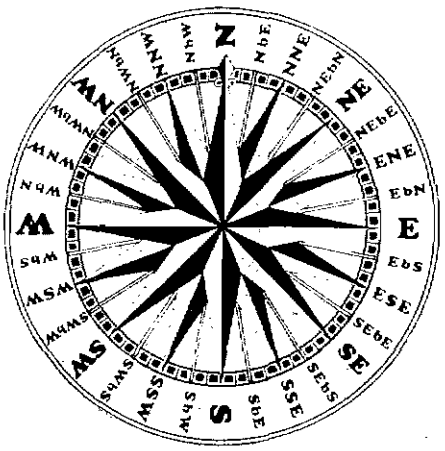

NEW YORK BIGHT ICHTHYOPLANKTON SURVEY — PROCEDURES AND TEMPERATURE AND SALINITY OBSERVATIONS

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New York Bight Ichthyoplankton Survey - Procedures and Temperature and Salinity Observations

by

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ABSTRACT

A summary of procedures and of temperature and salinity observations from a series of 15 ichthyoplankton cruises conducted in the New York Bight from July 1974 to June 1976 is presented. Surface and bottom temperature and salinity distributions and several vertical sections of temperatures and salinities from each of these cruises are included.

INTRODUCTION

From July 1974 to June 1976, 15 cruises were conducted to investigate the seasonal and onshore-offshore distribution of ichthyoplankton in the New York Bight. These cruises were supported in part by an interagency agreement with the Energy Research and Development Administration (ERDA) through Brookhaven National Laboratory. This report summarizes the collecting methods and equipment used and presents temperature and salinity surface and bottom charts and vertical sections for these cruises. Other operations conducted during these cruises that will be detailed elsewhere included bottom fish trawling, nearshore discrete-depth plankton tows, and primary productivity measurements, nutrient determinations, and chlorophyll measurements.

PROCEDURES

Station Pattern (Fig. 1, Table 1) - A grid pattern of 20 stations 21 n miles (38.9 km) apart was laid out. On most cruises the easternmost stations were at 72°00'W and the southernmost stations were at 39°07'N. Ship-time constraints required deletion of some stations on most cruises.

Cruise Schedule (Table 2) - From July 1974 to September 1975 cruises (13) were monthly, with the exception of December 1974 and January 1975. In addition a cruise was conducted in May and in June 1976. Stations were occupied in a variety of sequences on the cruises. On four cruises (D-74-15, C-75-3, A-75-4 and D-76-7) sampling was suspended because of adverse weather.

Station Procedures - Station positions were determined by LORAN A for cruises before May 1975 and LORAN C for cruises thereafter supplemented by RADAR fixes when possible. Temperature profiles were obtained with mechanical bathythermographs (cruises D-74-7 and D-74-8) or expendable bathythermographs (XBT) (accuracy of ± 0.2°C). Surface temperatures were observed with a bucket stem thermometer. Water samples were collected with 1.7 ℓ or larger Niskin bottles at depths of 5, 10, 20, 30,

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50, 75, 100, 150, 200, 300 m and bottom as water depth permitted. Plankton sampling was accomplished with 20- and 61-cm bongo nets (Smith and Richardson 1977) equipped with General Oceanics flowmeters. The paired 20-cm bongo, used only after cruise D-74-15, were fitted with 0.253-mm mesh nets on cruise D-75-1 and 0.223-mm mesh on all other cruises. The paired 61 cm bongo had 0.333- and 0.505-mm mesh nets. A 45-kg ball was suspended 1 to 2 m below the 61-cm bongo as a depressor. The 20-cm bongo was affixed to the towing wire 1 to 2 m above the 61-cm bongo and a Bendix bathythermograph was placed on the wire between the bongos to monitor the tow depths. Double oblique tows were made to sample the water column to within 2 m of the bottom or to a depth of 200 m. Pay-out and retrieval rates were varied to sample adequate amounts of water at shallow stations. To assure equal sampling intensity at all depths, a 45° wire angle was maintained during the tows by adjusting the ship speed. The towing speed was about 1.8 knots (0.93 m/sec). Mechanical problems with winches on cruises D-74-7, D-74-8 and D-74-11 precluded ideal towing procedures. Plankton samples were preserved in 5% seawater-buffered formalin. Neuston tows were made with a Haedrich net (Bartlett and Haedrich 1968). The net was fitted with a 0.780-mm mesh on cruise D-74-7 and a 1.800-mm mesh net on all other cruises. We towed the neuston net for 10 min at 5 knots (9.3 km/h) following each bongo tow.

Laboratory Procedures - Salinities were determined using a Beckman induction salinometer (accuracy ± 0.003 o/oo). Plankton samples from the 20-cm bongo nets and the 0.333-mm mesh, 61-cm bongo net were processed for invertebrate zooplankton at Brookhaven National Laboratory (Judkins, Wirick and Esais in prep.). All fish eggs and larvae from the 0.505-mm mesh, 61-cm bongo net samples were removed by sorting successive aliquots with low magnification. The larvae were then identified to the lowest possible taxon, counted and measured to the nearest 0.1 mm with an ocular micrometer or dial calipers. Fish eggs from the samples were counted. Neuston samples were treated similarly, except only larval and juvenile fish were processed and measurements were made to whole millimeter intervals.

Data Processing - All cruise, temperature, salinity, and ichthyoplankton data are being machine processed through the MARMAP Information System (Petersen, Marak and Jossi 1975).

TEMPERATURE OBSERVATIONS

The annual temperature cycle of shelf water in the New York Bight during the period of our cruises can be seen in the plan views and vertical sections shown in Figures 2 to 31. Our observations demonstrate the patterns reported by Bowman and Wunderlich (1977). General features of interest are the

formation and breakdown of the seasonal thermocline in the warmer months with the concomitant development of the cold cell and the establishment of isothermal conditions in cooler months with onshore-offshore gradients of cold to warmer waters. Surface temperatures varied from 4° to 24°C annually, while bottom temperatures in mid-shelf remained fairly constant at 6° to 10°C. There was a narrow band of bottom water over the outer portion of the shelf that remained nearly isothermal year-round at about 10° to 11°C. This area warmed to about 13° to 14°C during the autumnal turnover. The following is a month-by-month account of this cycle as observed during our cruises.

In July 1974, the seasonal thermocline was well established at 15 to 30 m. Above the thermocline temperatures were greater than 20°C; below 30 m they were generally less than 10°C. The cold cell was present as a pool of 8°C bottom water. By August 1974, surface temperatures had warmed slightly with large areas of 23°C water observed. The thermocline was still quite pronounced and the cold cell had warmed to about 9°C. In September 1974, surface temperatures had dropped to below 20°C and the upper part of the thermocline had eroded, creating a mixed layer about 20 m deep. The cold cell was still present, but the temperature there had increased to about 11°C. By

October 1974, further cooling had reduced surface temperatures to about 14°C. The water was only slightly stratified with shelf bottom water at a minimum of 12°C. In November 1974, the shelf water was practically isothermal and rather uniform over the area at about 12° to 14°C. Cooler water, less than 12°C, was observed nearshore. In February 1975, further cooling had occurred. The water was isothermal, but there was a pronounced onshore-offshore gradient, with nearshore stations being 5° to 6°C and those offshore reaching 10° to 12°C. The March 1975 temperature pattern was quite similar to that of the previous month except the entire area had cooled about one degree. April 1975 was again similar to the two previous months with most of the shelf covered with 5° to 6°C water. Water at the edge of the shelf was 7° to 10°C. By May 1975, surface warming had begun and some stratification had developed. Surface temperatures had increased to 8° to 10°C and large areas of 6°C water were present at depth. In June 1975, further warming and stratification was noticed. Surface waters had reached 15° to 17°C with a sharp thermocline at 10 to 20 m. Water below the thermocline was less than 10°C and the cold cell was 6°C. The July 1975 temperature pattern was similar to that of July 1974, but the water was about one degree cooler. Surface waters were mostly 20° to 21°C and the cold

cell was 7°C. The seasonal thermocline was well established at 10 to 30 m. In August 1975, surface waters had warmed to their August 1974 levels of 22° to 24°C. Temperatures in the cold cell remained cooler at 7° to 8°C than in the previous August. By September 1975, autumnal cooling had started with surface waters at 19° to 20°C. The top of the thermocline was eroded and temperatures were nearly uniform in the upper 20 m of the water column. The cold cell was still evident at about 8°C -- it was 11°C in September 1974.

The next cruise was in May 1976 when observed surface temperatures were considerably warmer than in May 1975. Stratification was already evident with surface waters about 12°C and bottom waters at 8° to 10°C over much of the shelf. The June patterns for 1975 and 1976 were quite similar with surface waters generally 16°C, a thermocline at 15 to 30 m and bottom temperatures of 8°C. The 8°C water was in the position of the cold cell.

SALINITY OBSERVATIONS

The pattern of salinity of shelf waters of the New York Bight results from a combination of nearshore freshening by runoff and intrusion of saline offshore water (Bowman and Wunderlich 1977). This creates an onshore-offshore gradient of salinity that is modified by the seasonal development of

vertical stratification due to annual cooling and warming of surface waters. Nearshore surface waters are generally less than 32 o/oo and those offshore are usually greater than 34 o/oo. Offshore below 100 m water is >35 o/oo year-round. Vertical salinity gradients on the shelf rarely exceed 2 o/oo. The following is an account of the salinities observed during each cruise (see Figs. 32 to 61).

In July 1974, surface salinities varied from about 32 o/oo inshore to 35 o/oo offshore. Vertical stratification was slightly more evident inshore and offshore than in the mid-shelf region. The pattern for August 1974 was similar to that of the previous month with most of the surface having 31- to 34-o/oo water. In September 1974, more saline water of up to 37 o/oo was found offshore and the salinity of the inner part of the shelf had also increased to at least 32.5 o/oo. By October 1974, less salinity variation was seen in shelf waters - the range was 32.5 to 35.5 o/oo with most water between 33.0 and 35.5 o/oo. In November 1974, nearshore water was less than 32.5 o/oo and offshore water was slightly fresher than in the previous months. Vertical gradients did not exceed 1 o/oo. By February 1975, salinity had increased by about 0.5 o/oo over November 1974, but the pattern was quite similar. In March 1975, salinity had again decreased with 31.5 o/oo

water observed nearshore and 33- to 34-o/oo water covering most of the shelf. The salinity pattern for April 1975 was similar to that for March 1975 except that nearshore waters were more saline -- 32.5 to 33 o/oo. In May 1975, some vertical stratification was seen with most surface waters 32.5 to 34 o/oo and bottom waters about 1 o/oo more saline. By June 1975, more evidence of vertical stratification was seen with gradients of 1.5 o/oo common. Inshore, large areas of 32.5-o/oo water were seen and offshore salinities in midwater reached 36 o/oo. The salinity patterns for July 1974 and July 1975 were similar, but the water was generally 1 o/oo fresher in 1975. Vertical gradients of 1 to 1.5 o/oo were present. August 1975 salinities showed considerably more vertical stratification over much of the shelf than had been seen in the previous August. Salinities varied from 32 o/oo at the surface nearshore to 37 o/oo at 100 m offshore. By September 1975, vertical stratification had become less intense and most of the shelf was covered with 33- to 34-o/oo water. More saline water intruded onto the shelf offshore giving values up to 36.5 o/oo at depths greater than 100 m.

During the next cruise in May 1976, rather strong vertical gradients were present over much of the shelf. Surface water was 31.5 to 32.5 o/oo while that on the bottom was generally 33 to 35 o/oo. Vertical gradients of 2 o/oo were common. During the previous May, vertical gradients were only about

1 o/oo. Water at the eastern end of the sampling pattern was slightly less saline than elsewhere. The salinity patterns for June of 1975 and 1976 were more similar than those for May of the two years, although in June 1976 the water was about 1 o/oo fresher than in 1975. There was an area of low salinity water (<29 o/oo) nearshore in the apex of the Bight in June 1976.

WATER MASSES

Wright (1976), Wright and Parker (1976) and Bowman and Wunderlich (1977) discuss the water masses of the continental shelf and slope of the New York Bight. The shelf water is characterized by salinities of <35 o/oo and is divided into coastal water (<33.6 o/oo) and shelf-edge water (33.6-35.0 o/oo). A water mass at mid depth over the slope characterized by temperatures of 10° to 13°C and salinities of 35.0 to 35.6 o/oo is called the upper slope thermostad. Gulf Stream water characterized by salinities >36.0 o/oo and/or temperatures >18°C at 100 m or >15°C at 200 m (Wright 1976) occasionally impinges on this area. During summer, a cool pool of bottom water exists over the middle and outer continental shelf. All of these features were observed at various times during our cruises.

The boundary between coastal and shelf edge water occurred in our sampling area on all cruises. It was variable in position and shape, but was usually close to the 60 m isobath.

Extremes occurred in May 1976 when coastal water occurred at the surface at all stations except one, and in September 1974 when salinities at the bottom at all stations but one were greater than 33.5 o/oo. These variations probably reflect seasonal differences in runoff, position of slope and Gulf Stream water, and short-term effects of winds shortly before or during our cruises.

The upper slope thermostad was seen on and near the bottom at depths of 75 to 150 m on all cruises except in November 1974. This constitutes a rather narrow band of water near the shelf break.

Gulf Stream water indicated by temperatures >18°C at 100 m was seen beyond the edge of the shelf during the August 1974 cruise. Salinities >36 o/oo occurred offshore from July through September 1974 and in June, August and September 1975, but temperatures below 100 m were less than those characterizing Gulf Stream water.

The occurrence of the cool pool is detailed above in the discussion of the monthly temperature patterns. It was seen at mid depth over the shelf during the summer. The minimum temperature in the pool increased from month-to-month from 6°C in June to 8°C in September 1975. In 1974, remnants of the cool pool were seen as late as October when an area of 12°C bottom water was observed.

ACKNOWLEDGMENTS

We thank the many biologists and technicians for their assistance in obtaining the data at sea and M. Cox for drafting the figures.

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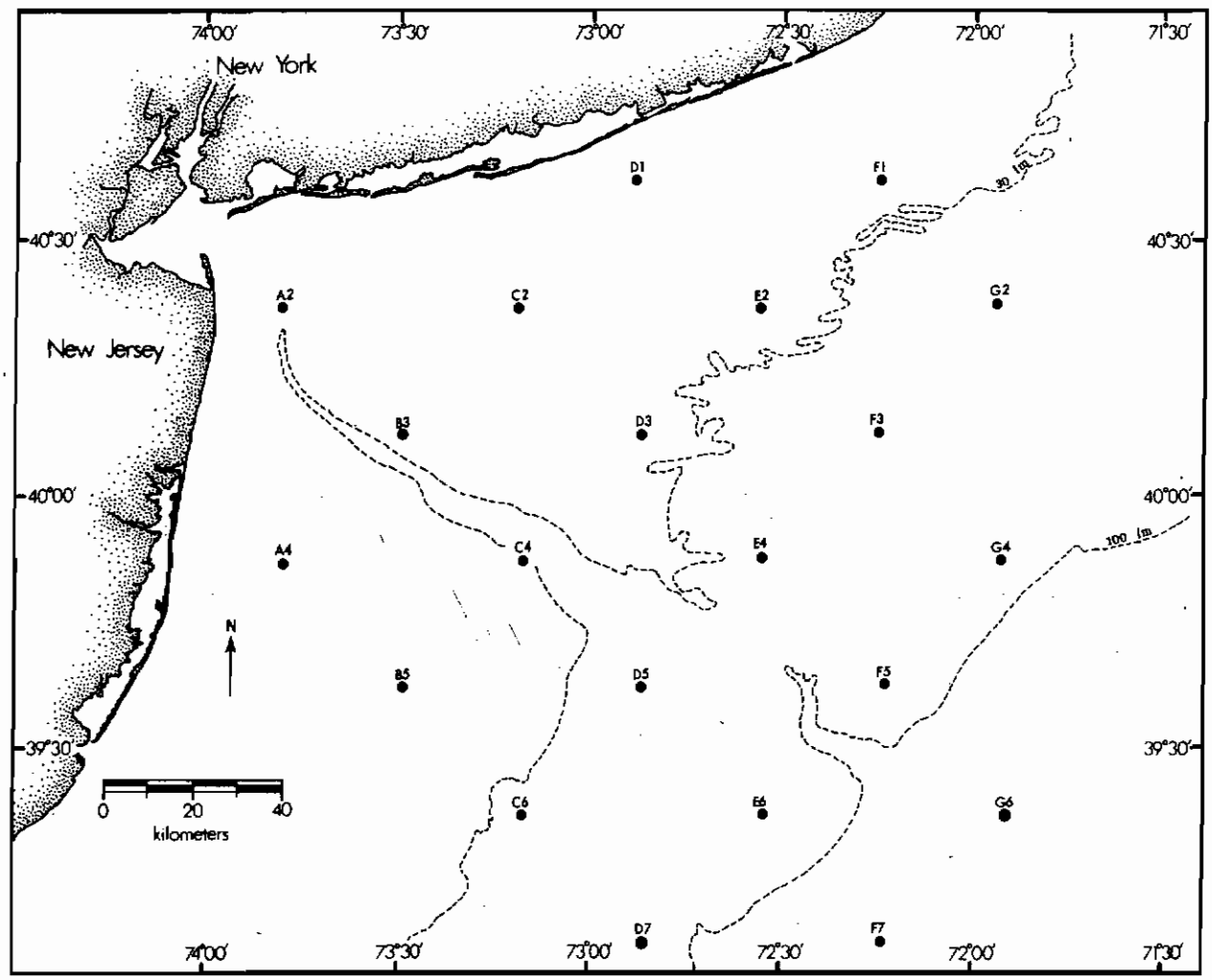


Figure 1. Station locations for New York Bight ichthyoplankton survey.

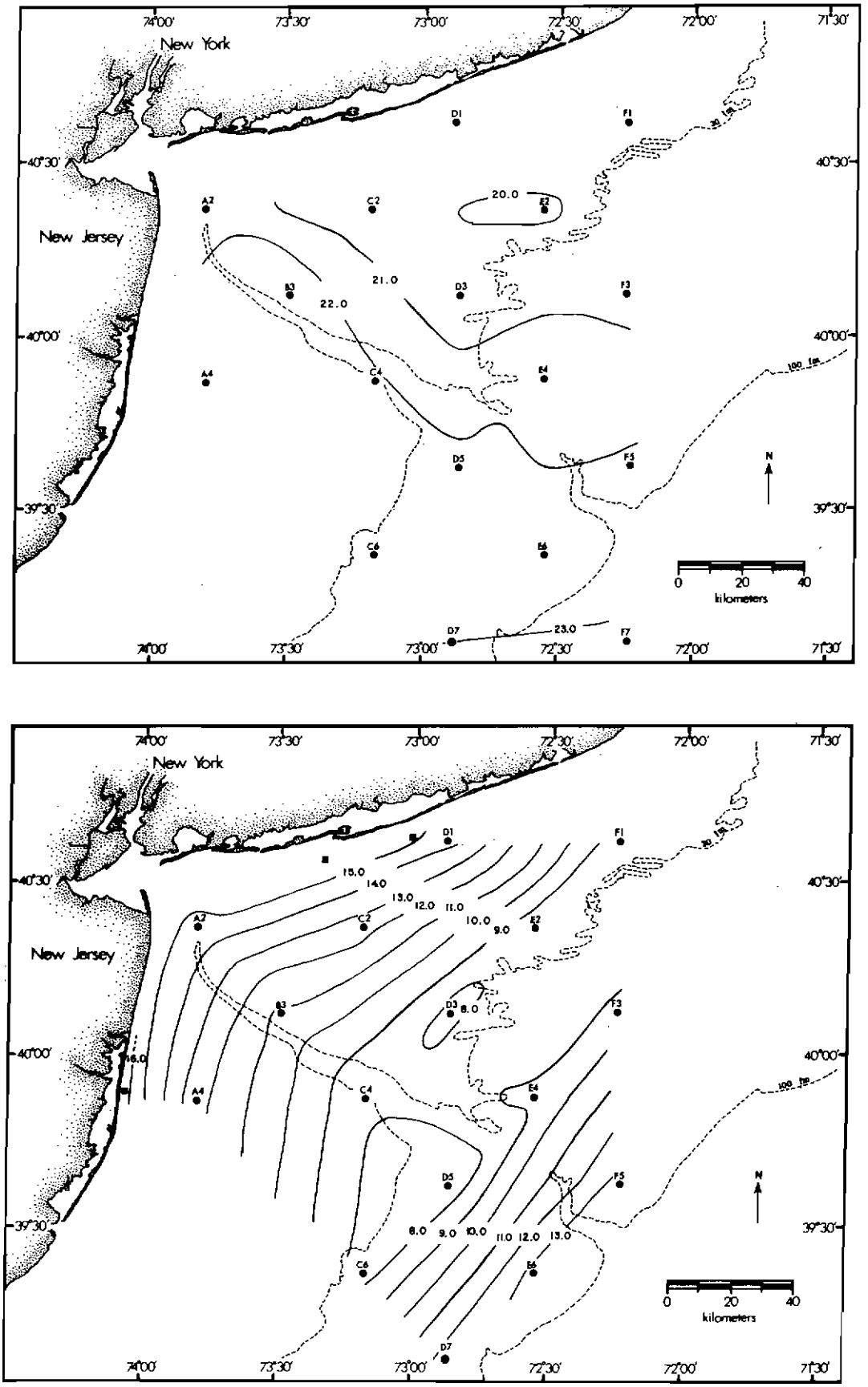


Figure 2. Surface (upper) and bottom (lower) water temperatures July 1974.

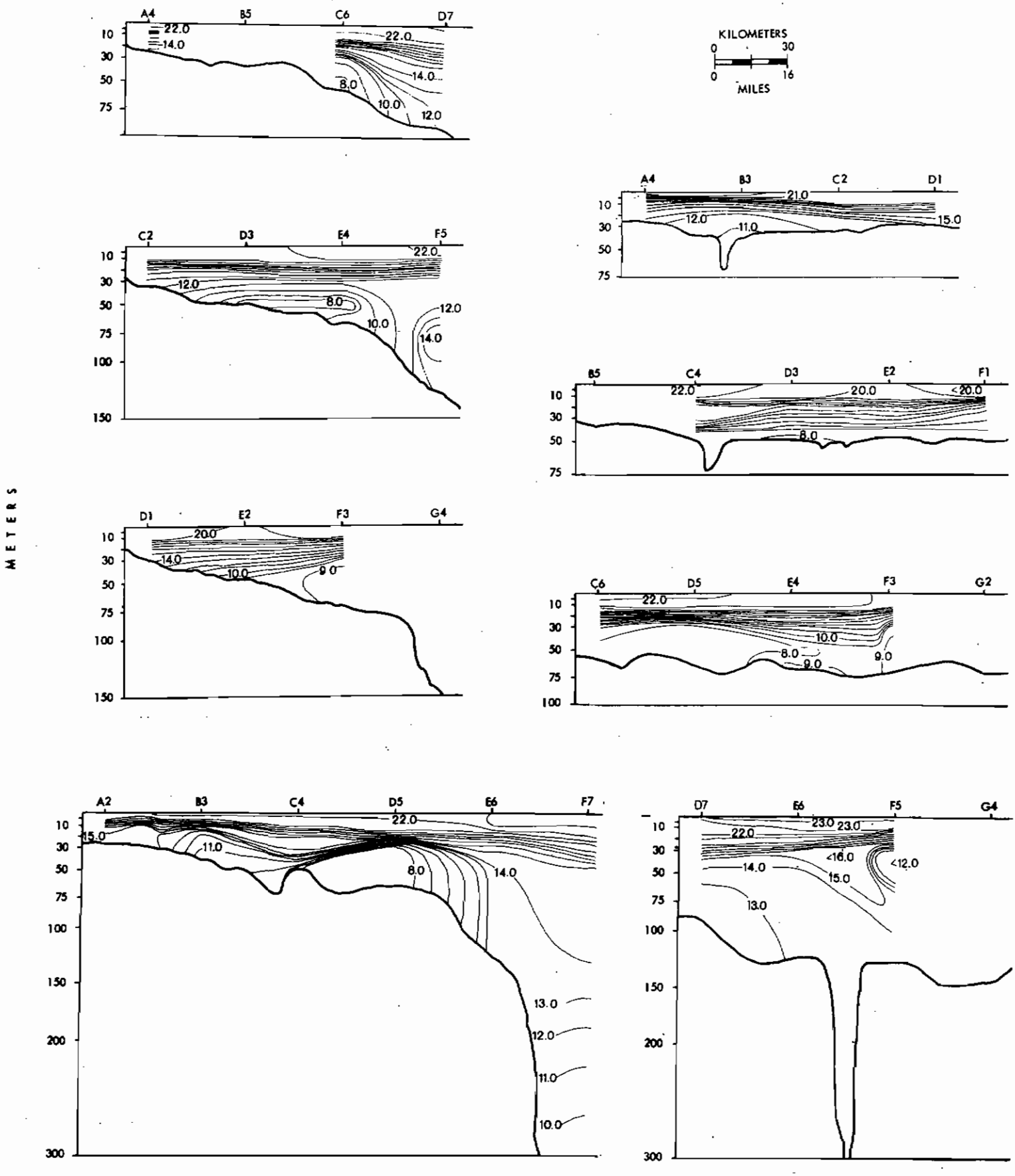
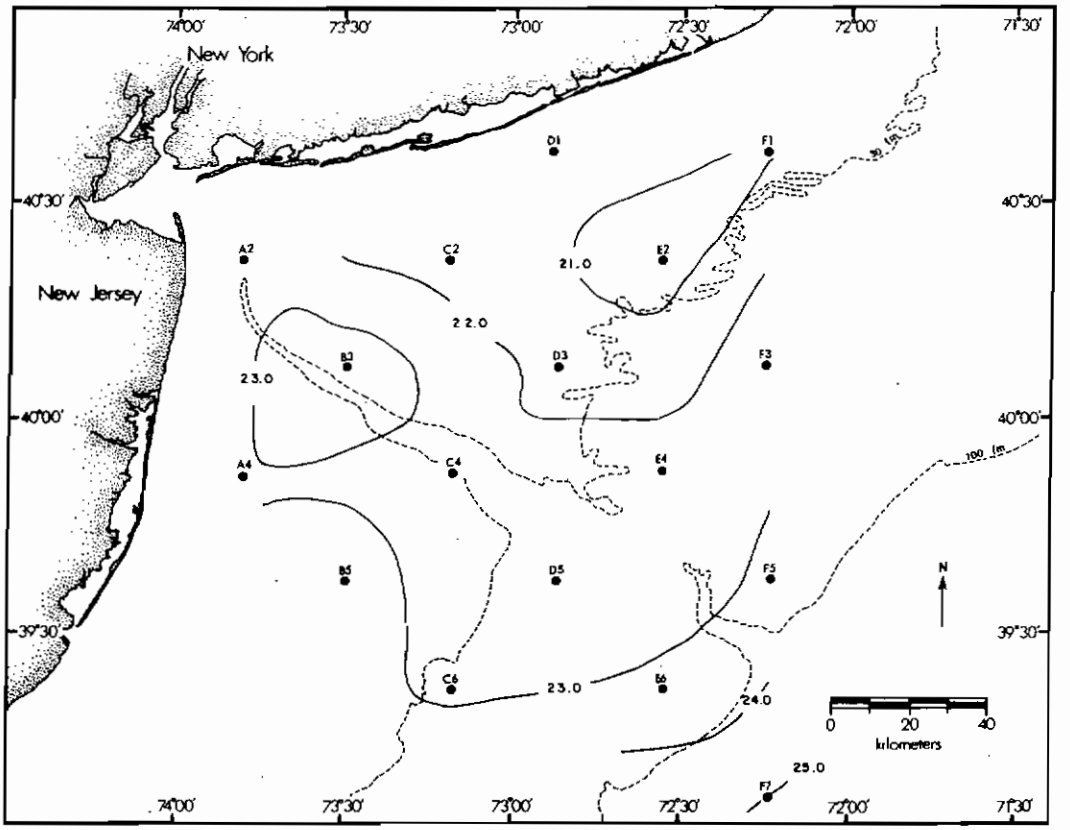


Figure 3. Vertical profiles of water temperature July 1974.



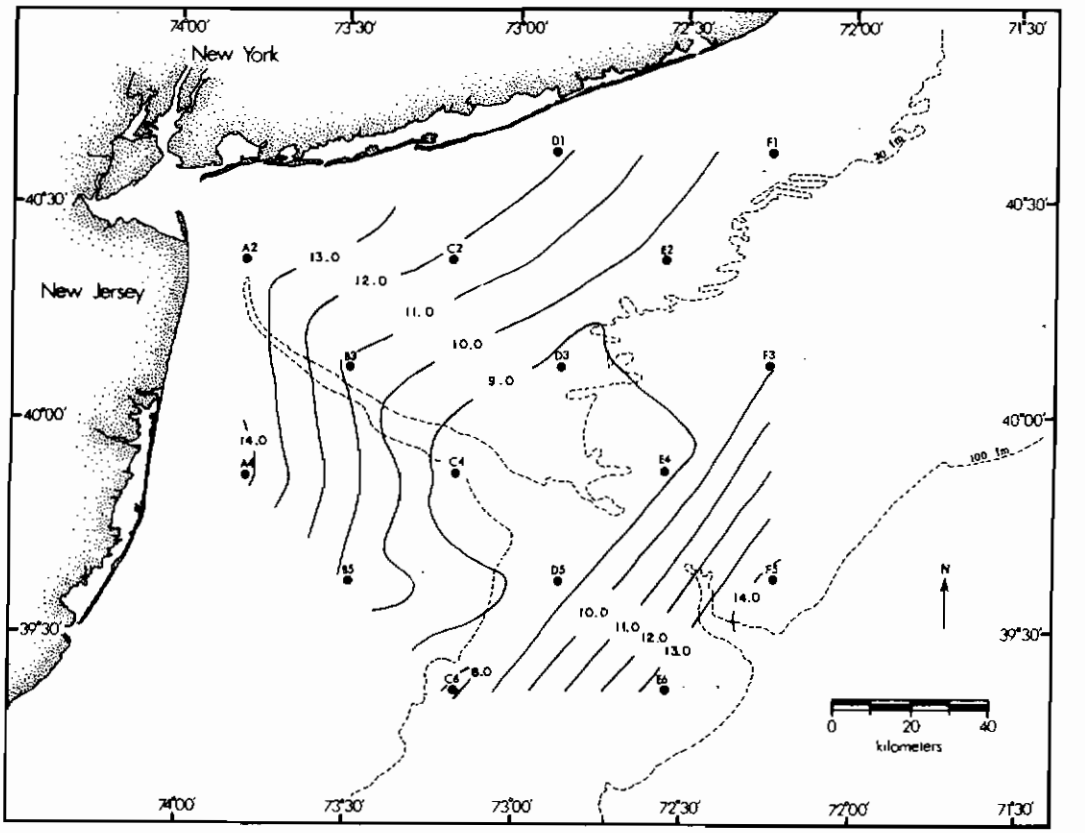
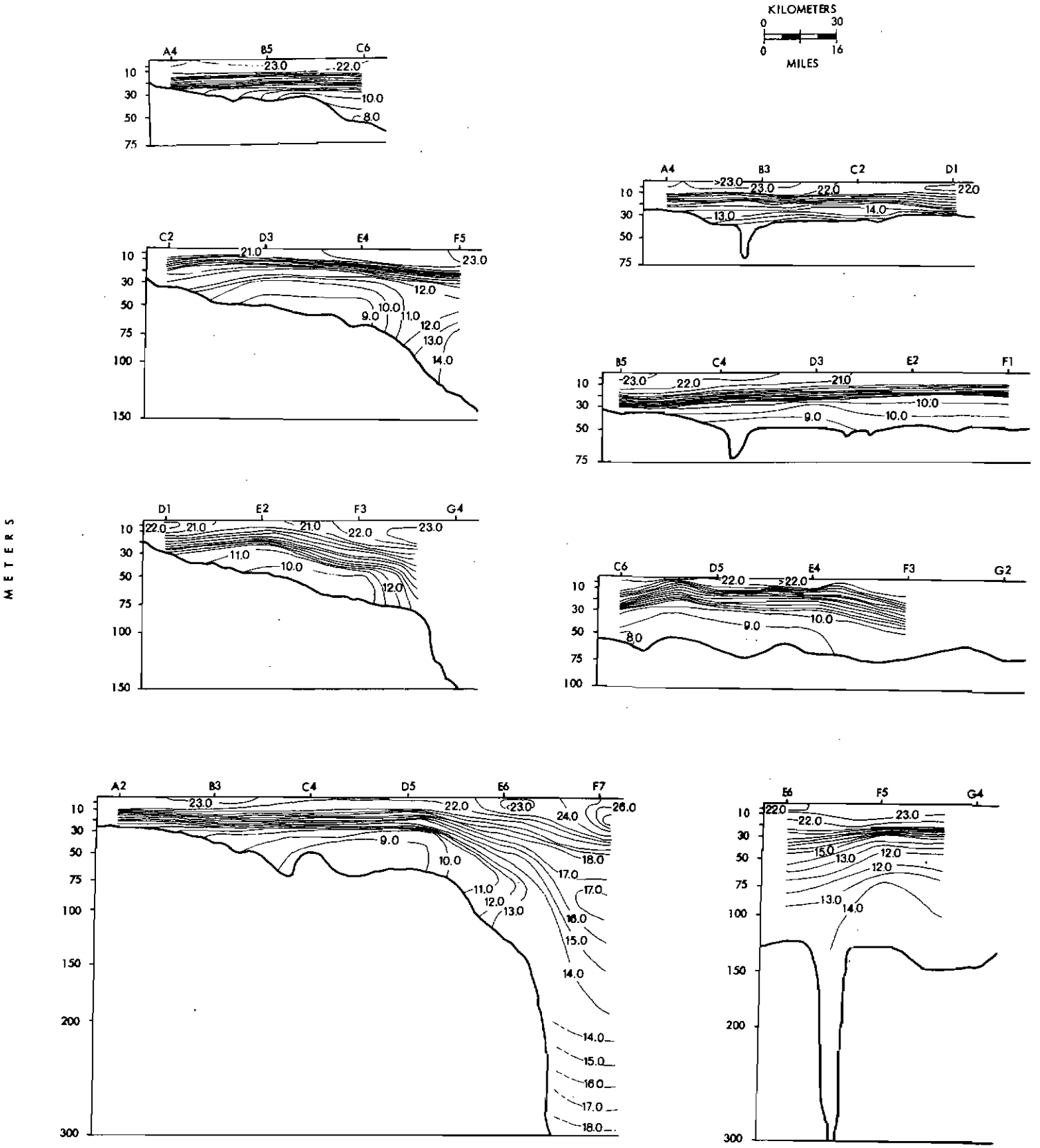


Figure 4. Surface (upper) and bottom (lower) water temperatures August 1974.



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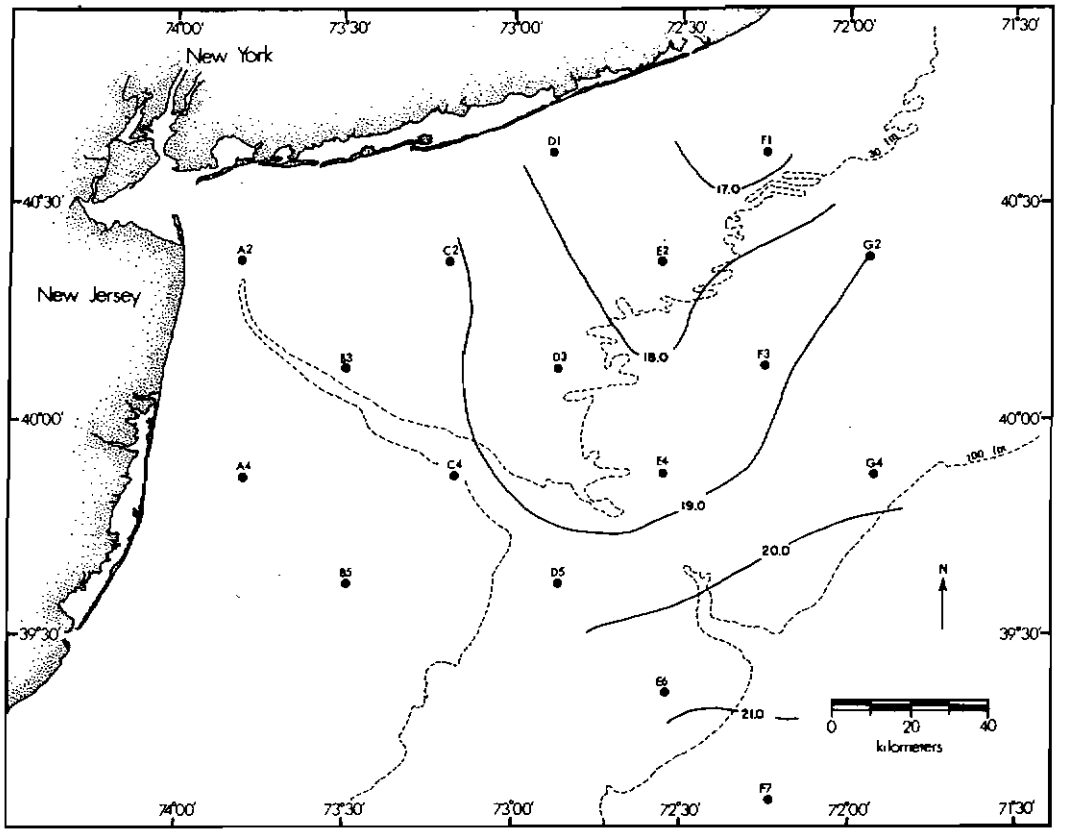


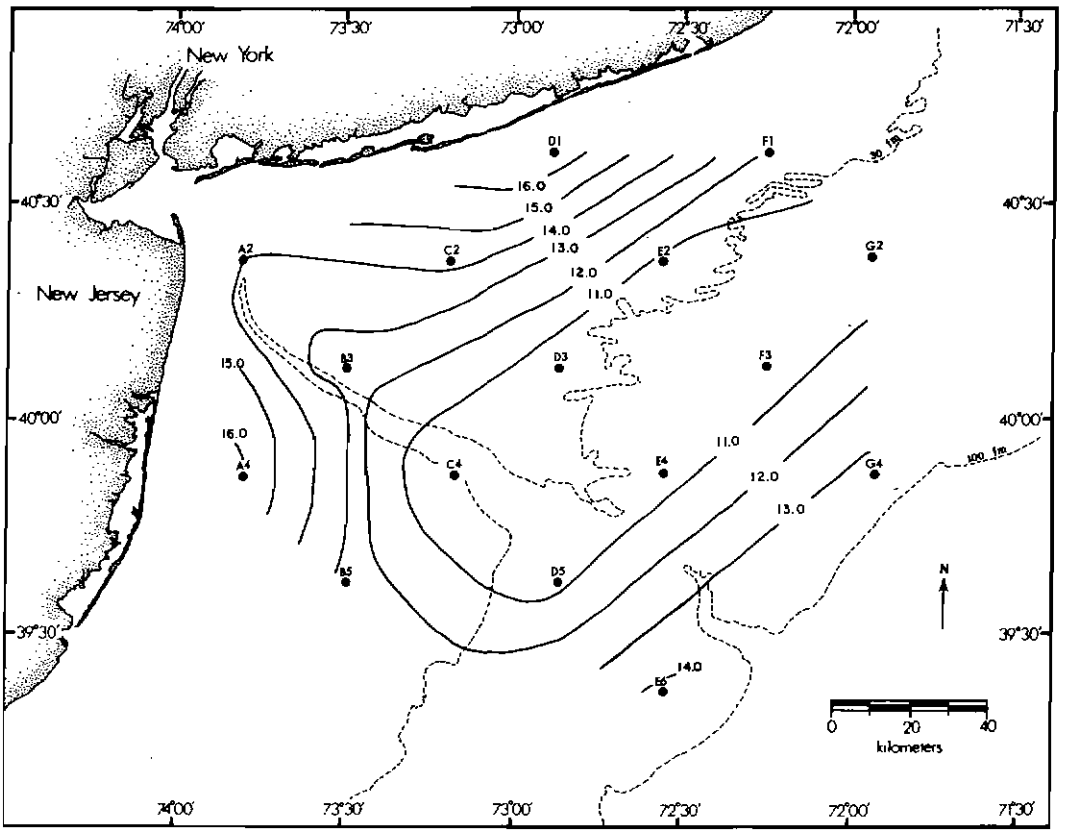


Figure 6. Surface (upper) and bottom (lower) water temperatures September 1974.

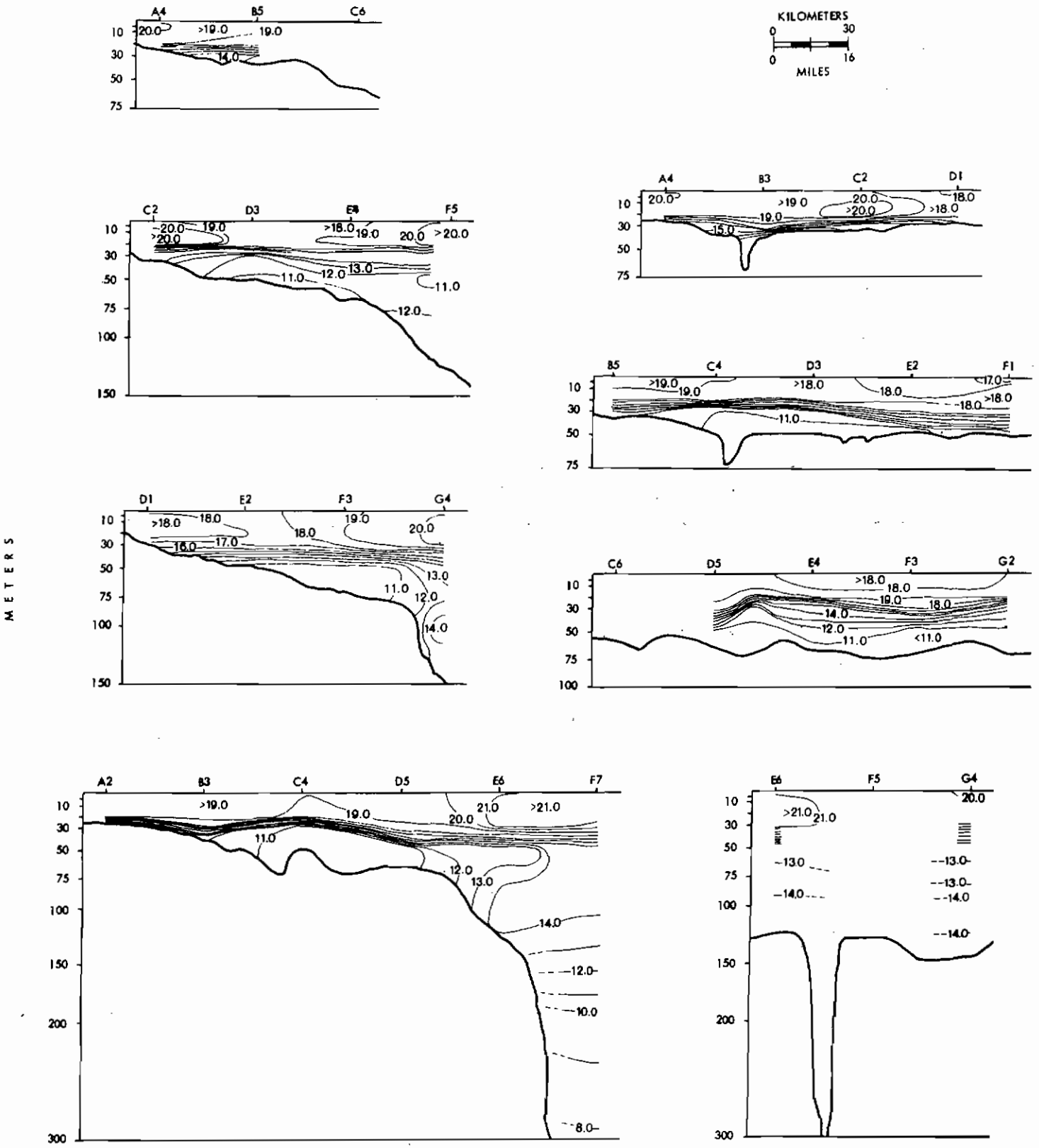
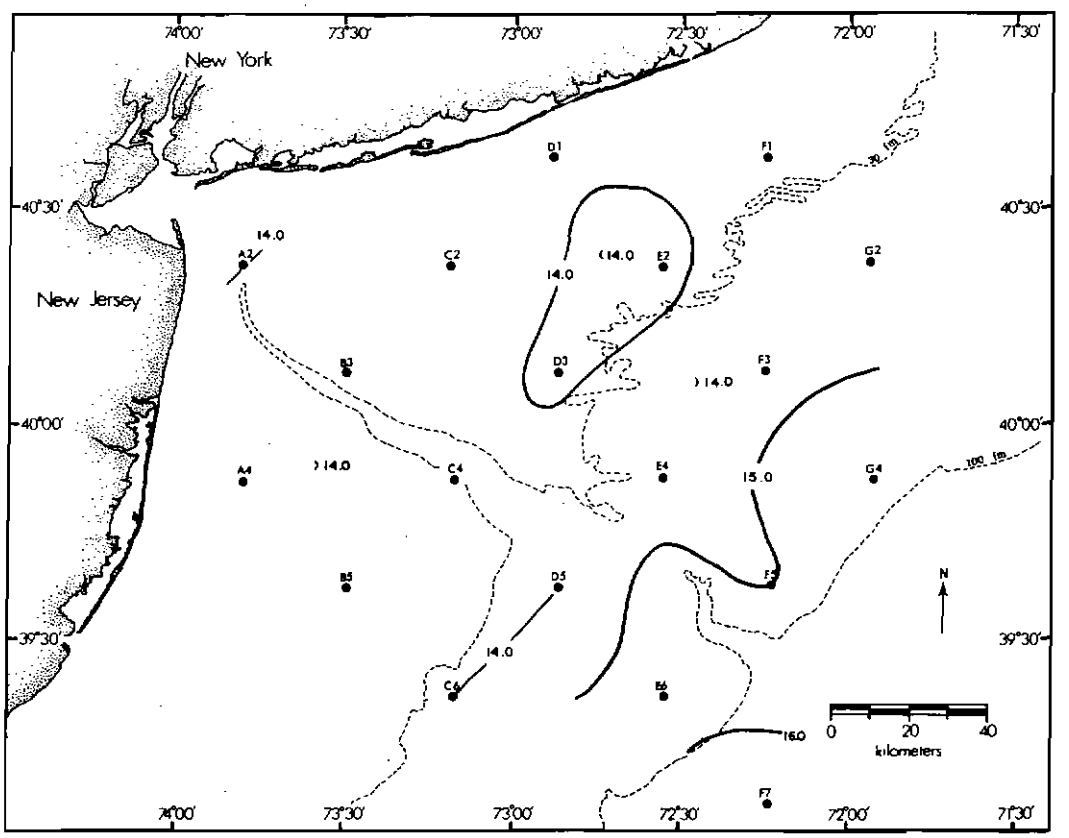


Figure 7. Vertical profiles of water temperature September 1974.



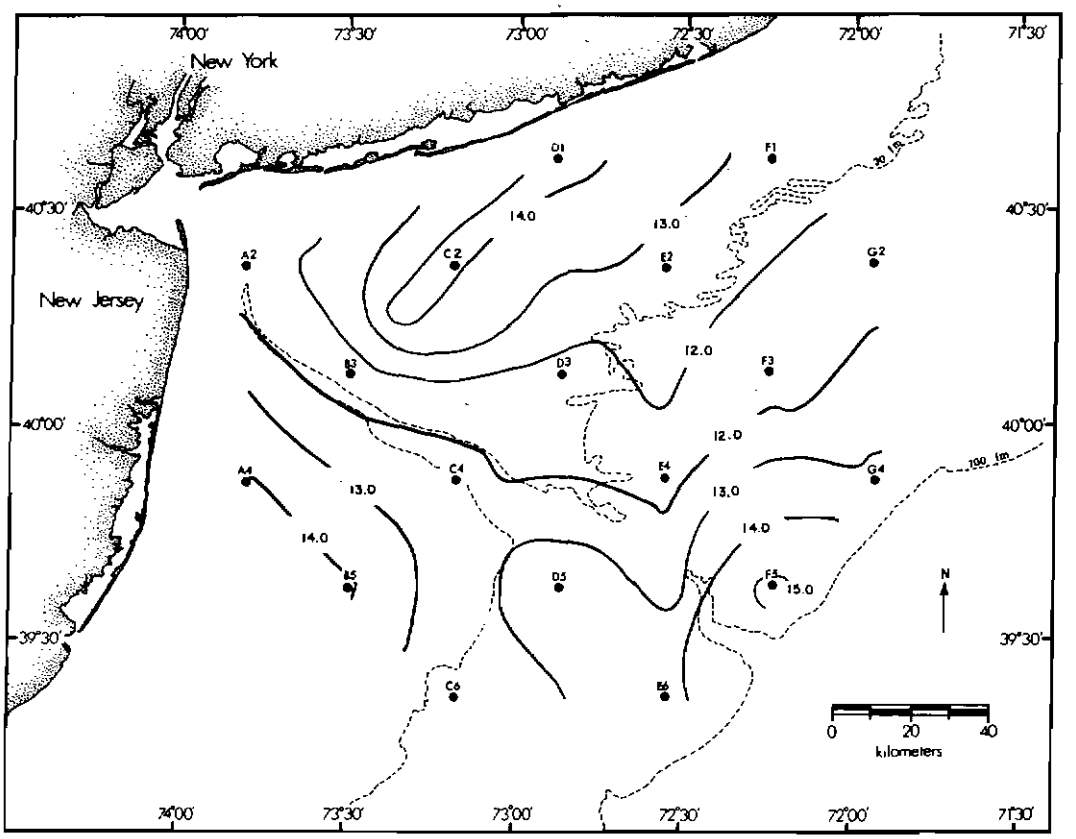


Figure 8. Surface (upper) and bottom (lower) water temperatures October 1974.

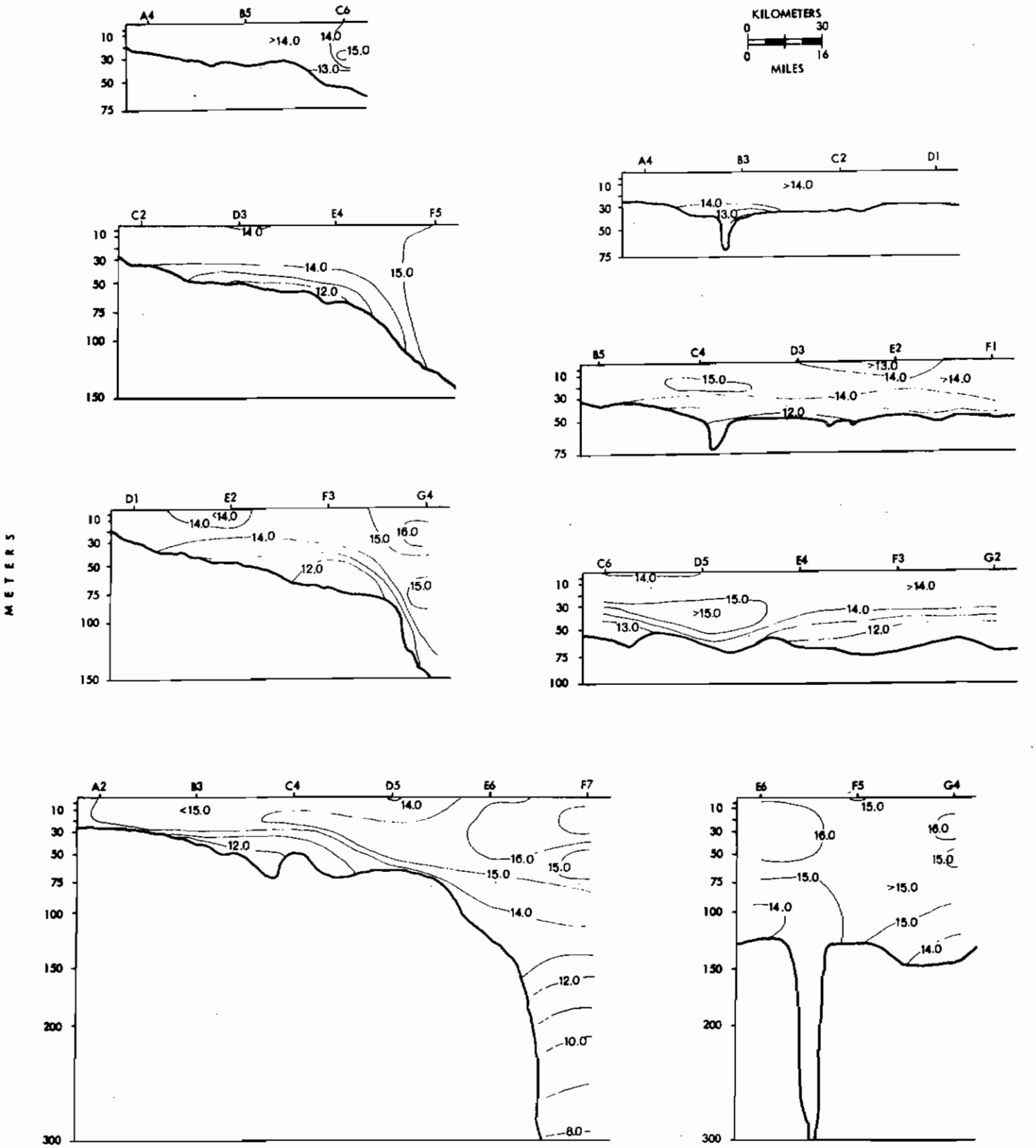
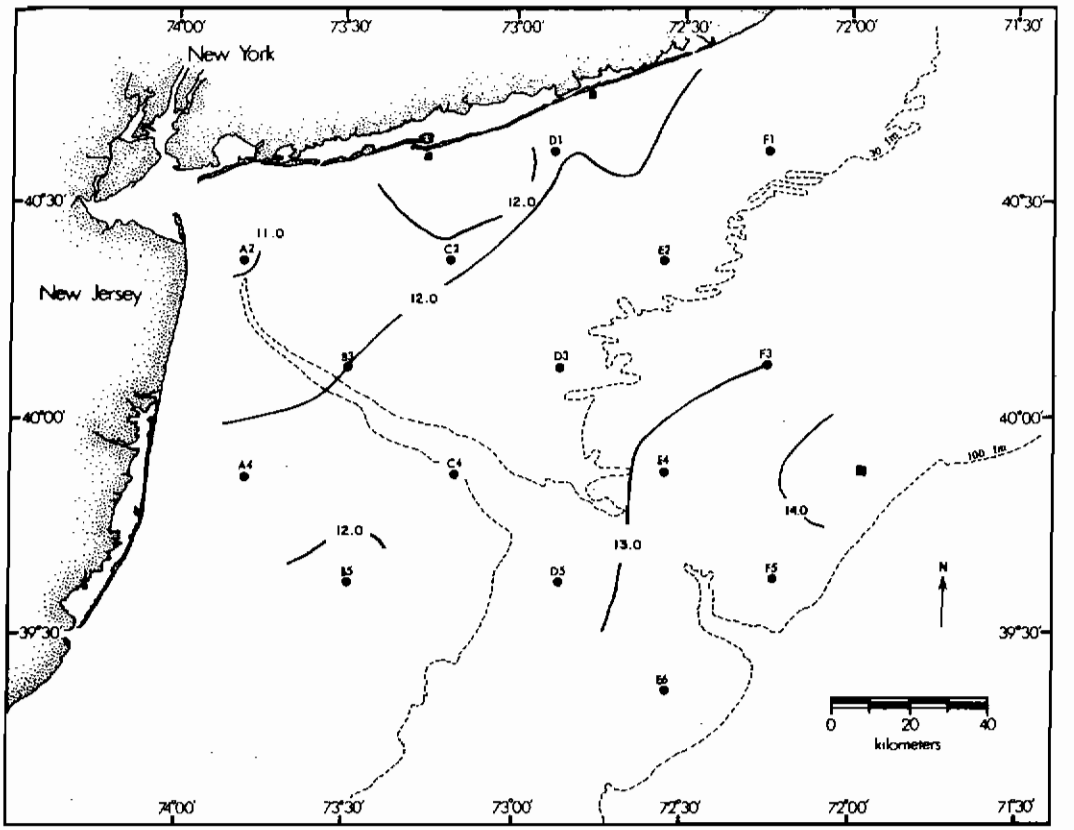


Figure 9. Vertical profiles of water temperature October 1974.



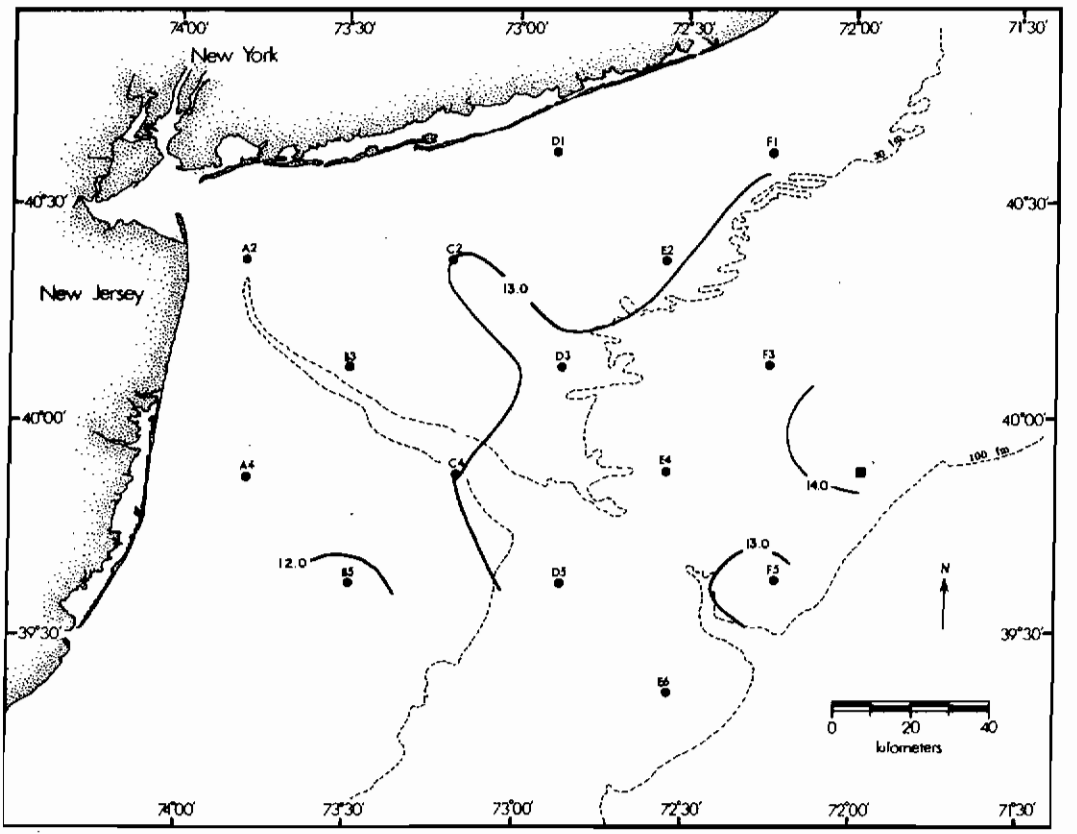


Figure 10. Surface (upper) and bottom (lower) water temperatures November 1974.

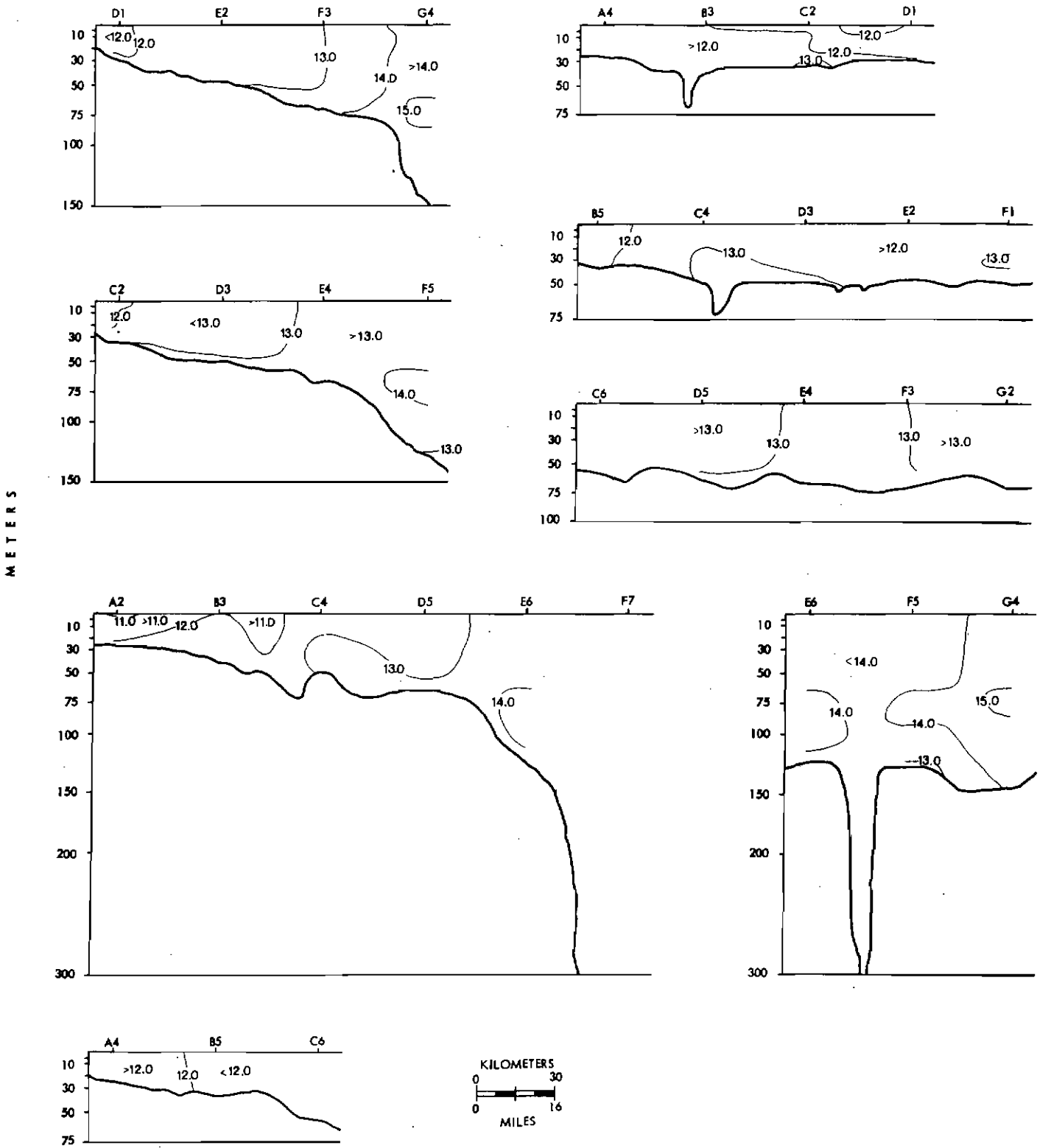
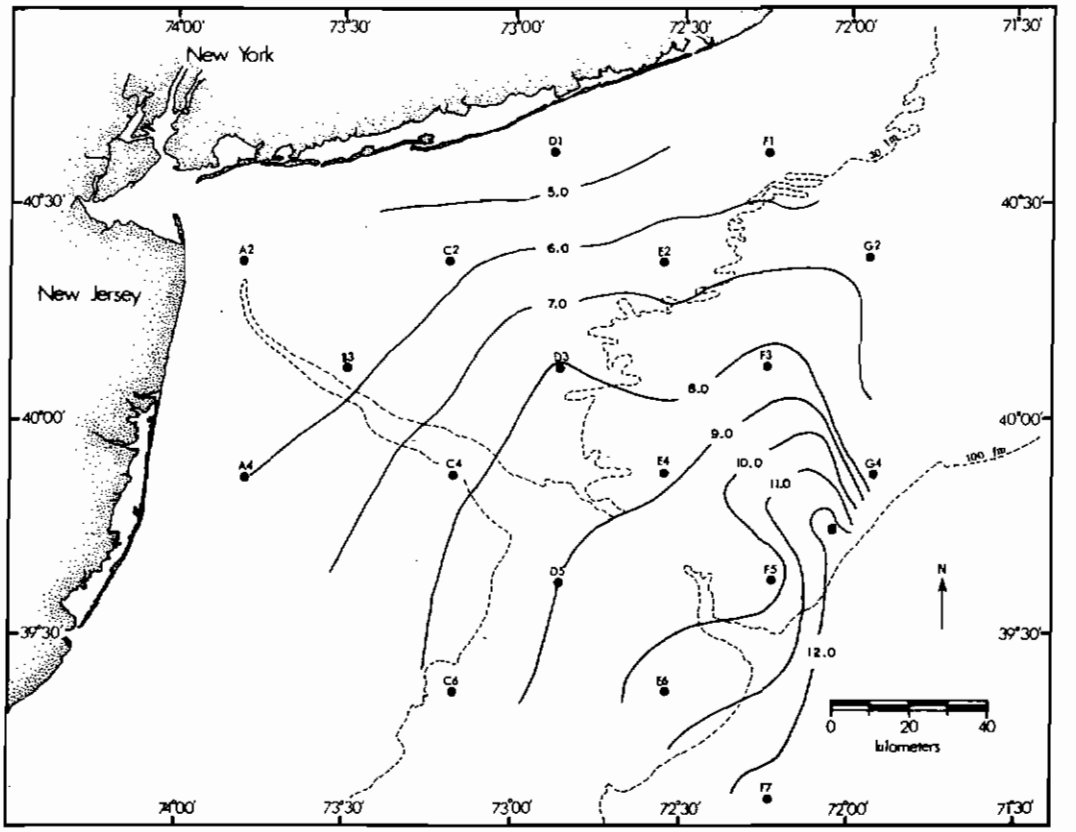
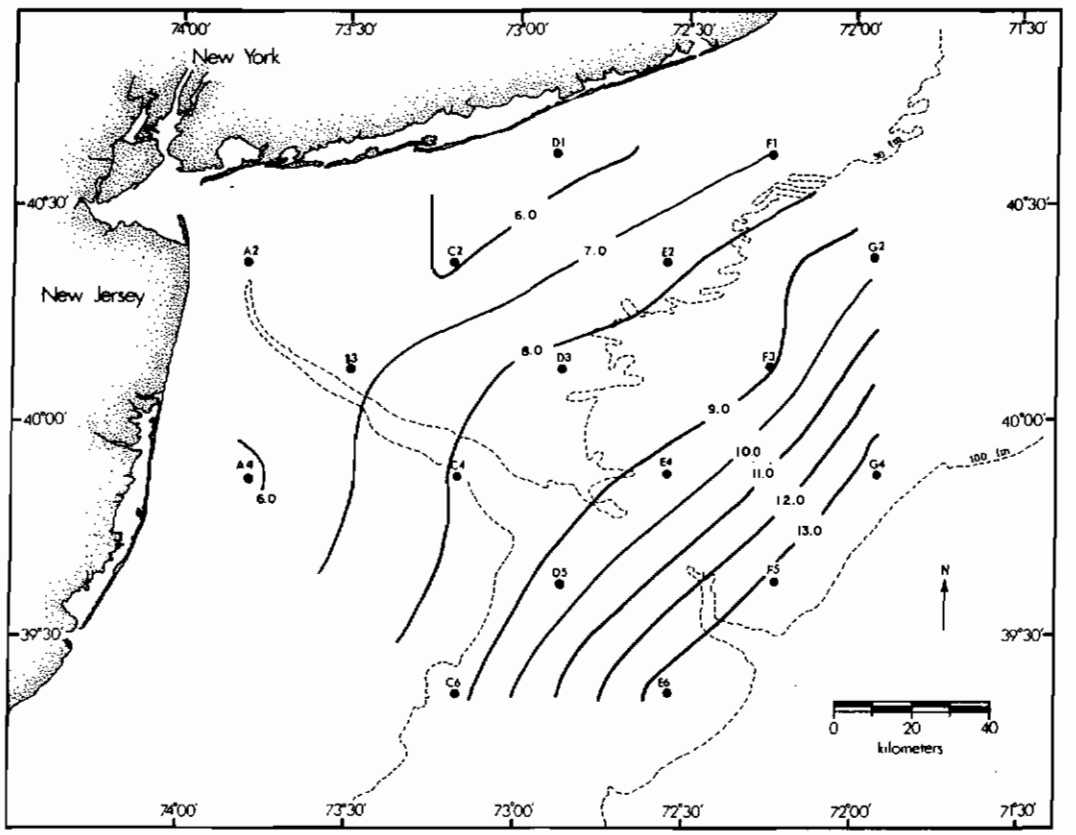


Figure 11. Vertical profiles of water temperature November 1974.





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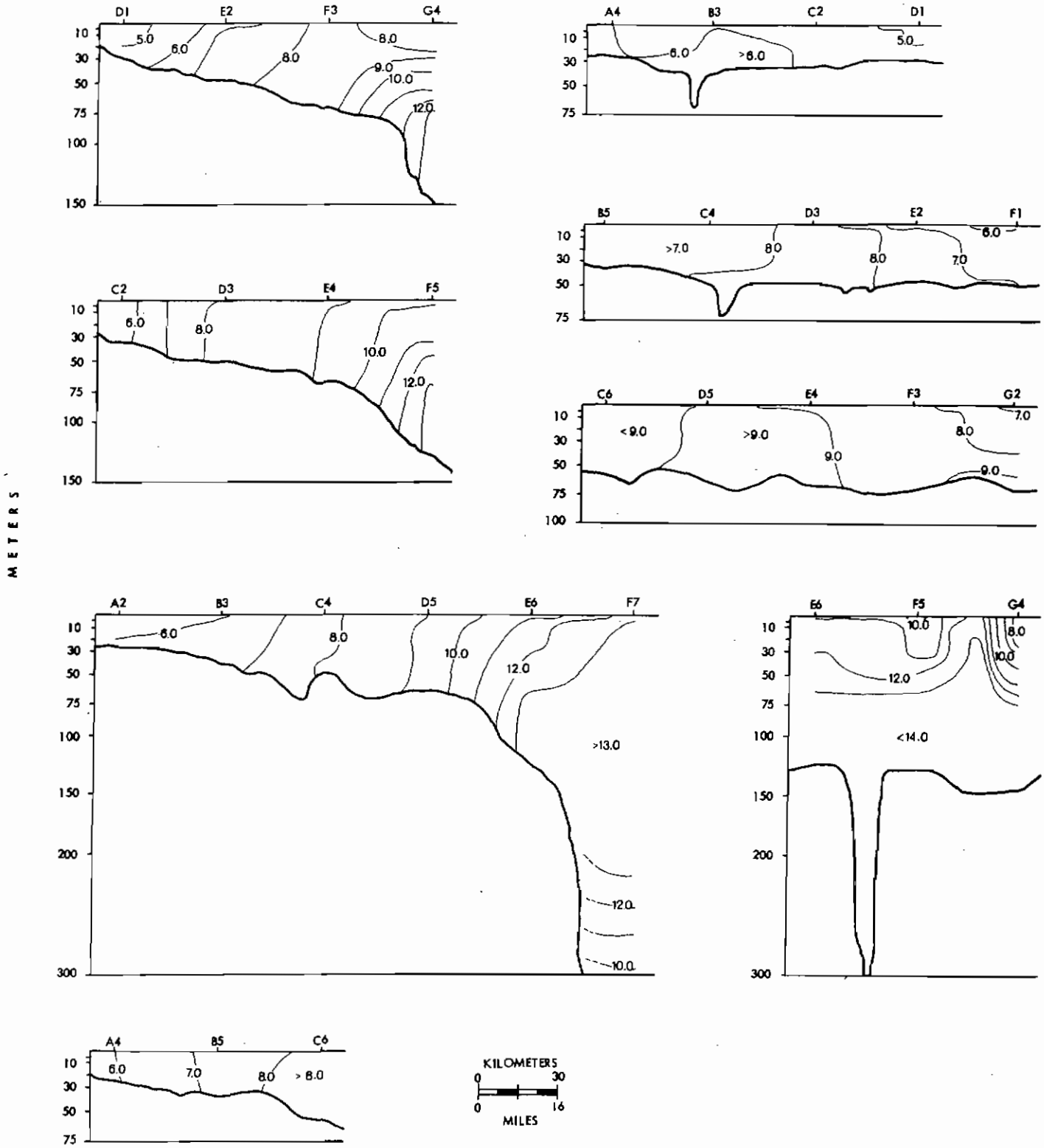


Figure 13. Vertical profiles of water temperature February 1975.

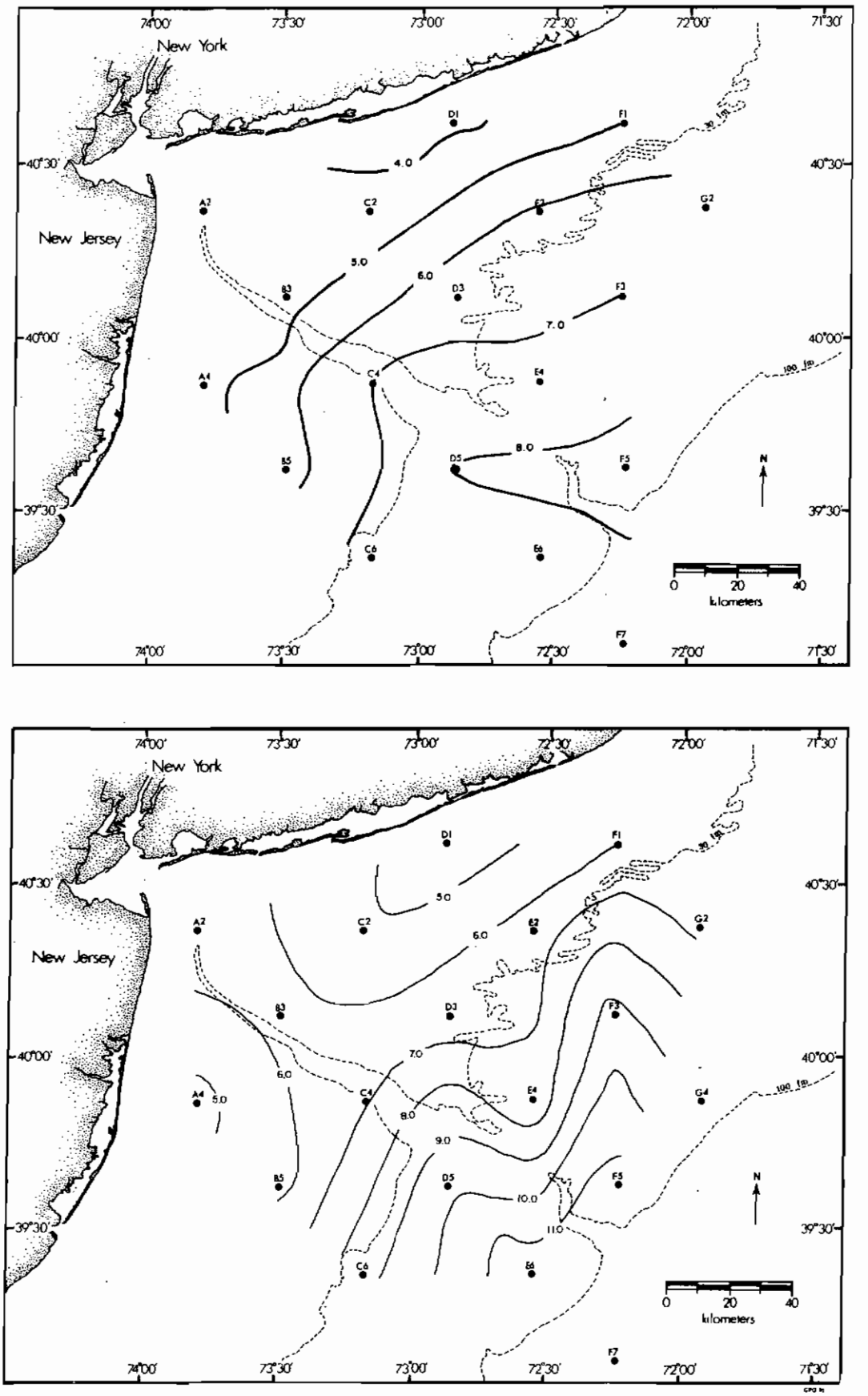


Figure 14. Surface (upper) and bottom (lower) water temperatures March 1975.

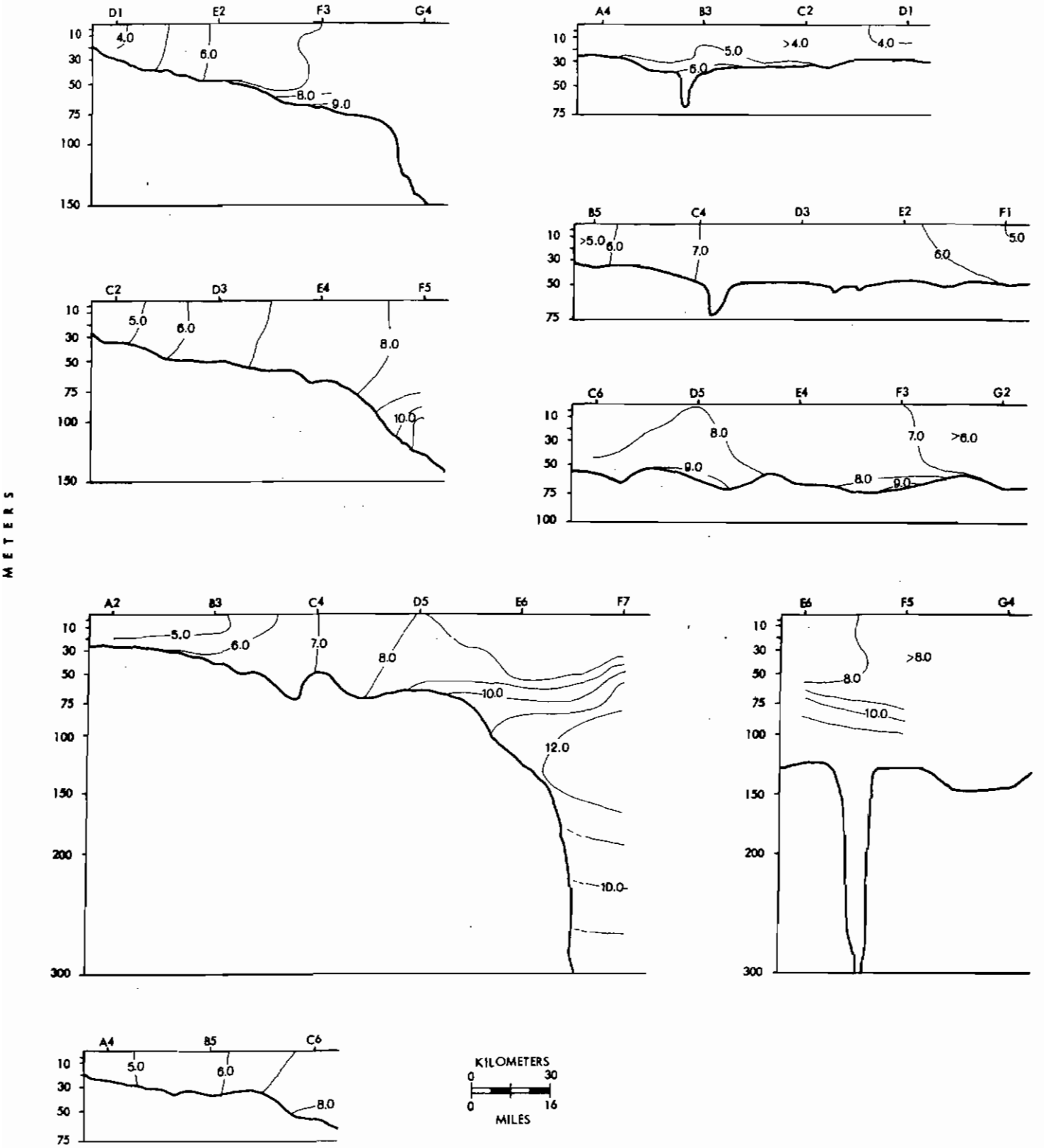


Figure 15. Vertical profiles of water temperature March 1975.

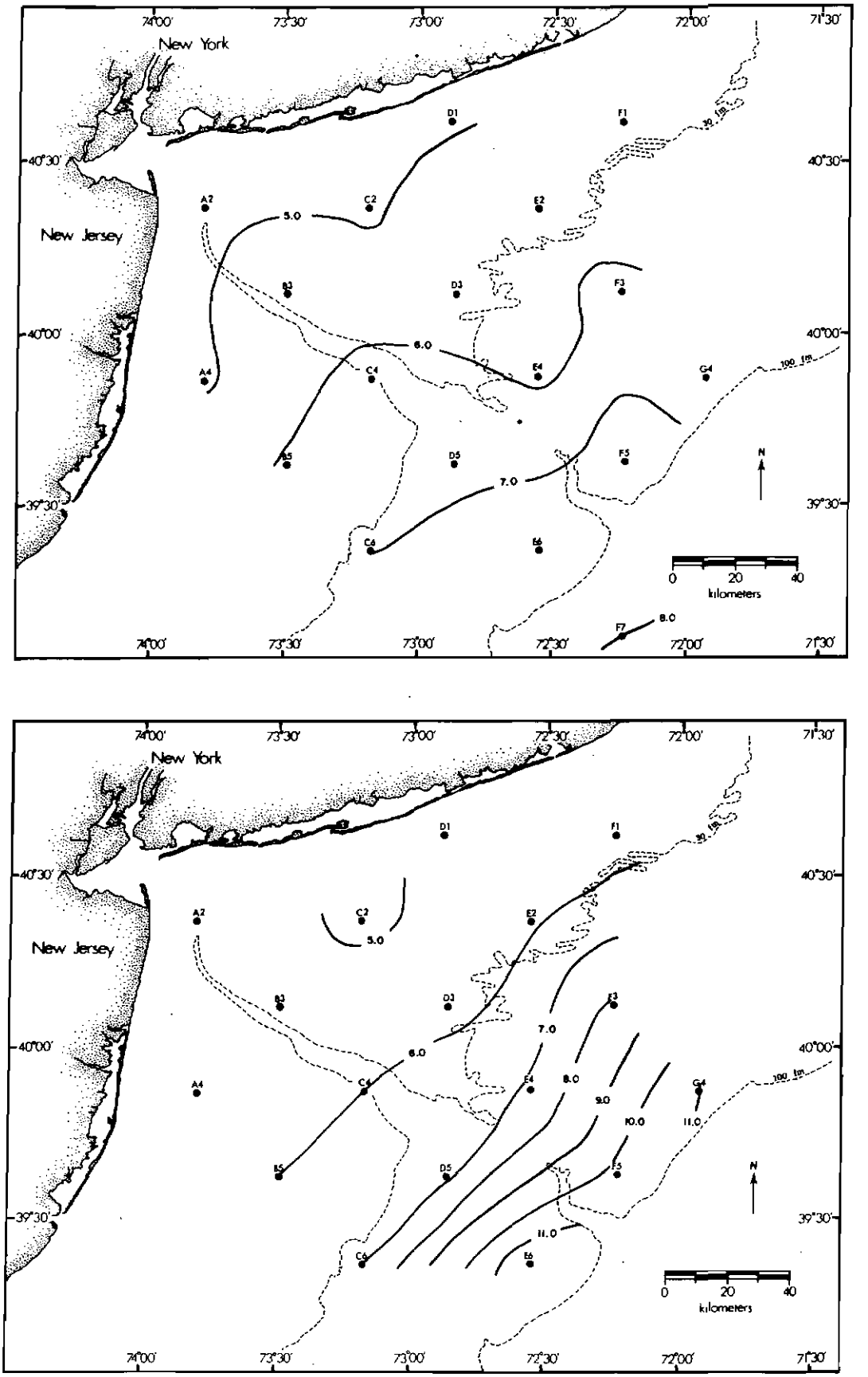


Figure 16. Surface (upper) and bottom (lower) water temperatures April 1975.

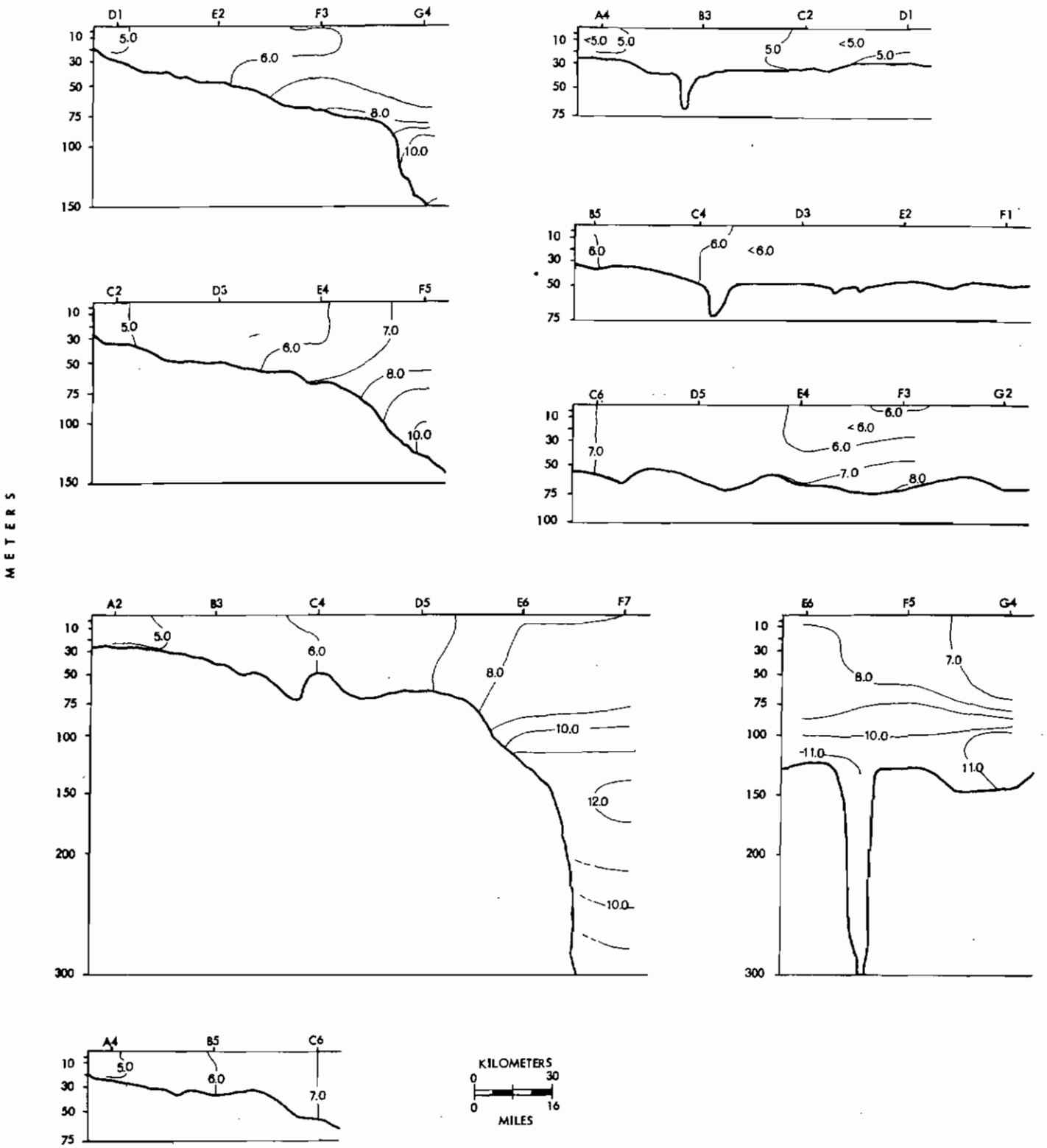


Figure 17. Vertical profiles of water temperature April 1975.

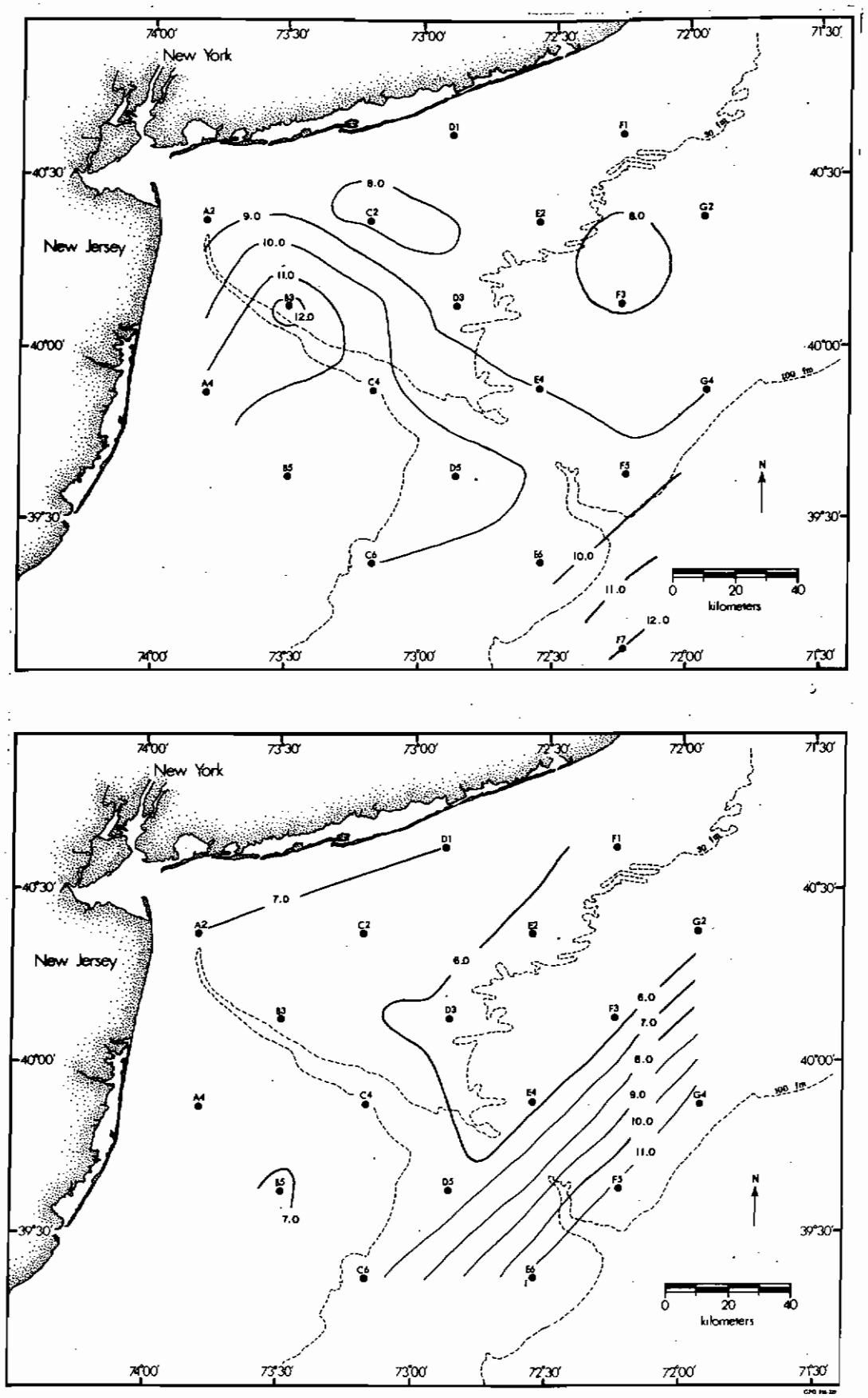


Figure 18. Surface (upper) and bottom (lower) water temperatures May 1975.

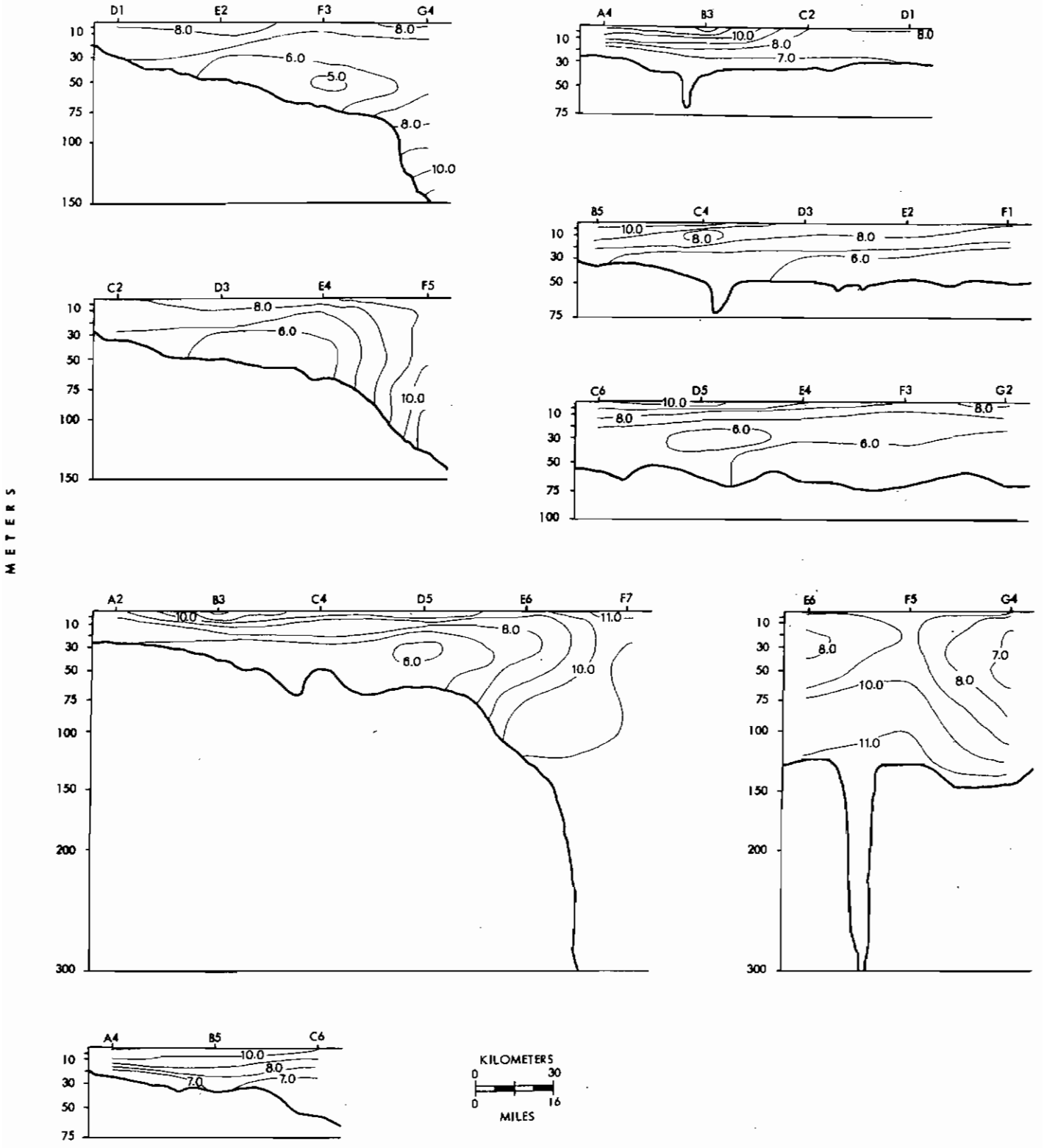
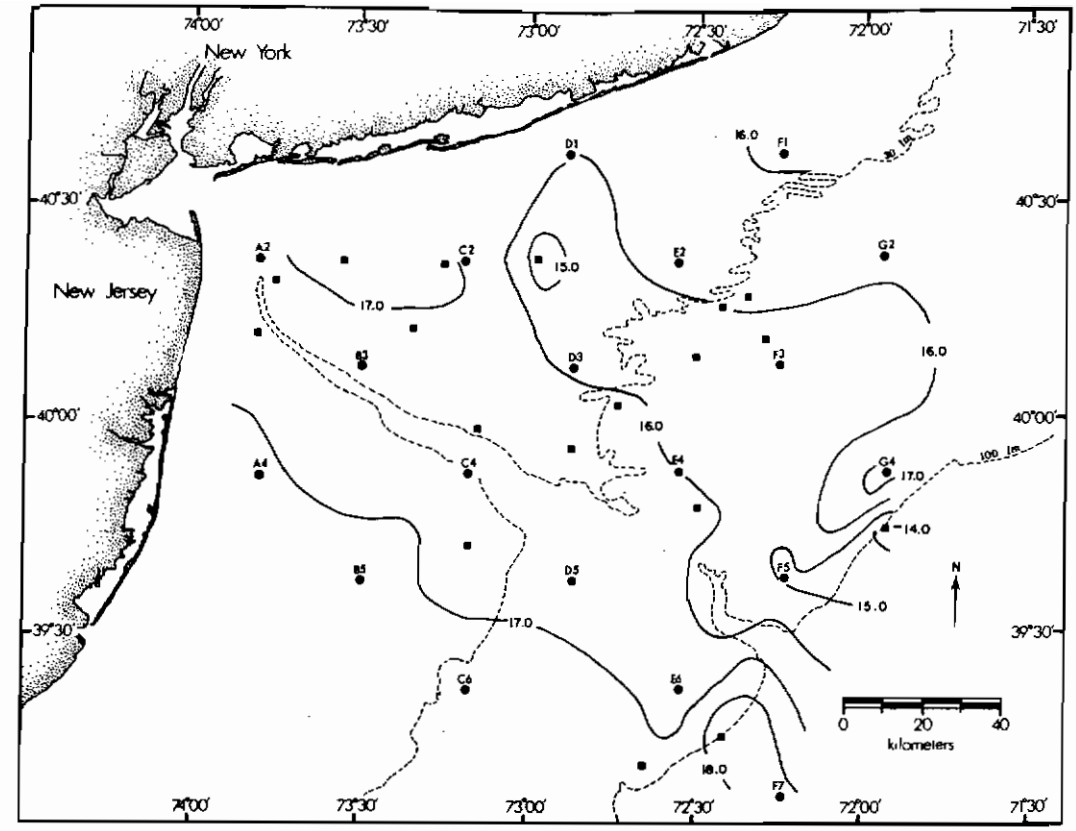


Figure 19. Vertical profiles of water temperature May 1975.



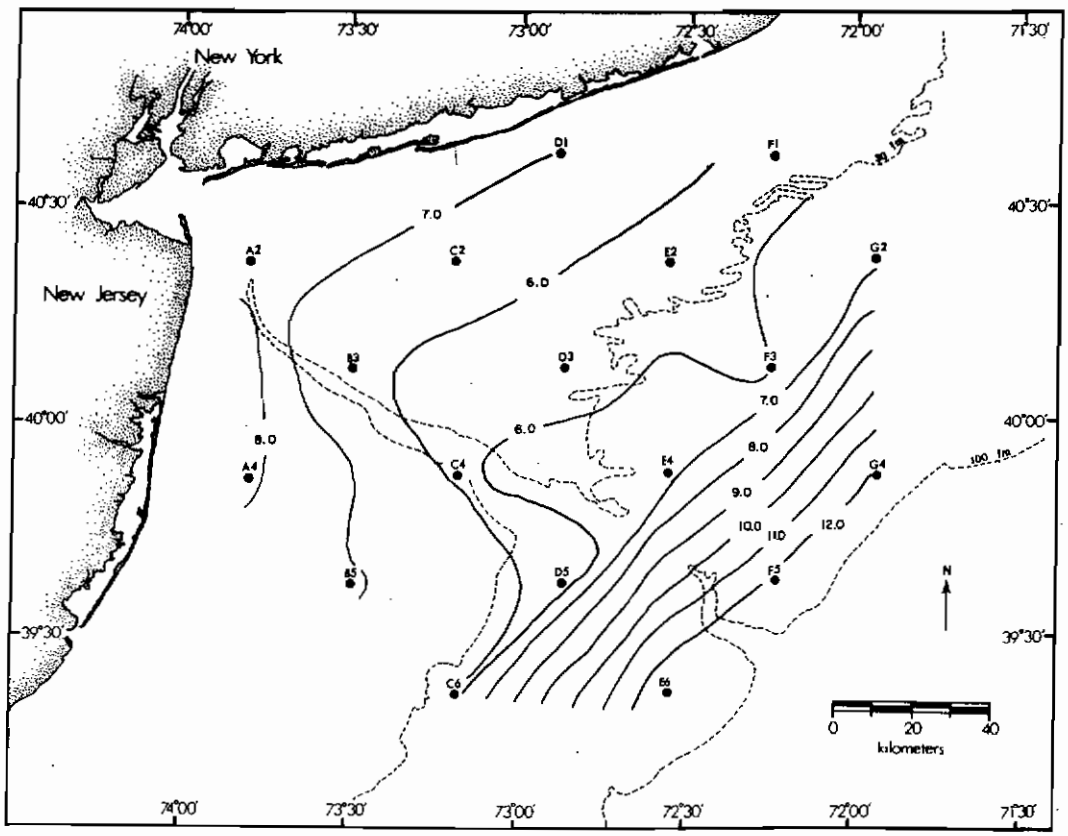


Figure 20. Surface (upper) and bottom (lower) water temperatures June 1975.

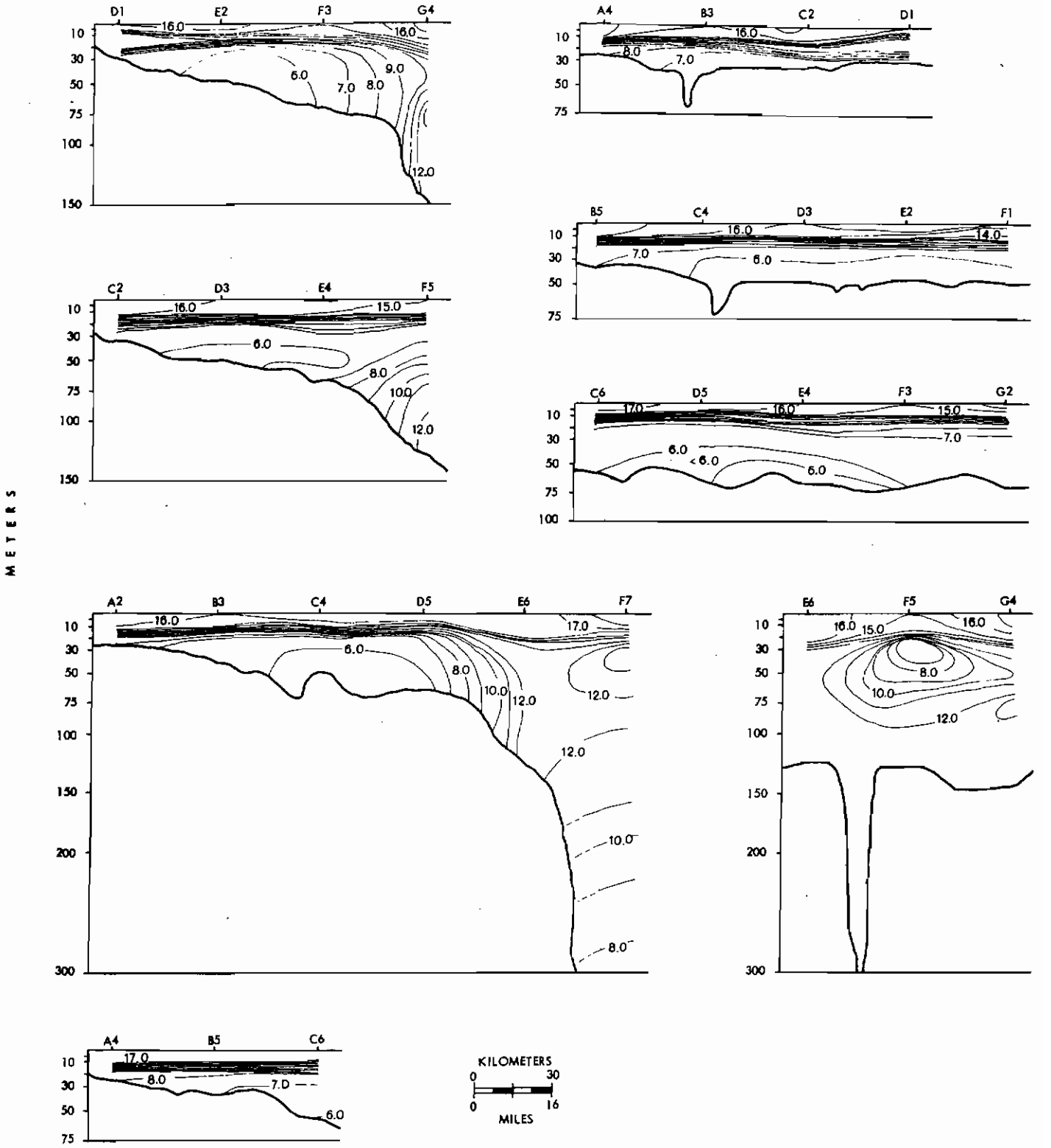


Figure 21. Vertical profiles of water temperature June 1975.

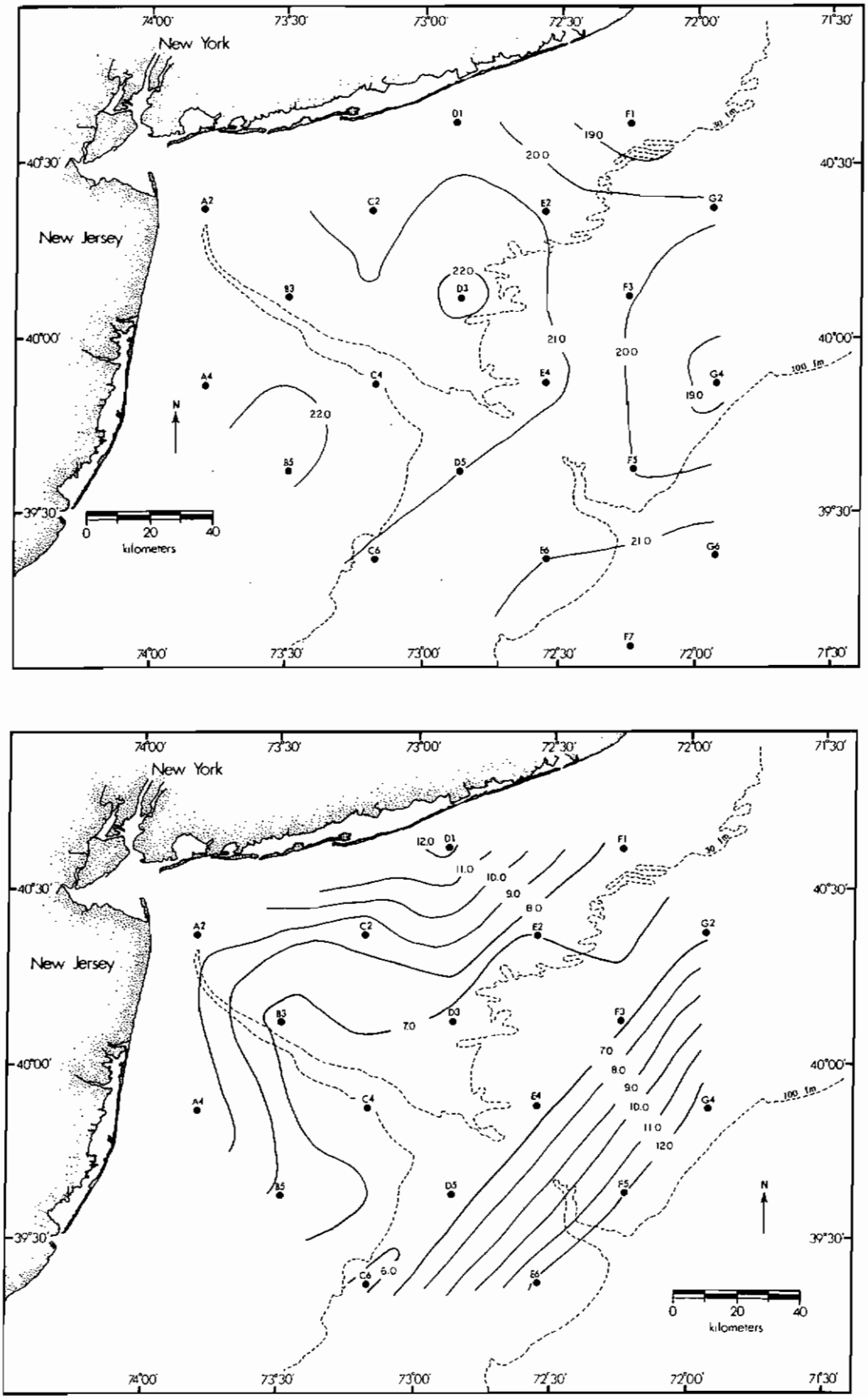


Figure 22. Surface (upper) and bottom (lower) water temperatures July 1975.

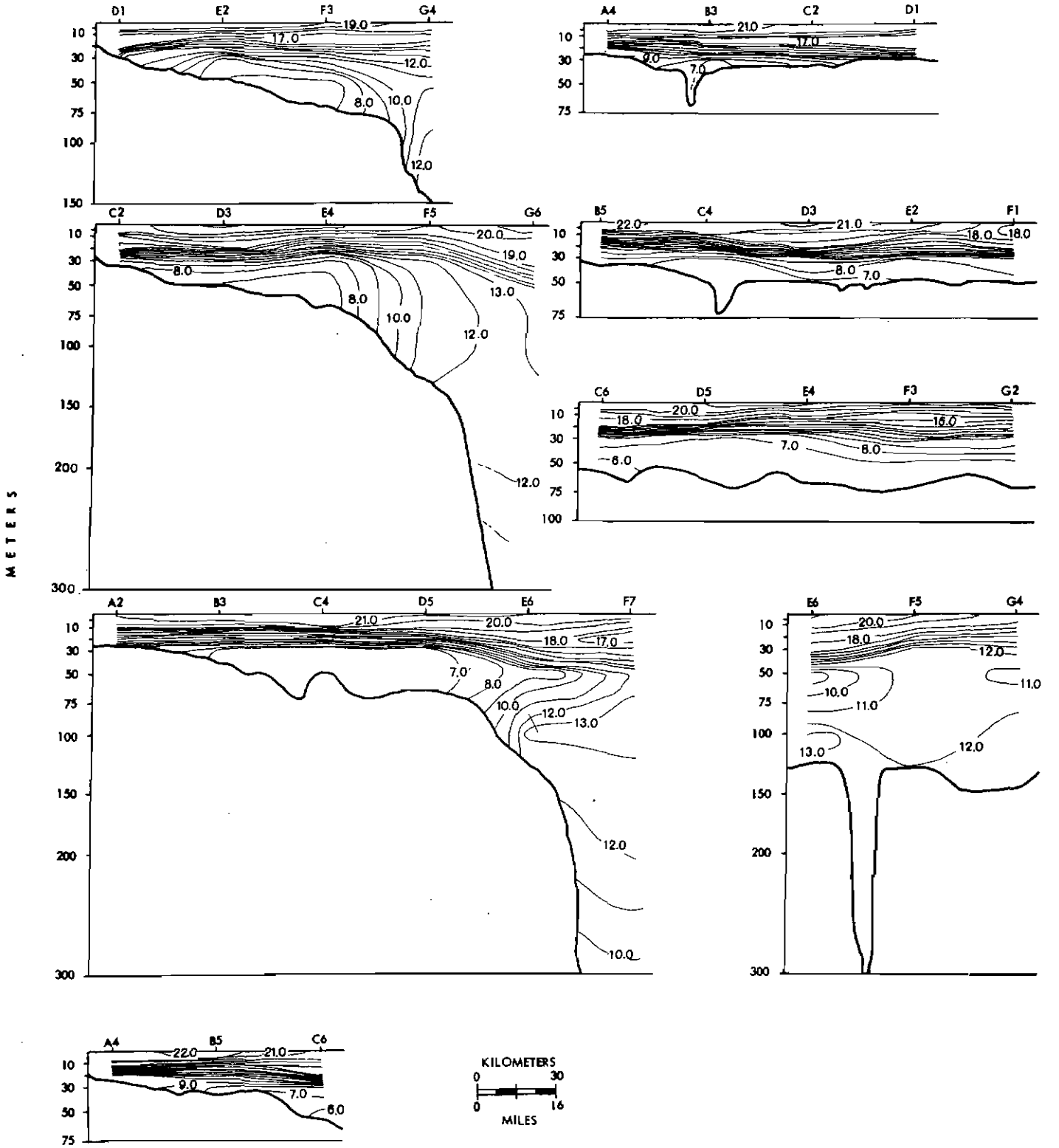


Figure 23. Vertical profiles of water temperature July 1975.

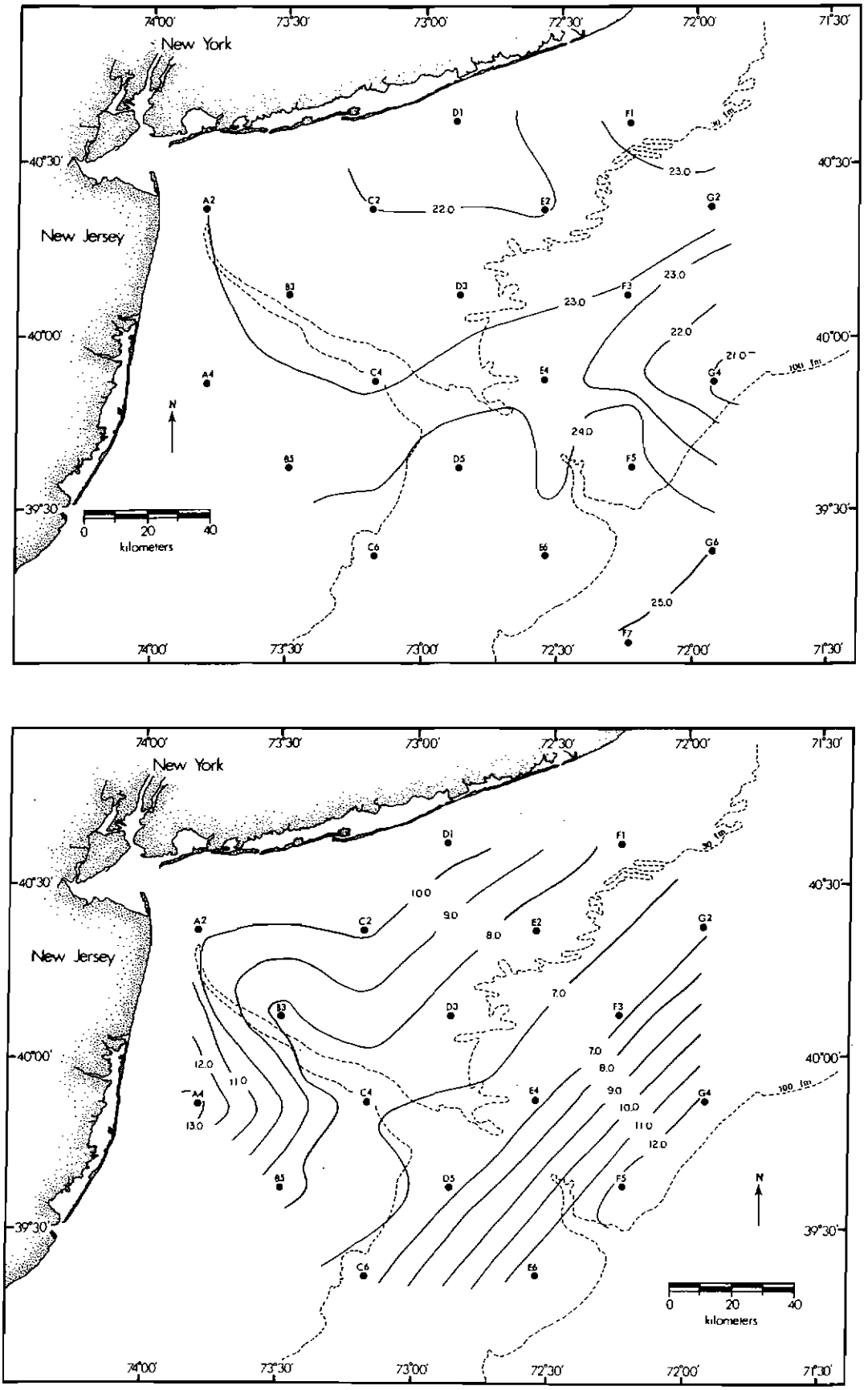


Figure 24. Surface (upper) and bottom (lower) water temperatures August 1975.

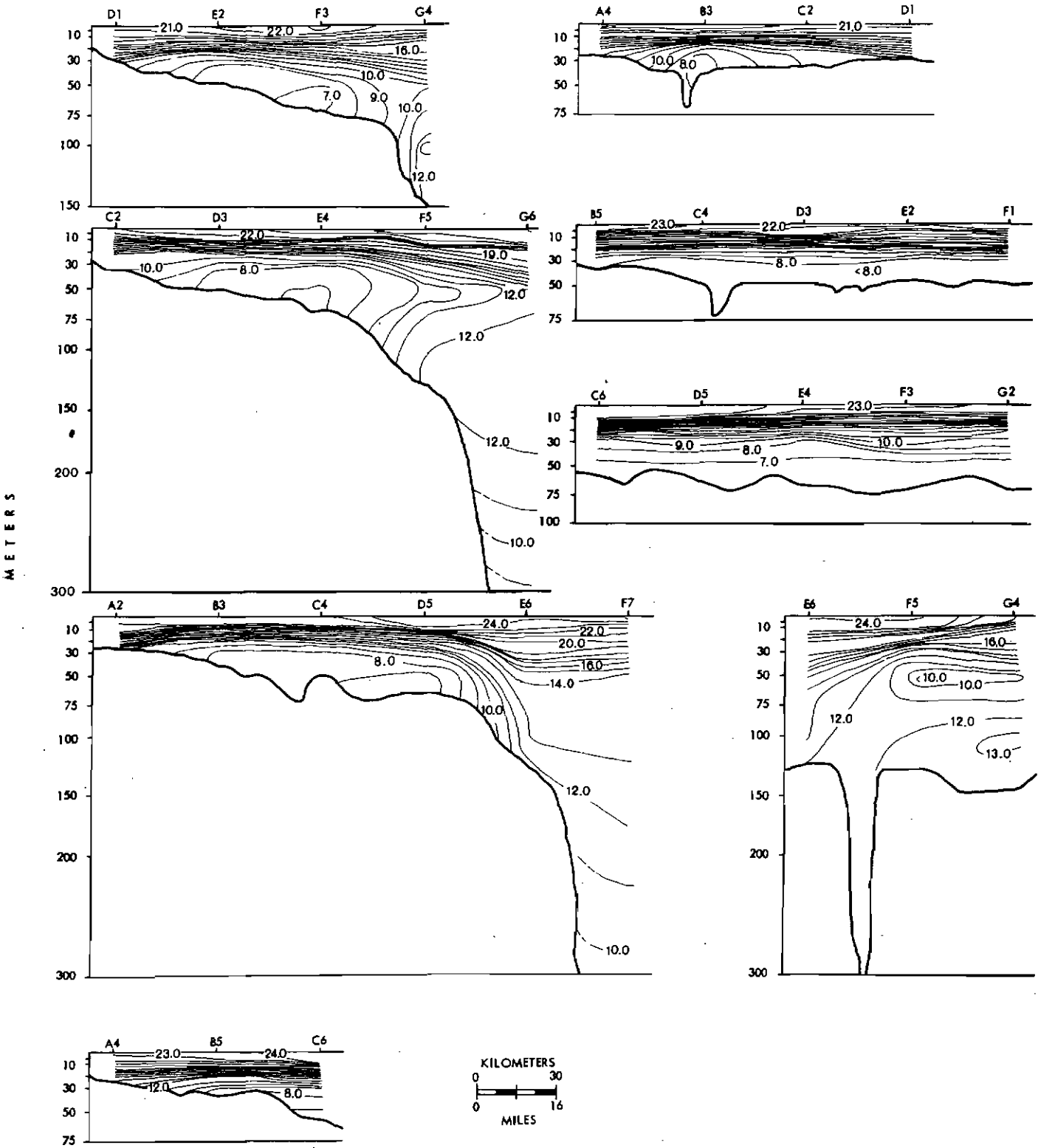


Figure 25. Vertical profiles of water temperature August 1975.

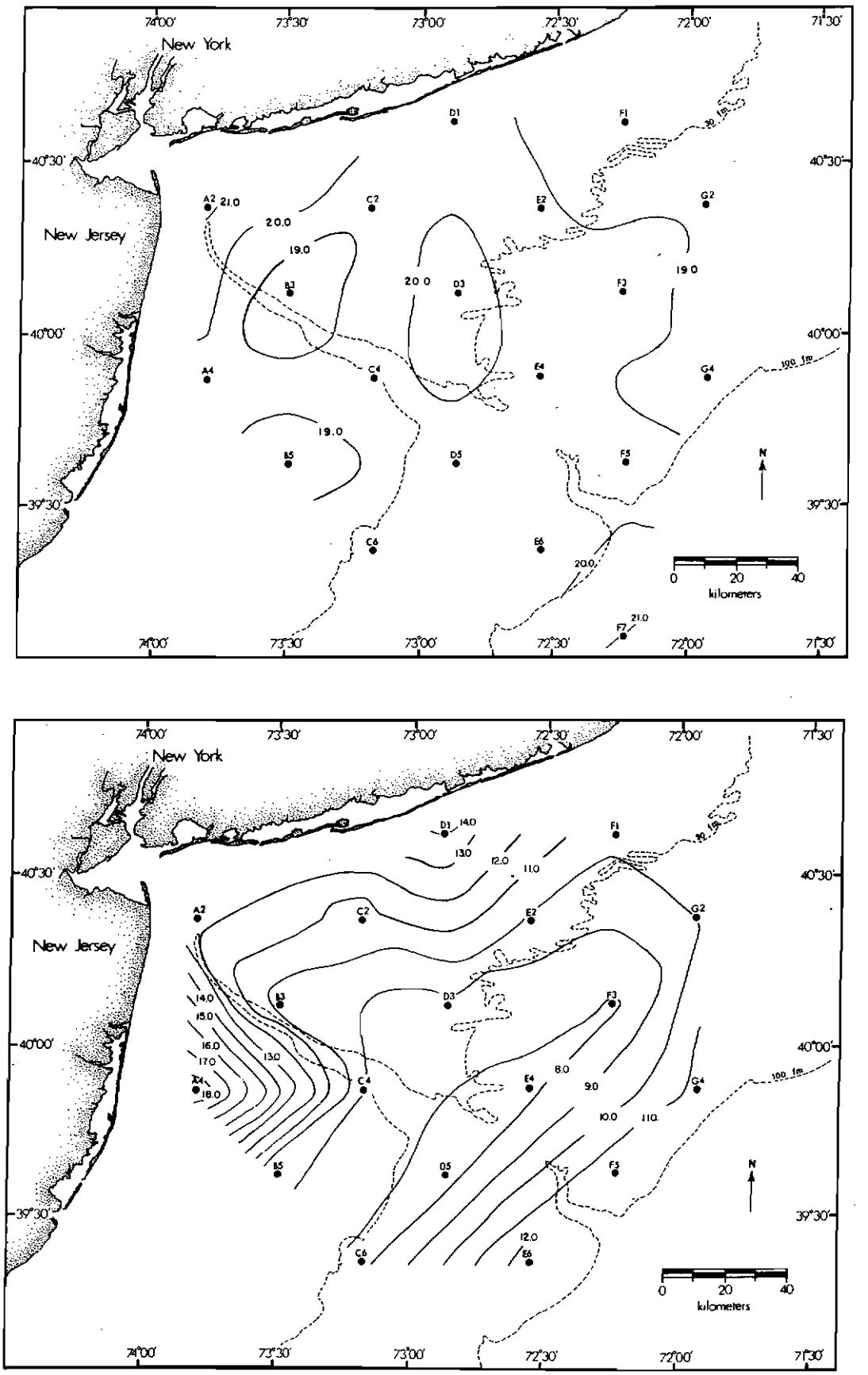


Figure 26. Surface (upper) and bottom (lower) water temperatures September 1975.

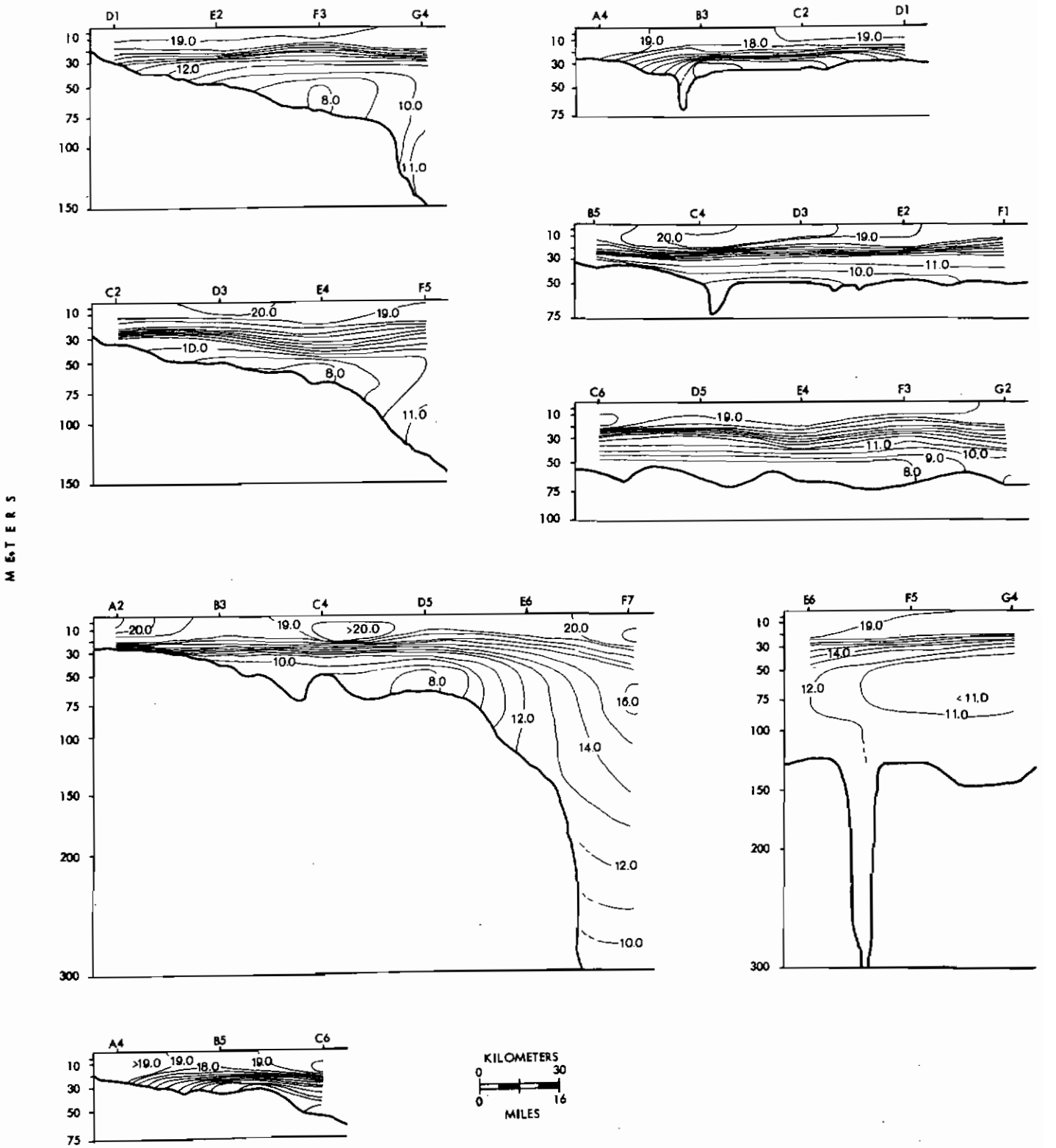
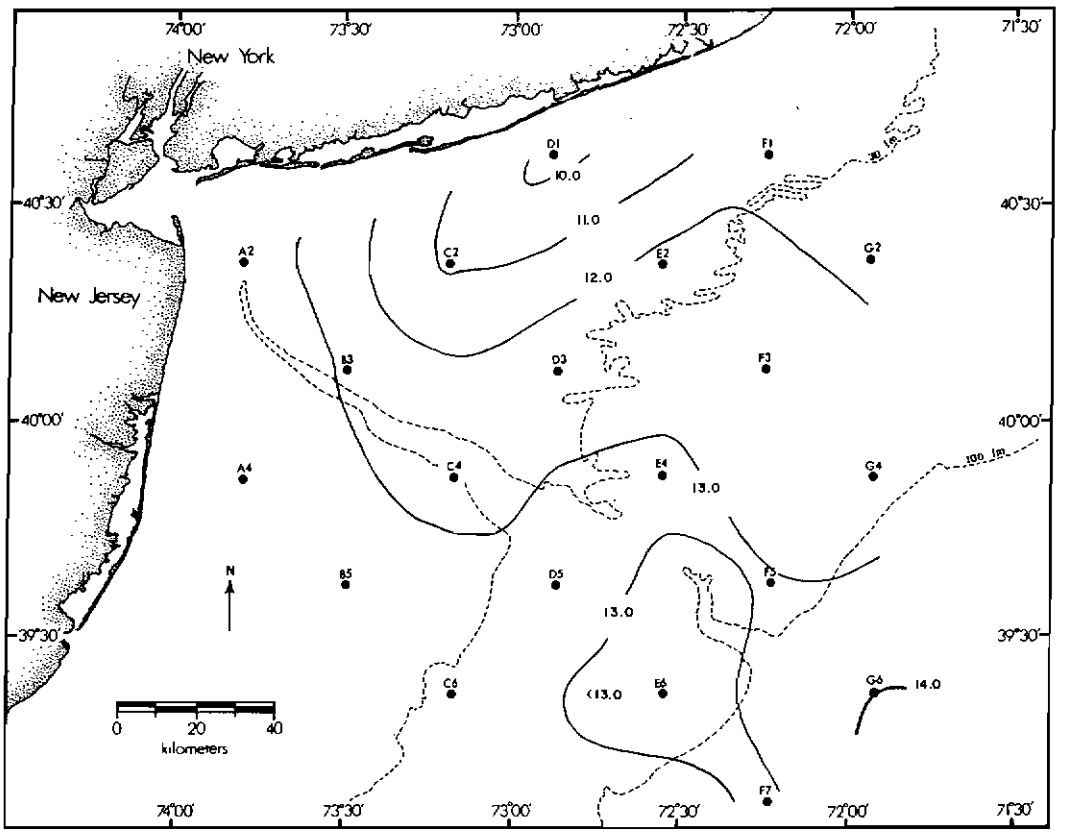


Figure 27. Vertical profiles of water temperature September 1975.



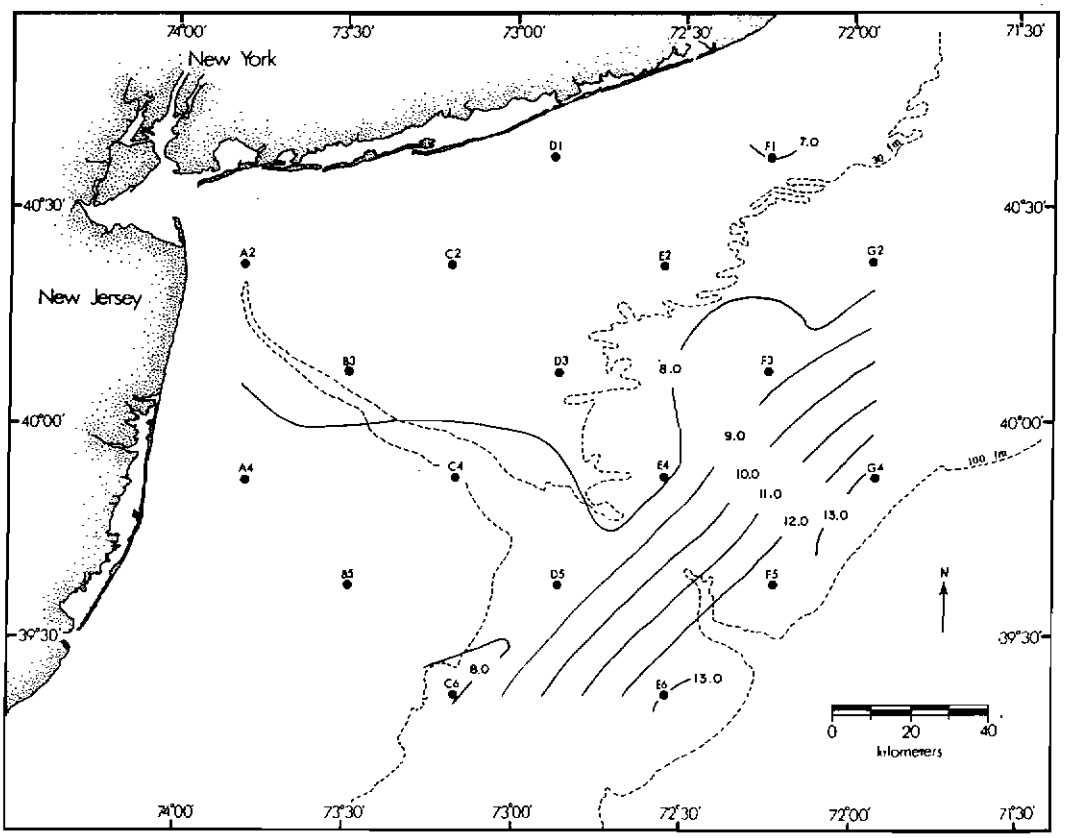


Figure 28. Surface (upper) and bottom (lower) water temperatures May 1976.

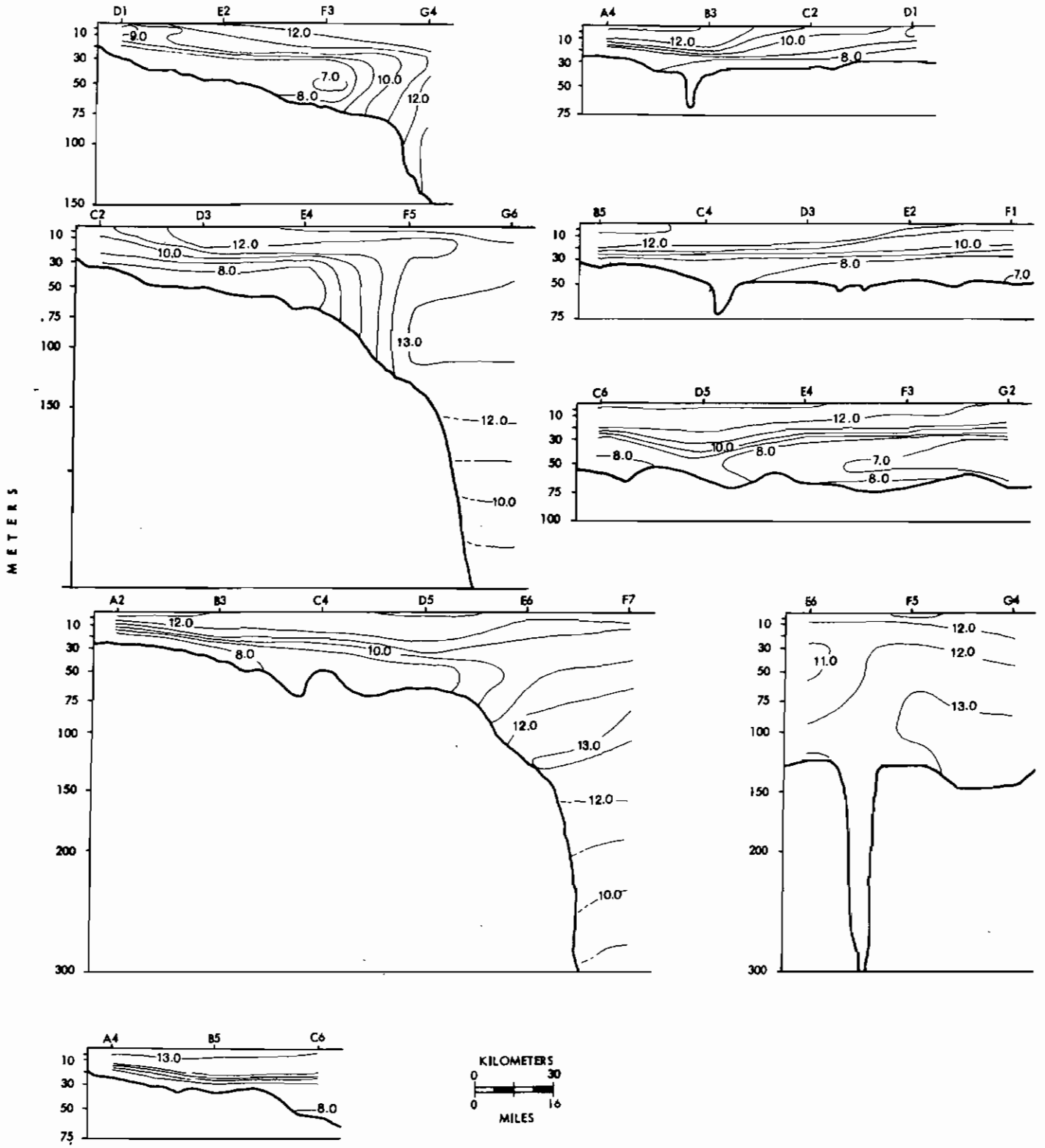


Figure 29. Vertical profiles of water temperature May 1976.

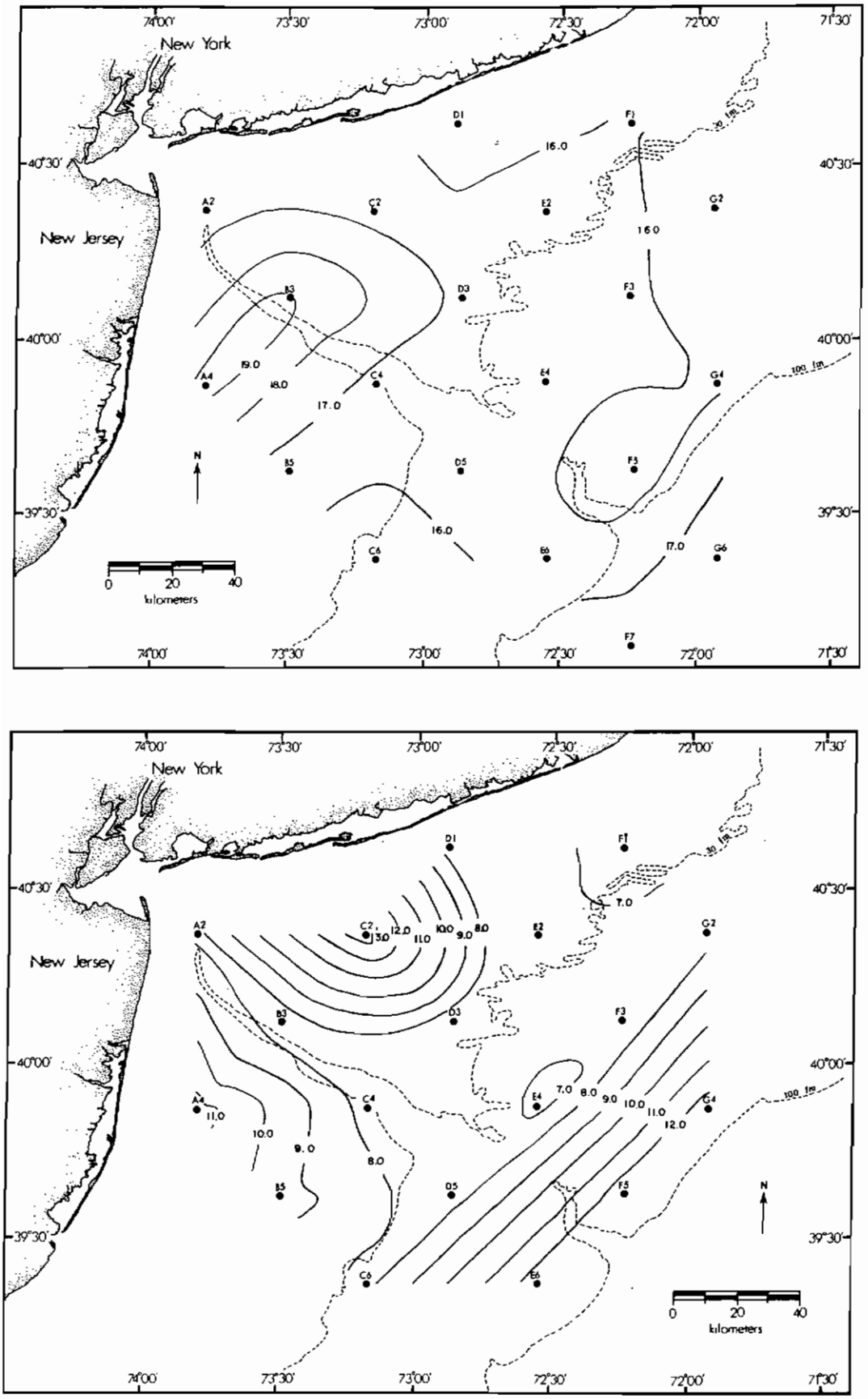


Figure 30. Surface (upper) and bottom (lower) water temperatures June 1976.

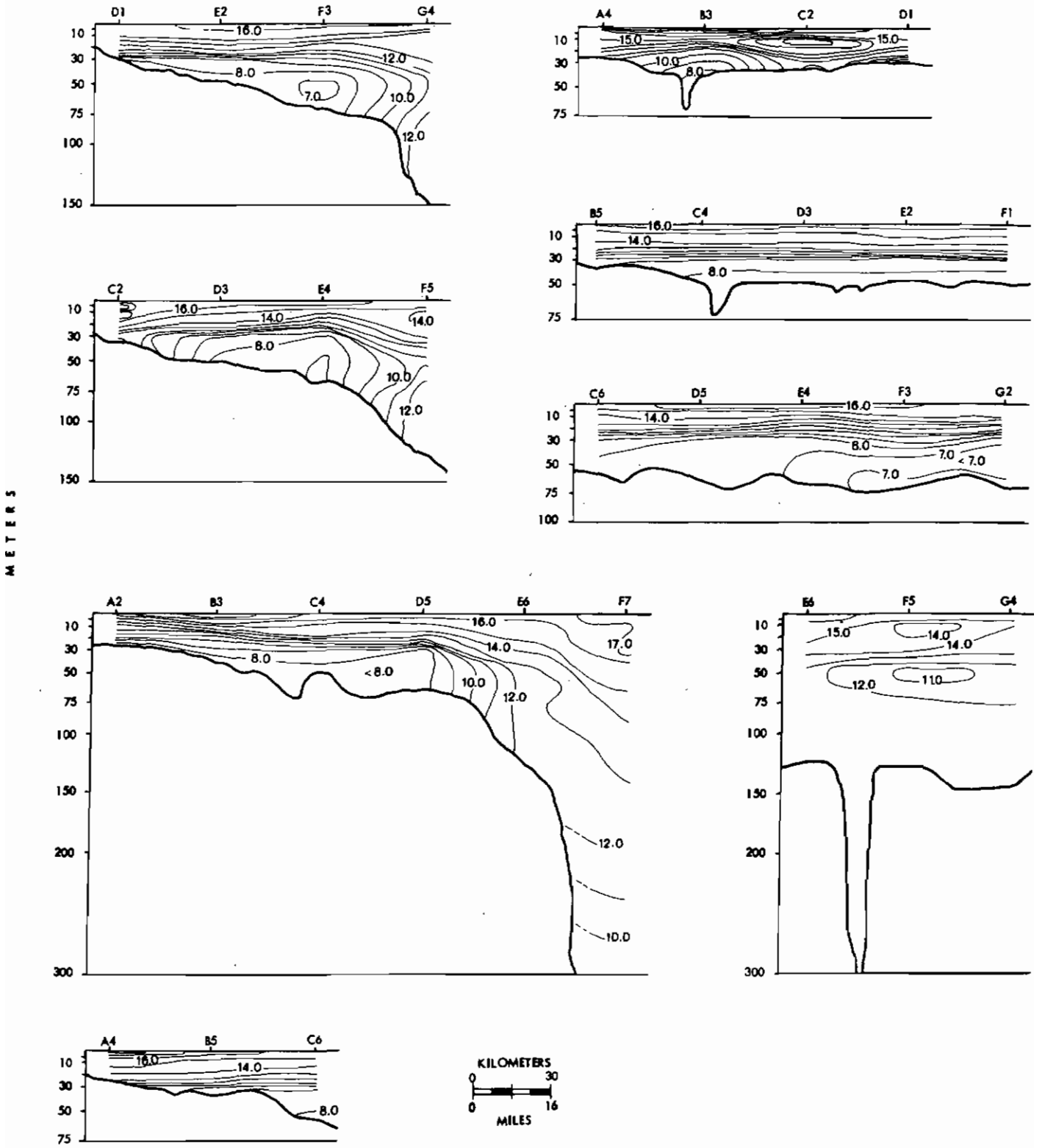


Figure 31. Vertical profiles of water temperature June 1976.

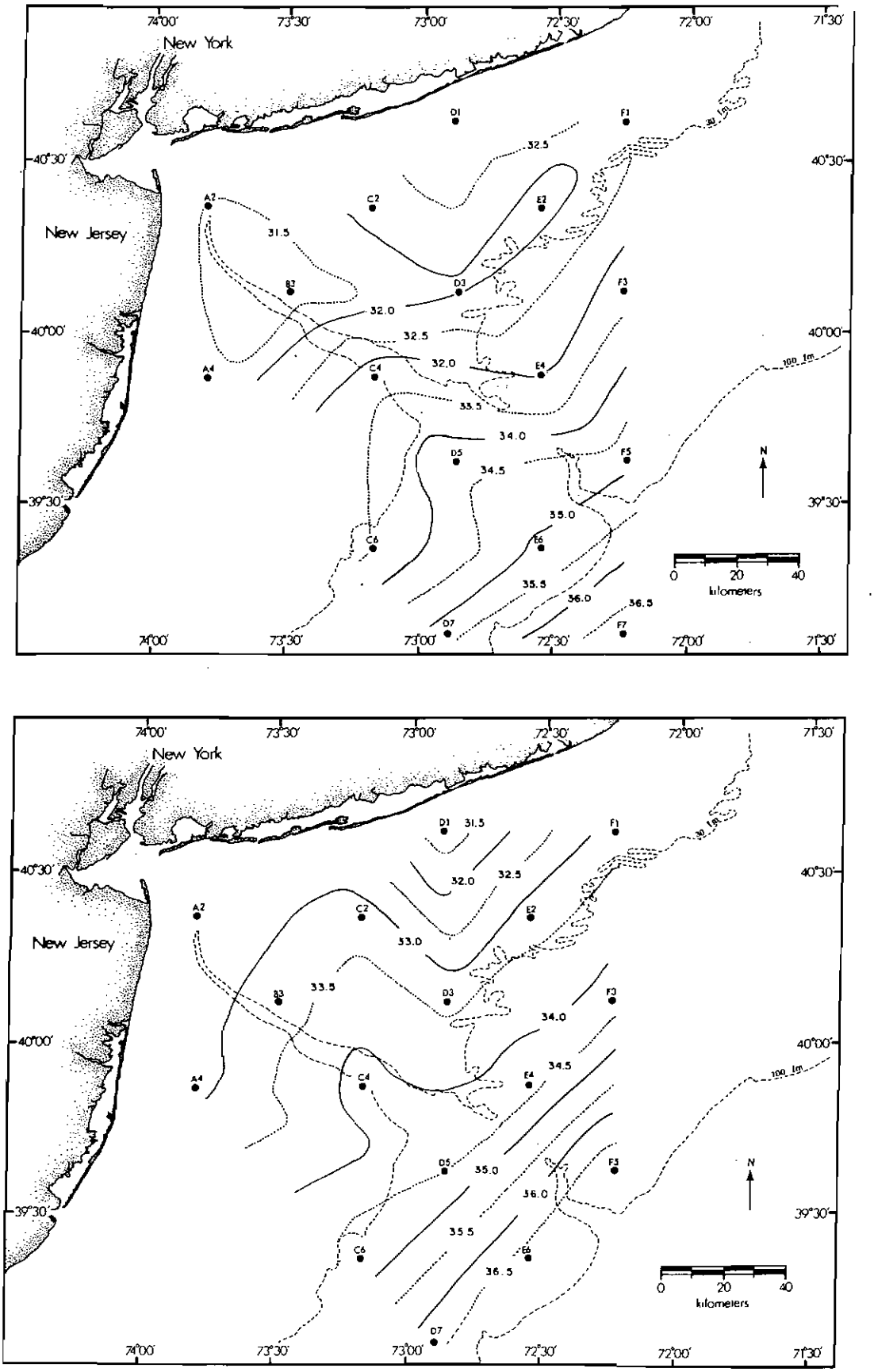


Figure 32. Surface (upper) and bottom (lower) salinity July 1974.

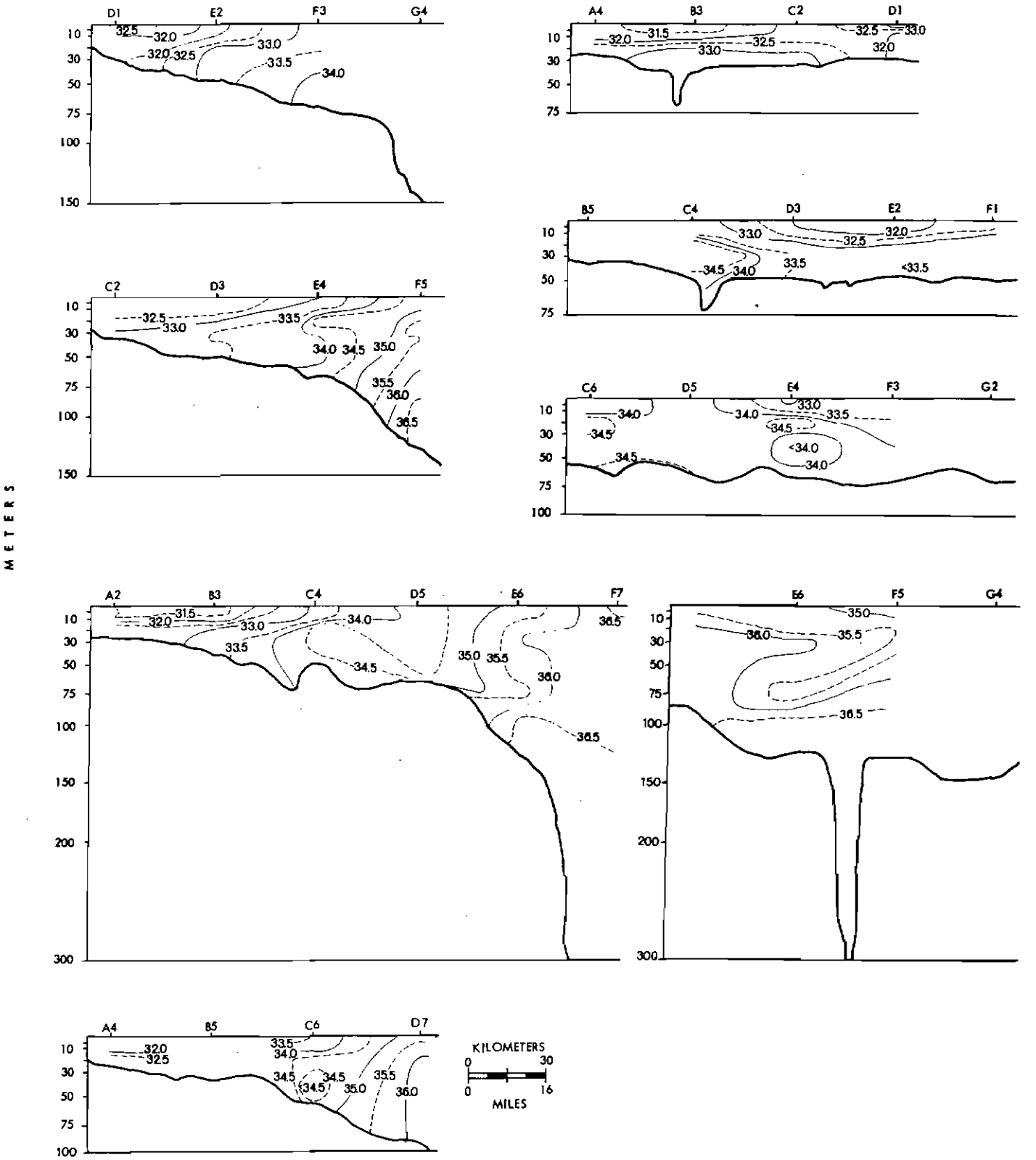


Figure 33. Vertical profiles of salinity July 1974.

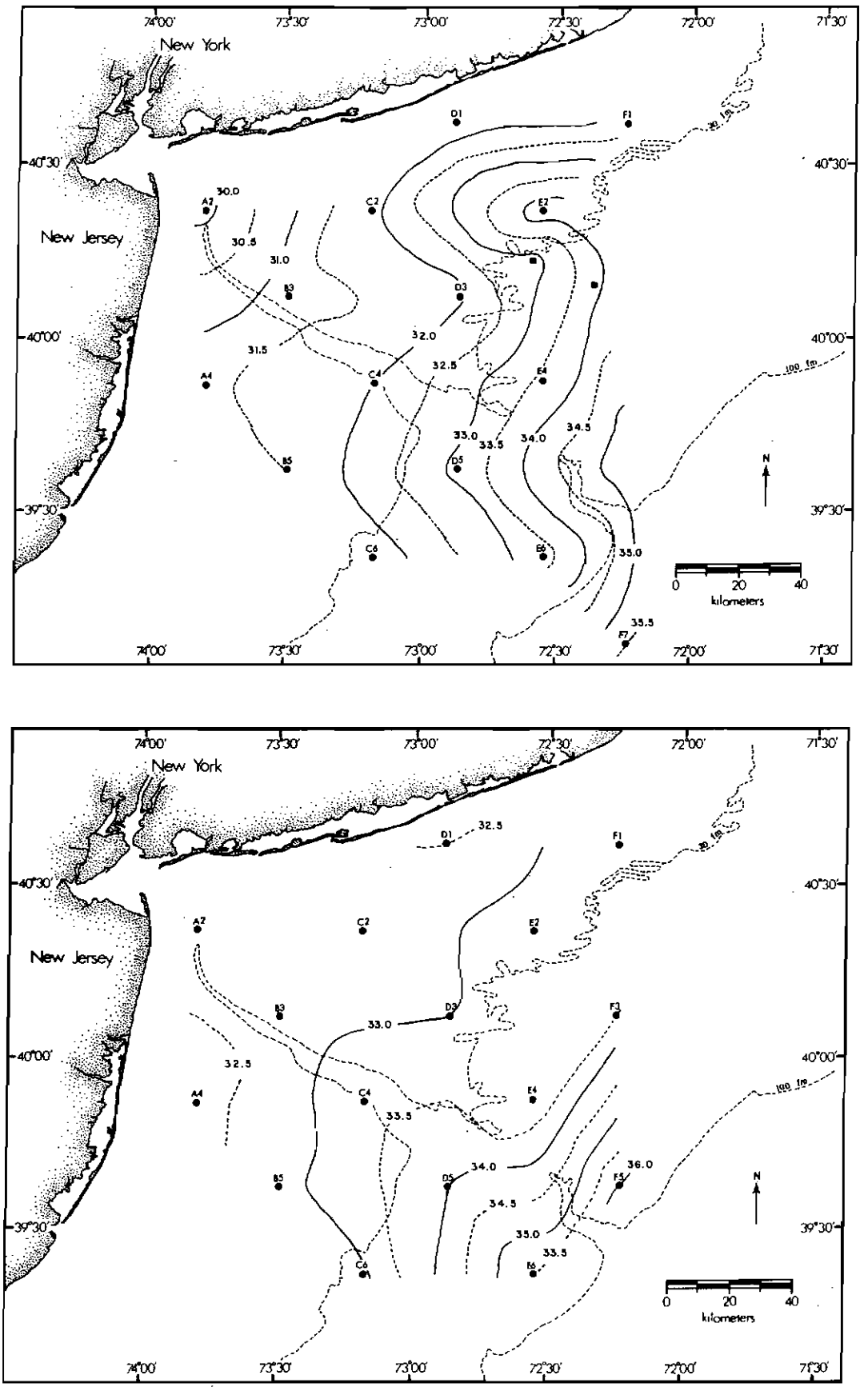


Figure 34. Surface (upper) and bottom (lower) salinity August 1974.

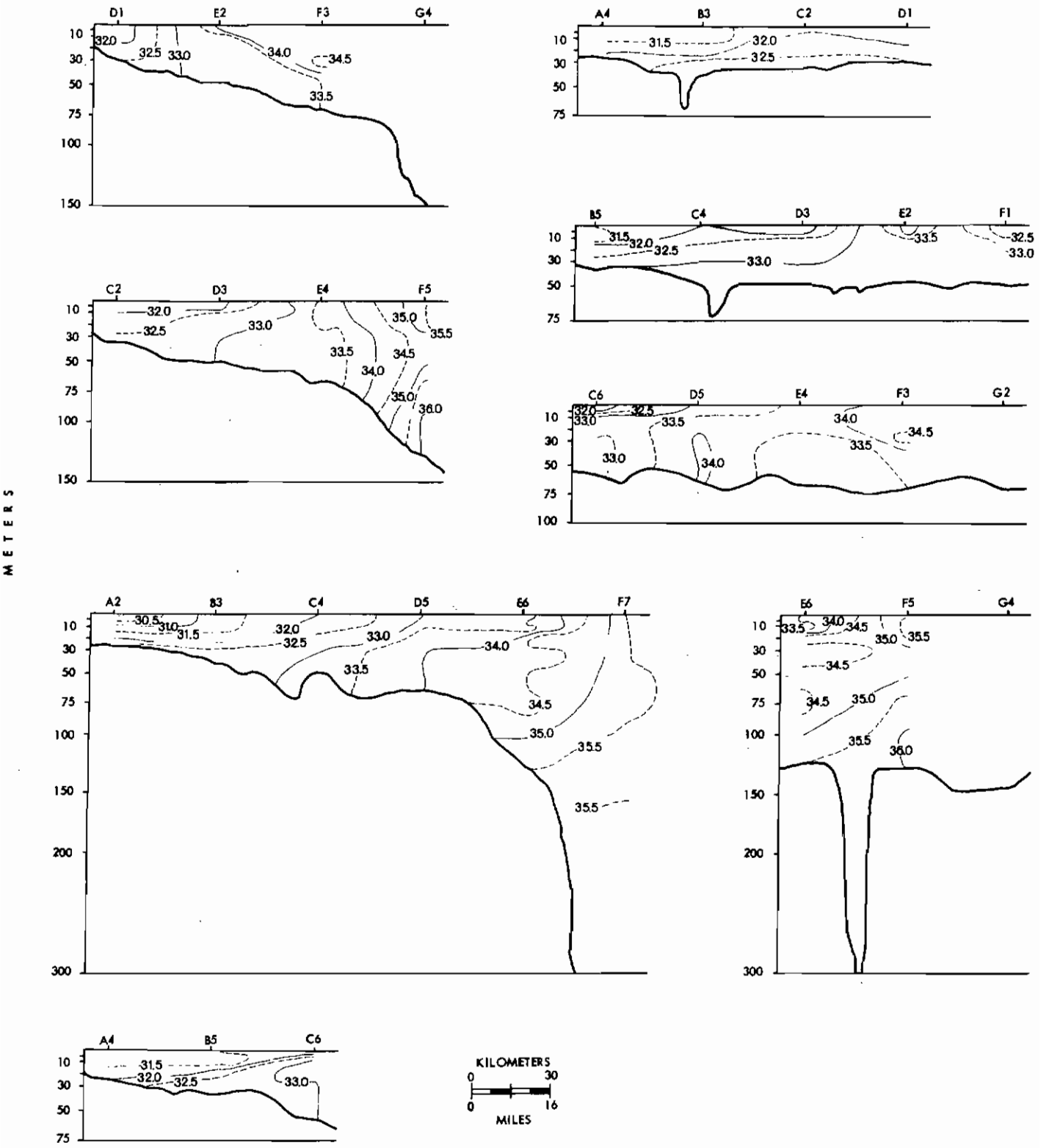


Figure 35. Vertical profiles of salinity August 1974.

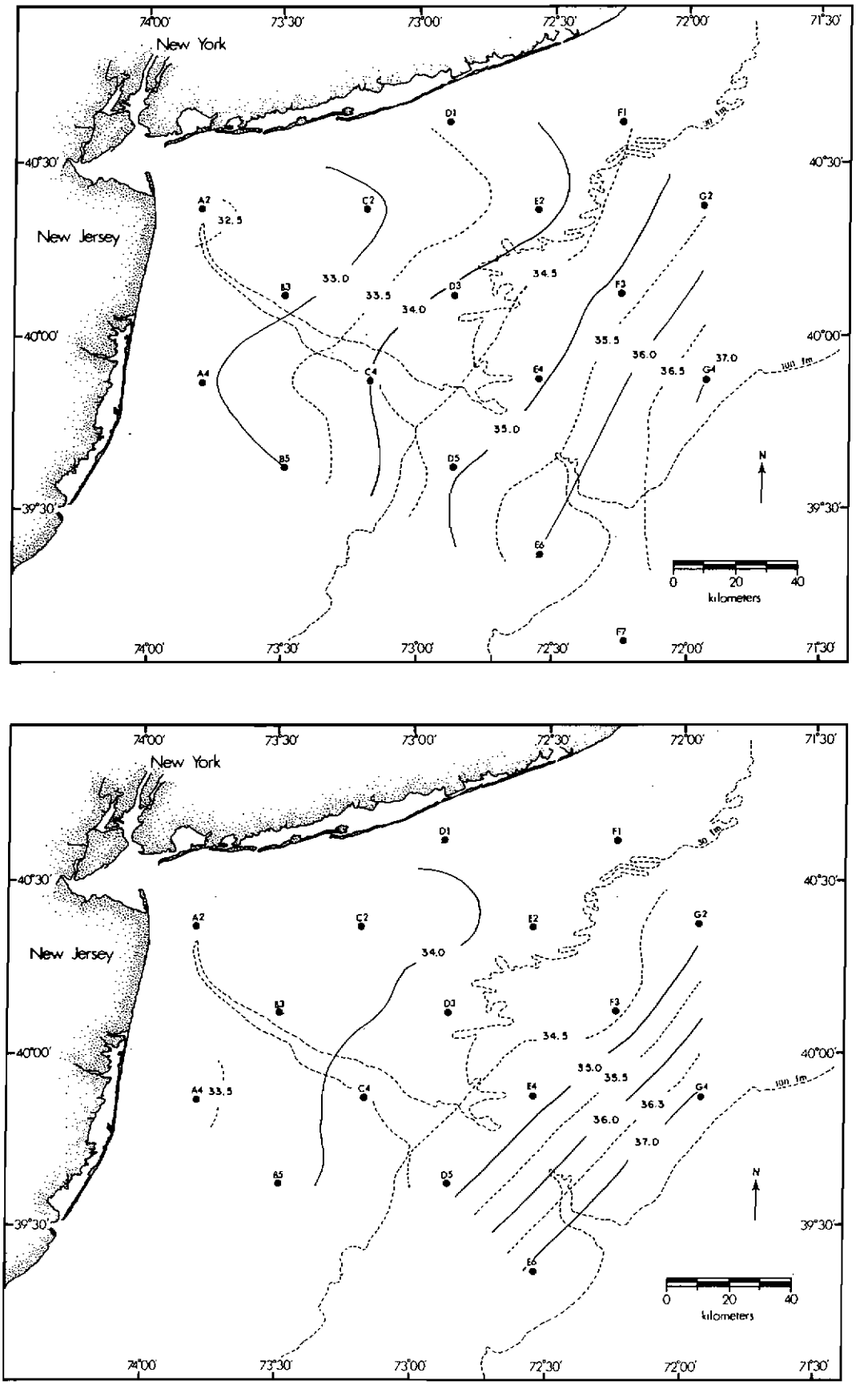


Figure 36. Surface (upper) and bottom (lower) salinity September 1974.

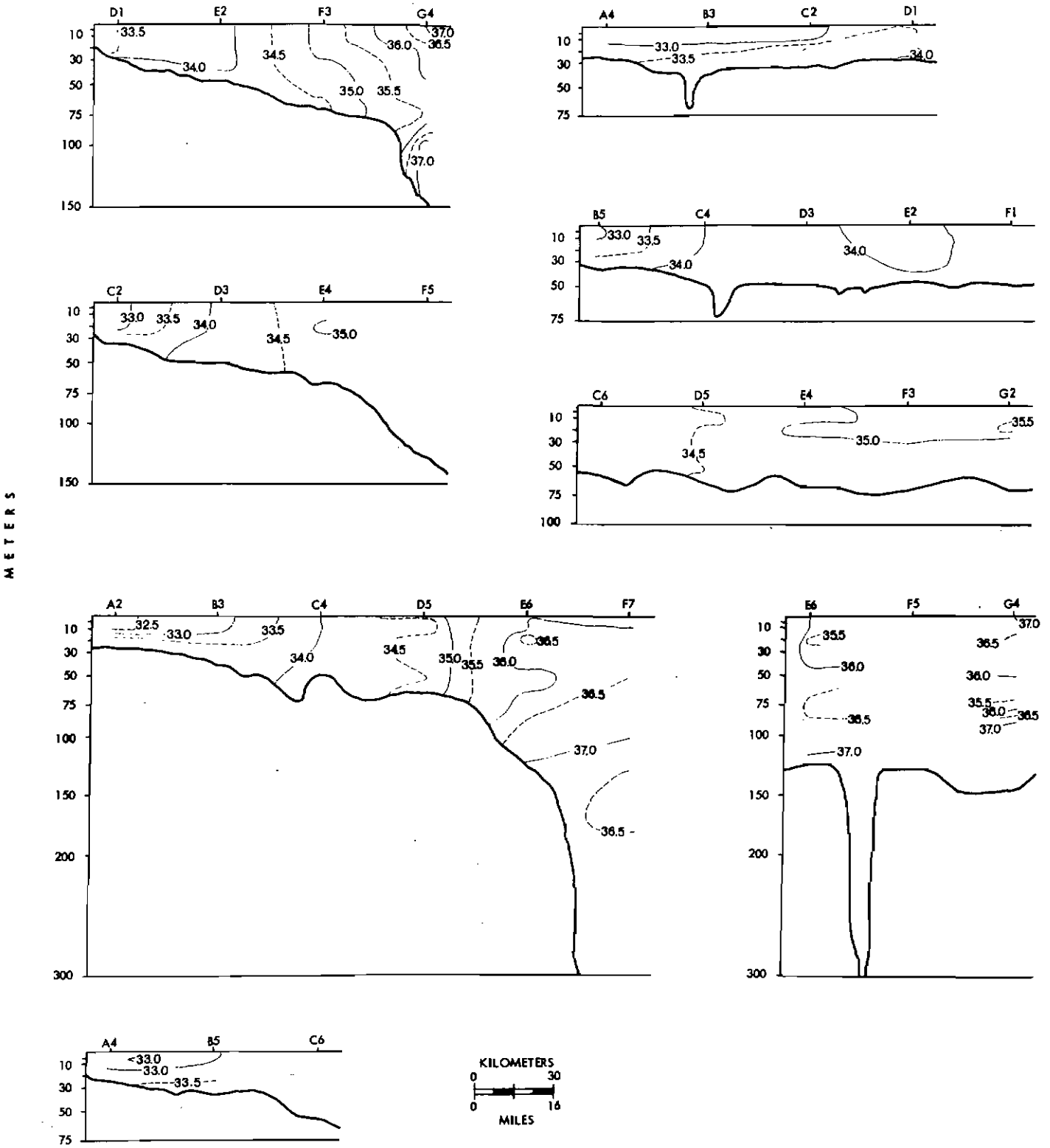


Figure 37. Vertical profiles of salinity September 1974.

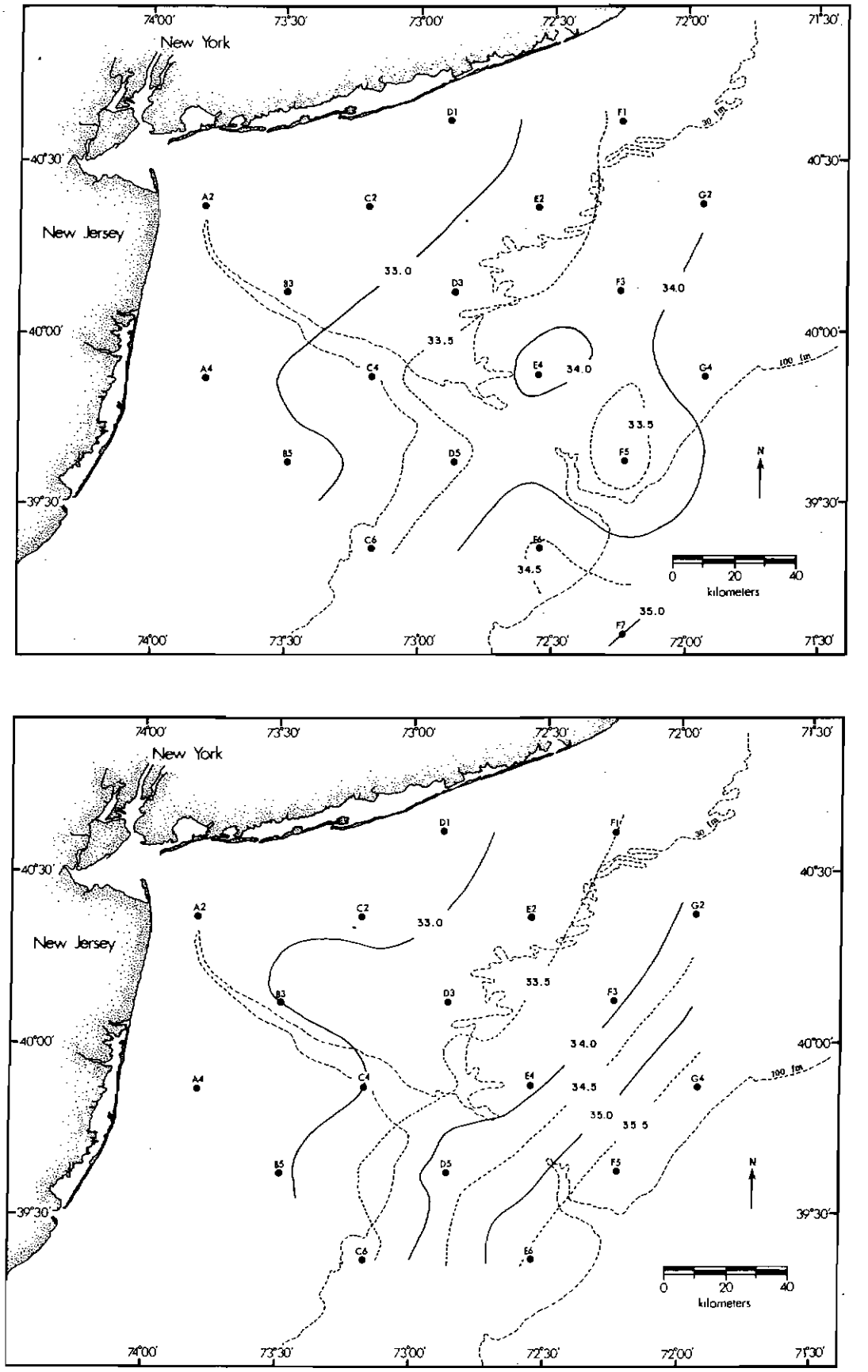


Figure 38. Surface (upper) and bottom (lower) salinity October 1974.

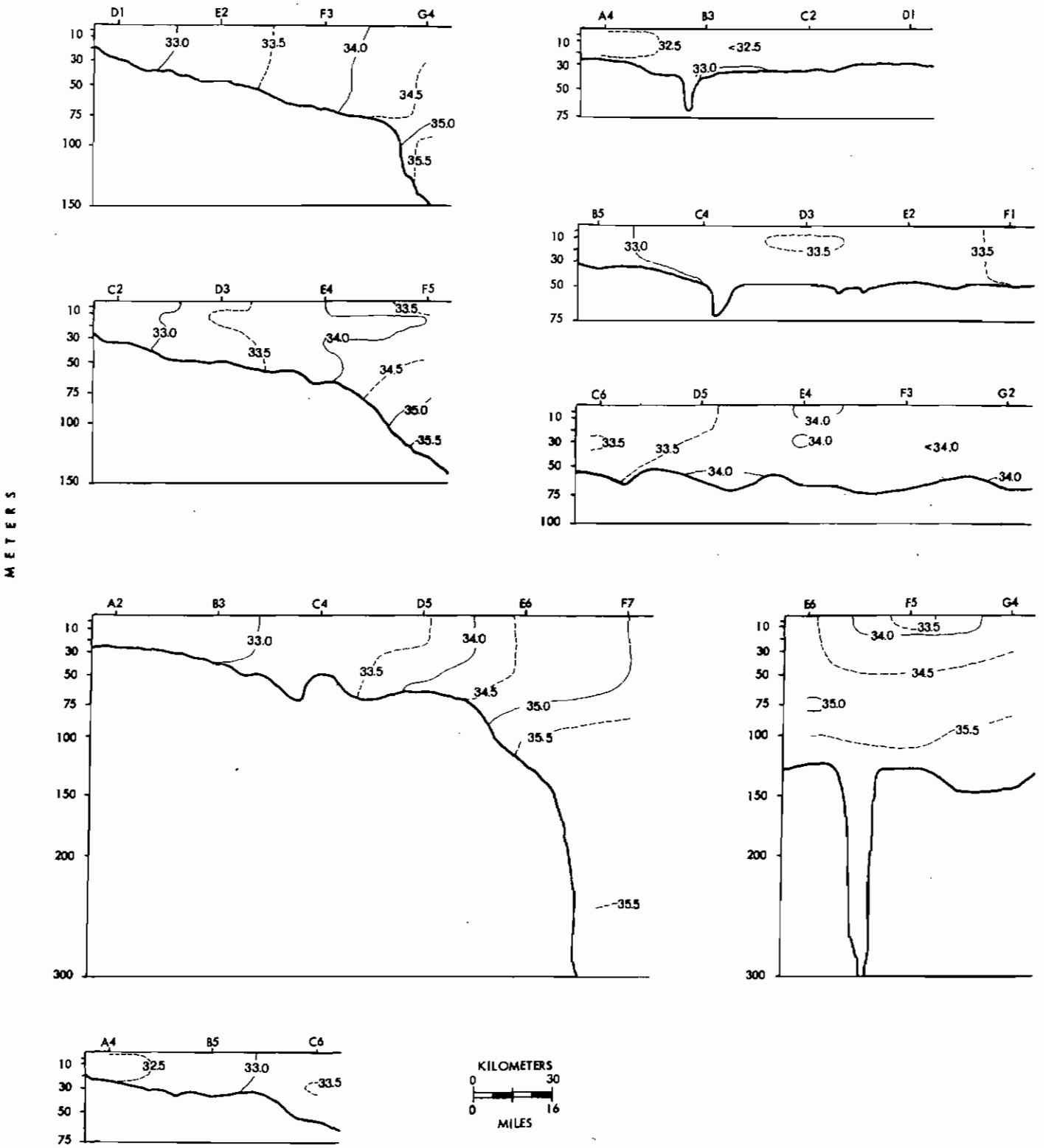


Figure 39. Vertical profiles of salinity October 1974.

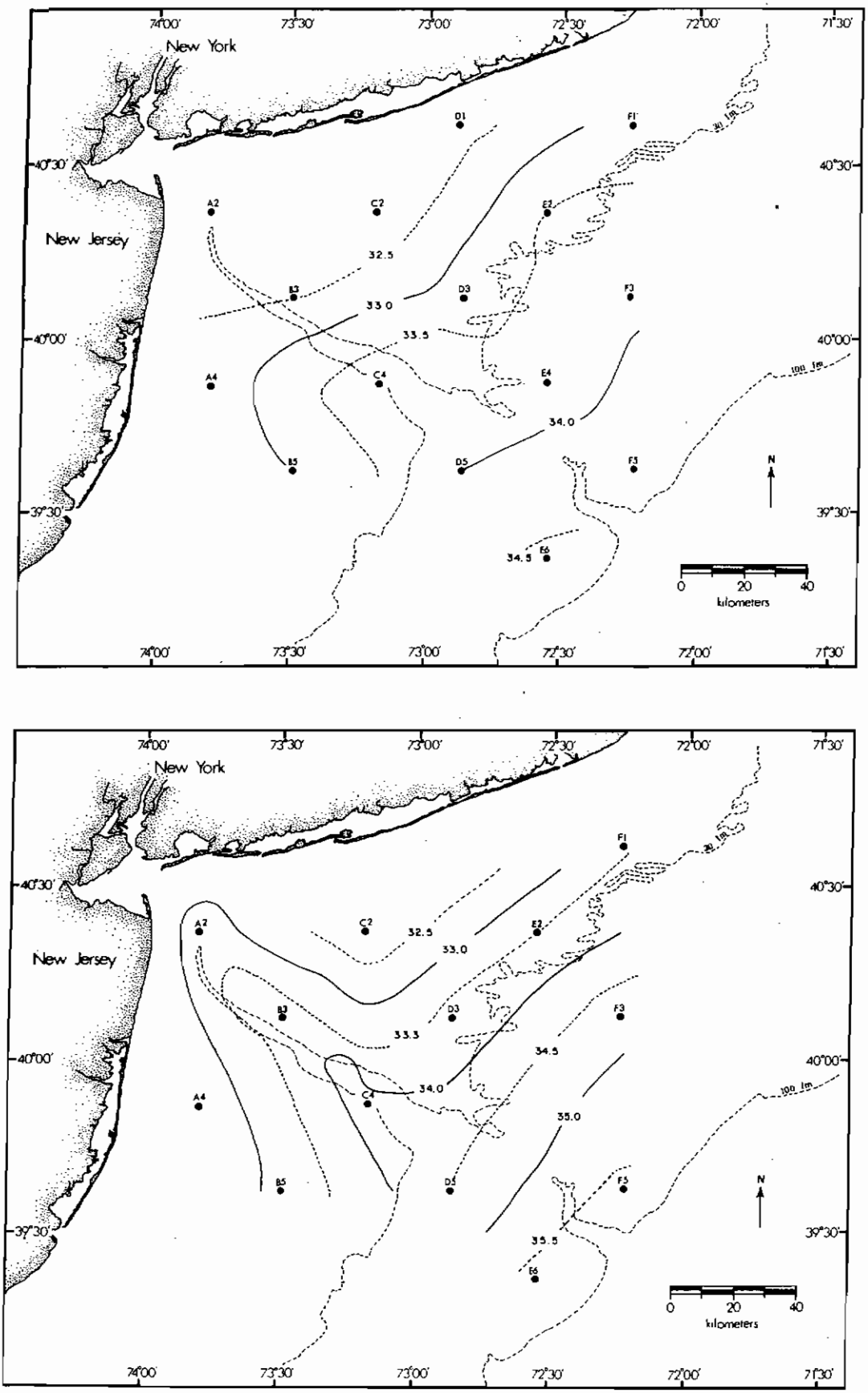


Figure 40. Surface (upper) and bottom (lower) salinity November 1974.

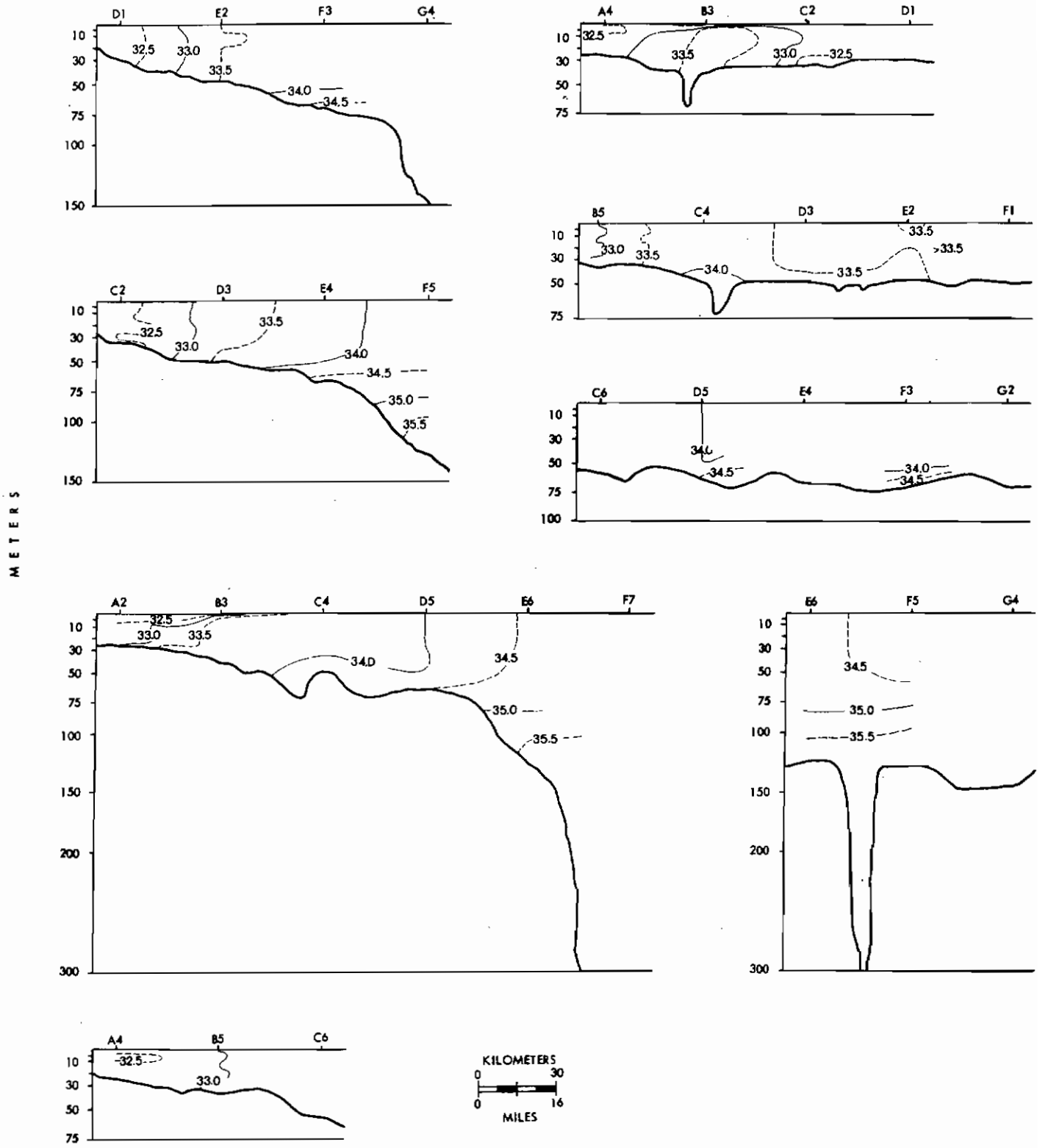


Figure 41. Vertical profiles of salinity November 1974.

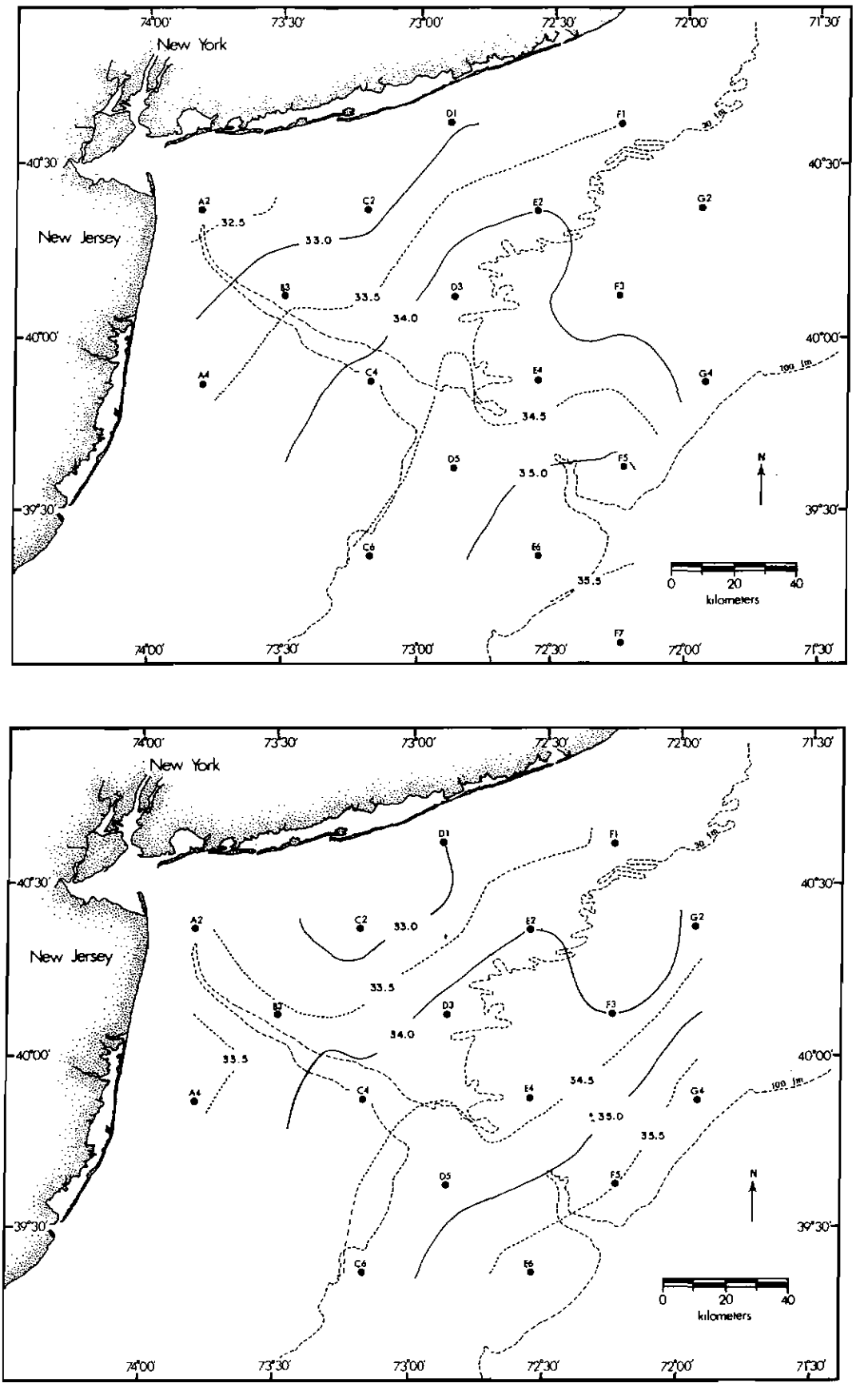


Figure 42. Surface (upper) and bottom (lower) salinity February 1975.

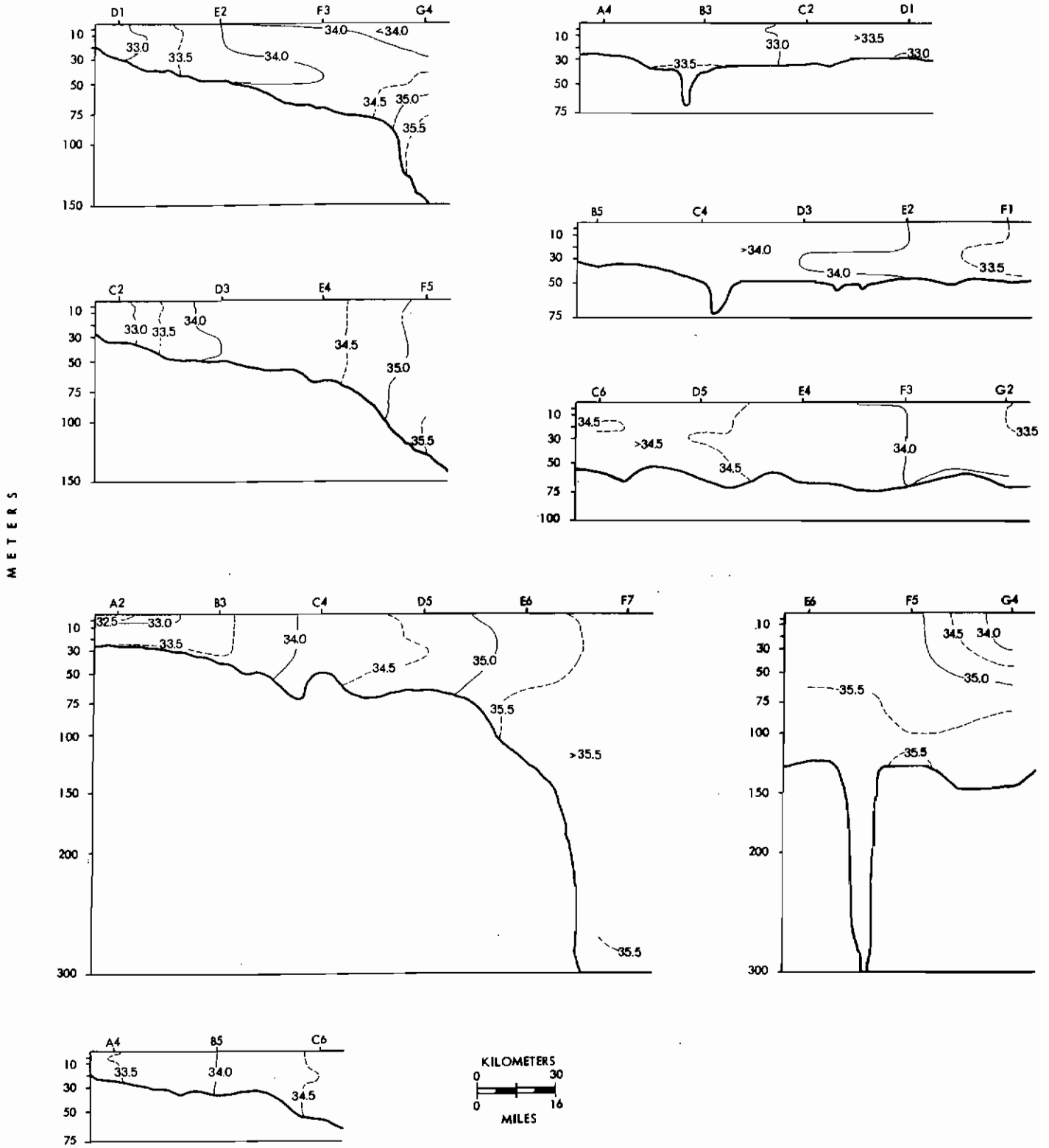


Figure 43. Vertical profiles of salinity February 1975.

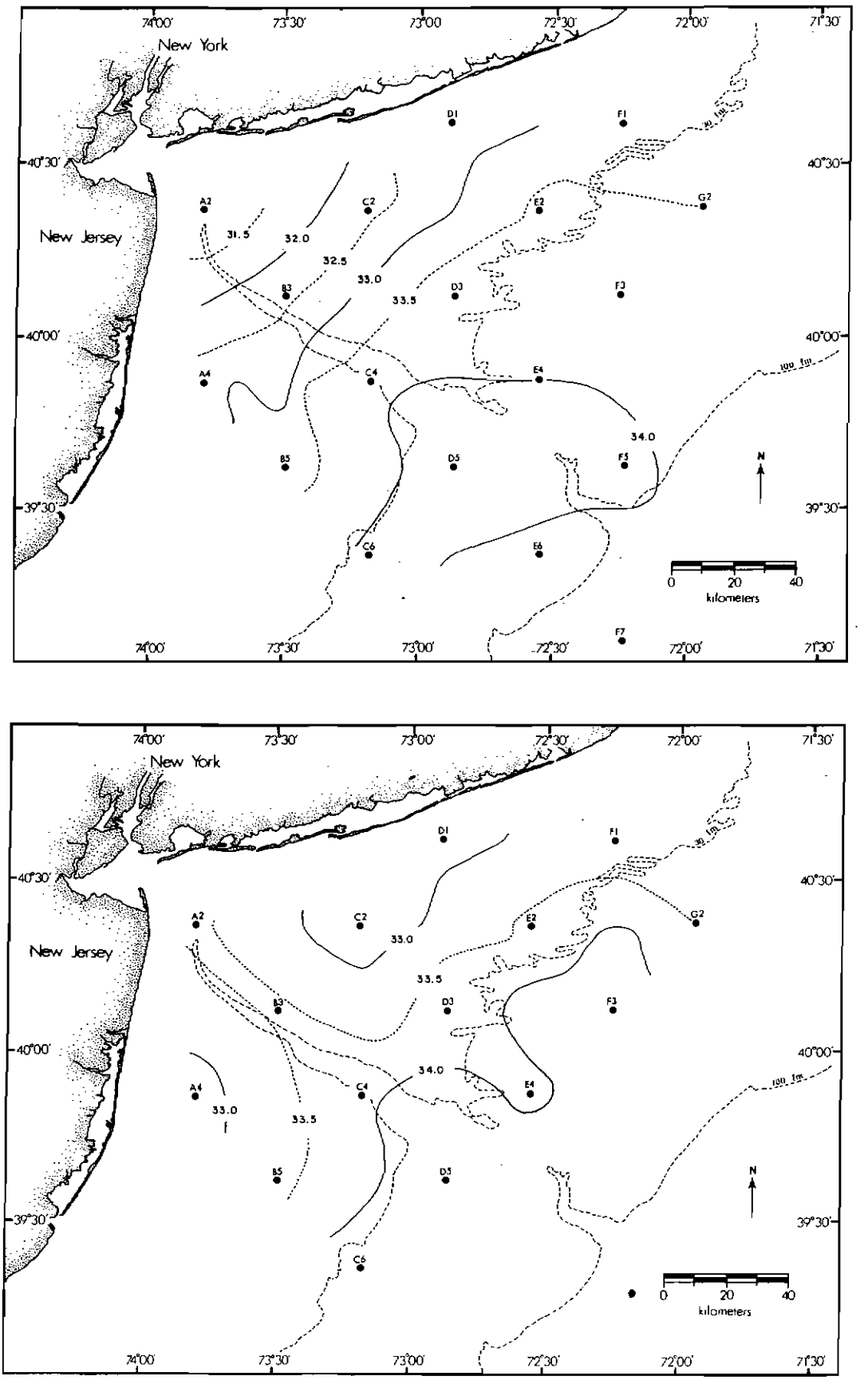


Figure 44. Surface (upper) and bottom (lower) salinity March 1975.

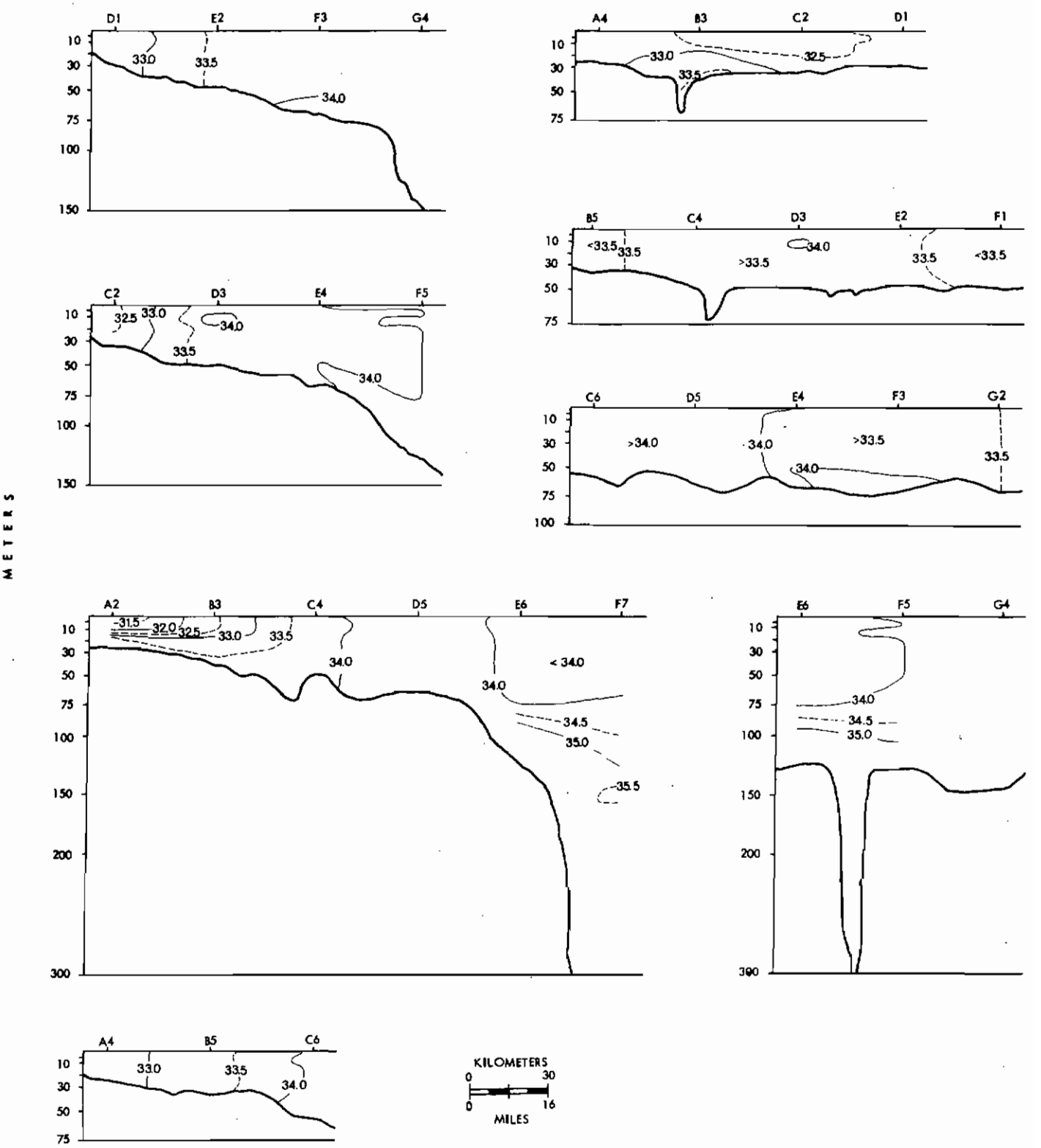


Figure 45. Vertical profiles of salinity March 1975.

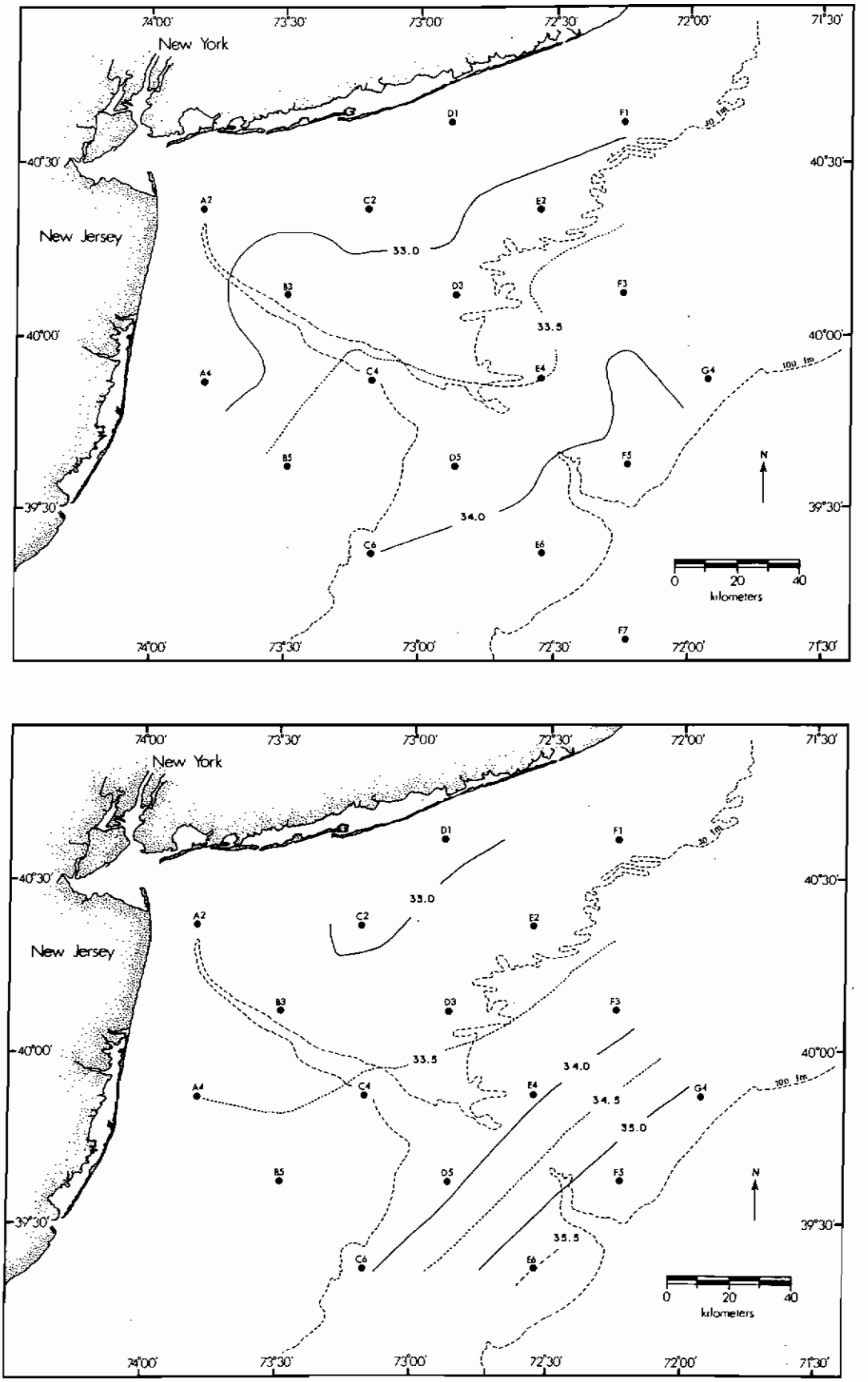


Figure 46. Surface (upper) and bottom (lower) salinity April 1975.

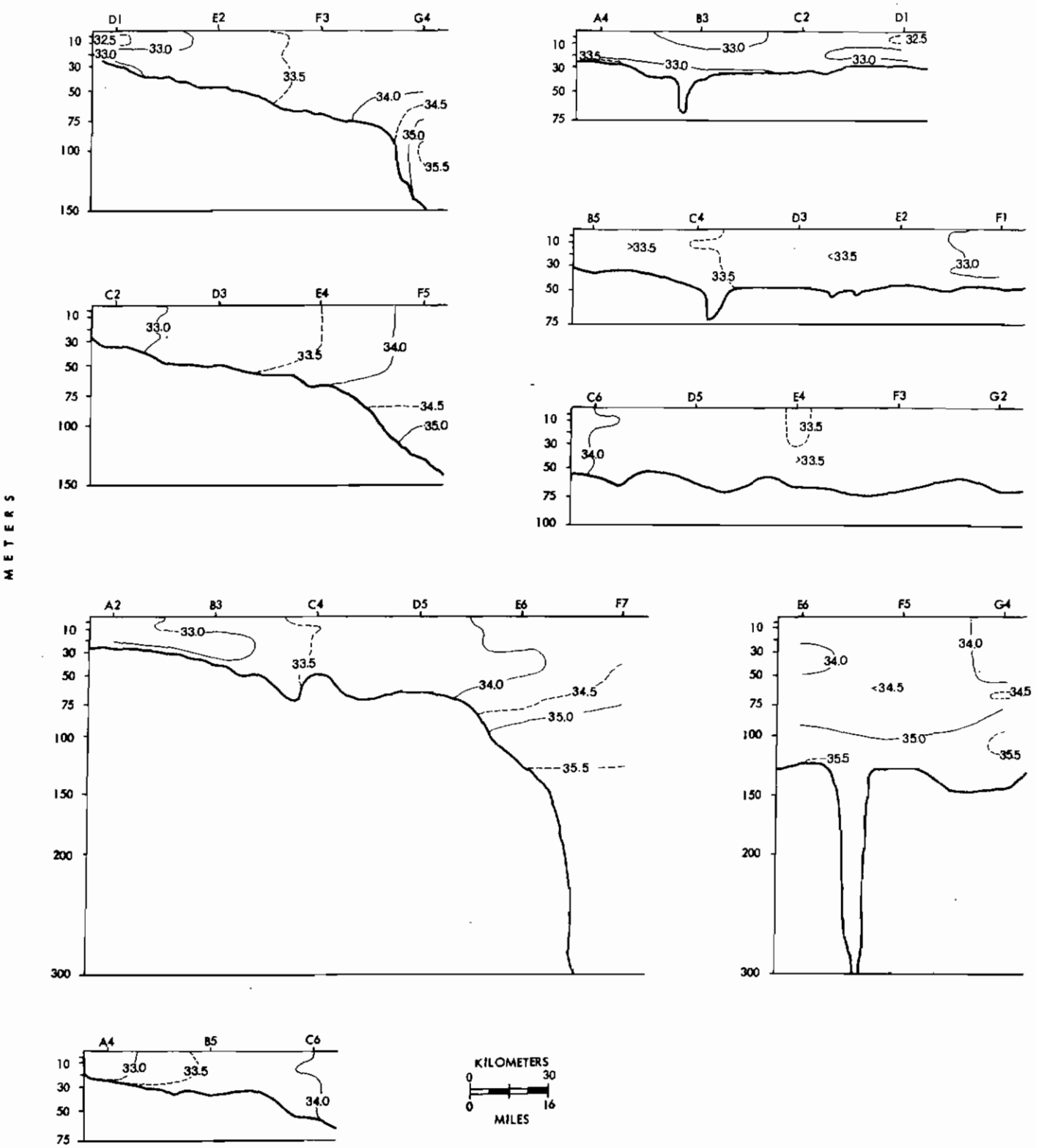


Figure 47. Vertical profiles of salinity April 1975.

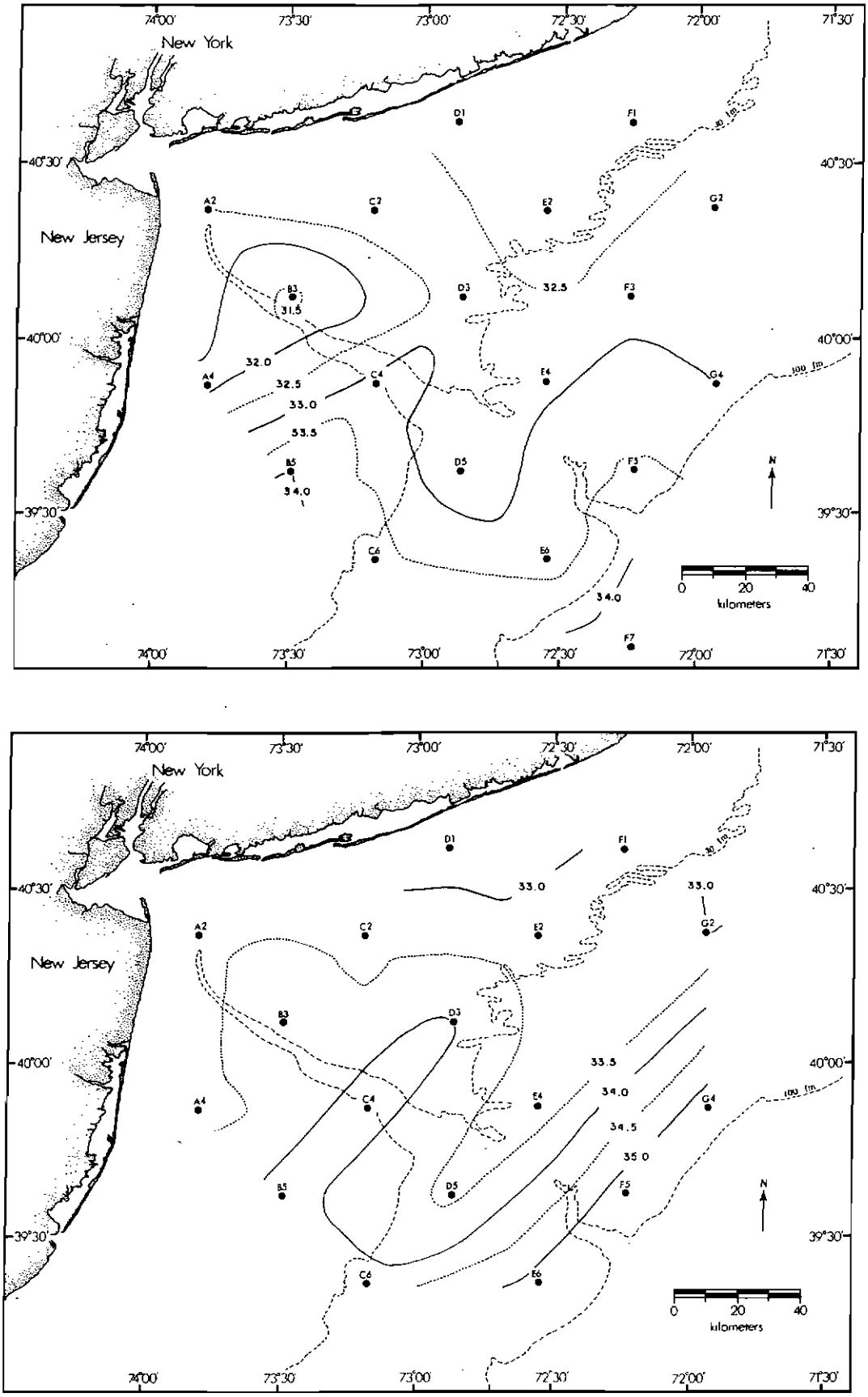


Figure 48. Surface (upper) and bottom (lower) salinity May 1975.

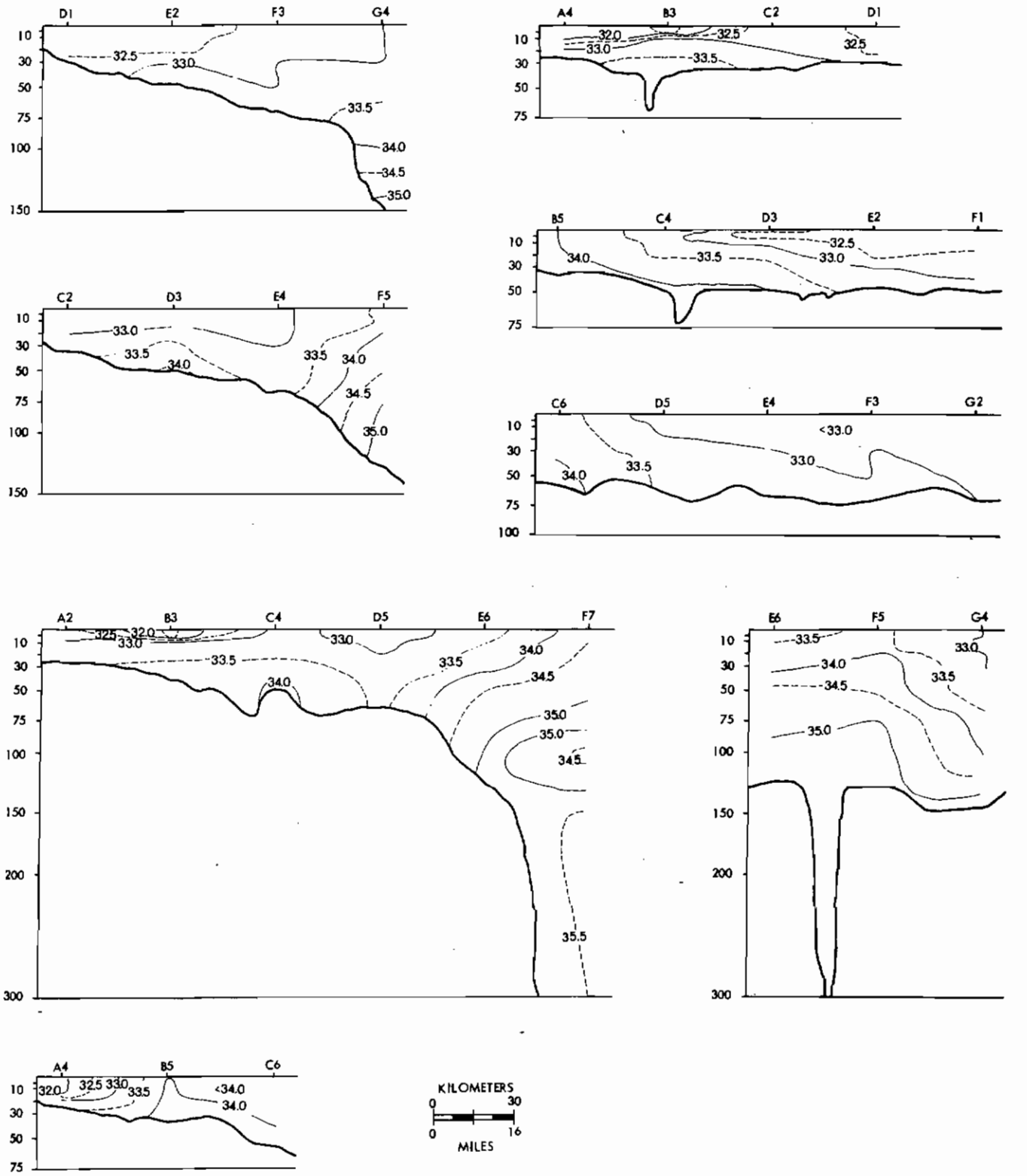
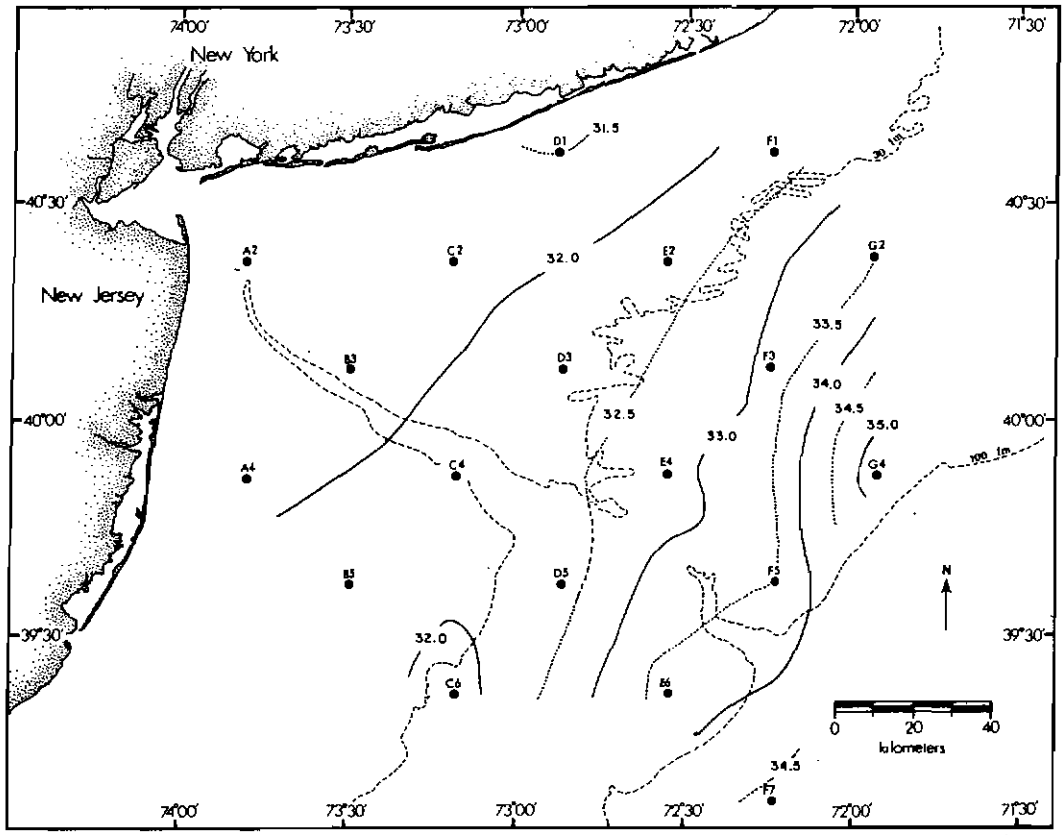


Figure 49. Vertical profiles of salinity May 1975.



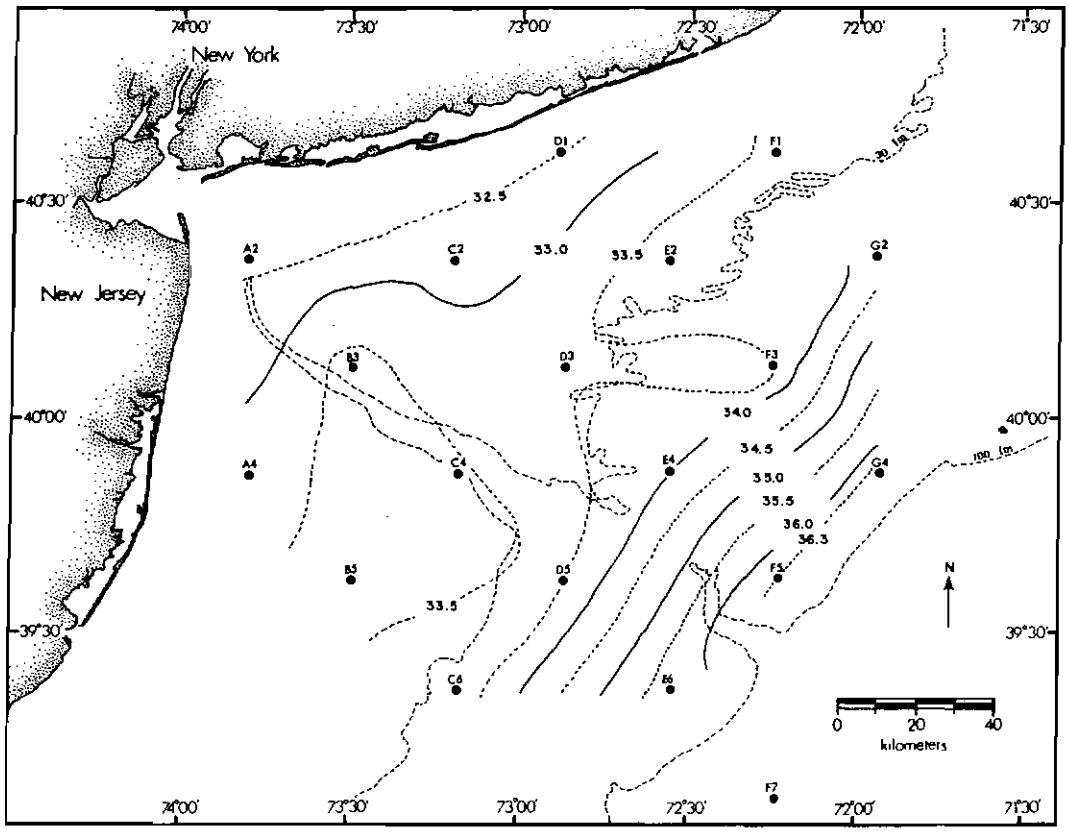


Figure 50. Surface (upper) and bottom (lower) salinity June 1975.

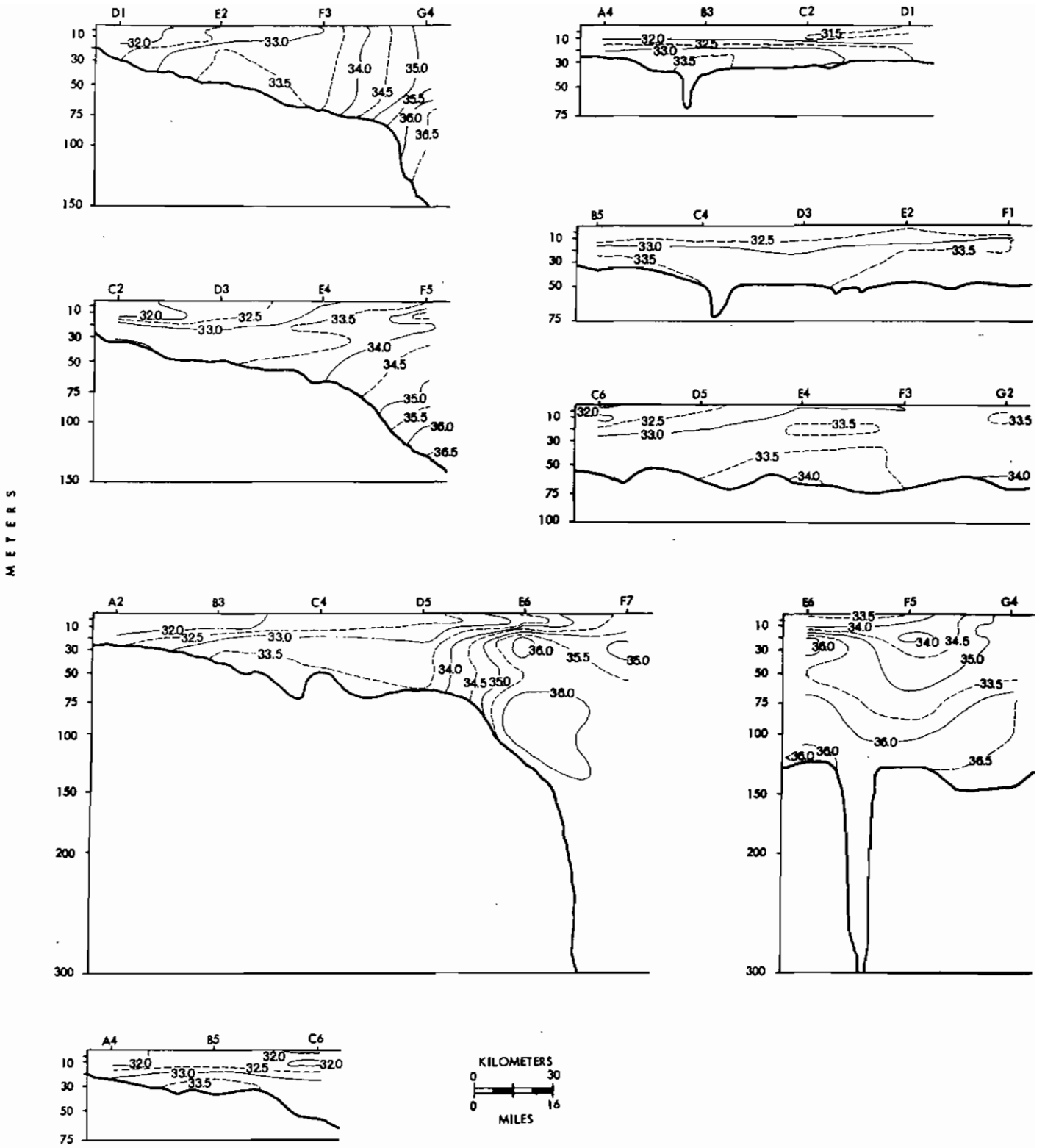


Figure 51. Vertical profiles of salinity June 1975.

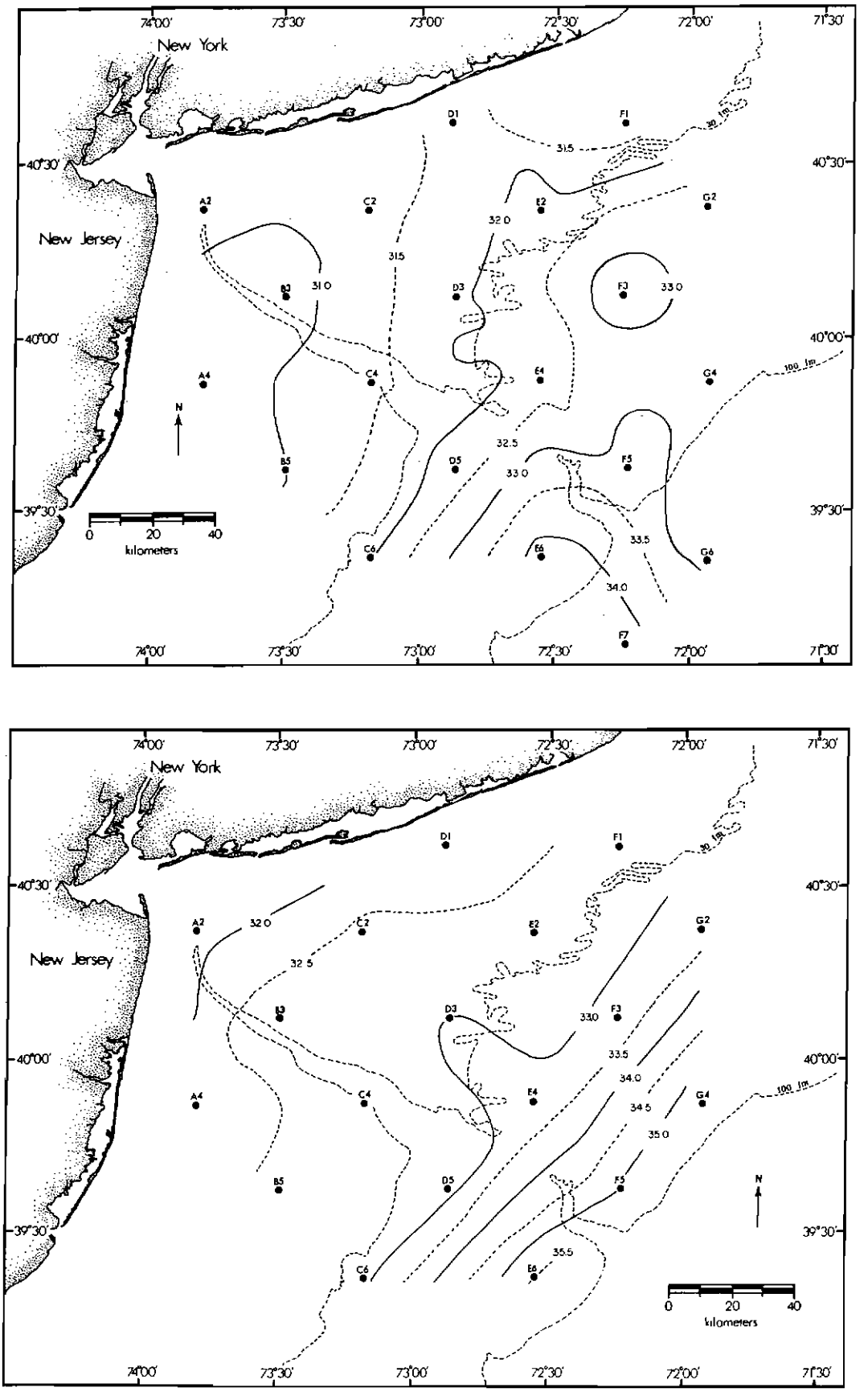


Figure 52. Surface (upper) and bottom (lower) salinity July 1975.

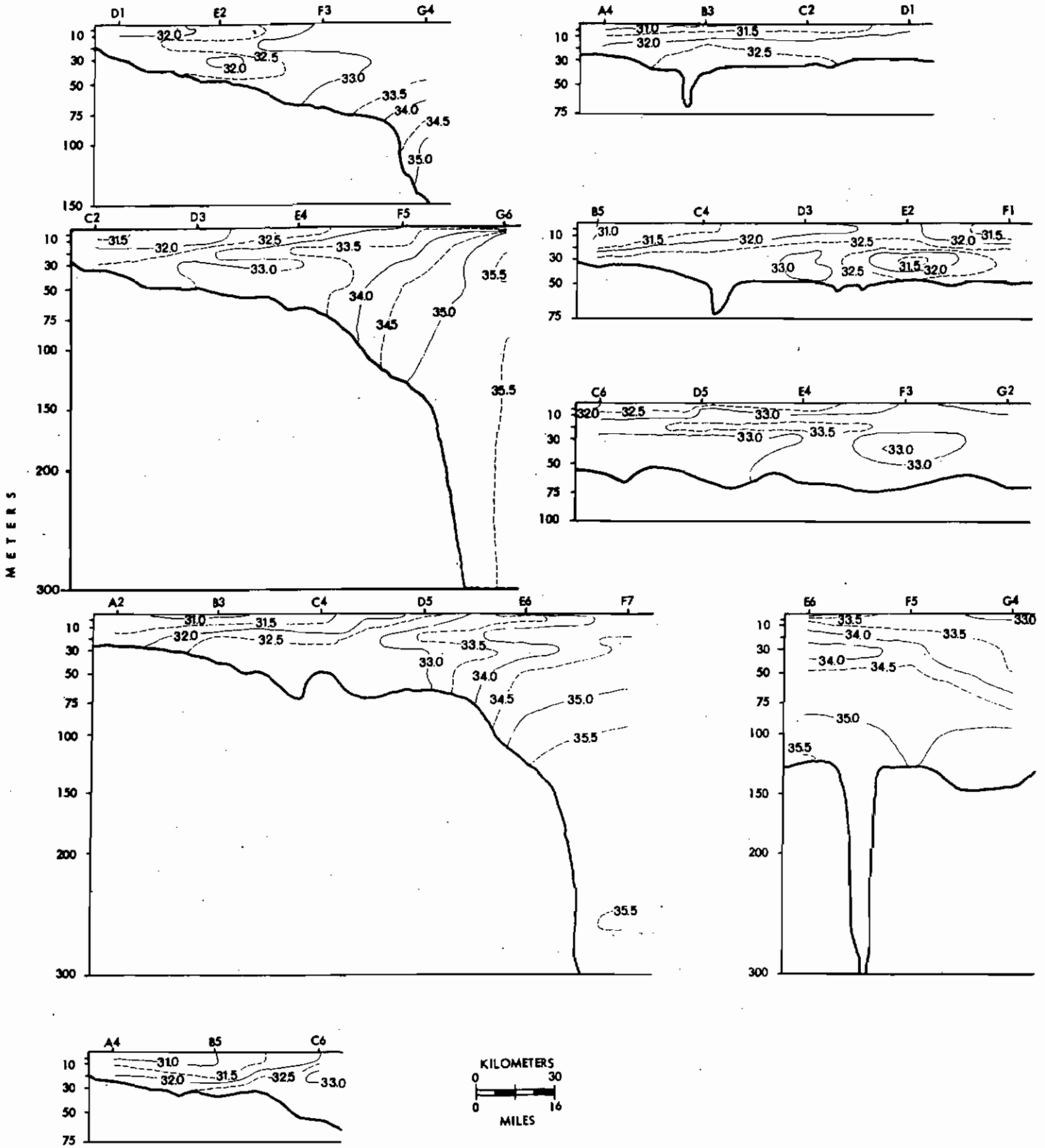


Figure 53. Vertical profiles of salinity July 1975.

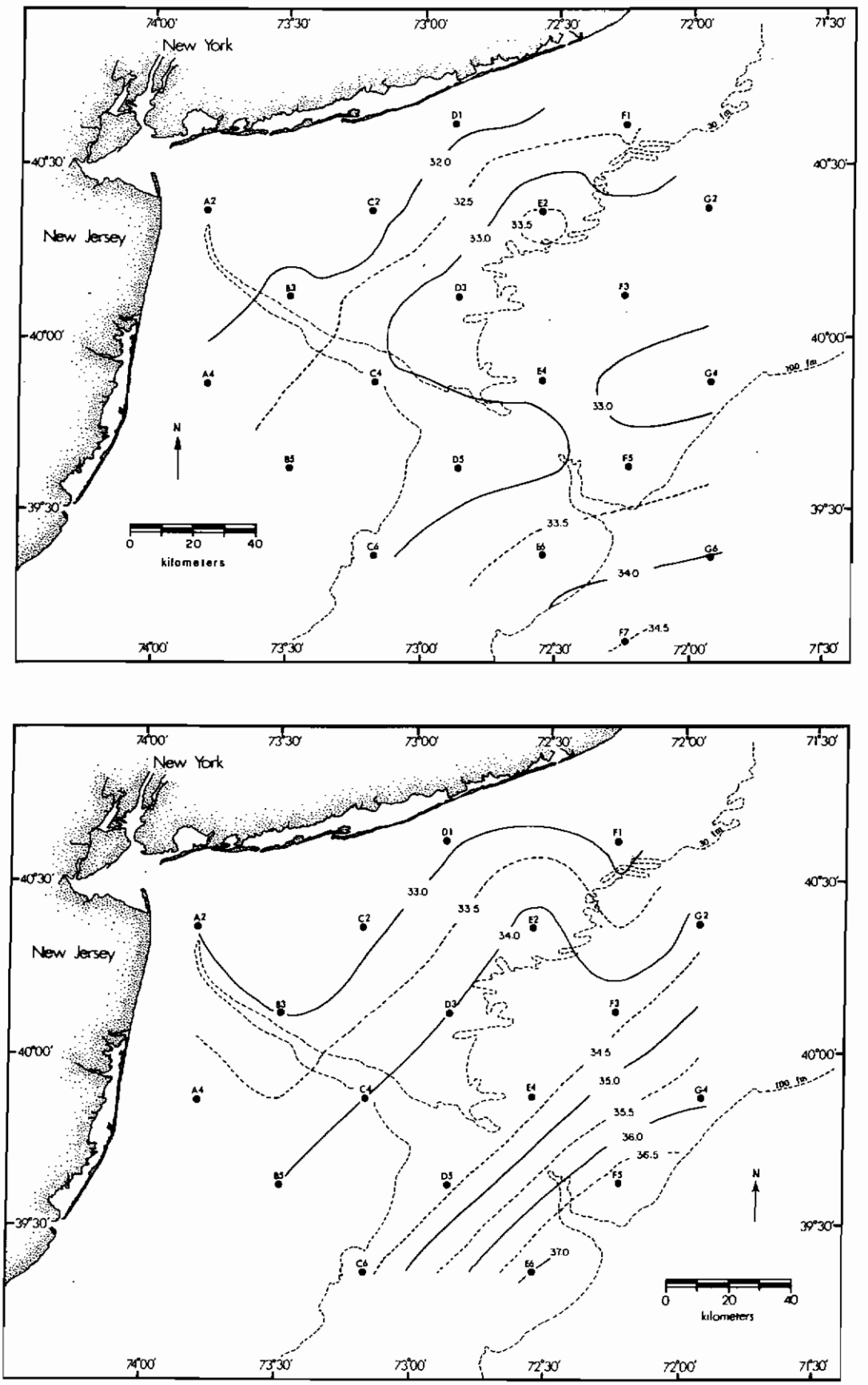


Figure 54. Surface (upper) and bottom (lower) salinity August 1975.

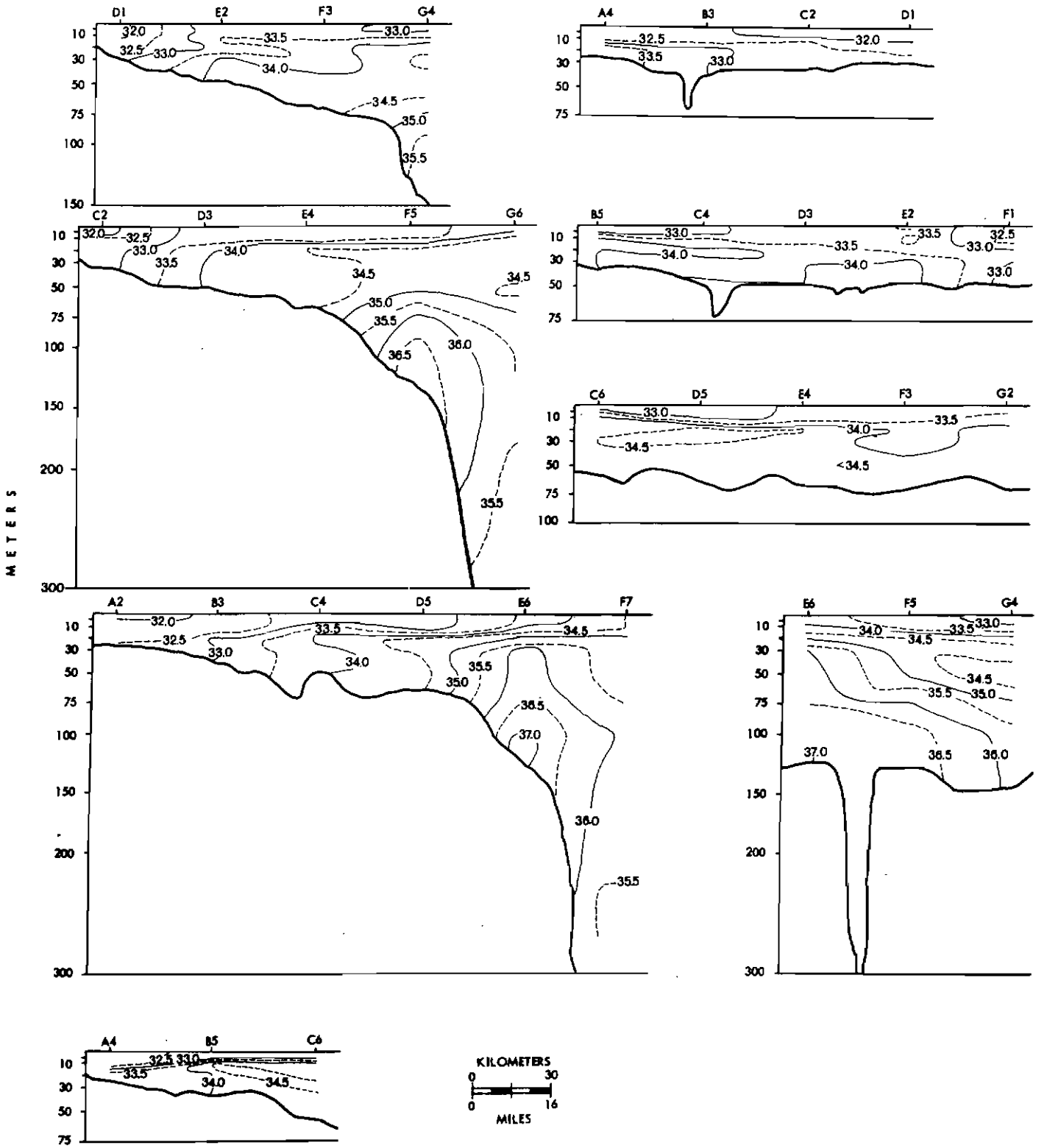
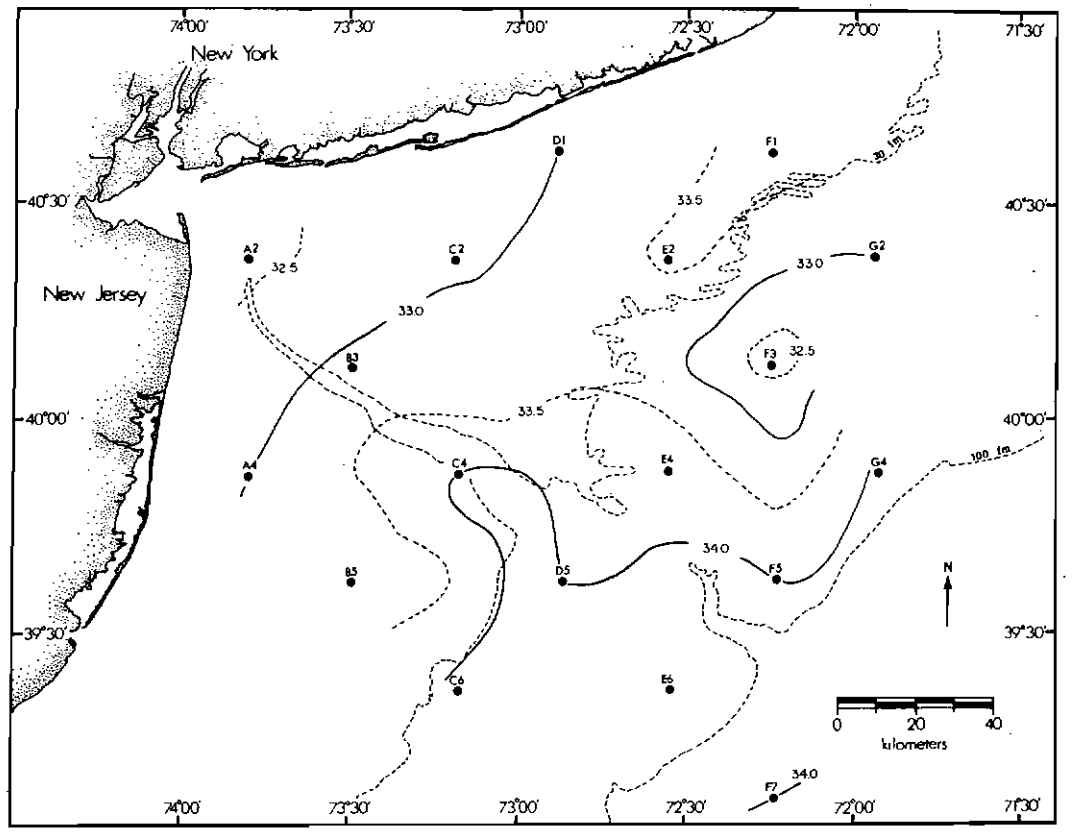


Figure 55. Vertical profiles of salinity August 1975.



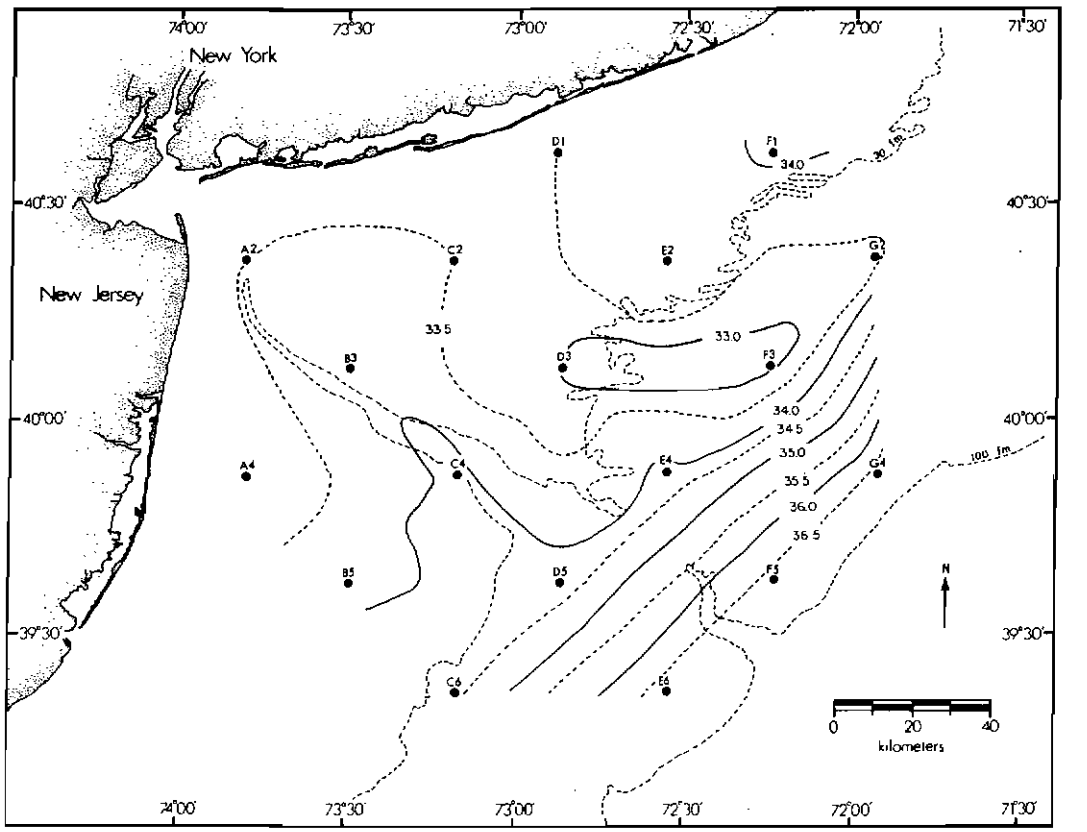


Figure 56. Surface (upper) and bottom (lower) salinity September 1975.

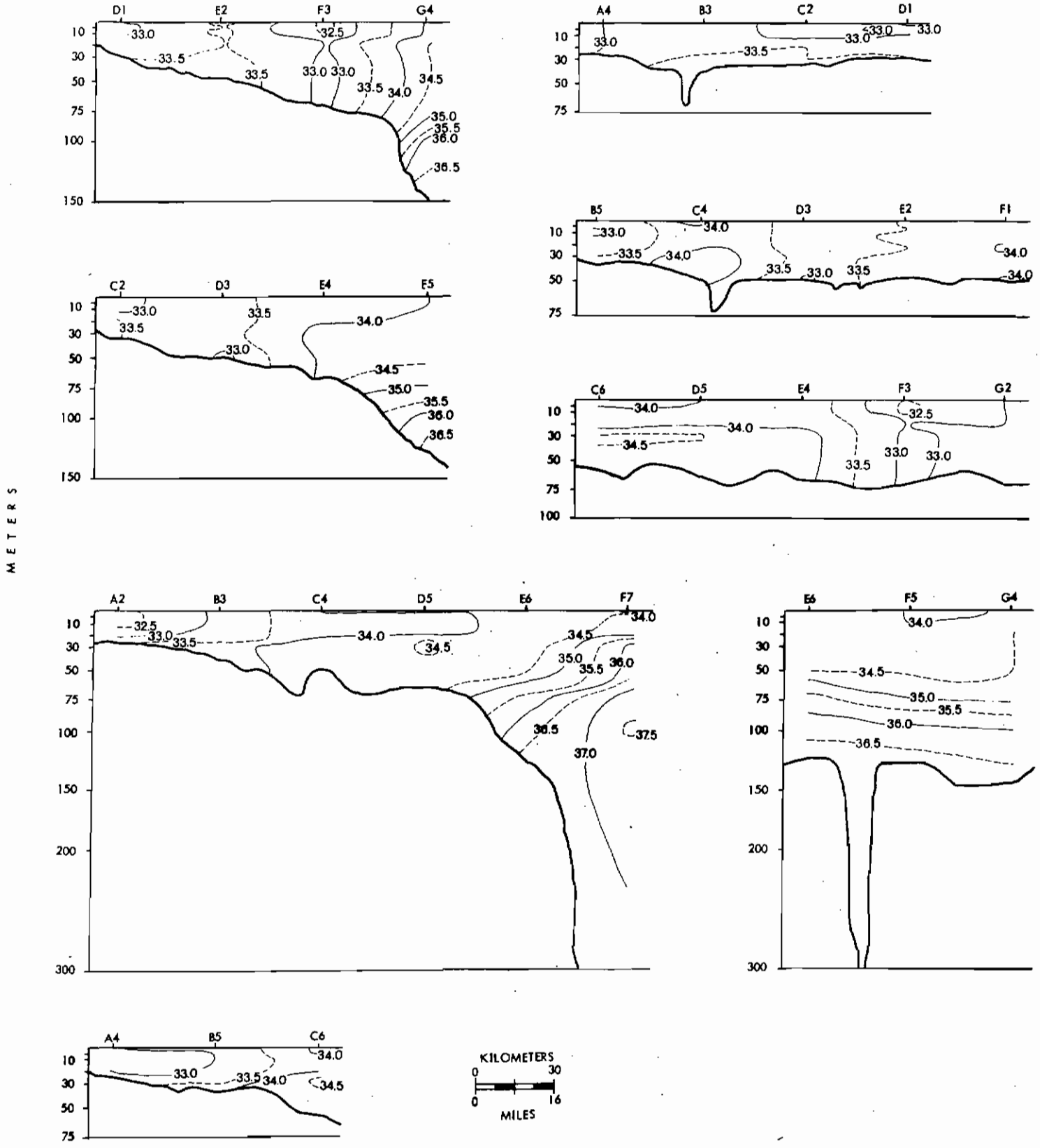


Figure 57. Vertical profiles of salinity September 1975.

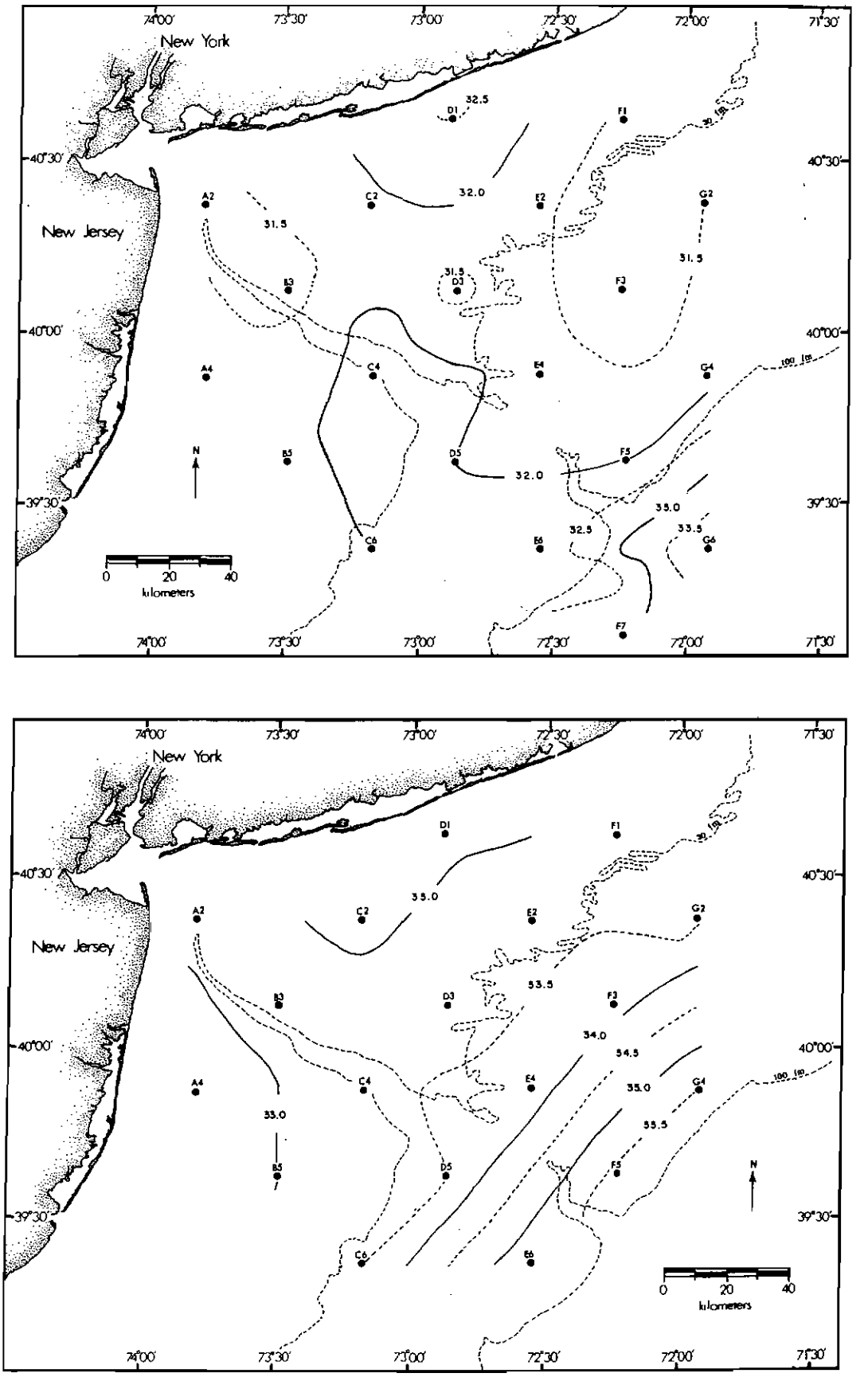


Figure 58. Surface (upper) and bottom (lower) salinity May 1976.

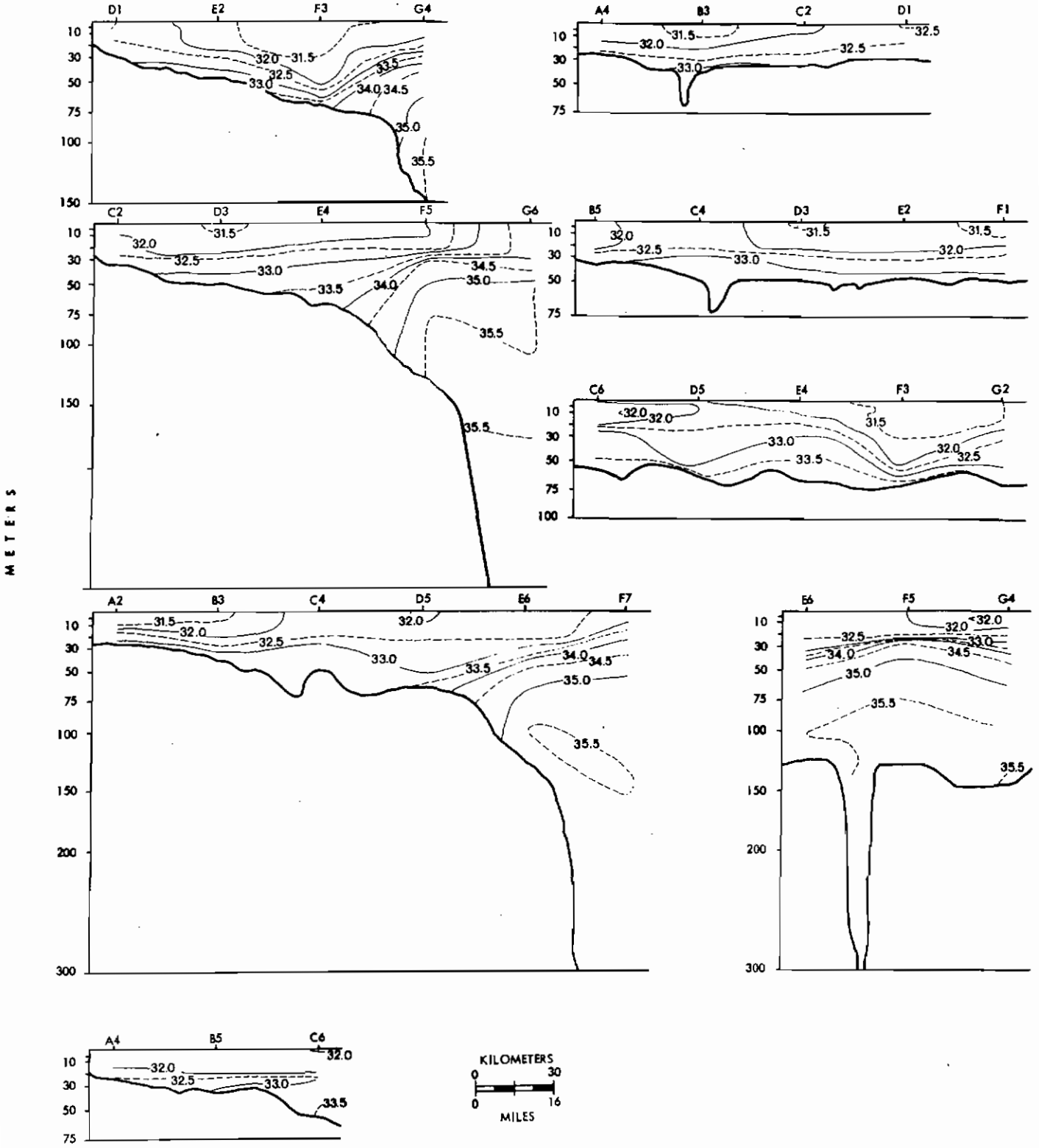
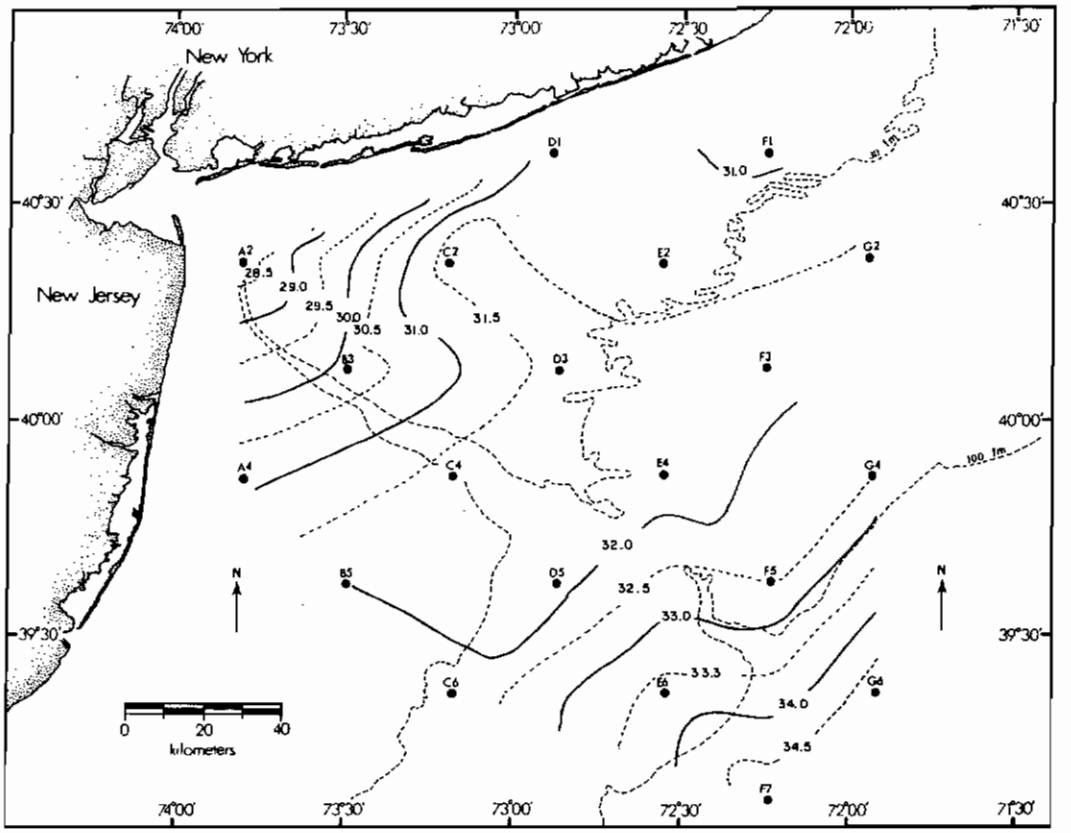


Figure 59. Vertical profiles of salinity May 1976.



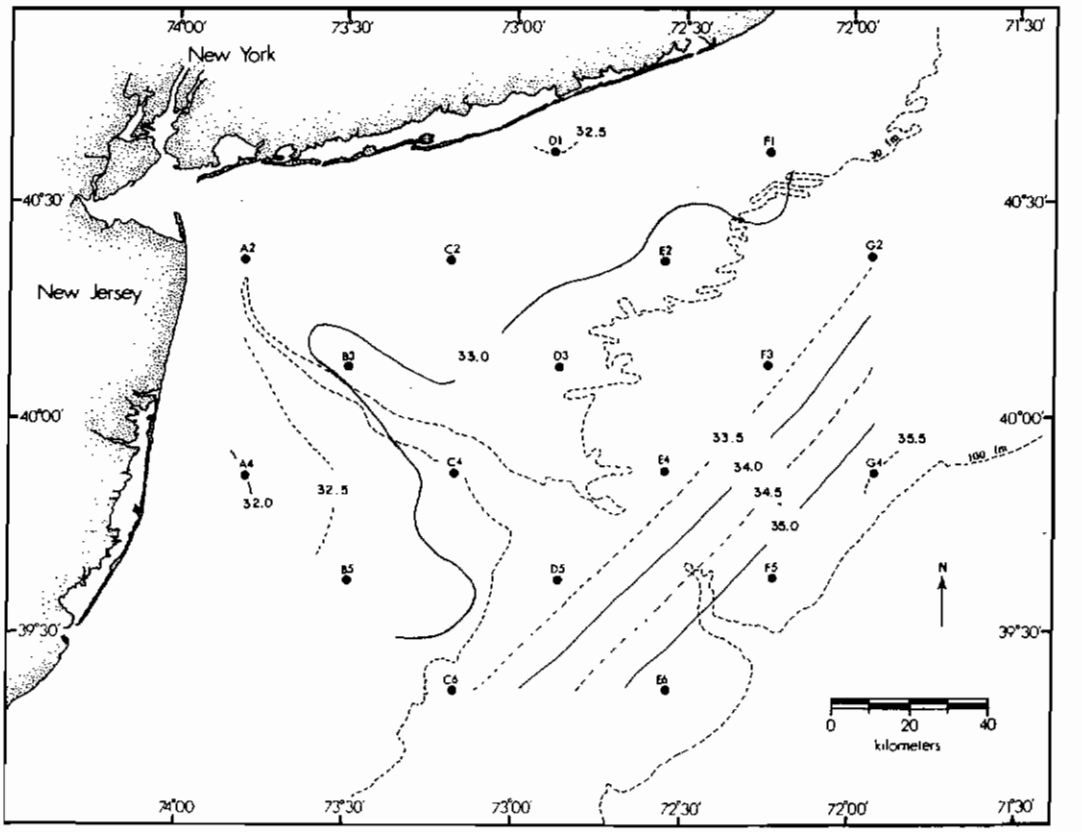


Figure 60. Surface (upper) and bottom (lower) salinity June 1976.

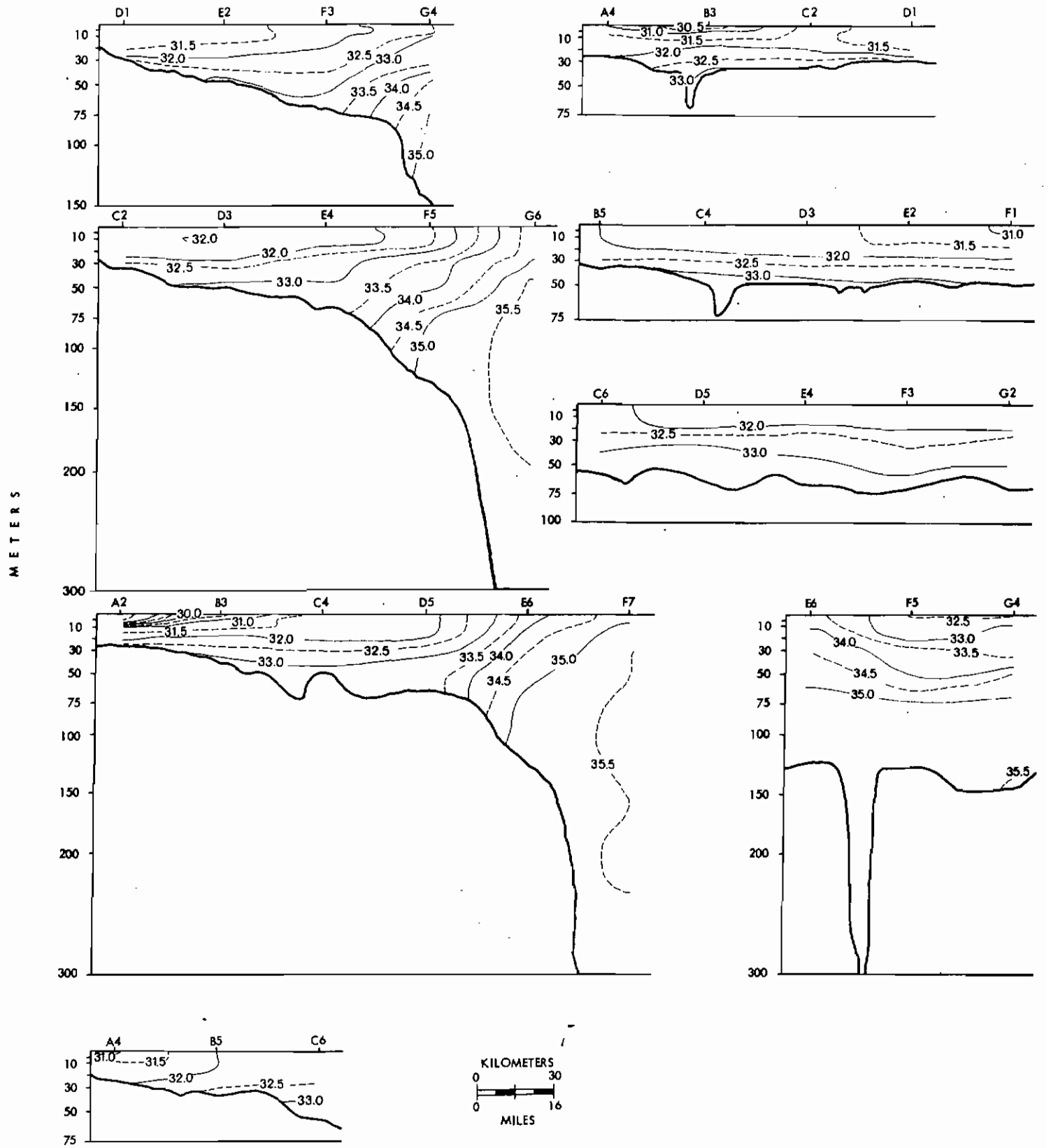


Figure 61. Vertical profiles of salinity June 1976.

TABLE 1. Stations for New York Bight ichthyoplankton survey.

Station	Latitude (N)	Longitude (W)	Depth (m)	Number of cruises on which occupied
A2	40°22.5'	73°48.5'	27	15
A4	39°52.0'	73°48.5'	26	15
B3	40°07.0'	73°29.5'	40	15
B5	39°37.0'	73°29.5'	37	13
C2	40°22.5'	73°10.0'	33	15
C4	39°52.0'	73°10.0'	49	15
C6	39°22.5'	73°10.0'	59	13
D1	40°37.0'	72°50.0'	29	15
D3	40°07.0'	72°50.0'	49	15
D5	39°37.0'	72°50.0'	64	15
D7	39°07.0'	72°50.0'	85	1
E2	40°22.5'	72°31.0'	48	15
E4	39°52.0'	72°31.0'	66	15
E6	39°22.5'	72°31.0'	124	15
F1	40°37.0'	72°11.0'	49	15
F3	40°07.0'	72°11.0'	71	15
F5	39°37.0'	72°11.0'	128	14
F7	39°07.0'	72°11.0'	~1400	14
G2	40°22.5'	71°51.0'	71	11
G4	39°52.0'	71°51.0'	146	11
G6	39°22.5'	71°51.0'	~800	4

TABLE 2. Station data summary for New York Bight ichthyoplankton survey.

Cruise*	Sta.	Date	61-cm, 0.505-mm mesh bongo tow: Start Time (EST)	Max. Depth (m)	Volume Filtered (m^3)	Wind: Speed (knots)	Wind: Direction (°T)	Temperature (°C): Surface	Temperature (°C): Air
		July							
D-74-7	C2	25	0204	33	171.66	12	120	20.1	20.8
	D1	25	1020	33	117.74	16	50	20.4	19.0
	F1	26	0016	49	235.07	6	70	20.6	19.5
	E2	26	0504	45	207.02	8	95	19.9	19.9
	D3	26	0844	48	209.43	6	60	20.4	26.3
	E4	26	1228	65	277.26	14	70	21.7	23.2
	F3	26	1850	69	164.99	8	80	20.7	21.1
	F5	27	0253	95	317.04	8	130	22.2	22.9
	F7	27	0843	145	414.21	10	100	23.1	24.8
	E6	27	1143	125	289.32	8	135	22.7	25.8
	D7	27	1542	70	209.43	6	130	23.0	27.6
	C6	27	1824	47	162.50	8	75	22.9	24.6
	D5	27	2200	48	182.03	6	90	22.3	23.0
	C4	28	0226	53	135.74	3	90	22.1	22.7
	A4	28	1007	23	116.61	4	90	22.7	28.8
	B3	28	1850	41	159.53	12	160	22.7	22.8
	A2	29	0845	25	120.63	6	165	20.1	24.1
		Aug.							
D-74-8	C2	17	0310	9	24.83	13	180	21.5	22.6
	D1	17	1100	8	43.13	14	180	21.5	23.6
	F1	17	2105	38	198.83	18	200	20.9	22.5
	E2	17	2355	42	178.33	10	180	20.5	22.7
	D3	18	0508	42	186.93	10	315	21.7	22.0
	C4	18	0735	35	226.39	8	315	22.5	24.3
	D5	18	1415	51	270.35	8	300	22.2	26.9
	E4	18	1930	60	228.08	6	270	22.5	23.8
	F3	18	2322	64	168.21	8	230	22.8	23.7
	F5	19	0715	108	355.30	4	290	23.1	25.0
	F7	19	1105	164	415.73	0	-	25.0	26.1
	E6	19	1629	80	244.79	2	350	23.2	25.9
	C6	19	2105	32	149.24	0	-	22.8	23.4
	B5	20	0138	25	138.87	2	310	23.5	23.3
	A4	20	0930	23	184.05	25	45	22.9	27.0
	B3	20	1903	9	65.11	4	135	23.6	25.0
	A2	21	0142	26	132.76	5	90	22.5	23.2
		Sept.							
D-74-11	C2	24	1557	-	51.5	7	65	18.7	16.4
	D1	24	2215	-	88.3	8	90	17.6	16.3
	E2	25	1220	45	97.8	12	110	17.9	16.4
	F1	25	1458	55	102.2	14	130	18.2	16.1
	G2	25	1741	64	152.1	10	120	19.0	18.0
	F3	25	2018	66	-	10	130	18.8	18.1
	G4	25	2400	120	207.0	14	360	19.8	16.3
	F7	26	0920	184	260.7	10	270	21.4	21.0
	E6	26	1447	100	173.0	5	290	20.9	21.0
	D5	26	1725	60	91.2	4	210	19.4	20.7
	E4	26	2045	48	97.7	8	200	18.5	19.0
	D3	27	0243	54	106.0	10	220	18.4	19.1
	C4	27	0930	53	84.5	-	-	19.2	22.4
	B5	27	1414	28	71.6	9	160	19.9	22.3
	A4	27	2020	25	82.7	10	180	19.9	21.2
	B3	28	0408	32	110.3	12	155	19.7	20.9
	A2	28	0634	26	75.3	12	140	19.7	21.9
		Oct.							
D-74-13	C2	23	1015	34	85.7	15	290	14.3	14.5
	D1	24	0703	29	82.8	18	25	14.1	18.4
	F1	24	2005	50	109.1	3	180	14.6	10.7
	G2	24	2145	60	166.4	5	180	14.6	10.3
	E2	25	0123	42	101.5	8	175	13.8	11.2
	D3	25	0720	40	113.0	8	200	13.9	13.1
	F3	25	1455	55	110.1	25	210	14.8	17.7
	G4	26	0535	160	206.2	14	355	15.4	13.9
	F5	26	1125	108	163.7	15	330	15.0	12.4
	F7	26	1530	163	295.6	16	344	16.5	16.4

TABLE 2. (continued)

Cruise	Sta.	Date	61-cm, 0.505-mm mesh bongo tow: Start Time (EST)	Max. Depth (m)	Volume Filtered (m^3)	Wind: Speed (knots)	Wind: Direction (°T)	Temperature (°C): Surface	Temperature (°C): Air
		July							
AT-75-7	A2	7	2045	29	107.3	7	135	21.7	21.8
	C2	8	0214	28	80.7	5	360	20.6	21.3
	D1	8	0600	20	110.1	10	25	20.6	20.3
	F1	9	0725	40	119.9	10	225	18.2	23.1
	E2	9	1220	44	100.0	-	-	20.9	23.7
	D3	9	1716	38	90.6	10-15	105	22.0	21.4
	C4	9	2045	44	85.6	15	225	21.6	22.4
	B5	10	0035	34	111.7	15	225	22.3	22.3
	C6	10	0345	63	90.2	10	225	20.8	21.8
	D5	10	0713	58	98.9	5-10	225	21.0	22.2
	E4	10	1115	59	133.0	10	205	21.3	26.7
	F3	10	1635	43	308.9	5-10	105	20.1	22.8
	G2	10	2124	63	114.54	10-15	225	20.3	21.2
	G4	11		NO BONGO		15-20	155	18.6	21.1
	F5	11	1135	92	153.6	10-15	105	20.0	22.8
	E6	11	1503	72	194.3	10-15	105	21.0	23.1
	F7	11	1902	180	359.3	10	105	20.8	22.7
	G6	11	2244	180	240.4	10-15	105	21.6	22.2
	B3	12	1515	17	111.4	10-15	225	21.7	22.1
	A4	12	2057	11	66.8	15	105	21.8	22.4
		Aug.							
AT-75-8	A2	12	1955	29	77.4	10	225	23.0	24.6
	B3	12	2335	36	104.0	5	225	22.9	23.5
	C2	13	0245	33	79.8	5	-	22.0	22.8
	D1	13	0600	34	68.5	5	-	21.3	22.2
	F1	13	1835	43	82.9	-	-	23.3	24.7
	E2	14	0625	41	91.9	15-20	255	22.0	22.7
	D3	14	0947	43	74.7	-	-	22.7	24.1
	C4	14	1250	33	64.5	15	255	22.9	25.0
	D5	14	1600	56	108.7	15	255	24.8	30.6
	E4	14	1900	46	119.4	15	255	23.6	26.2
	F3	14	2220	63	120.7	5	225	23.1	23.6
	G2	15	0115	53	114.8	-	-	22.8	22.4
	G4	15	0545	135	249.7	0	-	21.0	21.6
	F5	15	1505	125	175.1	5	360	24.5	25.3
	G6	15	1810	202	281.2	5-10	360	25.0	27.5
	F7	15	2130	202	289.5	5-10	90	25.1	24.2
	E6	16	0050	125	178.1	5	90	24.2	23.7
	C6	16	0505	49	91.4	5	90	24.7	23.9
	B5	16	0755	32	52.2	10	155	23.6	24.9
	A4	16	1018	24	106.8	15-20	105	23.1	22.9
		Sept.							
D-75-14	A2	8	1856	24	78.1	15	180	21.1	21.1
	C2	9	0945	32	85.0	15	310	19.3	19.4
	D3	9	1220	48	112.4	15	300	20.5	23.8
	E2	9	1905	49	88.8	1	310	19.1	18.9
	D1	9	2231	23	64.5	18	315	19.4	17.2
	F1	11	0430	49	115.8	10	235	18.3	17.2
	G2	11	0915	72	91.9	8	225	18.7	19.4
	F3	11	1523	66	69.6	15	180	19.8	18.9
	E4	11	1925	66	92.8	18	170	19.6	18.9
	G4	12	1440	143	105.9	22	180	18.3	21.1
	F5	12	1940	114	120.4	20	180	19.5	21.1
	F7	13	0008	210	249.4	18	315	21.0	21.1
	E6	13	1805	126	108.0	10	310	19.4	17.2
	D5	14	0230	58	98.4	22	320	19.7	15.6
	C6	14	0535	57	94.2	18	340	19.9	14.4
	C4	14	1527	52	91.3	16	325	19.7	14.4
	B5	14	1800	31	66.9	10	340	18.5	16.1
	A4	14	2230	19	72.0	-	-	19.6	16.7
	B3	15	0137	41	79.7	16	30	18.3	15.6

TABLE 2. (continued)

Cruise	Sta.	Date	61-cm, 0.505-mm mesh bongo tow: Start Time (EST)	Max. Depth (m)	Volume Filtered (m^3)	Wind: Speed (knots)	Wind: Direction (°T)	Temperature (°C): Surface	Temperature (°C): Air
	E6	26	2010	87	236.9	10	250	15.7	13.8
	C6	27	0107	55	95.7	18	255	14.0	13.4
	D5	27	0355	56	129.5	25	295	14.0	15.1
	E4	27	0810	39	127.9	20	270	14.7	15.6
	C4	27	1250	40	91.7	20	270	14.3	18.3
	B5	27	1528	37	103.4	12	260	14.3	17.2
	A4	27	1810	20	79.7	8	280	14.1	16.6
	B3	28	0417	34	100.7	8	85	14.1	12.4
	A2	28	0820	28	83.9	12	45	14.0	16.4
		Nov.							
D-74-15	C2	19	0805	27	126.8	11	270	11.9	11.1
	D1	19	1332	29	80.7	8	180	11.9	16.9
	F1	20	0755	50	157.8	15	170	12.8	13.9
	E2	20	1135	52	129.0	12	170	12.9	15.5
	D3	20	1414	51	147.5	16	165	12.7	15.2
	E4	20	2155	55	122.3	8	225	13.1	15.4
	B3	22	2330	48	80.6	18	345	12.0	6.3
	C4	23	0300	67	155.3	16	360	12.4	4.8
	F3	23		NO BONGO		5	360	12.2	6.5
	F5	23		NO BONGO		4	315	13.2	7.2
	E6	24		NO BONGO		14	220	13.4	10.0
	D5	24		NO BONGO		-	-	12.7	-
	B5	24		NO BONGO		20	205	11.8	13.3
	A4	24		NO BONGO		-	-	12.4	-
	A2	24		NO BONGO		8	225	10.9	12.2
		Feb.							
D-75-1	C2	1	0800	31	117.6	8	20	5.7	2.8
	D1	1	1630	21	95.0	8	320	4.4	1.7
	F1	2	0318	29	122.7	15	20	5.4	.0
	E2	2	0915	37	106.6	12	45	6.5	1.7
	D3	2	1155	51	108.3	10	45	8.1	1.1
	G2	2	1842	43	68.0	12	355	6.7	1.1
	F3	2	2309	58	135.9	15	340	8.3	2.8
	G4	3	1237	137	256.3	20	310	7.2	2.2
	E4	3	2115	64	159.4	30	325	8.8	1.1
	D5	4	0040	62	112.2	18	90	9.0	4.4
	F5	4	0637	112	286.1	10	30	9.8	.0
	E6	4	1112	120	220.5	10	20	10.4	2.2
	F7	4	1412	204	345.0	12	40	12.5	1.7
	C6	4	2055	61	107.8	15	80	8.3	4.4
	C4	5	0547	47	111.0	28	125	7.8	7.2
	A4	6	0030	21	79.9	2	210	6.0	4.4
	B3	6	0805	47	87.7	22	265	5.7	3.9
	A2	6	2013	27	91.2	10	225	5.5	5.6
		Mar.							
C-75-3	A2	5	1110	19	70.3	5	280	4.3	3.4
	B3	5	1435	31	106.5	10	250	5.7	6.9
	A4	5	2050	24	89.6	10	260	5.1	4.3
	B5	6	0008	34	101.0	8	205	6.4	4.6
	C6	6	0334	58	101.4	7	210	7.7	6.1
	D5	6	0700	66	120.1	9	160	8.3	6.9
	E6	6	1040	120	202.8	8	145	7.9	13.8
	F7	6	1445	204	296.1	5	200	7.9	8.3
	F5	6	2030	124	154.5	8	215	8.5	9.3
	E4	7	0015	47	93.1	9	290	7.7	8.9
	D3	7	0405	54	94.9	3	180	7.6	8.6
	C4	7	0816	51	100.7	10	105	7.2	8.8
	C2	7	1225	31	69.7	10	80	4.8	8.1
	F1	10	1221	52	97.5	6	270	5.3	6.4
	G2	10	1544	72	122.8	8	25	6.5	6.1

TABLE 2. (continued)

Cruise	Sta.	Date	61-cm, 0.505-mm mesh bongo tow: Start Time (EST)	Max. Depth (m)	Volume Filtered (m^3)	Wind: Speed (knots)	Wind: Direction (°T)	Temperature (°C): Surface	Temperature (°C): Air
	F3	10	1923	68	129.3	4	130	7.0	3.1
	E2	10	2305	50	96.7	3	25	6.5	4.1
	D1	11	0216	27	104.3	14	90	4.6	2.5
		Apr.							
A-75-4	C2	2	0225	34	122.7	6	45	4.6	4.8
	D1	2	1110	33	77.2	6	45	5.0	5.2
	F1	2	2125	46	160.9	8	135	5.3	5.1
	E2	3	0223	50	78.3	15	135	5.8	6.4
	B3	6	0620	37	93.4	-	315	4.7	2.4
	G4	7	1337	120	241.5	20	315	6.8	5.5
	F5	7	2100	122	221.6	25	315	7.5	5.1
	E4	8	0320	60	159.4	-	-	6.0	2.4
	E6	8	1407	118	247.9	15	315	7.5	2.7
	F7	8	1611	224	346.0	15	315	7.9	3.9
	C6	9	0200	58	87.0	15	315	7.1	3.3
	D5	9	0800	60	114.6	12	340	6.6	4.2
	D3	9	1305	40	83.3	15	315	5.7	4.7
	C4	9	1750	26	114.6	7	270	6.2	6.5
	B5	9	2210	22	105.4	8	270	6.1	6.1
	A4	10	0120	19	128.6	12	360	5.0	3.7
	B3	10	0347	34	93.4	-	315	5.4	2.2
	A2	10	0800	25	66.0	-	-	4.8	3.0
		May							
D-75-5	A2	6	0528	19	102.2	6	270	8.4	10.5
	C2	7	0415	40	94.5	15	85	7.8	9.3
	D1	7	1448	15	84.7	15	235	8.3	12.8
	E2	7	2314	51	108.2	6	40	8.0	10.6
	F1	8	0305	50	99.4	8	125	7.7	9.6
	D3	8	2240	44	95.2	10	150	8.2	11.3
	G2	9	0510	59	132.8	5	180	7.8	10.5
	F3	9	0749	68	136.8	0	-	8.2	11.5
	G4	9	1916	132	224.4	8	125	9.5	12.7
	E4	10	0314	62	117.2	2	150	8.7	10.8
	F5	10	1031	118	229.0	6	90	9.5	15.7
	F7	10	1653	210	359.0	5	70	12.0	18.5
	E6	10	2158	112	153.4	6	70	9.3	11.7
	D5	11	0323	61	110.7	5	140	10.2	10.3
	C6	11	0728	56	103.3	5	140	10.0	15.3
	B5	11	0959	35	81.6	10	180	10.5	14.8
	C4	11	1638	56	106.9	7	190	10.6	14.1
	A4	11	2319	21	67.6	-	-	10.9	12.4
	B3	12	0919	37	95.8	10	180	12.0	16.3
		June							
D-75-6	D1	3	1523	27	76.1	10	190	16.0	18.3
	F1	4	1624	55	104.5	8	325	15.9	21.5
	G2	4	1856	64	122.6	10	270	16.5	18.4
	E2	5	0015	51	97.6	5	315	16.5	16.8
	C2	5	0406	32	82.8	6	110	16.9	16.8
	C4	5	1238	55	127.5	20	100	16.6	19.8
	D3	5	1918	33	102.6	18	110	15.9	17.0
	F3	6	0338	70	91.5	10	190	15.1	17.8
	G4	6	1443	137	231.9	12	225	17.5	18.3
	E4	7	0025	68	111.1	14	225	16.0	16.8
	F5	7	0400	112	205.4	16	225	15.0	16.8
	E6	7	0945	108	195.5	12	270	16.4	20.2
	F7	7	1400	-	316.7	10	265	18.4	21.4
	C6	7	2142	66	87.1	12	270	17.4	19.0
	D5	8	0135	67	153.0	16	300	16.8	18.1
	B5	8	0918	37	87.1	20	315	17.4	18.4
	A4	8	1757	20	82.7	8	10	17.2	26.0
	B3	9	1027	47	42.4	10	360	16.0	17.1
	A2	9	2042	21	83.8	6	135	16.6	15.1

TABLE 2. (continued)

Cruise	Sta.	Date	61-cm, 0.505-mm mesh bongo tow: Start Time (EST)	Max. Depth (m)	Volume Filtered (m^3)	Wind: Speed (knots)	Wind: Direction (°T)	Temperature (°C): Surface	Temperature (°C): Air
		May							
D-76-7	A2	17	1816	20	68.3	8	202	12.2	20.0
	A4	18	1935	23	93.0	18	338	13.8	14.0
	C2	21	0935	-	77.3	8	225	10.9	16.5
	D1	21	1226	26	73.8	12	202	9.8	18.1
	E2	21	1520	37	83.2	5	135	11.5	13.5
	G2	21	1900	71	94.6	10	248	11.7	22.0
	F1	21	2215	47	87.0	10	248	11.2	14.5
	F3	22	1128	70	97.3	10	248	12.3	17.5
	G4	22	1542	121	226.7	10	248	12.4	16.8
	G6	22	2110	225	296.1	10	225	13.4	14.5
	F7	23	0100	235	253.4	14	225	12.9	14.5
	E6	23	0910	126	167.9	5	23	12.2	17.2
	F5	23	1237	120	168.4	2	270	13.0	18.2
	E4	23	1526	59	90.9	12	248	13.2	15.4
	D5	23	1815	61	81.9	7	202	13.5	14.0
	C6	23	2100	52	72.0	8	202	13.6	14.0
	B5	23	2351	31	145.4	6	293	13.3	14.0
	C4	24	0245	49	109.6	8	360	12.5	14.3
	D3	24	0535	43	101.8	10	360	12.4	12.5
	B3	24	0935	35	87.9	6	-	12.8	15.0
	A4	24	1212	18	83.0	4	45	13.9	15.0
	A2	24	1640	23	93.7	8	113	13.5	15.0
		June							
D-76-10	A2	9	1137	31	86.5	1	180	16.5	25.0
	A4	9	1544	23	93.5	10	200	19.0	25.5
	B3	9	1838	39	125.3	13	210	19.0	24.0
	C2	9	2140	33	88.0	12	225	15.7	21.0
	D3	10	0052	46	101.8	13	210	16.8	19.0
	C4	10	0355	46	111.3	11	230	16.7	19.4
	B5	10	0706	32	94.0	8	225	16.4	20.5
	C6	10	1004	62	100.6	12	202	15.9	20.0
	D5	10	1315	61	114.1	12	202	16.4	22.4
	E4	10	1642	64	116.4	14	215	16.1	21.4
	F5	10	1951	129	220.0	16	210	15.5	18.0
	E6	10	2346	118	208.5	15	202	16.2	18.5
	F7	11	0320	215	340.6	15	225	17.6	17.8
	G6	11	1040	218	335.0	16	225	17.6	22.0
	G4	11	1603	142	239.3	16	225	14.9	18.5
	F3	11	2027	64	115.0	18	225	15.9	18.0
	G2	11	2355	64	116.4	16	225	15.4	12.0
	F1	12	0307	46	99.0	22	225	15.6	17.0
	E2	12	0601	42	97.6	12	290	16.2	20.5
	D1	12	0852	22	98.9	18	338	15.5	20.5
	D1	13	0507	20	79.3	5	180	15.5	15.0
	C2	13	0753	32	79.0	15	170	15.8	20.0
	B3	13	1032	37	77.7	15	158	17.2	19.0
	A2	13	1319	26	86.5	14	180	16.5	20.5

* Ship code: D=R/V Delaware II, C= R/V Commonwealth, A= R/V Albatross IV, AT= R/V Atlantic Twin

NORTHEAST FISHERIES CENTER
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NUMBER	TITLE AND AUTHOR	DATE
1	Proceedings of a workshop on egg, larval and juvenile stages of fish in Atlantic coast estuaries, by Anthony L. Pacheco (editor).	August 1973
2	Diagnosis and control of mariculture diseases in the United States, by Carl J. Sindermann (editor).	December 1974 (out of print)
3	Oxygen depletion and associated environmental disturbances in the Middle Atlantic Bight in 1976 (composite authorship).	February 1977 (out of print)
4	Biological and fisheries data on striped bass, Morone saxatilis (Walbaum), by W. G. Smith and A. Wells.	May 1977 (out of print)
5	Biological and fisheries data on tilefish, Lopholatilus chamaeleonticeps Goode and Bean, by Bruce L. Freeman and Stephen C. Turner.	May 1977
6	Biological and fisheries data on butterfish, Peprilus triacanthus (Peck), by Steven A. Murawski, Donald G. Frank, and Sukwoo Chang.	March 1978
7	Biological and fisheries data on black sea bass, Centropristis striata (Linnaeus), by Arthur W. Kendall.	May 1977
8	Biological and fisheries data on king mackerel, Scomberomorus cavalla (Cuvier), by Peter Berrien and Doris Finan.	November 1977 (out of print)
9	Biological and fisheries data on Spanish mackerel, Scomberomorus maculatus (Mitchill), by Peter Berrien and Doris Finan.	November 1977
10	Biological and fisheries data on Atlantic sturgeon, Acipenser oxyrhynchus (Mitchill), by Steven A. Murawski and Anthony L. Pacheco.	August 1977

NUMBER	TITLE AND AUTHOR	DATE
11	Biological and fisheries data on bluefish, *Pomatomus saltatrix* (Linnaeus), by Stuart J. Wilk.	August 1977 (out of print)
12	Biological and fisheries data on scup, *Stenotomus chrysops* (Linnaeus), by Wallace W. Morse.	January 1978
13	Biological and fisheries data on northern searobin, *Prionotus carolinus* (Linnaeus), by Susan C. Roberts.	June 1978
14	A guide for the recognition of some disease conditions and abnormalities in marine fish, by Carl J. Sindermann, John J. Ziskowski, and Valentine T. Anderson.	March 1978
15	Ichthyoplankton from the RV *Dolphin* survey of continental shelf waters between Martha's Vineyard, Massachusetts and Cape Lookout, North Carolina, 1965-66, by P. L. Berrien, M. P. Fahay, A. W. Kendall, Jr., and W. G. Smith.	March 1978
16	The seasonal maxima of *Ceratium tripos* with particular reference to a major New York Bight Bloom.	August 1978
17	Biological and fisheries data on American eel, *Anguilla rostrata* (LeSueur), by Michael P. Fahay.	August 1978
18	New York Bight ichthyoplankton survey - procedures and temperature and salinity observations, by Myron J. Silverman and Arthur W. Kendall, Jr.	August 1978