N00102.AR.001798
NSY PORTSMOUTH
5090.3a

PRESENTATION FROM TECHNICAL REVIEW COMMITTEE MEETING ON 9 JUNE 1992 REGARDING ESTUARINE ECOLOGICAL RISK ASSESSMENT NSY PORTSMOUTH ME
6/9/1992
PORTSMOUTH NAVAL SHIPYARD

ESTUARINE ECOLOGICAL RISK ASSESSMENT FOR NAVAL SHIPYARD PORTSMOUTH

Status Report for the Technical Review Committee

June 9, 1992

ESTUARINE ECOLOGICAL RISK ASSESSMENT FOR NAVAL SHIPYARD PORTSMOUTH

Status Report for the Technical Review Committee

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INTRODUCTION
- What is Ecological Risk Assessment?
- Why Conduct Ecological Risk Assessments?

PARTICIPANTS

PURPOSE AND RATIONALE

TECHNICAL APPROACH
- Ecological Risk Assessment Framework
- PHASE I Activities and Status
- PRELIMINARY RESULTS & DISCUSSION
  - Biology & Toxicology
  - Chemistry
    - Methods & QA/QC
    - Analytical Screen Results
  - Hydrodynamics & Modeling
- PHASE II Approach
- Projected Schedule

SUMMARY

What is Ecological Risk Assessment?

Quantitatively estimating the likelihood of adverse ecological impact resulting from exposure to toxic substances.

Why Conduct Ecological Risk Assessments?

CERCLA 121(d)

"Degree of Cleanup. Remedial actions ... shall attain a degree of cleanup ... which assures protection of human health and the environment."

RCRA 1003(b)

"National Policy. Waste that is generated should be treated, stored, or disposed of so as to minimized the present and future threat to human health and the environment."

National Contingency Plan (55 FR 8741)

"Remedies must be protective of human health and the environment <u>and</u> attain ARARs"

PARTICIPANTS

Naval Command, Control, & Ocean Surveillance Center, San Diego, CA

EPA Environmental Research Laboratory, Narragansett, RI

UNH Jackson Estuarine Laboratory & Civil Engineering Dept., Durham, NH

URI Graduate School of Oceanography, Narragansett, RI

Woods Hole Institute of Oceanography, Woods Hole, MA

Normandeau Associates, Bedford, NH

McLaren/Hart Consultants, Albany, NY

Ceimic Corporation, Narragansett, RI

PURPOSE OF STUDY

Provide an Ecological Risk Assessment Framework to Assess the Potential Environmental Impact, If Any, of Hazardous Waste Storage, Treatment, and Disposal at NSY Portsmouth.

RATIONALE

DESIGN STUDY TO MEET:

- CONDITIONS OF RCRA PERMIT
- FUTURE REQUIREMENTS

ASSESSMENT ENDPOINTS

- SEDIMENT QUALITY
- CONTAMINANT SOURCES AND DISTRIBUTION
- BIOLOGICAL IMPACTS
- APPROPRIATE ANALYTICAL METHODS

APPLICATION OF ECOLOGICAL RISK ASSESSMENT TECHNOLOGY

FORMULA:

- Develop Cooperative Research Program
  - EPA Environmental Research Laboratory Narragansett
  - Universities
  - Local Experts
- Case Study Application of R&D
  - Site Specific
  - Ecologically Based Monitoring
- Involve Regulatory Agencies
  - Technical Review Committee
  - State Agencies
  - NOAA Trustee
  - Fish and Wildlife Trustee
  - EPA Region
- Satisfy Public Concern

NSY PORTSMOUTH CASE STUDY

PHASE I - INFORMATION GATHERING

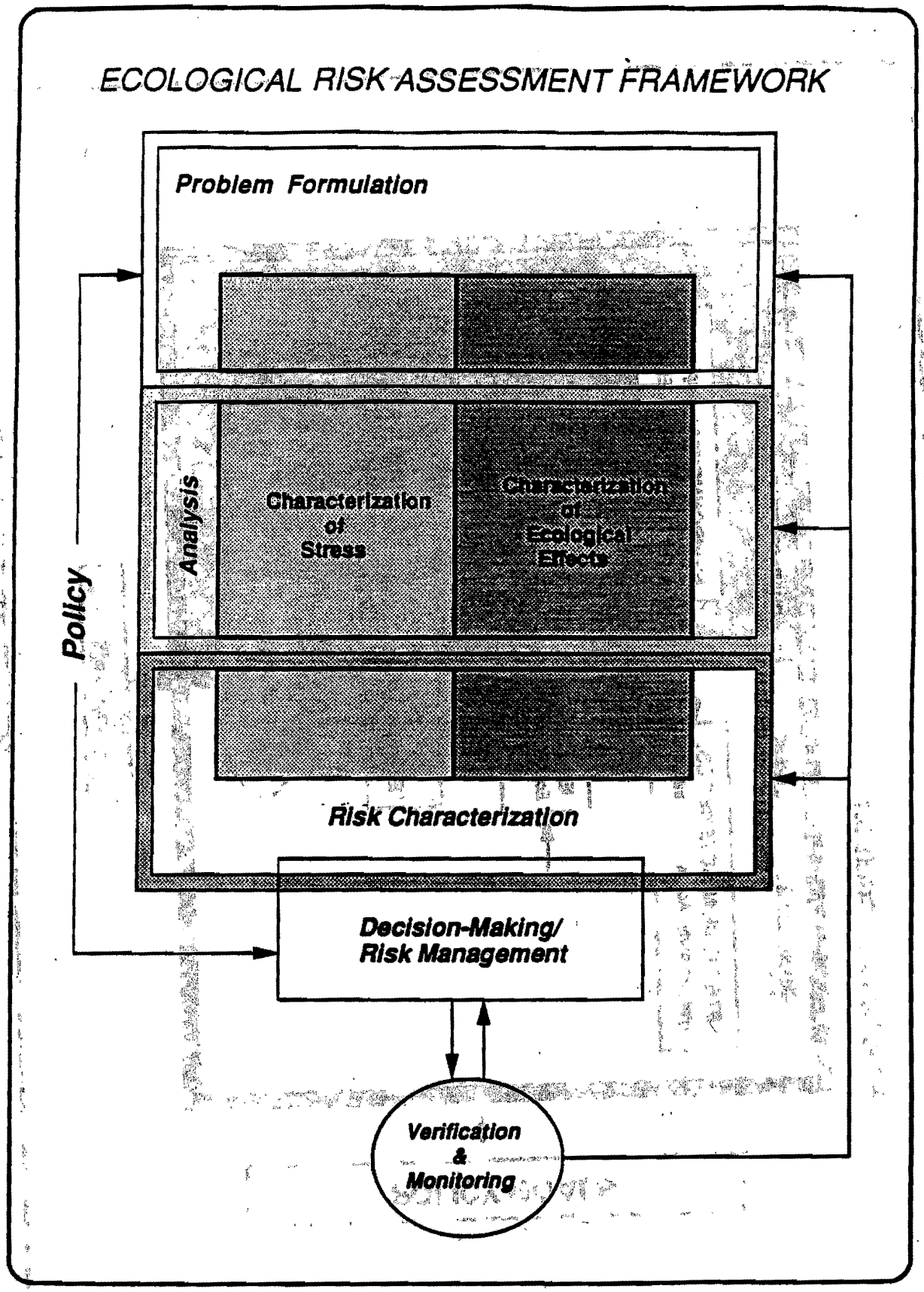
Determine if Significant Ecological Impacts Can be Related to NSY Portsmouth.

PHASE II - VERIFY AND QUANTIFY ECOLOGICAL RISK

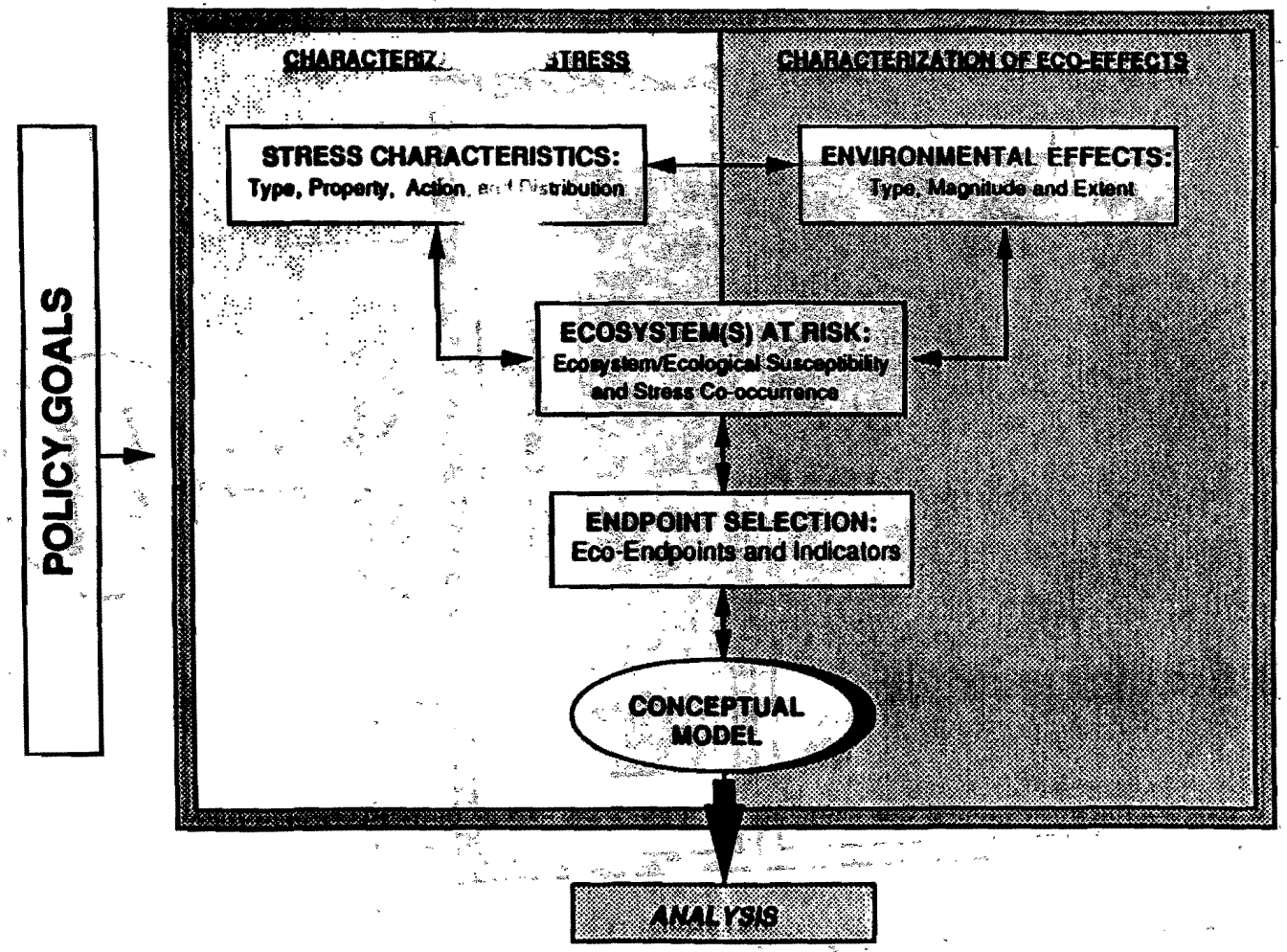
Quantify Exposure-Response of Ecological Risk From Shipyard Contaminants

If Necessary, Provide Detailed Ecological Assessment of Impact

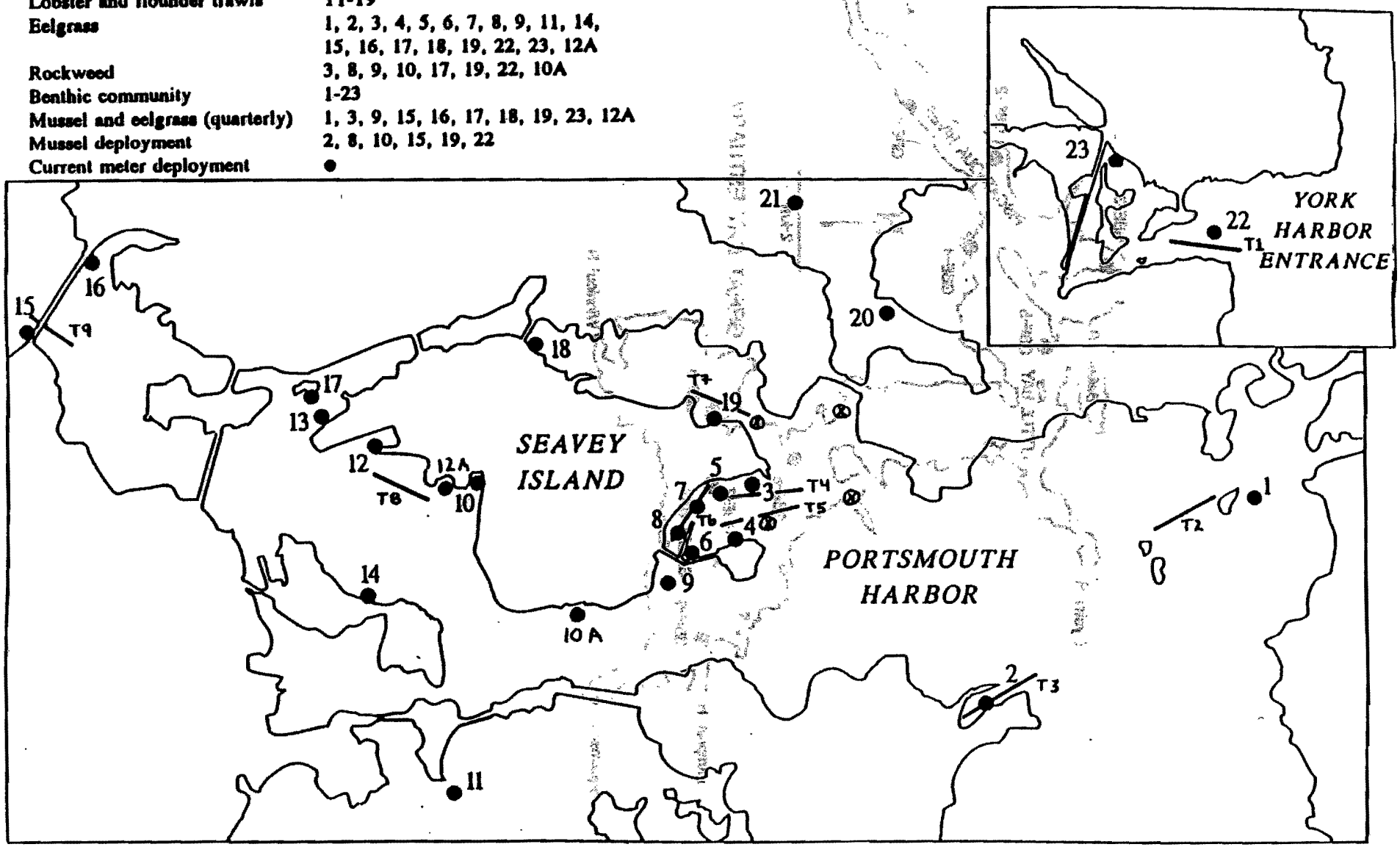
Develop Long-Term Monitoring Strategy

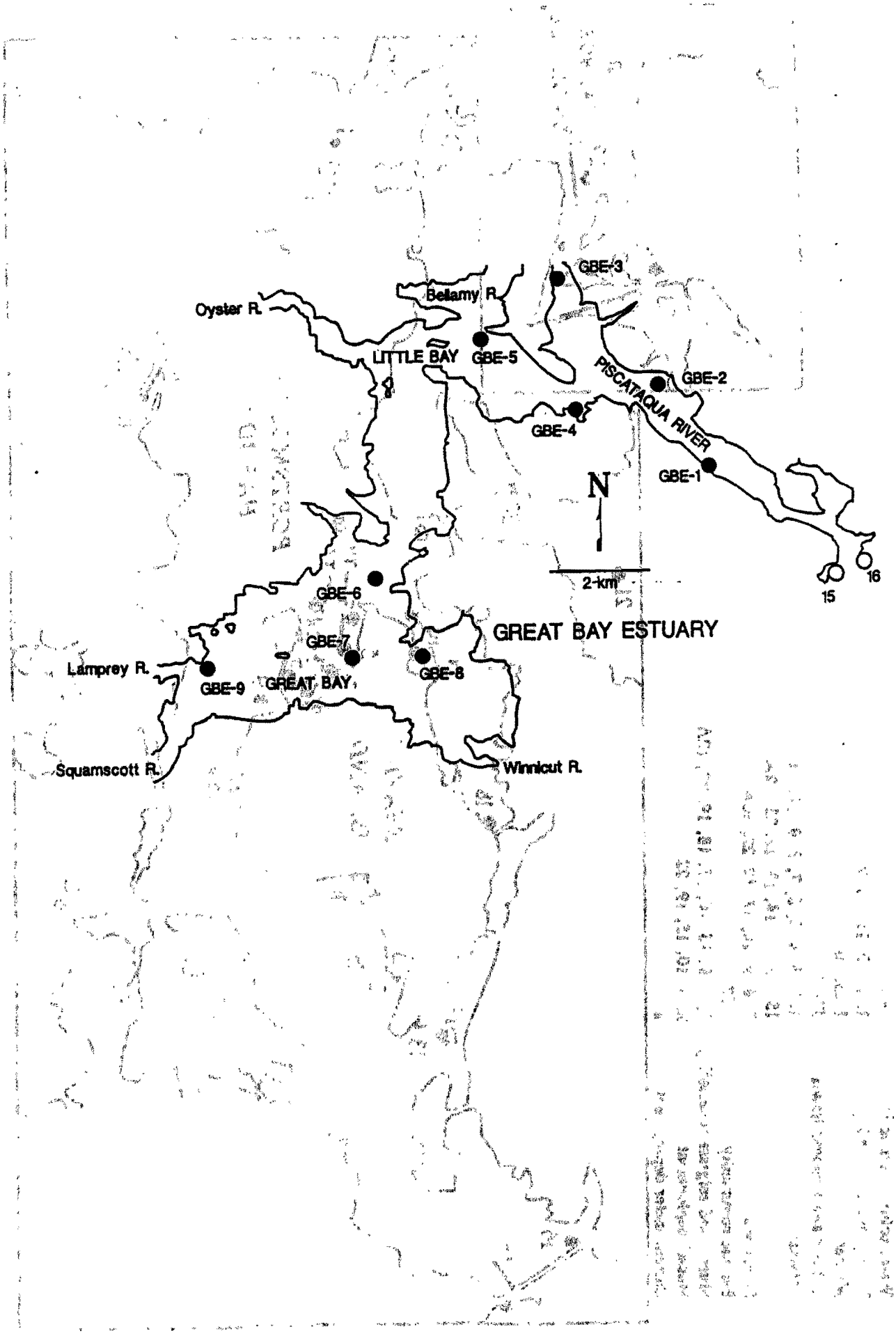

ECOLOGICAL RISK ASSESSMENT FRAMEWORK
Problem Formulation
Analysis
Characterization of Stress
Characterization of Ecological Effects
Risk Characterization
Policy
Decision-Making/ Risk Management
Verification & Monitoring

Problem Formulation



	Stations
Sediment	1-23
Water column (synoptic)	1-23
Water column (monthly)	1, 8, 10, 15, 16, 23
Mussel	1-23, 10A
Lobster and flounder trawls	T1-T9
Eelgrass	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 14, 15, 16, 17, 18, 19, 22, 23, 12A
Rockweed	3, 8, 9, 10, 17, 19, 22, 10A
Benthic community	1-23
Mussel and eelgrass (quarterly)	1, 3, 9, 15, 16, 17, 18, 19, 23, 12A
Mussel deployment	2, 8, 10, 15, 19, 22
Current meter deployment	●




GBE-3
Bellamy R.
Oyster R.
LITTLE BAY
GBE-5
PISCATAQUA RIVER
GBE-2
GBE-4
GBE-1
N
2-km
16
15
GBE-6
GREAT BAY ESTUARY
GBE-7
Lamprey R.
GBE-9
GREAT BAY
GBE-8
Squamscott R.
Winnicut R.

FIELD WORK IN PROGRESS (PHASE I)

TASKS:

1. HISTORICAL OVERVIEW (completed)

2. CHARACTERIZE SEDIMENTS

   23 STATIONS
   - Seavy Island
   - Reference
   - Background

   FIELD SAMPLING (completed)
   CHEMICAL ANALYSIS (completed)
   TOXICITY ANALYSIS (completed)
   GEOPHYS. AND MICROBIAL ANALYSIS (completed)
   SEDIMENT DISTRIBUTION MAP

FIELD WORK IN PROGRESS (PHASE I)

TASKS (continued):

3. CHARACTERIZE WATER COLUMN

   23 STATIONS
   5 STATIONS FOR MONTHLY MONITORING

   FIELD SAMPLING (completed)
   WATER QUALITY (completed)
   WATER TOXICITY (completed)
   CAGED MUSSELS (completed)
   HYDRODYNAMIC MODELING
   SEEP SAMPLING

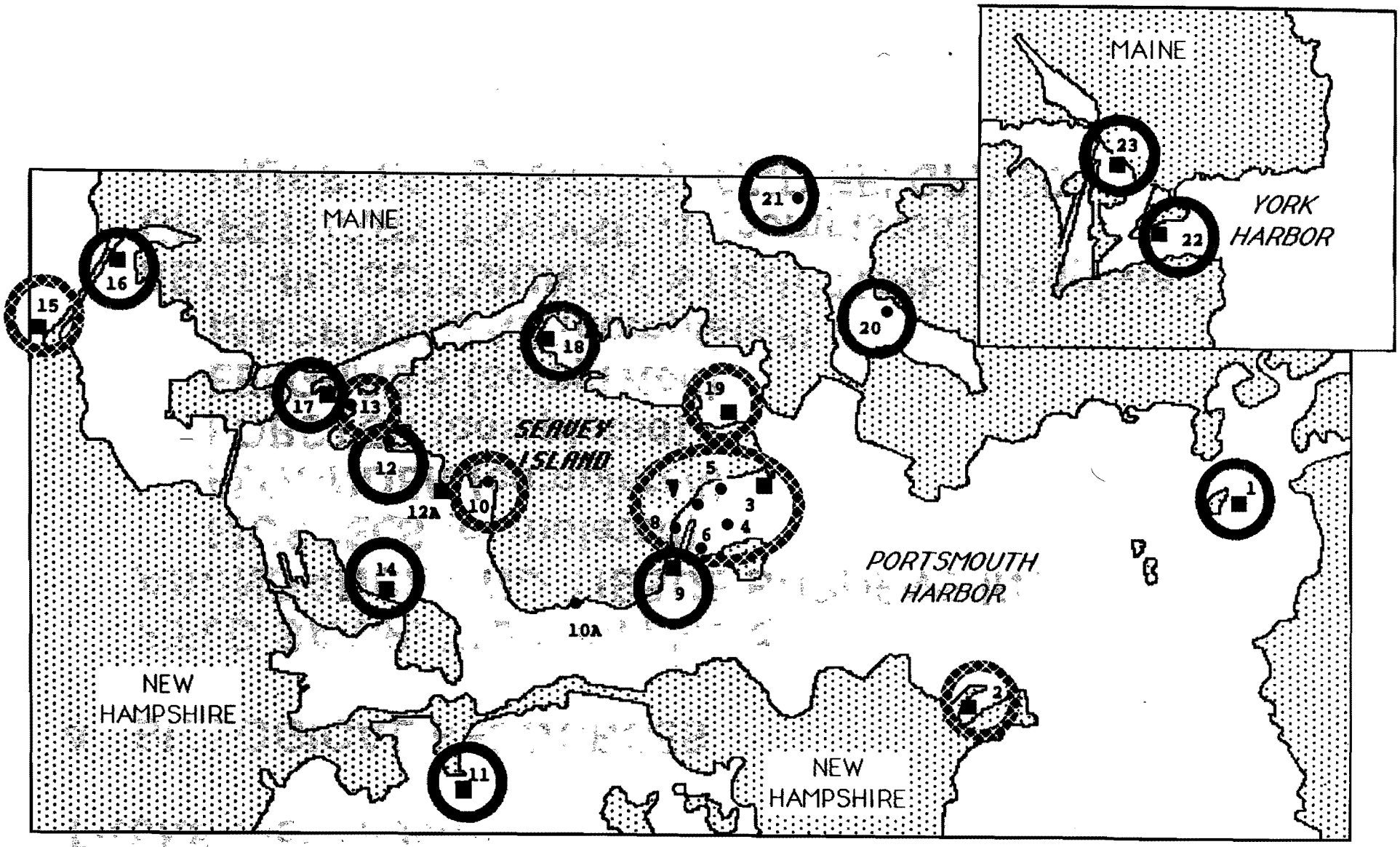
FIELD WORK IN PROGRESS (PHASE I)

TASKS (continued):

4. BIOLOGICAL RESOURCES

FIELD SAMPLING (completed)
ABUNDANCE AND TISSUE BURDENS IN:
- MUSSELS (completed)
- FLOUNDER (completed)
- LOBSTER (completed)
- EELGRASS (completed)
- MACROALGAE (completed)

BENTHIC COMMUNITY STRUCTURE (completed)
UP-ESTUARY TRANSECT (completed)
- MUSSELS, OYSTERS, AND EELGRASS



Location of Portsmouth Harbor and York River Sampling Stations

■ Denotes Eelgrass Station.

• Non-eelgrass Station.

Sand Sediment

Mud Sediment

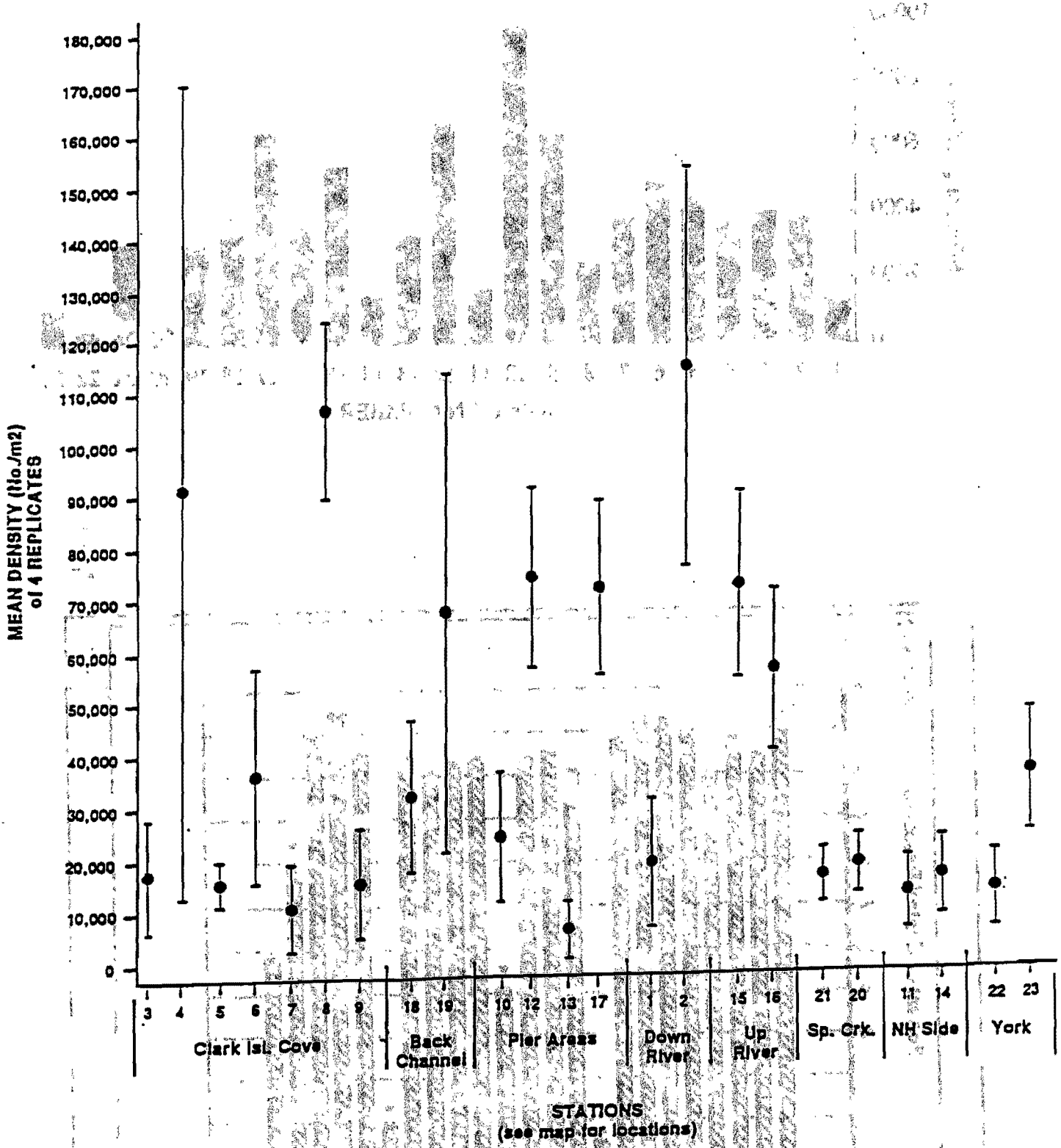
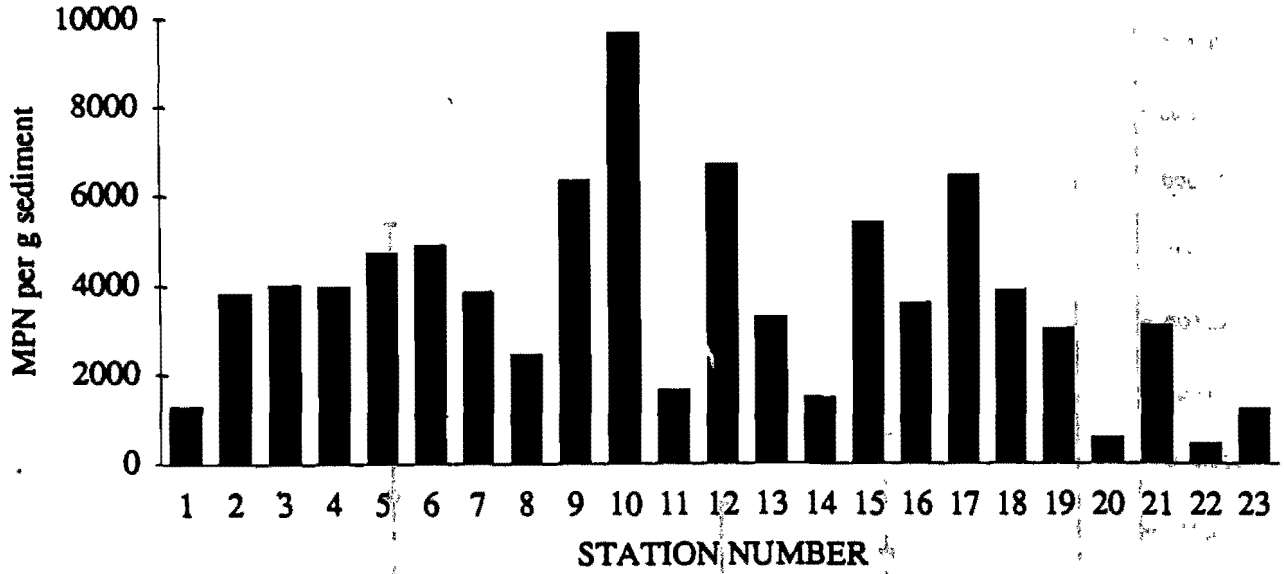


Figure 2. Mean density and ± 1 standard deviation of benthic infauna at each station, September 1991. Portsmouth Naval Shipyard Ecological Risk Assessment.

C. perfringens concentrations in surface sediments from Portsmouth (#1-21) and York (#22-23) Harbors: September, 1991.



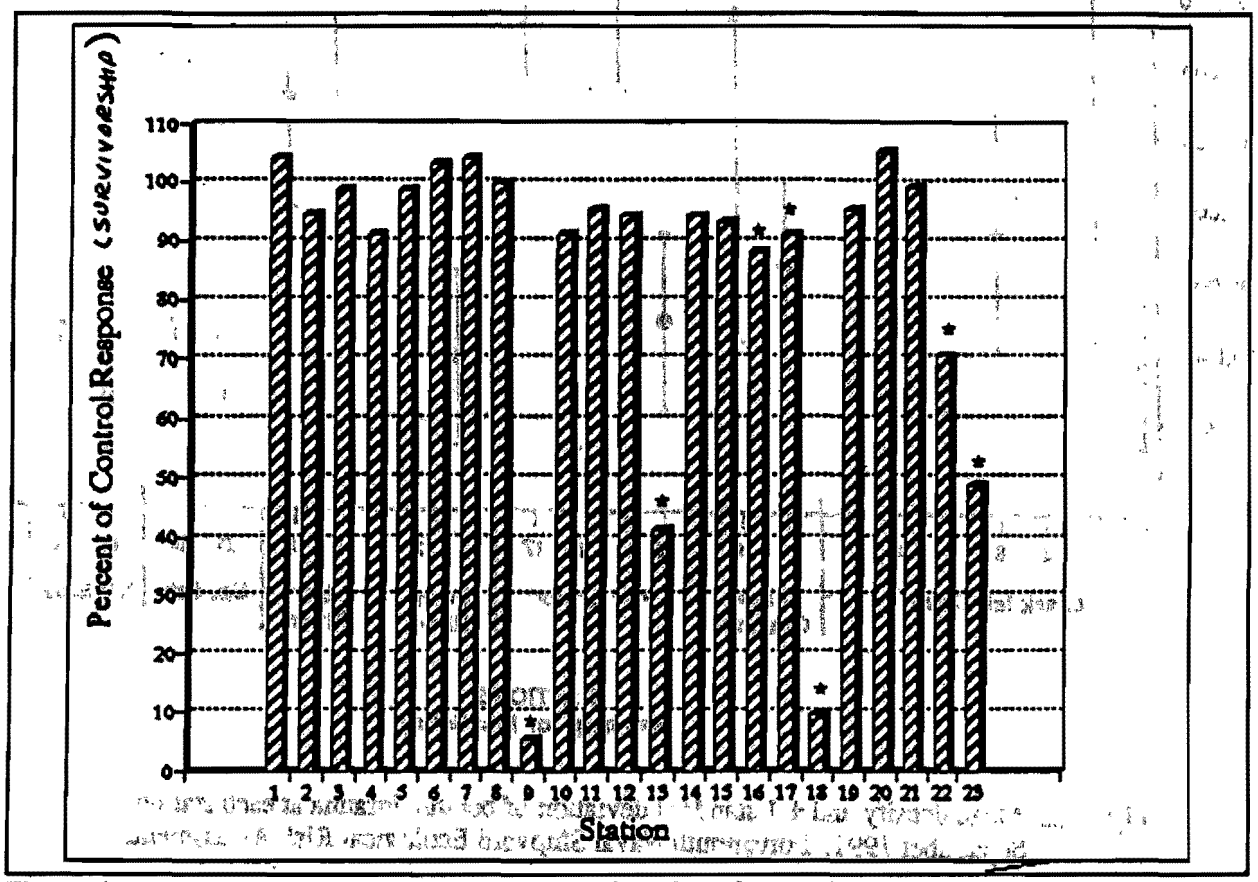
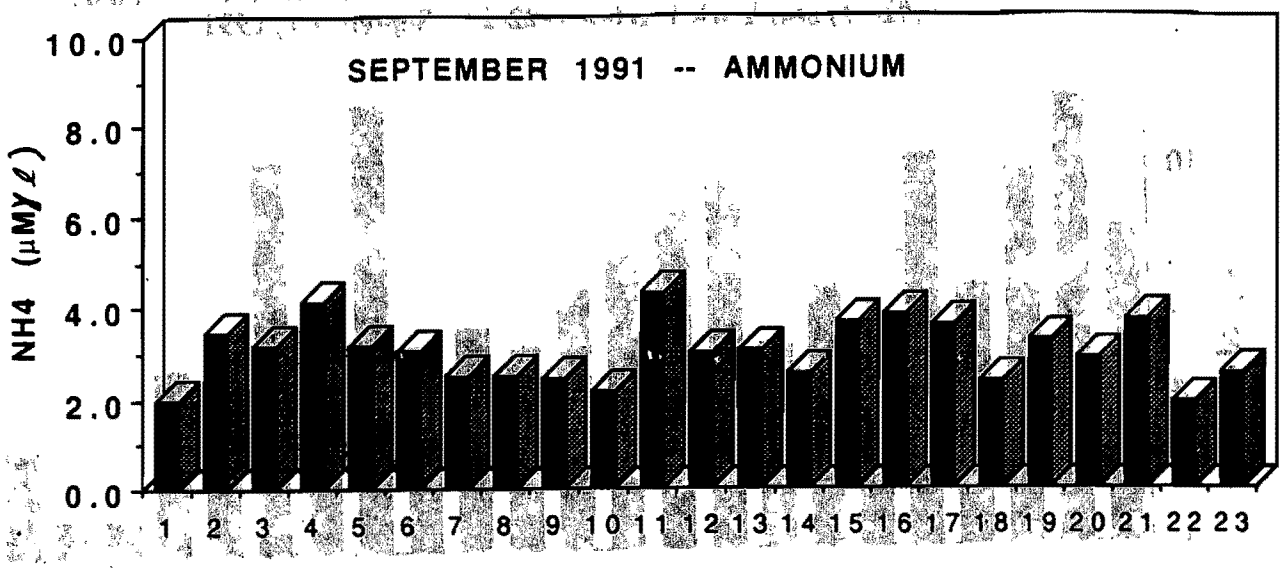
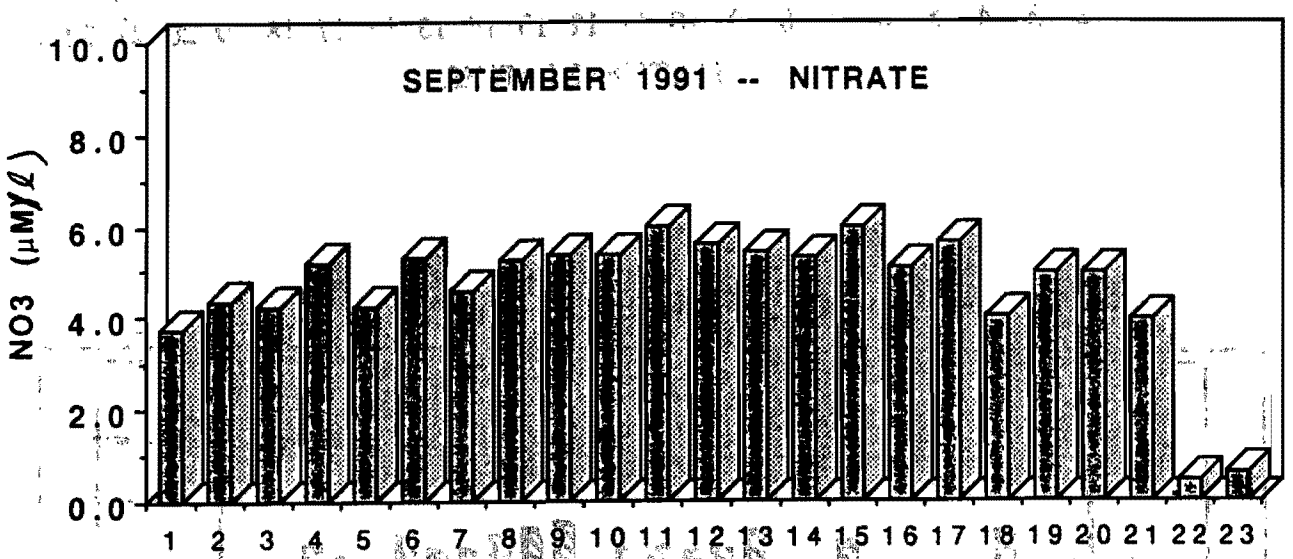
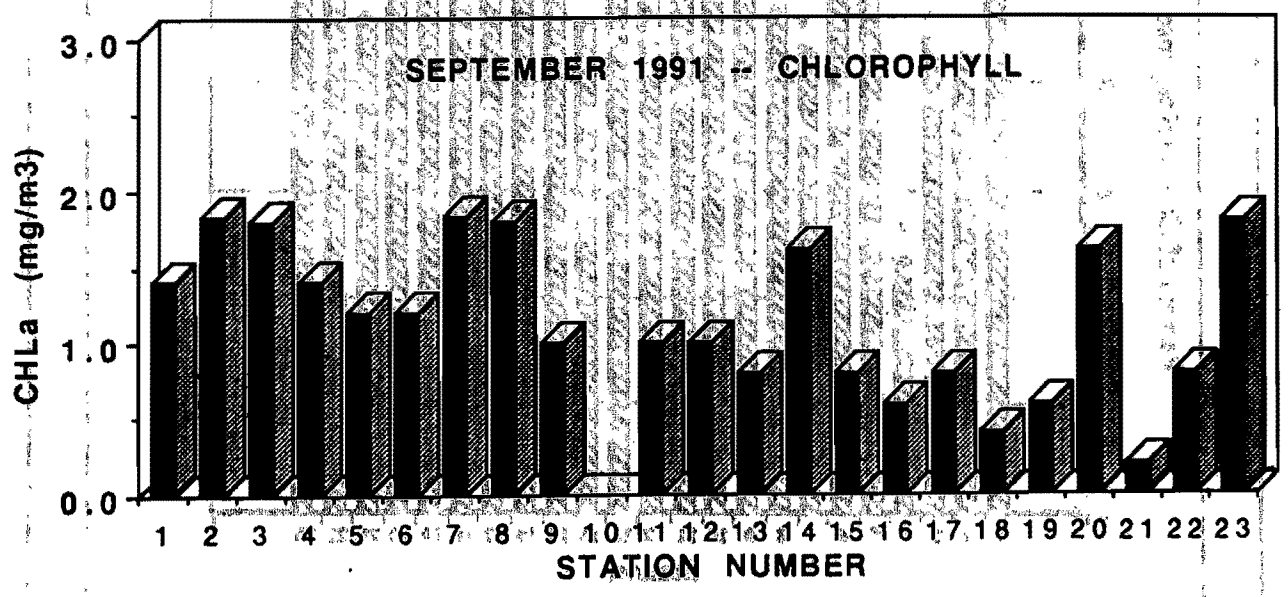


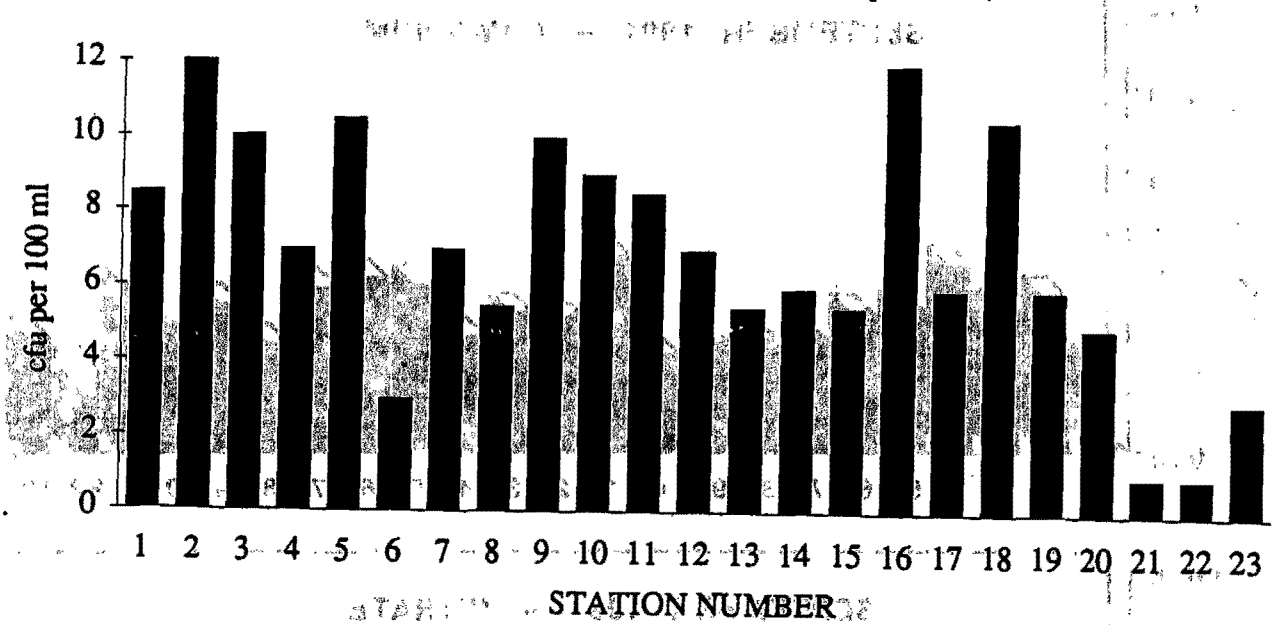
Figure 6. ***Ampelisca*** **survivorship expressed as a function of control response.**


SEPTEMBER 1991 -- AMMONIUM
NH4 (µMγℓ)
10.0
8.0
6.0
4.0
2.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23


SEPTEMBER 1991 -- NITRATE
NO3 (µMγℓ)
10.0
8.0
6.0
4.0
2.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23


SEPTEMBER 1991 -- CHLOROPHYLL
CHLa (mg/m3)
3.0
2.0
1.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
STATION NUMBER

C. perfringens concentrations in water samples from Portsmouth Harbor (#1-21) and York Harbor (#22-23): September, 1991



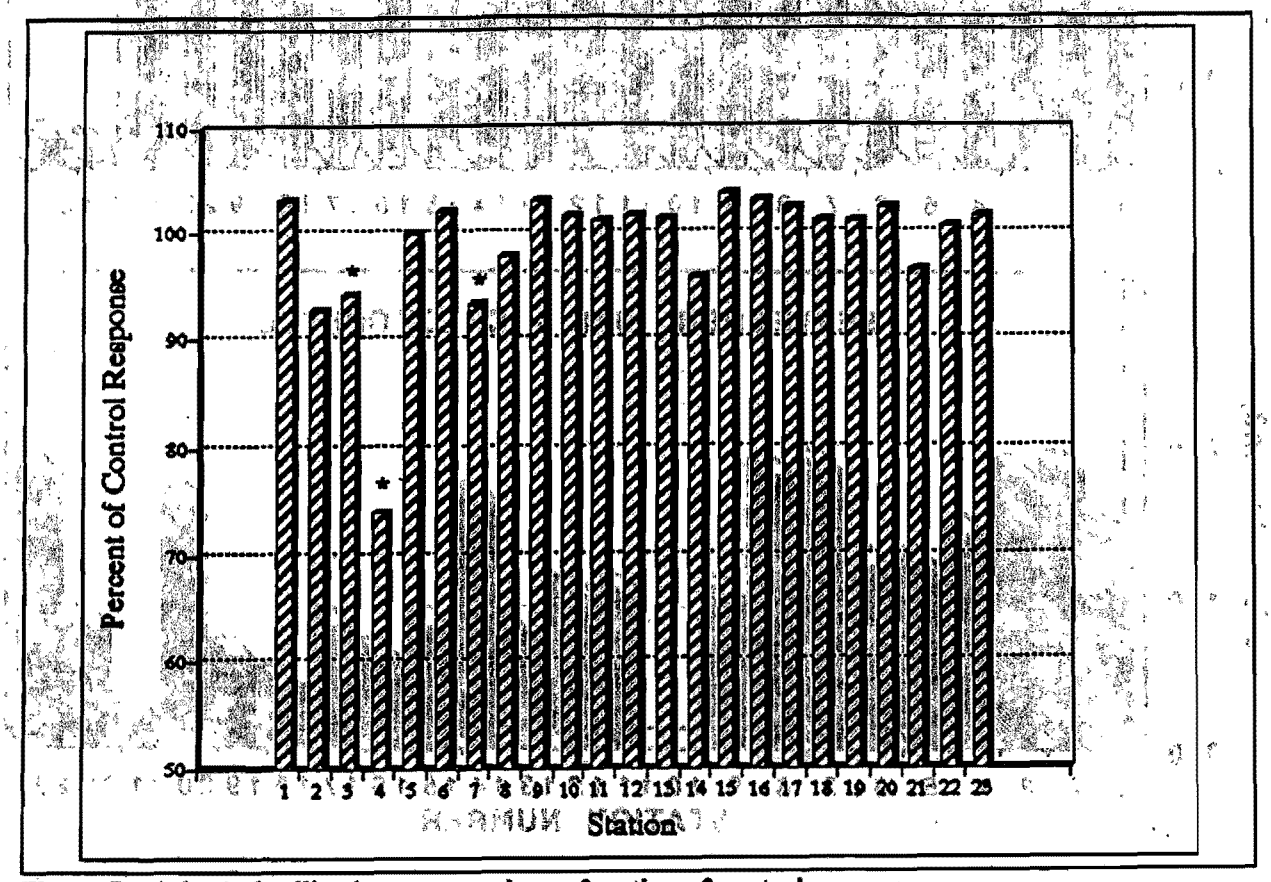
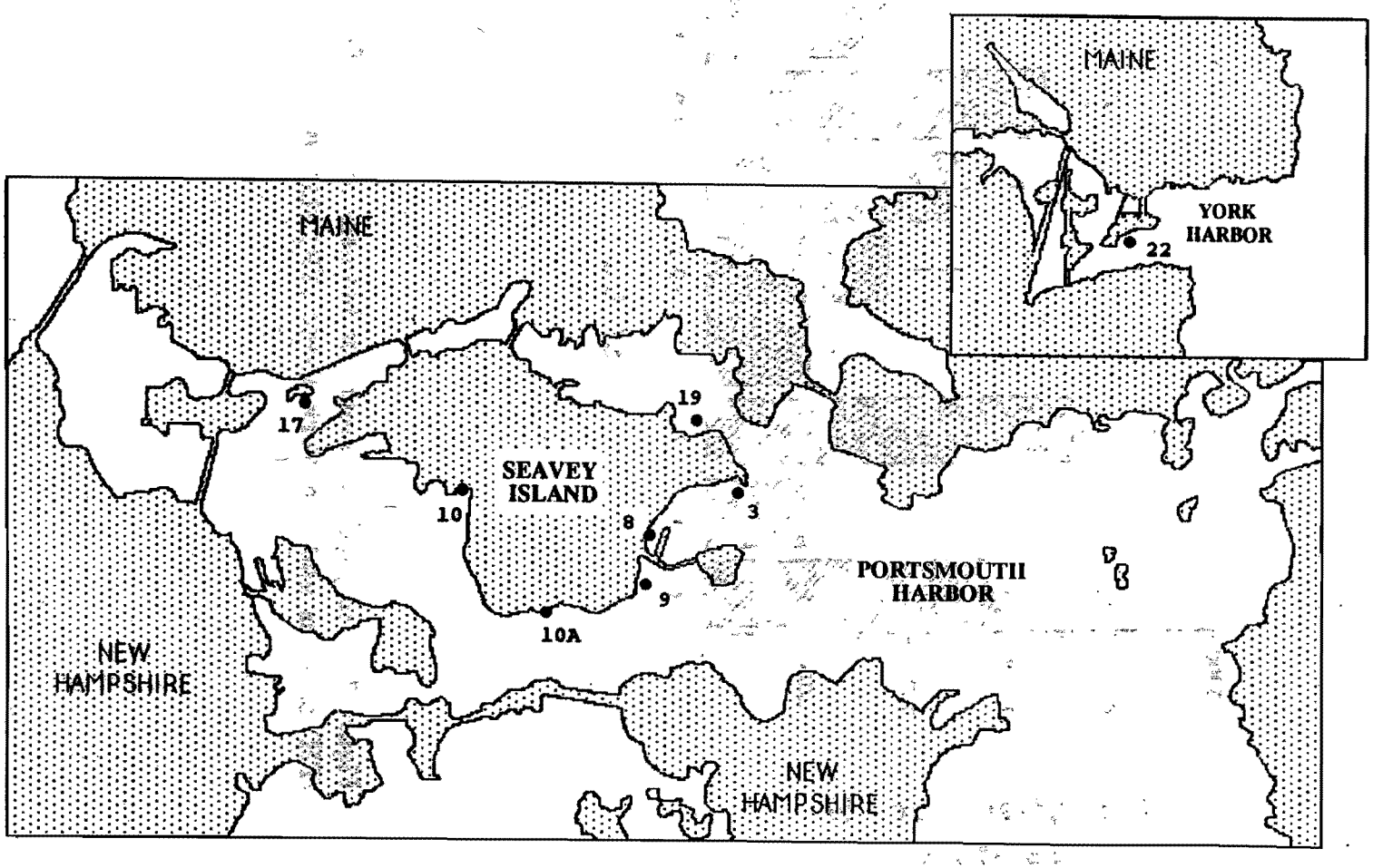


Figure 7. ***Arbacia*** **fertilization expressed as a function of control response.**



Portsmouth Harbor (PH) and York River (YR) Ascophyllum sampling locations.

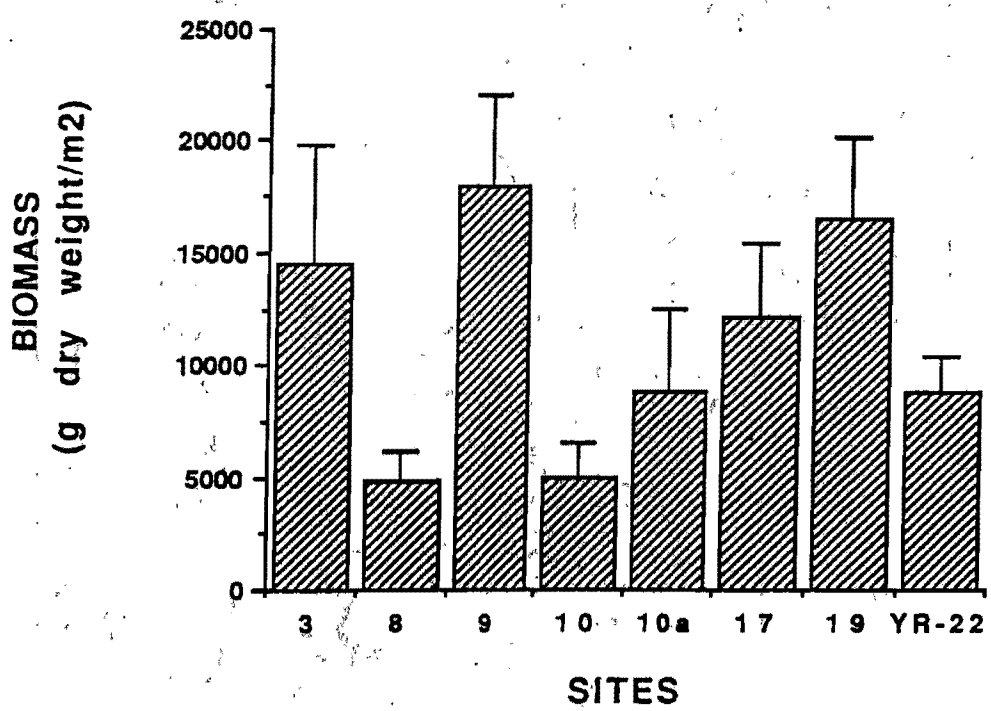
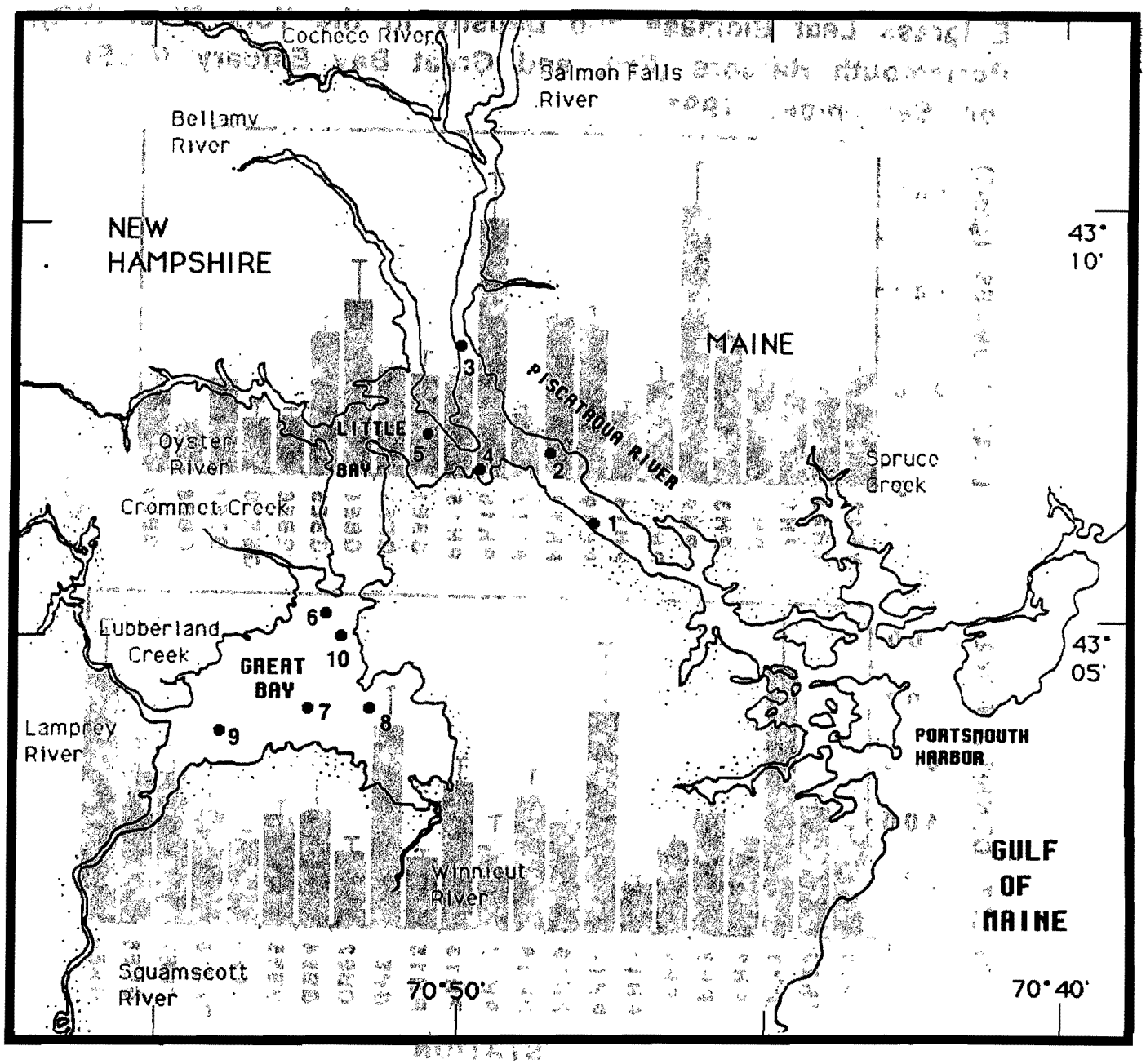
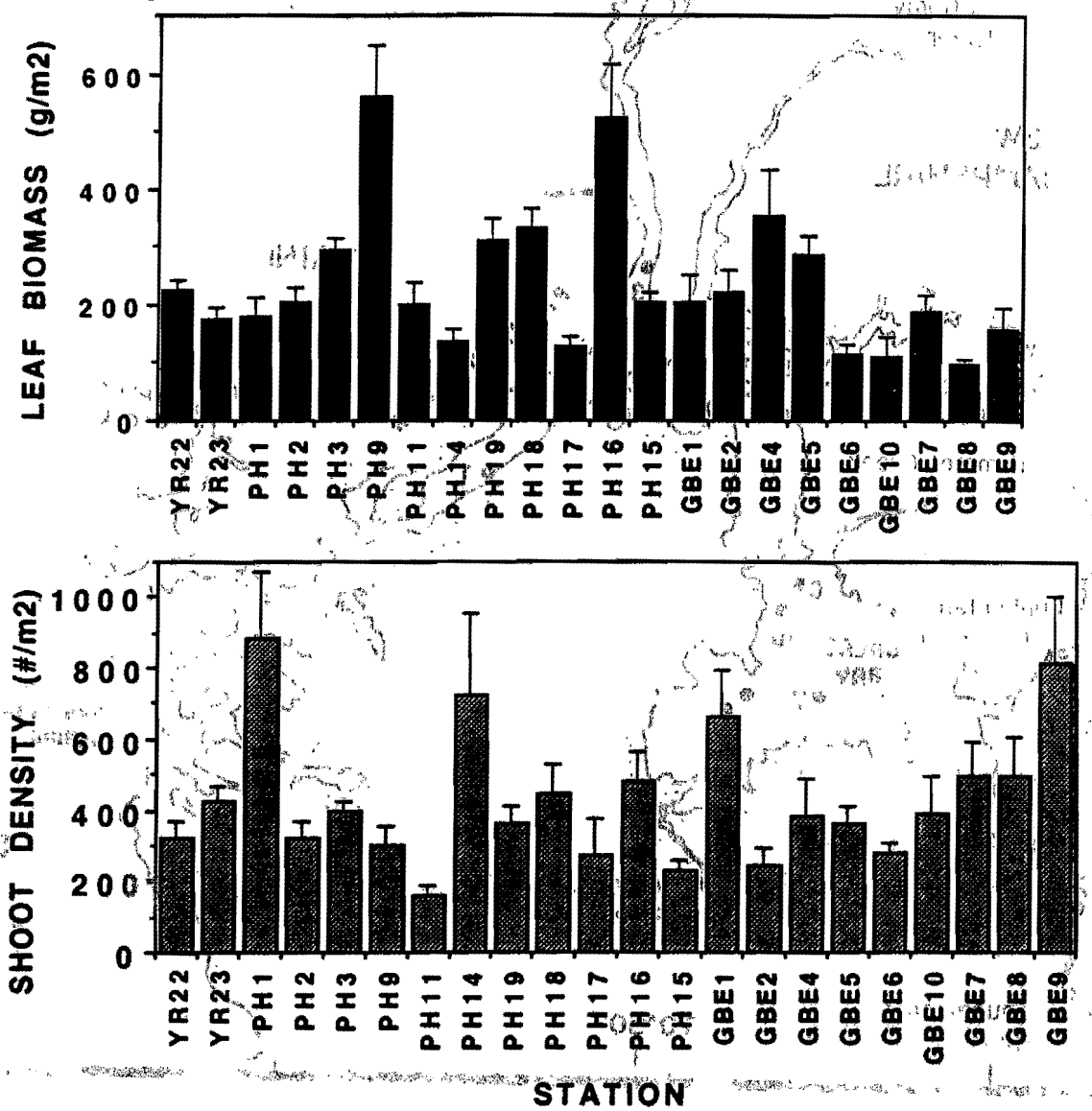


Figure 2. ***Ascophyllum nodosum*** **biomass at seven Portsmouth Harbor (PH) stations and one York River (YR) station.**

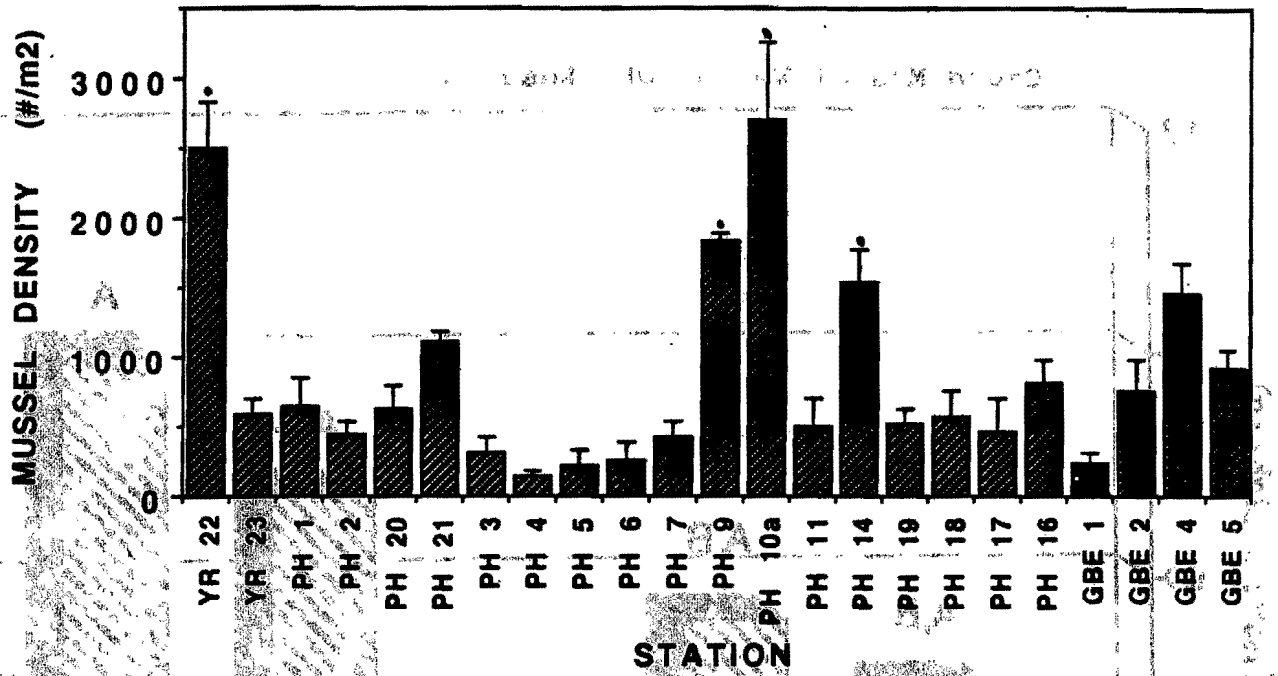


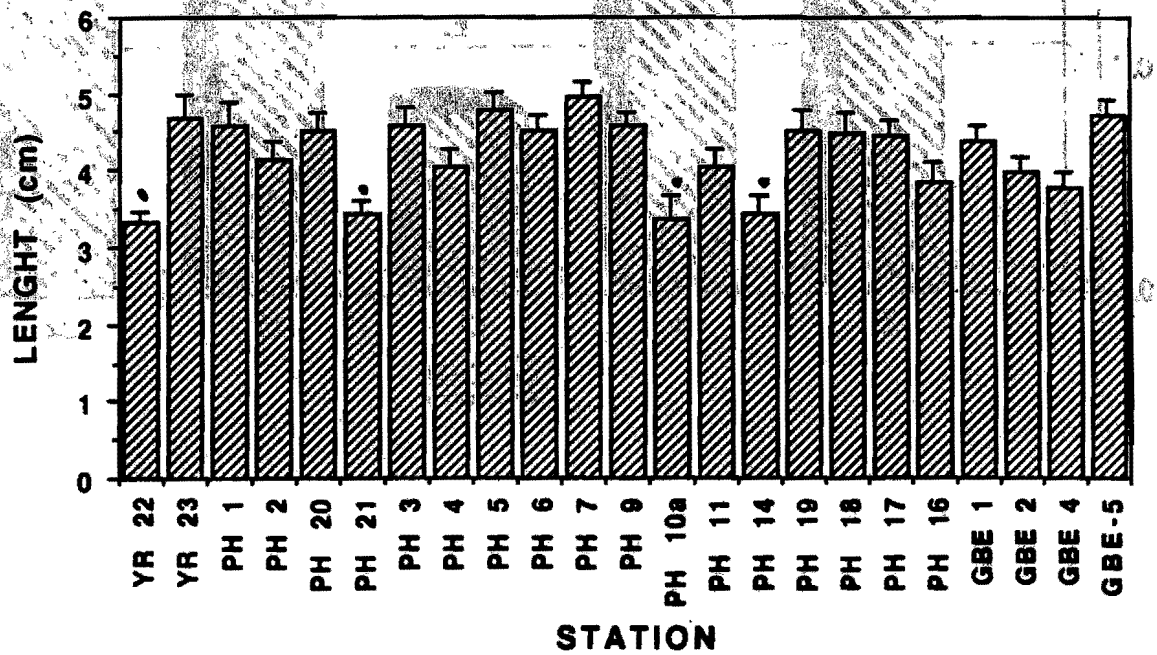
Map of the Great Bay Estuary showing the location of stations for the eelgrass and bivalve up bay transect (GBE1 through GBE10).

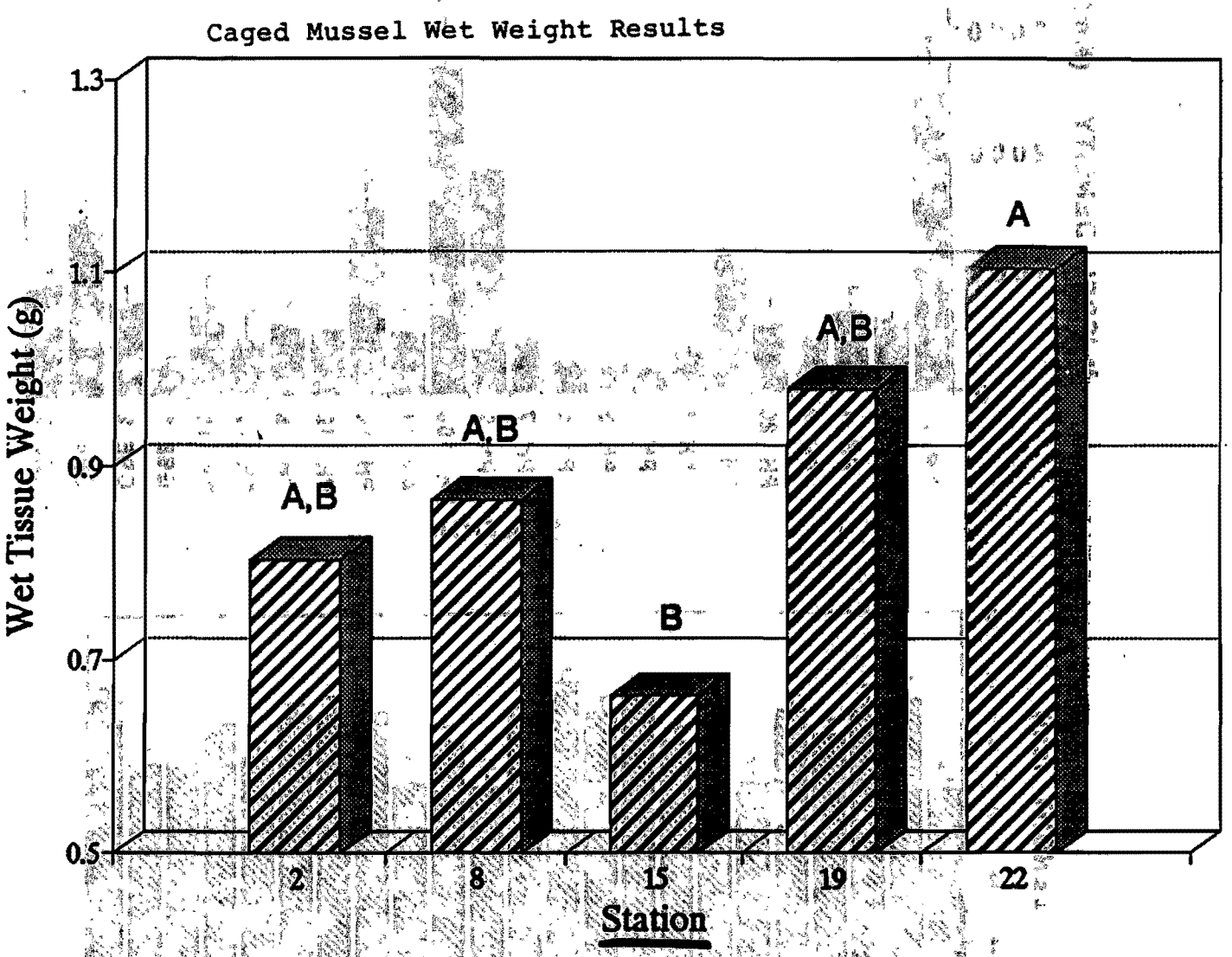
Eelgrass Leaf Biomass and Density in the York River (YR), Portsmouth Harbors (PH), and Great Bay Estuary (GBE) for September 1991



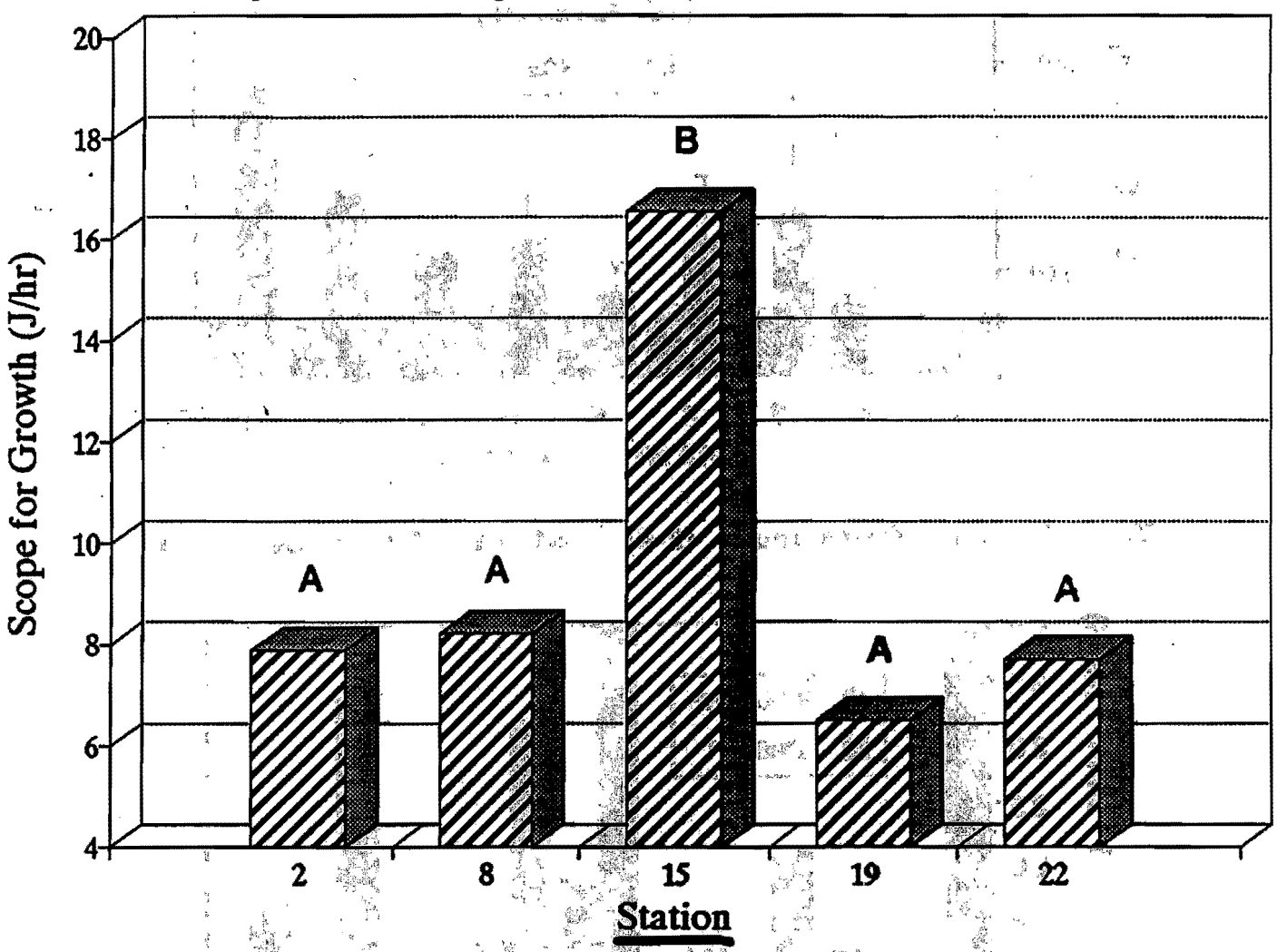
Blue Mussel Density and Length in York River (YR), Portsmouth Harbor (PH), and Great Bay Estuary (GBE) for September 1991



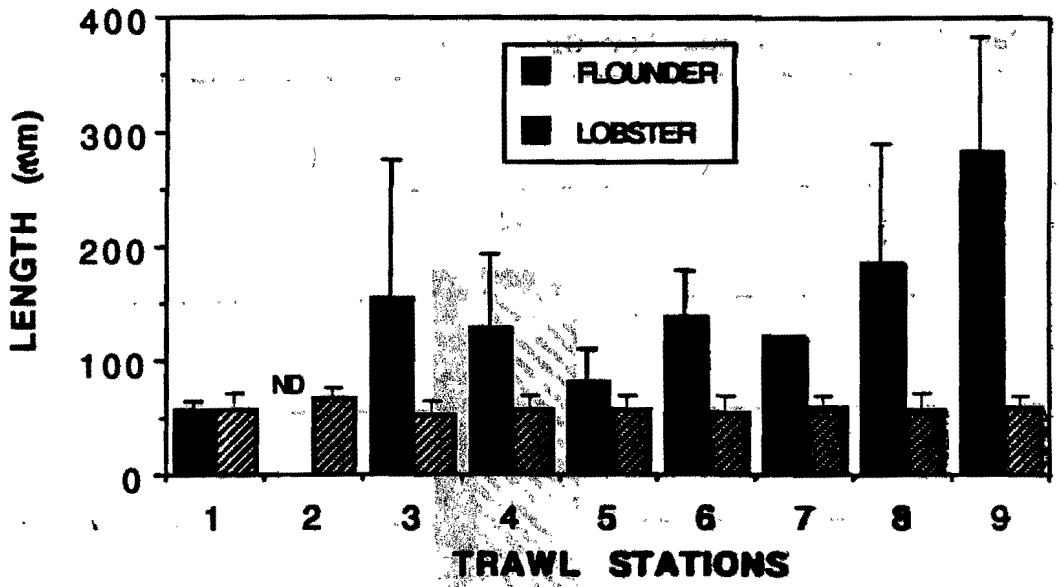



Caged Mussel Wet Weight Results
Wet Tissue Weight (g)
1.3
1.1
0.9
0.7
0.5
A,B
A,B
B
A,B
A
2
8
15
19
22
Station

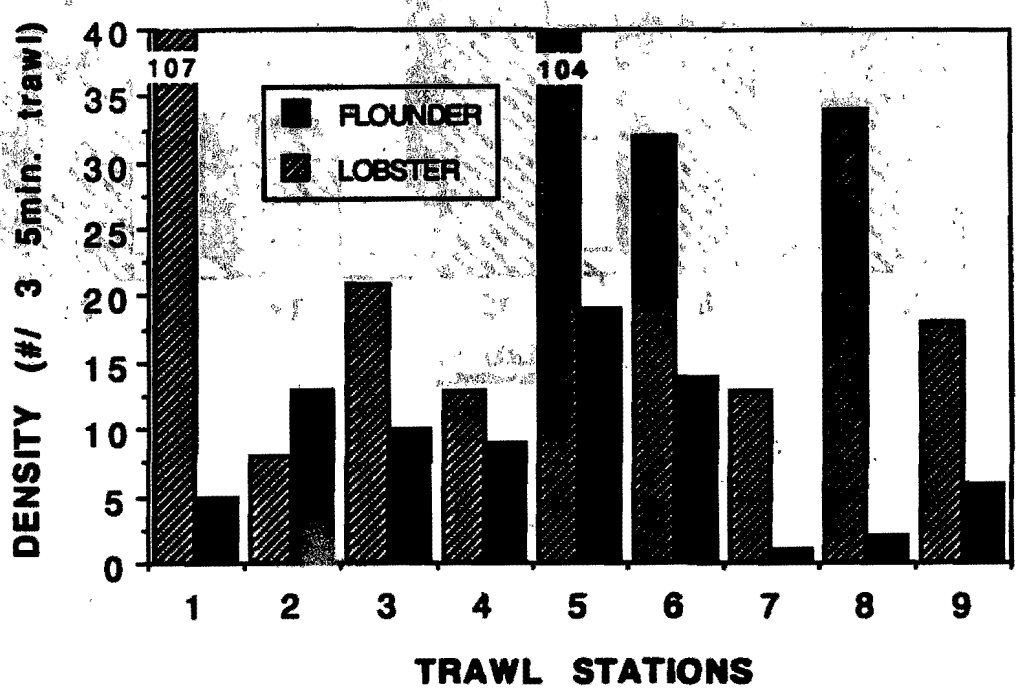
Caged Mussel Scope for Growth Results



York (1) and Portsmouth (2-9) Harbors September 1991



York (1) and Portsmouth (2-9) Harbors September 1991



ANALYTICAL CHEMISTRY

QUALITY ASSURANCE AND QUALITY CONTROL

PROTOCOLS, CRITERIA, AND CORRECTIVE ACTION

FOR THE

ESTUARINE ECOLOGICAL RISK ASSESSMENT

AT NAVAL SHIPYARD PORTSMOUTH, KITTERY, ME

Prepared by:

Marine Environmental Support Office
Naval Ocean Systems Center
San Diego, CA 92152-5000

and

Environmental Research Laboratory Narragansett
United States Environmental Protection Agency
27 Tarzwell Drive
Narragansett, RI 02882

March 31, 1992

TABLE 2. Target analytes for chemical analysis.

A. Organic compounds. Analyte	Sample Matrix	(Dry weight for sediment and biota) Target Detection Limit
VOCs	seep water	0.1 ug/L
PAHS	**seep water**	**1-5 ug/L**
	sediment	**1-5 ng/g**
	biota	**10-20 ng/g**
Pest.	**seep water**	**0.6 ng/L**
	sediment	**0.6 ng/g**
	biota	**0.6 ng/g**
PCBs	**seep water**	**1 ug/L**
	sediment	**0.5 ng/g**
	biota	**0.5 ng/g**

B. Target MDLs for inorganic compounds.

Analyte	Matrix Sediment (ug/g)	Matrix Tissue (ug/g)
As	**1.1**	**4.3**
Cd	**0.4**	**0.06**
Cr	**3.2**	**0.3**
Cu	**1.3**	**5.0**
Pb	**1.2**	**0.6**
Hg	**0.01**	**0.04**
Ni	**1.1**	**0.7**
Ag	**0.04**	**0.04**
Sn	**1.8**	**NS**
Zn	**2.2**	**11.65**

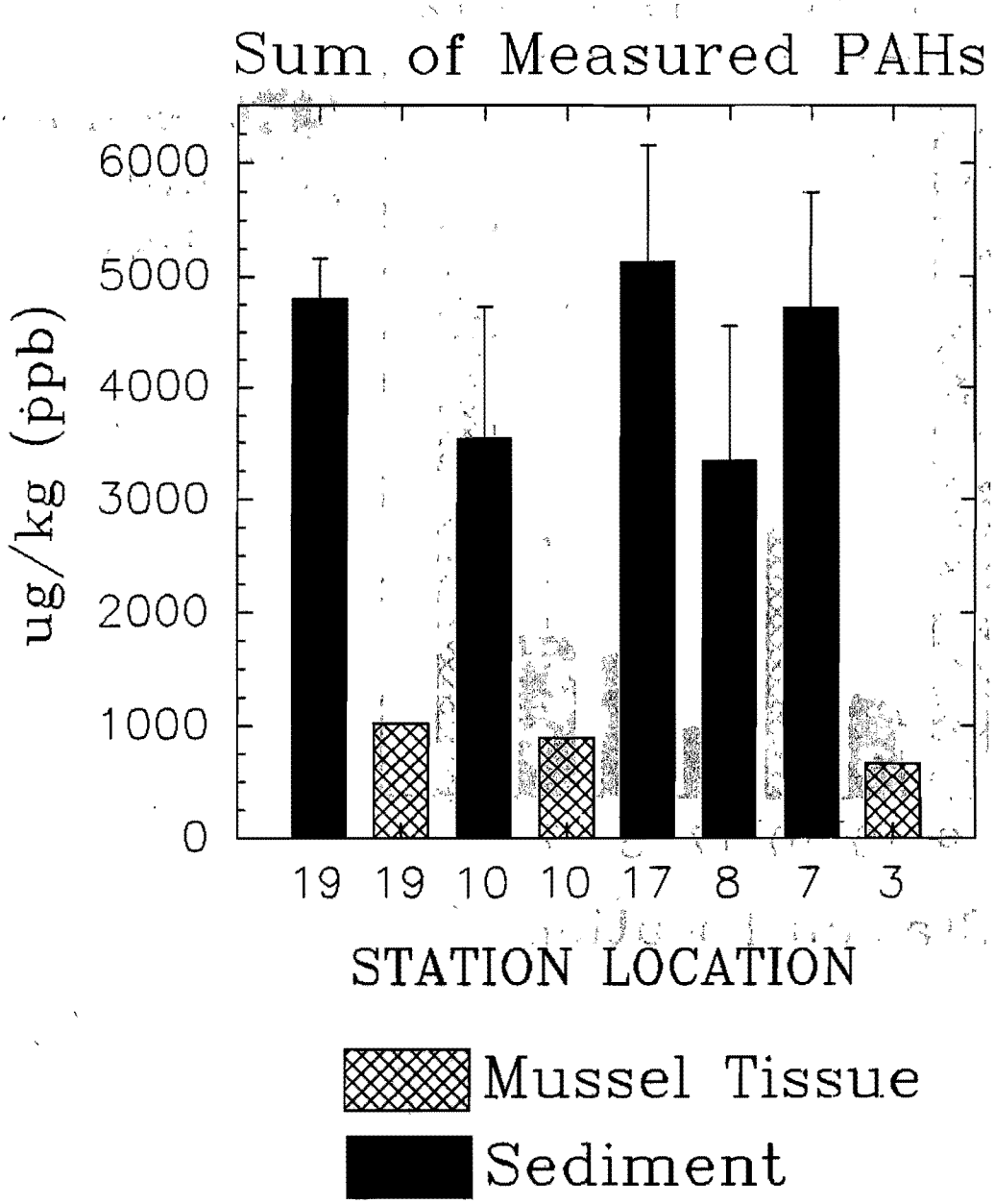
Abbreviations Used :

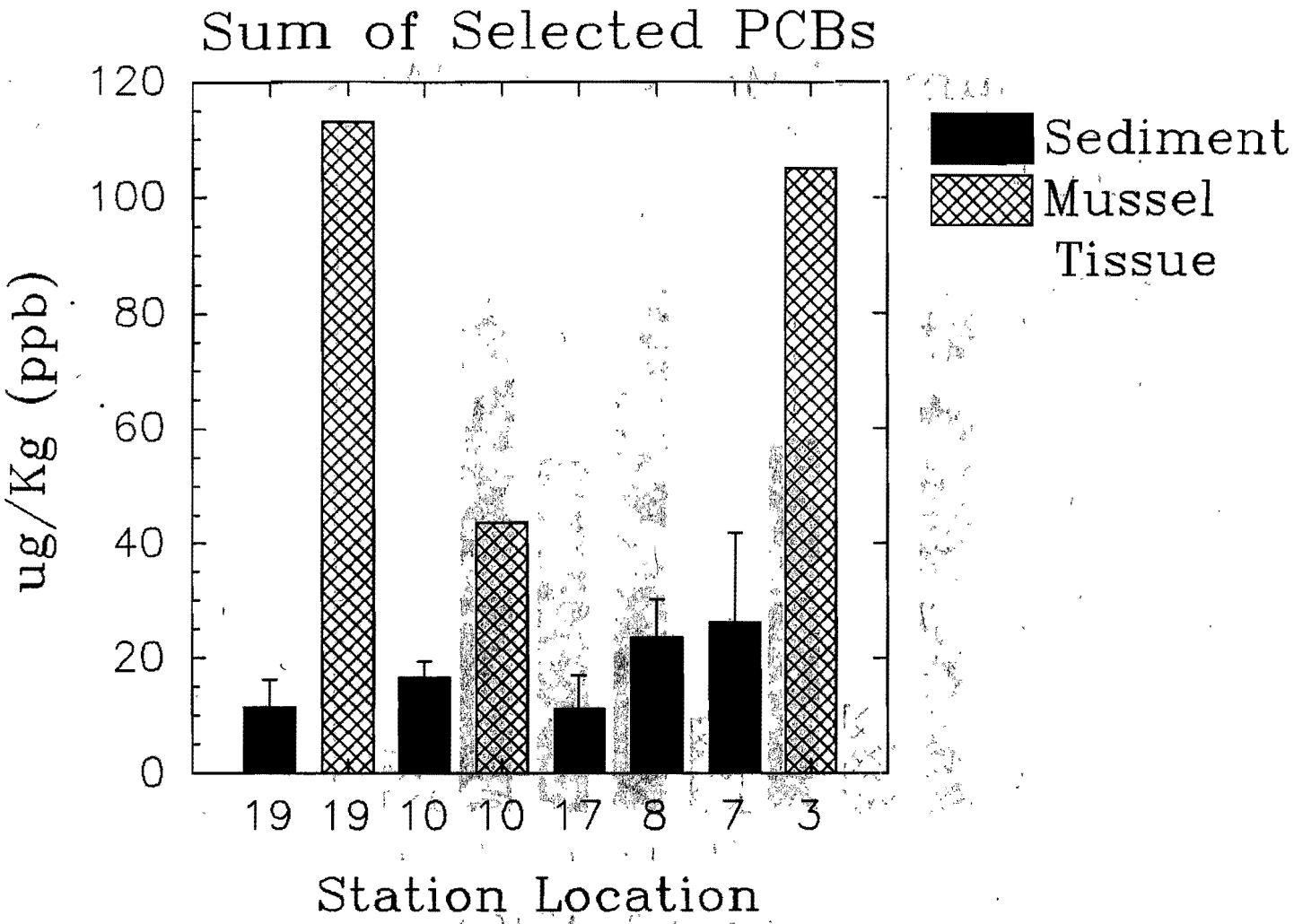
Organics

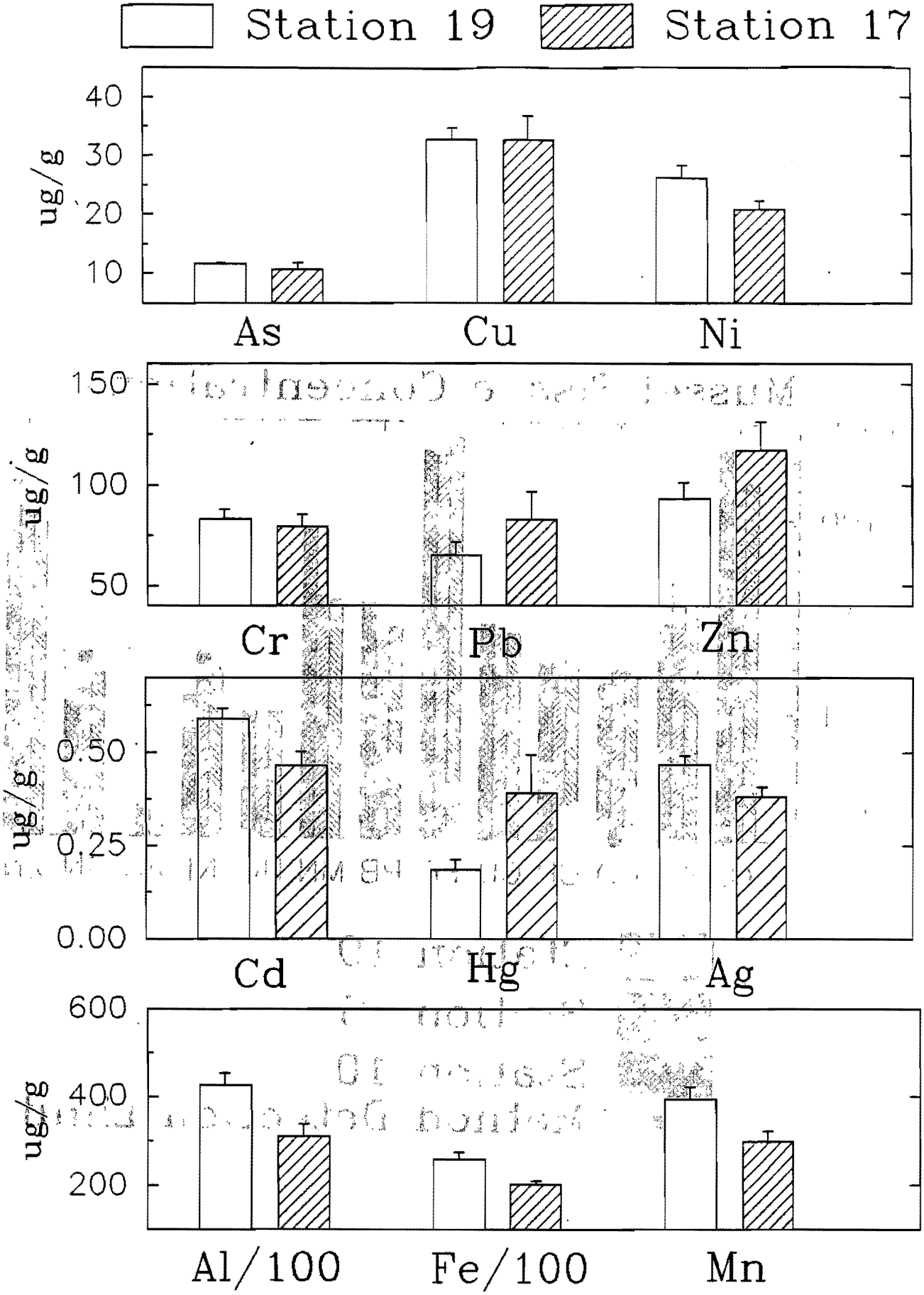
PCB	- Polychlorinated Biphenyls	PAH	-Polycyclic Aromatic Hydrocarbons
BaP	- Benzo[a]pyrene	BAA	-Benzo[a]anthracene
Phen	- Phenanthrene	DDD	-Dichlorodiphenyldichlorine
DDE	- Dichlorodiphenyl-dichloroethene		
HBC	- Hexachlorobenzene		
TBT	- Tributyltin		

METALS

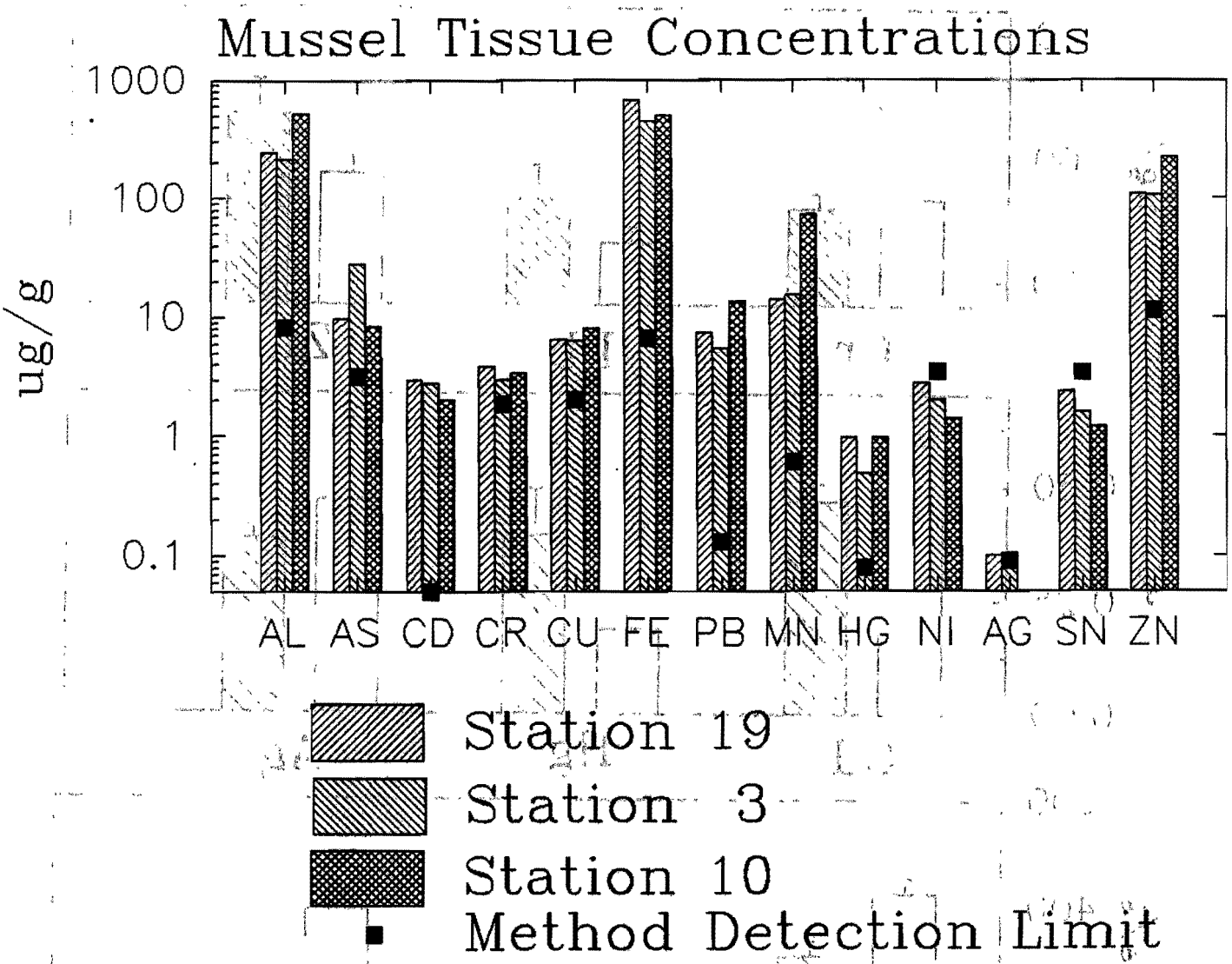
Cu	- Copper	Al	-Aluminium
Zn	- Zinc	Fe	-Iron
Cr	- Chromium	Mn	-Manganese
Pb	- Lead	Hg	-Mercury
Ni	- Nickel	Cd	-Cadmium
As	- Arsenic		

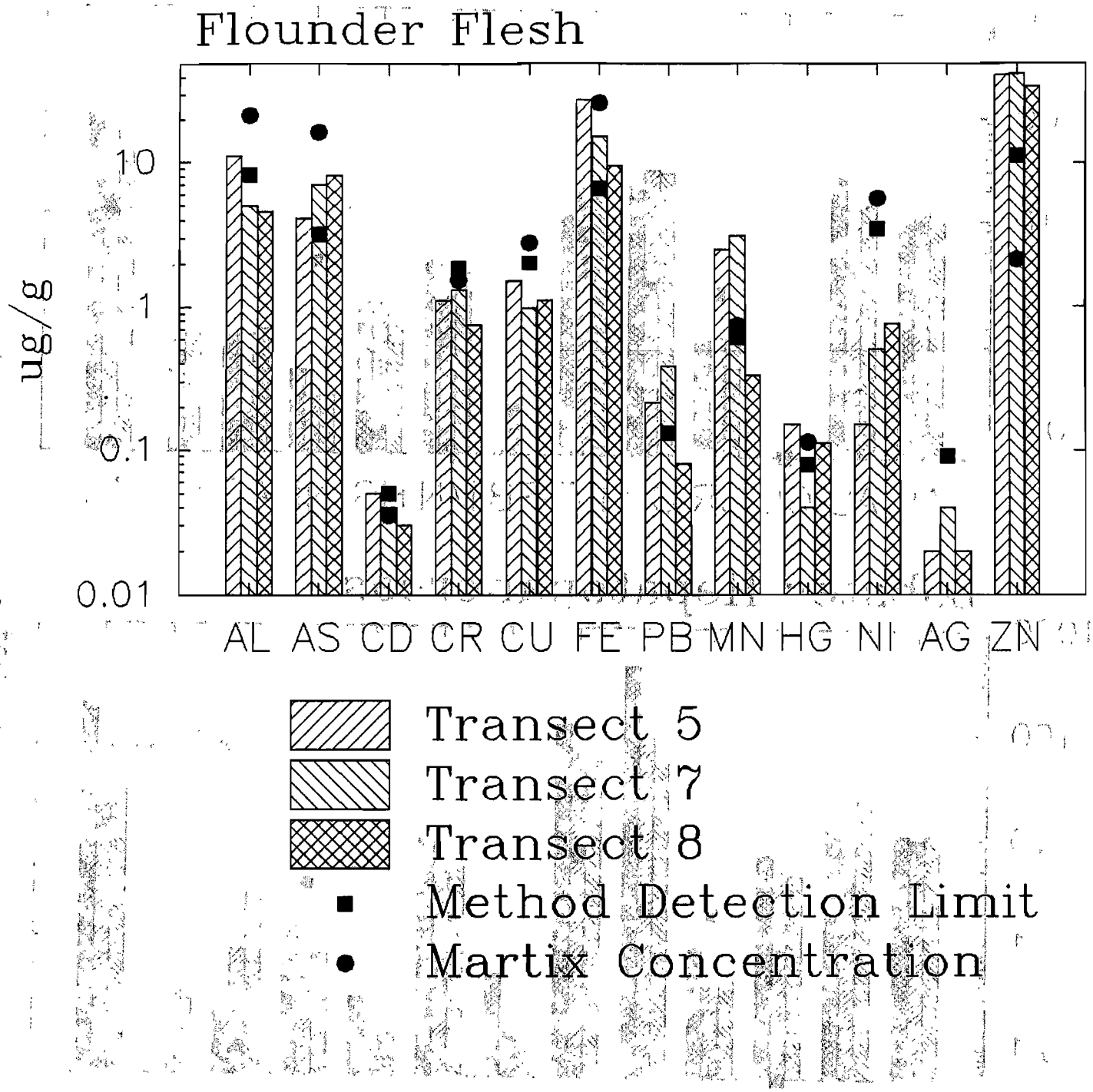

Sum of Measured PAHs
ug/kg (ppb)
6000
5000
4000
3000
2000
1000
0
19 19 10 10 17 8 7 3
STATION LOCATION
Mussel Tissue
Sediment

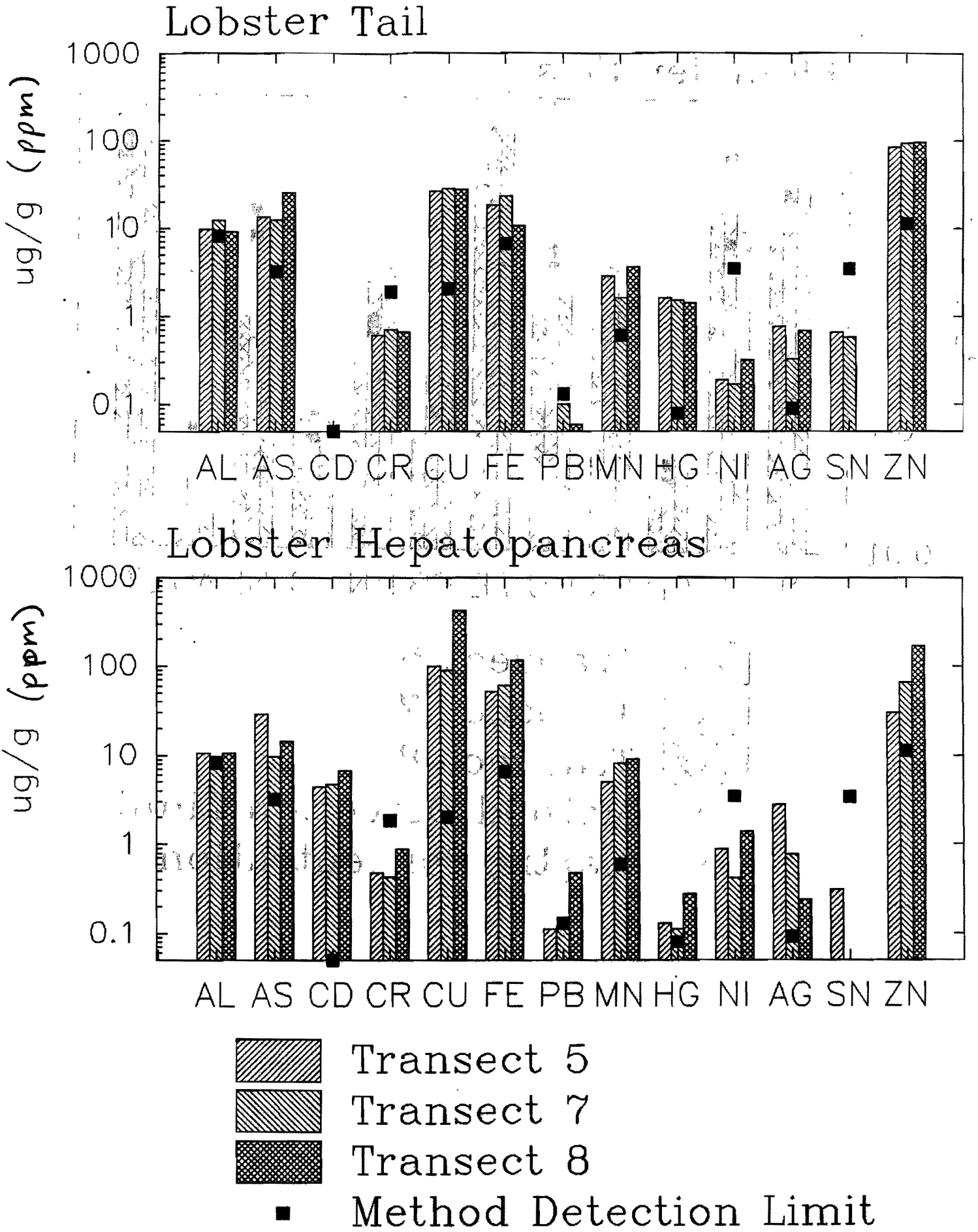

Sum of Selected PCBs
120
100
80
60
40
20
0
ug/Kg (ppb)
19
19
10
10
17
8
7
3
Station Location
Sediment
Mussel Tissue

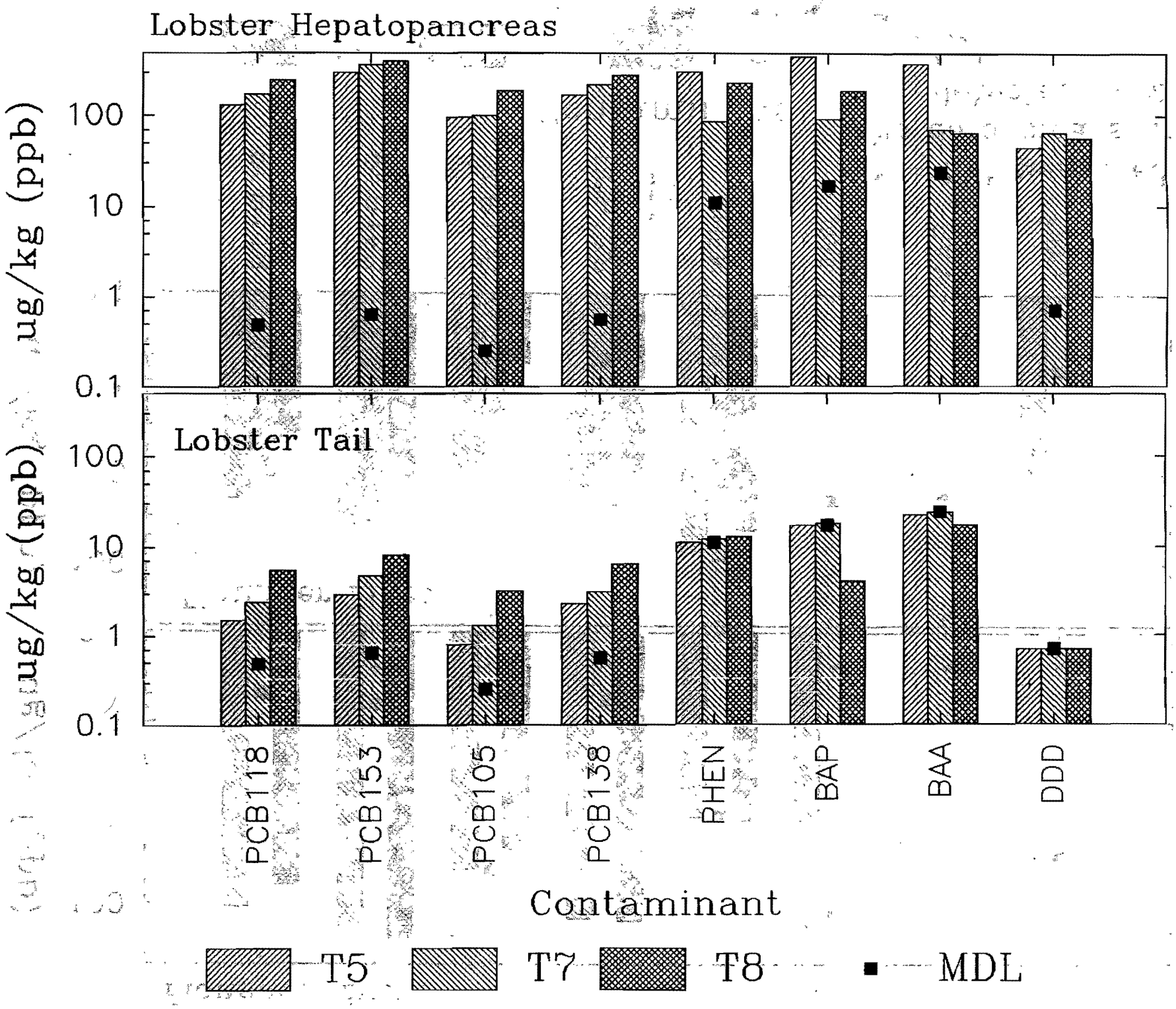


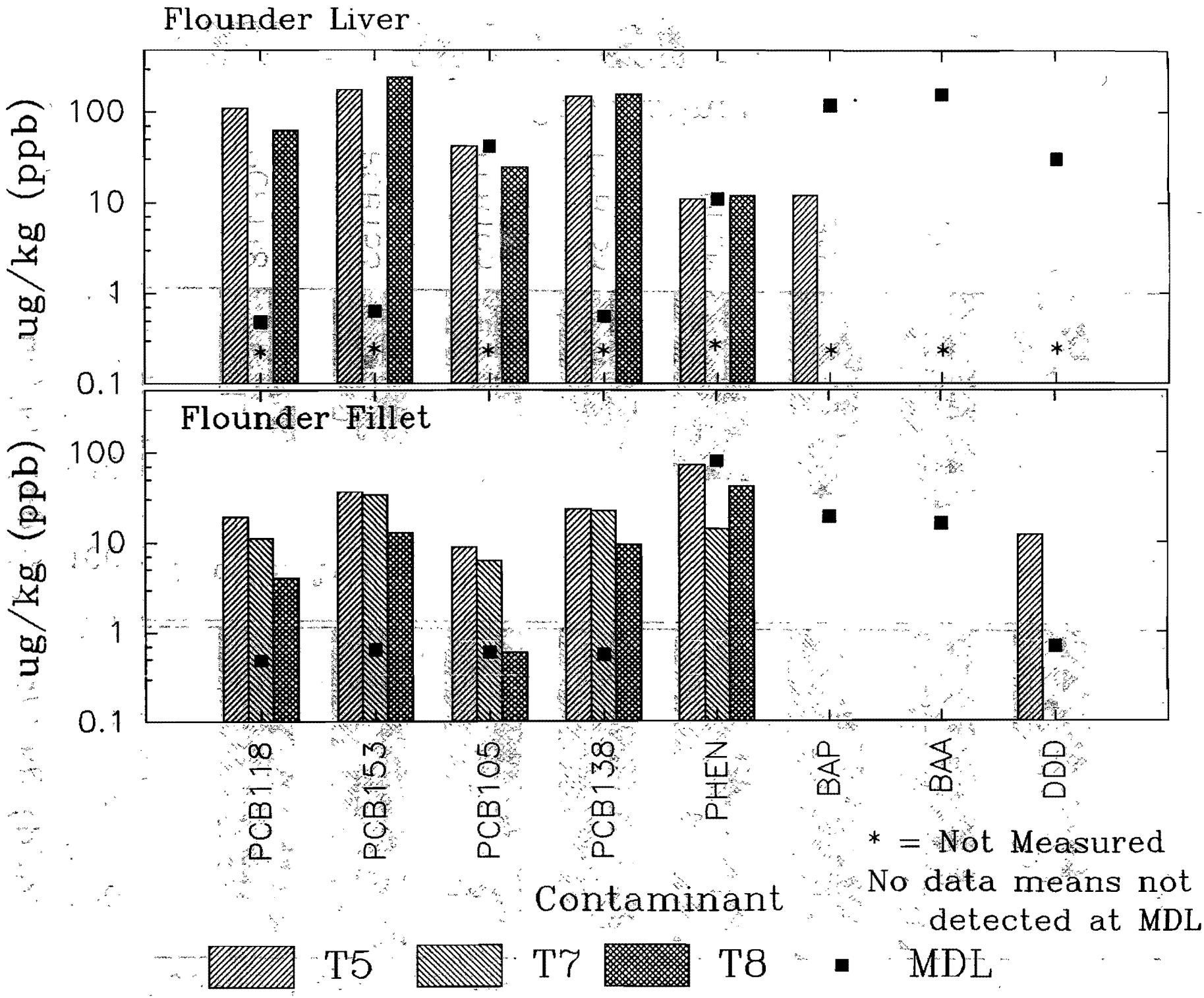
Concentration of inorganic compounds measured in sediment samples from stations 19 and 17.


Mussel Tissue Concentrations
1000
100
10
1
0.1
ug/g
AL AS CD CR CU FE PB MN HG NI AG SN ZN
Station 19
Station 3
Station 10
Method Detection Limit

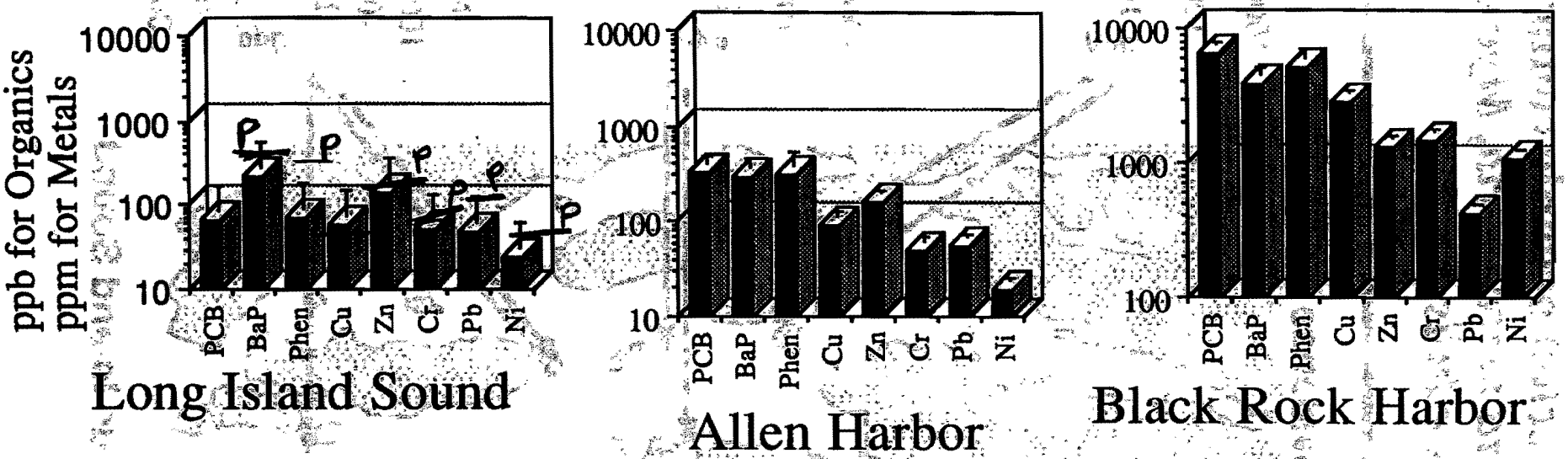

Flounder Flesh
ug/g
10
1
0.1
0.01
AL AS CD CR CU FE PB MN HG NI AG ZN
Transect 5
Transect 7
Transect 8
Method Detection Limit
Martix Concentration


Lobster Tail
ug/g (ppm)
1000
100
10
1
0.1
AL AS CD CR CU FE PB MN HG NI AG SN ZN
Lobster Hepatopancreas
ug/g (ppm)
1000
100
10
1
0.1
AL AS CD CR CU FE PB MN HG NI AG SN ZN
Transect 5
Transect 7
Transect 8
Method Detection Limit

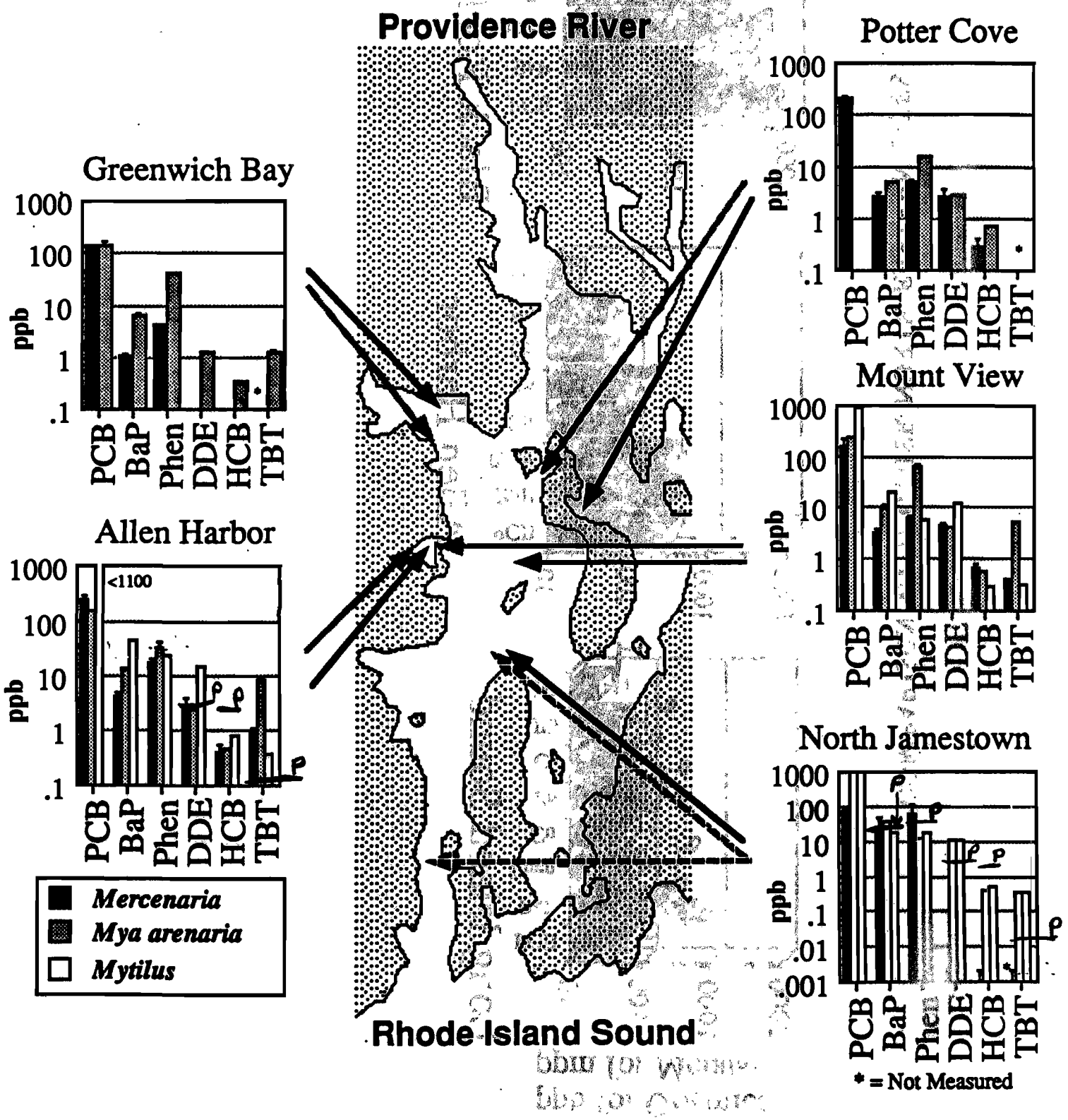

Lobster Hepatopancreas
Lobster Tail
ug/kg (ppb)
100
10
1
0.1
PCB118
PCB153
PCB105
PCB138
PHEN
BAP
BAA
DDD
Contaminant
T5
T7
T8
MDL


Flounder Liver
Flounder Fillet
ug/kg (ppb)
100
10
1
0.1
PCB118
PCB153
PCB105
PCB138
PHEN
BAP
BAA
DDD
Contaminant
* = Not Measured
No data means not detected at MDL
T5
T7
T8
MDL

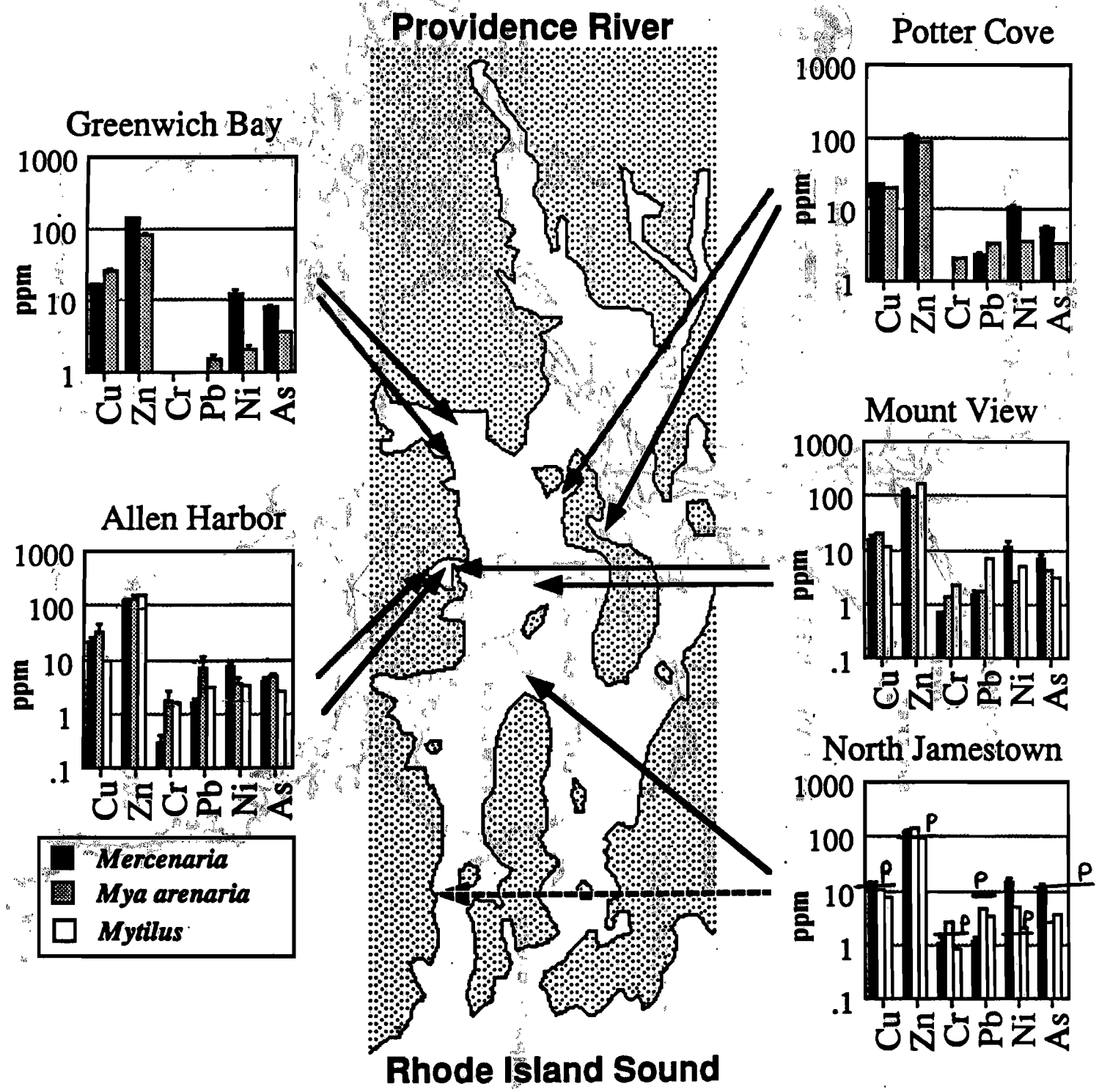
COMPARISON WITH OTHER NORTH EASTERN SITES



Tissue residues of selected organic contaminants in indigenous *Mercenaria mercenaria*, *Mya arenaria*, and deployed *Mytilus edulis*.



Tissue residues of selected toxic metals in indigenous *Mercenaria mercenaria*, *Mya arenaria*, and deployed *Mytilus edulis*.



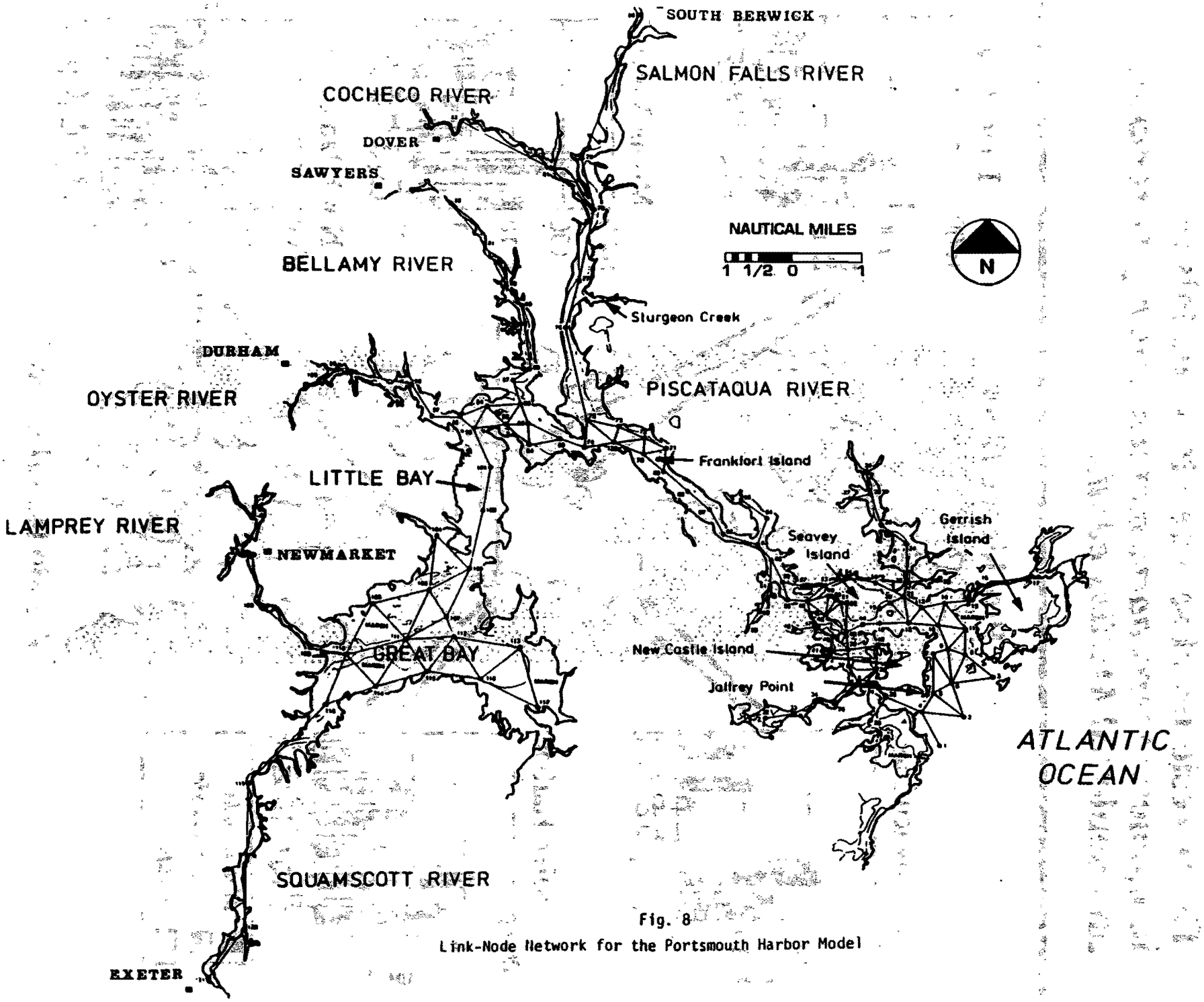


Fig. 8
Link-Node Network for the Portsmouth Harbor Model

PHASE II TECHNICAL APPROACH

1. Quantify Ecological Risk From Exposure

    a. Exposure-Response Bioassays
    b. Salt Marsh and Benthic Ecology
    c. Bioaccumulation Potential
        (1) Lobsters
        (2) Flounder
        (3) Food Chain

2. Conduct Detailed Ecological Assessment of Impact or Lack Thereof

    a. Sedimentation and Accumulation
        (1) sediment transport
        (2) suspended sediment dynamics
        (3) geochemical assimilation capacity
    b. Dispersion Dynamics
        (1) track water masses
        (2) measure dispersion coefficients
        (3) quantify current regimes
        (4) modelling
    c. Chemical and Microbial Markers

3. Long Term Monitoring

4. Ecological Risk Synthesis & Analysis

SUMMARY

- STUDIES ARE DESIGNED TO MEET AND EXCEED REGULATORY REQUIREMENTS
- STUDIES FOCUSED ON ECOLOGY OF THE SYSTEM
- CASE STUDIES ARE APPLICATIONS OF R&D
- CASE STUDIES ARE AN EFFECTIVE MEANS FOR TECHNOLOGY TRANSFER
- GENERIC APPROACH TO ECOLOGICAL RISK ASSESSMENT

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L. 102, NO. 14

WEDNESDAY, JANUARY 15, 1992

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Public happy with EPA, Yard waste update

By Jack Spillane
Herald York Bureau

KITTERY — Kittery residents and environmental activists reacted positively Tuesday evening to an open forum held by the Environmental Protection Agency and the Navy to discuss the status of hazardous waste sites at the Portsmouth Naval Shipyard.

An audience of approximately 50 people listened for an hour and a half at Shapleigh School in Kittery to the EPA, the Maine Department of Environmental Protection and their consultants describe what they are doing to investigate 13 waste sites at the yard.

After the meeting, environmentally concerned citizens, who say they have been frustrated with the quality of information supplied by the EPA and the Navy in the past, said they were impressed.

"I still have a lot of questions, but I'm basically pleased with the meeting," said John Burns, chairman of the Southern Maine Toxics Campaign, an area environmental activist group.

EPA SPOKESPERSONS outlined in step-by-step detail how they have conducted the investigation of each of 13 sites that the Navy and the federal agency have agreed could be potentially hazardous.

Officials also provided specific information about the kinds of toxic substances that are located at the sites, and how the process will be developed to control them. They estimated that cleanup measures or other actions aimed at controlling the dangerous substances would be developed by March, 1994.

The program dealt only with materials on site at the shipyard, and the possible effects of those materials on waters adjacent to the yard.

Environmentally dangerous materials were stored at the Portsmouth Naval Shipyard for many years before environmental consciousness developed. The hazardous materials primarily consist of heavy metals such as chromium, lead, mercury, waste oils, potentially hazardous-exposed water, and PCBs (polychlorinebyphenyls — chemical products found in the oils of the electrical transfer process).

OFFICIALS SAID there are no nuclear waste materials stored at the shipyard because such matter has always been disposed of off-site.

Roger Cole, a Kittery resident who said he has attended the EPA and shipyard public meetings on hazardous waste sites for years, said last night's gathering was more "candid and complete" than past meetings have been.

"I think it's sort of our glasnost," he said. According to the concerned citizen, the openness of the meeting represented a victory for area residents, who have demanded more information from the EPA and Navy.

Although residents were pleased with the approach taken by the government organizations last night, areas of contention remained.

Conrad Quimby, chairman of the Kittery Conservation Commission, asked for information about the amount of toxics stored at the Jamaica Island Landfill, an estuary area of the shipyard that was filled with a variety of waste materials for many years.

The EPA consultants, however, said quantitative data on the amount of hazardous materials is not yet available because the scientific process of taking sediment samples and extrapolating level of hazardous concentrations has not been completed.

HOWEVER, MR. COLE said such data does exist. He cited an Initial Assessment Study conducted by environmental consultant Ray Weston in 1983 that stated data seemed to indicate the landfill was the source of contamination in mussels and algae in the estuaries that surround the shipyard.

Mr. Cole said that study indicated tidal fluctuations are causing inundation of the landfill that could result in contamination of the Piscataqua River.

"I'd be concerned about eating anything near the Navy Yard," he said.

Shipyard commander Capt. Lewis Felton ordered an interim study of the possible effects on a shipyard child-care center located near the landfill, and Steve Urschel, a consultant with McLaren Hart Corporation, a national environmental consultant group, reported the health risks were "very low."

The EPA seemed to give little encouragement to requests that waste material assessments of Spruce Creek, Chauncey Creek, or private wells that are located in Kittery along the Piscataqua River, will be conducted at this time.

Robert Johnston, project coordinator for the offshore effects of the waste site investigation, said the sites being examined have been selected to provide information of the overall contamination of the estuaries. Adding more sites would be limited by time and funding. However, he said if flow data indicates contamination was headed for a particular area, further studies would be requested.

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Abstract submitted for presentation at the Annual Meeting of the Society of Environmental Toxicology and Chemistry (November 1992)

AN ESTUARINE ECOLOGICAL RISK ASSESSMENT FOR THE PISCATAQUA AND GREAT BAY ESTUARY, NH. R.K. Johnston, NCCOSC, San Diego, CA USA; W.R. Munns, Jr., SAIC, Narragansett, RI USA; F.T. Short, JEL-UNH, Durham, NH USA; and W.G. Nelson, EPA-ERLN, Narragansett, RI USA.

An ecological risk assessment framework is being applied to assess the ecological risk of past hazardous waste disposal operations at Naval Shipyard Portsmouth on the Piscataqua and Great Bay Estuary. The framework was developed to meet conditions of the Shipyard's environmental compliance requirements. The initial phase consists of evaluating existing environmental data and comparing measures of contamination and biological impact made at sites in the immediate vicinity of the shipyard with similar measures made at reference and background sites. Appropriate analytical methods, implemented using a performanced-based quality control program, were used to assess the distribution of contaminants in sediments and biota. The second phase will quantify the ecological risks of future impacts with data from exposure-response assays, bioaccumulation experiments, and measurements of sedimentation rates, assimilation potential, and dispersion dynamics. Sources of contamination will be determined with chemical and microbial markers. A long-term monitoring plan will provide data for effective risk management.