

LONG ISLAND SOUND ESTUARINE STUDY
HISTORICAL DATA ANALYSES
FOR
TOXIC CONTAMINANTS IN THE WATER COLUMN

DRAFT

PREPARED BY

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INTRODUCTION

Long Island Sound is one of the nation's unique and irreplaceable resources. It is bounded on the north by the Connecticut and New York shorelines and on the south by Long Island. The Sound is surrounded by a large population which has placed various and extensive demands on its waters. There is a growing feeling that the conflicting demands are destroying the Sound and that appropriate measures should be taken before the situation worsens and/or becomes irreversible. In this regard, a comprehensive estuary program was initiated by US EPA in 1985.

The Interstate Sanitation Commission has been involved in various aspects of this program since its inception. One of the objects of the study was to evaluate the toxics contamination in the water column which might threaten the uses of the Sound. Several toxic substances have been identified as being of primary concern to the Sound, its biota and marine life and became an objective in the initial workplan. These are cadmium, copper, lead, mercury, polycyclic aromatic hydrocarbons (PAHs) and some halogenated hydrocarbons -- PCBs, chlordanes, dieldrin, and DDT and its metabolites.

A necessary first step in developing a pollution abatement strategy is the evaluation of historical data and establishment of current conditions. This report provides a reference resource of historical trends of toxics contamination and ongoing monitoring programs in the study area. To accomplish this ISC has:

- a) assembled an inventory of the historical data relevant to toxics from state and local agencies;
- b) identified and summarized the ongoing pollution abatement programs including the sampling frequency, sampling procedures, the pollutants monitored, and the area covered;
- c) performed preliminary data analysis to identify the potentially problematic pollutants and areas, if any, as the reference point for developing future toxics abatement strategies.

This report deals only with toxic contamination in the water column. Similar assessments of toxic contamination in fish tissue and sediments are being performed by other Long Island Sound Study participants. The results of these individual studies will be brought together to get an overall picture of the situation in the Sound.

Historical and Ongoing Toxics Datasets

In cooperation with the state and local agencies, ISC acquired the available water quality datasets within the study area. A preliminary review revealed that a majority of the datasets contain information only for conventional pollutants and that toxics data are extremely limited. Table 1 summarizes the datasets which contain toxics information for the parameters of interest.

As noted in Table 1 only four datasets have been computerized and are easily accessible. Because each study was designed to address different environmental issues and management strategies, the information contained in the datasets varies. Attempts to unify all information into one dataset and perform the analyses on a Sound-wide basis were not successful. The first four datasets, all computerized, were used for the analyses presented in this report.

METHODS OF DATA ANALYSES

The datasets used for analysis were retrieved from the US EPA STORET system at the National Computer Center (NCC). Various types of analyses were performed by utilizing various statistical programs available through STORET. Attempts to perform Sound-wide temporal analyses were hampered by unsatisfactory durations and frequencies of sampling. Furthermore, a serious deficiency in the spatial coverage of the monitoring stations did not allow broad characterizations of pollutant distributions to be made throughout the Sound. Numerous types of analyses were tried before it was decided that the following major guidelines would be used to present the historical data:

- a) The New York State Department of Environmental Conservation (NYS DEC) Ambient Water Quality Standards (Feb. 1986) were chosen as the reference for evaluation of the current estuarine waters because it is the only available source containing numerical values for each specific pollutant. Table 2 shows the current status of water quality criteria from several different regulatory agencies.

It should be noted that the NYS DEC adopted standards using the "acid soluble" form of the metals. The US EPA suggests that a measurement such as "acid-soluble" would provide a more scientifically correct basis upon which to establish criteria for metals. However, at this time, no EPA-approved methods for such measurements are available to implement these criteria. Until they become available, EPA recommends applying the criteria using "total recoverable analyses" which, in effect, will create more stringent criteria than if "acid-soluble" analyses were used.

- b) The data were grouped by monitoring station for trend analysis; further detailed groupings would be meaningless and possibly lead to wrong conclusions due to insufficient sampling frequencies and inconsistent periods of sampling. The actual division of concentration ranges were developed both by reviewing frequency distributions generated and by using the New York State Water Quality Standards.

c) Cumulative frequency distributions were used for analysis because they yield reasonable interpretations for small datasets especially for non-normal types of distributions.

The specific methodologies employed for each analysis are discussed later in this report.

RESULTS OF ANALYSIS

As previously mentioned, each dataset was generated from monitoring programs that were governed by sampling strategies based on different environmental management concerns. For instance, the Upper East River has been continuously monitored by the New York City DEP and the ISC for metals since 1974. Figures 3 to 6 show a marked difference between the two datasets. The metals data reported by NYC DEP show much higher values than those reported by ISC. This difference exists because the sampling procedures employed are not the same. NYC DEP takes water samples from both the surface and bottom and composites them before analysis; ISC samples the surface water only (five feet below the surface).

This type of data incompatibility differs even more upon examination of the intensive survey data taken by US EPA - Region II in 1970, in which the lowest detection limits reported for several metals were well above the prevailing water quality criteria. The inconsistencies among the datasets necessitated evaluations on the basis of individual datasets or specific regional zones, whichever was more appropriate.

Upper East River

The East River has a constant interchange with saline water at both ends via tidal currents. The term "strait" probably describes its nature more precisely. It is the connecting waterway between Upper New York Harbor and Long Island Sound. It is surrounded by four of the largest New York City treatment plants which discharge more than 700 million gallons per day of treated sewage.

The NYC DEP dataset contains 504 observations, of which 94 occurred in the Upper East River. The monitoring sites are listed in Table 3 and plotted in Figure 5. In the water column, metals were sampled once a year at each station. They are composites of surface (about 2 feet below the water surface) and bottom (about 2 feet above the bottom) samples, but no samples are taken more than 40 feet below the water surface.

Frequency distribution tables were generated for each metal using the NYC DEP Harbor Survey Data and are shown on Tables 4 to 7.

The cadmium concentrations predominately range from 0.5 ug/l to 5.0 ug/l. It was found that the water samples collected from this area had low cadmium content (all below 6.6 ug/l) except at Station E6 where a high value of 27 ug/l was measured in 1977. The median value is 1.3 ug/l.

Almost all of the copper values in the water column measured by NYC DEC exceeded the NYS DEC standards. The copper content ranges primarily from 20.0 ug/l to 200 ug/l with a median value of 62 ug/l. At Station E6, a high value of 260 ug/l was measured in 1974.

Lead concentrations were moderate to high based upon the criteria promulgated by NYS DEC in 1986. They are basically in the range of 8.6 ug/l to 120.0 ug/l with a median value of 38.5 ug/l. The highest lead concentration in this area, 850 ug/l, was detected at station E9 in 1975.

Mercury concentrations ranged from the lowest detection limit of 0.1 ug/l to 1.4 ug/l with the median value of 0.5 ug/l.

The Westernmost Long Island Sound

The Interstate Sanitation Commission water quality survey data was used to evaluate toxic contamination of the westernmost Sound east to Stamford, Connecticut. The surveys were continuously conducted since 1975 and the sampling locations are shown on Table 8 and Figure 6. The samples were taken five feet below the water surface and were analyzed for conventional pollutants (D.O., temperature, Coliforms, etc.), 10 selected metals, and 27 toxic halogenated hydrocarbons.

The dataset has two subsets -- one containing 1130 observations for metals and the other containing 94 observations for toxic organics. The dataset was first run through descriptive statistics analysis for each toxic pollutant to obtain frequency distributions. An appropriate concentration range table was developed for each toxic by checking with the New York State Marine Water Quality Standards. Concentration ranges were developed for each substance and frequency and percent of frequency tables were constructed using these ranges.

Tables 9 to 12 show the information for cadmium, copper, lead and mercury. Going down the tables, the stations are organized from west to east. The last character of the station name (N/S/M) denotes the relative station location "N" for "North Shore" (Westchester/Connecticut), "S" for "South Shore" (Nassau/Suffolk) and "M" for "Middle Channel" (Mid Long Island Sound).

From Table 9 it can be seen that 87.2 percent of the samples collected from the westernmost Long Island Sound met the NYS DEC "SA" classification standard of 2.7 ug/l for cadmium. The median value of cadmium concentrations is 1.0 ug/l.

Copper concentrations tended to be high in this area. The median value for copper is 12 ug/l and 91% of the samples occur in the range of 3.3 ug/l to 60 ug/l. Only 2.8 percent of the values fell below 2.0 ug/l, the NYS DEC "SA" classification for copper.

For lead (see Table 11), the median value is 10 ug/l, which is slightly over the NYS DEC standard of 8.6 ug/l for the "SA" classification standard.

The mercury concentrations showed little variation among the stations. The highest concentration measured was 1.8 ug/l at Station ER-09 in 1982 and at Station LI-31 and ER-15 in 1985. The median value is <0.1 ug/l which meets the NYS DEC guidance value for the "SA" classification.

Another subset of the ISC survey data is the only dataset found containing information on toxic halogenated hydrocarbons. Even this dataset, which was started in 1975, presently contains less than 100 observations for the 25 toxics shown on Table 13. The lack of a comprehensive database does not make an in-depth statistical analysis for toxics possible. After a review of the data, it was found that no toxic organics have been detected (all values below the instrumentation lowest detection limits - G.C. method) since 1975 within the westernmost Long Island Sound area, except dioctylphthalate and chlordane (see Table 13) -- both on U.S. EPA's list of priority pollutants. Dioctylphthalate is one of the additives (plasticizer) used during the polymer processing. More than 80% of samples analyzed for dioctylphthalate were found to be below the instrumentation lowest detection limit; the highest value measured was 187 ug/l at Station LI-25N in 1983. Chlordane was almost undetectable; however, it was found once at Station LI-25N with a value of 0.67 ug/l in 1981. Table 13 summarizes the toxic contaminants in the form of cumulative frequency distributions.

The Central and Eastern Sound

The U.S. EPA - Region II conducted three intensive water quality surveys in Long Island Sound from 1970 through 1973. The sampling stations are shown on Table 14 and plotted on Figure 7. Although the surveys have very good spatial coverage of the Sound, only four toxic pollutants were measured -- cadmium, copper, lead and mercury. Table 15 summarizes these survey results in chronological order.

In the mid-1970s, the U.S. Geological Survey began to annually publish the water resource data of the State of Connecticut. As the program proceeded, more monitoring sites were added and the database became more comprehensive. Currently, there are 39 sampling stations established along the major tributaries within the State of Connecticut. These stations are monitored for the conventional pollutants (DO, coliform bacteria, etc.), heavy metals, and selected toxic organics. The entire dataset, dating back to 1953, was retrieved from STORET. It was found that the majority of the monitoring stations are located too far upstream in the major rivers to be able to extrapolate their impact on the waters of Long Island Sound. Three stations were selected for use in this report: 01209910 in Stamford Harbor, 01308823 in the Housatonic River, and 01196656 in New Haven Harbor. Table 16 and Figure 8 outline the monitoring station locations and Table 17 shows the dates when sampling was conducted for metals. Although a representative temporal database was established for these stations, information for the total recoverable form of metals is limited. Tables 18 to 20 are the summaries of the frequency distributions for cadmium, copper and lead.

Other datasets which have the coverage of this area have been mentioned previously (see Table 1). The LILCO-Shoreham dataset has configured the metals contamination around the Herod Point Shoal and concluded that the bottom water is worse than the surface water. The Millstone Nuclear Power Station contains extensive information for copper and lead at Niantic Bay since 1971.

Pollutant Distributions by Geographic Area

The Upper East River is a very complex hydrologic system which has been studied under numerous projects in the past. It receives approximately 702 MGD of sewage (Farrow, D., November 1986, NOAA, The National Coastal Pollutant Discharge Inventory Estimates for Long Island Sound) from four large treatment plants. It receives water from the western Sound during ebb tide and discharges it back to the Sound during the flood tide.

To acquire a better understanding of the special distribution of toxics, the ISC harbor survey data was divided into three groupings based on the coastal county. Figure 9 shows the stations included in each area. Figures 10 to 13 show the 95th percentile values (95% of the data fell below or at that value) for cadmium, copper, lead, and mercury for each area. For all four parameters the highest 95 percentile values occur in the Upper East River and the values decrease going from west to east in Long Island Sound. The same pattern was further observed by plotting the cumulative percent of frequency vs. pollutant concentration (shown in Figures 14 to 17), where the Area 1 curves constantly fall below the curves for Areas 2 and 3. The higher values in Area 1 may, in part, be the result of long time pollutant accumulations in the sediments from the source loadings, which are being resuspended in to the water column. The higher pollutant concentrations in Area 1 can also be a result of greater pollutant loadings than those into Areas 2 and 3 and a much smaller hydrologic water volume and poorer dispersion compared to that for Area 2 or Area 3. Table 21 gives an estimation of the pollutant loadings for the three different areas and shows that the copper, lead and mercury loadings in Area 1 are approximately 9 times, 2 times and 18 times higher, respectively, than those for Area 2. If the source loading is the only factor considered, the pollutant concentrations in Area 2 and Area 3 are higher than expected. This could be the result of exchange of water among the three areas via the strong tidal action. However, the details of the mechanism of transport and the degree of influence are beyond the scope of this report and are being examined in the water quality and hydrologic modeling phases of this study.

The data was further divided into two groups for analyses of the longitudinal distributions of the pollutants in the westernmost portion of Long Island Sound. Group one, which is the Connecticut (Westchester/Connecticut) shore, contains stations LI-24, LI-25, LI-26, LI-27, LI-28 and LI-29; these stations are located within Westchester County, NY and Fairfield, County, Ct. Group two, which is the Long Island shore, includes stations LI-31, LI-32, LI-33 and LI-34 located in Nassau County, NY. The data set has 798 observations, 60% occurring along the Connecticut shore and 40% occurring along the Long Island shore. The data were first categorized into several different ranges of concentration for each pollutant before cumulative frequency distributions were generated for each shore (see Figures 18 to 21). Figure 18 shows that approximately the same percent of cadmium values are meeting the NYS DEC standard of 2.7 ug/l on both shores. However the Long Island shore appears to have slightly lower cadmium concentrations than does the Connecticut shore. For copper (see Figure 19) the concentrations along the Long Island shore are lower than those found along the Connecticut shore. Although slightly more lead values are meeting the NYS DEC standard along the Long Island shore (Figure 20) the concentrations of lead are approximately the same along both shores. The mercury concentrations along both shores are essentially the same (see Figure 21). The concentration patterns of these pollutants are primarily a combination of the effects of pollutant loadings and water circulation. Farrow (1986) provided an estimate of annual loadings for several metals, as indicated in Table 22. The loading patterns, though not proportionately related (which will never be possible for a circulating estuary), match the analyses very well. The magnitude of mercury loadings is relatively lower than others and, consequently, the contamination level has become nondistinguishable.

The ISC metals data were further examined regardless of geographic setting. Table 23 summarizes the ISC metals data for all three areas of western Long Island Sound. From the table it can be seen that, compared to the NYS DEC Criteria, copper values seem to be most the problematic and cadmium the least problematic. Lead and mercury values are meeting the criteria approximately 50 percent of the time.

Conclusions and Recommendations

Only six major datasets -- four of which are computerized -- containing data for toxic contaminants in the waters of Long Island Sound were available during the research phase of this project. The four computerized datasets have been integrated in to this report for examining the water quality of Long Island Sound relevant to toxics contamination. A basic objective of any water quality monitoring program is to document the conditions of a water body with sufficient resolution to support environmental management decision-making goals. Because a comprehensive toxics database does not exist for Long Island Sound, the conclusions drawn here must be considered as preliminary in nature and are subject to further verification.

- The existing historical data (collected since 1974) and current ongoing water quality monitoring programs have greatly emphasized the area of the extreme western portion of Long Island Sound, which is from Hell Gate in the East River to a line between Stamford, CT and Huntington, New York. There are a total of 29 established sampling stations (16 maintained by ISC, 12 by NYC DEP and 1 by CONN/USGS) within this area for monitoring the selected toxic pollutants. The area sampled comprises only about 20 percent of the total surface area of the Sound; extremely limited toxics data exist for the remaining 80 percent of Long Island Sound.

- During the past ten years' surveys, the toxic chlorinated hydrocarbons (see Table 13) were almost undetectable (lower than the lowest instrumentation detection limits) in the western portion of Long Island Sound.

- Although the special distributions of four heavy metals -- (cadmium, copper, lead and mercury) show significant variations among the stations, they clearly indicate that the values decrease going eastward in the Sound.

- The Sound was identified as having high concentrations of copper -- 97.2% of the values not meeting the NYS DEC standard. The contamination levels of lead and mercury are marginal based upon the NYSDEC water quality standards -- approximately 50% of the value meeting standards. Cadmium probably does not present a problem -- meeting the NYS DEC standard 87.8% of the time.

Although the database is limited and several important factors such as storm water run-off, hydrographic impacts and circulation patterns were not examined, a high degree of confidence can be placed on the qualitative interpretations. To gain a better understanding of toxics contamination in Long Island Sound, several points are recommended for future programs.

(a) An extensive monitoring program should be carefully planned and adopted to fill the spatial and temporal deficiencies of the existing database. The sampling schedules should be carefully designed to detect any seasonal variations. The ongoing pollution abatement programs should be coordinated (including sampling and analyses) to prevent duplication of effort.

(b) The monitoring program should extend to cover all critical areas (e.g. heavily industrialized with metal finishing) and sampled for the associated environmental pollutants. Control stations are recommended to be established, as well, to generate baseline information.

(c) Discharge of toxic compounds, especially copper, should be minimized or eliminated. The present standards should be reviewed and updated, if necessary.

(d) Bottom and mid-depth samples should be taken along with surface samples to insure the proper characterization of the water quality of Long Island Sound. This type of information is particularly essential for interpreting stratification and will also provide valuable data for calibration and verification of the models presently being developed for Long Island Sound.

(e) A Sound-wide hydrographic and circulation model, as well as a water quality model is essential to the program. A global understanding of the system will substantially improve the skills for projecting the water quality of the Sound in a more proper manner.

TABLE 1

LONG ISLAND SOUND ESTUARINE STUDY
 HISTORIC AND ONGOING DATASETS OF
 TOXIC CONTAMINANTS IN THE WATER COLUMN

<u>COLLECTING AGENCY</u>	<u>PARAMETER AVAILABILITY</u>	<u>YEARS</u>	<u>FREQUENCY OF SAMPLING*</u>	<u>DEPTH OF SAMPLING</u>	<u>AREA COVERED</u>	<u>AVAIL-ABILITY**</u>
ISC	Cd, Cu, Pb, Hg, PCBs, chlordanes, dieldrin, DDT, etc.	'74-Present	2+/yr.	Surface	Upper East River to WLIS III	STORET /LIS
NYCDEP	Cd, Cu, Pb, Hg	'40-Present	yearly	Composite of surface & bottom	Upper East River to Hart Island	STORET /LIS
CONN/USGS	Diss.-Cd, Cu, Pb; Total-Cd, Cu, Hg, Pb	'74-Present	4+/yr. limited	Surface	New Haven Harbor, Housatonic River, Stamford Harbor	STORET /LIS
USEPA II	Cd, Cu, Pb, Hg	'70-'73	intensive survey	Surface	NYS & CT shore-line	STORET /LIS
LILCO Shoreham	Cu, Fe, B	'73-Present	monthly	Surface & bottom	Herod Point Shoal	Hard Copy
Millstone Nuclear Power Station	Cu, Pb, Zn, Cr, Fe	'71-'83	5+/yr.	Surface	Niantic Bay	Hard Copy

* Estimated

** STORET - U.S. EPA'S national database for water quality data
 LIS - A database developed for the Long Island Sound Estuary Project

Table 2

Summary of Ambient Water Quality Criteria
 Within the Study Area for Selected Metals

Parameter	Agency			
	US EPA (1)	NYS DEC (2)(3)	CT DEP	ISC (6)
Cadmium	10 ug/l	2.7 ug/l (5)	----	
Copper	(4)	2.0 ug/l	----	
Lead	50 ug/l	8.6 ug/l	----	
Mercury	0.144 ug/l	0.1 ug/l (5)	----	

- (1) US EPA Quality Criteria for Water, EPA 440/5-86-001, 1986.
- (2) New York State Surface Quality Regulations, 6 NYCRR, Part 701, NYSDEC, 1986.
- (3) All standards apply to "acid-soluble" which is defined as the substance that passes through a 0.45 micrometer membrane after the sample is acidified to pH 1.5 to 2.0 with nitric acid.
- (4) 1-hour average concentration does not exceed 2.9 ug/l more than once every 3 years on the average.
- (5) Guidance values
- (6) No toxic or deleterious substances shall be present, either alone or in combination with other substances, in such concentrations as to be detrimental to fish or inhibit their natural migration or that will be offensive to humans or which would produce offensive tastes or odors or be unhealthful in biota used for human consumption.

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TABLE ~~4-1~~

LONG ISLAND SOUND ESTUARINE STUDY

NYCDEP ~~NEW YORK HARBOR WATER QUALITY SURVEY~~
 SAMPLING STATIONS IN ~~EAST RIVER~~ ~~1974 TO PRESENT~~
 THE

OBS	STATION	YEAR-STARTED	LATITUDE	LONGITUDE
1	E4	1974	40-46-57	73-55-21
2	E5	1974	40-48-03	73-53-12
3	E6	1974	40-47-08	73-51-41
4	E7	1974	40-48-18	73-49-14
5	E8	1974	40-47-58	73-47-13
6	E9	1974	40-49-59	73-46-42
7	E10	1974	40-50-42	73-45-58
8	E11	1984	40-47-15	73-45-48
9	E12	1984	40-50-45	73-48-12
10	E13	1984	40-48-21	73-50-20
11	E14	1984	40-48-03	73-51-52
12	E15	1984	40-45-47	73-50-59

SOURCE OF DATA: NEW YORK CITY DEPT. OF ENVIRONMENTAL PROTECTION.

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TABLE 4.2

LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF CADMIUM CONCENTRATIONS IN THE WATER COLUMN

1974 TO 1985 DATA COLLECTED BY THE NEW YORK CITY D.E.P.

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE					
	CADMIUM CONCENTRATIONS IN UG/L					TOTALS
	<0.5	0.6-1.0	1.1-2.7	2.8-5.0	>5.0	
E10	2 16.7	5 41.7	3 25.0	1 8.3	1 8.3	12 100.0
E11	0 0.0	0 0.0	0 0.0	2 100.0	0 0.0	2 100.0
E12	0 0.0	0 0.0	1 50.0	1 50.0	0 0.0	2 100.0
E13	0 0.0	0 0.0	1 50.0	1 50.0	0 0.0	2 100.0
E14	0 0.0	0 0.0	1 50.0	1 50.0	0 0.0	2 100.0
E15	0 0.0	0 0.0	1 50.0	1 50.0	0 0.0	2 100.0
E4	0 0.0	4 33.3	5 41.7	3 25.0	0 0.0	12 100.0
E5	0 0.0	2 16.7	7 58.3	3 25.0	0 0.0	12 100.0
E6	1 8.4	4 33.3	4 33.3	2 16.7	1 8.3	12 100.0
E7	1 8.4	4 33.3	4 33.3	3 25.0	0 0.0	12 100.0
E8	1 8.4	5 41.7	4 33.3	1 8.3	1 8.3	12 100.0
E9	1 8.4	4 33.3	3 25.0	3 25.0	1 8.3	12 100.0
TOTALS:						
FREQUENCY/	6	28	34	22	4	94
% OF TOTAL						
FREQUENCY	6.4	29.8	36.2	23.4	4.2	100.0

Table 5

Change to headings as in Table 4

INTERSTATE SANITATION COMMISSION
 NYCDEP HARBOR WATER QUALITY SURVEY
 TABLE OF STATION BY CUGRP

STATION	CUGRP (TOTAL COPPER IN WHOLE WATER, UG/L AS CU)				TOTAL
	< 2.0	10.0-20.0	20.1-60.0	> 60.0	
FREQUENCY	LESS	10.0	20.0	50.0	OVER 50.0
ROW PCT	LESS	10.0	20.0	50.0	OVER 50.0
E10	0	2	6	4	12
	0.00	16.67	50.00	33.33	100.0
E11	0	0	0	2	2
	0.00	0.00	0.00	100.00	100.0
E12	0	0	0	2	2
	0.00	0.00	0.00	100.00	100.0
E13	0	0	1	1	2
	0.00	0.00	50.00	50.00	100.0
E14	0	0	0	2	2
	0.00	0.00	0.00	100.00	100.0
E15	0	0	1	1	2
	0.00	0.00	50.00	50.00	100.0
E4	0	0	4	8	12
	0.00	0.00	33.33	66.67	100.0
E5	0	0	6	6	12
	0.00	0.00	50.00	50.00	100.0
E6	0	0	6	6	12
	0.00	0.00	50.00	50.00	100.0
E7	0	0	4	8	12
	0.00	0.00	33.33	66.67	100.0
E8	0	0	8	4	12
	0.00	0.00	66.67	33.33	100.0
E9	1	1	6	4	12
	8.33	8.33	50.00	33.33	100.0
TOTAL	1	3	42	48	94
	1.0	3.2	44.7	51.1	100.0

TABLE 6
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LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF LEAD CONCENTRATIONS IN THE WATER COLUMN

1974 TO 1985 DATA COLLECTED BY THE NEW YORK CITY D.E.P.

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE							TOTALS
	LEAD CONCENTRATION IN UG/L							
	<8.6	8.6-15	15.1-25	25.1-40	40.1-220	>220		
E10	0	1	4	1	5	1	12	
	0.0	8.3	33.4	8.3	41.7	8.3	100.0	
E11	0	0	0	2	0	0	2	
	0.0	0.0	0.0	100.0	0.0	0.0	100.0	
E12	0	0	0	1	1	0	2	
	0.0	0.0	0.0	50.0	50.0	0.0	100.0	
E13	0	0	0	1	1	0	2	
	0.0	0.0	0.0	50.0	50.0	0.0	100.0	
E14	0	0	1	0	1	0	2	
	0.0	0.0	50.0	0.0	50.0	0.0	100.0	
E15	0	0	1	1	0	0	2	
	0.0	0.0	50.0	50.0	0.0	0.0	100.0	
E4	0	1	1	3	7	0	12	
	0.0	8.3	8.3	25.0	58.4	0.0	100.0	
E5	1	1	1	4	5	0	12	
	8.3	8.3	8.3	33.4	41.7	0.0	100.0	
E6	0	2	1	2	7	0	12	
	0.0	16.7	8.3	16.7	58.3	0.0	100.0	
E7	0	1	2	2	7	0	12	
	0.0	8.3	16.7	16.7	58.3	0.0	100.0	
E8	0	1	4	3	3	1	12	
	0.0	8.3	33.4	25.0	25.0	8.3	100.0	
E9	0	1	2	4	4	1	12	
	0.0	8.3	16.6	33.4	33.4	8.3	100.0	
TOTALS:								
IFREQUENCY/	1	8	17	24	41	3	94	
I% OF TOTAL								
IFREQUENCY	1.1	8.5	18.1	25.5	43.6	3.2	100.0	

TABLE ⁷/₄₋₃

LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF MERCURY CONCENTRATIONS IN THE WATER COLUMN

1974 TO 1985 DATA COLLECTED BY THE NEW YORK CITY D.E.P.

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE					TOTALS
	MERCURY CONCENTRATIONS IN UG/L					
	<0.1	0.11-0.31	0.31-0.51	0.51-1.01	>1.0	
E10	3 25.0	3 25.0	1 8.3	5 41.7	0 0.0	12 100.0
E11	1 50.0	0 0.0	0 0.0	1 50.0	0 0.0	2 100.0
E12	0 0.0	0 0.0	1 50.0	0 0.0	1 50.0	2 100.0
E13	0 0.0	0 0.0	1 50.0	1 50.0	0 0.0	2 100.0
E14	0 0.0	0 0.0	0 0.0	2 100.0	0 0.0	2 100.0
E15	0 0.0	1 50.0	1 50.0	0 0.0	0 0.0	2 100.0
E4	3 25.0	1 8.3	3 25.0	5 41.7	0 0.0	12 100.0
E5	3 25.0	1 8.3	3 25.0	4 33.4	1 8.3	12 100.0
E6	1 8.4	4 33.3	2 16.7	4 33.3	1 8.3	12 100.0
E7	3 25.0	5 41.7	0 0.0	3 25.0	1 8.3	12 100.0
E8	3 25.0	3 25.0	1 8.3	5 41.7	0 0.0	12 100.0
E9	2 16.7	2 16.7	2 16.7	4 33.2	2 16.7	12 100.0
TOTALS:						
IFREQUENCY/	19	20	15	34	6	94
I% OF TOTAL						
IFREQUENCY	20.2	21.3	15.9	36.2	6.4	100.0

Table ~~4-6~~⁸

LONG ISLAND SOUND ESTUARINE STUDY
 INTERSTATE SANITATION COMMISSION ~~HARBOR~~ ^{water quality} SURVEY
 SAMPLING LOCATIONS ~~1975 to~~ PRESENT

DES	STATION	LAT_DEG	LAT_MIN	LAT_SEC	LNG_DEG	LNG_MIN	LNG_SEC
1	ER-09	40	47	26	73	54	53
2	ER-11	40	47	50	73	52	2
3	ER-15	40	47	58	73	47	38
4	LI-17M	40	49	43	73	46	46
5	LI-19M	40	51	33	73	45	3
6	LI-24N	40	53	57	73	44	27
7	LI-34S	40	50	0	73	44	2
8	LI-25N	40	55	25	73	42	1
9	LI-33S	40	51	42	73	40	7
10	LI-26N	40	58	47	73	38	59
11	LI-32S	40	54	39	73	38	7
12	LI-27N	41	0	8	73	36	4
13	LI-28N	40	59	42	73	33	58
14	LI-29N	41	0	54	73	32	14
15	LI-31S	40	55	29	73	30	11
16	LI-35M	40	59	33	73	28	53

SOURCE OF DATA: ~~IC~~ INTERSTATE SANITATION COMMISSION

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TABLE 4-7

LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF CADMIUM CONCENTRATIONS IN THE WATER COLUMN
1975 TO 1985 DATA COLLECTED BY THE INTERSTATE SANITATION COMMISSION

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE						TOTALS
	CADMIUM CONCENTRATIONS IN UG/L						
	<0.5	0.6-1.0	1.1-2.7	2.8-5.0	>5.0		
ER-09	6 37.5	4 25.0	3 18.7	2 12.5	1 6.3	16 100.0	
ER-11	2 33.3	1 16.7	2 33.3	0 0.0	1 16.7	6 100.0	
ER-15	7 29.2	7 29.2	6 25.0	0 0.00	4 16.6	24 100.0	
LI-17M	11 40.8	6 22.2	6 22.2	2 7.4	2 7.4	27 100.0	
LI-19M	14 51.9	7 25.9	4 14.8	0 0.0	2 7.4	27 100.0	
LI-24N	9 34.6	7 26.9	6 23.1	3 11.5	1 3.9	26 100.0	
LI-34S	11 45.8	7 29.2	4 16.7	2 8.3	0 0.0	24 100.0	
LI-25N	7 29.2	3 12.5	10 41.7	2 8.3	2 8.3	24 100.0	
LI-33S	11 50.0	3 13.6	7 31.8	1 4.6	0 0.0	22 100.0	
LI-26N	12 46.2	7 26.9	4 15.4	3 11.5	0 0.0	26 100.0	
LI-32S	12 48.0	6 24.0	4 16.0	3 12.0	0 0.0	25 100.0	
LI-27N	11 47.9	6 26.1	3 13.0	3 13.0	0 0.0	23 100.0	
LI-28N	9 36.0	8 32.0	5 20.0	3 12.0	0 0.0	25 100.0	
LI-29N	9 40.9	4 18.2	8 36.4	1 4.5	0 0.0	22 100.0	
LI-31S	10 43.5	5 21.7	4 17.4	1 4.4	3 13.0	23 100.0	
LI-35M	1 25.0	1 25.0	0 0.0	1 25.0	1 25.0	4 100.0	
TOTALS:							
FREQUENCY/	142	82	76	27	17	344	
% OF TOTAL							
FREQUENCY	41.3	23.8	22.1	7.9	4.9	100.0	

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TABLE 4-8

LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF COPPER CONCENTRATIONS IN THE WATER COLUMN

1975 TO 1985 DATA COLLECTED BY THE INTERSTATE SANITATION COMMISSION

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE							TOTALS
	COPPER CONCENTRATION IN UG/L							
	<2.0	2.1-3.2	3.3-10	10.1-20	20.1-60	>60.1		
ER-09	0	0	9	3	3	2	17	
	0.0	0.0	52.9	17.7	17.7	11.7	100.0	
ER-11	0	1	2	1	2	0	6	
	0.0	16.7	33.3	16.7	33.3	0.0	100.0	
ER-15	0	1	8	10	4	2	25	
	0.0	4.0	32.0	40.0	16.0	8.0	100.0	
LI-17M	3	1	7	11	6	0	28	
	10.7	3.6	25.0	39.3	21.4	0.0	100.0	
LI-19M	1	4	9	9	4	0	27	
	3.8	14.8	33.3	33.3	14.8	0.0	100.0	
LI-24N	0	0	6	10	9	2	27	
	0.0	0.0	22.2	37.1	33.3	7.4	100.0	
LI-34S	0	1	10	8	4	1	24	
	0.0	4.2	41.7	33.3	16.6	4.2	100.0	
LI-25N	1	0	6	8	10	0	25	
	4.0	0.0	24.0	32.0	40.0	0.0	100.0	
LI-33S	1	1	9	10	2	0	23	
	4.3	4.3	39.2	43.5	8.7	0.0	100.0	
LI-26N	1	1	9	12	4	0	27	
	3.7	3.7	33.3	44.5	14.8	0.0	100.0	
LI-32S	2	1	11	9	4	0	27	
	7.4	3.7	40.8	33.3	14.8	0.0	100.0	
LI-27N	0	2	8	8	5	1	24	
	0.0	8.3	33.3	33.3	20.9	4.2	100.0	
LI-28N	1	1	12	8	4	0	26	
	3.9	3.9	46.1	30.7	15.4	0.0	100.0	
LI-29N	0	0	12	7	5	0	24	
	0.0	0.0	50.0	29.2	20.8	0.0	100.0	
LI-31S	0	0	11	10	3	0	24	
	0.0	0.0	45.8	41.7	12.5	0.0	100.0	
LI-35M	0	0	2	1	1	0	4	
	0.0	0.0	50.0	25.0	25.0	0.0	100.0	
TOTALS:								
IFREQUENCY/	10	14	131	125	70	8	358	
1% OF TOTAL								
IFREQUENCY	2.8	3.9	36.6	34.9	19.6	2.2	100.0	

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TABLE 49

LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF LEAD CONCENTRATIONS IN THE WATER COLUMN
1975 TO 1985 DATA COLLECTED BY THE INTERSTATE SANITATION COMMISSION

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE					
	LEAD CONCENTRATIONS IN UG/L					
	<8.6	8.7-15	15.1-25	25.1-40	40.1-190	TOTALS
ER-09	4	9	3	0	1	17
	23.5	52.9	17.7	0.0	5.9	100.0
ER-11	3	1	1	0	1	6
	50.0	16.7	16.7	0.0	16.6	100.0
ER-15	12	4	3	4	2	25
	48.0	16.0	12.0	16.0	8.0	100.0
LI-17M	13	9	4	1	1	28
	46.4	32.1	14.3	3.6	3.6	100.0
LI-19M	9	10	6	2	1	28
	32.2	35.7	21.4	7.1	3.6	100.0
LI-24N	5	14	5	0	3	27
	18.5	51.9	18.5	0.0	11.1	100.0
LI-34S	12	8	4	1	0	25
	48.0	32.0	16.0	4.0	0.0	100.0
LI-25N	8	9	6	2	0	25
	32.0	36.0	24.0	8.0	0.0	100.0
LI-33S	12	6	2	2	1	23
	52.2	26.1	8.7	8.7	4.3	100.0
LI-26N	13	9	2	3	0	27
	48.2	33.3	7.4	11.1	0.0	100.0
LI-32S	11	9	6	1	0	27
	40.8	33.3	22.2	3.7	0.0	100.0
LI-27N	13	6	3	2	0	24
	54.2	25.0	12.5	8.3	0.0	100.0
LI-28N	13	10	2	1	0	26
	50.0	38.5	7.7	3.8	0.0	100.0
LI-29N	12	10	0	2	0	24
	50.0	41.7	0.0	8.3	0.0	100.0
LI-31S	13	6	2	1	2	24
	54.2	25.0	8.3	4.2	8.3	100.0
LI-35M	3	0	1	0	0	4
	75.0	0.0	25.0	0.0	0.0	100.0
TOTALS:						
IFREQUENCY/	156	120	50	22	12	360
I% OF TOTAL						
IFREQUENCY	43.4	33.3	13.9	6.1	3.3	100.0

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TABLE 4-10

LONG ISLAND SOUND ESTUARINE STUDY

FREQUENCY DISTRIBUTIONS OF MERCURY CONCENTRATIONS IN THE WATER COLUMN
1975 TO 1985 DATA COLLECTED BY THE INTERSTATE SANITATION COMMISSION

STATIONS	FREQUENCY & PERCENT FREQUENCY OF OCCURENCE					TOTALS
	MERCURY CONCENTRATIONS IN UG/L					
	<0.1	0.11-0.3	0.31-0.5	0.51-1.0	>1.0	
ER-09	9 60.0	4 26.6	1 6.7	0 0.0	1 6.7	15 100.0
ER-11	2 33.4	2 33.3	0 0.0	2 33.3	0 0.0	6 100.0
ER-15	9 39.1	9 39.1	1 4.4	3 13.0	1 4.4	23 100.0
LI-17M	17 70.8	2 8.3	3 12.5	1 4.2	1 4.2	24 100.0
LI-19M	14 58.3	6 25.0	2 8.3	1 4.2	1 4.2	24 100.0
LI-24N	13 56.5	7 30.4	2 8.7	1 4.4	0 0.0	23 100.0
LI-34S	13 59.1	5 22.7	1 4.6	2 9.0	1 4.6	22 100.0
LI-25N	9 40.9	8 36.4	2 9.1	2 9.1	1 4.5	22 100.0
LI-33S	11 52.4	5 23.8	3 14.3	2 9.5	0 0.0	21 100.0
LI-26N	15 65.2	6 26.0	1 4.4	1 4.4	0 0.0	23 100.0
LI-32S	13 56.6	7 30.5	1 4.3	1 4.3	1 4.3	23 100.0
LI-27N	11 52.4	6 28.6	0 0.0	4 19.0	0 0.0	21 100.0
LI-28N	13 59.1	5 22.7	2 9.0	1 4.6	1 4.6	22 100.0
LI-29N	10 47.6	5 23.8	3 14.3	3 14.3	0 0.0	21 100.0
LI-31S	9 42.8	7 33.3	3 14.3	1 4.8	1 4.8	21 100.0
LI-35M	0 0.0	2 50.0	1 25.0	0 0.0	1 25.0	4 100.0
TOTALS:						
FREQUENCY	168	86	26	25	10	315
% OF TOTAL						
FREQUENCY	53.3	27.3	8.3	7.9	3.2	100.0

old 11

Table 13

LONG ISLAND SOUND ESTUARINE STUDY
 CUMULATIVE FREQUENCY DISTRIBUTIONS OF TOXIC HALOGENATED HYDROCARBONS
 IN THE WATER COLUMN
 1975 to 1985 DATA COLLECTED BY THE INTERSTATE SANITATION COMMISSION

TOXIC ORGANIC COMPOUND	CUMULATIVE FREQUENCIES AND CUMULATIVE PERCENT FREQUENCIES								
	CONCENTRATIONS (ug/l)								
	<0.001	<0.002	<0.003	<0.005	<0.01	<0.02	<0.2	<0.4	>1.0
Diethyl phthalate	-	-	-	-	-	-	52	59	64
Phthalate	-	-	-	-	-	-	81.3	92.2	100
Chlordane	-	-	-	63	63	63	63	64	100
	-	-	-	98.4	98.4	98.4	98.4	100	
Mirex	-	-	-	-	-	24	100		
	-	-	-	-	-	100			
PCB 1016	-	-	-	-	89	100			
	-	-	-	-	100				
PCB 1221	-	-	-	-	89	100			
	-	-	-	-	100				
PCB 1232	-	-	-	-	89	100			
	-	-	-	-	100				
PCB 1248	-	-	-	-	89	100			
	-	-	-	-	100				
PCB 1254	-	-	-	-	89	100			
	-	-	-	-	100				
PCB 1260	-	-	-	-	89	100			
	-	-	-	-	100				
Methoxychlor	-	-	-	-	89	100			
Heptachlor Epoxide	-	-	-	-	89	100			
Endosulfan	-	-	-	39	100				
	-	-	-	100					
^{o,p'} DDD	-	-	89	100					
^{p,p'} DDD	-	-	89	100					
Beta - EHC	-	-	89	100					
^{o,p'} DDT	-	89	100						
^{p,p'} DDT	-	89	100						
Dieldrin	-	70	100						
Aldrin	-	89	100						
Endrin	-	89	100						
Heptachlor	-	89	100						
Alpha - EHC	89	100							
Lindane	89	100							
^{o,p'} DDE	50	100							
^{p,p'} DDE	89	100							

small p
phthalate

break word
Methoxy-chlor

Small letters
o,p'
m
p,p'

Note: (1) Area covered is from the Upper East River to WLIS III
 (2) The top number in each cell describe the number of analysis; the bottom number reveals the cumulative percentage of frequency distribution.

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 Table ~~4A~~
 LIS EP & Apell out
 INTERSTATE SANITATION COMMISSION

U.S. EPA REGION II (VARIOUS STUDIES) X SAMPLING STATIONS FOR

OBS STATION	LAT_DEG	LAT_MIN	LAT_SEC	LNG_DEG	LNG_MIN	LNG_SEC	
1 577	41	9	24	73	5	28	✓
2 27E	41	1	55	73	30	57	✓
3 42E	41	8	32	73	13	59	✓
4 43E	41	9	11	73	13	3	✓
5 44E	41	10	35	73	11	9	✓
6 45E	41	10	35	73	10	36	✓
7 46E	41	10	0	73	10	35	✓
8 51E	41	10	33	73	7	14	✓
9 52E	41	12	12	73	6	36	✓
10 62E	41	16	39	72	56	12	✓
11 54E	41	18	30	72	53	18	✓
12 65E	41	18	10	72	54	20	✓
13 66E	41	17	30	72	54	42	✓
14 67E	41	16	18	72	54	45	✓
15 71E	41	15	15	72	49	17	✓
16 77E	41	15	47	72	31	34	✓
17 85E	41	18	37	72	20	57	✓
18 87E	41	17	26	72	13	50	✓
19 90E	41	19	21	72	10	38	✓
20 94E	41	19	18	72	4	57	✓
21 4044500073558000	40	44	50	73	59	0	✓
22 404647007355380	40	46	47	73	55	38	✓
23 404801007353100	40	48	1	73	53	10	✓

Table ¹⁵ ~~4-13~~

INTERSTATE SANITATION COMMISSION
LISEP - SPELL OUT

METALS DATA FROM

U.S. EPA REGION II VARIOUS STUDIES CONDUCTED BY

OBS	DATE	STATION	CD (TOT)	CU (TOT)	PB (TOT)	HG (TOT)	CU (DISS)	PB (DISS)
1	07/16/70	E77	.	.	.	.	150.0	<300
2	07/17/70	27E	.	.	.	.	<100.0	<300
3	07/17/70	42E	.	.	.	.	160.0	<300
4	07/17/70	43E	.	.	.	.	170.0	<300
5	07/17/70	44E	.	.	.	.	120.0	<300
6	07/17/70	45E	.	.	.	.	<100.0	<300
7	07/17/70	46E	.	.	.	.	120.0	<300
8	07/16/70	51E	.	.	.	.	170.0	<300
9	07/16/70	52E	.	.	.	.	<100.0	<300
10	07/16/70	62E	.	.	.	.	<100.0	<300
11	07/16/70	64E	.	.	.	.	260.0	<300
12	07/16/70	65E	.	.	.	.	210.0	<300
13	07/16/70	66E	.	.	.	.	<100.0	<300
14	07/16/70	67E	.	.	.	.	<100.0	<300
15	07/15/70	71E	.	.	.	.	<100.0	<300
16	07/15/70	77E	.	.	.	.	<100.0	<300
17	07/15/70	85E	.	.	.	.	<100.0	<300
18	07/15/70	87E	.	.	.	.	<100.0	<300
19	07/15/70	90E	.	.	.	.	<100.0	<300
20	07/14/70	94E	.	.	.	.	<100.0	<300
21	02/17/71	404450007358000	120	50	310	0.40	.	.
22	02/17/71	404647007355380	110	60	320	0.40	.	.
23	02/17/71	404801007353100	120	70	200	0.50	.	.
24	03/29/73	404450007358000	9	27	70	0.25	.	.
25	03/29/73	404801007353100	8	13	70	0.40	.	.

NOTE: (1) ALL UNITS ARE UG/L.

(2) TOT = TOTAL IN WHOLE WATER; DISS = DISSOLVED

Table 16
~~4-14~~
LISEP spell out

~~INTERSTATE SANITATION COMMISSION~~

CONN/USGS TRIBUTARY MONITORING * STATION LOCATIONS

~~QBS
1
2
3~~

STATION	LOCATION STNREF	LATITUDE	LONGITUDE
01209910	1 STAMFORD Harbor	41 01 47.0	073 32 17.0
01209829	2 HOUSATONIC River	41 12 01.0	073 06 39.0
01196656	3 NEW HEAVEN Harbor	41 16 11.0	072 54 44.0

Table #17
LISEP = spell out

INTERSTATE SANITATION COMMISSION

SAMPLING DATES OF CONN/USGS TRIBUTARY MONITORING PROGRAM
FOR TOTAL CD, CU AND PB AT 01209910, 01208828 AND 01208628 STATIONS

STATIONS

des	STATION	STATION REFERENCE	LOCATION	SAMPLING DATE
1	01209910	1	STAMFORD-H	81-10-23
2	01209910	1	STAMFORD-H	83-03-08
3	01208828	2	HOUSATONIC-R	80-10-22
4	01208828	2	HOUSATONIC-R	81-01-15
5	01208828	2	HOUSATONIC-R	81-04-16
6	01208828	2	HOUSATONIC-R	81-07-10
7	01208828	2	HOUSATONIC-R	81-10-23
8	01208828	2	HOUSATONIC-R	82-01-22
9	01208828	2	HOUSATONIC-R	92-04-19
10	01208828	2	HOUSATONIC-R	82-07-13
11	01208828	2	HOUSATONIC-R	82-11-16
12	01208828	2	HOUSATONIC-R	83-01-11
13	01208828	2	HOUSATONIC-R	83-01-11
14	01208828	2	HOUSATONIC-R	83-05-23
15	01208828	2	HOUSATONIC-R	83-07-11
16	01208828	2	HOUSATONIC-R	83-07-11
17	01208828	2	HOUSATONIC-R	83-11-15
18	01208828	2	HOUSATONIC-R	84-01-25
19	01208828	2	HOUSATONIC-R	84-05-22
20	01208828	2	HOUSATONIC-R	84-07-11
21	01208828	2	HOUSATONIC-R	84-11-19
22	01208828	2	HOUSATONIC-R	85-01-22
23	01208828	2	HOUSATONIC-R	85-05-16
24	01208828	2	HOUSATONIC-R	85-07-10
25	01208828	2	HOUSATONIC-R	85-01-22

Table ¹⁸ 4-16

CISEP & Spell out

~~INTERSTATE SANITATION COMMISSION~~

CONN/USGS TRIBUTARY MONITORING DATA

~~TABLE OF STATIONS BY CDTOTORF T-CD~~

STATIONS *Frequency Distribution for* TOTAL CADMIUM IN WHOLE WATER, ~~UG/L AS CD~~

FREQUENCY ROW PCT	TOTAL LEAD (ug/l)			TOTAL
	1.0 - 1.0	2.0 - 2.0	3.0 - 3.0	
1 STAMFORD Harbor	2	0	0	2
	100.00	0.00	0.00	100.0
2 HOUSATONIC Riv	18	4	1	23
	78.263	17.394	4.3%	100.0
3 NEW-HEAVEN R	0	0	0	0
TOTAL: FREQUENCY	20	4	1	25
% Frequency	80.0	16.0	4.0	100.0

~~1~~

Table = 19
4-7

LTSEP ← spell out

~~INTERSTATE SANITATION COMMISSION~~

CONN/USGS TRIBUTARY MONITORING DATA

TABLE OF STATIONS BY ~~CUTOTGRP~~ ~~T-SU~~

Frequency Distributions for

STATIONS	CUTOTGRP TOTAL COPPER IN WHOLE WATER, UG/L AS OUT					TOTAL
FREQUENCY ROW PCT	total copper (ug/l)					
	12.0 OR LESS	13.2 - 20.0	20.0 - 40.0	40.0 - 100.0	OVER 100.0	
16-STAMFORD Harbor	1 50.00	0 0.00	1 50.00	0 0.00	0 0.00	2 100.0
8-HOUSATONIC River	0 0.00	2 9.09	8 36.36	8 36.36	4 18.18	22 100.0
3-NEW-HEAVEN H	0 .0	0 .0	0 .0	0 .0	0 .0	0 0.0
TOTAL: Frequency	1	2	9	8	4	24
Row Frequency	4.2	8.3	37.5	33.3	16.7	100.0

~~Line~~

Table 20
~~#18~~

LISEP ← spell out

INTERSTATE SANITATION COMMISSION

CONN/USGS TRIBUTARY MONITORING DATA

~~TABLE OF STATIONS BY PBTOTGRP~~

STATIONS Frequency Distribution for PBTOTGRP TOTAL LEAD IN WHOLE WATER, UG/L AS PBT

STATIONS ↓ FREQUENCY ROW PCT	Total Lead (ug/l)			TOTAL
	18.6 - 18.7	15.0 - 21.0	22.0	
1 STAMFORD Harbor	1 50.0%	1 50.0%	0 0.0%	2 100.0
2 HOUSATONIC Riv	14 66.7%	6 28.6%	1 4.7%	21 100.0
3 NEW HEAVEN-H	0	0	0	0
TOTAL: Frequency	15	7	1	23
% Frequency	65.2	30.4	4.4	100.0

~~Table 18~~

21
 TABLE ~~4~~ x 19

ANNUAL POLLUTANT DISCHARGES TO THE WESTERN PORTION OF LONG ISLAND SOUND(1)

LOADING IN YEAR =====	AREA 1(2) =====	AREA 2(3) =====	AREA 3(4) =====
CADMIUM (TONS)	2	3	0.5
COPPER (TONS)	109	12	2
LEAD (TONS)	29	15	2
MERCURY (LBS)	3792	218	14

(1) SOURCE OF DATA: FARROW D., NOAA, ~~THE~~ NATIONAL COASTAL POLLUTANT DISCHARGE INVENTORY, NOV. 1986.
 (2) INCLUDES BRONX AND QUEENS CO., N.Y. *Estimates for Long Island Sound*
 (3) INCLUDES WESTCHESTER AND NASSAU CO., N.Y.
 (4) INCLUDES EXTREME PORTIONS OF FAIRFIELD CO., C.T. AND SUFFOLK CO., N.Y.; ESTIMATE WAS ~~DONE~~ ONLY WITH HUNTINGTON STP, GREENWICH STP AND STAMFORD STP.

Table 22

ANNUAL POLLUTANT DISCHARGES TO THE LONG ISLAND SOUND BY COAST COUNTY*

LOADING ~~IN~~ YEARLY

	L.I. SHORE		CONN. SHORE	
CADMIUM (TONS)	NASSAU, NY	0	WESTCHESTER, NY	3
			FAIRFIELD, CT	8
	SUBTOTAL:	0		11

COPPER (TONS)	NASSAU, NY	3	WESTCHESTER, NY	9
			FAIRFIELD, CT	48
	SUBTOTAL:	3		57

LEAD (TONS)	NASSAU, NY	5	WESTCHESTER, NY	10
			FAIRFIELD, CT	42
	SUBTOTAL:	5		52

MERCURY (LBS)	NASSAU, NY	70	WESTCHESTER, NY	148
			FAIRFIELD, CT	2220
	SUBTOTAL:	70		2368

*SOURCE OF DATA: FARROW D., NOAA, THE NATIONAL COASTAL POLLUTANT DISCHARGE INVENTORY, NOV. 1986.
Estimates for Long Island Sound

Table ~~5~~ / 23

SUMMARY OF CONTAMINATION LEVELS
OF SELECTED METALS IN THE WATERS OF
WESTERN LONG ISLAND SOUND
(1975 - 1985)

<u>POLLUTANT</u>	<u>RANGE*</u>	<u>NYS DEC CRITERIA*</u>	<u>% OF VALUES NOT MEETING NYS DEC CRITERIA</u>
Cadmium	≤ 0.5 - 27	2.7	12.8
Copper	≤ 1.0 - 2032	2.0	97.2
Lead	≤ 5.0 - 190	8.6	56.6
Mercury	≤ 0.1 - 1.8	0.1	46.7

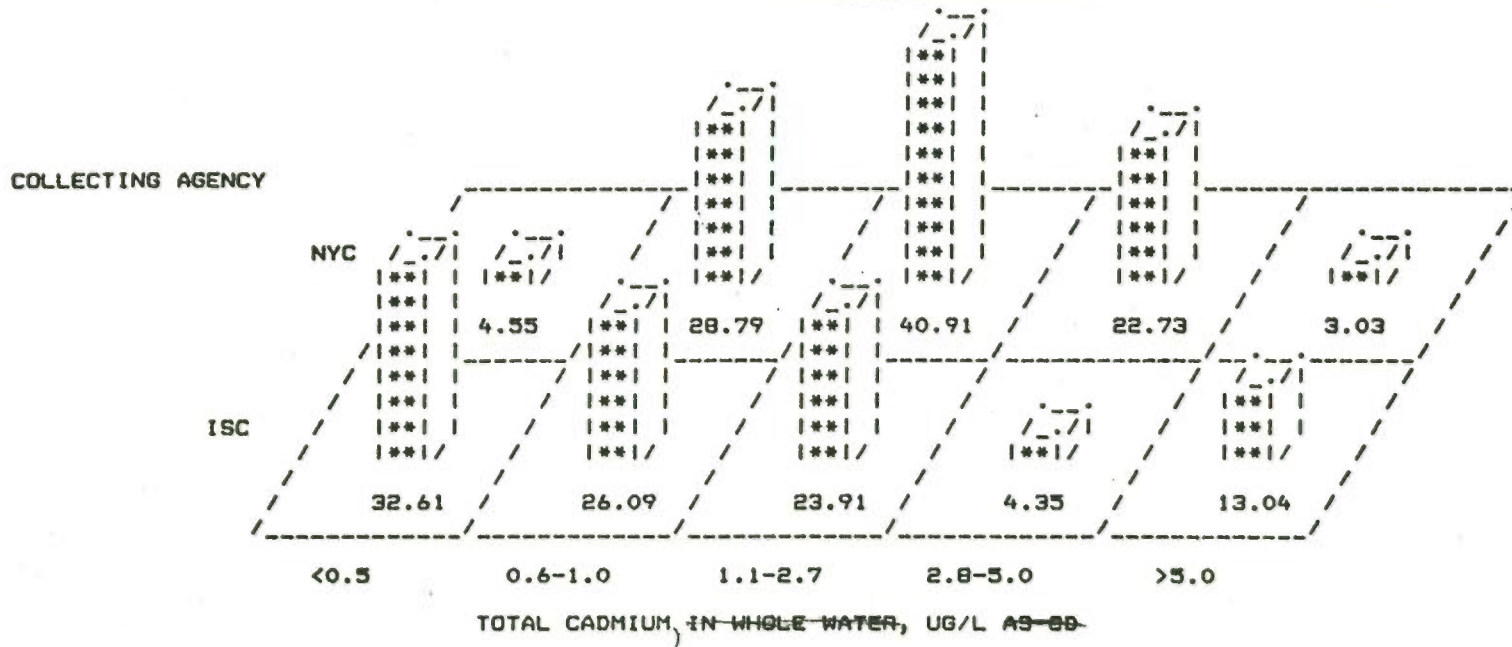
* All values are ug/l

Source of Data: Interstate Sanitation Commission ~~Harbor~~ Survey
Data (1975 - 1985)

Figure B
 Chart 4-1
 CADMIUM

ISC AND NYCDEP DATA COMPARISON IN THE AREA OF UPPER EAST RIVER

PERCENTAGE BLOCK CHART Frequency DISTRIBUTIONS OF

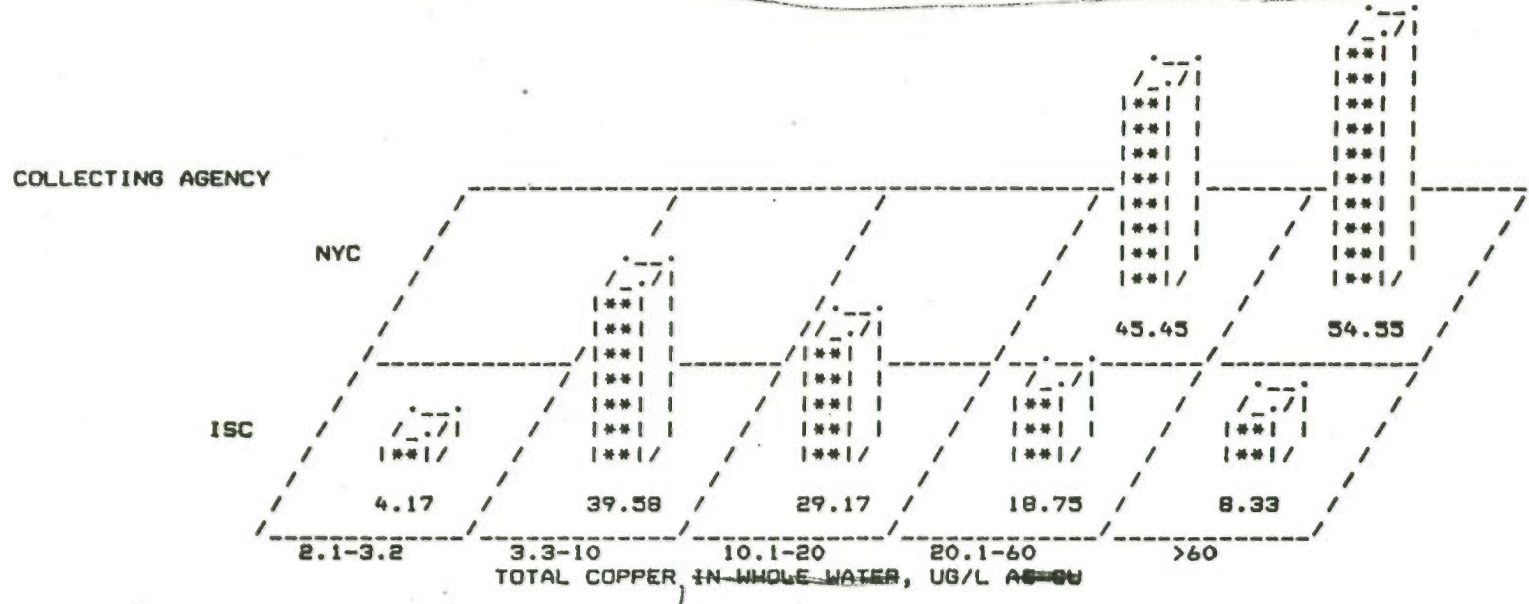


Note: The numbers within each cell denote the percentage of occurrence for that collect of sample.

Figure 2
Chart 4-2

COPPER

ISC AND NYC DEP DATA COMPARISON IN THE AREA OF UPPER EAST RIVER
PERCENTAGE BLOCK CHART FREQUENCY DISTRIBUTIONS

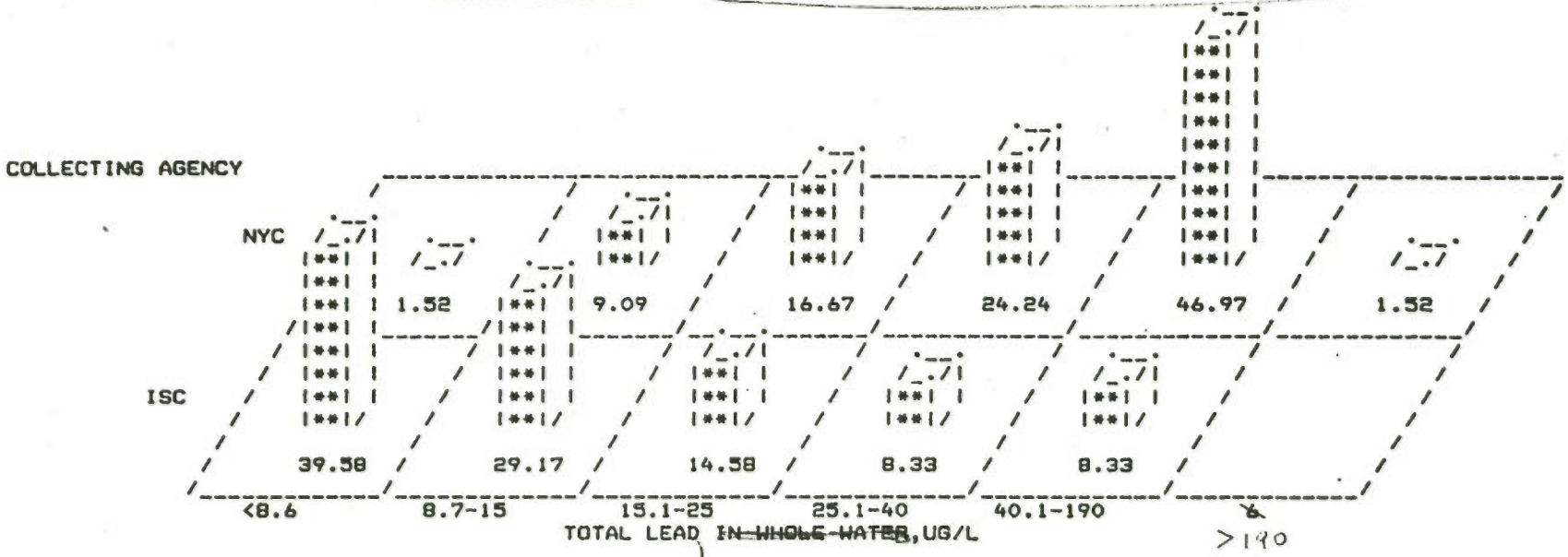


Note: the number within each cell denotes the percentage of occurrence for that category.

Figure 3
~~Chart 4-3~~

LEAD

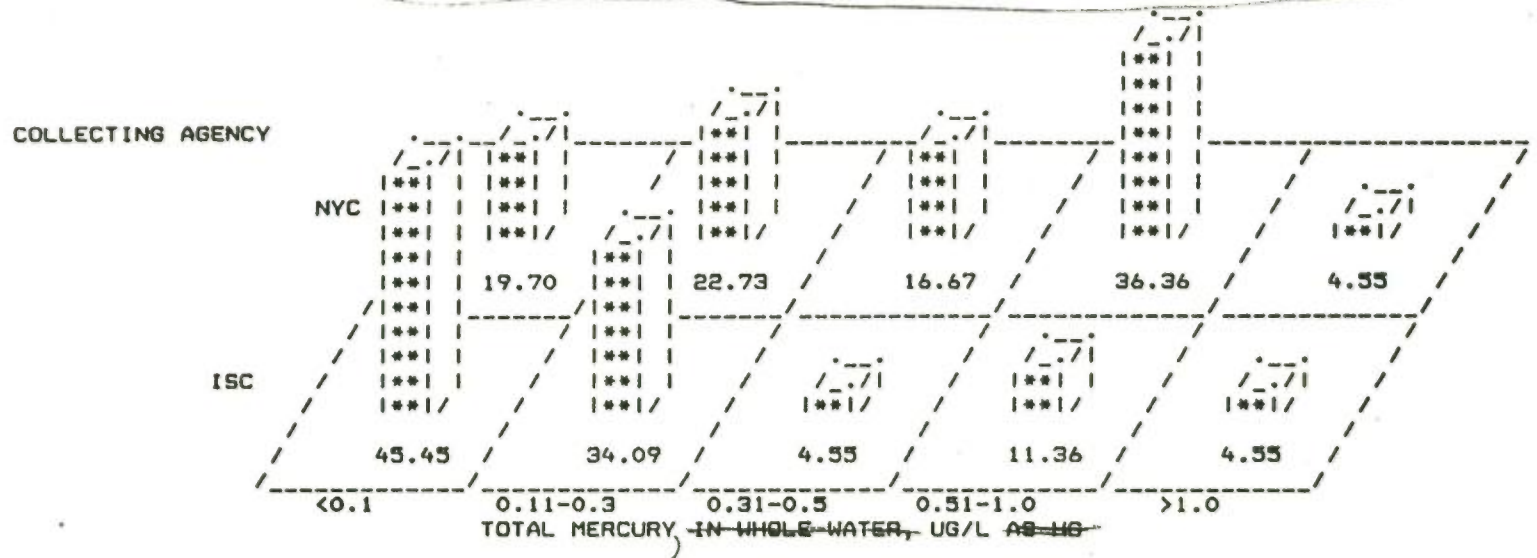
ISC AND NYCDEP DATA COMPARISON IN THE AREA OF UPPER EAST RIVER
 PERCENTAGE BLOCK CHART FREQUENCY DISTRIBUTION OF



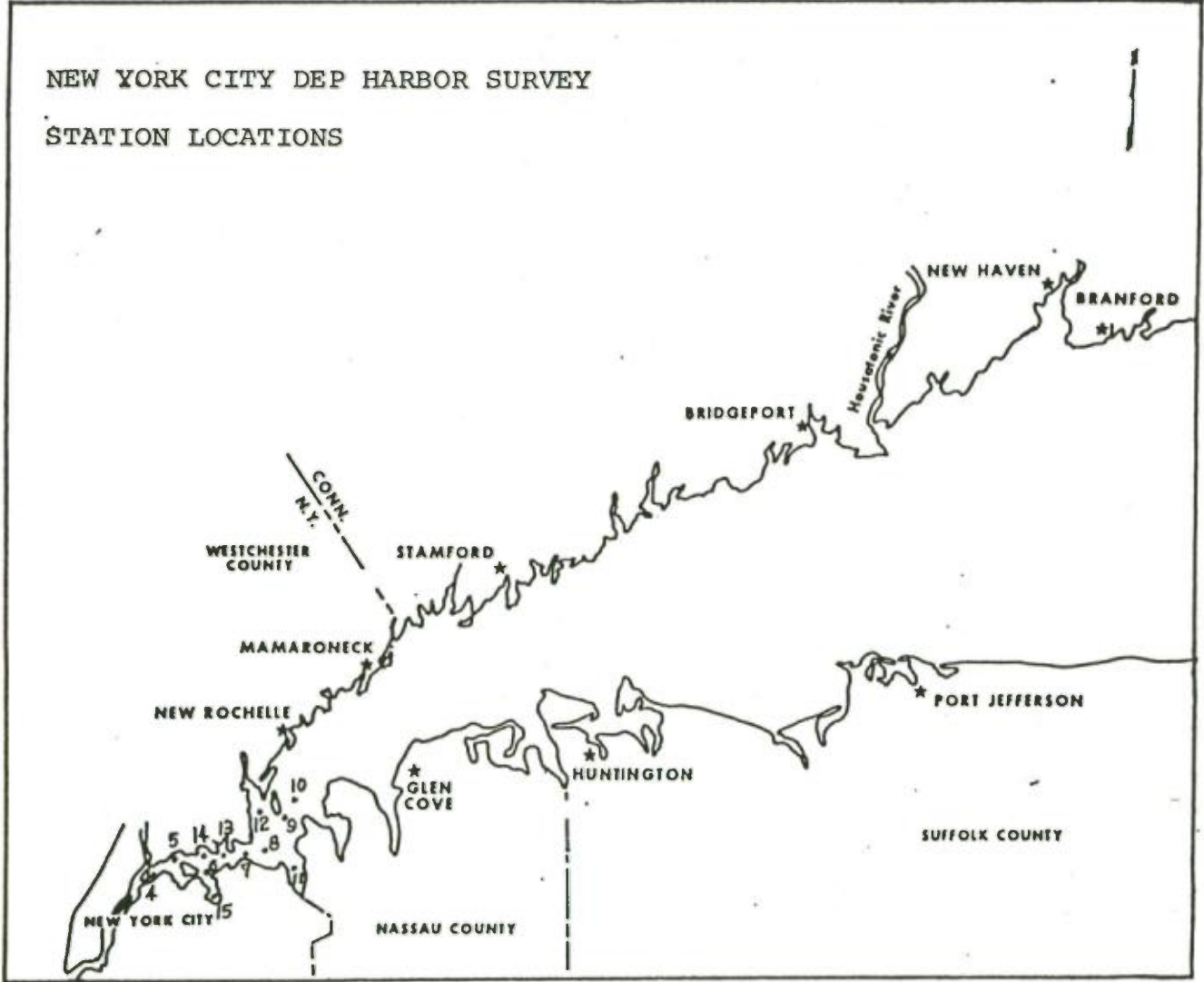
Note: The number within each cell denotes the percentage of occurrence for that collecting agency

Figure 4
Chart 4-4:

MERCURY
OF ISC AND NYCDEP DATA COMPARISON IN THE AREA OF UPPER EAST RIVER
PERCENTAGE BLOCK CHART FREQUENCY DISTRIBUTIONS



Note: The number within each cell denotes the percentage of occurrence for that collecting agency



Map. 4-1

Figure 5

INTERSTATE SANITATION COMMISSION
Water Quality
~~HARBOR~~ SURVEY SAMPLING LOCATIONS

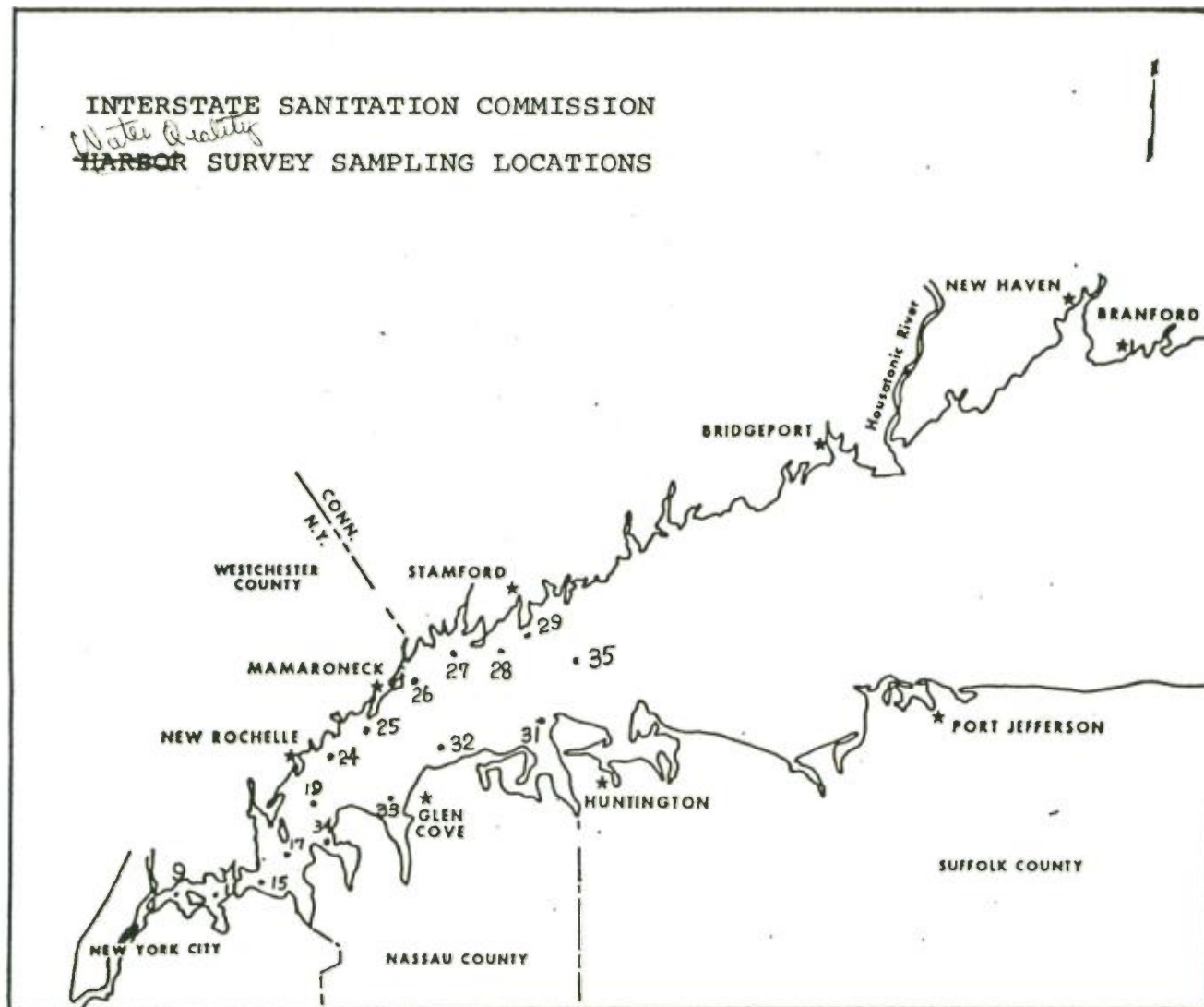
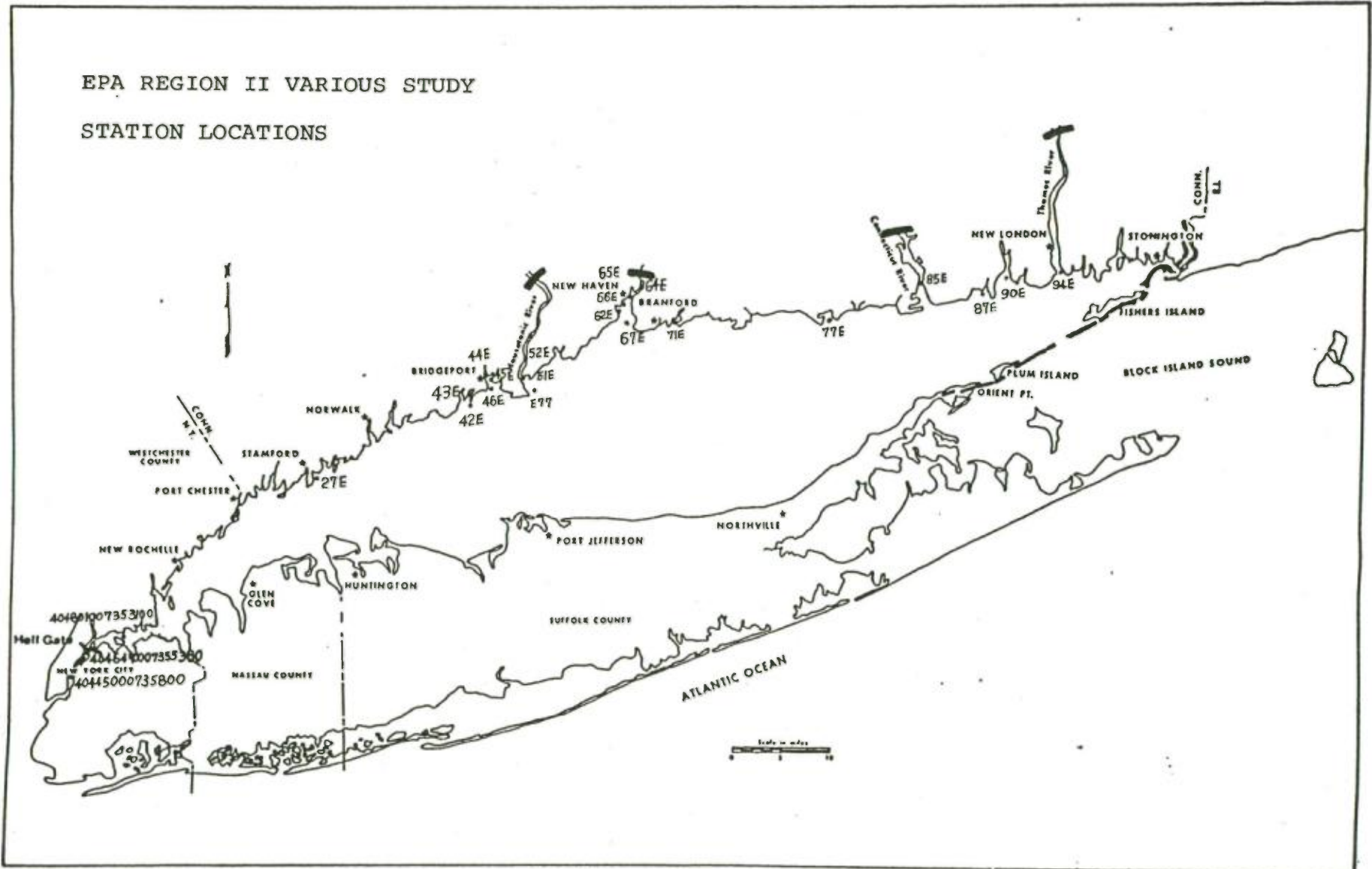


Figure 6

Map: ~~4-18~~

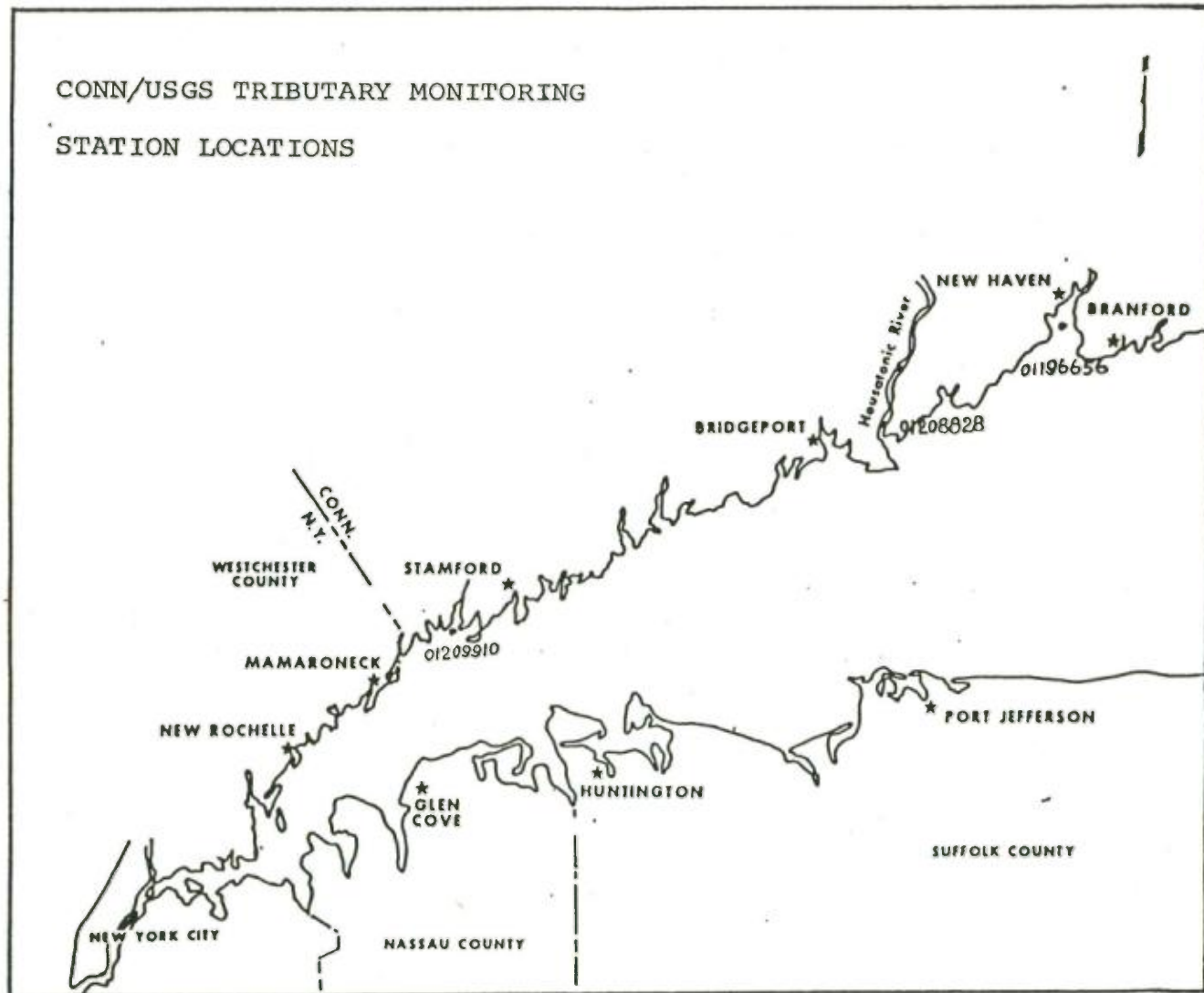
EPA REGION II VARIOUS STUDY
STATION LOCATIONS



Map: 61
43

Figure 7

CONN/USGS TRIBUTARY MONITORING
STATION LOCATIONS

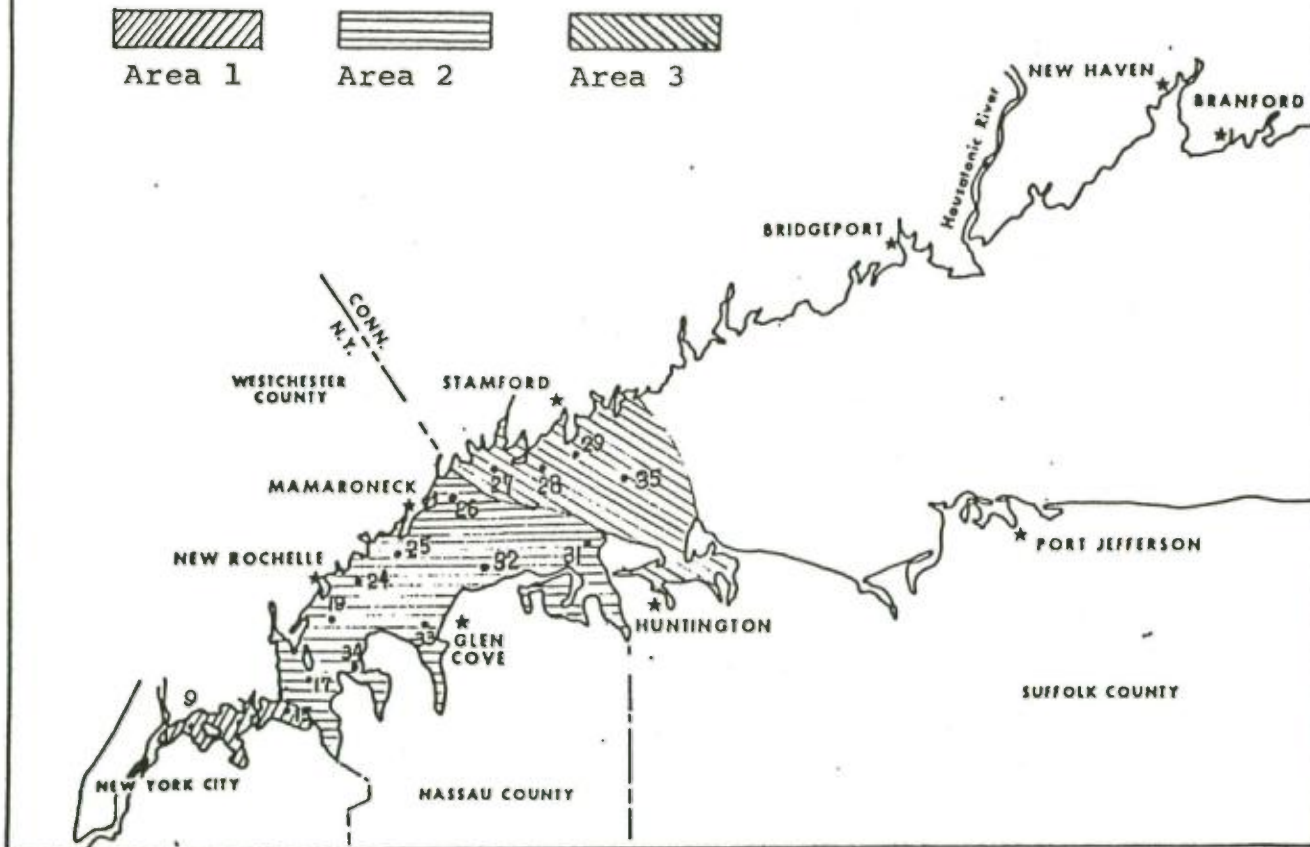


Map: ~~5-1~~
~~4-4~~

Figure 8

INTERSTATE SANITATION COMMISSION

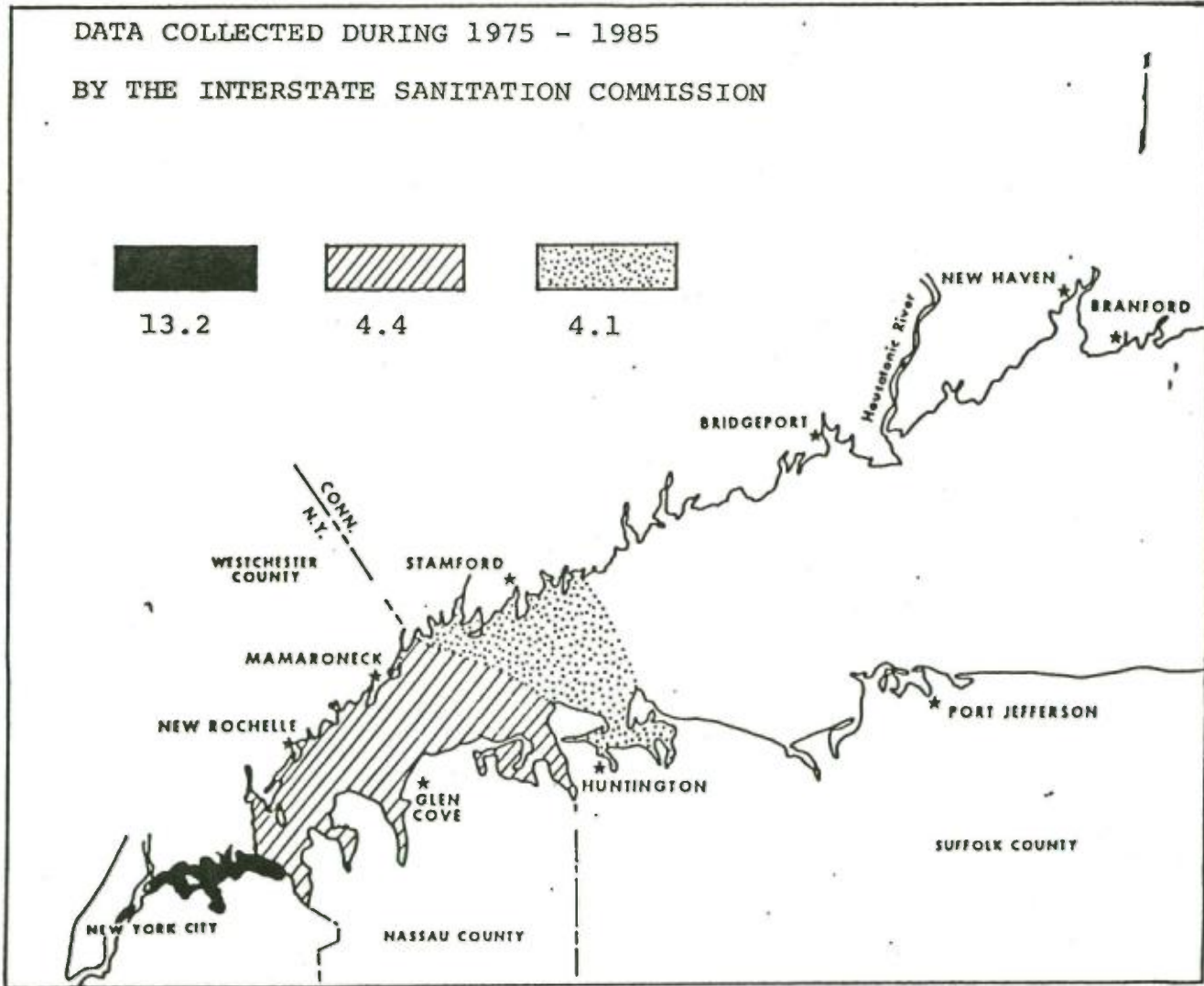
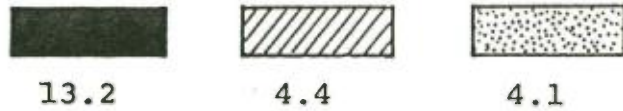
HARBOR SURVEY SEGMENTATION MAP



Map: ~~4-5~~

Figure 4

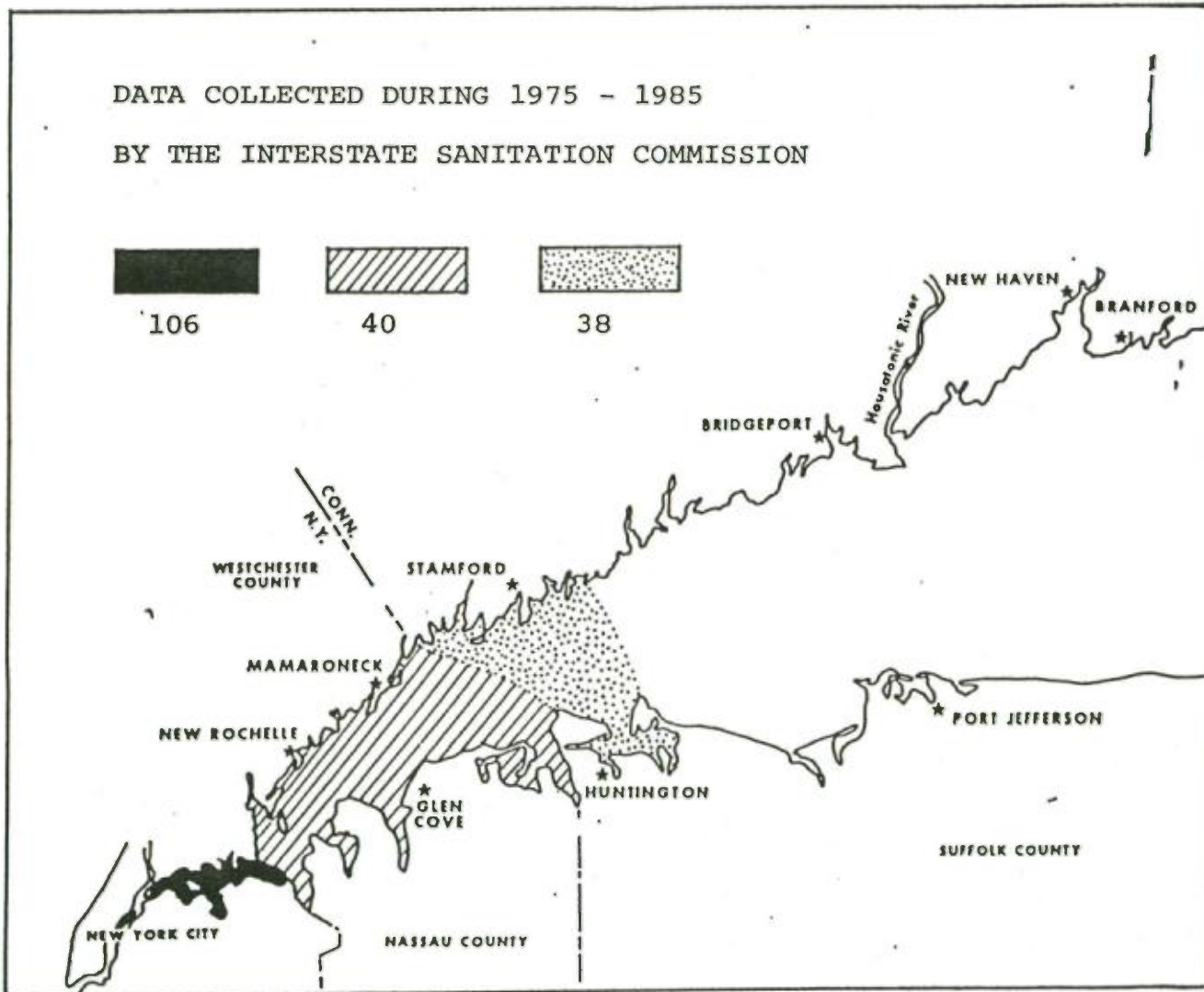
DATA COLLECTED DURING 1975 - 1985
BY THE INTERSTATE SANITATION COMMISSION



Map 3-4. 95th Percentile of ^{Total} Cadmium Concentrations (Units (ug/l))

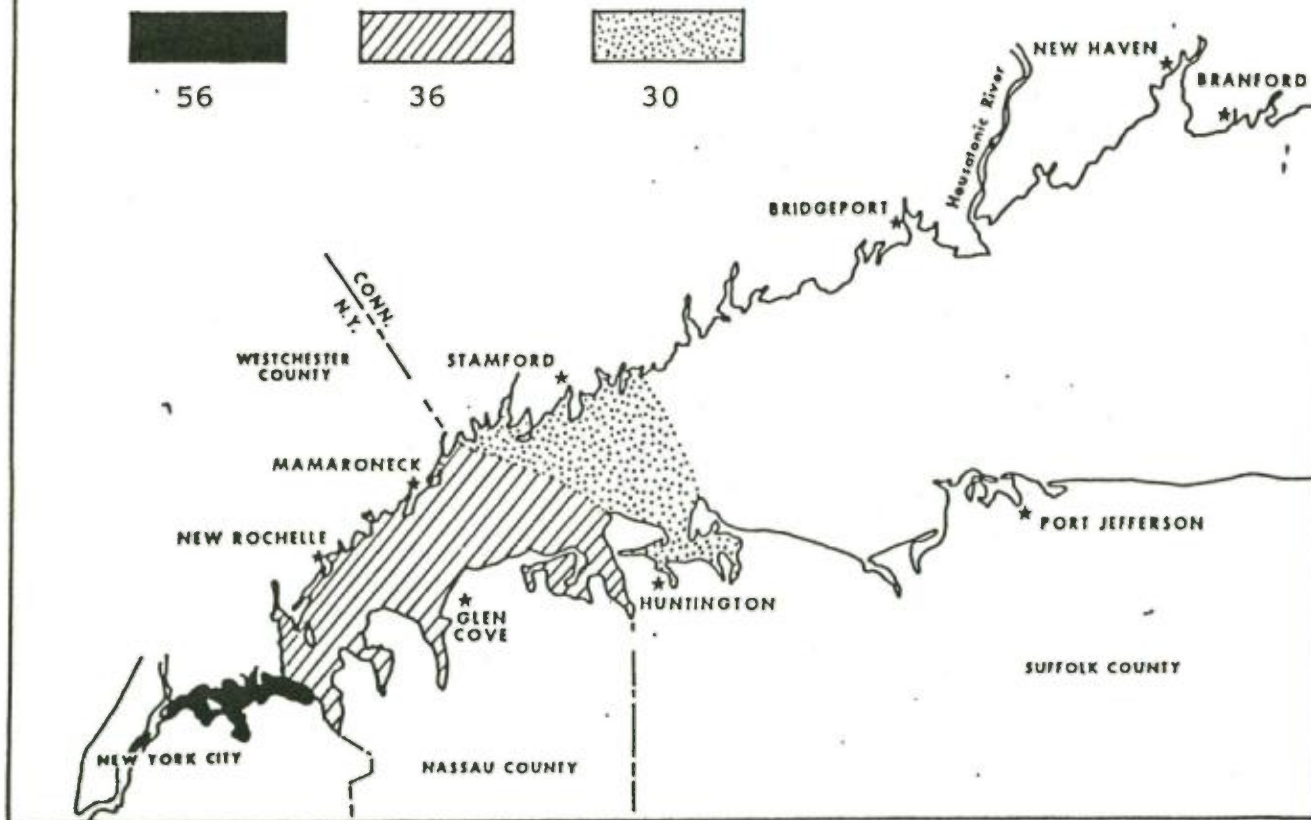
Figure 10

DATA COLLECTED DURING 1975 - 1985
 BY THE INTERSTATE SANITATION COMMISSION



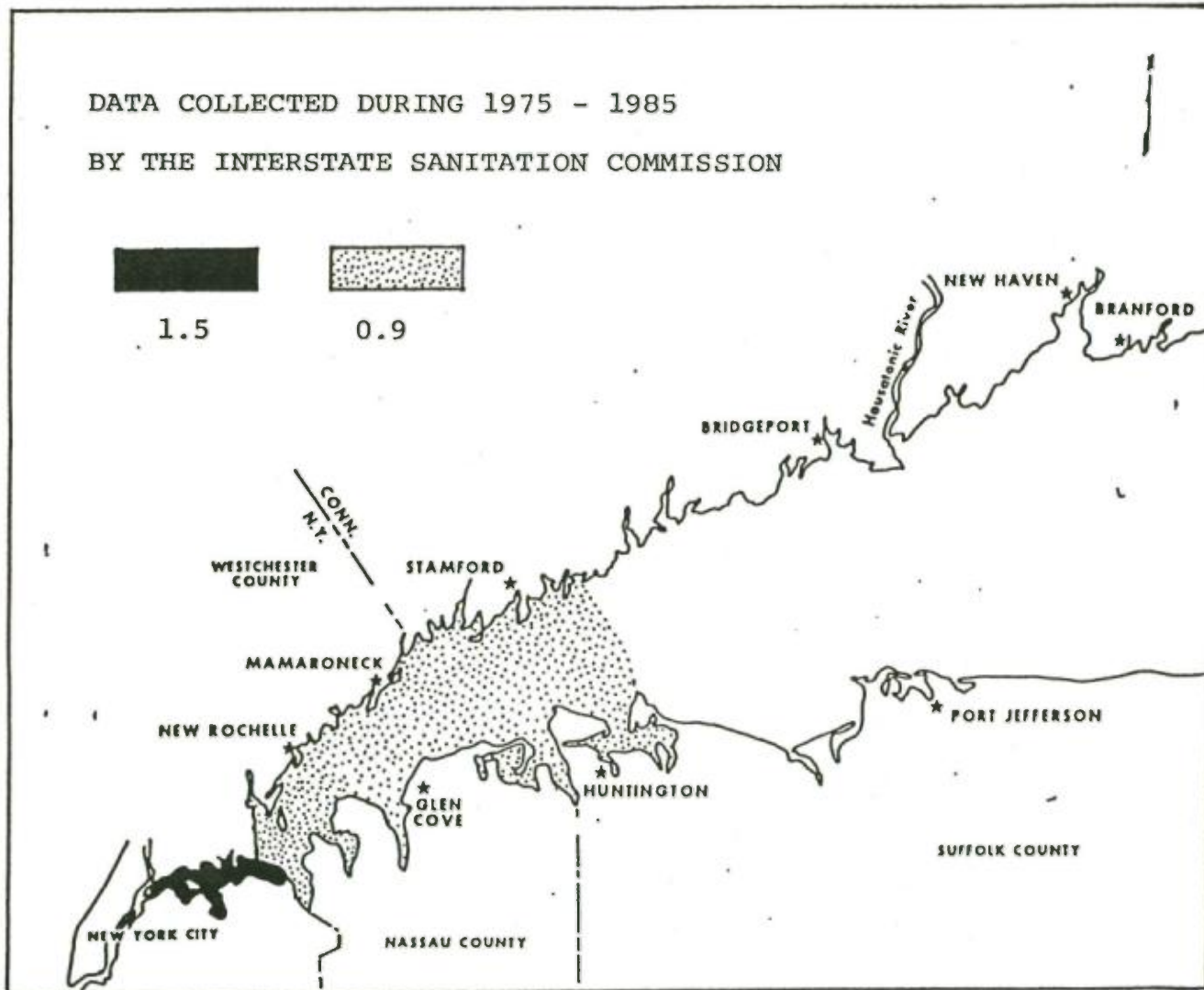
Map 5-5: 95th Percentile of ^{total} Copper Concentrations (Units: (ug/L))
 Figure 11

DATA COLLECTED DURING 1975 - 1985
 BY THE INTERSTATE SANITATION COMMISSION



Map ~~6-6~~ ^{Total} 95th Percentile of Lead Concentrations (ug/l)
 Figure 12

DATA COLLECTED DURING 1975 - 1985
BY THE INTERSTATE SANITATION COMMISSION



Map 8-77
469
Total
95th Percentile of Mercury Concentration (ug/l)

Figure 13

Cadmium ^{by Geographic Area} POLLUTANT DISTRIBUTION IN WESTERN LONG ISLAND SOUND - ISC H.S. DATA (1975-1985)

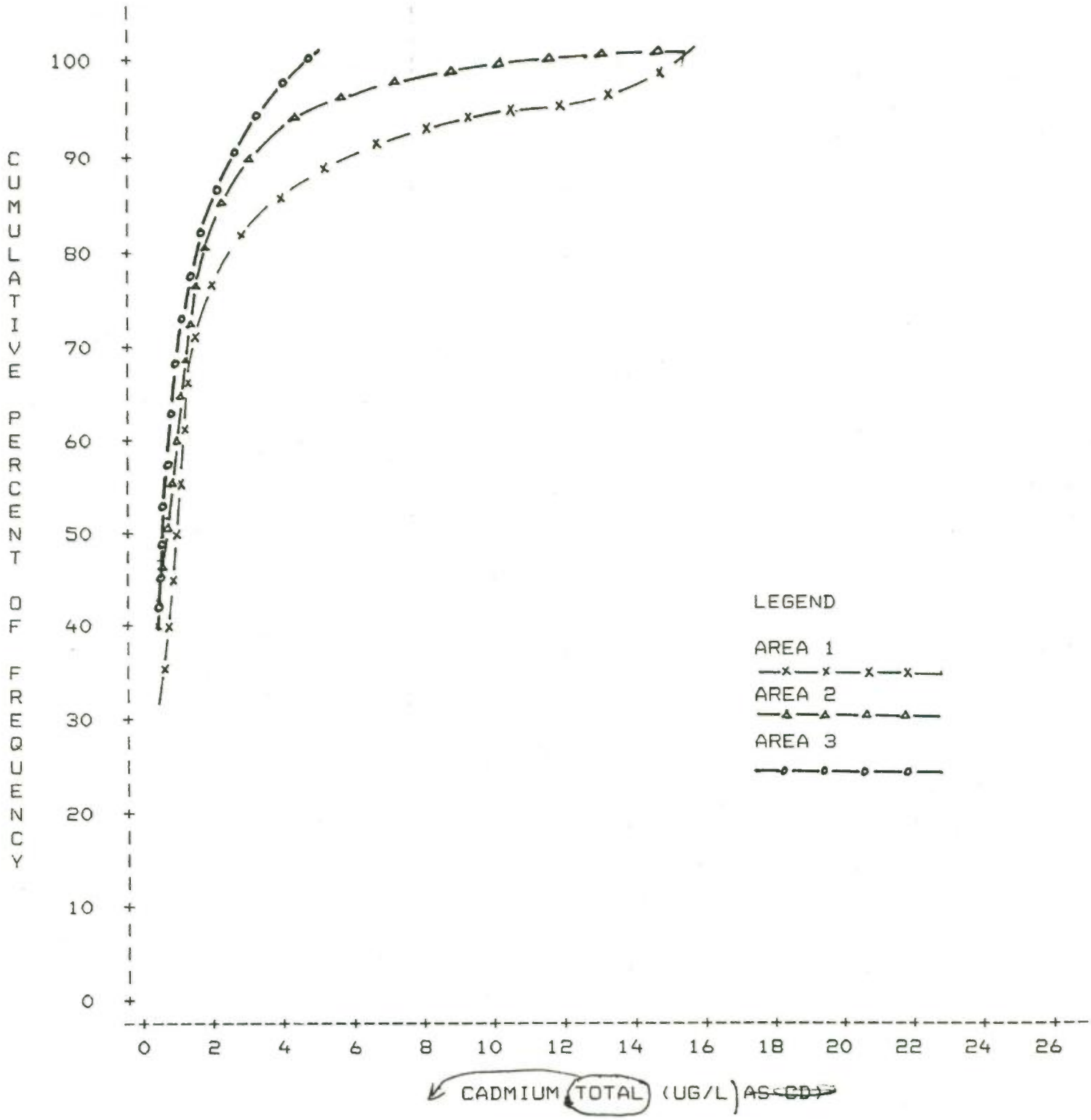


Figure 14

POLLUTANT DISTRIBUTION IN WESTERN LONG ISLAND SOUND - ISC H.S. DATA (1975-

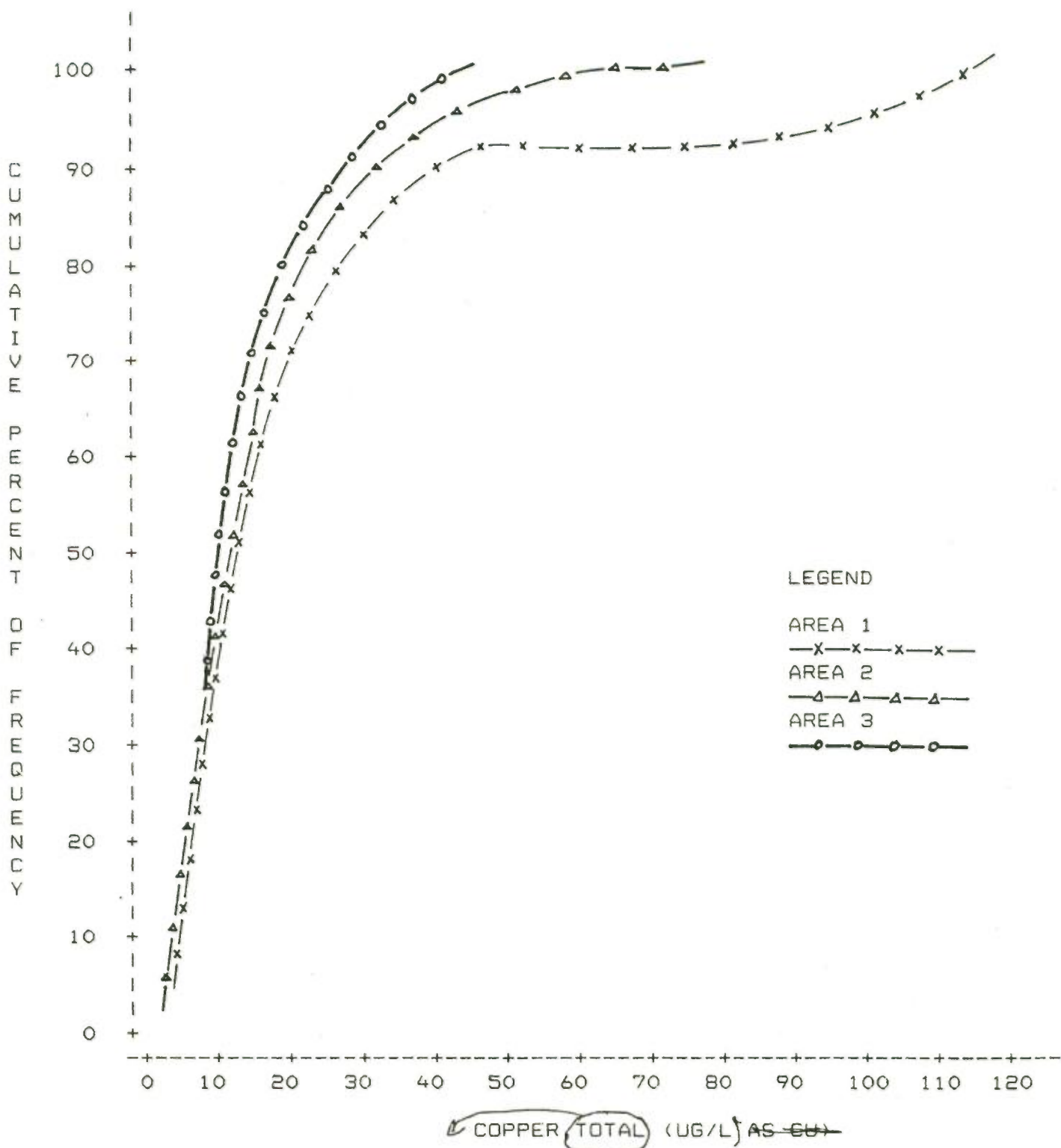


Figure 15

POLLUTANT DISTRIBUTION IN WESTERN LONG ISLAND SOUND - ISC H.S. DATA (1975-1985)

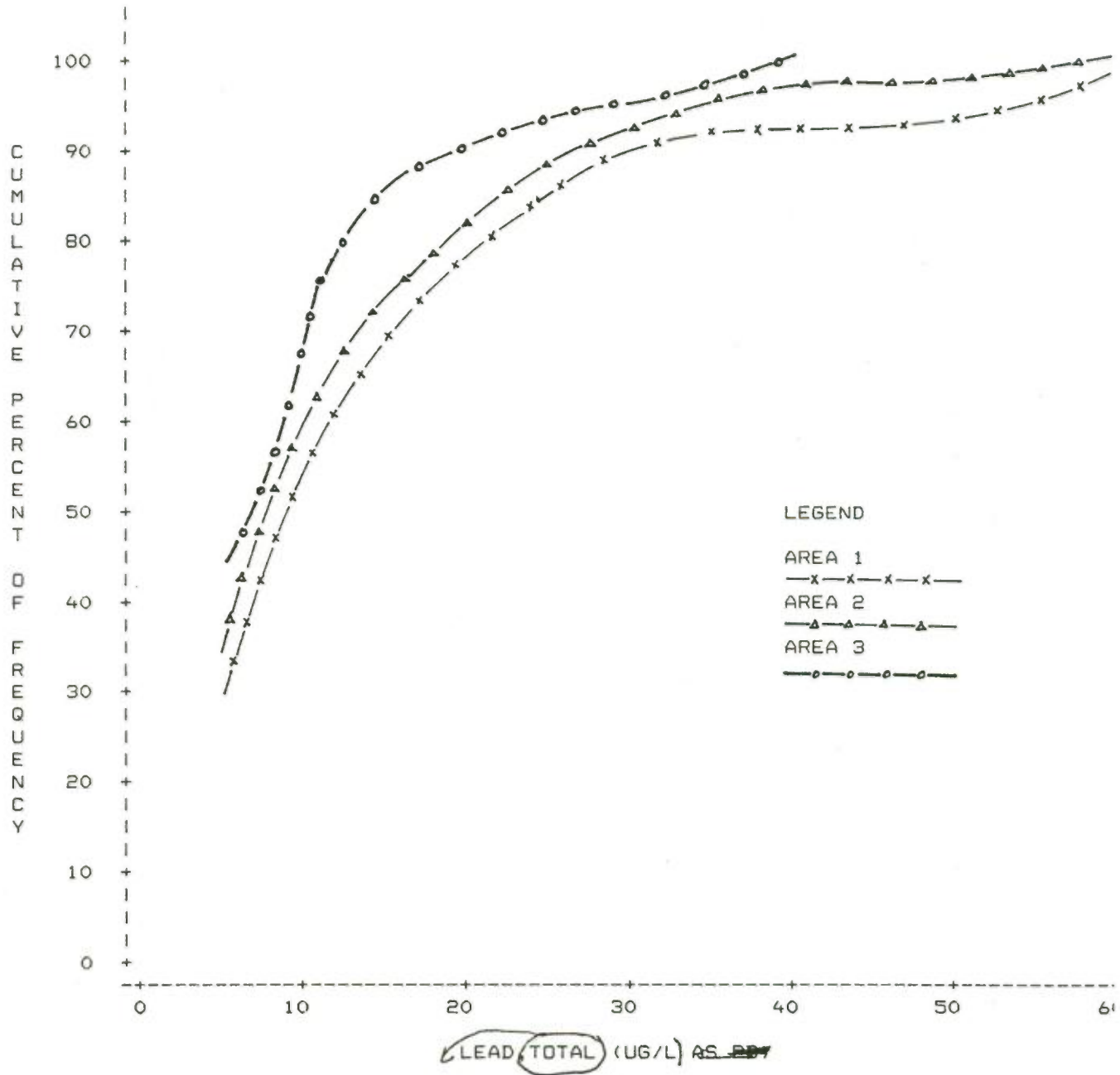


Figure 16

3.1.1

POLLUTANT DISTRIBUTION IN WESTERN LONG ISLAND SOUND - ISC H.S. DATA (1975-1985)

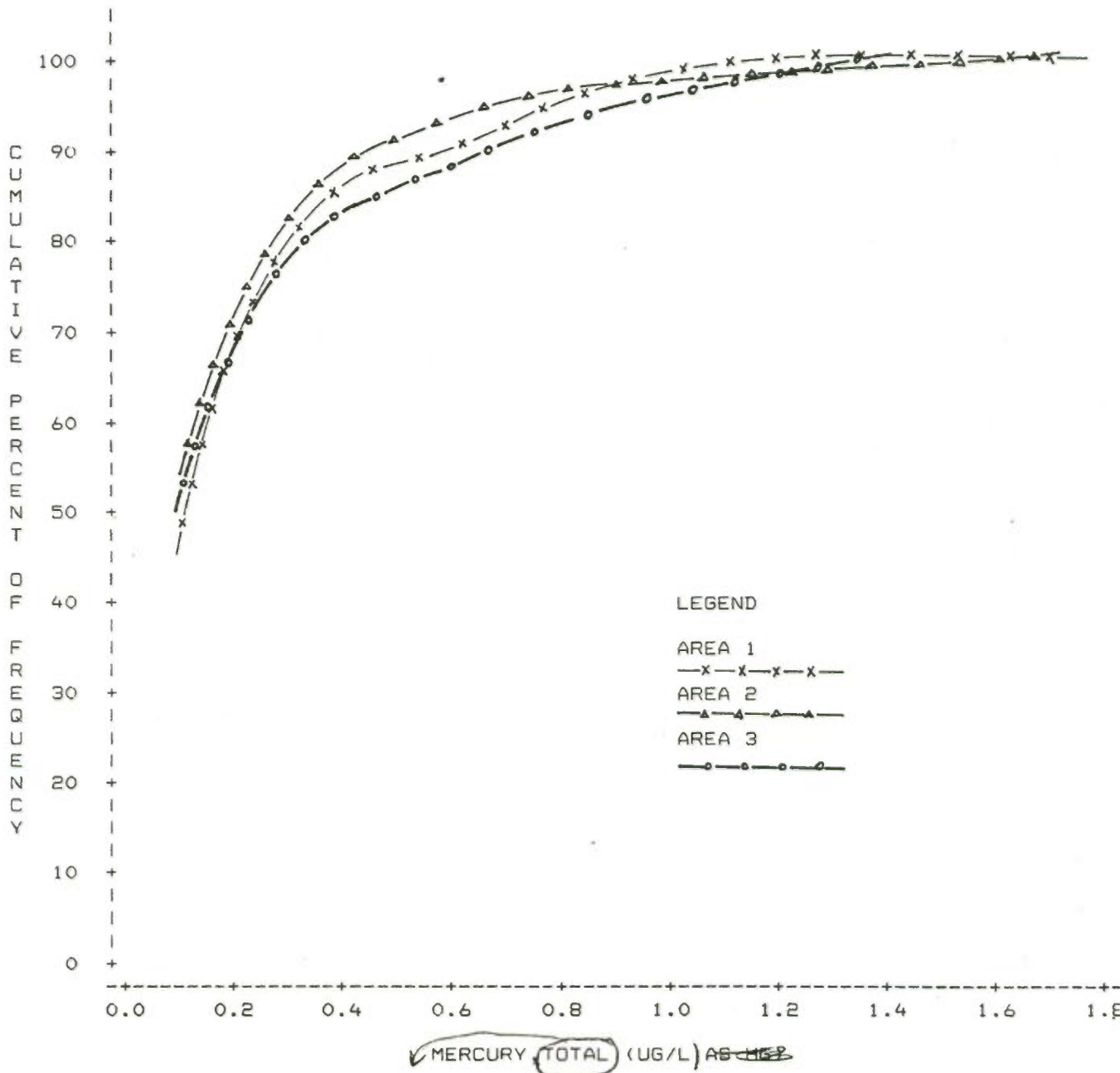


Figure 17

Chart Figure 18
4-5

LONG ISLAND SOUND ESTUARINE STUDY
 CUMULATIVE FREQUENCY OF CADMIUM CONCENTRATIONS IN THE WATER COLUMN
 CUMULATIVE PERCENTAGE BLOCK CHART

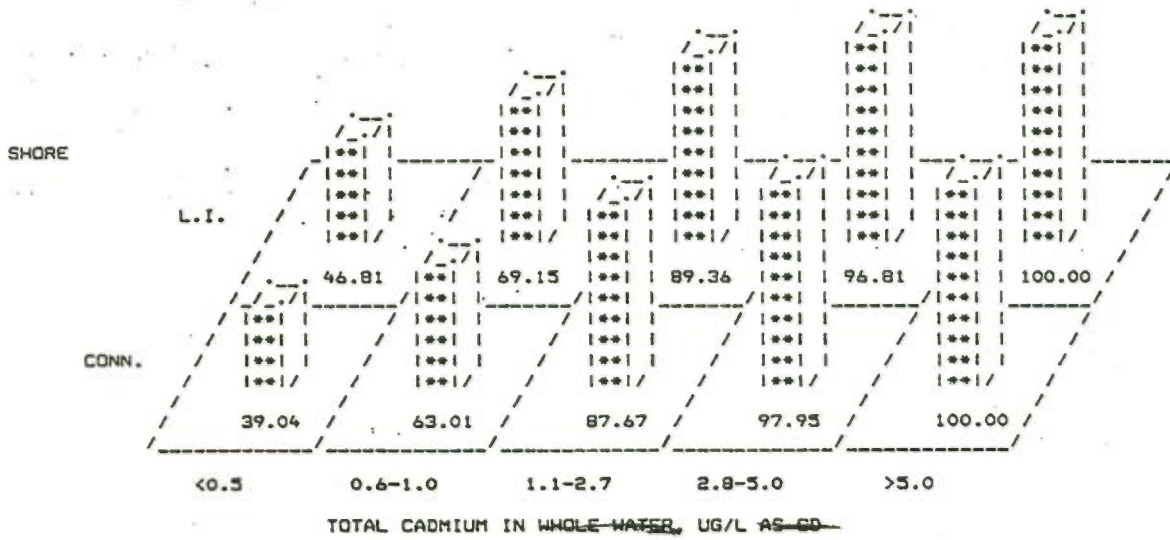


Figure 19
Chart 4-6

LONG ISLAND SOUND ESTUARINE STUDY
 CUMULATIVE FREQUENCY OF COPPER CONCENTRATIONS IN THE WATER COLUMN
 CUMULATIVE PERCENTAGE BLOCK CHART

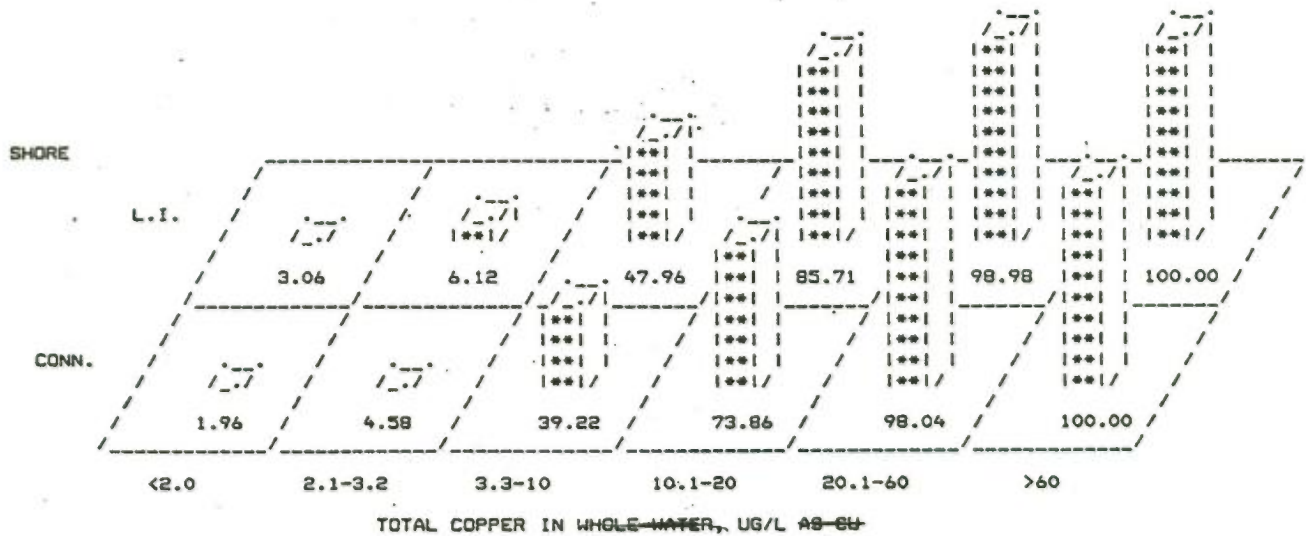
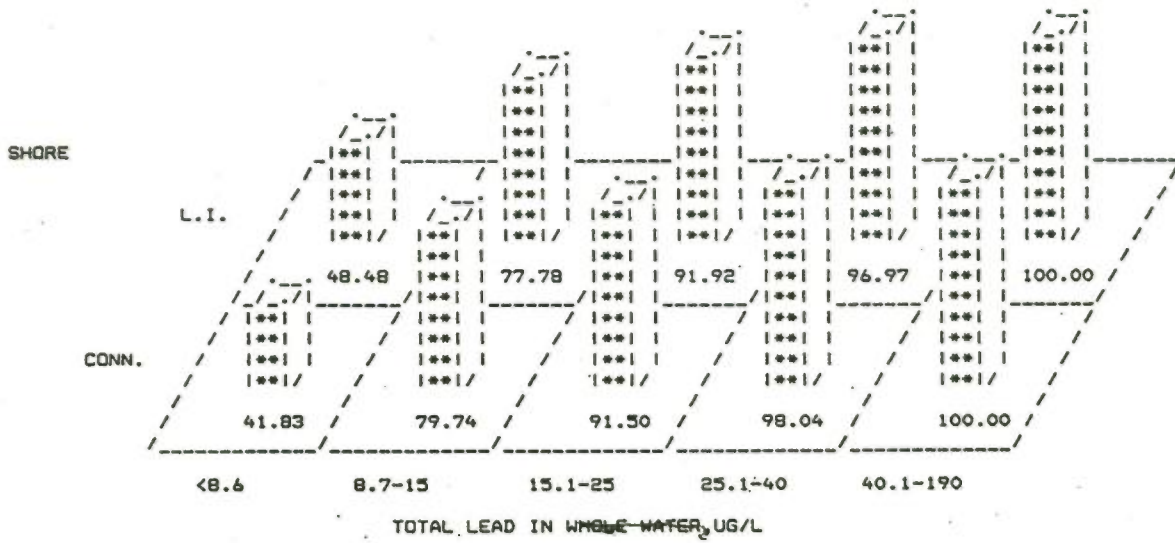


Figure 20
Chart 6

LONG ISLAND SOUND ESTUARINE STUDY
 CUMULATIVE FREQUENCY OF LEAD CONCENTRATIONS IN THE WATER COLUMN
 CUMULATIVE PERCENTAGE BLOCK CHART



*Chart Figure 21
4-8*

LONG ISLAND SOUND ESTUARINE STUDY

CUMULATIVE FREQUENCY OF MERCURY CONCENTRATIONS IN THE WATER COLUMN

CUMULATIVE PERCENTAGE BLOCK CHART

