

**U.S. Environmental Protection Agency, Region II  
New York/New Jersey Harbor Estuary Program  
Water Management Division  
Surface Water Quality Branch**

**DEVELOPMENT OF TOTAL MAXIMUM DAILY  
LOADS AND WASTELOAD ALLOCATIONS  
FOR TOXIC METALS IN NY/NJ HARBOR**

**MODELING REPORT  
APPENDICES**

**Job Number: TETRO103**

**Prepared by:**

**HydroQual, Inc.  
1 Lethbridge Plaza  
Mahwah, New Jersey 07430**

**September 1995**

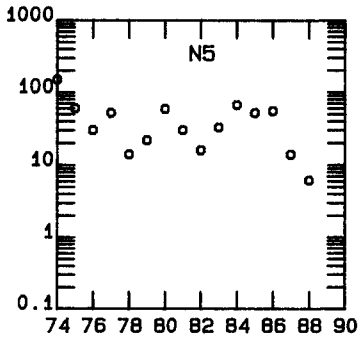
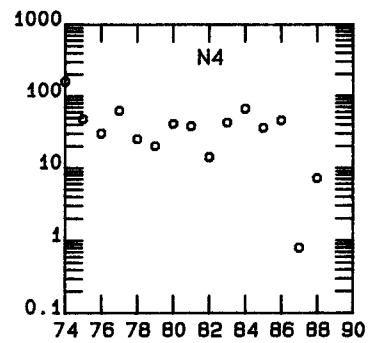
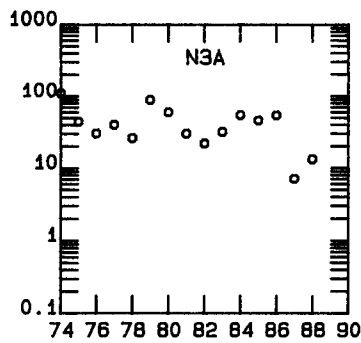
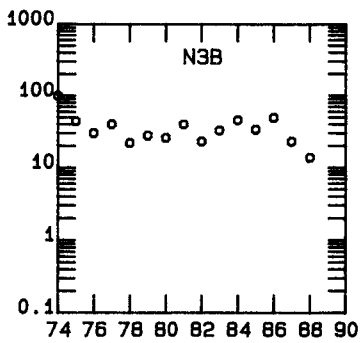
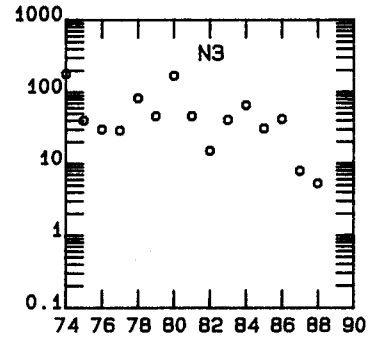
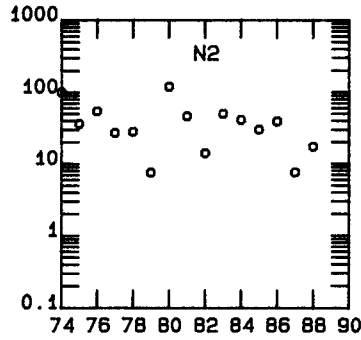
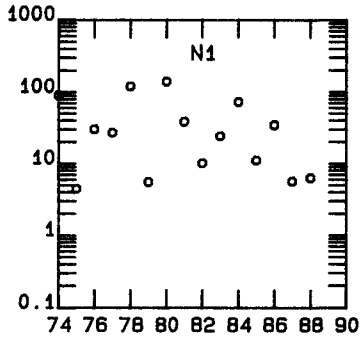
## CONTENTS

- APPENDIX I      SPATIAL AND TEMPORAL ANALYSES OF NYCDEP HARBOR  
SURVEY HISTORICAL METALS DATA
- APPENDIX II     BATTELLE - NYCDEP  
INTER-LABORATORY COMPARISONS
- APPENDIX III    SUSPENDED SOLIDS DATA BASES  
                  BOKUNIEWICZ  
                  BERO  
                  NYCDEP
- APPENDIX IV     PROBABILITY DISTRIBUTIONS  
DISSOLVED, PARTICULATE AND TOTAL RECOVERABLE  
ARSENIC, CADMIUM, SILVER AND ZINC
- APPENDIX V      MODEL CALIBRATIONS

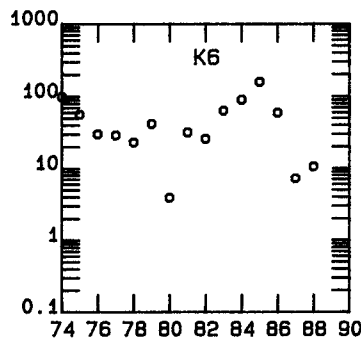
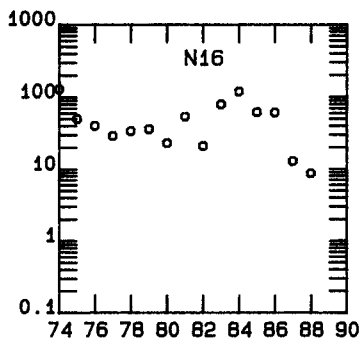
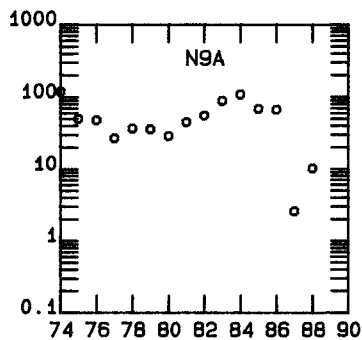
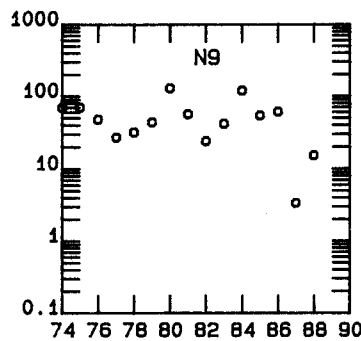
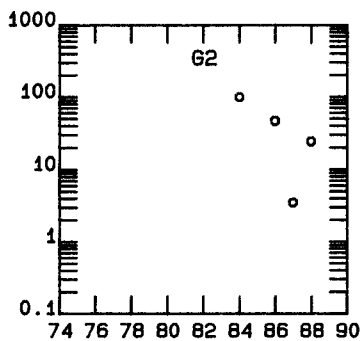
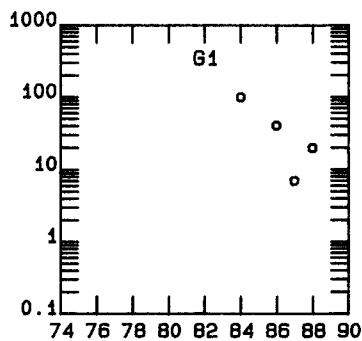
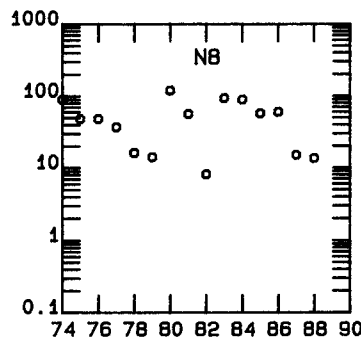
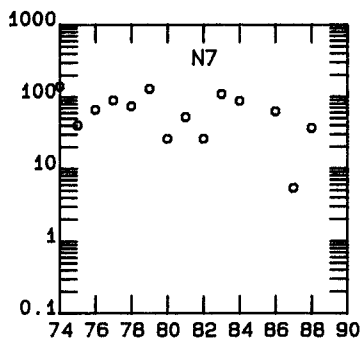
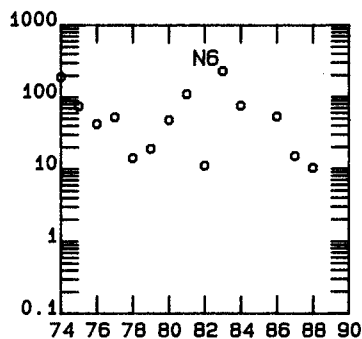
**APPENDIX I**

**SPATIAL AND TEMPORAL ANALYSES  
OF NYCDEP HARBOR SURVEY  
HISTORICAL METALS DATA**

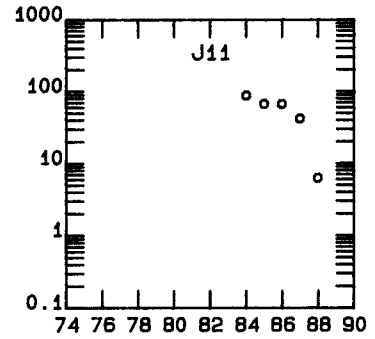
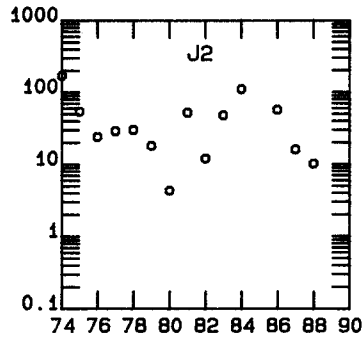
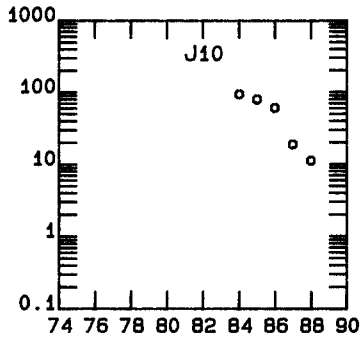
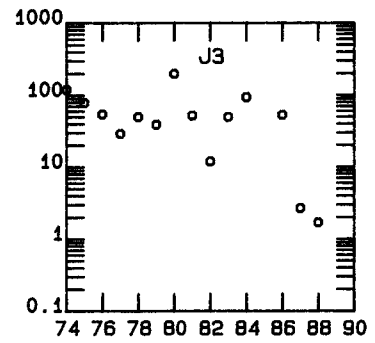
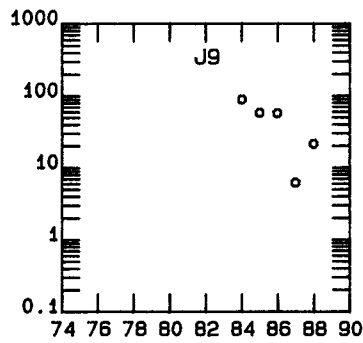
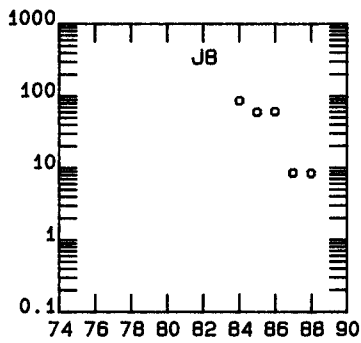
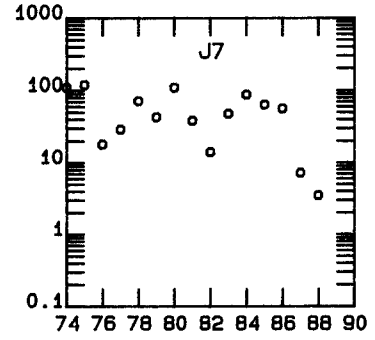
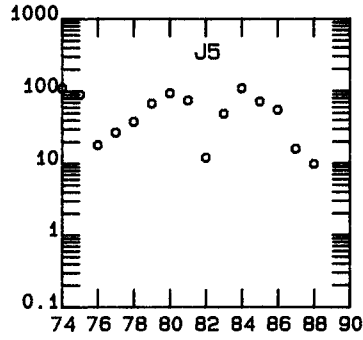
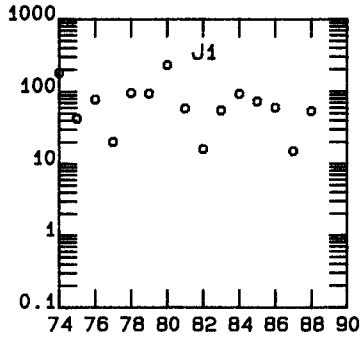
Hudson River Water Column Copper (ug/l)  
NYC DEP Harbor Survey 1974-1988



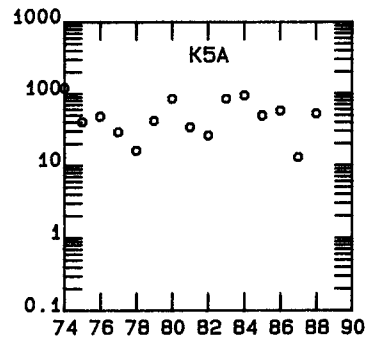
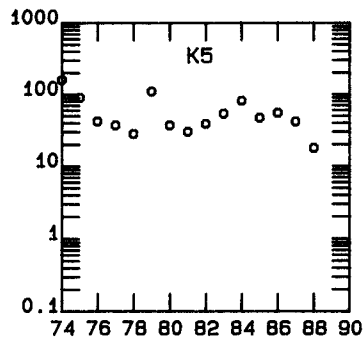
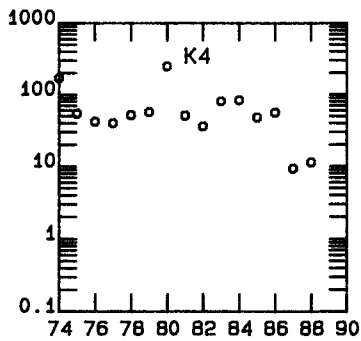
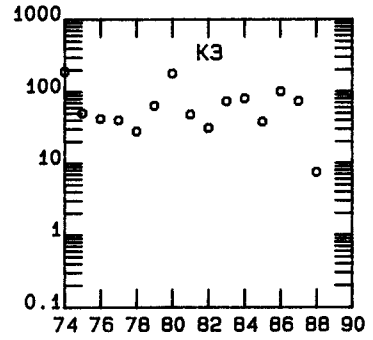
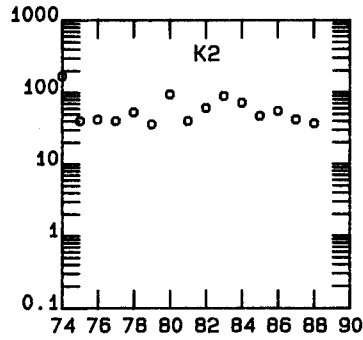
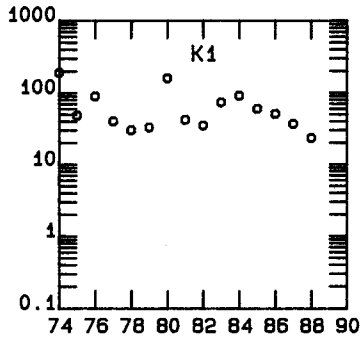
# Inner and Outer Harbor Water Column Copper (ug/l) NYC DEP Harbor Survey 1974-1988



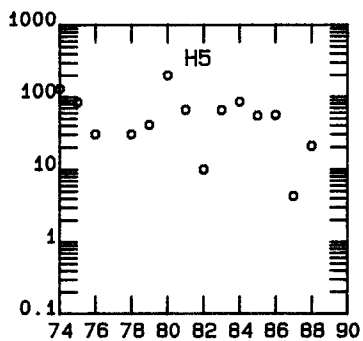
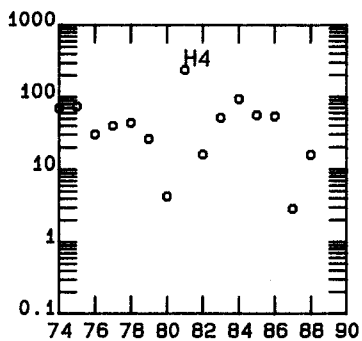
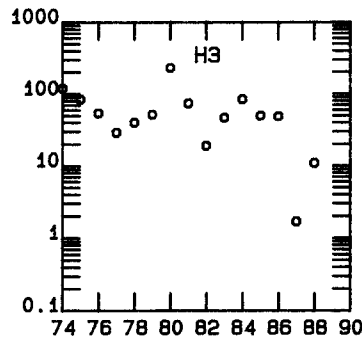
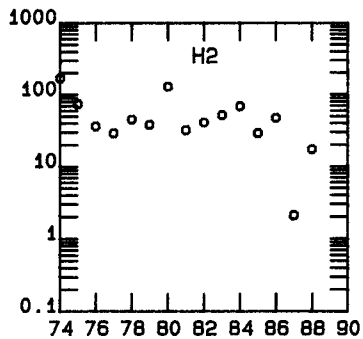
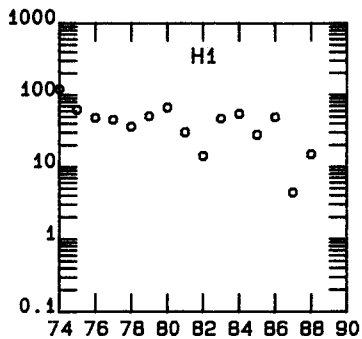
Jamaica Bay Water Column Copper (ug/l)  
NYC DEP Harbor Survey 1974-1988



Kills - Raritan Bay Water Column Copper (ug/l)  
NYC DEP Harbor Survey 1974-1988

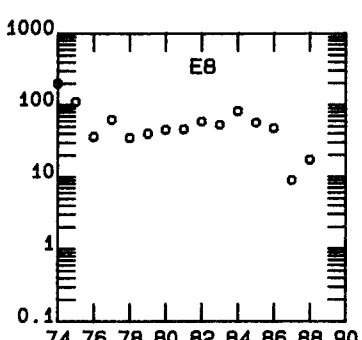
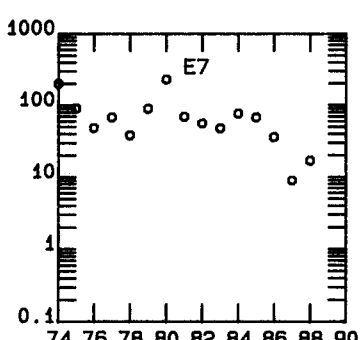
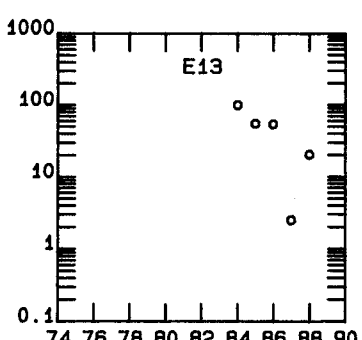
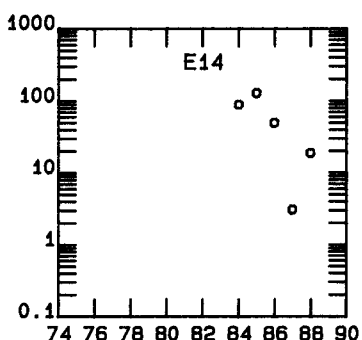
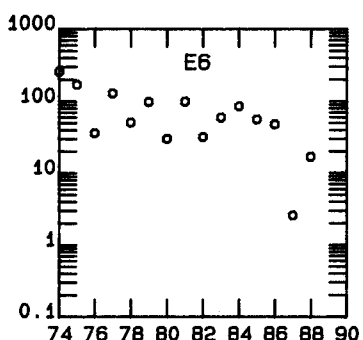
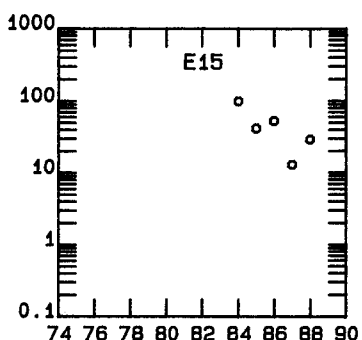
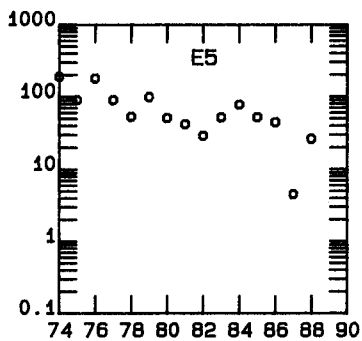
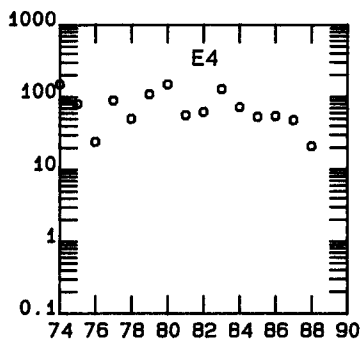
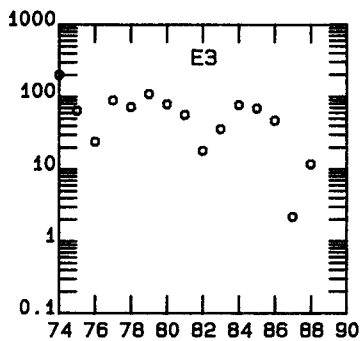
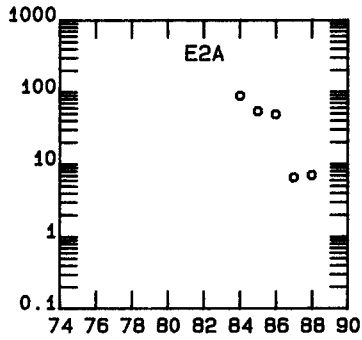
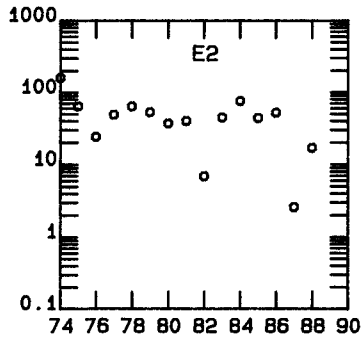
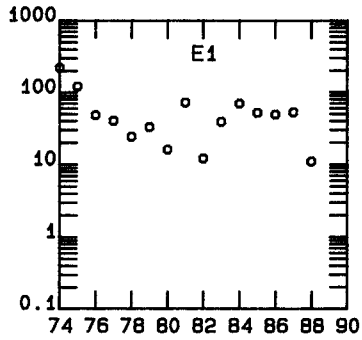


Harlem River Water Column Copper (ug/l)  
NYC DEP Harbor Survey 1974-1988

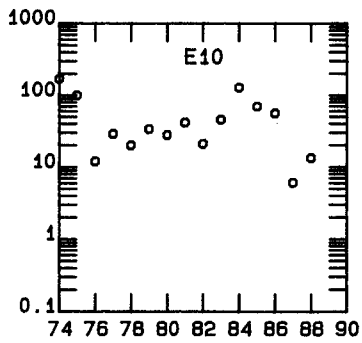
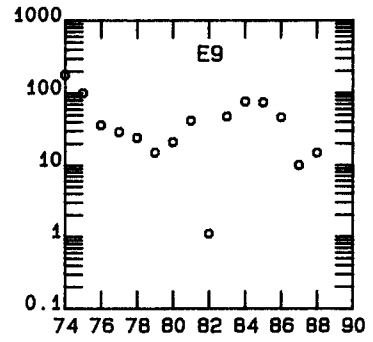
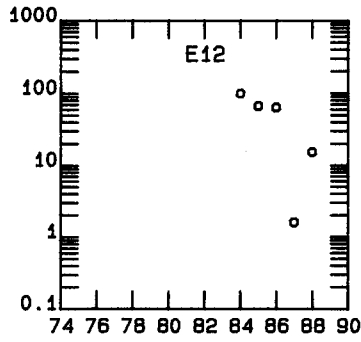
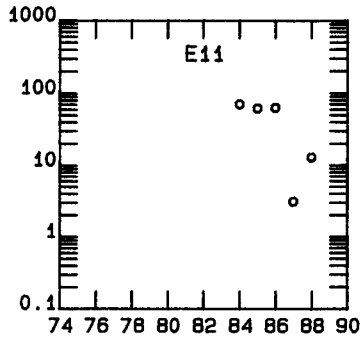




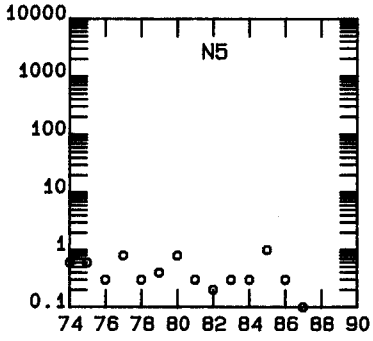
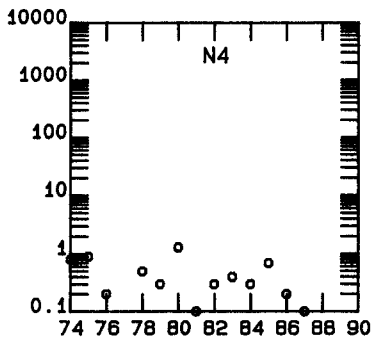
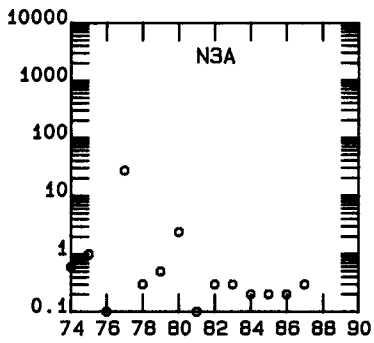
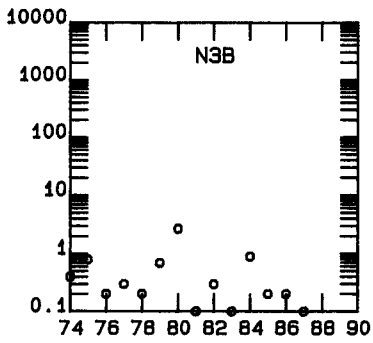
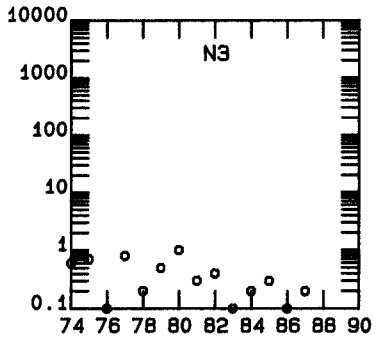
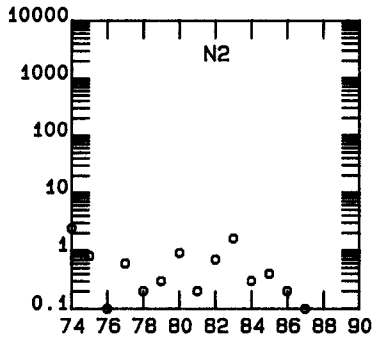
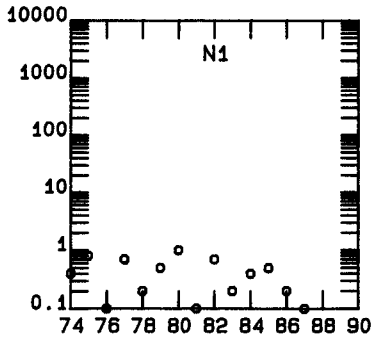
East River Water Column Copper (ug/l)  
NYC DEP Harbor Survey 1974-1988



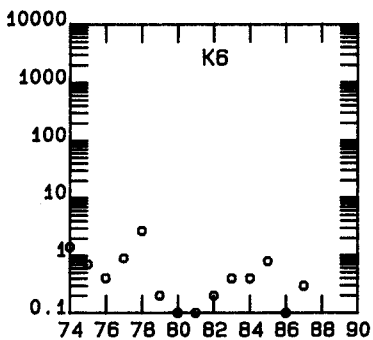
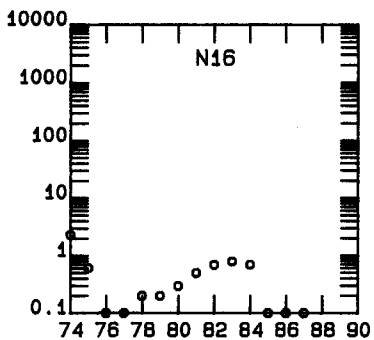
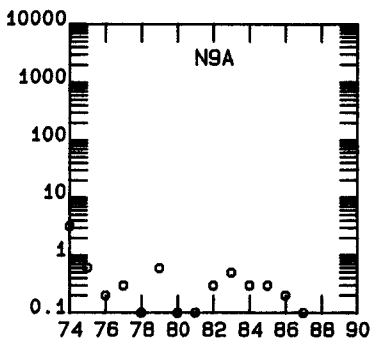
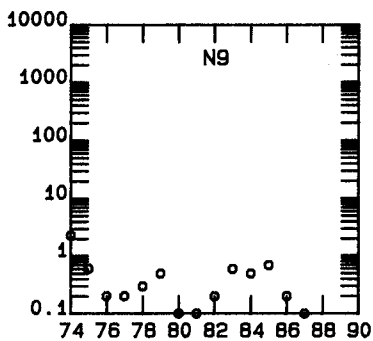
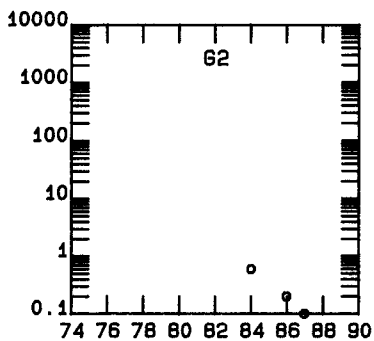
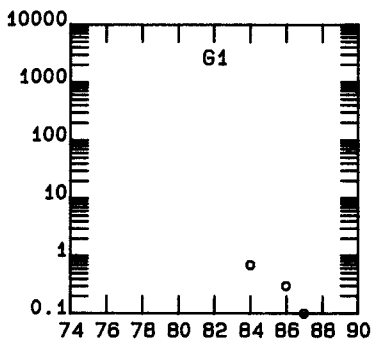
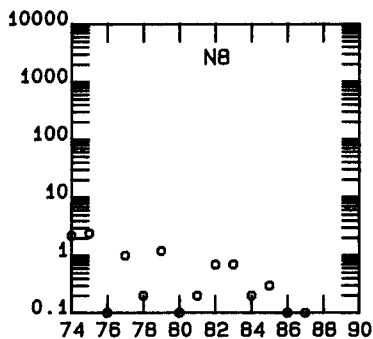
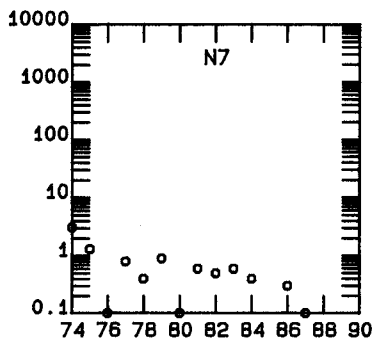
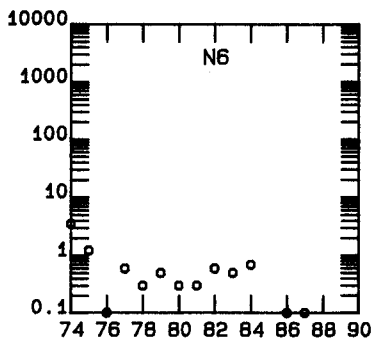
Outer East River Water Column Copper (ug/l)  
NYC DEP Harbor Survey 1974-1988



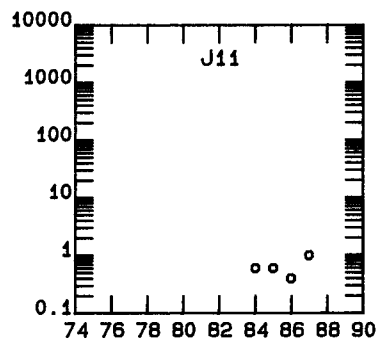
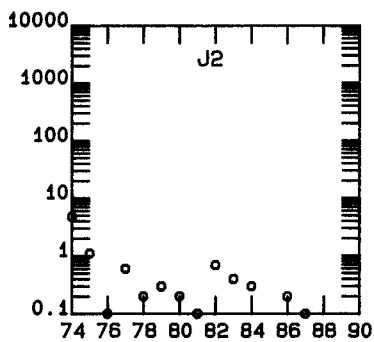
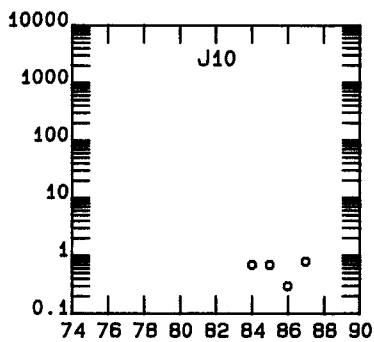
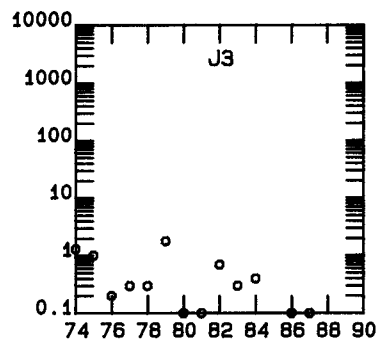
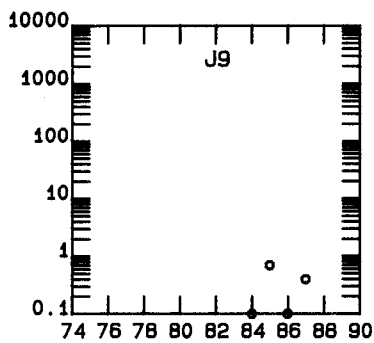
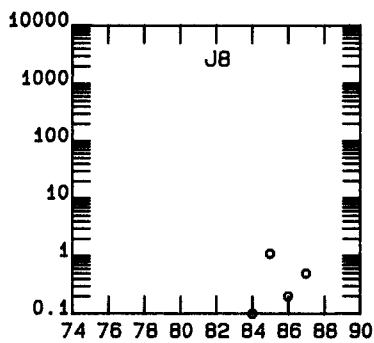
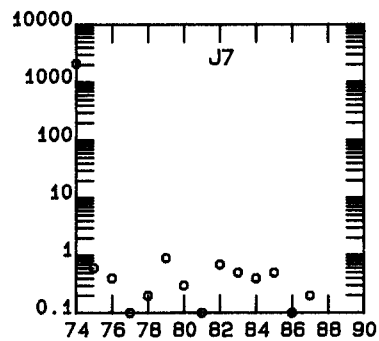
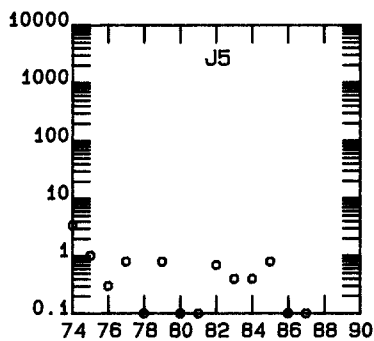
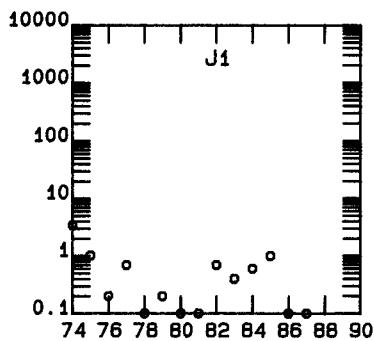
Hudson River Water Column Mercury (ug/l)  
NYC DEP Harbor Survey 1974-1988



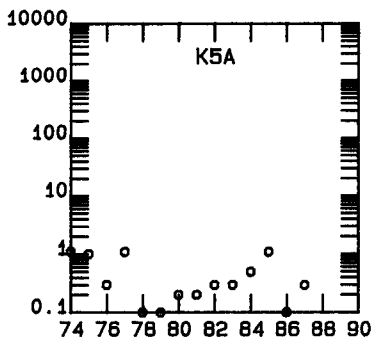
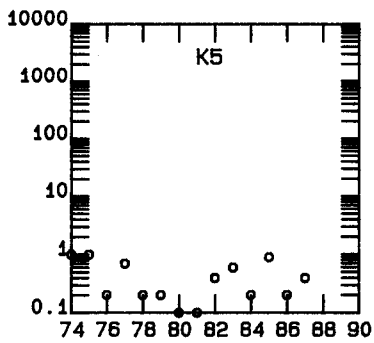
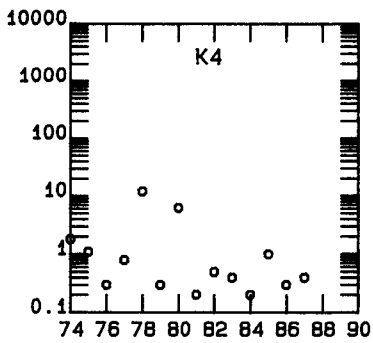
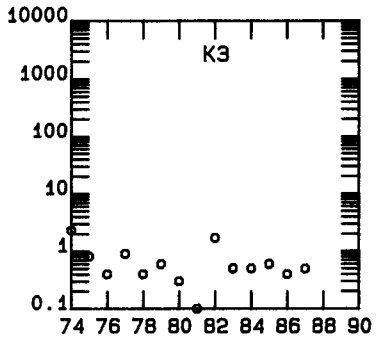
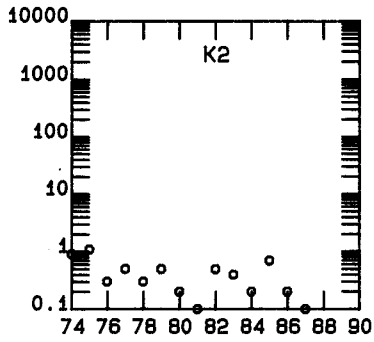
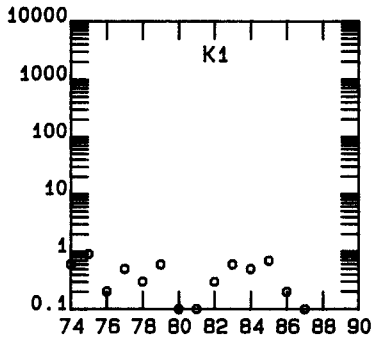
# Inner and Outer Harbor Water Column Mercury (ug/l) NYC DEP Harbor Survey 1974-1988



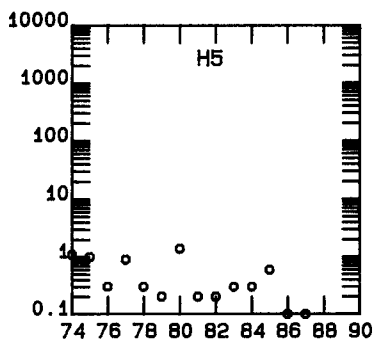
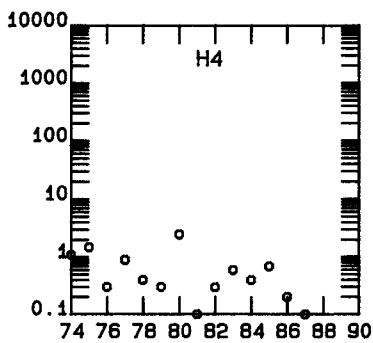
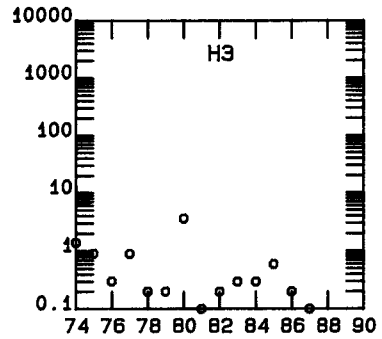
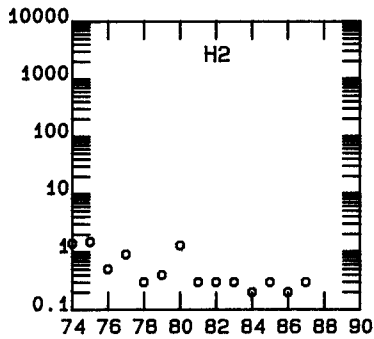
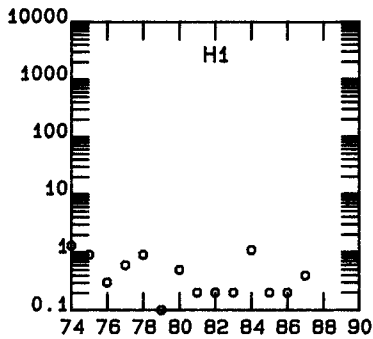
# Jamaica Bay Water Column Mercury (ug/l) NYC DEP Harbor Survey 1974-1988



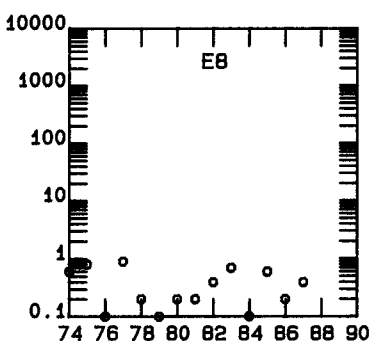
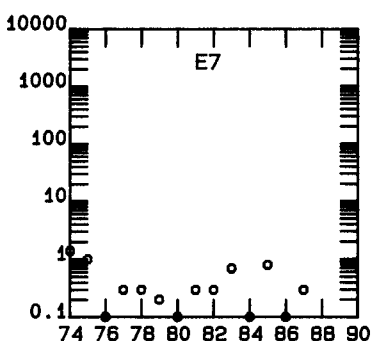
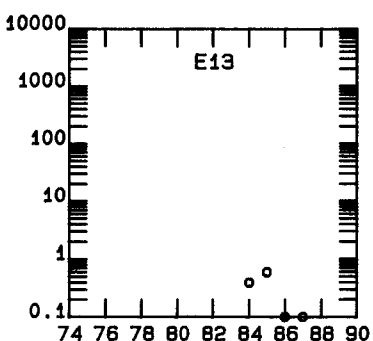
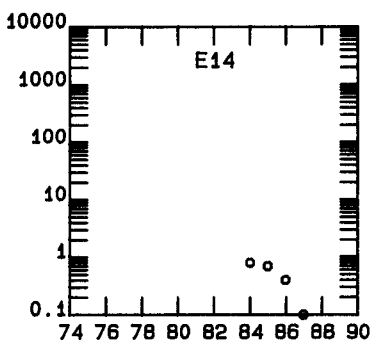
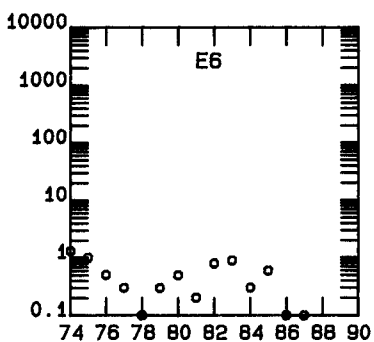
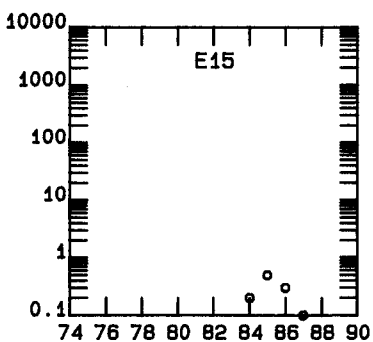
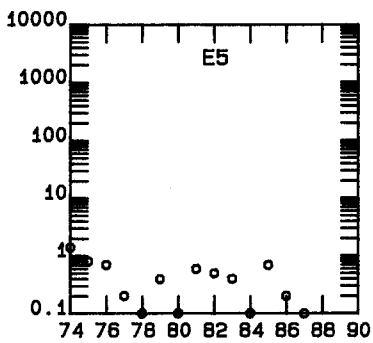
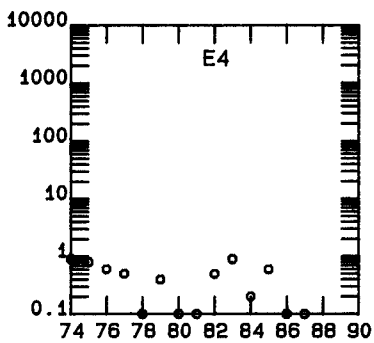
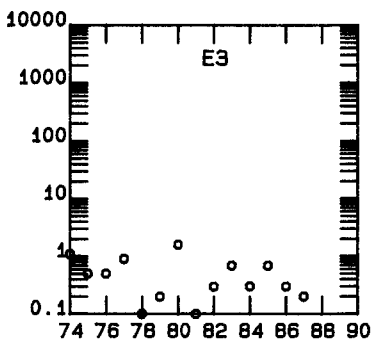
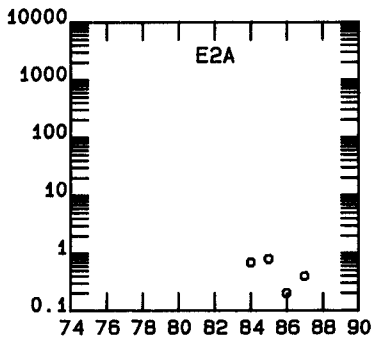
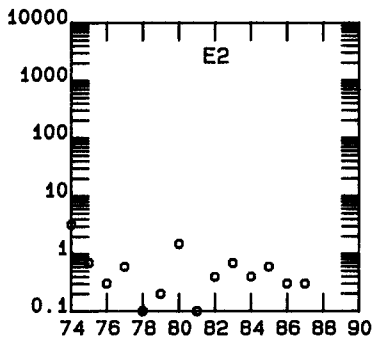
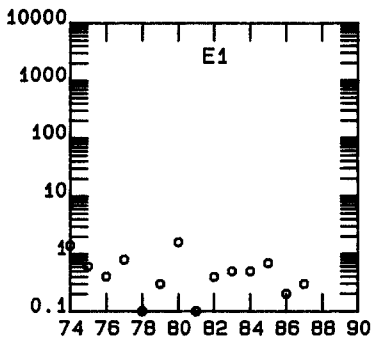
Kills - Raritan Bay Water Column Mercury (ug/l)  
NYC DEP Harbor Survey 1974-1988



# Harlem River Water Column Mercury (ug/l) NYC DEP Harbor Survey 1974-1988

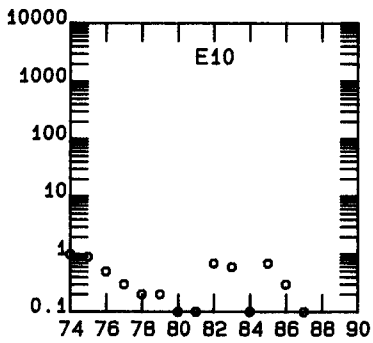
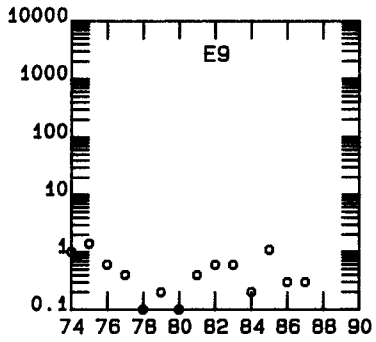
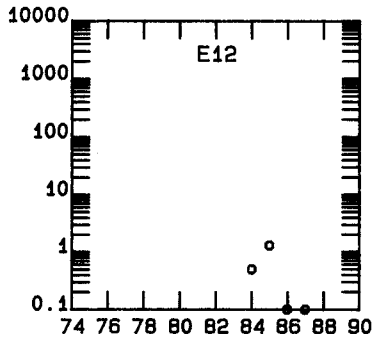
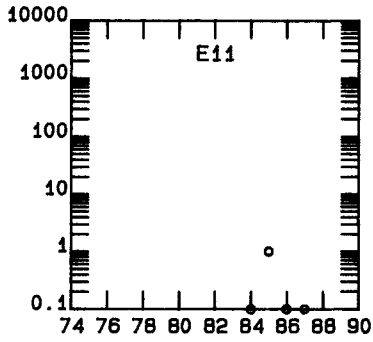


East River Water Column Mercury (ug/l)  
NYC DEP Harbor Survey 1974-1988

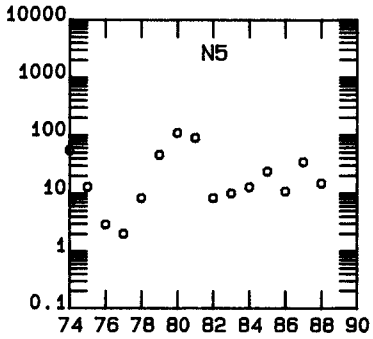
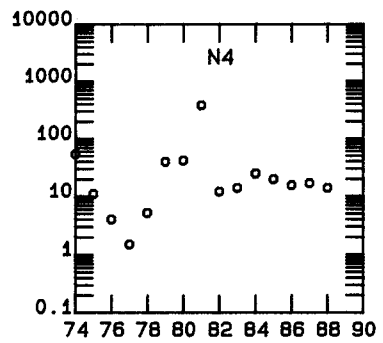
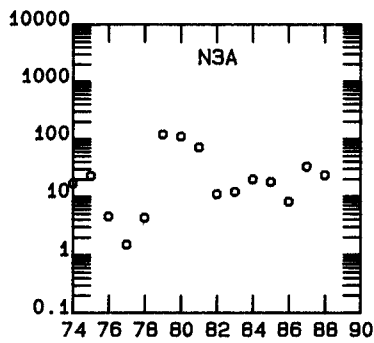
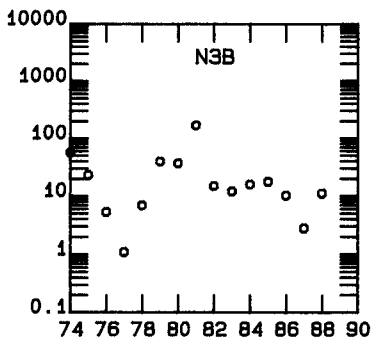
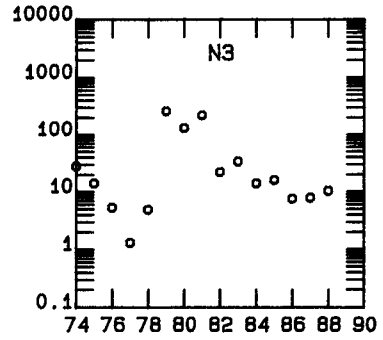
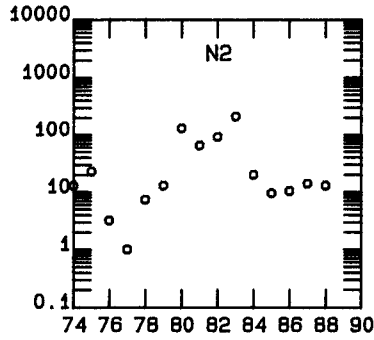
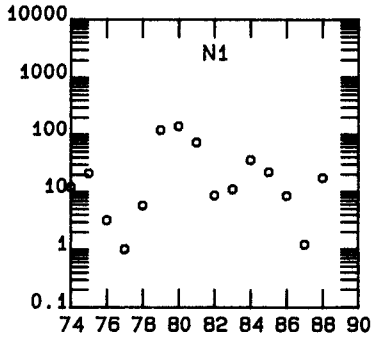




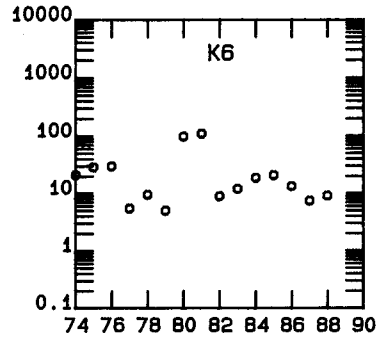
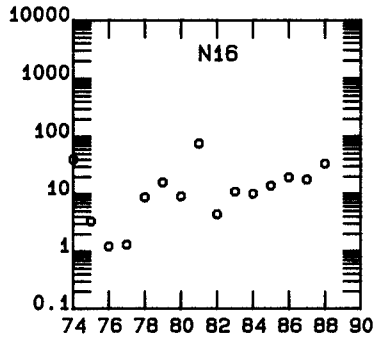
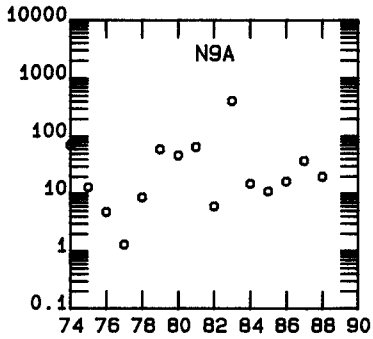
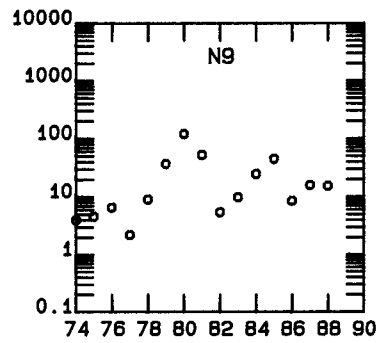
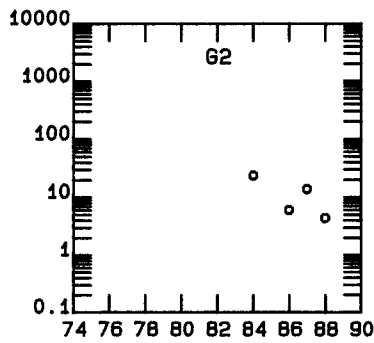
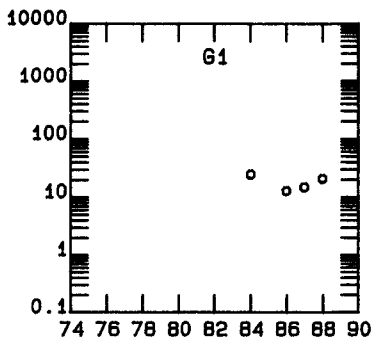
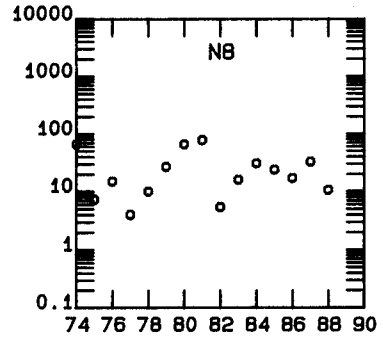
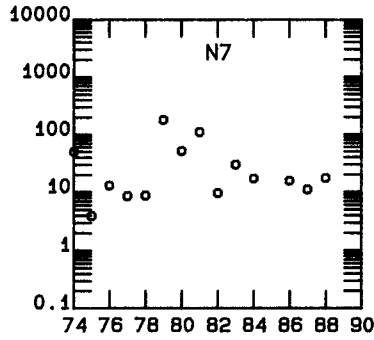
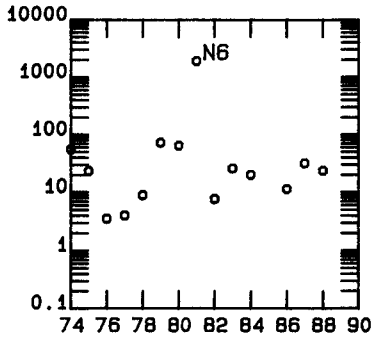
Outer East River Water Column Mercury (ug/l)  
NYC DEP Harbor Survey 1974-1988



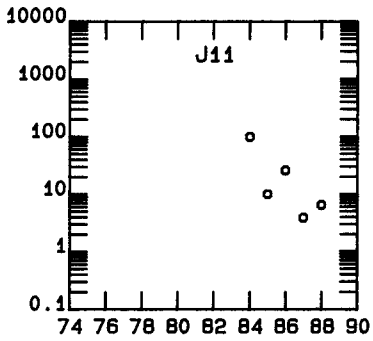
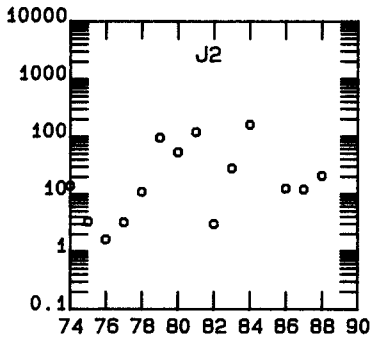
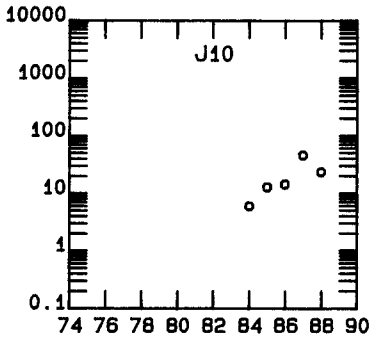
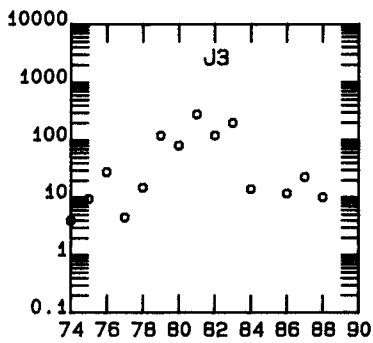
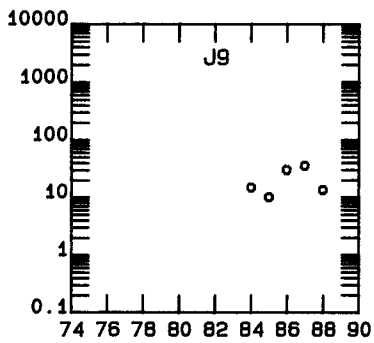
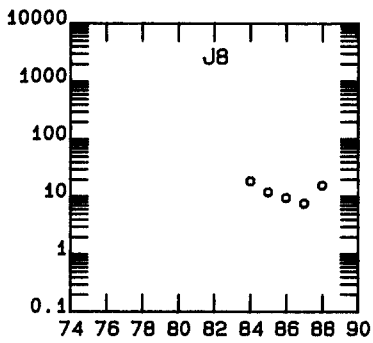
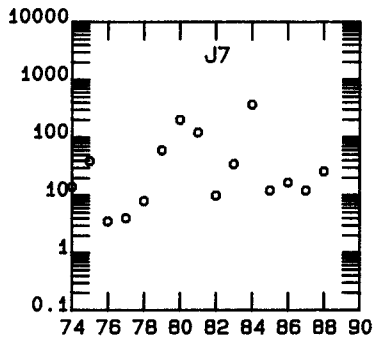
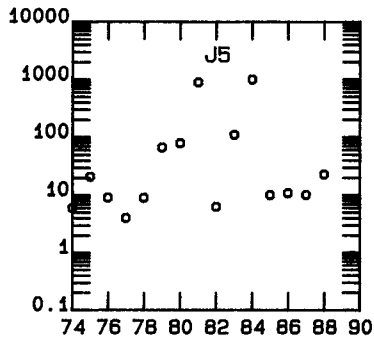
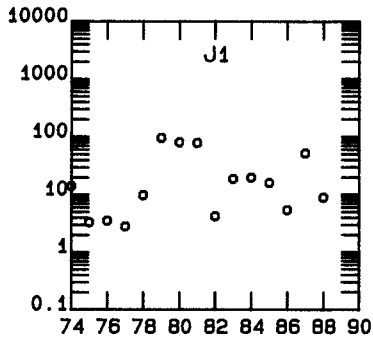
Hudson River Water Column Nickel (ug/l)  
NYC DEP Harbor Survey 1974-1988



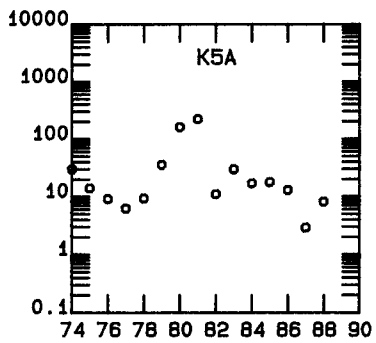
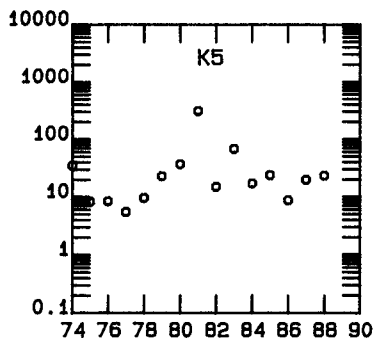
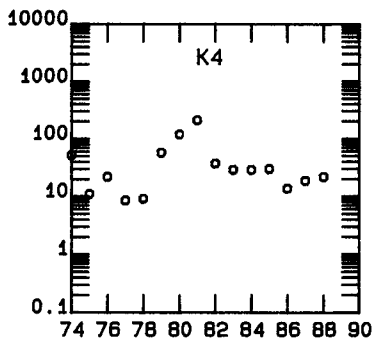
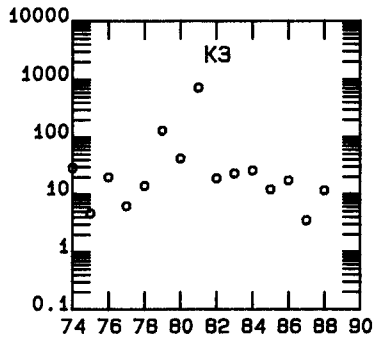
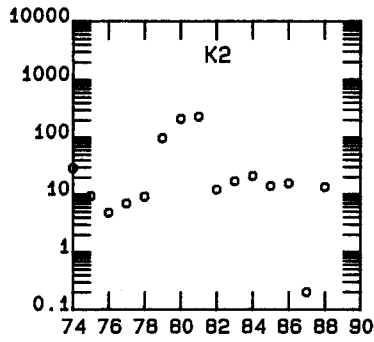
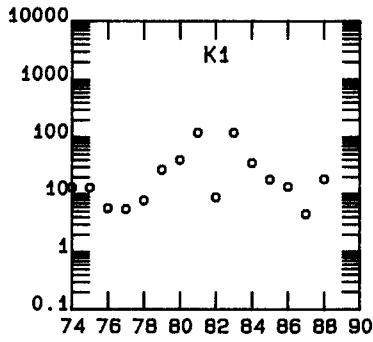
Inner and Outer Harbor Water Column Nickel (ug/l)  
NYC DEP Harbor Survey 1974-1988



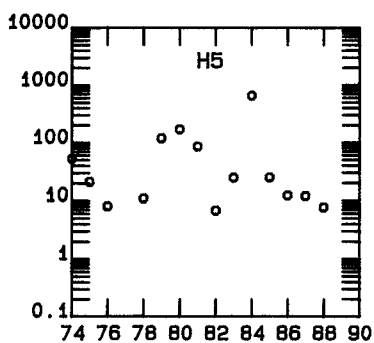
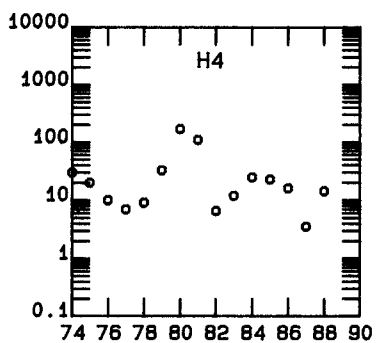
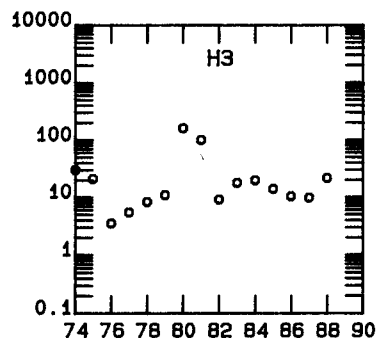
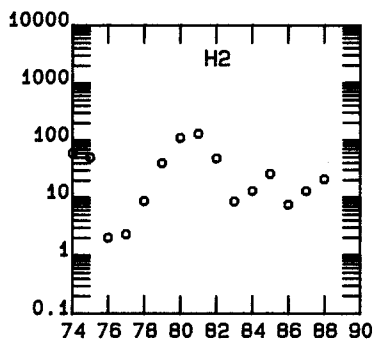
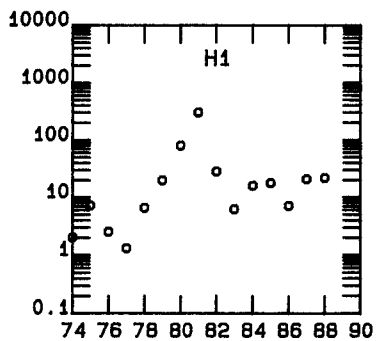
Jamaica Bay Water Column Nickel (ug/l)  
NYC DEP Harbor Survey 1974-1988



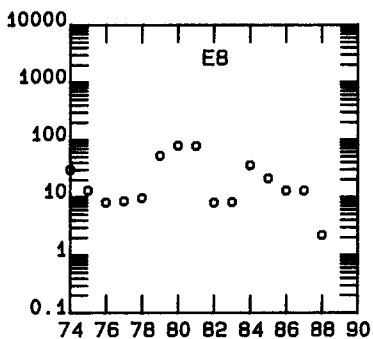
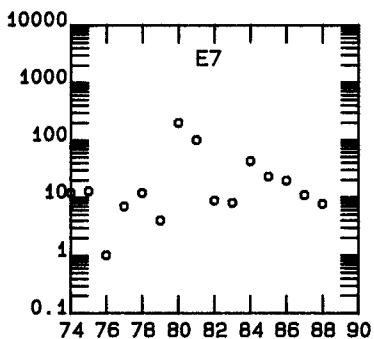
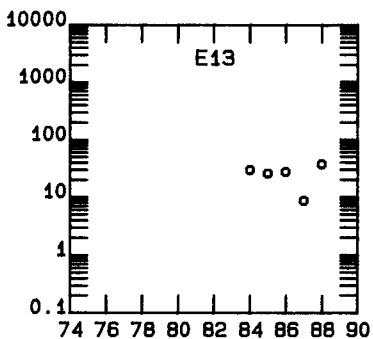
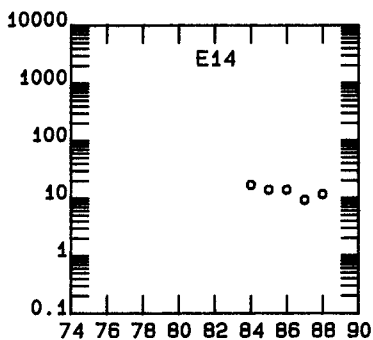
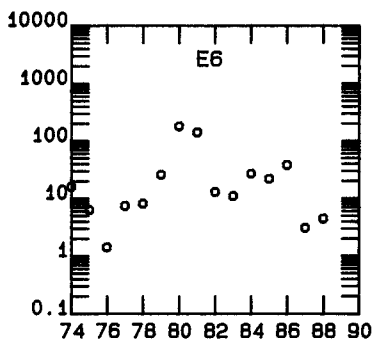
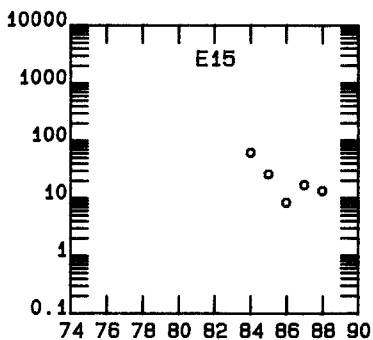
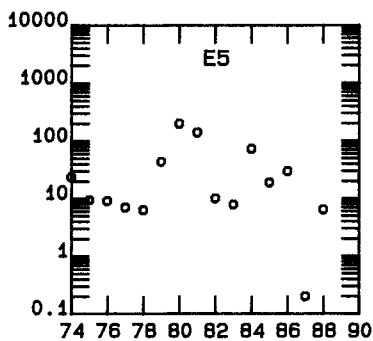
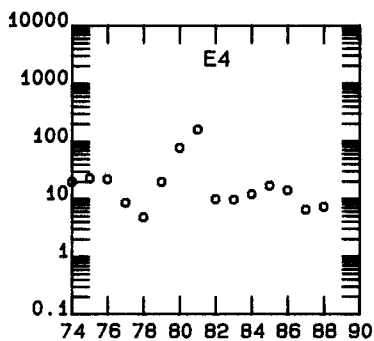
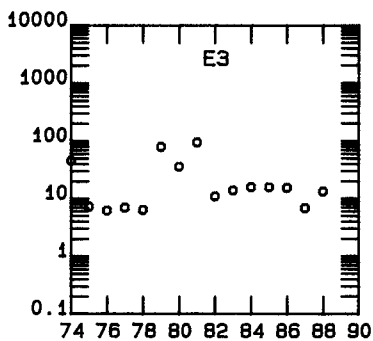
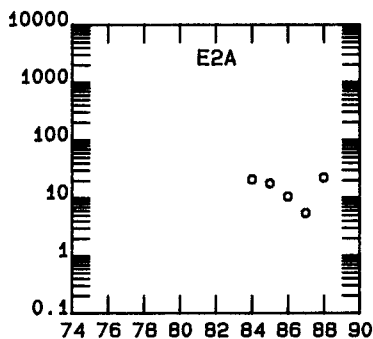
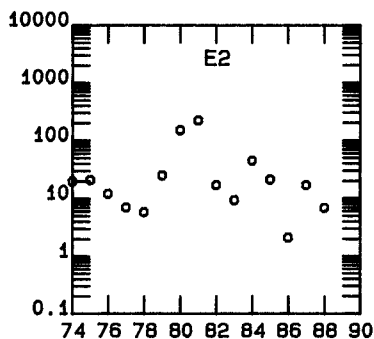
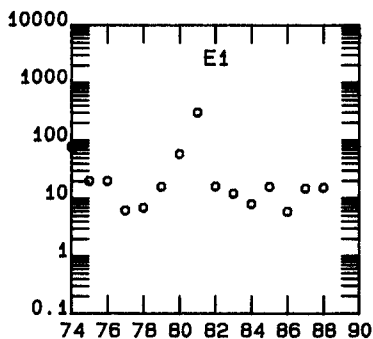
Kills - Raritan Bay Water Column Nickel (ug/l)  
NYC DEP Harbor Survey 1974-1988



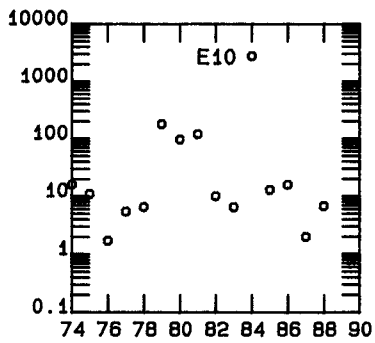
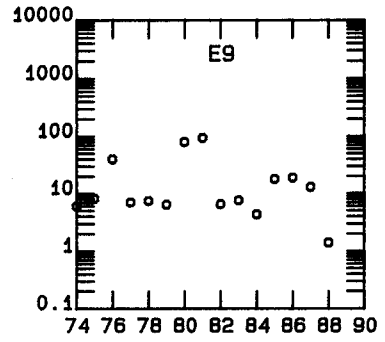
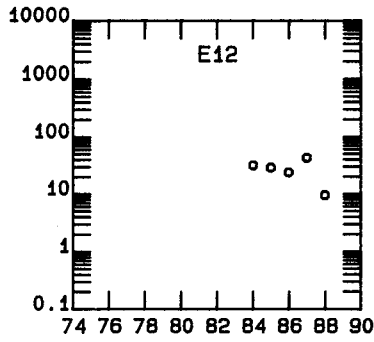
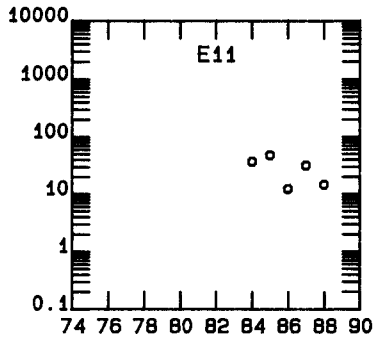
# Harlem River Water Column Nickel (ug/l) NYC DEP Harbor Survey 1974-1988



East River Water Column Nickel (ug/l)  
NYC DEP Harbor Survey 1974-1988

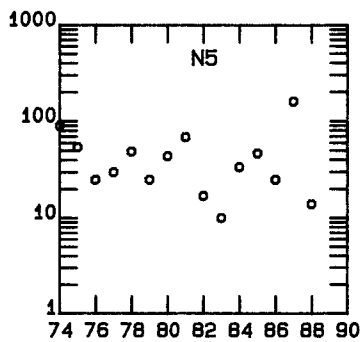
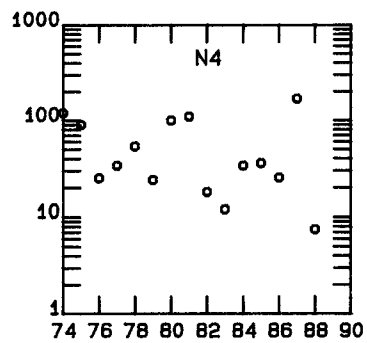
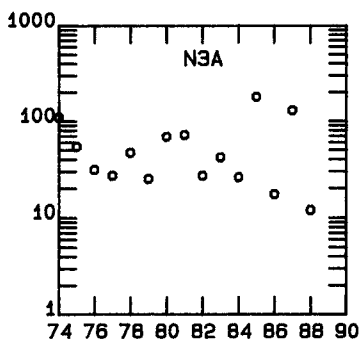
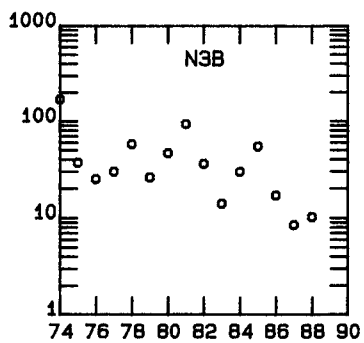
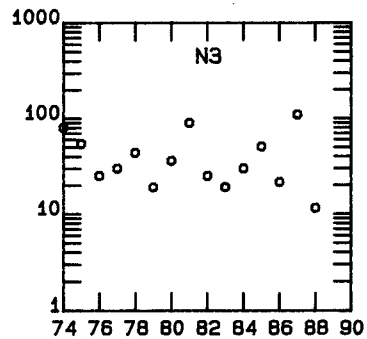
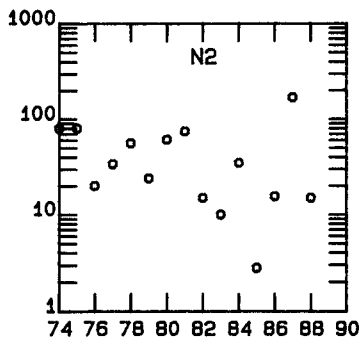
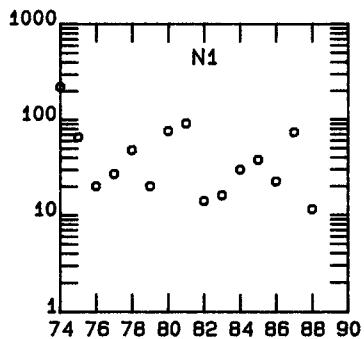


Outer East River Water Column Nickel (ug/l)  
NYC DEP Harbor Survey 1974-1988

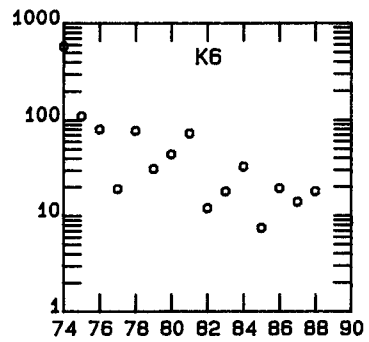
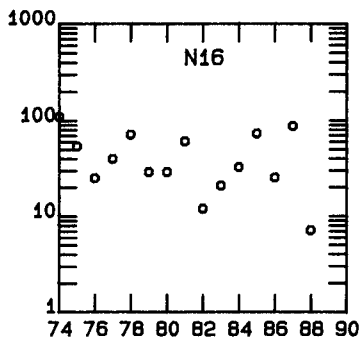
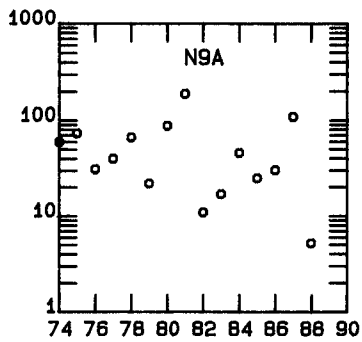
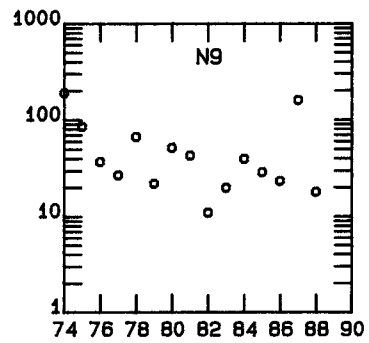
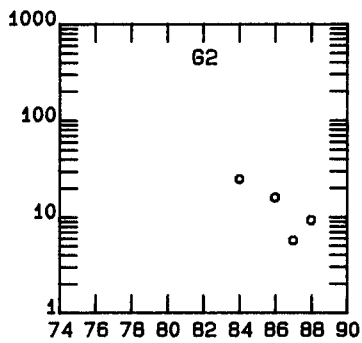
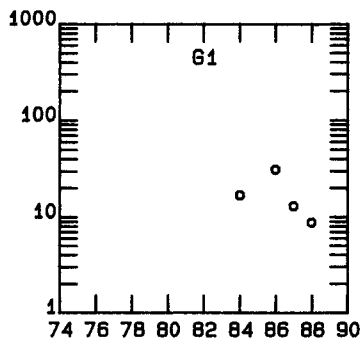
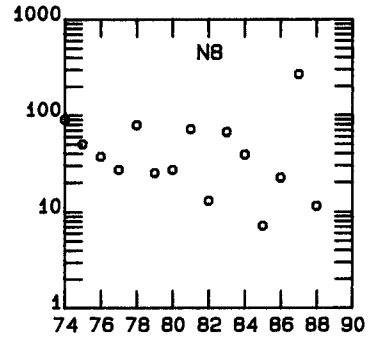
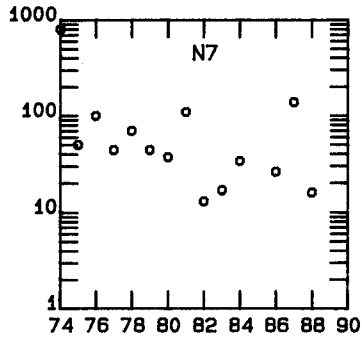
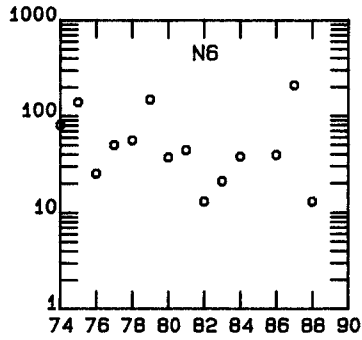




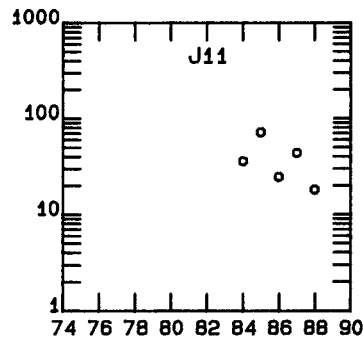
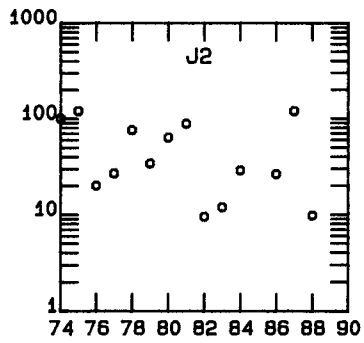
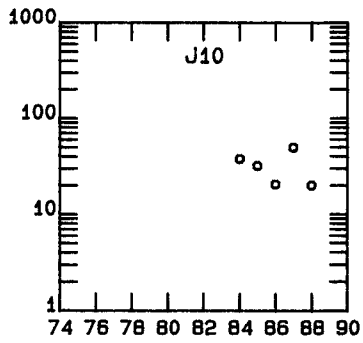
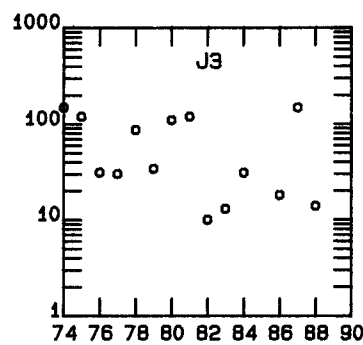
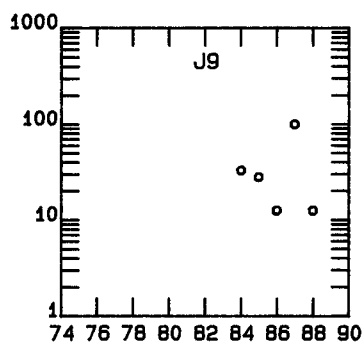
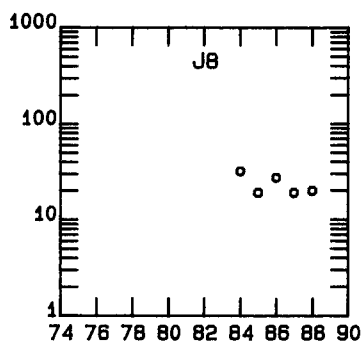
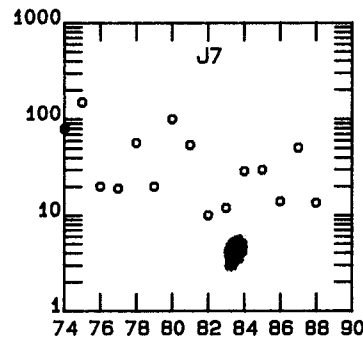
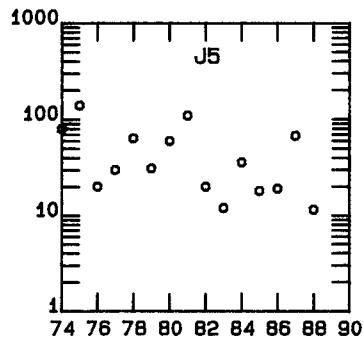
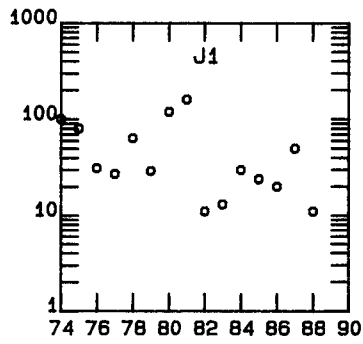
Hudson River Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988



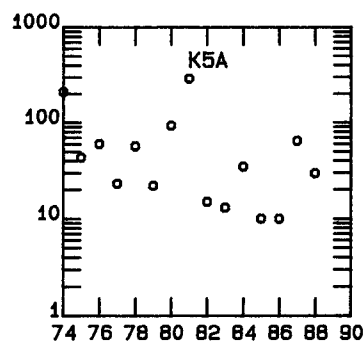
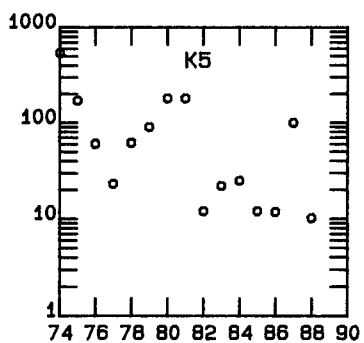
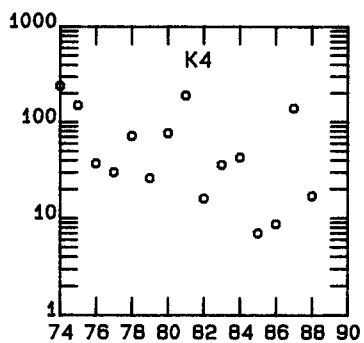
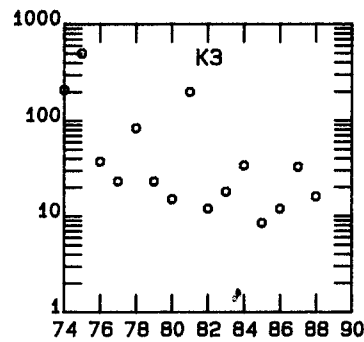
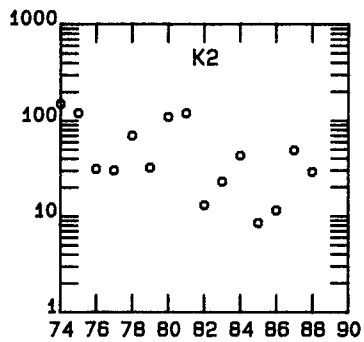
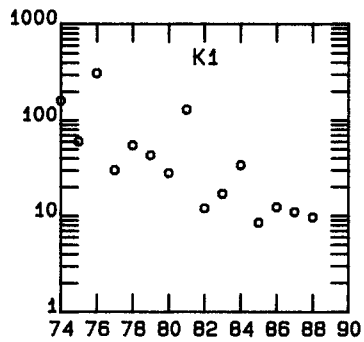
Inner and Outer Harbor Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988



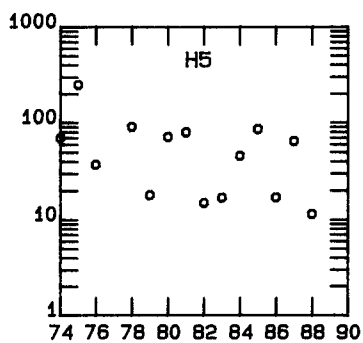
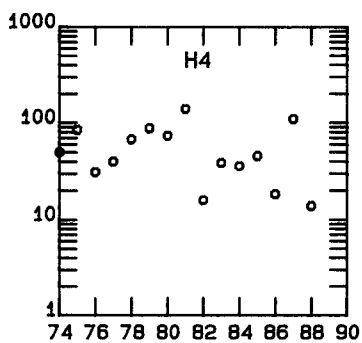
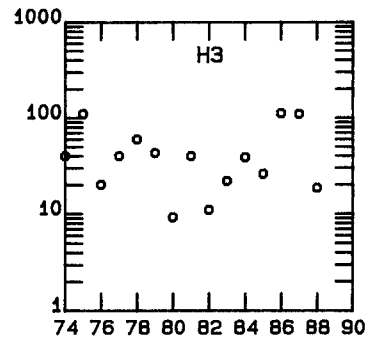
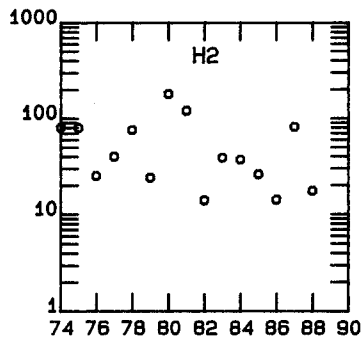
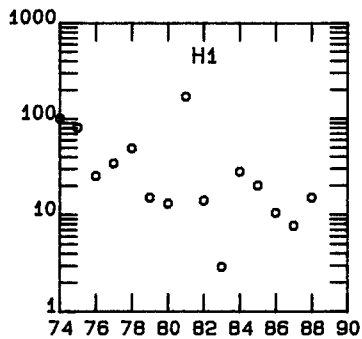
Jamaica Bay Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988



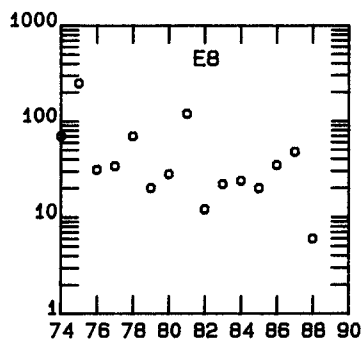
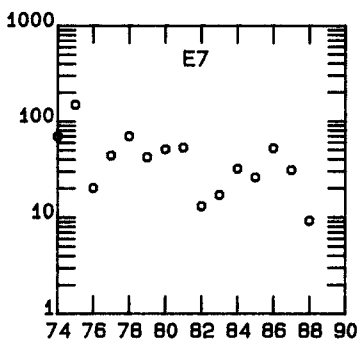
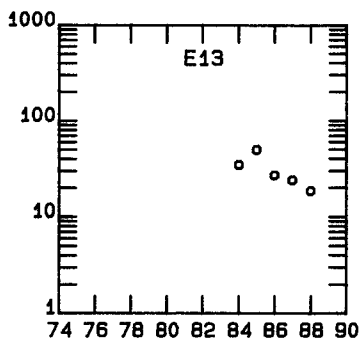
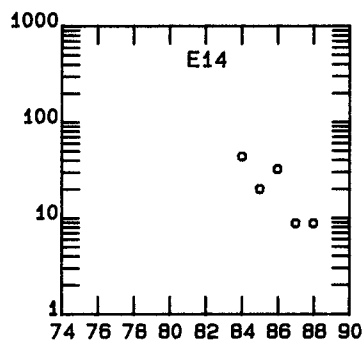
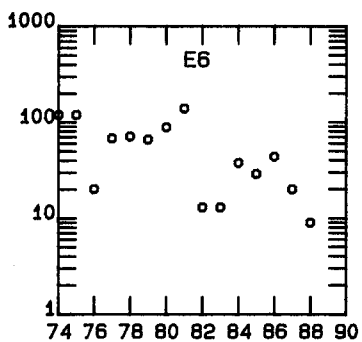
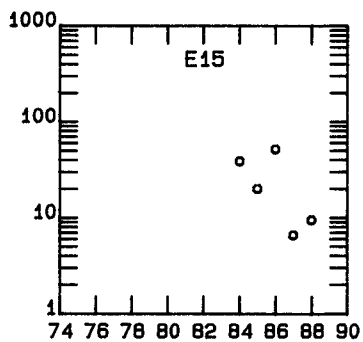
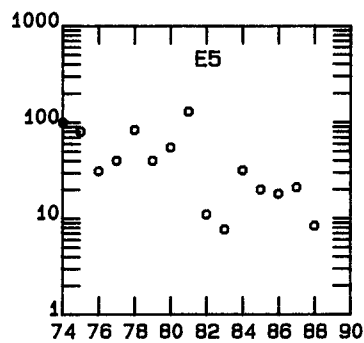
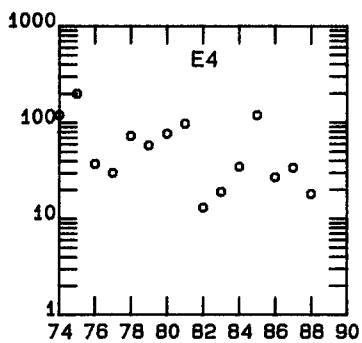
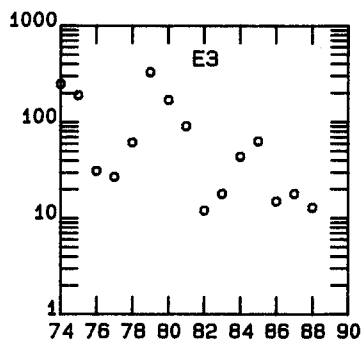
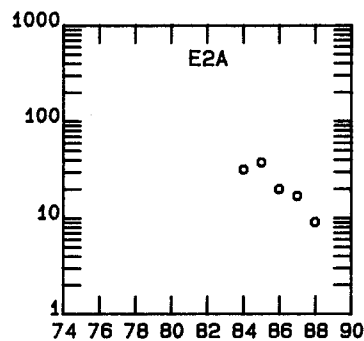
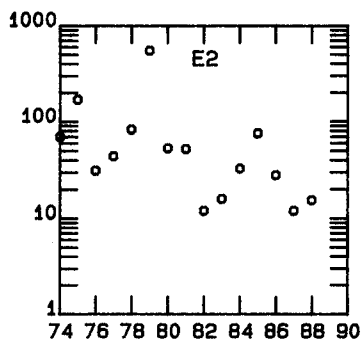
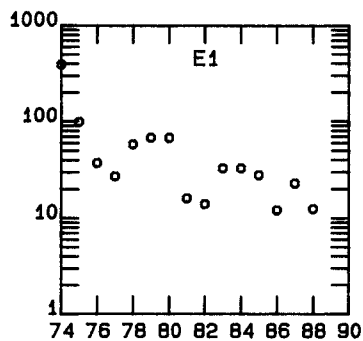
Kills - Raritan Bay Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988



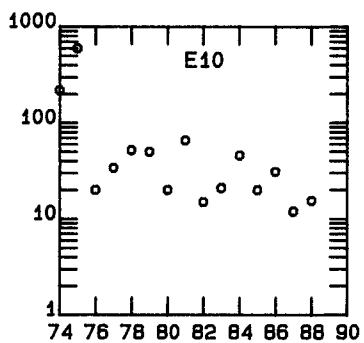
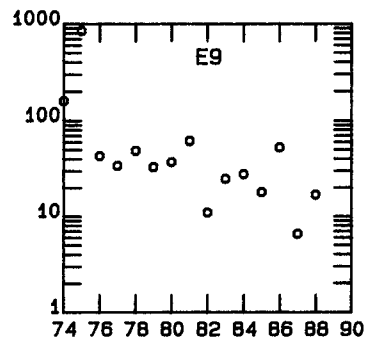
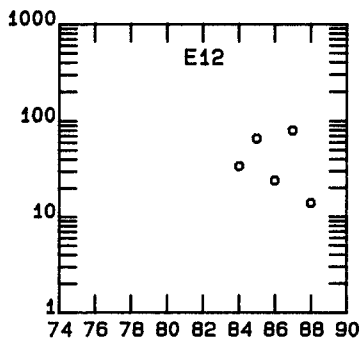
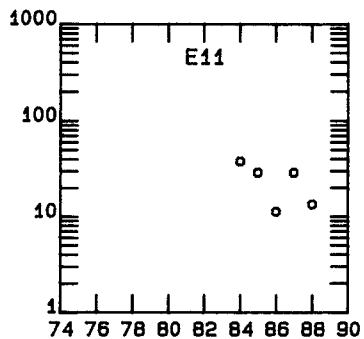
Harlem River Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988



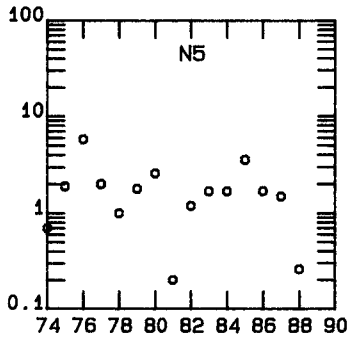
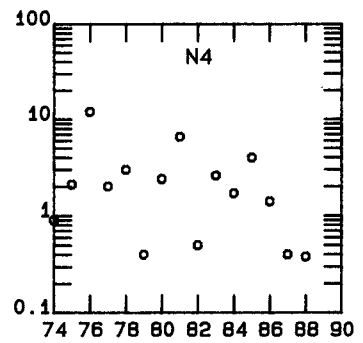
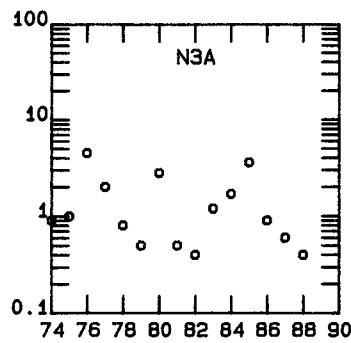
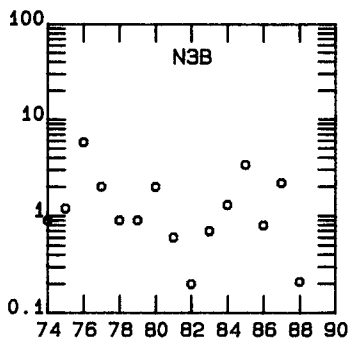
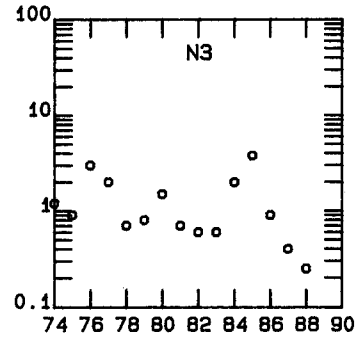
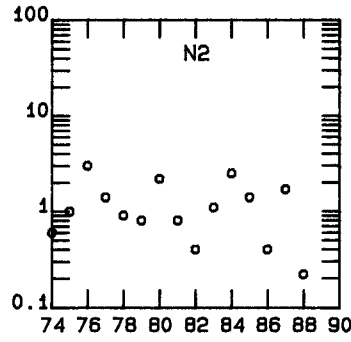
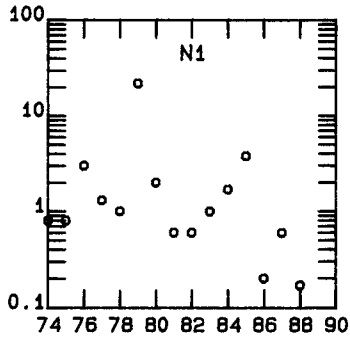
East River Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988



Outer East River Water Column Lead (ug/l)  
NYC DEP Harbor Survey 1974-1988

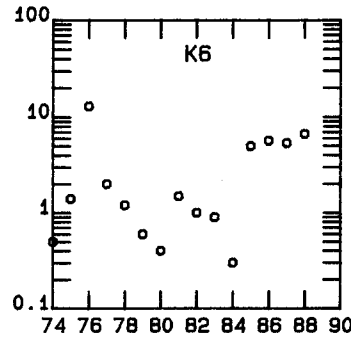
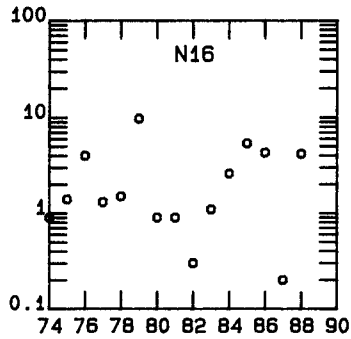
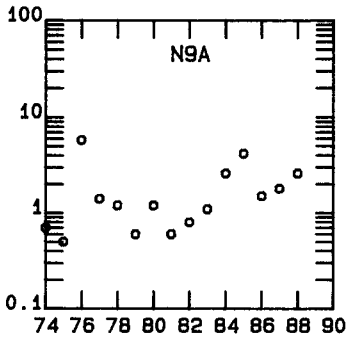
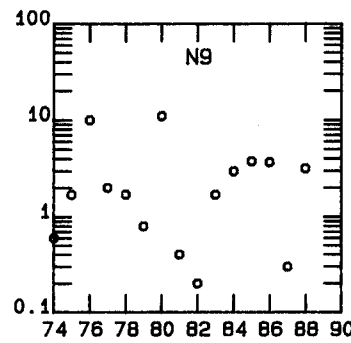
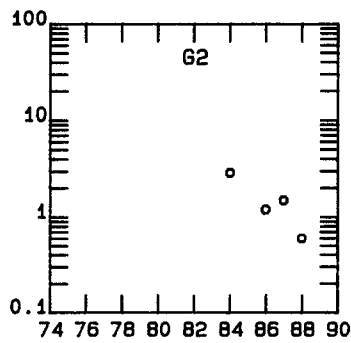
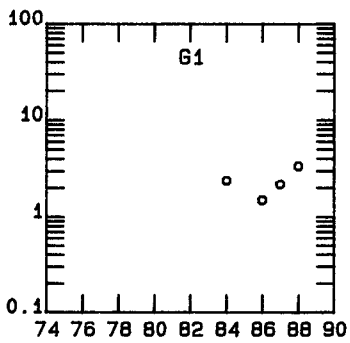
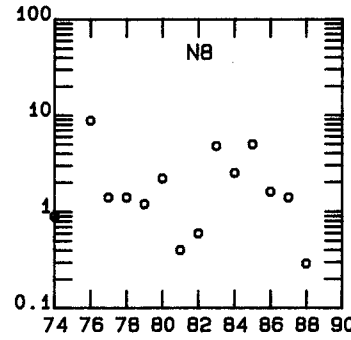
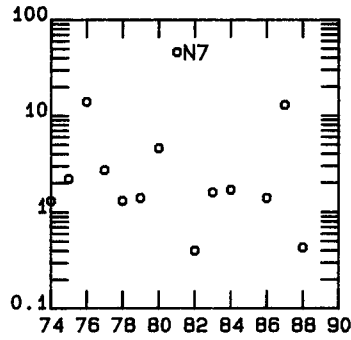
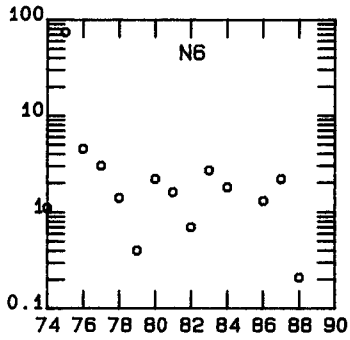


Hudson River Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988

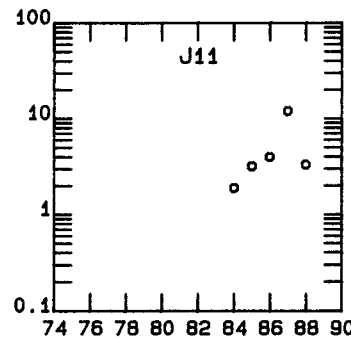
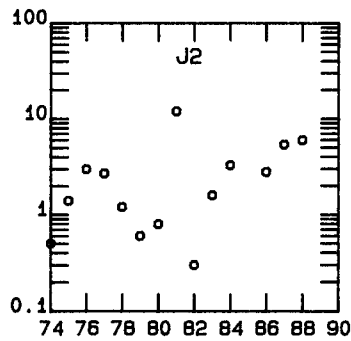
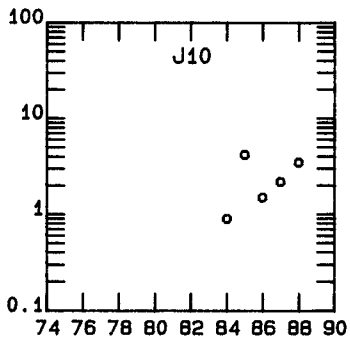
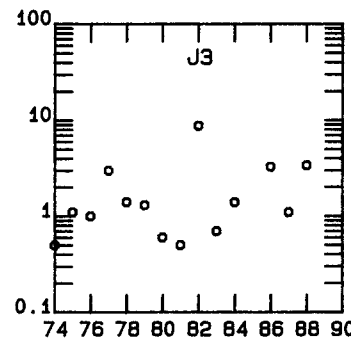
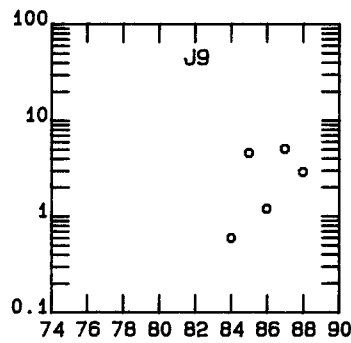
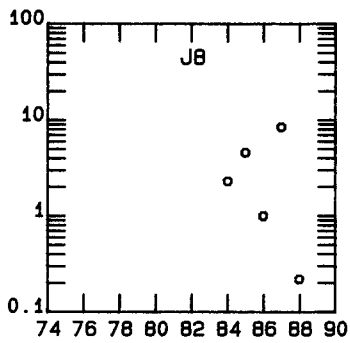
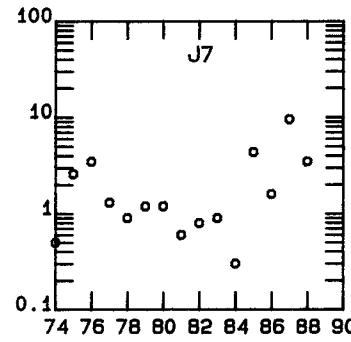
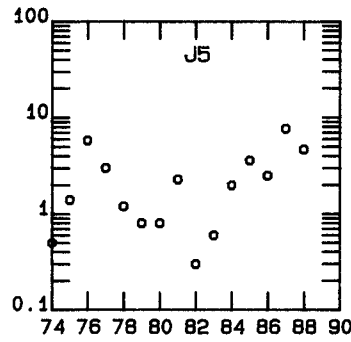
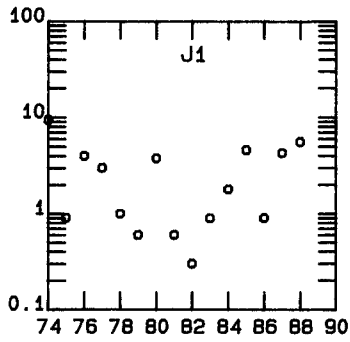




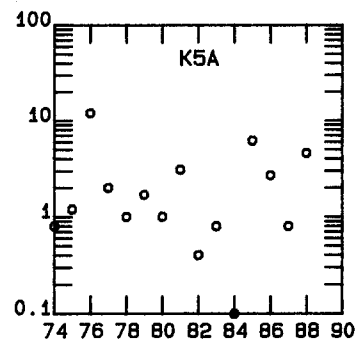
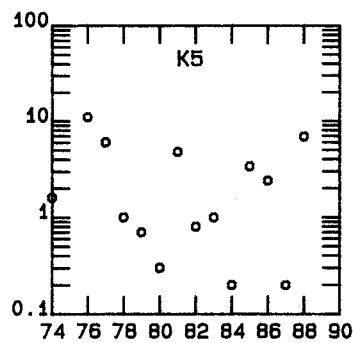
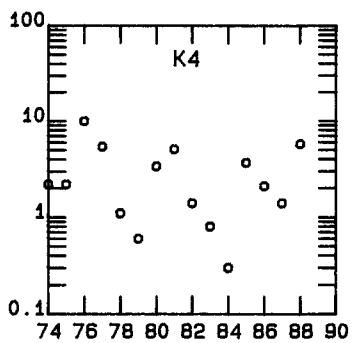
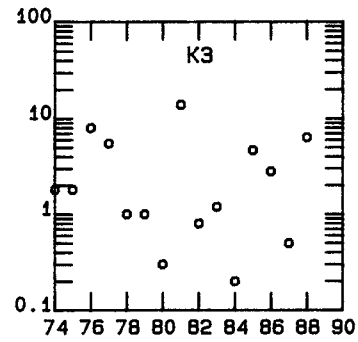
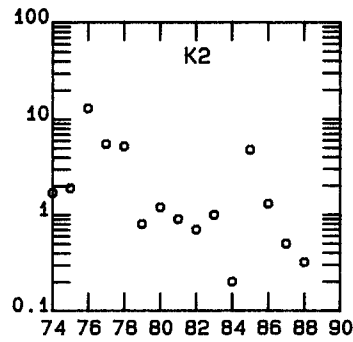
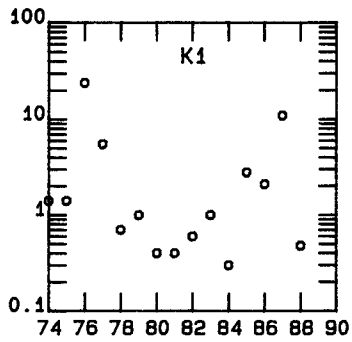
Inner and Outer Harbor Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988



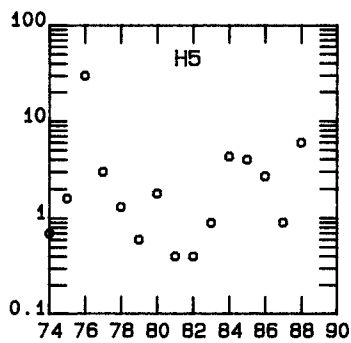
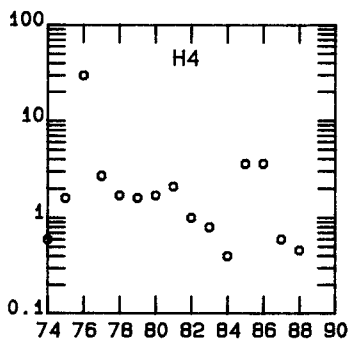
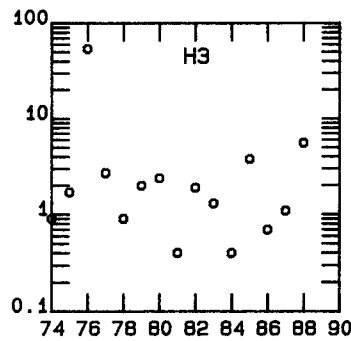
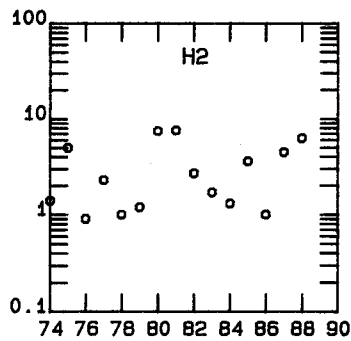
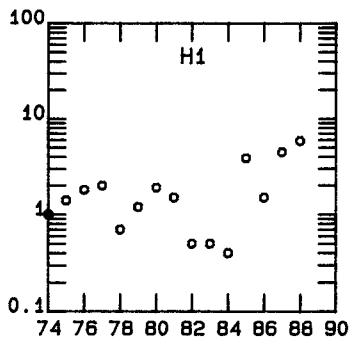
Jamaica Bay Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988



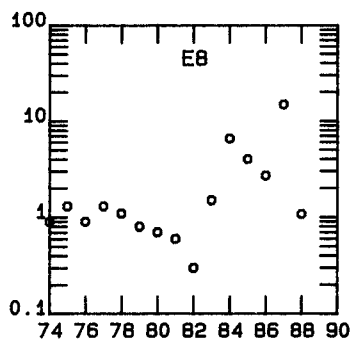
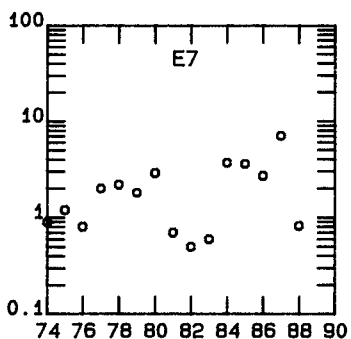
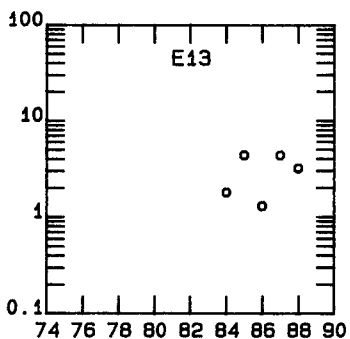
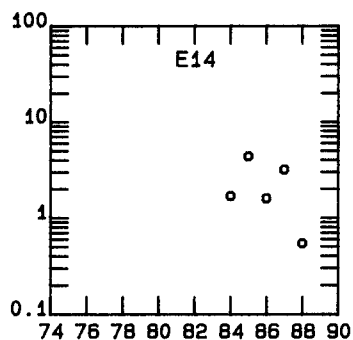
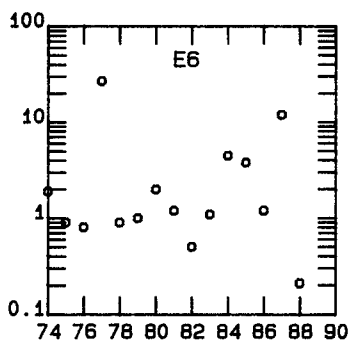
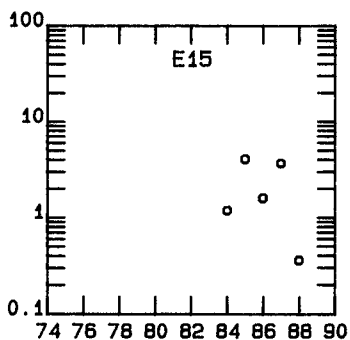
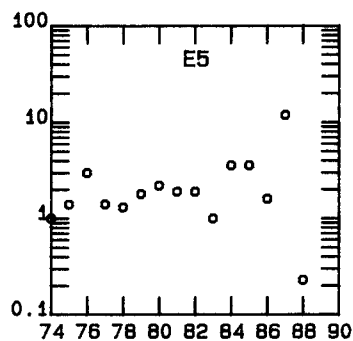
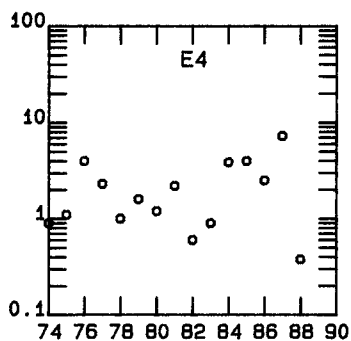
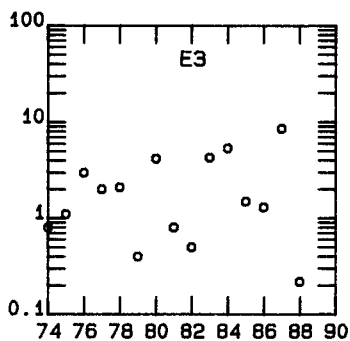
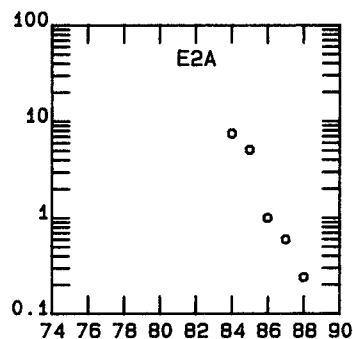
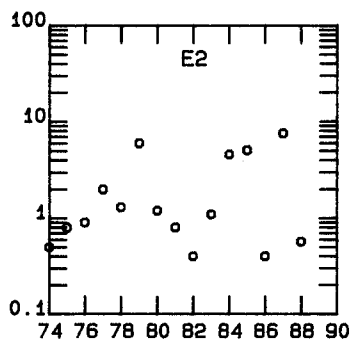
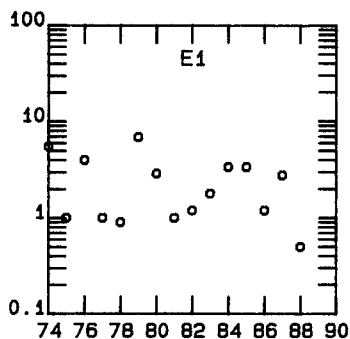
Kills - Raritan Bay Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988



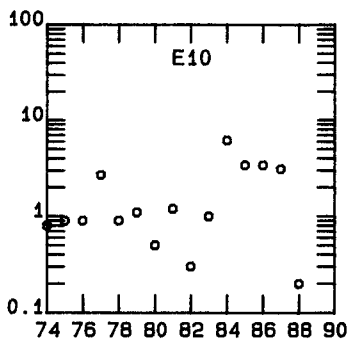
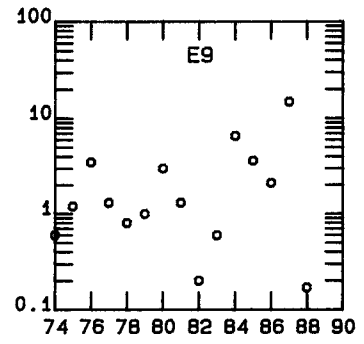
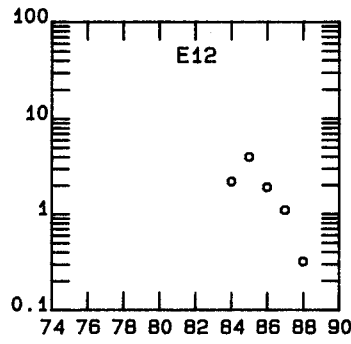
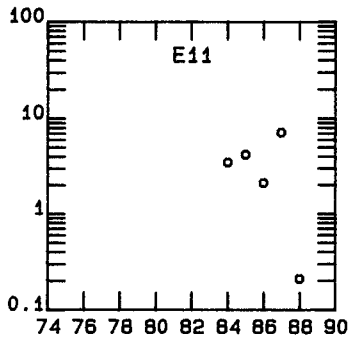
Harlem River Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988



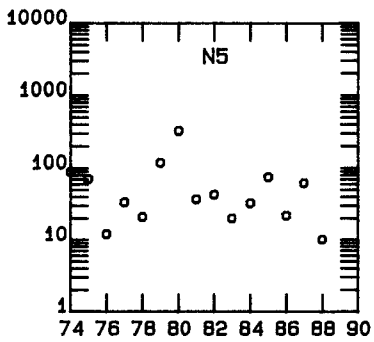
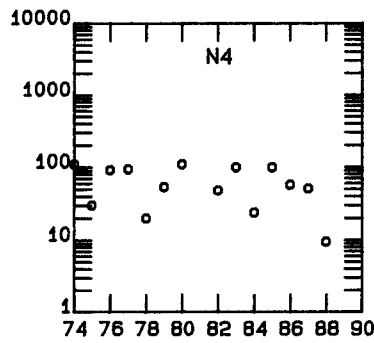
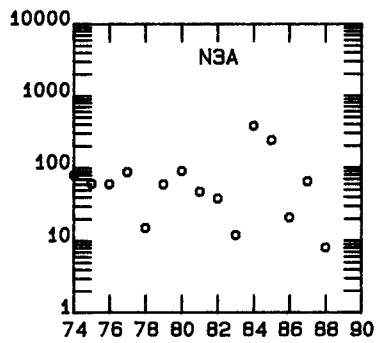
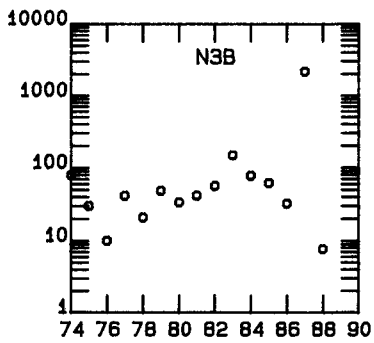
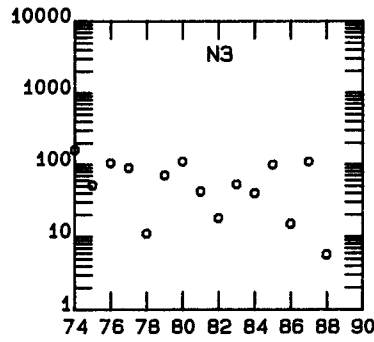
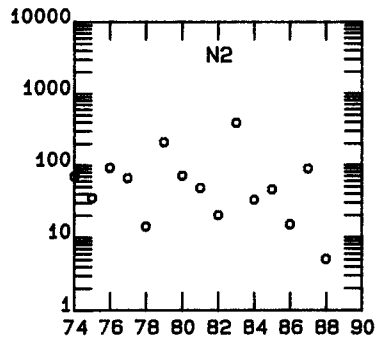
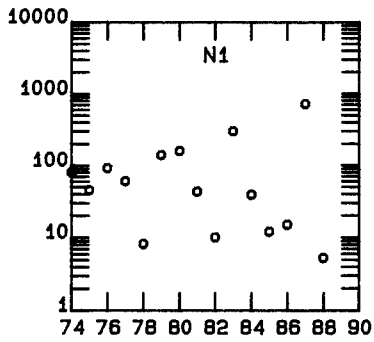
East River Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988



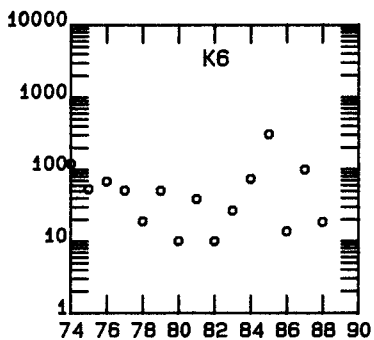
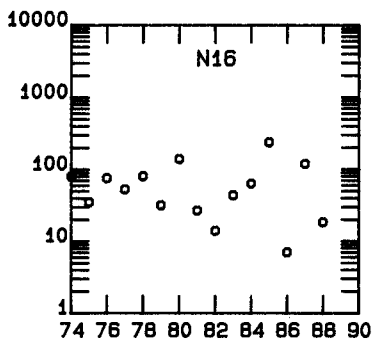
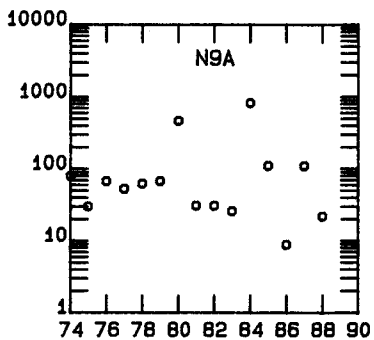
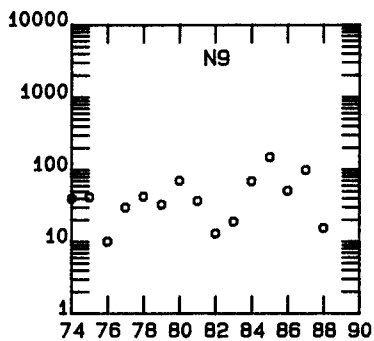
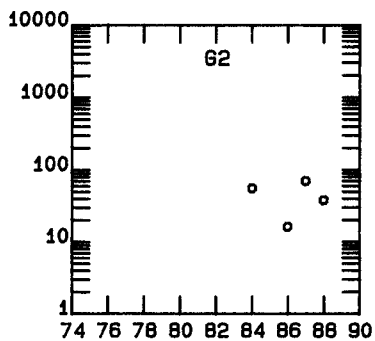
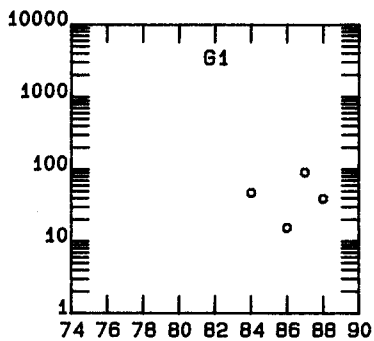
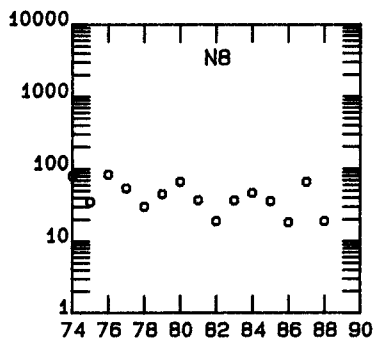
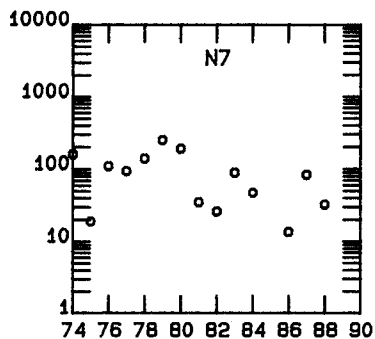
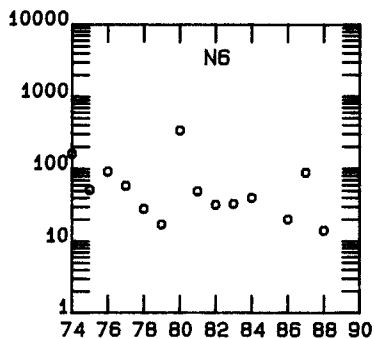
Outer East River Water Column Cadmium (ug/l)  
NYC DEP Harbor Survey 1974-1988



Hudson River Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988

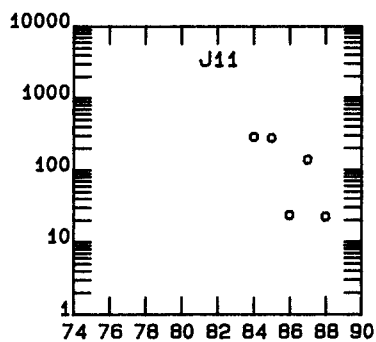
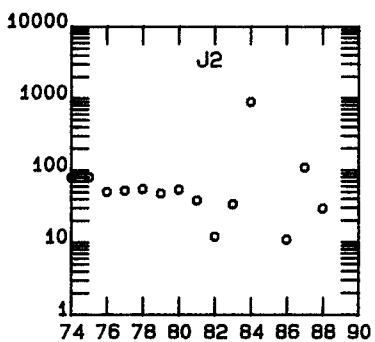
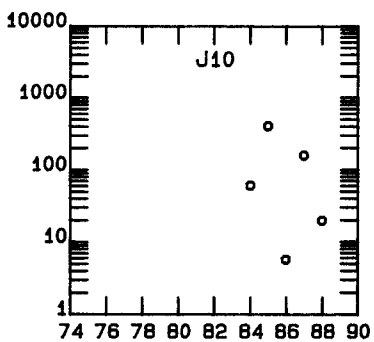
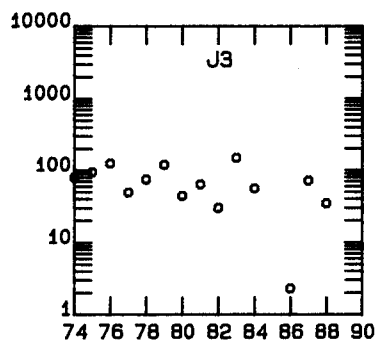
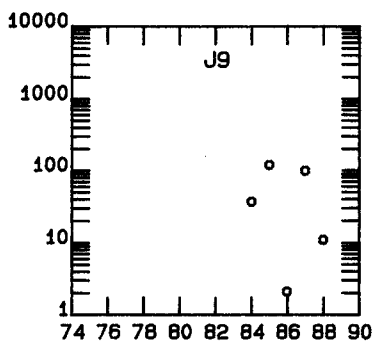
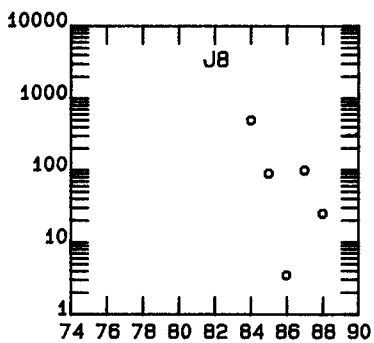
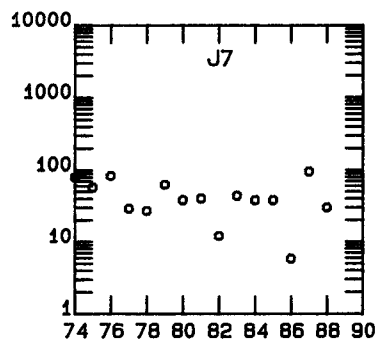
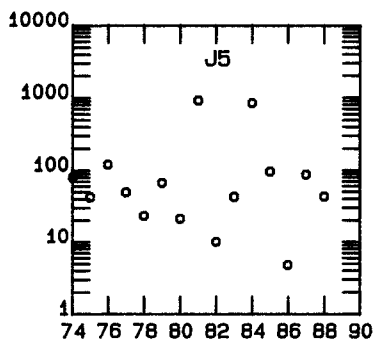
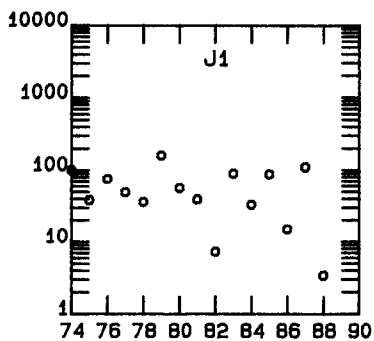


Inner and Outer Harbor Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988

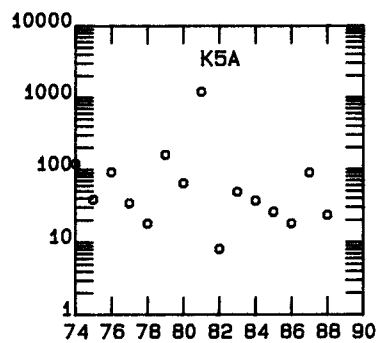
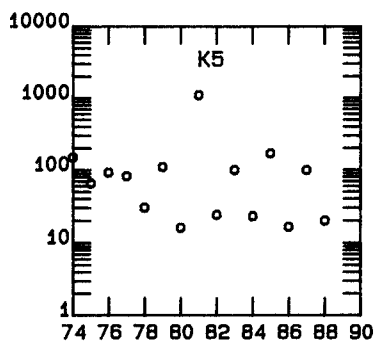
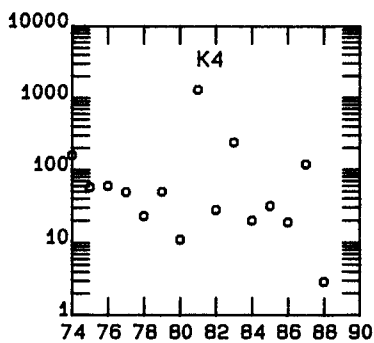
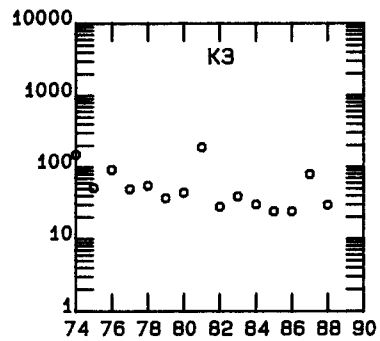
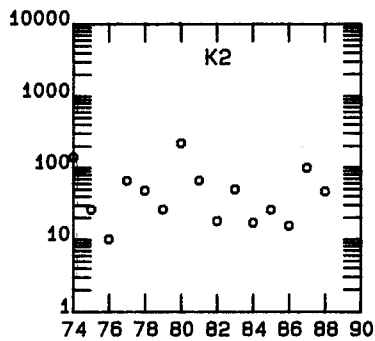
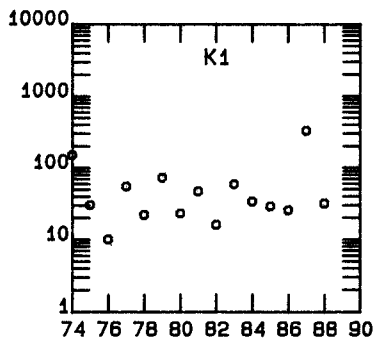




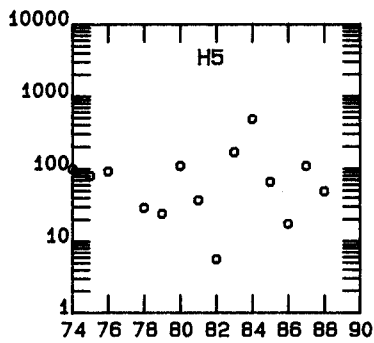
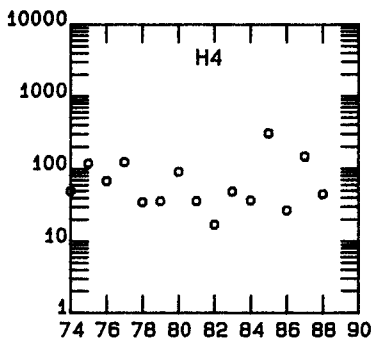
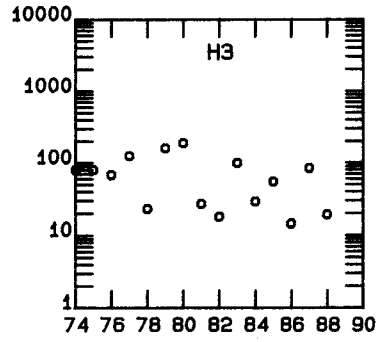
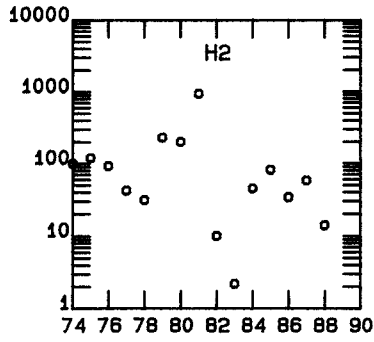
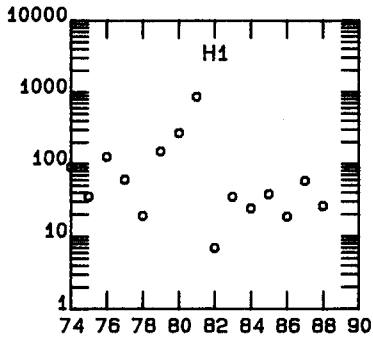
Jamaica Bay Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988



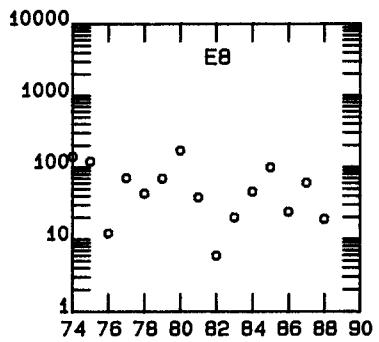
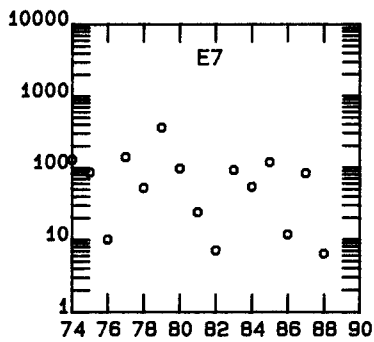
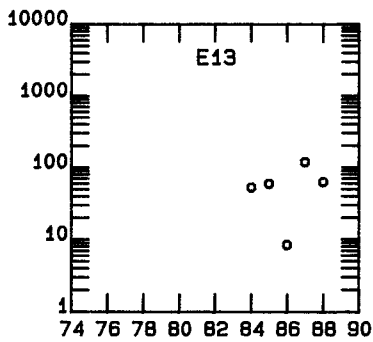
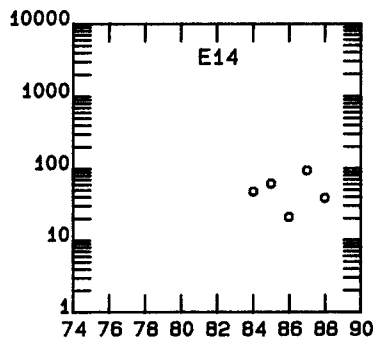
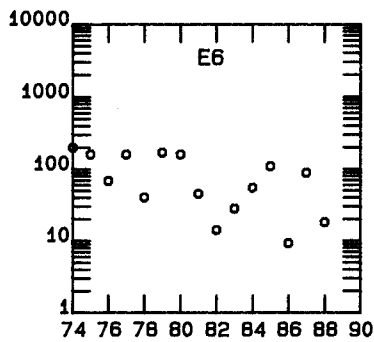
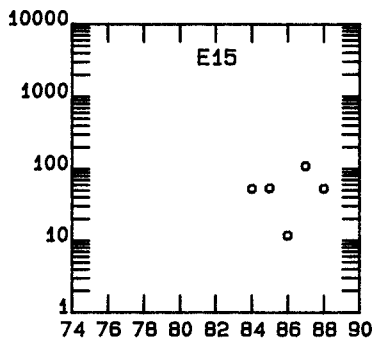
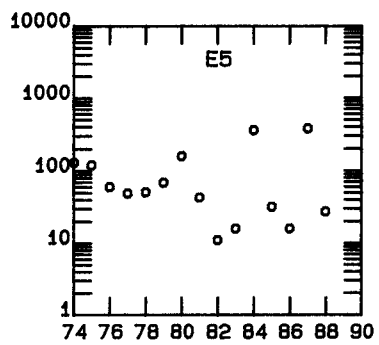
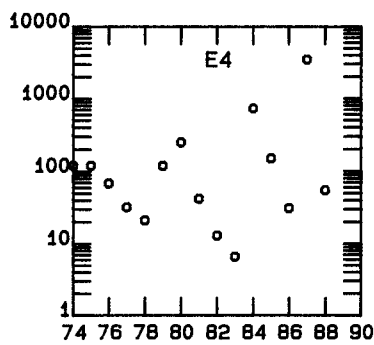
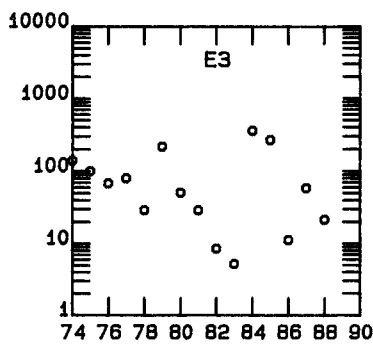
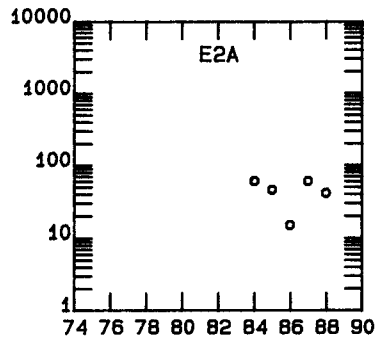
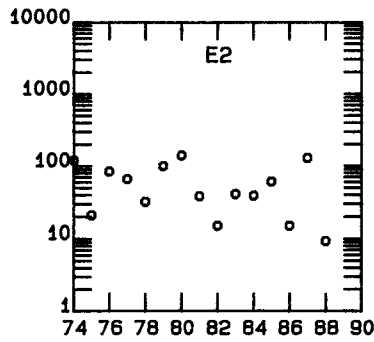
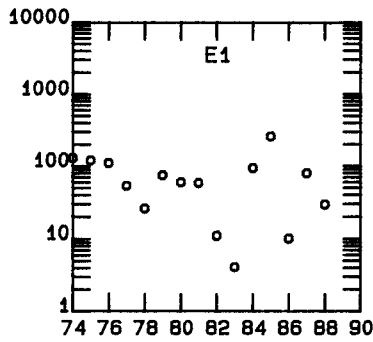
Kills - Raritan Bay Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988



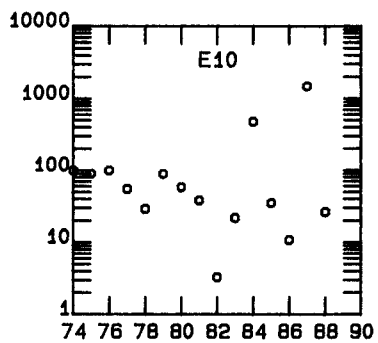
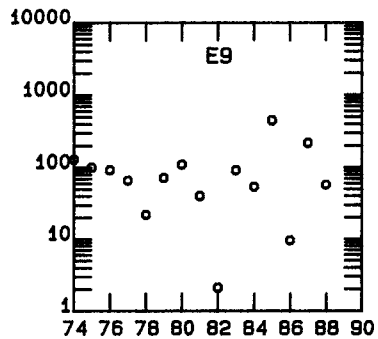
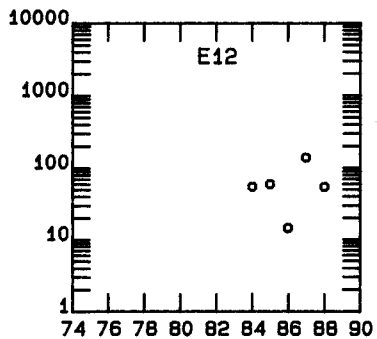
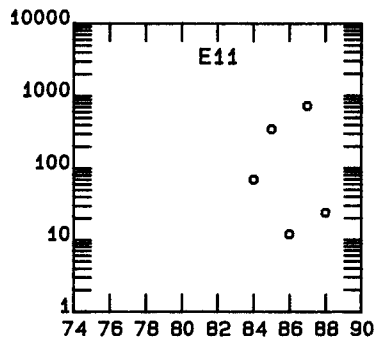
Harlem River Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988

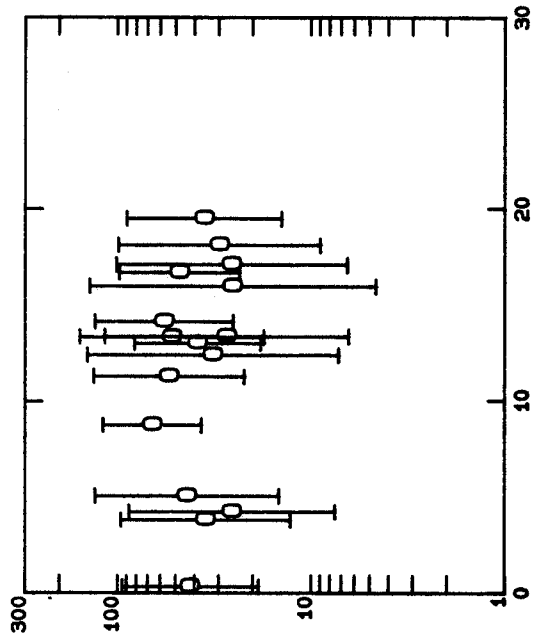


East River Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988

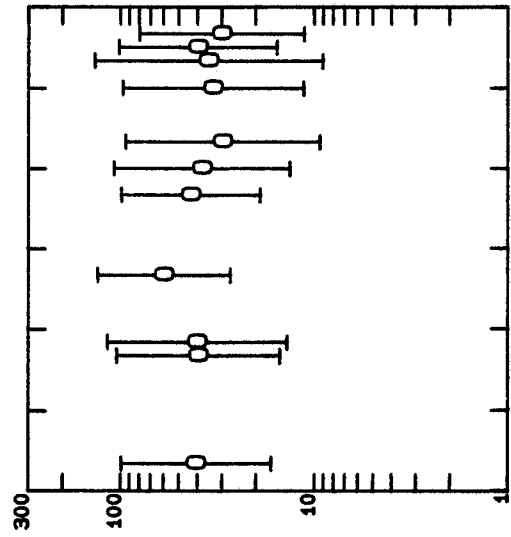


Outer East River Water Column Zinc (ug/l)  
NYC DEP Harbor Survey 1974-1988

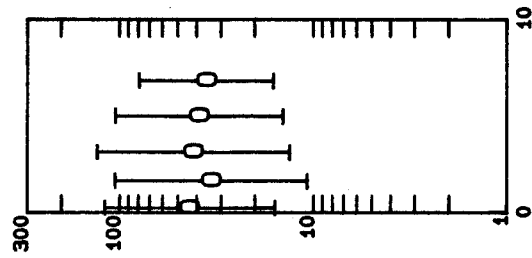




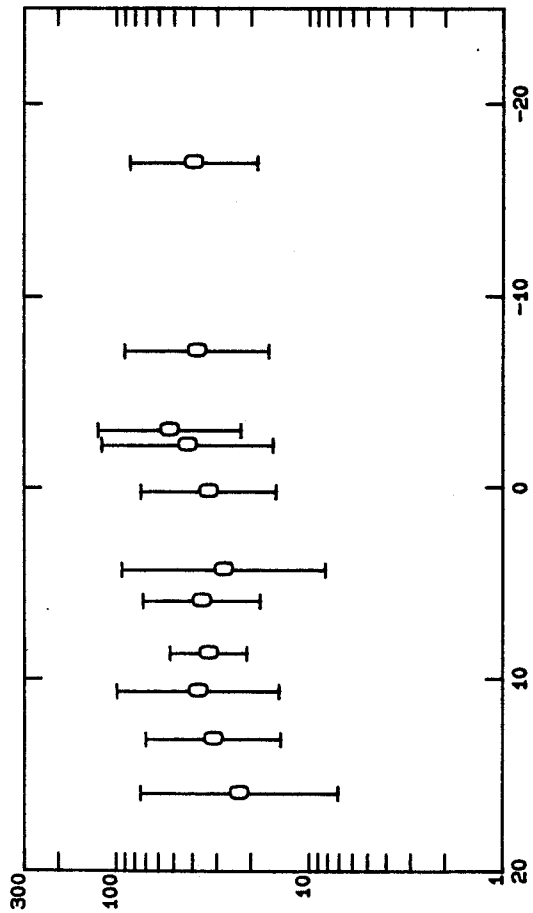
EAST RIVER



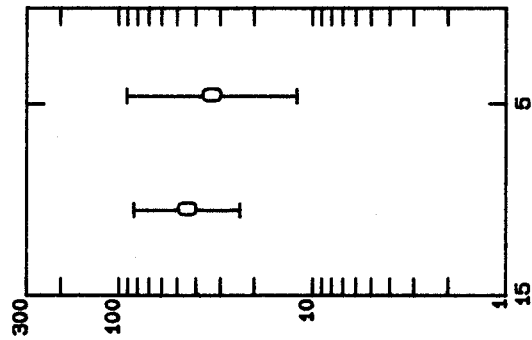
CONEY ISLAND  
JAMAICA BAY TRANSECT



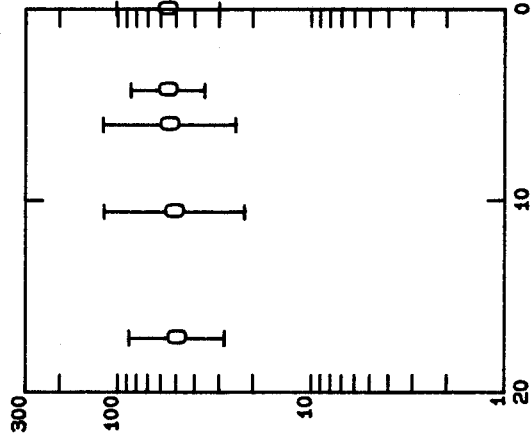
HARLEM  
RIVER



HUDSON, UPPER AND LOWER BAY, OCEAN



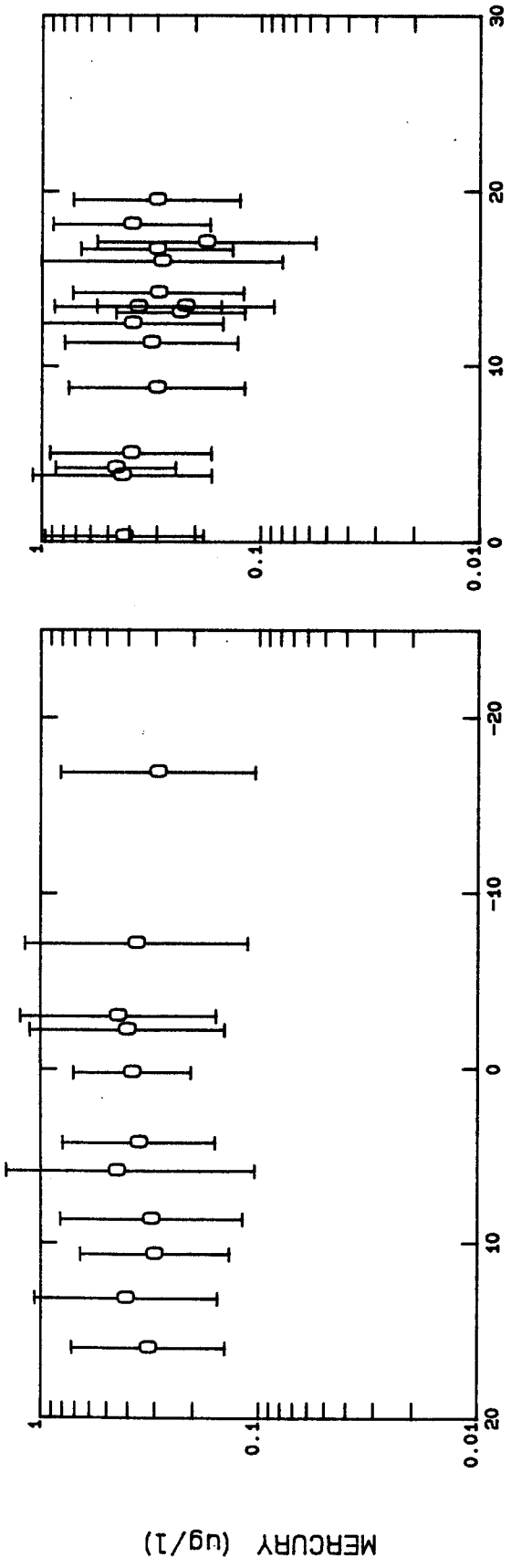
RARITAN BAY



KILLS

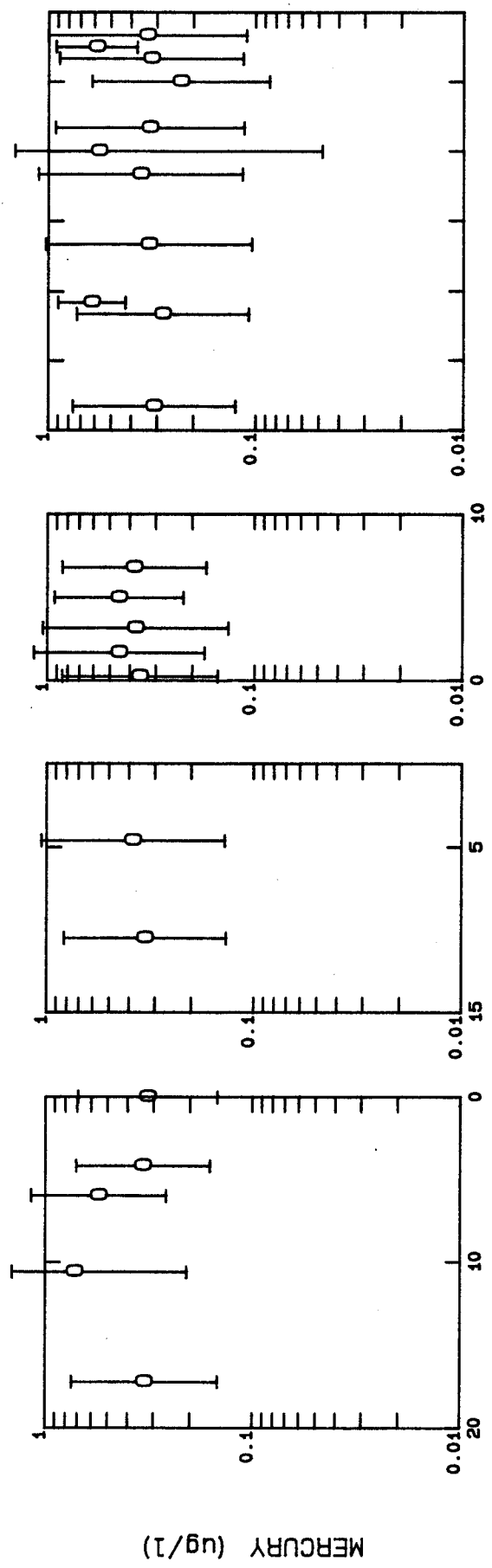
COPPER (ug/l)

COPPER (ug/l)



HUDSON, UPPER AND LOWER BAY, OCEAN

HUDSON RIVER



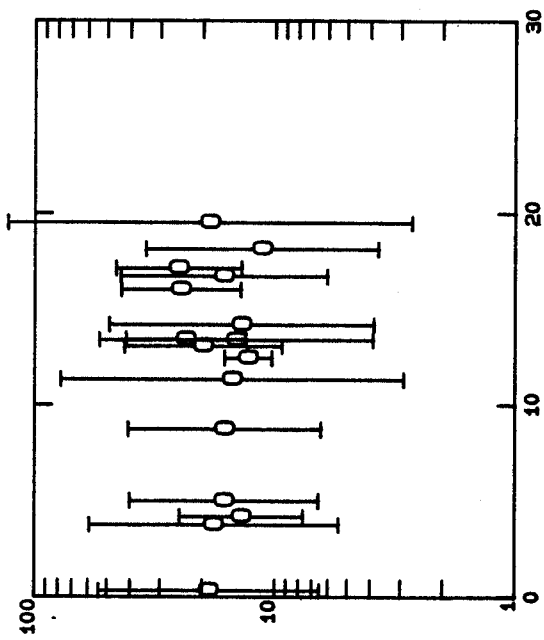
KILLS

RARITAN BAY

HARLEM RIVER

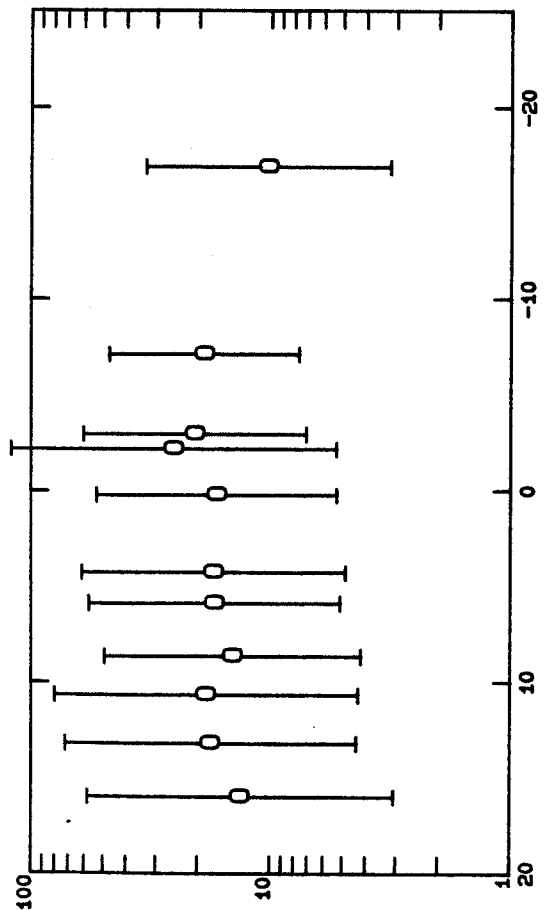
CONEY ISLAND JAMAICA BAY TRANSECT

NICKEL (ug/l)

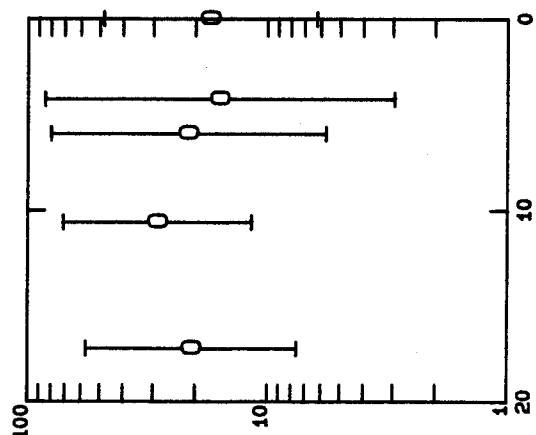


EAST RIVER

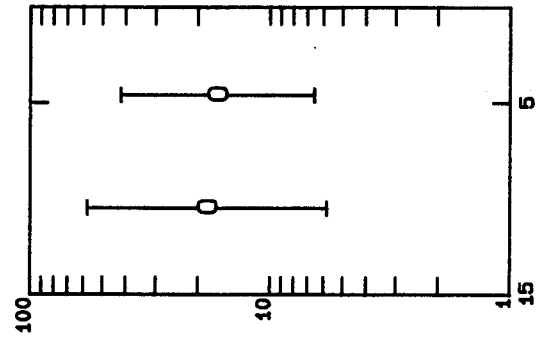
HUDSON, UPPER AND LOWER BAY, OCEAN



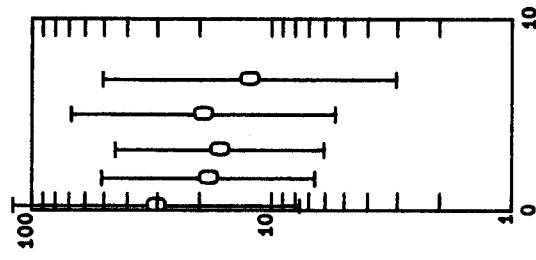
NICKEL (ug/l)



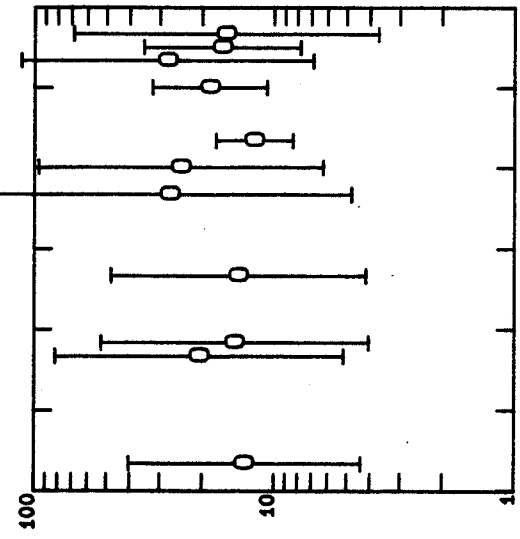
KILLS



RARITAN BAY

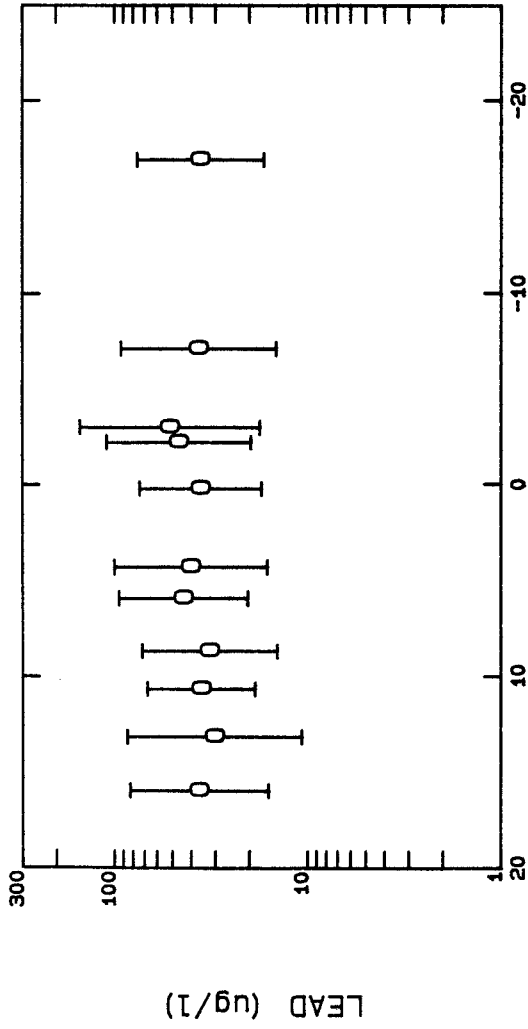


HARLEM RIVER

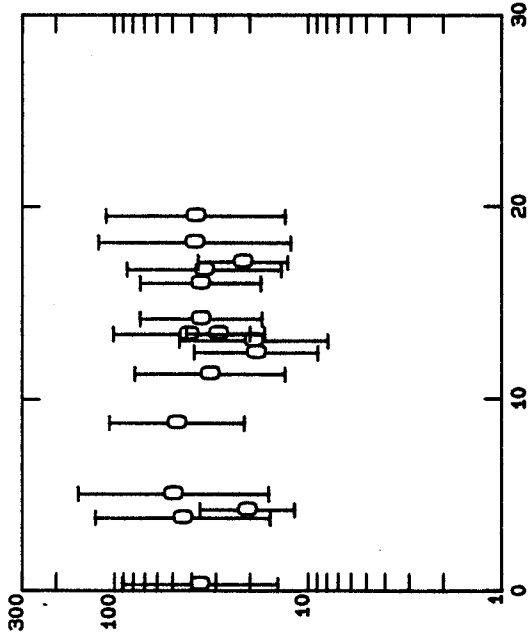


CONEY ISLAND JAMAICA BAY TRANSECT

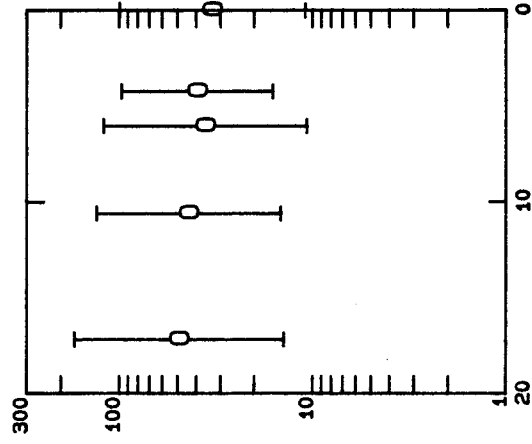




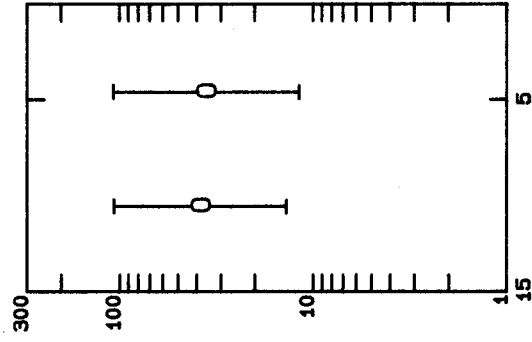
HUDSON, UPPER AND LOWER BAY, OCEAN



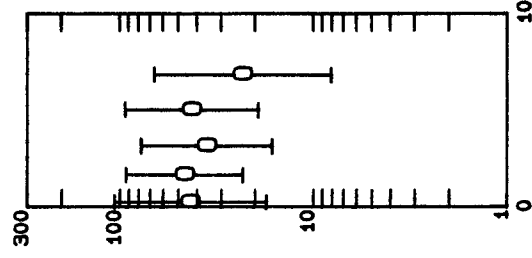
EAST RIVER



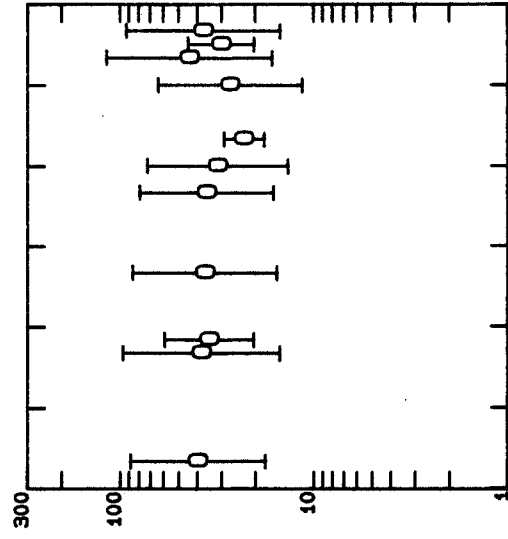
KILLS



RARITAN BAY



HARLEM RIVER



CONEY ISLAND JAMAICA BAY TRANSECT