COLIFORM AND METAL CONCENTRATIONS IN SEDIMENTS FROM THE ATLANTIC AND LONG BEACH AREA - NEW YORK BIGHT, JANUARY 15-17, 1974

U.S. DEPARTMENT OF COMMERCE
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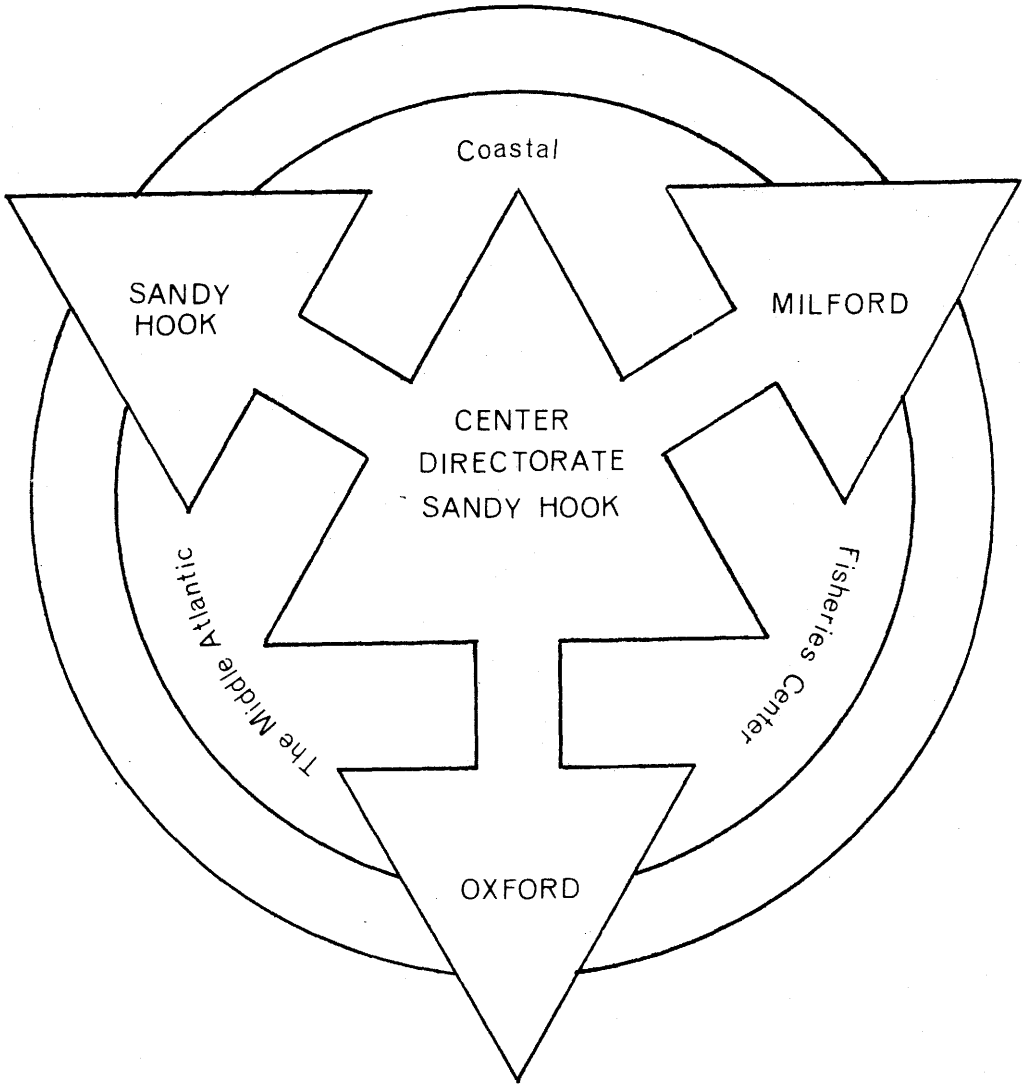
Northeast Region

MIDDLE ATLANTIC COASTAL FISHERIES CENTER



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Coliform and Metal Concentrations in Sediments from the Atlantic and Long Beach Area - New York Bight, January 15-17, 1974.

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INTRODUCTION

The following account represents the information obtained on coliform counts and heavy metal burdens in sediments by the Environmental Microbiology and Chemistry Investigation of the Middle Atlantic Coastal Fisheries Center (NMFS). The study was a collaborative effort of several agencies to assess the status of water and sediment quality near the shores of Atlantic and Long Beach (Long Island) New York on January 15, 16, 17, 1974. A major objective of this study was to determine if sewer sludge was indeed migrating from the existing dumping site in the New York Bight.

MATERIALS AND METHODS

1. Collection and Handling of Samples

The bottom sediments were obtained using a Smith-McIntyre dredge. For bacterial studies the top centimeter was removed with a sterile tongue depressor and placed in a sterile 8 oz. French square bottle. The sample represented approximately 100 cm^2 of the surface area of the sediment. The samples were refrigerated and examined within 24 hours for this study. However, some previous studies showed that sediments for coliform counts could be refrigerated for several days at 4^oC without any appreciable effect on the coliform count.

For the chemical analysis a core was extruded from an undistributed portion of the grab by means of a 35 mm diameter polyethylene plastic tube, capped, refrigerated and then frozen until time for chemical analysis.

Sediment samples were obtained from all stations for chemical analysis. Samples were not obtained at all stations for bacterial analysis because of limitations on the number of samples that could be effectively analyzed in this short period of time by the Microbiology team.

II. Analysis for Coliform Bacteria

The procedure used for determining total coliform (confirmed) and fecal coliform MPN follows the procedures as outlined in Standard Methods of the Examination of Water and Waste Water, 13th edition, except for changes to make them applicable to the examination of bottom sediments.

The initial dilution of sediment is made by adding the sample to 100 ml of 0.5% sterile peptone contained in an 8 oz. French square bottle until it reaches a precalibration mark of 200 ml. The bottle is weighed in order to approximate the specific gravity of the sediment as a reference point in identifying the sediment type. After thoroughly shaking, appropriate dilutions are made for inoculation of the media. For this study the 5 tube MPN technique was employed. The results by this procedure are expressed as the number of coliforms per 100 ml of sediment.

III. Analysis for Metals in Sediments

The analysis of metals in sediments was a procedure developed and employed by the Environmental Protection Agency (Great Lake Region, Committee on Analytical Methods). The method is briefly outlined as follows: A 1-1/2 inch section is obtained from the top of the core. The sediment is dried at 60°C for 48 hours. Nitric acid and hydrogen peroxide are added to the sample followed by heating at 200-250°C until a dry residue is obtained.

The residue is then taken up with a mixture of nitric and hydrochloric acid, ammonium chloride and calcium nitrate. The solution is filtered, diluted to the desired volume and analyzed by means of a Perkin Elmer 403 atomic absorption spectrophotometer. The results are expressed as ppm of the metal per dry weight of sediment.

RESULTS

Sediment Types

The station numbers sampled for this study appear in Figure 1 and the coordinates are listed in Table 1. Samplings were obtained by a member of the Investigation aboard the R/V RORQUAL.

Except for the samples from station 24, 25, and 19 the bottom sediments were of a sandy type. Sediments from station 24 and 25 were of a sandy type with a small amount of black sediment intermixed. The sediment from station 19 was uniformly black but did not appear to be sewage sludge.

Coliform Counts

The data, both on the total and fecal MPN counts in the top layer of the sediments,are tabulated in Table 2. The distribution as related to station numbers for total coliform counts and fecal coliform counts are present in Figures 2 and 3, respectively.

As can be seen, the distribution of total coliform counts does not correlate with the fecal coliform count, with one possible exception at station 19. Here both the total and fecal coliform counts were high. The total coliform count increased in the sediments obtained on the transects away from the beach area. However, the fecal coliform MPN count did

not show a similar tendency. The fecal coliform count in the sediments from both the in-shore and off-shore stations were quite similar. The significance of the total coliform count in the sediments is unknown. The relationship between total coliform and fecal contamination in marine sediments has not been established.

The distribution of the fecal coliforms in the sediments as presented in Figure 3 does not indicate that the wastes from the sewage sludge disposal site are causing fecal contamination of the area surveyed. Previous studies have shown the specificity of the fecal coliform MPN procedure for detecting coliforms of fecal origin in marine sediments.

Metal Concentrations in the Sediments

The results of the analysis for the seven heavy metals, silver, cadmium, chromium, copper, nickel, lead, and zinc, in sediments from the 31 stations are presented in Table 3. The concentrations of zinc and chromium in sediments from each station are presented as isopleths in Figures 4 and 5, respectively. The concentrations of the other heavy metals were not of sufficient magnitude or were below our levels of detection for this type of presentation.

The highest levels of metals were found in the sediment from station 19. Copper, chromium, lead, and zinc concentrations in the sediments from this station ranged from 100-155 ppm. The level of nickel was 27 ppm. Silver and cadmium were at 3-4 ppm. The next highest level of metal concentration was in the sediment obtained from station 24. However, the concentrations were much lower, being one-fourth to one-sixth that observed in the sediment from station 19.

The distribution of zinc and chromium in the sediments from all stations as evident from the figures was similar. The lowest concentration of the metals appears to be in sediments from station sampled nearest the coast. The concentrations of the other heavy metals were in most cases below detectable levels by our techniques so distribution patterns could not be attempted.

For comparative purposes of a proximate geographical area, the levels of metals found in the sediments from all stations with the exception of station 19, were of the same order of magnitude as we observed in sediments obtained in a previous study from Gardner's Bay, Long Island.

The data, both on coliform numbers and metal concentrations, were observed to be highest from station 19. The sediment was unique in that it differed from that obtained from the other stations. Unfortunately, other stations were not sampled peripheral to this station so that a distribution pattern of coliforms and heavy metals for this sediment type could not be established for this area.

FUTURE CONSIDERATIONS

The limited information demonstrates the need for a more comprehensive survey to definitely locate the sources of fecal contamination and heavy metal concentrations especially on radial transects to peripheral areas from the center of dumping and in-shore-bay areas. It would again need to be a cooperative effort to examine both the water column and sediment for coliforms and for select heavy metals.

Table I. Station Coordinates

Station Number	
	West to East
1.	40°34.75'N, 73°46.00'W
2.	40°34.75'N, 73°45.00'W
3.	40°34.75'N, 73°44.00'W
4.	40°34.75'N, 73°43.00'W
5.	40°34.75'N, 73°42.00'W
6.	40°34.75'N, 73°41.00'W
7.	40°34.75'N, 73°40.00'W
	South and then West
8.	40°34.50'N, 73°40.00'W
9.	40°34.50'N, 73°41.00'W
10.	40°34.50'N, 73°42.00'W
11.	40°34.50'N, 73°43.00'W
12.	40°34.50'N, 73°44.00'W
13.	40°34.50'N, 73°45.00'W
14.	40°34.50'N, 73°46.00'W
	South and then East
15.	40°34.00'N, 73°46.00'W
16.	40°34.00'N, 73°44.00'W
17.	40°34.00'N, 73°42.00'W
18.	40°34.00'N, 73°40.00'W
19.	40°34.00'N, 73°38.00'W
	South and then West
23.	40°33.00'N, 73°40.00'W
22.	40°33.00'N, 73°42.00'W
21.	40°33.00'N, 73°44.00'W
20.	40°33.00'N, 73°46.00'W
	South and then East
24.	40°32.00'N, 73°46.00'W
25.	40°32.00'N, 73°44.00'W
26.	40°32.00'N, 73°42.00'W
27.	40°32.00'N, 73°40.00'W
	South and then West
31.	40°31.00'N, 73°40.00'W
30.	40°31.00'N, 73°42.00'W
29.	40°31.00'N, 73°44.00'W
28.	40°31.00'N, 73°46.00'W

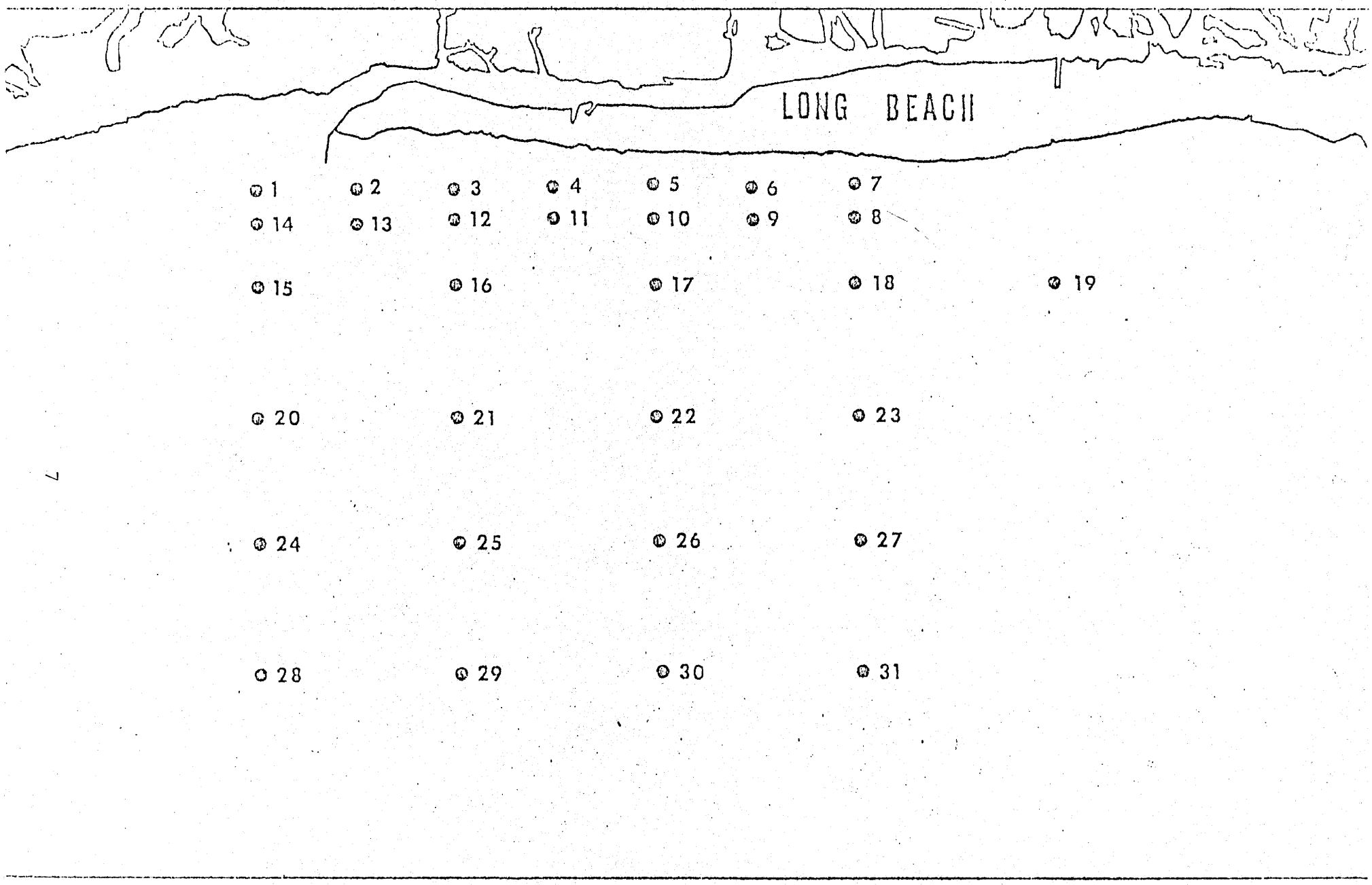

Figure 1. Station Numbers Sampled.

Table 2. Distribution of coliforms in top layer of sediments - Long Beach Area, New York Bight

Stations	Coliforms/100 ml Sediment	
	Total	Fecal
1	460	79
3	240	8
5	240	2
8	330	79
9	330	33
10	330	17
12	270	33
15	130	13
16	490	16
17	790	17
19	3,330	330
20	790	11
21	790	11
22	790	13
24	330	13
25	4,900	8
26	1,090	7
28	4,900	79
29	7,900	33
30	1,090	13

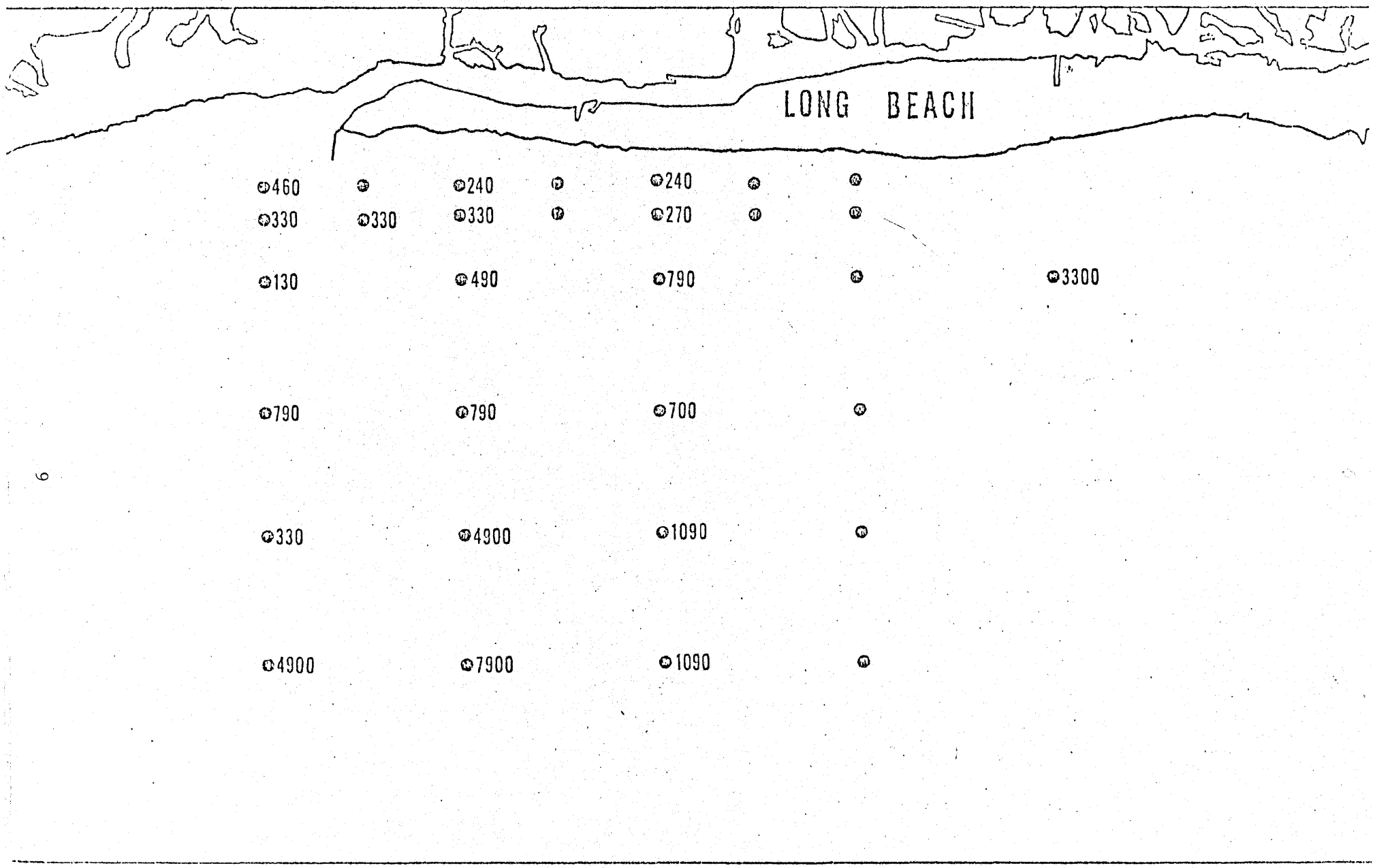

Figure 2. Distribution of Total Coliforms/100 ml Sediment

Table 3. Trace Metal Concentrations in Top Layer of Sediments from Long Beach Area--New York Bight

Station	Ag	Cd	Cr	Cu	Ni	Pb	Zn
	Concentration of Metal* ppm dry weight						
1	< 1	< 1	4.1	< 4	< 2	< 6	7.6
2	< 1	< 1	7.0	< 4	< 2	7.0	15.1
3	< 1	< 1	2.7	< 4	< 2	< 6	10.2
4	"	"	5.8	"	"	8.0	16.0
5	"	"	6.5	"	"	6.0	14.0
6	"	"	2.9	"	"	< 6	9.7
7	"	"	1.0	"	"	< 6	3.2
8	"	"	2.8	"	"	< 6	9.8
9	"	"	16.1	12.1	4.5	17.3	29.3
10	"	"	3.1	< 4	< 2	< 6	13.8
11	"	"	2.2	< 4	2.9	< 6	7.5
12	"	"	6.9	< 4	3.7	8.0	19.6
13	"	"	6.0	"	2.4	< 6	14.3
14	"	"	3.7	"	< 2	< 6	6.7
15	"	"	6.7	"	3.4	8.0	19.3
16	"	"	3.9	"	< 2	< 6	12.7
17	"	"	4.3	"	2.8	< 7	18.0
18	"	"	4.7	"	2.6	< 6	15.6
19	3.7	3.0	102.	108.	26.7	130.	155.
20	< 1	< 1	7.7	< 4	3.0	11.0	28.7
21	< 1	< 1	4.9	< 4	2.0	< 6	11.2
22	< 1	< 1	11.8	< 4	4.5	17.0	32.0
23	"	"	8.2	"	2.9	11.0	27.0
24	"	"	17.1	8.5	4.9	25.0	43.5
25	"	"	11.2	4.9	4.0	12.0	30.0
26	"	"	7.5	< 4	3.3	8.0	25.0
27	"	"	4.0	< 4	< 2	6.0	13.0
28	"	"	14.0	9.1	5.7	15.0	29.5
29	"	"	10.7	4.6	2.8	14.0	28.7
30	"	"	9.5	< 4	3.4	13.0	27.0
31	"	"	4.6	< 4	3.2	< 7	20.0

*Average of duplicate analyses.

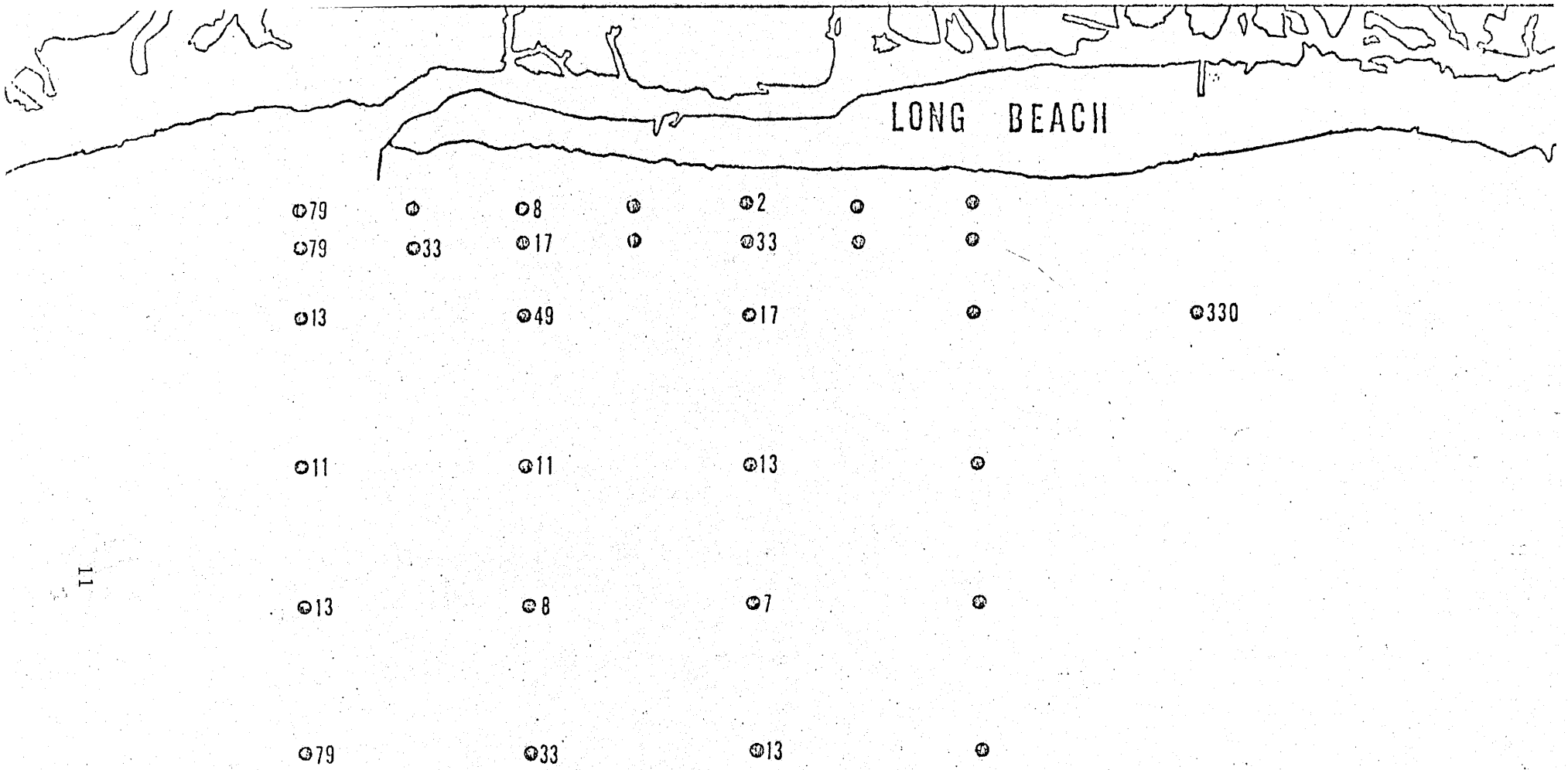

Figure 3. Distribution of Fecal Coliforms/100 ml Sediment

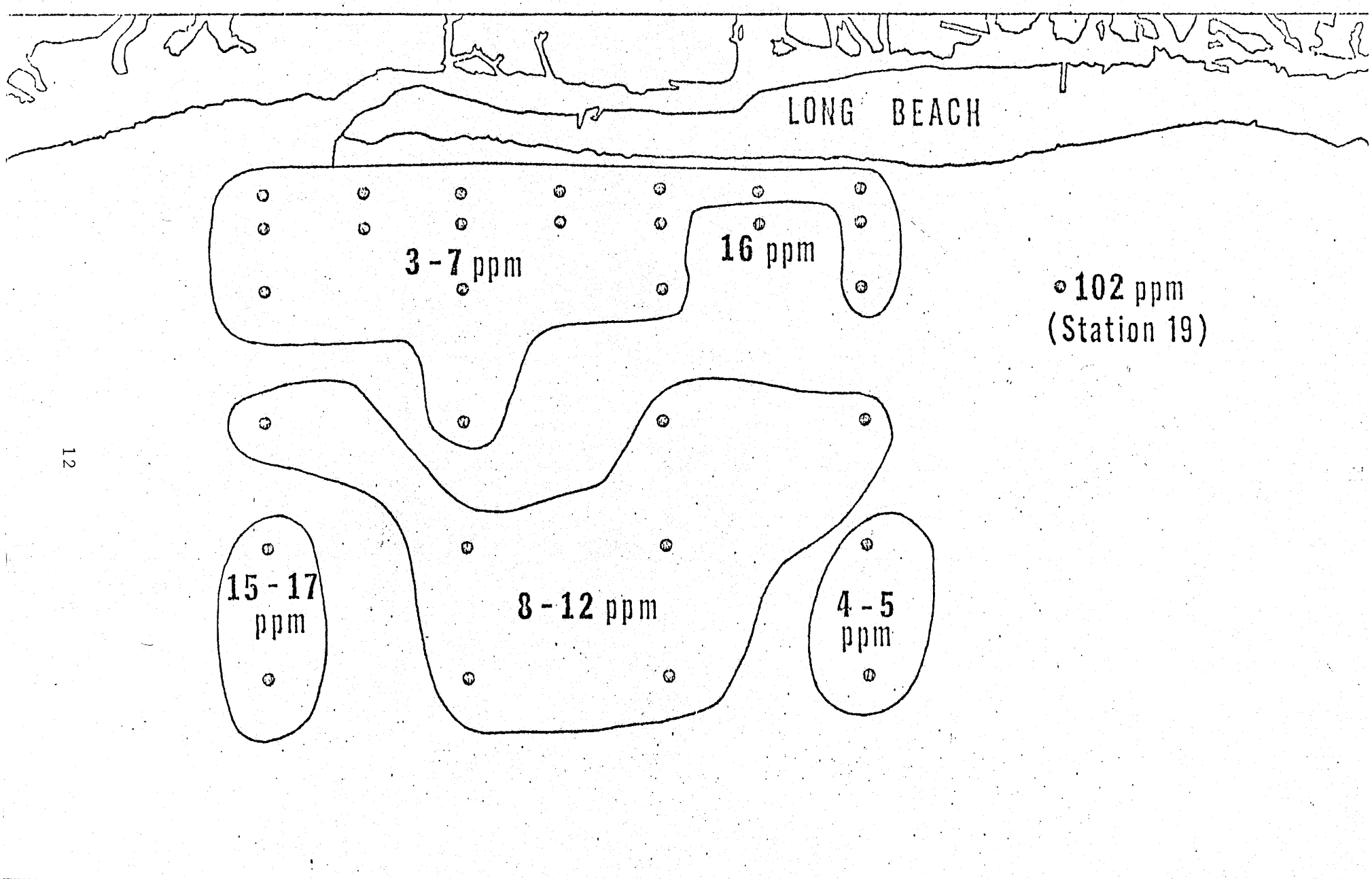

Figure 4. Levels of chromium in top layers of sediments (dry weight) from Long Beach Area--New York Bight.

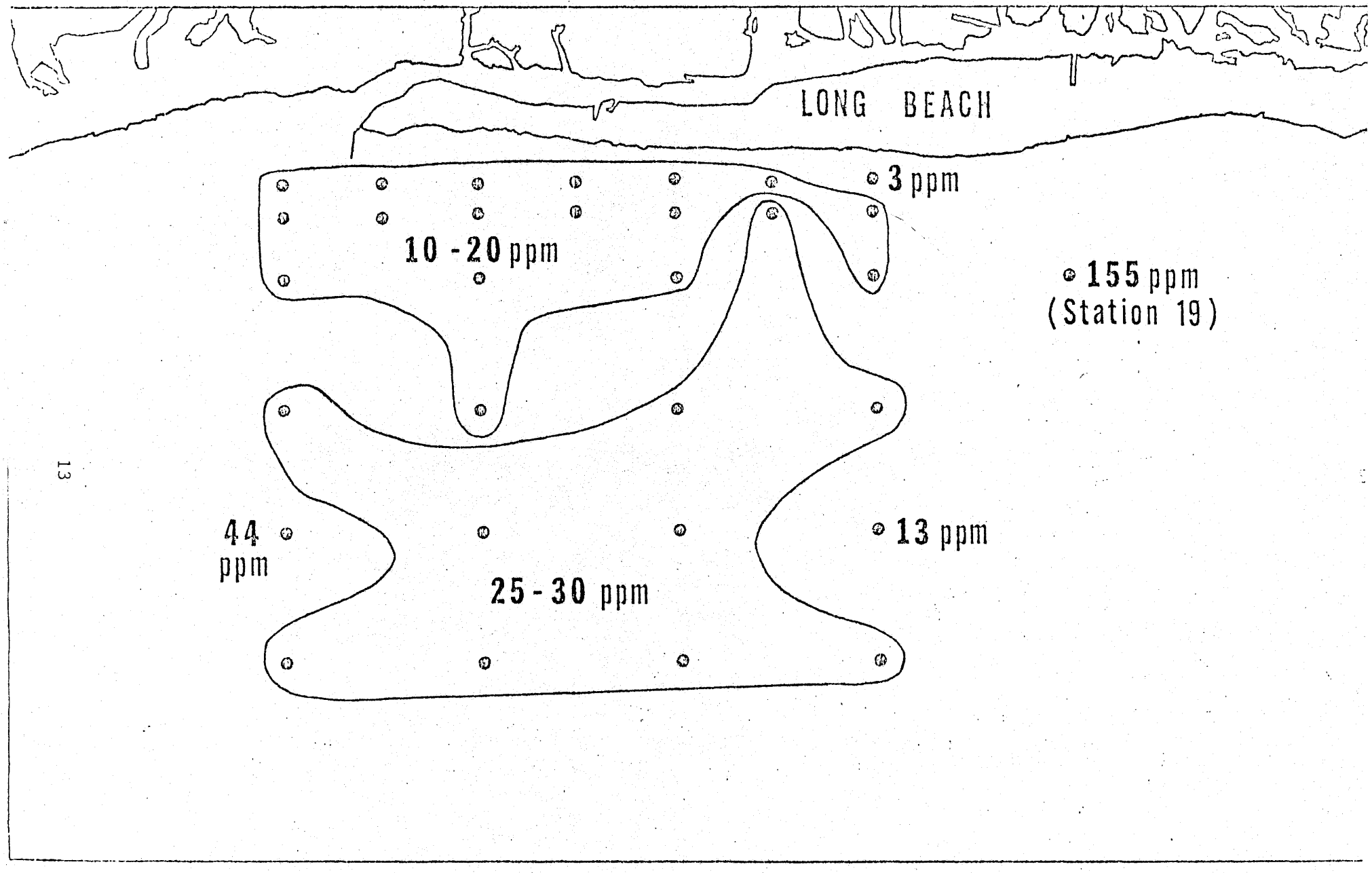

Figure 5. Levels of zinc in top layer of sediments (dry weight) from Long Beach Area--New York Bight.