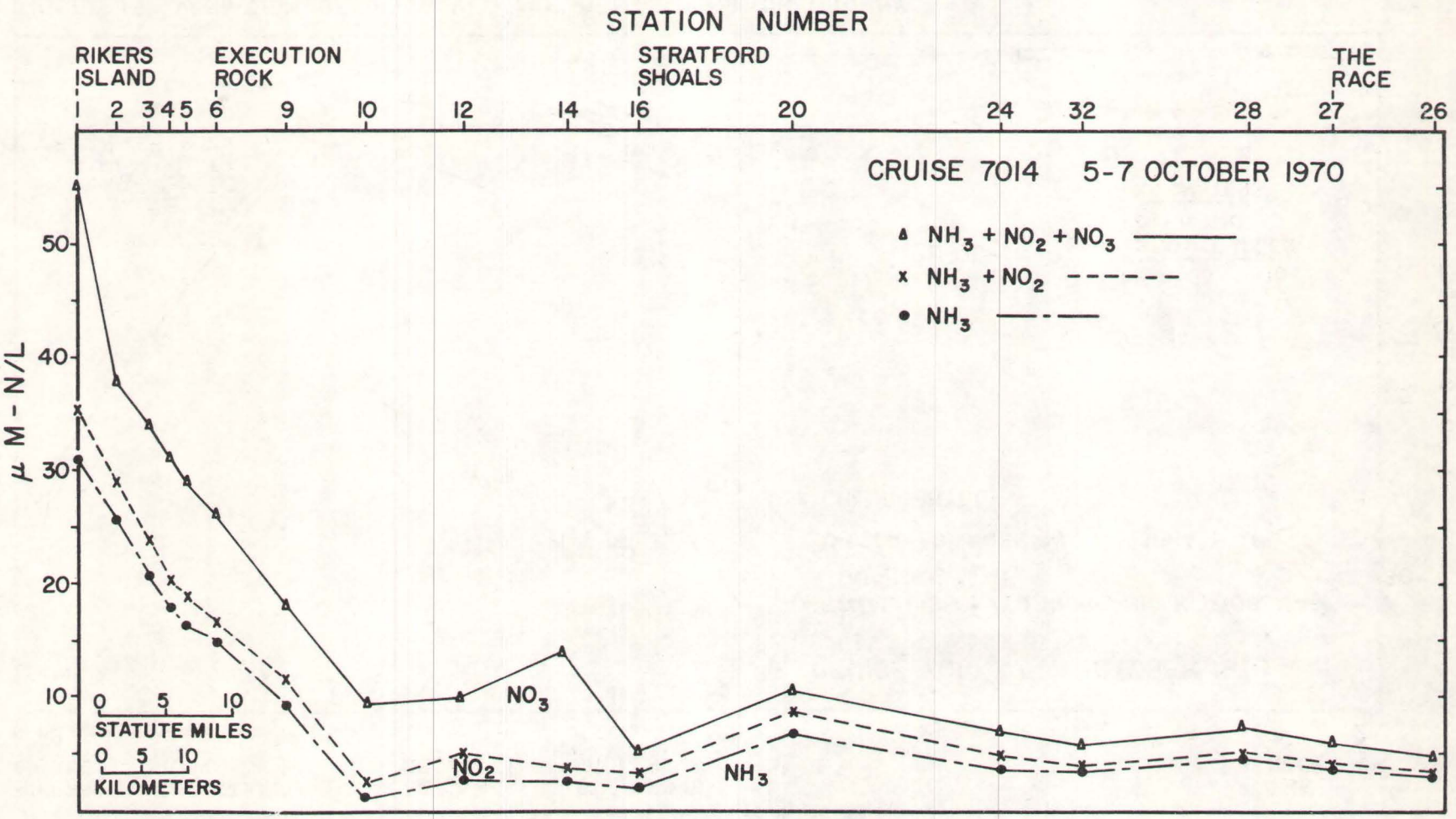

FIGURE 12. SUMMATION OF TOTAL DISSOLVED INORGANIC NITROGEN FRACTIONS ($NH_3 + NO_2 + NO_3$)

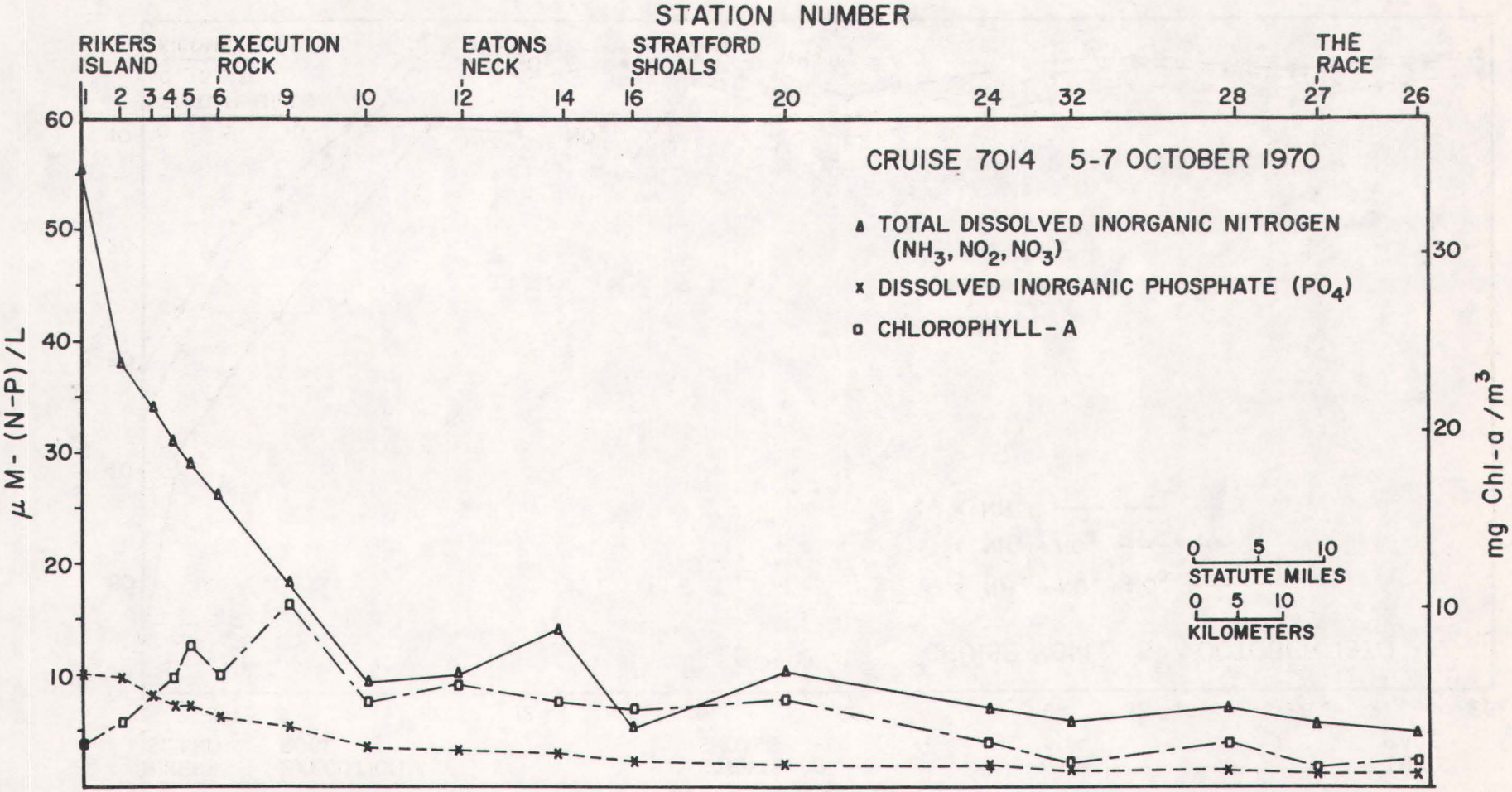

FIGURE 13. VARIATION OF DISSOLVED NUTRIENTS AND CHLOROPHYLL-A

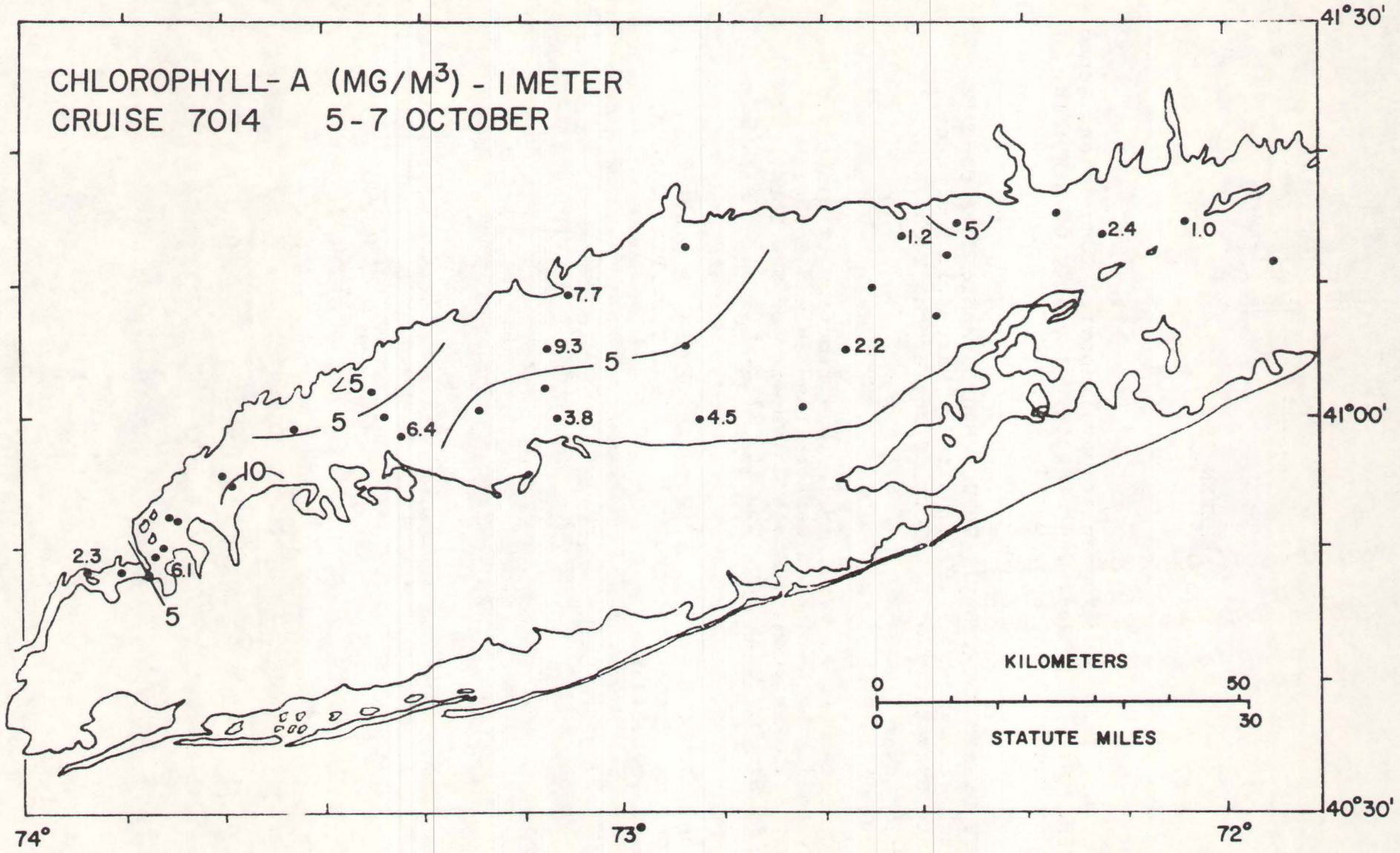

FIGURE 14. CHLOROPHYLL-A IN SURFACE WATERS

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APPENDIX

Formulas for Metric and English Unit Conversion

	Multiply by →	Multiply by ←	
Length			
Meters	3.281	0.305	Feet
Kilometers	0.53995	0.852	Nautical miles
Statute miles	0.8689	1.15	Nautical miles
Kilometers	0.62137	1.609	Statute miles
Area			
Square meters	10.8	0.0929	Square feet
Square kilometers	0.386	2.5899	Square statute miles
Square kilometers	247.1	0.0040	Acres
Acres	43560	2.295×10^{-5}	Square feet
Volume			
Cubic kilometers	10^{9}	10^{-9}	Cubic meters
Cubic meters	35.314	0.02832	Cubic feet
Liters	0.2642	3.7853	Gallons
Cubic feet	7.48	0.1337	Gallons
Cubic meters	264.2	0.00378	Gallons
Acre-feet	1233.48	0.00081	Cubic meters
Flow			
Cubic meters per second	22.82	0.0438	Million gals per day
Gallons per minute	1440.0	0.00069	Gallons per day
Cubic feet per second	0.6463	1.547	Million gals per day
Cubic meters per second	35.31	0.028316	Cubic feet per second
Cubic meters per second	264.2	0.003785	Gallons per second
Million cubic meters per year	0.723	1.383	Millions gals per day
Cubic meters per day per square kilometer	684.3	0.0015	Gallon per day per square mile
Mass			
Long tons	2273	0.00044	Pounds (avdp.)
Short tons	2000	0.0005	Pounds
Metric tons	2205	0.00045	Pounds
Grams	0.035	28.349	Ounces (avdp.)
Kilograms	2.2046	0.4536	Pounds
Grams	0.00220	453.59	Pounds

	→	←	
Velocity			
Meters per second	2.247	0.4470	Statute miles per hour
Meters per second	1.944	0.5144	Knots (nautical miles per hour)
Parts per Million			
Milligrams per liter	1	1	Parts per million
Parts per million	8.235	0.1214	Pounds per million gallons
Dissolved Oxygen			
Parts per million	62.54	0.0160	Microgram-atoms O_2 per liter
Parts per million	31.25	0.0320	Micromoles O_2 per liter
Milliliters per liter	1.428	0.7002	Milligrams per liter
Dissolved Nutrients			
Microgram-atoms Phosphorus per liter	0.031	32.26	Milligrams per liter Phosphorus
Microgram-atoms Nitrogen per liter	0.014	71.43	Milligrams per liter Nitrogen
Grams Carbon per square meter per year	8.922	0.1121	Pounds Carbon per acre per year
Time			
Days	86400	$1x10^{-5}$	Seconds
Seconds	$3.17x10^{-8}$	$3.1536x10^{7}$	Years