Assessment of the Environmental Impacts of the Hart-Miller Island Confined Disposal Facility, Maryland

Year 15 Exterior Monitoring Data Report (September 1995-August 1996)

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Prepared For
Maryland Port Administration
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LIST OF ACRONYMS AND ABBREVIATIONS

AAS - Atomic Absorption Spectrometry

Ag - Silver

As - Arsenic

AVS - Acid Volatile Sulfide

BAF - Bioaccumulation Factor

BCF - Bioconcentration Factor

B-IBI - Benthic Index of Biotic Integrity

CBL - Chesapeake Biological Laboratory

Cd - Cadmium

CDF - Confined Disposal Facility

COC - Citizens' Oversight Committee

COMAR - Code of Maryland Regulations

CWA - Clean Water Act

Cr - Chromium

Cu - Copper

CWA - Clean Water Act

DCAD - Dredging Coordination and Assessment Division

ERL - Effects Range Low

ERM - Effects Range Median

Fe - Iron

GC - Gas Chromatography

GFAAS - Graphite Furnace Atomic Absorption Spectrometry

Hg - Mercury

HMI - Hart-Miller Island Confined Disposal Facility

ICAP - Inductively Coupled Argon Plasma

LBP - Lipid Bioaccumulation Potential

MCY -Million Cubic Yards

MDE - Maryland Department of the Environment

MDNR - Maryland Department of Natural Resources

MES - Maryland Environmental Service

MGD - Million Gallons Per Day

MGS - Maryland Geological Survey

Mn - Manganese

MPA - Maryland Port Administration

MS - Mass Spectrometry

NBS - National Bureau of Standards

NEPA - National Environmental Policy Act

Ni - Nickel

NIST - National Institute of Standards and Technology

NOAA - National Oceanic and Atmospheric Administration

NRC - National Research Council of Canada

OC - Organochlorine Pesticide

PAH - Polynuclear Aromatic Hydrocarbon

Pb - Lead

PCB - Polychlorinated Biphenyl

PI(s) - Principal Investigator(s)

PPB - Parts Per Billion

PPM - Parts Per Million

PPT - Parts Per Thousand

QA - Quality Assurance

QC - Quality Control

SOP - Standard Operating Procedure

SQC - Sediment Quality Criteria

SQS - Sediment Quality Standard

SRM - Standard Reference Material

TBP - Theoretical Bioaccumulation Potential

TDL - Target Detection Limit

TEF - Toxicity Equivalency Factor

TOC - Total Organic Carbon

USACE - U.S. Army Corps of Engineers

UMCES - University of Maryland Center for Environmental Science

USCS - Unified Soil Classification System

USEPA - U.S. Environmental Protection Agency

USFDA - U.S. Food and Drug Administration

WMA - Water Management Administration

WQC - Water Quality Criteria

WQS - Water Quality Standards

Zn - Zinc

CONVERSIONS[1]

WEIGHT:

$1Kg = 1000g = 2.205lbs.$
$1g = 1000mg = 2.205 \times 10^{-3}lb$
$1mg = 1000\mu g = 2.205 \times 10^{-6}lb$

$1\ lb = 16oz = 0.454Kg$

LENGTH:

$1m = 100cm = 3.28ft = 39.370in$
$1cm = 10mm = 0.394in$
$1mm = 1000\mu m = 0.0394in$

$1ft = 12in = 0.348m$

CONCENTRATION:

$1ppm = 1mg/L = 1mg/Kg = 1\mu g/g = 1mL/m^3$
$1g/cc = 1Kg/L = 8.345\ lbs/gallon$
$1g/m^3 = 1mg/L = 6.243 \times 10^{-5}lbs/ft^3$

$1\ lb/gal = 7.481\ lbs/ft^3 = 0.120g/cc = 119.826g/L = 119.826Kg/m^3$
$1oz/gal = 7.489Kg/m^3$

VOLUME:

$1L = 1000mL$
$1mL = 1000\mu L$
$1cc = 10^{-6}m^3$

$1yd^3 = 27ft^3 = 764.55L = 0.764m^3$
$1acre\text{-}ft = 1233.482m^3$
$1\ gallon = 3785cc$
$1ft^3 = 0.028m^3 = 28.317L$

FLOW:

$1m/s = 196.850ft/min = 3.281ft/s$
$1m^3/s = 35.7ft^3/s$

$1ft^3/s = 1699.011L/min = 28.317L/s$
$1ft^2/hr = 2.778 \times 10^{-4}ft^2/s = 2.581 \times 10^{-5}m^2/s$
$1ft/s = 0.031m/s$
$1yd^3/min = 0.45ft^3/s$
$1yd^3/s = 202.03gal/s = 764.55L/s$

AREA:

$1m^2 = 10.764ft^2$
$1hectare = 10000m^2 = 2.471acres$

$1ft^2 = 0.093m^2$
$1acre = 4046.856m^2 = 0.405\ hectares$

[1] Modified from the June 1994 Draft "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual" published by the U.S. Environmental Protection Agency and the U. S. Army Corp of Engineers.

ACKNOWLEDGMENTS

The Year 15 Hart-Miller Island (HMI) Exterior Monitoring Program would not have been successful without the help of several Technical and Regulatory Services Administration (TARSA) staff members, including: Mr. Visty P. Dalal, Chairman; Mr. Matthew Rowe, Technical Coordinator; Mr. Nathaniel Brown, Budget Manager; and, Ms. Ellen Lathrop-Davis, Environmental Specialist. The Chairman was responsible for making sure that the project work was done efficiently, in a coordinated manner, and met all the technical goals set by the Technical Review Committee (TRC) for Year 15. The Technical Coordinator wrote the Project I sections of the HMI reports, standardized the Data and Technical reports among projects, conducted data management, and facilitated the peer review process. The Budget Manager was responsible for assuring that all project related budgetary products, services, and activities had been implemented by each Principal Investigator (PI) and accounted for in a budgetary tracking system. The Environmental Specialist provided insightful comments on and scientific review of the data and technical reports.

The Maryland Department of the Environment would like to thank all the members of the HMI Exterior Monitoring Program's TRC and the HMI Citizens' Oversight Committee (COC) for their useful comments and suggestions throughout the project year. A thank you also goes out to Dr. Steve Storms and Shane Moore of the Maryland Environmental Service (MES) for providing information on dredged material inputs to HMI for Year 15.

Lastly, thanks to Dr. Robert Summers, Director, Mr. Narendra Panday and Dr. Rich Eskin, of TARSA, for their guidance, suggestions and commitment to the Hart-Miller Island Exterior Monitoring Program.

INTRODUCTION

Site Background

Dredging to facilitate ship passage and remove navigational hazards has been a common practice in Chesapeake Bay for well over a hundred years. Many of the lighthouses scattered throughout the Bay were constructed in the 1880s, providing early historical precedent to major capital investments in shipping. As ships have grown larger over the years and deepened their drafts in order to accommodate more cargo, dredging volume has increased proportionately. Providing long-term placement sites for material dredged from the approach channels to Baltimore Harbor is an annual concern.

In 1983, the Hart-Miller Island Confined Disposal Facility (HMI) was constructed to address the need for long-term dredged material placement. HMI is located in Chesapeake Bay at the mouth of Back River, northeast of Baltimore Harbor. Construction of HMI began in 1981 through creation of a dike connecting the remnants of Hart and Miller Islands and encompassing approximately 1,100 acres. The dike was constructed of sandy sediments excavated from the proposed interior of the facility. The eastern or Bay side of the dike was reinforced with filter cloth and rip-rap to protect the dike from wave and storm induced erosion. Completed in 1983, the dike is approximately 29,000 feet long and is divided into North and South Cells by a 4,300 foot interior cross-dike. Placement of dredged material within HMI began with dike completion in 1983.

Environmental Monitoring

Hart-Miller Island was designed to accommodate contaminated (trace metals and organic compounds) sediments from the Inner Harbor and other polluted sites. In accordance with the Federal Clean Water Act section 404 (b&c) and as a special condition of the State Wetlands License 72-127(R), whereby the license is "revocable or subject to modification prior to the completion of the project when such action is deemed in the State's interest"[2], an Exterior Monitoring Program was developed to assess the impacts of HMI on the surrounding environment.

The Exterior Monitoring Program is dynamic, maintaining the flexibility to adapt according to new results or improvements in analytical methods. Previous studies of the impacts on benthic epifauna and fish populations around the facility were discontinued as their utility as a compliance monitoring tool became questionable. Improved laboratory/analytical techniques and locational devices (global positioning systems) have also been incorporated into the monitoring program over the years. The Exterior Monitoring Program is regularly evaluated to obtain the best possible data.

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[2] Quoted from State Wetlands License 72-127(R) issued by the Board of Public Works in response to an application for a Wetlands License for the Hart-Miller Island Confined Disposal Facility dated February 23rd, 1972.

Project Summaries

Four independent projects, which have been around since the inception of the Exterior Monitoring Program, were conducted during Year 15. Summaries of the objectives and results for each project are included below.

Project I: Project Management and Scientific/Technical Coordination – Maryland Department of the Environment (MDE)

The Dredging Coordination and Assessment Division (DCAD) of MDE is responsible for coordinating field sampling, reviewing project proposals, technical/scientific and peer review of the Exterior Monitoring Reports, facilitating HMI Technical Review Committee meetings, and data and budget management. In short, it is DCAD's responsibility to ensure smooth and efficient operation in every aspect of the Exterior Monitoring Program.

Quality assurance through standardization among the reports for each project, promotion of rigorous programs for scientific/technical review, meeting the expectations of the public, and guaranteeing that the newest technological and analytical methods are used for laboratory and data analyses are among MDE's top priorities. Since Project I does not directly entail the collection of data, no separate chapter for Project I is included in this Data report.

Project II: Sedimentary Environment – Maryland Geological Survey (MGS)

The MGS has been involved in monitoring the sedimentary environment around HMI since 1981, when the baseline surveys were conducted. The two major components of MGS's monitoring program are grain size and trace metals analyses. Grain size analysis, including a determination of sediment moisture content, is used to assess whether construction of HMI has altered the hydrodynamic environment surrounding the facility. Predominance of finer-grained sediments from baseline conditions around HMI would indicate that the hydrodynamic environment has changed from being erosional to more depositional in nature. A coarsening of sediments from baseline conditions would indicate the opposite, that the hydrodynamic environment has changed from being depositional to more erosional. Trace metal analyses are conducted to determine whether concentrations of metals in the sediments adjacent to HMI are increasing from baseline conditions. Since HMI is designed to receive contaminated material from the Inner Harbor, contamination of sediments exterior to HMI is a concern.

The *Year 15 Data Report* for Project II contains the raw data for the current monitoring effort, including: station locations in NAD83 units, Wentworth size nomenclature, field descriptions of sediment samples, sedimentological parameters of field samples, geochemical parameters of field samples, and visual and radiographic observations of gravity cores. Field and laboratory methods utilized for this year's monitoring are also included in the *Year 15 Data report*. For a discussion of the results of this year's monitoring, refer to the *Year 15 Technical Report*.

Project III: Benthic Community Studies – University of Maryland Center for Environmental Science (UMCES)

The University of Maryland has also been involved with the HMI Exterior Monitoring since its beginnings. The goal of the Benthic Community Studies at HMI is to detect any shift in distributions or abundances of benthic macroinvertebrates surrounding the facility. Benthic stations in the vicinity of HMI (nearfield and zinc-enriched) are compared to baseline data and reference stations removed from the influence of the facility.

The *Year 15 Data Report* for Project III presents the raw benthic data for stations surrounding the facility, including: a graphic representation of the Year 15 monitoring stations, abiotic factors (depth, temperature and salinity) recorded at each station, benthic biomass measurements, latitude and longitude for each station, and the number of species per Ponar grab per station. Refer to the *Year 15 Technical Report* for the results and conclusions of statistical tests on benthic data.

Project IV: Analytical Services – University of Maryland Center for Environmental Science (UMCES)

Tissue analyses of the biota surrounding HMI has been the most dynamic of all the projects since the monitoring effort began. Earlier studies have been conducted on different organisms and by different laboratories. More recently, tissue analyses have been conducted on one species only, the clam *Rangia cuneata.*

The University of Maryland has been involved with interpretation of the Project IV data since Year 9. In Year 15, UMCES started doing both tissue analyses and data interpretation. The goal of Project IV is to analyze *Rangia* tissues for trace metals and organic contaminant burdens. Project IV is important in shedding light on the separate components of Projects II and III. Project II, for example, may show that trace metal loadings to sediments are increasing while Project IV shows no metal accumulation in the biota surrounding HMI. Alternatively, Project III may show a shift in benthic community structure, while project IV shows bioaccumulation in benthic tissues. In this way, Project IV is a compliment to the other two projects and improves the overall analytical reach of the Exterior Monitoring Program.

The *Year 15 Data Report* for Project IV includes: metal and organic contaminant concentrations in *Rangia,* metal and organic concentrations in sediment, analytical methods used, a graphical representation of station locations, comparison of laboratory duplicates and standard reference materials. A discussion of laboratory techniques is also provided. Refer to the *Year 15 Technical Report* for results and conclusions.

CHAPTER 1: SEDIMENTARY ENVIRONMENT (PROJECT II)

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INTRODUCTION

This report partially fulfills the requirements of a contract with the State of Maryland to assess the environmental impacts of construction and operation of HMI. The reported data were collected under the Sedimentary Environment project (Project II) of that contract. One of the primary objectives of the project was to identify the sedimentological and geochemical conditions of the near-surface sediment column in the vicinity of HMI.

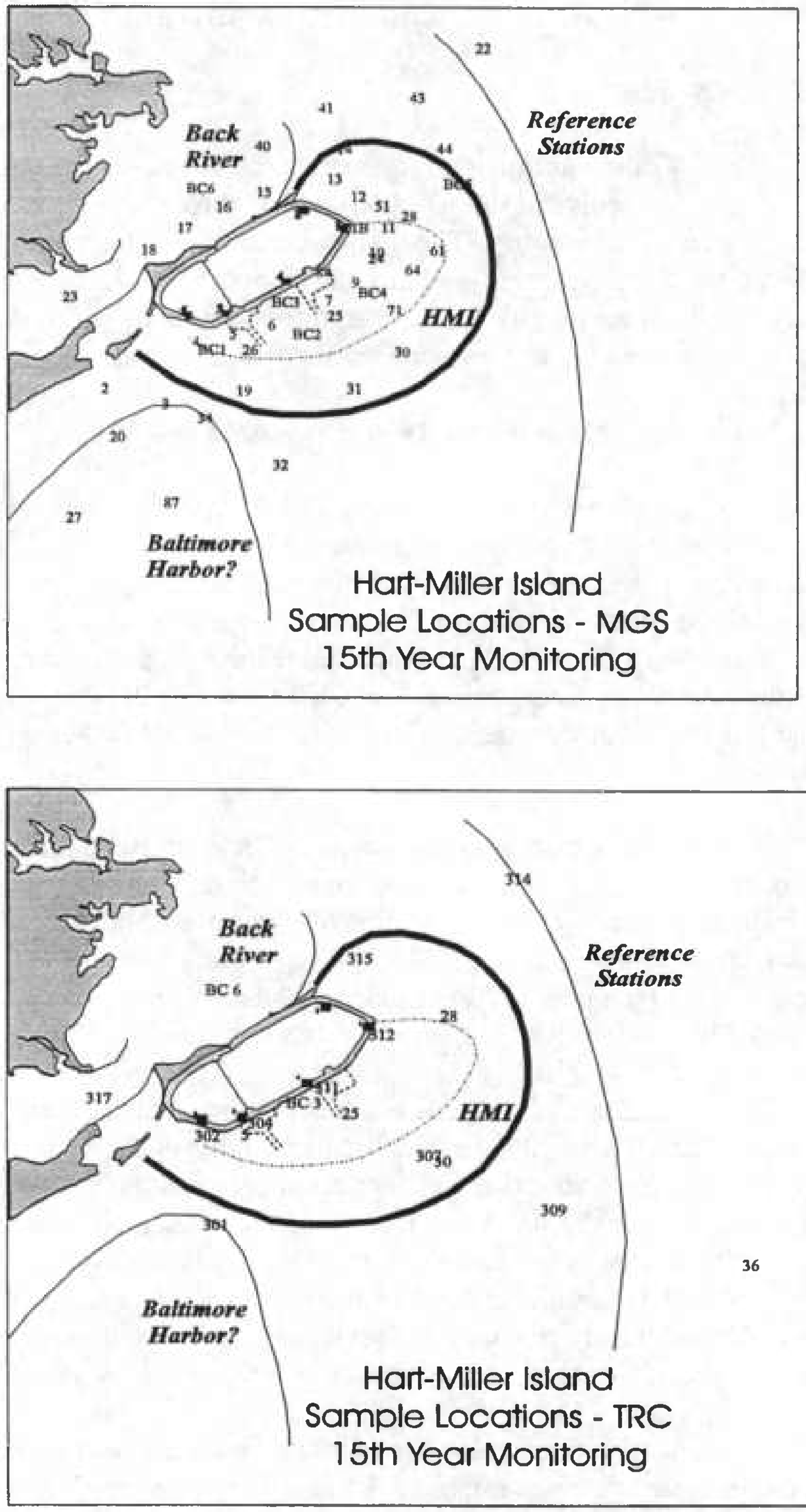


Figure 2-1: Station locations for Year 15. The November and May cruises used the MGS stations; the August cruise used the TRC stations. Lines denote apparent zones of influence.

METHODS AND MATERIALS

Field Methods

The information presented in this report is based on observations and analyses of sediment samples collected on three cruises during Year 15 of exterior monitoring. The first two cruises, in November 1995 and May 1996, took place aboard the *R/V Discovery*; the third, in August 1996, was conducted aboard the *R/V Aquarius*. Field methods for the first two cruises differed from those for the third. The remainder of this section discusses the first two cruises and the third cruise separately.

1. November 1995 and May 1996 (Cruises 34 and 35)

During the first two cruises of Year 15, sampling sites (Figure 2-1) were located in the field by means of a MX300 survey-grade Differential Global Positioning System (DGPS) with a MS50R radio beacon receiver for differential corrections. The repeatability of the navigation system, the ability to return to a location at which a navigation fix has been previously obtained, is 3-5 m (10-16 ft) according to the manufacturer's specifications. On the basis of experimental results, the actual accuracy is 1-3 m (3-10 ft). Table 2-1 lists target, as opposed to actual, latitude and longitude (North American Datum of 1983 or NAD83) for stations sampled during these two cruises.

Surficial sediment samples were collected in November 1995 (Cruise 34) and May 1996 (Cruise 35). During Year 9 of monitoring, the number of surficial sampling stations was increased in response to the detection of abnormally high zinc (Zn) levels in sediments near HMI spillway #1 (Hennessee and Hill 1992). Sampling sites were added to determine the extent of the area of Zn-enrichment and to coincide with benthic sampling stations. The expanded sampling scheme (60-66 locations/cruise) was retained through the Year 11.

During Year 12, the number of stations occupied during each cruise was reduced to 47, based, in part, on output from the 3-D hydrodynamic model of the upper Chesapeake Bay (Wang 1992). The 24 stations that had been monitored continuously since dike completion were retained, as were the stations that corresponded to benthic sampling sites. Selection of the remaining stations was based on discharge activity during the months preceding each cruise, coupled with the results of the 3-D hydrodynamic model. All of the sites chosen on the basis of the 3-D model had been occupied previously. The same locations sampled during the Year 12 were revisited during all subsequent cruises through May 1996.

Undisturbed samples of the surficial sediments surounding HMI were obtained with a dip-galvanized Petersen sampler. A minimum of one grab sample was collected at each station and split for textural and trace metal analyses. Triplicate grab samples were collected at seven stations (11, 16, 24, 25, 28, BC3, and BC6). Upon collection, each sediment sample was described lithologically and subsampled. Tables 2-3 and 2-6 contain the field descriptions of samples collected in November 1995 and May 1996, respectively.

Sediment and trace metal subsamples were collected using plastic scoops rinsed with distilled water. These samples were taken several centimeters from the top, below the flocculent layer, and away from the sides of the sampler to avoid possible contamination by the sampler. The samples were placed in 18-oz Whirl-Pak™ bags. Samples designated for textural analysis were stored out of direct sunlight at ambient temperatures. Those intended for trace metal analysis were refrigerated and maintained at 4°C until they could be processed in the laboratory.

In May 1996, gravity cores were collected at three stations (25, BC3, and BC6) (Figure 2-1). A Benthos gravity corer (Model #2171) fitted with clean cellulose acetate butyrate (CAB) liners, 6.7 cm in diameter, was used. Each core was cut and capped at the sediment-water interface, then refrigerated until it could be x-rayed and processed in the lab.

2. August 1996 (Cruise 36)

In August 1996, during the third cruise of the monitoring year, the captain of the R/V Aquarius used LORAN-C to navigate to the sampling stations. The repeatability of LORAN-C is affected by seasonal and weather-related changes along the signal transmission path. Halka (1987) estimated that when a vessel equipped with LORAN-C re-occupies an established station in Chesapeake Bay, it should be within about 100 m (328 ft) of its original location. While on station, the captain recorded the DGPS coordinates (latitude/longitude, NAD83) at each point. In the future, these geographic coordinates will be used in revisiting stations. For samples collected in August 1996, Table 2-1 lists target and actual LORAN-C time delays (TDs) and actual latitude and longitude (NAD83) computed by the DGPS unit.

In response to a decision made this year by the newly-constituted Hart-Miller Island TRC, the sampling plan was radically altered beginning with this cruise. The TRC decided (1) to limit monitoring to once a year, in August, (2) to coordinate benthic and sediment sampling, and (3) to collect fewer samples. In August 1996, surficial sediment and benthic samples were collected at 17 sites. Only seven of these correspond to previously established sediment sampling locations and only four date back to the early years of monitoring. No cores were taken.

Undisturbed samples of the surficial sediments surrounding HMI were obtained with a Wildco Ponar Dredge. At least one grab sample was collected at each station and split for textural and trace metal analyses. Triplicate grab samples were collected at three stations (25, 28, BC6). Upon collection, each sediment sample was described lithologically and subsampled. Table 2-11 contains the field descriptions of samples collected in August 1996. The collection techniques - type of scoop, location of sample within grab, storage conditions - were similar to those described for the two previous cruises.

Laboratory Procedures

1. Radiographic Technique

Prior to processing, the upper 50 cm of each core were x-rayed at MGS, using a TORR-MED x-ray unit (x-ray settings: 90 kv, 5 mas, 30 sec). A negative x-ray image of the core was obtained by xeroradiographic processing. On a negative xeroradiograph, denser objects or materials, such as shells or sand, produce lighter images. Objects of lesser density permit easier penetration of x-rays and, therefore, appear as darker features. The xeroradiographs are reproduced in the Appendix of this report.

Each core was then extruded, split with an electro-osmotic knife, photographed, and described. Visual and radiographic observations of the cores are also presented in the Appendix. On the basis of these observations, sediment samples for textural and trace metal analyses were taken at selected intervals from each core.

2. Textural Analysis

In the laboratory, subsamples from both the surficial grabs and gravity cores were analyzed for water content and grain size composition (sand-silt-clay content).

Water content was calculated as the percentage of the water weight to the total weight of the wet sediment:

$$\mathbf{Wc = \frac{Ww}{Wt} \times 100}$$

where: Wc = water content (%)
Ww = weight of water (g)
Wt = weight of wet sediment (g).

Water weight was determined by weighing approximately 25 g of the wet sample, drying the sediment at 65°C, and reweighing it. The difference between total wet weight (Wt) and dry weight equals water weight (Ww). Bulk density was also determined from water content measurements.

The relative proportions of sand, silt, and clay were determined using the sedimentological procedures described by Kerhin and others (1988). The sediment samples were pre-treated with hydrochloric acid and hydrogen peroxide to remove carbonate and organic matter, respectively. Then the samples were wet sieved through a 62-µm mesh to separate the sand from the mud (silt plus clay) fraction (see Table 2-2 for the definitions of sand, silt, and clay). The finer fraction was analyzed using the pipette method to determine the silt and clay components (Blatt et al. 1980). Each fraction was (1) weighed; (2) percent sand, silt, and clay were determined; and, (3) the sediments were categorized according to Pejrup's (1988) classification (Figure 2-2). The results of these analyses are presented in Tables 2-4, 2-7, and 2-12 for surficial samples collected in November 1995, May 1996, and August 1996, respectively, and in Table 2-9 for splits taken from the May 1996 gravity cores.

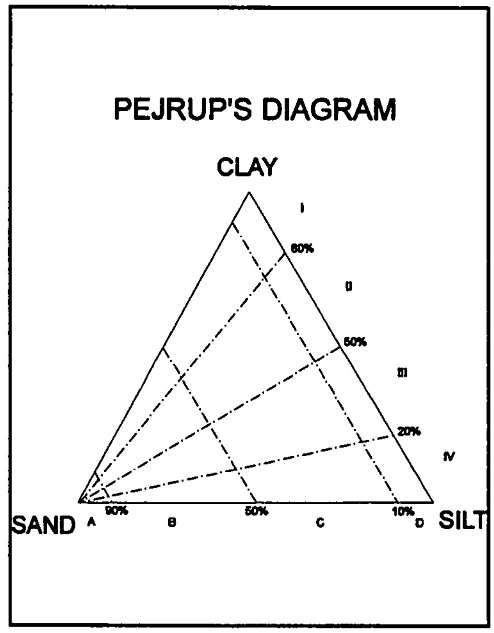


Figure 2-2: Pejrup's (1988) classification of sediment type.

3. Trace Metal Analysis

Sediment solids were analyzed for six trace metals - iron (Fe), manganese (Mn), Zinc (Zn), copper (Cu), chromium (Cr), Cadmium (Cd), Lead (Pb) and nickel (Ni). These metals are particularly useful in interpreting geochemical trends (Sinex and Helz 1981; Kerhin et al. 1982). Trace metal concentrations were determined using a microwave digestion technique, followed by analysis of the digestate on an Inductively Coupled Argon Plasma unit (ICAP).

Microwave digestion of the samples has several advantages over other digestion methods:

1. The system is sealed, so no volatile elements are lost;

2. Compared to strong acid reflux methods, microwave digestion is rapid (on the order of minutes as opposed to hours);

3. Samples must be weighed accurately, but not to precisely defined target weights, as in fusion methods;

4. Only acids are used. No flux is required, as in fusion, so additional sources of contamination are minimized. Also, in using an ICAP, as opposed to an atomic absorption spectrophotometer (AA), matrix modifiers are not required, further reducing sources of error; and

5. Recovery of the metals of interest is as good as or better than other digestion methods.

The steps in microwave digestion, modified from USEPA Method #3051, are outlined below:

1. Samples were homogenized in the "Whirl-Pak"™ bags in which they were stored and refrigerated (4°C).

2. Approximately 10 g of wet sample were transferred to Teflon evaporating dishes and dried overnight at 105-110°C.

3. Dried samples were then hand-ground with an agate mortar and pestle, powdered in a ball mill, and stored in "Whirl-Pak"™ bags.

4. 0.5000±0.0005 g of dried, ground sample was weighed and transferred to a Teflon digestion vessel.

5. 2.5 ml concentrated HNO_3 (trace metal grade), 7.5 ml concentrated HCl (trace metal grade), and 1 ml ultra-pure water were added to the Teflon vessel.

6. The vessel was capped with a Teflon seal, and the cap was hand tightened. Between four and twelve vessels were placed in the microwave carousel. (Preparation blanks were made by using 0.5 ml of high purity water plus the acids used in Step 5).

7. Samples were irradiated using programmed steps appropriate for the number of samples in the carousel. These steps have been optimized based on pressure and percent power. The samples were brought to a temperature of 175°C in 5.5 minutes, then maintained between 175-180°C for 9.5 minutes. The pressure during this time peaks at approximately 6 atm for most samples.

8. Vessels were cooled to room temperature and uncapped. The contents were transferred to a 100 ml volumetric flask, and high purity water was added to bring the volume to 100 ml. The dissolved samples were transferred to polyethylene bottles and stored for analysis.

9. The samples were analyzed.

Samples were analyzed using a Thermo Jarrel-Ash Atom-Scan 25 sequential ICAP. The wavelengths and conditions selected for the elements of interest were determined using digested bottom sediments from the vicinity of HMI and standard reference materials from the National Institute of Standards and Technology [(NIST0#1646 - Estuarine Sediment; #2704 - Buffalo River Sediment] and the National Research Council (NRC) of Canada (PACS-1 - Marine Sediment).

The wavelengths and conditions were optimized for the expected metal levels and the sample matrix. Quality control was maintained by routinely including blanks, replicates and standard reference materials in the analysis. Blanks were run every 10 samples; one sample in every ten was replicated; and a standard reference material was analyzed after every ten samples. Trace metal concentrations of surficial samples and core subsamples are reported in the tables in this report.

Table 2 - 1: Designations and target locations of stations sampled during Year 15.

Station	LORAN-C time delays		Latitude** (NAD83)	Longitude** (NAD83)
	X	Y	(DD MM SS.S)	(DD MM SS.S)
2			39 13 33.5	76 23 45.1
3			39 13 23.2	76 22 57.9
4			39 14 6.4	76 22 35.2
5*	actual - 8/96 27635.6 target - 8/96 27635.4	actual - 8/96 42897.4 target - 8/96 42897	actual - 8/96 39 14 14 target - 11/95 & 5/96 39 14 11.7	actual - 8/96 76 22 8 target - 11/95 & 5/96 76 22 6.8
6			39 14 17.9	76 21 37.9
7			39 14 35.6	76 20 54.4
8A			39 14 54.7	76 20 56.3
9			39 14 47.1	76 20 32.7
10			39 15 8.8	76 20 17.3
11			39 15 26.7	76 20 7.7
12			39 15 47.5	76 20 30.5
13			39 15 59.8	76 20 49.1
14			39 16 20.3	76 20 41.3
15			39 15 50.5	76 21 42.7
16			39 15 40.1	76 22 13.6
17			39 15 24.9	76 22 42.8
18			39 15 10.0	76 23 10.9
19			39 13 31.8	76 21 58.0
20			39 13 0.2	76 23 34.9
21B			39 15 25.8	76 20 33.1
22			39 17 30.3	76 18 55.9

Table 2-1: Continued

Station	LORAN-C time delays		Latitude** (NAD83)	Longitude** (NAD83)
	X	Y	(DD MM SS.S)	(DD MM SS.S)
23			39 14 36.8	76 24 12.8
24			39 15 5.2	76 20 18.2
25*	actual - 8/96 27630.1 target - 8/96 27629.7	actual - 8/96 42901.0 target - 8/96 42900.4	actual - 8/96 39 14 27 target - 11/95 & 5/96 39 14 24.1	actual - 8/96 76 20 50 target - 11/95 & 5/96 76 20 47.9
26			39 14 0.7	76 21 51.7
27			39 12 4.1	76 24 7.9
28*	actual - 8/96 27628.4 target - 8/96 27629.4	actual - 8/96 42914.7 target - 8/96 42915.1	actual - 8/96 39 15 32 target - 11/95 & 5/96 39 15 34.3	actual - 8/96 76 19 42 target - 11/95 & 5/96 76 19 52.4
30*	actual - 8/96 27623.1 target - 8/96 27624.3	actual - 8/96 42895.2 target - 8/96 42896.1	actual - 8/96 39 13 56 target - 11/95 & 5/96 39 14 0.1	actual - 8/96 76 19 47 target- 11/95 & 5/96 76 19 57.7
31			39 13 33.9	76 20 33.2
32			39 12 40.9	76 21 29.5
34			39 13 13.0	76 22 26.3
36*	actual - 8/96 27601.5 target - 8/96 27602.6	actual - 8/96 42884.1 target - 8/96 42884.7	actual - 8/96 39 12 49	actual - 8/96 76 16 9
40			39 16 22.1	76 21 43.7
41			39 16 48.9	76 20 55.7

Table 2-1: Continued

Station	LORAN-C time delays		Latitude** (NAD83) (DD MM SS.S)	Longitude** (NAD83) (DD MM SS.S)
	X	Y		
43			39 16 55.4	76 19 47.2
44			39 16 20.6	76 19 25.4
51			39 15 41.2	76 20 12.5
61			39 15 10.2	76 19 30.4
64			39 14 56.8	76 19 50.3
71			39 14 28.4	76 20 3.2
87			39 12 13.9	76 22 52.9
BC1			39 14 0.1	76 22 19.4
BC2			39 14 11.5	76 21 8.3
BC3*	actual - 8/96 27633.3 target - 8/96 27633.3	actual - 8/96 42901.9 target - 8/96 42901.9	actual - 8/96 39 14 34 target - 11/95 & 5/96 39 14 33.7	actual - 8/96 76 21 26 target - 11/95 & 5/96 76 21 25.0
BC4			39 14 40.9	76 20 19.4
BC5			39 15 57.1	76 19 16.1
BC6*	actual - 8/96 27642.3 target - 8/96 27643.4	actual - 8/96 42916.4 target - 8/96 42917.1	actual - 8/96 39 15 48 target - 11/95 & 5/96 39 15 52.4	actual - 8/96 76 22 23 target - 11/95 & 5/96 76 22 31.0
301*	actual - 8/96 27633.4	actual - 8/96 42885.1	actual - 8/96 39 13 14	actual - 8/96 76 22 26
302*	actual - 8/96 27637.5	actual - 8/96 42896.8	actual - 8/96 39 14 13	actual - 8/96 76 22 33
304*	actual - 8/96 27635.0	actual - 8/96 42898.8	actual - 8/96 39 14 20	actual - 8/96 76 21 57

Table 2-1: Continued

Station	LORAN-C time delays		Latitude** (NAD83)	Longitude** (NAD83)
	X	Y	(DD MM SS.S)	(DD MM SS.S)
307*	actual - 8/96 27624.1	actual - 8/96 42896.1	actual - 8/96 39 14 00	actual - 8/96 76 19 55
309*	actual - 8/96 27615.0	actual - 8/96 42889.9	actual - 8/96 39 13 25	actual - 8/96 76 18 28
311*	actual - 8/96 27632.6	actual - 8/96 42904.3	actual - 8/96 39 14 45	actual - 8/96 76 21 7
312*	actual - 8/96 27631.4	actual - 8/96 42911.5	actual - 8/96 39 15 19	actual - 8/96 76 20 28
314*	actual - 8/96 27629.5	actual - 8/96 42933.1	actual - 8/96 39 17 02	actual - 8/96 76 18 52
315*	actual - 8/96 27635.7	actual - 8/96 42921.6	actual - 8/96 39 16 9	actual - 8/96 76 20 44
317*	actual - 8/96 27645.2	actual - 8/96 42901.1	actual - 8/96 39 14 37	actual - 8/96 76 23 52

* Included in revised sampling plan, which was implemented in August 1996

** Latitude and longitude (NAD83) were determined by locating a station with LORAN-C and reading geographic coordinates from a GPS unit operating simultaneously with LORAN-C.

Table 2-2: Wentworth size nomenclature*

Diameter (mm)	Phi (ϕ)	Wentworth size class
Gravel		
> 2.00	< -1.0	gravel
Sand		
1.00 to 2.00	0.0 to -1.0	very coarse sand
0.50 to 1.00	1.0 to 0.0	coarse sand
0.25 to 0.50	2.0 to 1.0	medium sand
0.125 to 0.25	3.0 to 2.0	fine sand
0.0625 to 0.125	4.0 to 3.0	very fine sand
Mud		
0.0039 to 0.0625	8.0 to 4.0	silt
< 0.0039	> 8.0	clay

* from Folk (1974)

Table 2-3: Field descriptions - surficial sediment samples collected on November 16-17, 1995 (Cruise 34) [Note: Munsell colors and numerical designations from Rock-Color Chart (Rock-Color Chart Committee 1984)]

Station number	Water depth (ft)	Description
2	7.7	No floc layer; dark yellowish brown (10 YR 4/2) sand; a few articulated *Rangia cuneata*, 2.5-5 cm long; heavy minerals
3	15.8	Floc layer, 3-4 cm thick, consisting of soupy, slightly gritty, dark yellowish brown (10 YR 4/2) mud, grading into dark greenish gray (5 GY 4/1); overlies soft, mottled dark gray (N3) and olive gray (5 Y 4/1) mud; a few/some articulated and disarticulated *Rangia*; disarticulated oyster shells; *Cyathura*, 2.5 cm long
4	12.4	Floc layer, 3 cm thick, consisting of smooth, fluffy, dark yellowish brown (10 YR 4/2) mud, grading into olive gray (5 Y 4/1); overlies soft, smooth (not gritty), lumpy, dark gray (N3) mud, uniform in color and texture; some/many articulated *Rangia*, 5 cm long; broken oyster shells at top of dark gray layer; worms; plant matter
5	16.3	Thin (<1 cm) floc layer consisting of smooth, dark yellowish brown (10 YR 4/2) mud; overlies smooth, firm, very cohesive, crumbly, mottled grayish black (N2) and olive gray (5 Y 4/1) mud; many *Macoma*, most articulated
6	15.7	Floc layer consisting of soft, slightly gritty, soupy, mushy mud and grading from <1 cm of dark yellowish brown (10 YR 4/2) to 2 cm of dark greenish gray (5 GY 4/1); overlies soft, smooth, grayish black (N2) mud; a few/some disarticulated *Macoma* at depth, adults with barnacles, a few live; very shelly at bottom of grayish black layer
7	17.4	Floc layer, 2 cm thick, consisting of soft, smooth, soupy, dark yellowish brown (10 YR 4/2) mud; overlies soft, dark gray (N3) mud; some/many articulated and disarticulated *Rangia* at top of dark gray layer, up to 2.5 cm long; a few larger, live *Rangia*; a few disarticulated *Macoma*
8A	14.1	Floc layer, 1-2 cm thick, consisting of soft, gritty, dark yellowish brown (10 YR 4/2) mud; overlies mottled dark yellowish brown (10 YR 4/2) and grayish black (N2) sandy mud, variable in texture; disarticulated *Rangia* in mottled layer; small shell fragments; worms

Table 2-3: Continued

Station number	Water depth (ft)	Description
9	19.3	Floc layer, 2-3 cm thick, consisting of soft, smooth, mushy, dark yellowish brown (10 YR 4/2) mud; overlies soft, firm, lumpy (not gritty), dark gray (N3) mud with olive gray (5 Y 4/1) burrows; disarticulated *Rangia* in floc layer, up to 2 cm long, some with barnacles; *Macoma* at depth; burrows
10	16.4	No floc layer; fine to medium sand, dark yellowish brown (10 YR 4/2) and dark gray (N3); some/many articulated and disarticulated *Rangia*
11	13.9	No floc layer; clean, dark yellowish brown (10 YR 4/2) medium sand; articulated and disarticulated *Rangia*, 2.5 cm long; described first grab - all three look alike
12	11.4	No floc layer; very shelly, moderate brown (5 YR 3/4) fine sandy mud; many live *Rangia*, most 2 cm long; live crab
13	8.5	No floc layer; clean, dark yellowish brown (10 YR 4/2) medium sand; many articulated *Rangia*, most about 1 cm long, a few adults; heavy minerals
14	12.6	Floc layer consisting of soft, smooth mud and grading from <0.5 cm of dark yellowish brown (10 YR 4/2) to 3-4 cm of olive gray (5 Y 4/1); overlies mushy, olive black (5 Y 2/1) mud, firmer with depth; adult *Rangia*, most articulated, at top of olive black layer; *Cyathura*
15	11	Floc layer consisting of soft, smooth, mushy mud and grading from 0.5 cm of dark yellowish brown (10 YR 4/2) to 2-3 cm of olive gray (5 Y 4/1); overlies soft, smooth (not gritty), dark gray (N3) mud; some/many articulated and disarticulated *Rangia* at top of dark gray layer, varying in size
16	10	Floc layer consisting of gritty medium sandy mud and grading from 0.5 cm of dark yellowish brown (10 YR 4/2) to 3-4 cm of olive gray (5 Y 4/1); overlies mottled dark gray (N3) and olive gray (5 Y 4/1) fine sandy mud; *Rangia*, most disarticulated, 1-4 cm long; shell fragments; plant material; described first grab - all three look alike

Table 2-3: Continued

Station number	Water depth (ft)	Description
17	9.7	Floc layer, 2 cm thick, consisting of soft, mushy mud and grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies stiffer, lumpy, grayish black (N2) mud; disarticulated *Rangia*, 2.5 cm long, at top of grayish black layer; plant matter in grayish black layer
18	9.3	Floc layer consisting of soft, fluffy mud and grading from 0.5 cm of dark yellowish brown (10 YR 4/2) to 2-3 cm of olive gray (5 Y 4/1); overlies soft, smooth (not gritty), lumpy, grayish black (N2) mud, uniform in color and texture; some disarticulated *Rangia* in grayish black layer; oxidized burrows filled/lined with light olive gray to olive gray (5 Y 5/1) sediment; worms; plant matter
19	17	Floc layer, 2 cm thick, consisting of soft, lumpy, dark yellowish brown (10 YR 4/2) mud; overlies soft, dark greenish gray (5 GY 4/1) mud; very few articulated *Rangia*; oyster shells throughout; very shelly
20	14.2	Floc layer, 2-3 cm thick, consisting of fluffy, very slightly gritty, dark yellowish brown (10 YR 4/2) mud grading to dark greenish gray (5 GY 4/1); overlies sticky, lumpy, grayish black (N2) mud mottled with olive gray (5 Y 4/1); a few articulated adult *Rangia* at top of grayish black/olive gray layer; a few disarticulated *Rangia* at depth
21B	13.3	No floc layer; dark yellowish brown (10 YR 4/2) and moderate yellowish brown (10 YR 5/4) muddy fine to medium sand; a few *Rangia*; heavy minerals
22	11.1	Floc layer consisting of soft, slightly gritty, dark yellowish brown (10 YR 4/2) sandy mud; overlies soft, dark gray (N3) medium sandy mud; few/some *Rangia* at top of dark gray layer; worms; shell fragments
23	11.1	Shelly floc layer consisting of soft, fluffy, mushy, gritty mud and grading from 1 cm of dark yellowish brown (10 YR 4/2) to 1-2 cm of olive gray (5 Y 4/1); overlies gritty, mushy dark gray (N3) mud mottled with olive gray (5 Y 4/1); very many shells in floc layer, <1 cm long; articulated adult *Rangia* in dark gray/olive gray layer; mucus-lined burrows; worm

Table 2-3: Continued

Station number	Water depth (ft)	Description
24	20	Floc layer, 2 cm thick, consisting of gritty, soupy, dark yellowish brown (10 YR 4/2) mud; overlies dark gray (N3) fine to medium sandy mud; some disarticulated *Rangia* at top of dark gray layer and articulated *Rangia* at depth; described first grab - all three look alike
25	18.1	Thin (<1 cm), shelly floc layer consisting of gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth, cohesive, dark gray (N3) mud, neither soft nor firm; many articulated and disarticulated *Rangia*; worm; plant matter; described first grab - all three look alike
26	16.2	Floc layer, 2-3 cm thick, consisting of soft, slightly gritty, soupy, dark yellowish brown (10 YR 4/2) mud grading to olive gray (5 Y 4/1); overlies smooth (not gritty), lumpy, grayish black (N2) mud mottled with olive gray (5 Y 4/1); some articulated *Rangia* and a few disarticulated *Macoma*
27	15.4	Floc layer, 2-3 cm thick, consisting of smooth, fluffy, dark yellowish brown (10 YR 4/2) mud; overlies smooth mud mottled dark gray (N3), grayish black (N2), and dark yellowish brown (10 YR 4/2), stiffer with depth; a few disarticulated *Rangia* at top of mottled layer, 2.5 cm long; a few articulated *Macoma* at depth; burrows
28	18.2	Shelly floc layer, 2 cm thick, consisting of smooth, soupy, dark yellowish brown (10 YR 4/2) mud; overlies sandy mud grading from dark greenish gray (5 GY 4/1) to dark gray to grayish black (N2.5); disarticulated *Rangia* at top of grab and *Macoma* at depth; worms; described first grab - all three look alike
30		Floc layer, 2 cm thick, consisting of soft, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies soft, smooth (not gritty), lumpy, dark gray (N3) mud; very few dead, articulated adult *Macoma*; mucus-lined burrows; big, fat worm
31	17	Floc layer, 1-2 cm thick, consisting of soft, fluffy, dark yellowish brown (10 YR 4/2) mud; overlies lumpy, grayish black (N2) mud, neither soft nor firm; many articulated and disarticulated *Rangia*, varying in size, at top of grayish black layer; broken oyster shells; articulated, dead *Macoma* at depth; oxidized burrows filled/lined with dark yellowish brown (10 YR 4/2) sediment

Table 2-3: Continued

Station number	Water depth (ft)	Description
32	16.1	Floc layer, 2-3 cm thick, consisting of very slightly gritty, fluffy, dark yellowish brown (10 YR 4/2) mud grading to dark greenish gray (5 GY 4/1); overlies smooth, dark gray (N3) mud, neither soft nor firm, uniform in color and texture; some articulated and disarticulated *Rangia*; a few disarticulated *Macoma*
34	18.6	Floc layer, 2-3 cm thick, consisting of soft, smooth (not gritty or lumpy), soupy, dark yellowish brown (10 YR 4/2) mud grading into dark greenish gray (5 GY 4/1); overlies soft, mushy, greenish black (5 GY 2/1) mud; very few articulated *Macoma* in greenish black layer; no odor
40	11.3	Floc layer consisting of smooth, soupy mud and grading from 1 cm of dark yellowish brown (10 YR 4/2) to 2 cm of olive gray (5 Y 4/1); overlies lumpy, grayish black (N2) mud, not gritty, neither soft nor firm; some articulated and disarticulated adult *Rangia* and articulated juveniles at top of grayish black layer; lots of small shells (shell hash); oxidized burrows filled/lined with olive gray (5 Y 4/1) sediment; plant matter in grayish black layer
41	12.4	Floc layer consisting of smooth, soupy mud and grading from 1 cm of dark yellowish brown (10 YR 4/2) to 3-4 cm of olive gray (5 Y 4/1); overlies lumpy, mushy, grayish black (N2) mud; a few articulated adult *Rangia* at top of grayish black layer
43	12.7	Floc layer of smooth, fluffy dark yellowish brown (10 YR 4/2) mud grading to dark greenish gray (5 GY 4/1); overlies soft, smooth, olive gray (5 Y 4/1) mud grading to grayish black (N2); articulated and disarticulated *Rangia*, mostly adult, at top of olive gray/grayish black layer
44	14.5	Floc layer, 3-4 cm thick, consisting of soft, smooth, fluffy mud and grading from dark yellowish brown (10 YR 4/2) to dark greenish gray (5 GY 4/1); overlies soft, smooth, mushy, dark greenish gray (5 GY 4/1) mud mottled with dark gray (N3); disarticulated adult *Rangia* in mottled layer

Table 2-3: Continued

Station number	Water depth (ft)	Description
51	14.9	Floc layer, 2 cm thick, consisting of soft, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies gritty, grayish black (N2) fine sandy mud; some articulated and disarticulated *Rangia* at top of grayish black layer, varying in size; worms
61	20.4	Thin (<0.5 cm), shelly floc layer consisting of slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies soft, smooth, greenish black (5 GY 2/1) mud; few/some disarticulated *Rangia* in greenish black layer
64	21.3	Thin (<1 cm) floc layer consisting of smooth, dark yellowish brown (10 YR 4/2) mud; overlies soft, smooth (not gritty), lumpy, dark gray to grayish black (N2.5) mud; many disarticulated *Rangia*
71	18.3	Floc layer consisting of soupy mud and grading from <1 cm of dark yellowish brown (10 YR 4/2) to 2 cm of dark greenish gray (5 GY 4/1); overlies soft, smooth, cohesive, dark gray to grayish black (N2.5) mud; many *Rangia*, mostly disarticulated, 2.5 cm long
87	16.9	Floc layer, 2 cm thick, consisting of soupy, gritty, dark yellowish brown (10 YR 4/2) mud, not lumpy; overlies smooth (not gritty), firm, cohesive mud mottled dark gray (N3), dark yellowish brown (10 YR 4/2), and olive gray (5 Y 4/1); a few articulated *Macoma* at top of mottled layer
BC1	15.6	Floc layer, 3 cm thick, consisting of fluffy, dark yellowish brown (10 YR 4/2) mud grading to dark greenish gray (5 GY 4/1); overlies soft, smooth (not gritty), lumpy, dark gray (N3) mud mottled with dark yellowish brown (10 YR 4/2) and olive gray (5 Y 4/1); very few disarticulated *Rangia*
BC2	17.1	Thin (1 cm), shelly floc layer consisting of smooth, dark yellowish brown (10 YR 4/2) mud; overlies smooth, dark greenish gray (5 GY 4/1) mud grading to dark gray to grayish black (N2.5) with depth; a few *Macoma* in dark greenish gray/dark gray to grayish black layer

Table 2-3: Continued

Station number	Water depth (ft)	Description
BC3	14.7	Floc layer, 3-4 cm thick, consisting of soft, smooth (not gritty), fluffy, dark yellowish brown (10 YR 4/2) mud grading to dark greenish gray (5 GY 4/1); overlies sticky, dark gray (N3) mud, which, in turn, overlies cohesive, creamy, medium gray (N5) "fluid mud" layer; disarticulated *Rangia*; described first grab, which differs from second and third grabs (these two have a shellier floc layer, with barnacles and dead crab)
BC4	19.1	Thin floc layer (<1 cm) consisting of gritty, dark yellowish brown (10 YR 4/2) mud grading to dark greenish gray (5 GY 4/1); overlies soft, smooth (not gritty), lumpy, mostly dark gray (N3) mud; a few disarticulated *Rangia*, <2.5 cm long, at top of grab; oyster shells at depth; very few disarticulated *Macoma*; burrows; worm
BC5	16	Floc layer, 1-2 cm thick, consisting of soft, smooth, soupy, dark yellowish brown (10 YR 4/2) mud; overlies soft, dark gray (N3) mud; a few articulated (live) and disarticulated adult *Rangia*
BC6	11	Floc layer consisting of soft, slightly gritty mud grading from 0.5 cm of dark yellowish brown (10 YR 4/2) to 2-3 cm of olive gray (5 Y 4/1); overlies soft, mushy, lumpy, grayish black (N2) mud mottled with dark yellowish brown (10 YR 4/2); a few/some *Rangia*, mostly disarticulated, 2.5 cm in length; oyster shells; burrows; described first grab - all three look alike

Table 2-4: Sedimentological parameters - surficial sediment samples collected on November 16-17, 1995 (Cruise 34)

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
2	22.60	97.59	1.10	1.32	0.55	A,II
3	56.17	43.33	26.13	30.54	0.54	C,II
4	60.93	5.36	51.39	43.25	0.46	D,III
5	59.58	3.30	39.09	57.61	0.60	D,II
6	62.92	5.18	41.65	53.16	0.56	D,II
7	62.88	4.12	38.12	57.76	0.60	D,II
8A	30.52	73.26	15.17	11.57	0.43	B,III
9	59.22	5.35	41.44	53.21	0.56	D,II
10	39.56	85.69	5.83	8.49	0.59	B,II
11-1	31.49	92.80	2.78	4.42	0.61	A,II
11-2	35.20	93.07	2.60	4.33	0.62	A,II
11-3	29.78	96.90	0.70	2.41	0.78	A,II
12	24.63	85.44	7.86	6.71	0.46	B,III
13	26.21	99.08	0.83	0.00	0.00	A,IV
14	65.09	1.74	45.94	52.32	0.53	D,II
15	59.27	2.90	42.27	54.83	0.56	D,II
16-1	46.44	62.19	18.99	18.82	0.50	B,III
16-2	54.52	51.02	23.89	25.09	0.51	B,II
16-3	53.96	52.66	24.52	22.81	0.48	B,III
17	59.52	5.50	45.68	48.82	0.52	D,II
18	55.87	5.00	47.39	47.61	0.50	D,II
19	64.21	2.48	40.86	56.66	0.58	D,II
20	63.48	1.57	46.64	51.79	0.53	D,II
21B	20.64	96.62	2.35	1.03	0.30	A,III
22	49.31	49.76	23.95	26.29	0.52	C,II
23	52.87	42.33	34.04	23.64	0.41	C,III

Table 2-4: Continued

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
24-1	39.27	68.77	13.16	18.07	0.58	B,II
24-2	52.89	31.07	29.45	39.48	0.57	C,II
24-3	56.40	48.48	22.54	28.98	0.56	C,II
25-1	60.74	2.30	43.10	54.60	0.56	D,II
25-2	53.54	2.30	42.60	55.10	0.56	D,II
25-3	57.54	2.13	42.52	55.35	0.57	D,II
26	63.44	1.80	40.68	57.03	0.58	D,II
27	63.45	1.29	40.02	58.68	0.59	D,II
28-1	56.39	44.78	23.01	32.21	0.58	C,II
28-2	45.59	58.96	17.11	23.93	0.58	B,II
28-3	43.85	64.83	14.82	20.36	0.58	B,II
30	64.15	0.49	47.47	52.04	0.52	D,II
31	64.51	2.08	47.69	50.23	0.51	D,II
32	58.86	0.54	47.63	51.83	0.52	D,II
34	66.28	0.93	45.04	54.04	0.55	D,II
40	64.29	0.88	42.17	56.95	0.57	D,II
41	68.05	0.36	44.86	54.78	0.55	D,II
43	65.06	0.63	44.91	54.46	0.55	D,II
44	65.83	3.21	46.01	50.78	0.52	D,II
51	28.73	70.48	12.96	16.56	0.56	B,II
61	60.78	2.40	42.32	55.28	0.57	D,II
64	59.67	1.21	46.36	52.43	0.53	D,II
71	59.10	1.40	44.70	53.90	0.55	D,II
87	56.42	2.24	36.91	60.84	0.62	D,II
BC1	62.72	3.69	45.69	50.62	0.53	D,II
BC2	63.18	1.44	37.71	60.85	0.62	D,II

Table 2-4: Continued

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
BC3-1	57.56	12.33	44.39	43.28	0.49	C,III
BC3-2	53.51	14.02	45.79	40.19	0.47	C,III
BC3-3	53.57	10.76	49.04	40.20	0.45	C,III
BC4	57.15	2.84	42.12	55.05	0.57	D,II
BC5	59.53	2.38	47.57	50.05	0.51	D,II
BC6-1	63.32	2.94	43.19	53.87	0.55	D,II
BC6-2	66.32	2.34	40.45	57.21	0.59	D,II
BC6-3	66.42	4.36	41.20	54.44	0.57	D,II

Table 2-5: Geochemical parameters - surficial samples collected (in µg/g) on November 16-17, 1995 (Cruise 34)

Station	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
2	bdl	12.5	4.2	0.44	1850	20.6	1.33	37.5
3	bdl	90.2	34.7	3.34	4352	60.5	38.99	240.5
4	0.25	120.3	48.9	4.13	2629	76.2	59.01	302.4
5	1.28	152.0	80.2	5.65	3243	164.5	99.40	708.3
6	0.25	128.0	50.1	4.91	4115	92.7	50.20	350.6
7	0.32	125.6	57.9	4.79	2658	99.5	55.71	396.4
8A	bdl	36.9	13.4	1.46	759	21.1	11.33	80.7
9	0.57	123.2	73.5	5.04	2931	132.3	104.83	491.2
10	0.37	26.7	8.9	1.04	1283	23.5	6.06	73.0
11	bdl	14.8	6.0	0.57	1002	14.8	bdl	40.7
12	0.12	21.7	7.3	0.89	1566	18.4	7.35	63.8
13	bdl	6.7	2.5	0.28	1162	10.5	bdl	22.2
14	1.07	128.7	50.1	4.75	4163	87.0	44.24	299.2
15	0.49	129.6	48.6	4.94	1689	80.3	52.53	295.0
16-1	0.30	72.0	26.5	3.33	2523	45.6	35.75	175.3
17	0.24	116.6	46.2	4.32	1296	72.0	50.90	271.8
18	0.57	126.2	49.1	4.32	1897	72.4	59.78	281.3
19	0.47	106.1	31.6	4.70	2716	58.1	30.35	210.6
20	0.50	128.9	53.7	5.14	2996	86.8	71.38	364.4
21B	bdl	7.2	3.0	0.28	910	9.3	bdl	22.3
22	bdl	67.3	24.3	2.86	1305	50.0	11.23	162.7
23	0.84	89.5	36.5	3.04	1108	43.7	47.80	215.7
24	0.30	70.6	26.7	3.07	2914	49.3	15.91	194.9
25	0.95	127.6	69.3	5.51	3739	147.3	83.36	567.8
26	0.70	122.5	49.7	4.98	4155	88.6	64.77	334.5
27	1.15	144.9	59.2	5.67	6417	111.4	95.99	484.0
28	0.33	65.1	23.6	2.67	2596	47.4	26.48	194.5
30	bdl	118.9	44.3	bdl	bdl	86.3	bdl	294.2
31	0.68	112.3	48.1	4.68	3748	86.9	46.30	323.2
32	bdl	120.3	48.9	4.98	3414	91.6	42.94	339.3
34	0.26	132.4	49.5	5.20	6145	94.1	46.01	367.6
40	0.95	129.2	60.6	5.06	2762	116.3	73.80	403.0
41	0.11	131.3	49.2	5.33	4616	95.8	39.32	314.1
43	0.56	119.0	46.1	4.97	3578	85.3	33.05	297.2
44	0.65	120.1	42.9	4.98	4213	86.9	43.27	303.9
51	0.05	27.8	12.2	1.15	799	21.9	11.46	80.5
61	0.49	137.8	69.1	5.49	4311	107.0	63.69	377.2
64	0.90	123.0	49.4	4.99	2436	89.7	51.07	330.2
71	1.07	133.5	52.8	5.14	3952	109.8	58.67	410.3
87	0.39	148.6	56.8	5.83	4784	112.9	65.89	501.6
BC1	bdl	138.3	46.6	4.94	2868	85.1	45.00	338.6
BC2	0.74	137.8	48.5	5.10	2681	88.2	60.85	357.4

Table 2-5: Continued

Station	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
BC3	bdl	103.0	36.2	3.83	2308	59.6	39.14	233.3
BC4	0.62	118.2	64.0	5.19	2357	100.2	45.14	343.7
BC5	bdl	123.6	42.8	4.89	3676	82.9	43.04	310.5
BC6	0.57	134.7	52.8	4.83	1930	86.8	73.30	365.0

bdl = below detection limits.

Table 2-6: Field descriptions - surficial sediment samples collected on May 31, 1996 (Cruise 35) [Note: Munsell colors and numerical designations from Rock-Color Chart (Rock-Color Chart Committee 1984)]

Station number	Water depth (ft)	Description
2	8.1	No floc layer; well-sorted, moderate brown (5 YR 3/4) fine sand; a few disarticulated *Rangia cuneata*, 2 cm long, shells yellow in color; shell fragments; heavy minerals
3	16.6	Floc layer consisting of soft, soupy sandy mud; overlies very firm olive gray (5 Y 4/1) mud, which grades into dark gray (N3) mottled with dark yellowish brown (10 YR 4/2); copepod in floc layer; a few/some articulated and disarticulated *Rangia*, 1-4 cm long, a few *Macoma*,and worm in olive gray layer; burrows; smells like dead organisms
4	13.7	Floc layer, 2-3 cm thick, consisting of fluffy, mushy, dark yellowish brown (10 YR 4/2) mud, grading into olive gray (5 Y 4/1); overlies soft, lumpy (not gritty), olive gray (5 Y 4/1) mud, grading into dark gray to grayish black (N2.5); a few disarticulated adult *Rangia*; small shells; worms; burrows
5	16.9	Floc layer, 1-2 cm thick, consisting of soupy, dark yellowish brown (10 YR 4/2) mud; overlies firm, smooth (no grit), dark gray (N3) mud mottled with dark yellowish brown (10 YR 4/2) and olive gray (5 Y 4/1); very many disarticulated *Rangia*, 2.5 cm long on average, at top of dark gray layer
6	16.3	Floc layer, 1-2 cm thick, consisting of soft, watery, dark yellowish brown (10 YR 4/2) mud; overlies firm, cohesive, smooth, dark gray (N3) mud; evidence of "fluid mud" layer - creamy, pale red (5 R 6/2) mud; some/many articulated and disarticulated juvenile *Rangia* and disarticulated adults at top of dark gray layer; no odor
7	17.9	Thin (<1 cm) floc layer consisting of soupy, dark yellowish brown (10 YR 4/2) mud; overlies soft, smooth (not gritty), somewhat lumpy, dark gray (N3) mud, uniform in texture; some/many disarticulated juvenile and articulated (live) adult *Rangia* at top of dark gray layer; a few disarticulated *Macoma* at depth; crab; oxidized (olive gray - 5 Y 4/1) burrows
8A	14.3	Thin (<1 cm) floc layer consisting of fine sandy mud; overlies very soft, dark gray (N3) sandy mud or muddy sand mottled with dark yellowish brown (10 YR 4/2); a few articulated and disarticulated *Rangia*, 2.5 cm long, in dark gray layer; lot of worms; plant matter

Table 2-6: Continued

Station number	Water depth (ft)	Description
9	19.6	Thin (<1 cm) floc consisting of watery, gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), lumpy, grayish black (N2) mud; many disarticulated juvenile *Rangia* at top of grayish black layer; a few *Macoma* at depth; burrows
10	16.3	Thin (<1 cm) floc layer consisting of dark yellowish brown (10 YR 4/2) medium sandy mud; overlies dark gray to grayish black (N2.5) medium sandy mud, muddier than floc layer; articulated and disarticulated *Rangia*
11	14.3	No floc layer; fine to medium muddy sand, grading from moderate brown (5 YR 3/4) to medium dark to dark gray (N3.5), variably muddier and sandier; disarticulated *Rangia*, 1-3 cm long; shell fragments
12	12.3	Very shelly, thin (<1 cm) floc layer consisting of soft, dark yellowish brown (10 YR 4/2) sandy mud; overlies dark gray to grayish black (N2.5) fine sandy mud mottled with dark yellowish brown (10 YR 4/2), variably sandier and muddier; many disarticulated *Rangia*, varying in size; plant matter
13	8.7	No floc layer; clean, moderate brown (5 YR 4/4) medium sand; very few *Rangia*, mostly disarticulated juveniles, a few adults; shell fragments; heavy minerals.
14	13	Floc layer, 3 cm thick, consisting of soft, thick, fluffy, gelatinous mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth, dark gray (N3) mud, uniform in color and texture; no shells in floc layer; a few articulated and disarticulated adult *Rangia* in dark gray layer; patches of shell fragments; burrows
15	11	Floc layer, 2 cm thick, consisting of thick, soft, smooth, fluffy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth (not gritty), lumpy, dark gray (N3) mud; some *Rangia* at top of dark gray layer, mostly disarticulated adults, a few articulated; worms; some oxidized (olive gray - 5 Y 4/1) burrows

Table 2-6: Continued

Station number	Water depth (ft)	Description
16	10.4	Floc layer, 3-4 cm thick, consisting of gritty, fluffy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies mottled olive gray (5 Y 4/1) and dark gray (N3) very sandy mud with grayish black (N2) around decomposing clams, variably sandier and muddier; *Rangia*, mostly disarticulated adults, at top of mottled layer, some with barnacles; all three grabs look similar
17	10	Floc layer, 3 cm thick, consisting of soft, smooth, fluffy, pudding-like mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies smooth (not gritty), lumpy, dark gray (N3) mud; a few/some *Rangia*, mostly disarticulated adults, some articulated; oyster shell fragment at depth; oxidized (olive gray - 5 Y 4/1) burrows; plant matter
18	9.4	Floc layer, 2-3 cm thick, consisting of soft, smooth, fluffy, mushy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth (not gritty), lumpy, grayish black (N2) mud mottled with olive gray (5 Y 4/1); a few/some *Rangia* at top of grayish black layer, mostly disarticulated adults; oxidized burrows filled/lined with dark yellowish brown (10 YR 4/2) sediment; plant matter.
19	18.2	Floc layer, 2 cm thick, consisting of soft, mushy, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), lumpy, dark gray (N3) mud mottled with olive gray (5 Y 4/1), neither soft nor firm; no shells in floc layer; a few patches of disarticulated *Macoma*; clam guts
20	15.6	Floc layer, 3 cm thick, consisting of soft, smooth (not gritty), thick, fluffy, mud; overlies smooth (not gritty), sticky, lumpy, medium dark to dark gray (N3.5) mud, firmer than floc; some articulated and disarticulated *Rangia* at top of medium dark to dark gray layer, mostly about 2 cm long; patch of disarticulated *Macoma* at depth; worms; smells like dead organisms
21B	13.7	No floc layer; moderate brown (5 YR 3/4) fine to medium sand; a few disarticulated juvenile *Rangia*, 1 cm long; worms; heavy minerals
22	11	Floc layer consisting of dark yellowish brown (10 YR 4/2) fine to medium sandy mud; overlies dark gray (N3) fine to medium sandy mud; some *Rangia*, mostly articulated, 1-4 cm long

Table 2-6: Continued

Station number	Water depth (ft)	Description
23	11	Floc layer, 2-3 cm thick, consisting of soft, very slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth mud mottled dark gray (N3), olive gray (5 Y 4/1), and medium dark gray (N4), latter is creamier and slicker (more clay-rich?), neither soft nor firm; some/many articulated juvenile *Rangia*, 0.5-1 cm long and some disarticulated adult *Rangia* at top of mottled layer; articulated juvenile *Macoma*; shell fragments; worms; plant matter
24	18.2	Floc layer, 2-3 cm thick, consisting of mushy fine to medium sandy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, dark greenish gray (5 GY 4/1) fine to medium sandy mud, muddier than floc; many disarticulated *Rangia* and disarticulated oyster shells and oyster shell fragments throughout grab; crabs; worms; oxidized burrows; described second grab (more mud; fewer shells) - first grab was difficult to describe because of all the shells
25	18.9	Thin (<1 cm) floc layer consisting of smooth, soupy, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), lumpy, firm, grayish black (N2) mud; many *Rangia* at top of grayish black layer, mostly disarticulated, 1-2.5 cm long; very few disarticulated *Macoma* at depth, 2 cm long; worms
26	17.3	Thin (1 cm) floc layer consisting of smooth, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), dark gray to grayish black (N2.5) mud, neither soft nor firm; some *Rangia* at top of dark gray to grayish black layer, mostly disarticulated and varying in length from 1-4 cm; a few *Macoma* and a few/some *Rangia* at depth; some oxidized (olive gray - 5 Y 4/1) burrows
27		Floc layer, 2 cm thick, consisting of smooth, soupy, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), dark gray (N3) mud mottled with dark yellowish brown (10 YR 4/2); disarticulated *Rangia* at top of dark gray layer, 1 cm long; articulated and disarticulated *Macoma* at depth; worms; burrows

Table 2-6: Continued

Station number	Water depth (ft)	Description
28	19.6	Thin (1 cm) floc layer consisting of soupy, gritty mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, grayish black (N2) fine sandy mud mottled with olive gray (5 Y 4/1) and dark yellowish brown (10 YR 4/2); many *Rangia* at top of grayish black layer, mostly articulated juveniles, 1 cm long, with fewer disarticulated adults; not many shells at depth
30	17.9	Floc layer, 2-3 cm thick, consisting of soft, smooth (not gritty), thick, fluffy, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), dark gray (N3) mud, uniform in texture, neither soft nor firm; some *Rangia* at top of dark gray layer, mostly disarticulated adults, 2.5-3 cm long, some live, some with barnacles, a few juveniles; very few articulated and disarticulated *Macoma* at depth; oxidized (olive gray - 5 Y 4/1) burrows
31	17.6	Floc layer, 2-3 cm thick, consisting of soft, very slightly gritty, fluffy, dark yellowish brown (10 YR 4/2) mud; overlies lumpy, dark gray to grayish black (N2.5) mud, neither soft nor firm, not gritty; mostly disarticulated *Rangia* at top of dark gray to grayish black layer, 1-5 cm long; a few disarticulated *Rangia* at depth, some with barnacles; oxidized burrows
32	17.3	Floc layer, 3-4 cm thick, consisting of thick, soft, smooth, mushy, dark yellowish brown (10 YR 4/2) mud grading to olive gray (5 Y 4/1); overlies soft, smooth (not gritty), dark gray (N3) mud, uniform in texture; articulated and disarticulated *Rangia* at top of dark gray layer, varying in size; a few dead, articulated juvenile *Macoma* at depth; worms; oxidized burrows; no odor
34	19.2	Thin (0.5 cm) floc layer consisting of soft, smooth, soupy, dark yellowish brown (10 YR 4/2) mud; overlies soft, mushy, gelatinous, medium dark gray (N4) mud; a few articulated *Rangia* in medium dark gray layer, 2 cm long; worm
40	11.4	Floc layer, 2 cm thick, consisting of soft, smooth, fluffy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth (not gritty), dark gray (N3) mud; mostly disarticulated *Rangia* at top of dark gray layer, most 2.5-4 cm long; shell fragments; oxidized burrows filled/lined with olive gray (5 Y 4/1) sediment; plant matter

Table 2-6: Continued

Station number	Water depth (ft)	Description
41	12.7	Floc layer, 5 cm thick, consisting of soft, smooth, fluffy, mushy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, mushy, dark gray (N3) mud, uniform in texture; no shells in floc layer; very few (one of each) articulated and disarticulated adult *Rangia*
43	13	Floc layer, 2 cm thick, of soft, smooth, fluffy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies lumpy, cottage cheesy, dark gray (N3) mud, not gritty; a few/some articulated and disarticulated *Rangia* at top of dark gray layer, about 4 cm long; burrows
44	15.3	Floc layer, 3-4 cm thick, consisting of soft, smooth, fluffy, gelatinous mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth, mushy, fluffy, medium dark to dark gray (N3.5) mud, lumpy in places; a few articulated and disarticulated *Rangia* at top of medium dark to dark gray layer; worms; entire grab is mushy
51	15.3	Thin (<1 cm) floc layer consisting of dark yellowish brown (10 YR 4/2) fine sandy mud; overlies rather soft, medium dark to dark gray (N3.5) fine sandy mud; many disarticulated *Rangia*, varying in size; shelly throughout; worms
61	20.5	Floc layer, 2-3 cm thick, consisting of soft, very smooth, mushy, gelatinous mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth, cohesive, grayish black (N2) mud; many disarticulated juvenile *Rangia* at top of grayish black layer
64	21.5	Floc layer, 2 cm thick, consisting of very soft, thick, creamy, mushy, pudding-like, dark yellowish brown (10 YR 4/2) mud; overlies somewhat lumpy mud, grading from olive gray (5 Y 4/1) to grayish black (N2), not gritty, uniform in texture; disarticulated *Rangia* at top of olive gray/grayish black layer, most about 2.5 cm long; not many shells at depth; plant matter
71	18.9	Thin (<1 cm) floc layer consisting of slightly gritty, watery, dark yellowish brown (10 YR 4/2) mud; overlies soft, smooth (not gritty), dark gray to grayish black (N2.5) mud; very many disarticulated *Rangia*, 2.5 cm long on average; two crabs, 0.5 cm and 1 cm long, respectively; worm; burrows

Table 2-6: Continued

Station number	Water depth (ft)	Description
87	17.9	Floc layer, 1-2 cm thick, consisting of very soupy, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies smooth (not gritty), lumpy, medium dark to dark gray (N3.5) mud mottled with dark yellowish brown (10 YR 4/2); many disarticulated *Rangia*, 1-5 cm long, and a few disarticulated oyster shells at top of medium dark to dark gray layer; disarticulated adult *Macoma*; burrows
BC1	16.6	Floc layer, 1-2 cm thick, consisting of soft, smooth, fluffy, dark yellowish brown (10 YR 4/2) mud, no grit; overlies smooth, mushy, medium dark gray (N4) mud, which, in turn, overlies creamy, slick, pale red (10 R 6/2) mud of "fluid mud" layer; a few disarticulated adult *Rangia* at top of medium dark gray layer; disarticulated *Macoma* at depth; copepod; worms
BC2	17.9	Thin (1 cm) floc layer consisting of smooth (not gritty), watery, dark yellowish brown (10 YR 4/2) mud; overlies very lumpy, dark gray to grayish black (N2.5) mud, not gritty, neither soft nor firm; very many larger articulated and smaller disarticulated *Rangia* at top of dark gray to grayish black layer; crab, 1 cm long; no odor
BC3	15.6	Floc layer, 2-3 cm thick, consisting of soft, smooth, fluffy, dark yellowish brown (10 YR 4/2) mud; overlies soft, slick, olive gray (5 Y 4/1) mud grading into dark gray (N3); streaks of pale red (10 R 6/2) mud at bottom of grab - "fluid mud" layer; many disarticulated *Rangia* at top of olive gray/dark gray layer, mostly adults about 3 cm long, some with barnacles; disarticulated *Macoma* at depth
BC4	19.6	Thin (1 cm) floc layer consisting of soft, fluffy, slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies soft, lumpy, medium dark to dark gray (N3.5) mud; some/many disarticulated juvenile *Rangia* at top of medium dark to dark gray layer, some with barnacles; very few disarticulated adult *Macoma* at depth; no odor
BC5	16.3	Floc layer, 3-4 cm thick, consisting of soft, fluffy, gelatinous mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth (not gritty), dark gray (N3) mud; some articulated and disarticulated adult *Rangia* at top of dark gray layer; not many shells at depth

Table 2-6: Continued

Station number	Water depth (ft)	Description
BC6	11	Floc layer consisting of soft, smooth, fluffy, gelatinous mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, dark gray (N3) mud, uniform in texture; a few/some articulated and disarticulated *Rangia*, mostly adult, at top of dark gray layer; all three grabs look similar

Table 2-7: Sedimentological parameters - surficial samples collected on May 31, 1996 (Cruise 35)

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
2	27.55	98.84	0.62	0.54	0.47	A,III
3	43.00	56.49	20.68	22.83	0.52	B,II
4	59.10	8.40	50.51	41.08	0.45	D,III
5	66.70	2.73	40.06	57.22	0.59	D,II
6	55.40	3.66	42.52	53.82	0.56	D,II
7	64.34	5.52	39.06	55.43	0.59	D,II
8A	34.63	79.66	11.08	9.26	0.46	B,III
9	59.95	9.07	39.66	51.27	0.56	D,II
10	35.95	81.23	8.24	10.53	0.56	B,II
11-1	29.43	89.92	4.28	5.80	0.58	B,II
11-2	26.16	96.37	1.56	2.07	0.57	A,II
11-3	25.86	97.19	1.26	1.55	0.55	A,II
12*	44.23	60.30	19.23	20.21	0.51	B,II
13*	23.11	96.98	1.20	1.67	0.58	A,II
14	65.79	2.20	45.33	52.46	0.54	D,II
15	61.20	3.71	40.50	55.80	0.58	D,II
16-1	57.63	44.10	26.31	29.58	0.53	C,II
16-2	43.54	49.35	24.87	25.78	0.51	C,II
16-3	48.12	34.44	31.73	33.83	0.52	C,II
17	59.76	6.55	45.36	48.09	0.51	D,II
18	60.52	9.05	44.91	46.05	0.51	D,II
19	65.36	0.73	43.09	56.18	0.57	D,II
20	61.80	3.13	45.73	51.13	0.53	D,II
21B	25.50	95.08	2.49	2.43	0.49	A,III
22*	28.71	72.50	13.09	13.18	0.50	B,II
23	47.66	46.07	31.86	22.08	0.41	C,III

Table 2-7: Continued

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
24-1*	50.38	51.52	20.62	27.69	0.57	B,II
24-2	52.93	39.20	26.29	34.52	0.57	C,II
24-3	64.75	13.65	37.38	48.96	0.57	C,II
25-1	61.43	2.89	42.38	54.73	0.56	D,II
25-2	58.15	2.90	41.23	55.87	0.58	D,II
25-3*	61.88	3.29	41.24	55.34	0.57	D,II
26	64.17	2.20	42.48	55.32	0.57	D,II
27	63.36	2.06	41.92	56.01	0.57	D,II
28-1	53.34	61.13	16.32	22.55	0.58	B,II
28-2	45.11	54.40	19.45	26.16	0.57	B,II
28-3	42.86	69.09	13.26	17.64	0.57	B,II
30	61.25	0.66	50.05	49.28	0.50	D,III
31	65.44	0.84	50.40	48.76	0.49	D,III
32	62.07	0.59	48.21	51.20	0.52	D,II
34	66.15	0.79	43.49	55.72	0.56	D,II
40	66.20	0.76	44.64	54.60	0.55	D,II
41	66.29	0.38	44.20	55.42	0.56	D,II
43	64.20	1.03	43.53	55.44	0.56	D,II
44	63.70	1.89	47.79	50.32	0.51	D,II
51	40.71	75.73	11.17	13.10	0.54	B,II
61	61.68	2.32	43.03	54.65	0.56	D,II
64	62.89	0.99	44.11	54.90	0.55	D,II
71	60.01	0.95	46.90	52.15	0.53	D,II
87*	59.20	6.57	39.63	53.23	0.57	D,II
BC1	62.38	5.25	44.75	50.00	0.53	D,II
BC2	86.95	1.86	39.05	59.08	0.60	D,II

Table 2-7: Continued

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
BC3-1	55.17	15.36	43.07	41.57	0.49	C,III
BC3-2	56.21	10.97	49.02	40.01	0.45	C,III
BC3-3	54.14	16.96	43.34	39.69	0.48	C,III
BC4	55.57	3.71	42.82	53.47	0.56	D,II
BC5	62.91	2.06	43.22	54.72	0.56	D,II
BC6-1	68.59	3.12	42.87	54.01	0.56	D,II
BC6-2	63.99	2.45	41.58	55.97	0.57	D,II
BC6-3	65.80	2.13	42.51	55.36	0.57	D,II

* Contains minor amount of gravel (1.25%)

Table 2-8: Geochemical parameters - surficial samples (in µg/g) collected on May 31, 1996 (Cruise 35)

Station	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
2	bdl	10.0	4.6	0.4	933	21.5	10.0	36.1
3	0.28	60.9	25.0	2.4	2239	49.1	26.3	180.4
4	0.56	118.5	44.6	4.4	2745	77.5	53.9	319.4
5	0.47	128.0	51.1	5.3	5404	91.7	51.8	387.7
6	0.61	103.9	37.5	4.3	2075	65.8	30.4	233.1
7	0.95	133.3	61.2	5.3	2815	119.1	70.9	517.1
8A	0.59	33.3	14.1	1.5	1528	26.3	16.8	93.3
9	1.25	125.7	71.1	5.3	2965	156.0	84.1	638.3
10	0.39	26.1	11.1	1.2	1163	26.8	8.7	85.5
11	bdl	10.4	5.3	0.5	862	11.7	bdl	35.9
12	bdl	59.6	24.3	2.5	1577	41.1	28.6	163.4
13	bdl	6.1	4.1	0.3	1047	16.8	bdl	25.6
14	bdl	113.6	45.6	4.8	5578	87.5	48.6	333.0
15	bdl	112.7	45.9	4.6	1580	81.4	49.5	316.5
16	bdl	80.4	31.1	2.9	1207	55.1	28.6	216.8
17	0.38	121.4	47.3	4.2	1251	74.7	56.1	318.1
18	0.35	129.6	46.0	4.1	1309	73.3	51.3	290.3
19	bdl	133.1	49.1	5.2	5915	92.2	52.3	360.1
20	0.47	125.2	51.5	4.8	3502	87.7	66.1	387.7
21B	bdl	7.7	3.9	0.3	932	11.5	bdl	27.8
22	bdl	26.8	9.5	1.2	667	16.9	2.5	66.2
23	0.38	87.4	34.7	2.9	1095	43.2	50.6	222.2
24	bdl	85.2	31.5	3.8	4039	63.7	33.3	257.1
25	0.90	133.7	67.2	5.7	3342	143.6	76.6	594.0
26	0.69	122.6	47.4	5.3	3618	88.8	43.1	349.3
27	0.46	146.2	54.9	6.1	11143	112.0	84.7	519.3
28	bdl	62.9	22.9	2.8	1573	51.7	23.2	210.7
30	bdl	110.1	44.2	5.0	3554	83.8	27.5	321.2
31	0.30	116.0	45.5	5.3	6353	87.5	45.1	349.3
32	0.62	115.4	45.8	5.2	5688	88.1	50.5	348.7
34	0.21	125.7	50.0	5.6	6767	95.6	53.2	380.1
40	0.51	122.3	47.5	5.3	3431	90.6	41.3	333.5
41	0.33	119.8	47.7	5.3	3892	89.1	63.0	333.3
43	0.92	118.6	45.4	4.9	2962	89.1	38.9	332.4
44	0.83	118.7	44.1	4.7	4332	91.5	33.4	329.2
51	0.50	36.2	13.2	1.4	1698	21.3	19.8	115.4
61	0.84	131.3	52.2	5.0	3687	97.0	44.5	372.7
64	1.32	137.5	60.2	5.3	3295	107.0	49.2	399.7
71	1.04	123.4	58.8	5.0	3043	104.9	65.4	439.6
87	0.76	149.1	61.1	6.0	6852	148.6	72.5	647.9
BC1	1.00	140.2	56.3	4.7	3396	88.1	195.6	360.5
BC2	0.75	142.3	51.1	5.0	2512	102.2	48.6	384.9
BC3	0.66	98.7	36.7	3.7	2134	62.8	34.2	242.9

Table 2-8: Continued

Station	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
BC4	0.84	106.8	69.7	4.8	2080	110.4	48.3	392.8
BC5	1.16	122.7	43.9	4.9	3802	92.3	35.7	334.5
BC6	1.06	128.4	56.8	4.8	2209	94.5	66.7	398.7

bdl = below detection limits.

Table 2-9: Sedimentological parameters - gravity cores collected on May 30, 1996 (Cruise 35)

Sampling interval (cm)	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
Core 25						
0-2.5	51.64	4.34	41.95	53.71	0.56	D,II
2.5-5	51.36	1.58	44.17	54.25	0.55	D,II
5-7.5	49.30	1.43	43.59	54.98	0.56	D,II
7.5-10	51.17	1.04	44.24	54.73	0.55	D,II
20-24	52.90	0.51	37.87	61.62	0.62	D,II
42-46*	57.24	0.60	38.24	61.09	0.61	D,II
Core BC3						
0-2.5	52.32	12.54	47.67	39.79	0.45	C,III
2.5-5	37.70	4.49	65.26	30.25	0.32	D,III
5-7.5	40.15	1.77	60.62	37.61	0.38	D,III
7.5-10	48.99	0.40	48.12	51.48	0.52	D,II
14-18	58.18	1.50	41.19	57.31	0.58	D,II
30-34	56.65	2.77	40.45	56.78	0.58	D,II
46-50	54.78	2.92	38.90	58.18	0.60	D,II
Core BC6						
0-2.5	63.29	2.77	40.45	56.79	0.58	D,II
2.5-5	60.86	2.53	41.86	55.62	0.57	D,II
5-7.5	58.41	2.36	44.57	53.08	0.54	D,II
7.5-10	57.02	2.20	39.35	58.45	0.60	D,II
14-18	54.33	4.17	43.93	51.91	0.54	D,II
22-26	60.14	3.17	43.13	53.70	0.55	D,II
40-44	63.07	1.79	41.34	56.87	0.58	D,II

* Contains minor amount of gravel (<0.1%)

Table 2-10: Geochemical parameters - gravity cores collected on May 30, 1996 (Cruise 35)

Station	Top (cm)	Bottom (cm)	Cd (µg/g)	Cr (µg/g)	Cu (µg/g)	Fe (%)	Mn (µg/g)	Ni (µg/g)	Pb (µg/g)	Zn (µg/g)
25	0	2.5	1.55	122.2	73.6	5.0	3171	155.6	73.9	645.5
25	2.5	5	1.21	131.5	81.5	5.3	3399	181.6	73.0	714.5
25	5	7.5	1.25	115.2	80.7	4.9	2197	143.7	67.2	502.8
25	7.5	10	0.67	111.0	83.9	4.9	2800	122.3	59.1	420.8
25	20	24	bdl	104.8	49.7	4.9	2095	75.5	25.3	228.8
25	42	46	0.84	101.6	28.6	5.0	1732	48.3	13.2	135.7
BC3	0	2.5	0.42	87.4	35.2	3.6	1862	55.0	26.4	221.3
BC3	2.5	5	0.32	69.4	19.3	2.8	550	39.3	5.6	121.1
BC3	5	7.5	0.33	73.7	21.6	3.0	522	31.0	16.0	82.4
BC3	7.5	10	0.08	97.0	32.3	4.0	1291	47.8	35.3	160.9
BC3	14	18	1.28	119.3	50.2	4.9	2405	89.7	54.0	355.2
BC3	30	34	1.65	130.6	75.9	5.2	2321	157.1	93.2	685.6
BC3	46	50	0.35	111.4	64.6	4.9	1693	91.2	51.1	309.4
BC6	0	2.5	0.73	114.3	52.8	4.5	1673	86.6	62.3	351.6
BC6	2.5	5	1.26	141.3	67.2	4.8	1298	123.4	88.9	491.9
BC6	5	7.5	1.32	117.4	69.9	4.5	1127	110.7	82.3	448.6
BC6	7.5	10	1.24	99.7	57.3	4.5	1127	84.5	51.1	325.2
BC6	14	18	bdl	98.6	25.2	4.4	969	43.4	8.7	115.4
BC6	22	26	bdl	104.7	17.9	4.8	1139	39.1	8.9	111.4
BC6	40	44	bdl	111.2	16.1	4.8	1514	42.2		121.7

bdl = below detection limits.

Table 2-11: Field descriptions - surficial sediment samples collected on August 26-27, 1996 (Cruise 36)

Station number	Water depth (ft)	Description
5	16	Floc layer, 2-3 cm thick, consisting of very soft, smooth, mushy, fluffy, dark yellowish brown (10 YR 4/2) mud; overlies soft, mushy, olive gray (5 Y 4/1) and dark gray (N3) mud, variable texture, firmer with depth, slicker near bottom; a few disarticulated *Rangia*, 1-2 cm long, in olive gray/dark gray layer; worms in floc layer; plant matter; no odor
25	16	Thin (1 cm) floc layer consisting of soft, mushy, olive gray (5 Y 4/1) mud; overlies smooth (not gritty), crumbly, grayish black (N2) mud, firmer than floc layer; a few dead, articulated *Macoma*; *Rangia* shells with barnacles; plant matter; described first grab, second and third grabs contained more shells than first
28	15	Thin (1 cm) floc layer consisting of soft, mushy, dark yellowish brown (10 YR 4/2) very sandy mud; overlies fine to medium sandy mud, grading from olive gray (5 Y 4/1) to dark gray to grayish black (N2.5); very many disarticulated *Rangia*, varying in size; shell fragments; all three grabs similar in appearance - very shelly
30	16	Thin (1 cm) floc layer consisting of smooth, creamy, dark yellowish brown (10 YR 4/2) and olive gray (5 Y 4/1) mud; overlies soft, smooth, mushy, dark gray (N3) mud, firmer and lumpier than floc layer; some disarticulated *Rangia*, 1-2.5 cm long, and very few juvenile *Macoma* in dark gray layer; oxidized burrows; no odor
36	17	Thin (1 cm) floc layer consisting of soft, very slightly gritty, dark yellowish brown (10 YR 4/2) mud; overlies stiffer, very lumpy, grayish black (N2) mud mottled with dark yellowish brown (10 YR 4/2); very few *Macoma* and a few articulated and disarticulated *Rangia*, 2.5 cm long, in grayish black layer; oxidized burrows; bioturbated; no odor
BC3	13	Floc layer, 1-2 cm thick, consisting of soft, thick, very slightly gritty mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies stiff, dark gray (N3) mud with pale red (5 R 6/2) laminae - "fluid mud" layer, stiffer with depth; some/many adult *Rangia* at top of dark gray layer, most disarticulated, some live; worms; plant matter

Table 2-11: Continued

Station number	Water depth (ft)	Description
BC6	8	Floc layer, 2 cm thick, consisting of soft, fluffy, gelatinous, dark yellowish brown (10 YR 4/2) mud; overlies lumpy, cottage cheesy, dark gray (N3) mud; some disarticulated *Rangia*, varying in size, in dark gray layer; worms; a few oxidized burrows; all three grabs look very similar
301	16	Floc layer, 1-2 cm thick, consisting of thick, smooth (not gritty), olive gray (5 Y 4/1) mud; overlies very soft, mushy, dark gray (N3) mud, not sticky, lumpy with depth; one dead juvenile and one adult *Macoma* in dark gray layer; very few shells; plant matter; biologists on board collected and rinsed sample at this location before this one taken - may have disturbed bottom
302	10	Floc layer, 1-2 cm thick, consisting of thick, mushy, olive gray (5 Y 4/1) mud; overlies mushy, medium dark gray (N4) mud, firmer with depth; very few disarticulated adult (5 cm long) *Rangia*; worms; plant matter; no odor
304	19	Thin (1 cm) floc layer consisting of soft, gritty, dark yellowish brown (10 YR 4/2) mud; overlies slick, cohesive mud, between dark greenish gray (5 G 4/1) and medium bluish gray (5 B 5/1) in color, stiffer than floc layer, uniform in color and texture, except for pockets of wetter and drier sediment; very few disarticulated *Rangia*; oyster shell fragments
307	16	Floc layer, 1-2 cm thick, consisting of soft, smooth, dark yellowish brown (10 YR 4/2) mud; overlies soft, smooth, mushy, dark gray (N3) mud, lumpier than floc layer; some articulated and disarticulated *Rangia*, mostly disarticulated, some live; worms; no odor
309	19	Floc layer, 2 cm thick, consisting of slightly gritty, soupy, dark yellowish brown (10 YR 4/2) mud; overlies creamy, lumpy, dark gray (N3) mud; some articulated and disarticulated *Rangia* and a few articulated and disarticulated *Macoma* in dark gray layer; lots of worms; oxidized burrows, no odor
311	14	Thin (1 cm) floc layer consisting of soft, mushy, dark yellowish brown (10 YR 4/2) and olive gray (5 Y 4/1) sandy mud; overlies dark gray (N3) fine sandy mud, sandier than floc layer; a few disarticulated *Rangia* in dark gray layer; one worm

Table 2-11: Continued

Station number	Water depth (ft)	Description
312	11	No floc layer; dark yellowish brown (10 YR 4/2) fine sandy mud; very many disarticulated *Rangia*; juvenile blue crab; oyster shells; shell fragments; *Cyathura*; plant matter; very shelly sample - first grab taken at station all shells (discarded)
314	11	Floc layer, 2-3 cm thick, consisting of soft, smooth (not gritty), mushy, dark yellowish brown (10 YR 4/2) and olive gray (5 Y 4/1) mud; overlies soft, smooth (not gritty), lumpy, dark gray (N3) mud, homogeneous in texture; worms; oxidized burrows; plant matter
315	10	Floc layer, 2-3 cm thick, consisting of soft, mushy mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies lumpy, dark gray (N3) mud, not gritty, not firm, uniform in texture; a few disarticulated *Rangia* in dark gray layer; a few burrows; plant matter; no odor
317	15	Thin (1 cm) floc layer consisting of soft, gritty mud, grading from dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1); overlies soft, smooth, sticky, grayish black (N2) mud; juvenile *Rangia* on surface of grab; not many shells at depth; lots of burrows, some oxidized; plant matter; no odor

Table 2-12: Sedimentological parameters - surficial samples collected on August 26-27, 1996 (Cruise 36)

Station	Water (%)	Sand (%)	Silt (%)	Clay (%)	Clay:mud	Pejrup's class
5	65.94	4.08	46.03	49.89	0.52	D,II
25-1	67.14	1.67	41.69	56.64	0.58	D,II
25-2	62.04	1.91	42.16	55.93	0.57	D,II
25-3	59.54	1.91	42.67	55.41	0.56	D,II
28-1	51.10	75.19	10.74	14.07	0.57	B,II
28-2	41.49	68.02	13.91	18.07	0.57	B,II
28-3	40.99	69.71	12.81	17.48	0.58	B,II
30	61.31	0.57	54.66	44.77	0.45	D,III
36	53.39	4.12	52.51	43.37	0.45	D,III
BC3	51.69	6.95	51.42	41.63	0.45	D,III
BC6-1	69.51	4.05	41.35	54.59	0.57	D,II
BC6-2	71.87	3.12	41.58	55.30	0.57	D,II
BC6-3	68.70	3.25	39.17	57.57	0.60	D,II
301	64.27	0.85	44.61	54.54	0.55	D,II
302	60.14	6.51	56.15	37.34	0.40	D,III
304	57.87	5.02	38.40	56.58	0.60	D,II
307	60.81	0.54	49.95	49.51	0.50	D,III
309	63.24	2.67	56.91	40.42	0.42	D,III
311	35.71	81.03	9.91	9.06	0.48	B,III
312	37.10	84.64	7.52	7.84	0.51	B,II
314	63.73	2.75	48.28	48.97	0.50	D,II
315	66.47	7.04	44.32	48.64	0.52	D,II
317	53.64	31.35	36.31	32.34	0.47	C,III

Table 2-13: Geochemical parameters - surficial samples (µg/g) collected on August 26-27, 1996 (Cruise 36).

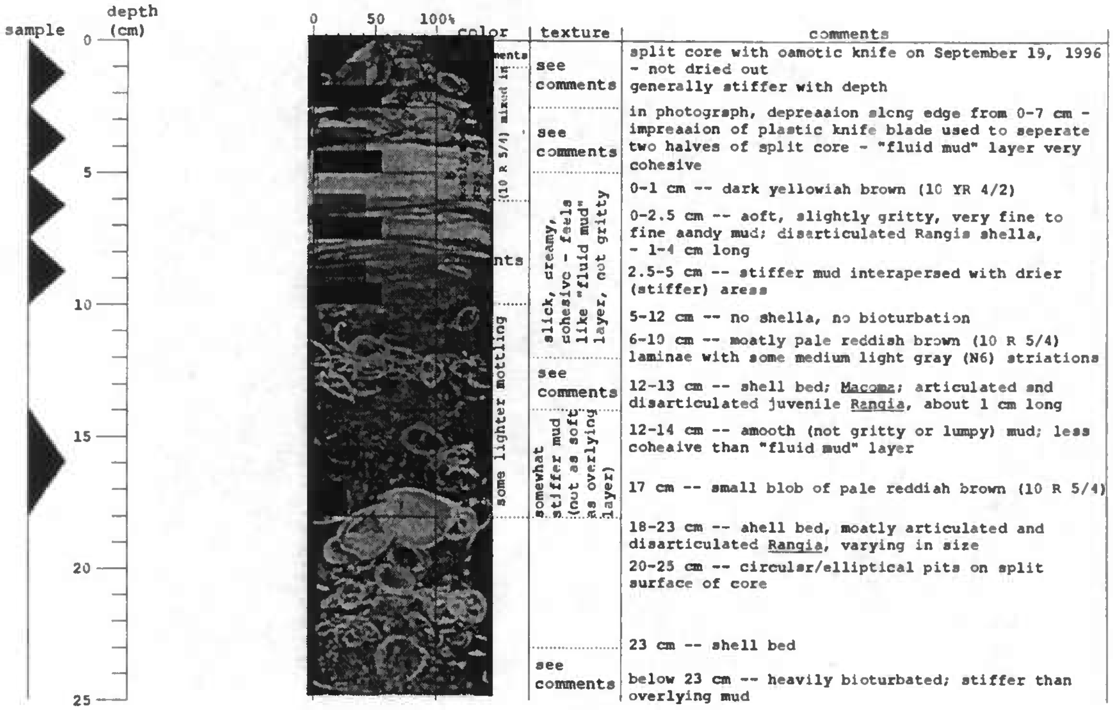
Station	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn
301	bdl	119.9	49.6	5.46	5096	85.6	58.2	362
302	bdl	96.2	38.4	4.02	4324	65.6	45.9	268.3
5	bdl	121.2	52.4	5.09	7370	85.3	72.5	368.2
304	bdl	95.1	17.1	4.54	1384	39.4	11.5	122.2
233	bdl	90.5	29.6	3.9	1809	56.2	19.1	186.1
25	0.57	133.5	67.4	5.75	4287	143.2	83.4	619
307	bdl	108.7	42.6	5.13	3780	79.6	42	303.3
30	bdl	103.5	43.2	5.16	5752	76.5	43	300.3
309	0.31	98	32.8	4.66	3794	63.8	39.1	252.3
36	bdl	107.4	43.7	4.67	1858	76.1	38	284.5
311	bdl	28.7	9.4	1.17	942	13.6	5.4	70.3
312	bdl	30.2	10.8	1.27	1491	19.6	3.8	100.4
28	bdl	48	16.5	2.04	1526	31.5	11.5	151.1
314	bdl	100.5	40	4.61	2948	75.9	40.9	289.5
315	bdl	103.8	60.4	4.55	6551	73.8	44.9	309.9
236	0.28	118.2	49	5.02	3124	81	61.7	339.1
317	bdl	97.5	41.8	3.16	1272	50.4	44.7	253.7

bdl = below detection limits.

APPENDIX

Visual and radiographic observations of gravity cores collected on April 21, 1994 (Cruise 31).

HART-MILLER ISLAND - 15th Year
Core BC3 May 30, 1996



HART-MILLER ISLAND - 15th Year
Core BC6 May 30, 1996

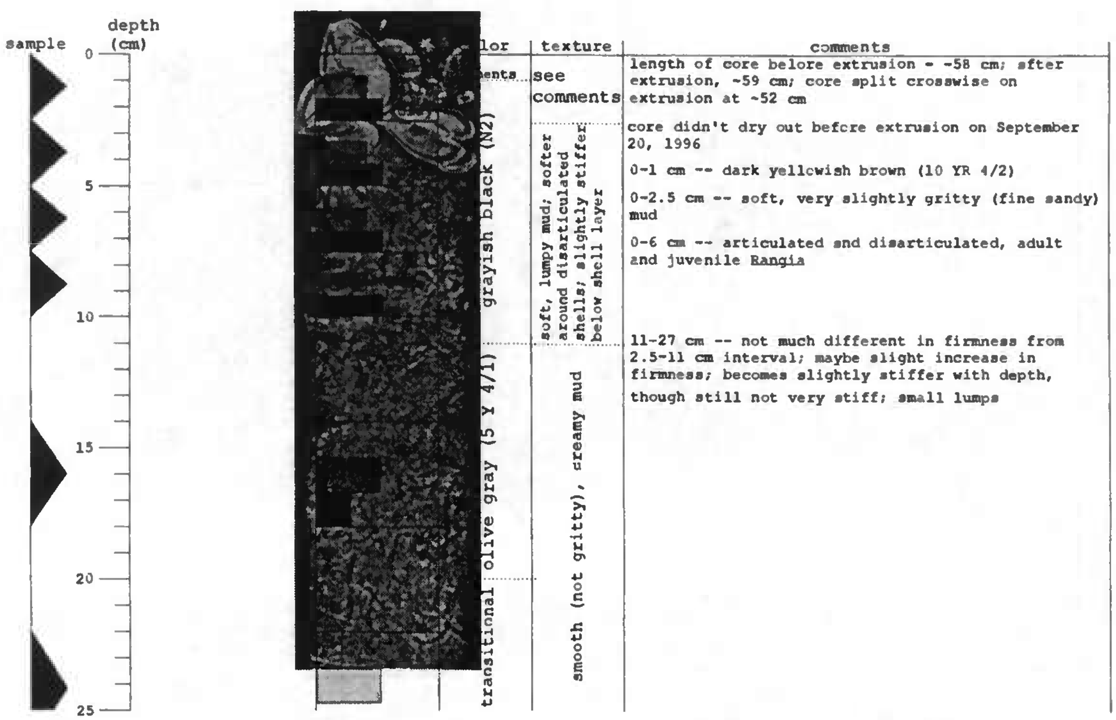


Figure 2-3: Radiographic observations.

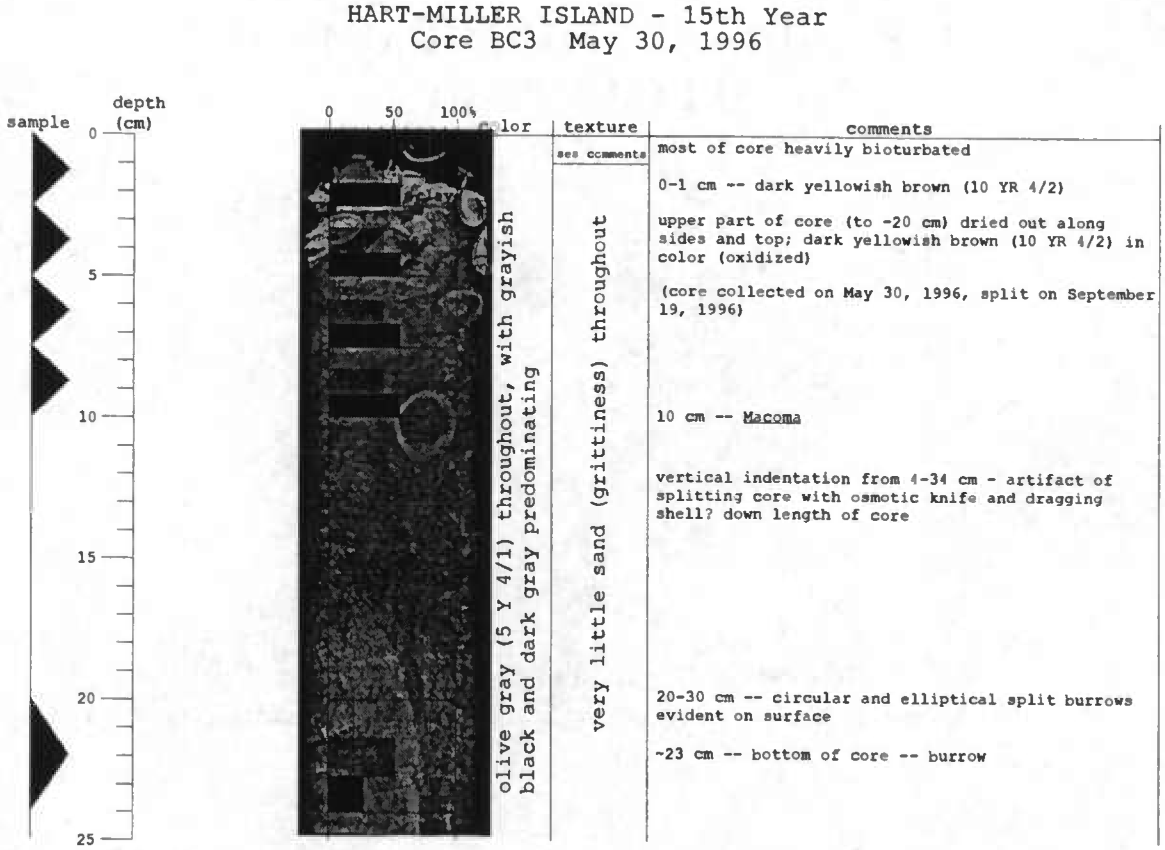


Figure 2-3: Continued.

CHAPTER 2: BENTHIC COMMUNITY (PROJECT III)

By

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INTRODUCTION

This report contains data collected during Year 15 of Benthic Community Studies (Project III) for the Hart-Miller Island Exterior Monitoring Program. A two day cruise was conducted aboard the University of Maryland research vessel *R/VAquarius* on August 26 & 27, 1996. All sampling (benthic, sediments, metals and organics) was conducted concurrently at each station.

All of the stations illustrated in Figure 3-1 (Chesapeake Biological Lab - Station Designations) were reached on the two day cruise in August. Based on the joint meeting of the Principal Investigators (PIs) with the Technical Review Committee (TRC) on 6 December 1995, only 17 stations were selected to be sampled this year. Five stations with the HM prefix (HM 7, HM9, HM16, HM22, and HM26) are benthic infaunal reference sites, and have been sampled since the inception of the project. The four stations with the S prefix (S2, S3, S5, and S6) are positioned around the perimeter of the island and represent the nearfield experimental infaunal stations. Four additional benthic infaunal stations (G5, G25, G84, and HM12) were added over the course of Year 9 in response to findings of the sedimentary group from MGS that elevated concentrations of Zn were present in the sediments. Four new stations were added this year (BC6, BC3, 30, and NEW). Station BC6 is northwest of the island and station BC3 is south of the island. Stations 30 and New were added to complete a transect leading in a southeast direction away from the facility.

The benthic samples were obtained with a 0.05 m^2 Ponar grab. Three replicate samples were obtained at each station. These samples were individually washed on a 0.7 mm mesh screen. Samples were preserved in a solution of 10% seawater/formalin with rose bengal stain. The samples were rinsed back at the laboratory on a 0.5 mm sieve and stored in 70% ethyl alcohol until the organisms could be picked, sorted and identified.

Individual specimens in the samples were identified to the lowest taxonomic unit possible. The actual number of individuals were recorded for each of the three replicate samples at the reference (HM7, HM9, HM16, HM22, HM26, BC6, 30, and New), nearfield (S2,S3,S5,S6, and BC3), and Zn-enriched (HM12,G5,G25, and G84) stations. Data for each station is presented in the accompanying tables.

Additional ecological data recorded for each station includes sampling depth (recorded from the ships fathometer), tidal state, weather conditions, temperature and salinity. Both temperature and salinity were measured on the surface and the bottom with Hydrolab's Surveyor 3 system and are presented in Table 3-1. Table 3-1 also lists the State of Maryland designations for each of the sampling stations.

After the identification and enumeration of the samples, they were analyzed for dry weight. All species for each sample were individually oven dried at 60°C to a constant weight. The clams were shucked and the shells were discarded before they were dried. Total dry weight of each sample was determined on an analytical balance. The total dry weights for the three replicates for each station were averaged and the data is presented are Table 3-2.

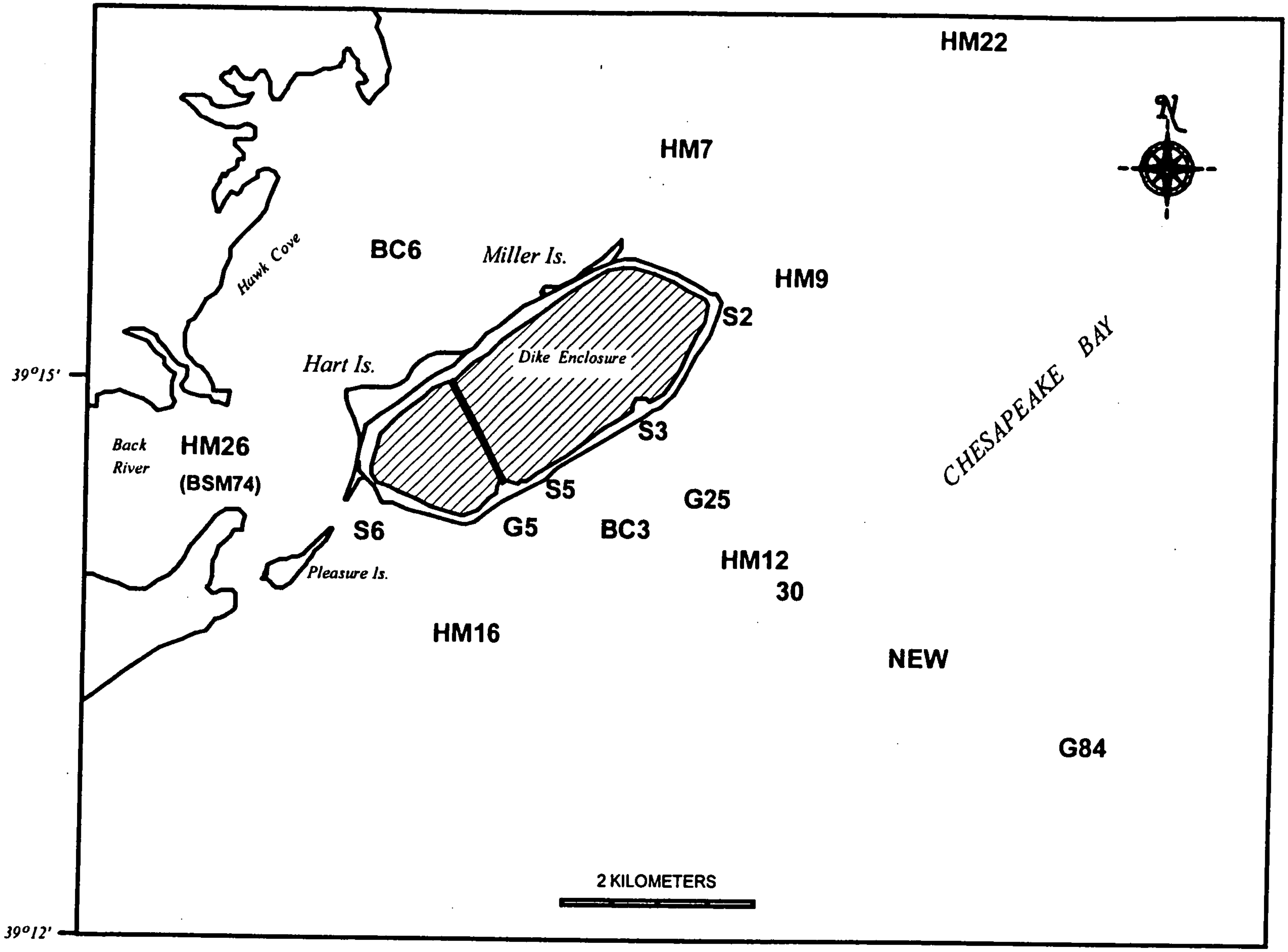

Figure 3-1: Year 15 Benthic Community sampling locations surrounding HMI

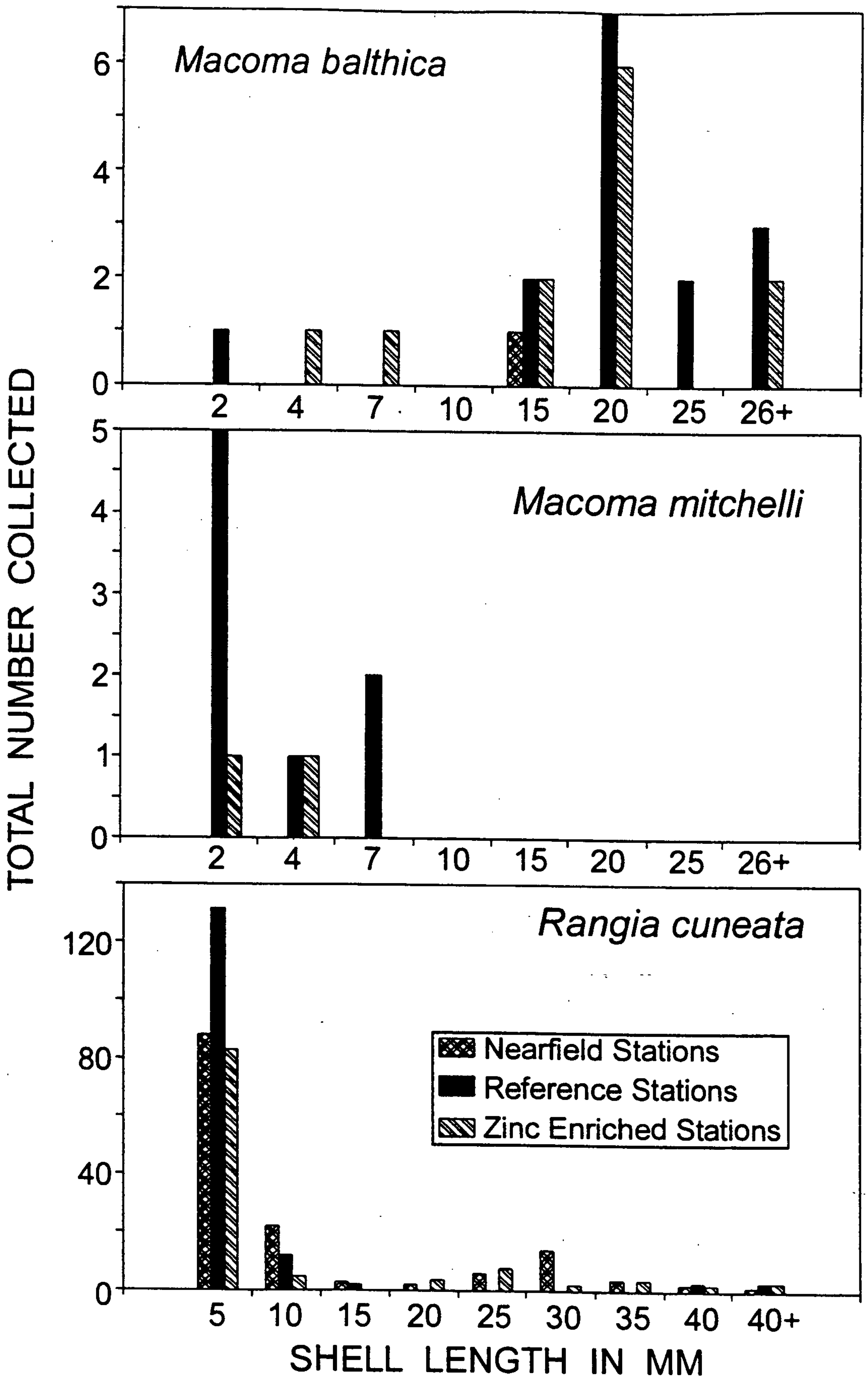

Figure 3-2: Length frequency distribution of the clams *Macoma balthica*, *Macoma mitchelli* and *Rangia cuneata* during Year 15 of Benthic Community Studies at HMI.

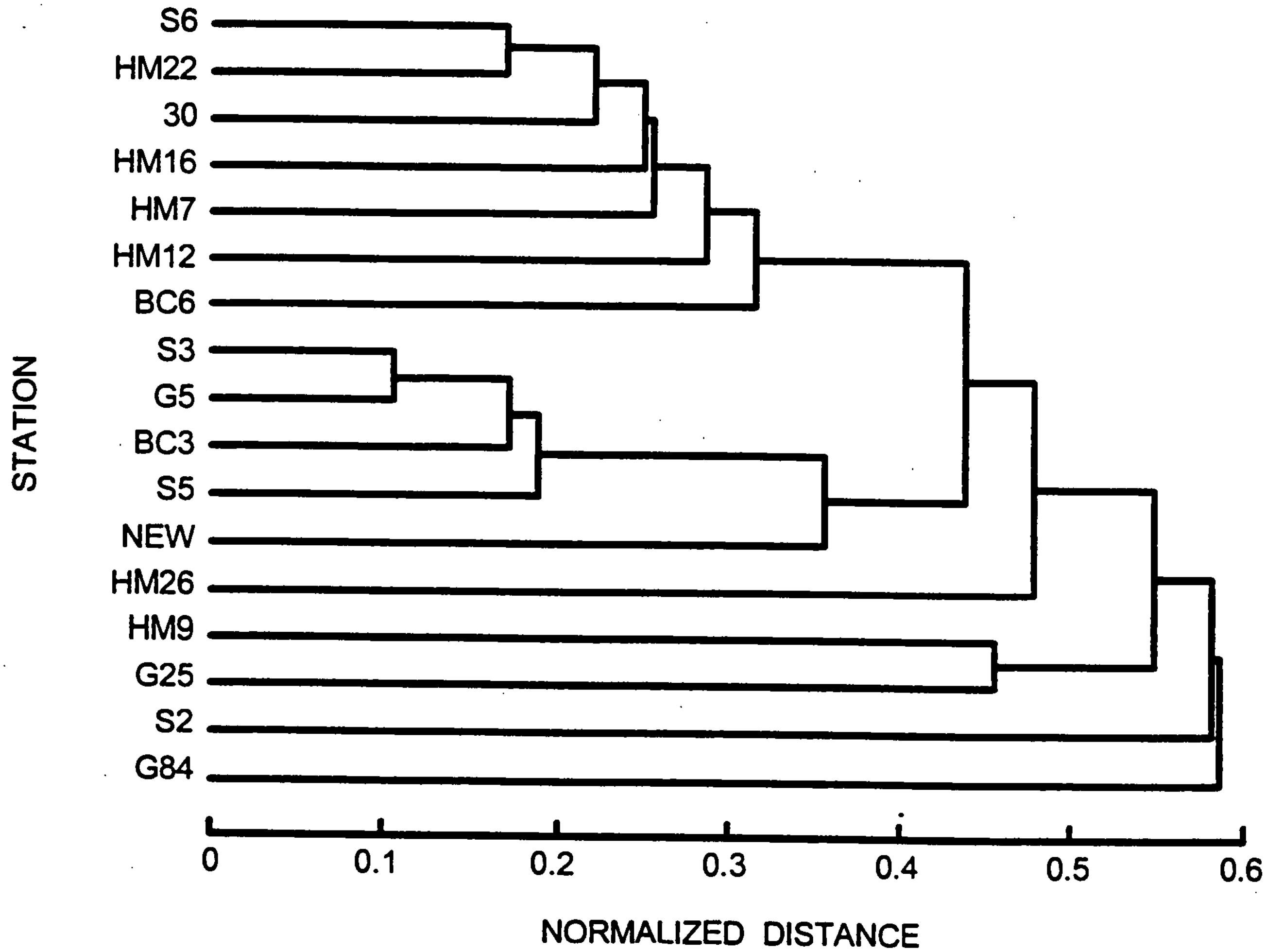

Figure 3-3: Cluster analysis for all of the HMI stations during Year 15 of Benthic Community Studies.

TABLE 3-1: Salinity (in parts/thousand), temperature (degrees centigrade), and depth (feet) for the benthic stations sampled during Year 15 of BenthicCommunity Studies at HMI (August 1996

CBL STATION ID	STATE STATION #	DEPTH (ft)	TEMPERATURE (oC)	SALINITY (0/00)
S2	XIF5406	0	**NR	**NR
S2	XIF5406	11	**NR	**NR
S3	XIF4811	0	28.00	4.0
S3	XIF4811	14	**NR	**NR
S5	XIF4420	0	26.83	3.0
S5	XIF4420	19	26.13	4.2
S6	XIF4327	0	26.53	3.4
S6	XIF4327	10	26.20	4.5
HM7	XIF6388	0	27.57	3.1
HM7	XIF6388	10	26.80	3.2
HM9	XIF5297	0	28.00	3.0
HM9	XIF5297	15	**NR	**NR
HM12	XIF5805	0	26.62	4.2
HM12	XIF5805	16	26.55	4.5
HM16	XIF3325	0	26.45	3.4
HM16	XIF3325	16	26.17	5.4
HM22	XIG7689	0	27.20	3.6
HM22	XIG7689	11	26.80	3.7
HM26	XIF5145	0	27.94	3.3
HM26	XIF5145	15	26.96	3.4
G5	XIF4221	0	26.56	3.1
G5	XIF4221	16	26.13	4.3
G25	XIF4405	0	27.42	3.2
G25	XIF4405	16	26.31	3.8
G84	XIG2964	0	26.33	5.6
G84	XIG2964	17	25.94	8.4
30	XIF4000	0	26.68	4.2
30	XIF4000	16	26.16	4.7
NEW		0	26.55	5.4
NEW		19	26.19	5.8
BC3	XIF4615	0	27.20	3.1
BC3	XIF4615	13	26.14	3.5
BC6	XIF5925	0	28.88	2.6
BC6	XIF5925	8	26.78	2.9

**NR= NOT RECORDED

**Table 3-2: Benthic biomass for Year 15 at HMI.
(average dry weight per station)**

Station	Dry wts (grams)
S2	0.5045
S3	1.0049
S5	0.0898
S6	0.2742
HM7	0.2704
HM9	0.2991
HM16	0.0843
HM22	0.2078
HM26	0.0827
G5	0.6966
G25	0.3751
G84	0.2410
30	0.1090
NEW	0.1827
HM12	1.0564
BC3	0.2371
BC6	0.4795

TABLE 3-3: YEAR 15 HMI BENTHIC DATA-PHYSICAL PARAMETERS

CBL STATION	DNR STATION	DATE	TIME	DEPTH (FT)	LAT.	LONG.	TIDE	WEATHER
S2	XIF5406	96-8-27	1117	11	391525	762035	EBB	PARTLY CLO
S3	XIF4811	96-8-27	1045	14	391450	762107	EBB	PARTLY CLO
S5	XIF4420	96-8-26	1245	19	391423	762200	EBB	CLEAR
S6	XIF4327	96-8-26	1100	10	391417	762241	EBB	CLEAR
HM7	XIF6388	96-8-27	1329	10	391615	762050	LOW SLACK	PARTLY CLO
HM9	XIF5297	96-8-27	1158	15	391553	761953	EBB	PARTLY CLO
HM12	XIF5805	96-8-26	1441	16	391405	762021	FLOOD	CLEAR
HM16	XIF3325	96-8-26	1007	16	391317	762230	EBB	CLEAR
HM22	XIG7689	96-8-27	1303	11	391658	761851	LOW SLACK	PARTLY CLO
HM26	XIF5145	96-8-27	1448	15	391439	762355	FLOOD	PARTLY CLO
G5	XIF4221	96-8-26	1133	16	391411	762208	EBB	CLEAR
G25	XIF4405	96-8-26	1405	16	391423	762048	FLOOD	CLEAR
G84	XIF2964	96-8-27	0843	17	391251	761623	HIGH SLACK	PARTLY CLO
BC6	XIF5925	96-8-27	1400	8	391551	762232	LOW SLACK	PARTLY CLO
NEW	?	96-8-27	0924	19	391325	761827	EBB	PARTLY CLO
30	XIF4000	96-8-27	1006	16	391359	761960	EBB	PARTLY CLO
BC3	XIF4615	96-8-26	1317	13	391433	762126	FLOOD	CLEAR

Table 3-4: HMI Benthic Species Invertebrate List for Year 15

CBL Code	Species
1	*Diadumene leucolena*
2	*Micrura leidyi*
3	*Heteromastus filiformes*
4	*Melinna* sp.
5	*Neanthes succinea*
6	*Leitoscoloplos fragilis*
7	*Pectinaria gouldi*
8	*Eteone heteropoda*
9	*Polydora cornuta*
10	*Marenzelleria viridis*
11	*Streblospio benedicti*
12	*Hobsonia florida*
13	*Limnodrilus hoffmeisteri*
14	*Peloscolex tubifici*
15	*Capitella capitata*
16	*Ischadium recurvus*
17	*Mytilopsis leucophaeata*
18	*Littoridinops tenuis*
19	*Macoma balthica*
20	*Macoma mitchelli*
21	*Rangia cuneata*
22	*Mya arenaria*
23	*Hydrobia sp.*
24	*Stiliger niger*
25	*Doridella obscura*
26	*Aegathoa medialis*
27	*Balanus improvisus*
28	*Balanus subalbidus*
	Neomysis americana
29	*Leucon americanus*
30	*Cyathura polita*
31	*Cassidinidea lunifrons*
33	*Edotea triloba*
34	*Neohaustorius bioarticulatus*
35	*Gammarus palustris*
36	*Leptocheirus plumulosus*
37	*Apocorophium lacustre*
38	*Gammarus daiberi*
39	*Gammarus tigrinus*
40	*Melita nitida*
41	*Chirodotea almyra*
42	*Ameroculodes* spp. complex
43	Chironomidae
44	*Rhithropanopeus harrisii*
45	*Mucrogammarus mucronatus*
46	*Cordylophora caspia*
47	*Garveia franciscana*
48	*Stylochus ellipticus*
49	*Membranipora tenuis*
50	*Victorella pavida*

TABLE 3-5: HMI DATASET: YEAR 15--AUGUST 1996

DATE	CBL STATION	SAMPLING METHOD	MEDIA	PARAMETER	METHOD	UNITS	SPECIES CODE	GRAB REP	NUMBER CAPTURE
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	3
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	1	3
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	2	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	3	2
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	209
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	92
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	107
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	17
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	13
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	8
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	1	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	2	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	3	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	19
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	19
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	11
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	51
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	35
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	37
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	2
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	2
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	1	6
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	2	2
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	3	10

96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	3
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	3
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	5
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	1	3
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	2	1
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	3	0
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	3
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	12
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	4
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	10
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	2
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	17
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	11
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	5
96-08-27	S2	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	6
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	2
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	1
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	95
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	53
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	138
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	4
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	10
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	14
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	9
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	14
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	35
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	28
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	20
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	4
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	2

96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	14
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	16
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	14
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	1
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	1
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	3
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	1	1
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	2	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	3	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	5
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	0
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	1
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	6
96-08-27	S3	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	3
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	3
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	15
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	16
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	210
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	2
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	10
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	5
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	5
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	8
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	27
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	21
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	35
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	1

96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	0
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	2
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	1
96-08-26	S5	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	5
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	3
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	3
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	39
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	23
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	22
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	6
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	2
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	18
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	6
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	3
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	17
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	19
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	16
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	16
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	7
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	7
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	1
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	1
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	2
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	0

96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	17
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	1
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	12
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	1
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	0
96-08-26	S6	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	3
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	47
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	56
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	26
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	1	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	2	2
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	3	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	5
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	5
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	2
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	17
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	12
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	6
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	25
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	33
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	19
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	4
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	6
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	5
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	5
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	5

96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	20
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	11
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	22
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	1
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	0
96-08-27	HM7	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	2
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	4
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	5
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	2
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	1
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	2
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	1	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	2	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	3	1
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	1	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	2	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	3	5
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	70
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	87
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	44
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	14
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	10
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	48
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	12
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	12
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	5
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	49
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	31
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	33
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	3
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	1	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	2	1
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	3	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	13

96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	10
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	3
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	2
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	1
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	1
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	0
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	13
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	9
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	18
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	11
96-08-27	HM9	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	23
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	2
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	3
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	1
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	25
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	11
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	7
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	10
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	7
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	6
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	1
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	3
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	1
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	1
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	1	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	2	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	3	2
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	20
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	3
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	10
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	17
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	50
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	7

96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	27
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	19
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	27
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	1
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	4
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	6
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	2
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	3
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	0
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	1
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	2
96-08-26	HM16	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	7
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	10
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	3
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	4
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	4
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	8
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	12
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	7
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	9
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	5
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	8
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	1
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	2
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	2

96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	0
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	7
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	4
96-08-27	HM22	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	1
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	4
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	4
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	7
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	1
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	1	1
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	2	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	3	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	8	1	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	8	2	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	8	3	6
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	14
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	4
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	9
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	4
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	16
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	1	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	2	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	3	1
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	6
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	16
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	6
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	8
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	7
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	19
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	2
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	7
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	58
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	57
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	51
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	1	0

96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	2	0
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	37	3	1
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	3
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	15
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	10
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	6
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	6
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	2
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	1	1
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	2	5
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	41	3	7
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	10
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	4
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	4
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	11
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	23
96-08-27	HM26	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	12
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	0
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	53
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	64
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	74
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	2
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	2
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	0
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	4
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	6
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	5
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	18
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	24
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	17
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	0
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	0

96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	6
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	5
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	9
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	1
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	0
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	2
96-08-26	G5	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	4
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	5
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	1	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	2	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	3	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	60
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	53
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	33
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	2
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	3
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	15
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	10
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	8
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	27	1	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	27	2	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	27	3	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	36
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	23
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	11
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	3

96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	4
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	7
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	0
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	5
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	7
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	2
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	9
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	1
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	30
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	19
96-08-26	G25	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	9
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	7
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	7
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	6
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	3
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	5
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	1	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	2	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	3	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	1	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	2	1
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	3	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	13
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	4
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	23
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	11	1	4
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	11	2	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	11	3	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	5
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	17
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	8
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	7

96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	1	1
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	2	1
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	3	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	2I	1	3
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	2I	2	1
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	23
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	5
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	31
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	I	5
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	3
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	I	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	1
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	I	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	1
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	1I
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	3
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	I	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	3
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	3
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	0
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	2
96-08-27	G84	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	3
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	7
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	2	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	3	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	I0	1	14
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	47
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	I0

96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	4
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	2	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	17	3	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	2
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	1	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	2	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	3	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	4
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	9
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	7
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	20
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	14
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	11
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	32
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	29
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	23
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	3
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	2
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	2
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	4
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	5
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	2
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	4
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	0

96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	0
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	1
96-08-27	30	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	5
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	4
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	1	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	5	3	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	1	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	9	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	82
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	120
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	52
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	11	1	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	11	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	11	3	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	3
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	8
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	5
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	6
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	1	3
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	20	3	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	13
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	3
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	35

96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	22
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	53
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	17
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	3
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	50
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	9
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	21
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	3
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	10
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	6
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	5
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	1
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	47	1	3
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	47	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	47	3	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	2
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	0
96-08-27	NEW	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	1
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	4
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	1	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	2	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	3	3	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	23
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	59
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	19

96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	3
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	9
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	1	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	2	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	18	3	1
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	6
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	23
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	30
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	9
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	25
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	56
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	1	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	2	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	33	3	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	23
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	14
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	20
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	1	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	2	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	39	3	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	5
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	7
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	1
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	3
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	1
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	1
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	2
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	0
96-08-26	HM12	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	2
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	2
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	0

96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	77
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	44
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	113
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	2
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	1	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	2	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	19	3	1
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	6
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	2
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	3
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	14
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	17
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	24
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	3
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	9
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	5
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	1	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	2	1
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	40	3	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	1	2
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	2	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	42	3	2
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	3
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	3
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	5
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	1	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	2	0
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	44	3	1
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	7
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	4
96-08-26	BC3	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	6
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	1	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	2	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	2	3	1
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	1	6

96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	2	2
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	10	3	10
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	1	5
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	2	5
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	14	3	7
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	1	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	2	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	21	3	2
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	1	3
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	2	3
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	30	3	8
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	1	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	2	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	36	3	2
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	1	9
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	2	6
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	43	3	5
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	1	0
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	2	1
96-08-27	BC6	GRAB	BIOTA	NO-OF-IND	64	COUNT	49	3	0

CHAPTER 3: ANALYTICAL SERVICES (PROJECT IV)

By

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OBJECTIVES

The objectives of the Year 15 study were to characterize trace metal and organic contaminant concentrations in both clams (*Rangia cuneata*) and sediments surrounding HMI (Figure 4-1). Samples have been collected at HMI since 1981 as part of an Exterior Monitoring Program. The current Year 15 sampling effort for Project IV was initiated in concert with this long-term study. Comparison and correlation of these Year 15 data with data from other nearby locations, as well as with historical HMI data, will indicate the extent of contamination and any trend in concentrations at this location.

The results of the quality assurance/quality controll (QA/QC) procedures and the description of the analytical and field protocols are contained in the *Year 15 Data Report*. Overall, the QA/QC results were acceptable for a study of this nature. No evidence of bias or lack of precision or accuracy was indicated by the QA/QC results. Comparisons of duplicate analyses and of measured values to certified values for the analyzed SRMs are also discussed in the *Year 15 Data Report*. The QA/QC objectives for SRMs, duplicates, spikes and blanks were met in this regard.

METHODS AND MATERIALS

Sampling Procedures

Attempts were made to collect *Rangia* samples from the 17 sites visited around HMI using a Ponar grab sampler. Up to six grabs of the sampler were taken at each site to provide enough clams for contaminant analyses. Some sites had no living clams or too few large ones to analyze. Overall, clams were found at 14 of the 17 sites (excluding HM26, S5 and New) and were saved for organic contaminant and trace metal analyses. Clam samples were placed in zip-lock bags and stored on ice until they were returned to the laboratory.

Many clams were taken that were less than 3.5 cm, but most clams selected for analysis were >3.0 cm. One site (S3) had enough clams that a separate comparison of small and large clams was made for organic contaminant analysis (*Year 15 Data Report*). For metals, no distinction with regard to size was made, but the total pooled sample was split to provide a field duplicate. An insufficient sample was available for organic analysis at site BC3, but the clams were analyzed for metals.

Back at the laboratory, the clam samples were cataloged and divided into subsamples for trace metal and organic contaminant analyses. For organic analysis, composite samples of clams from each site were prepared by removing whole fresh clams from their shells with a stainless steel scalpel. Most of the water and body fluids were then allowed to drain. A clean scalpel tip was used for the clams at each site to avoid cross contamination. Tissue was placed in a clean glass jar with a Teflon-lined lid and stored in the freezer. For metals analysis, clams were removed whole from their shells with a Teflon-coated spatula. Most of the water and body fluids were then allowed to drain. The spatula was acid rinsed between samples to avoid cross contamination. The clam bodies were homogenized in a plastic blender with a stainless steel blade. Unused samples were returned to their respective bags and stored in the freezer until further analysis.

Sediment samples were taken at all sites, even when no clams could be found. Sediment samples for metal analysis, however, were not saved initially from all sites and could not be later subsampled because of contamination concerns. Consequently, only 10 sediment samples were analyzed for metals. The sediment sample from site S5 was lost during transit back to the laboratory.. Surficial sediment was collected from each Ponar grab, and a single composite sample from each site was stored in a pre-cleaned glass jar (organic contaminants), or plastic bag (metals), and transported on ice back to the laboratory.

Analytical Procedures for Metals

Methods used for both trace metals and organic contaminant analyses are similar to those described in detail in Dalal et al. (1999). For metals, a subsample of each trace metal sample (sediments and clams) was used for dry weight determination. Weighed samples were placed in a VWR Scientific Forced Air Oven at 60^0C overnight and were then reweighed to calculate a dry/wet ratio. Another subsample of clam tissue (5 g wet weight) was placed in acid-cleaned flasks for further digestion, using USEPA Methods (USEPA Method 1620; Keith 1991) described below.

1. Ten mL of 1:1 HNO_3 was added and the slurry was mixed and covered with a watch glass;

2. The sample was heated to 95^0C and allowed to reflux for 15 minutes without boiling;

3. The samples were cooled, 5 mL of concentrated HNO_3 was added, and the samples were allowed to reflux for another 30 minutes. This step was repeated to ensure complete oxidation;

4. The watch glasses were removed and the resulting solution was allowed to evaporate to 5 mL without boiling;

5. When evaporation was completed and the samples cooled, 2 mL of 30% H_2O_2 was added;

6. The flasks were then covered and returned to the hot plate for warming. The samples were heated until effervescence subsided;

7. A solution of 30% H_2O_2 was continually added in 1 mL aliquots with warming until the effervescence was minimal. No more than a total of 10 mL of H_2O_2 was added to each sample;

8. Lastly, 5 mL of concentrated HCl and 10 mL of deionized water were added and the samples refluxed for 15 minutes; and

9. The samples were then cooled and filtered through Whatman No. 41 filter paper by suction filtration and diluted to 100 mL with deionized water. Sediments were digested in a similar fashion.

The clam and sediment homogenates were then analyzed using a Perkin-Elmer Zeeman 5000 HGA-400 Graphite Furnace Atomic Absorption Spectrophotometer (GF-AAS) for Cu, Cd, Pb, Cr, Ni and silver (Ag) concentrations (USEPA Methods, 7000 Series). Standards were prepared according to the Perkin-Elmer Analytical Methods manual. Spectral interferences associated with Pb were minimized using a $Mg(NO_3)_2$ and PO_4 matrix. Martix modifiers were not needed for Cu and Cd analysis. For enhanced sensitivity, pyrolytically coated graphite tubes with platforms were used. For arsenic (As), samples were analyzed by hydride generation techniques using a PSA analyzer. These techniques are similar to USEPA Method 1632.

Samples tested for mercury [Hg(1-3 g wet weight)] were digested in a solution of 70% sulfuric /30% nitric acid in Teflon vial and heated overnight in an oven at 60^0C (Mason et al. 1995). The digestate was then diluted to 10 mL with distilled-deionized water. Prior to analysis, the samples were further oxidized for 30 minutes with 2 mL of bromine monochloride solution. The excess oxidant was neutralized with 10% hydroxylamine solution and the concentration of mercury in an aliquot of the solution was determined by tin chloride reduction cold vapor atomic fluorescence detection in accordance with protocols outlined in USEPA Method 1631 (Mason et al. 1993).

Analytical Procedures for Organic Contaminants

Whole clams were removed from shells using a stainless steel scalpel and stored in pre-cleaned glass jars with Teflon lined lids. The clams were separated by site and collection date. The clam bodies were homogenized in a stainless steel tissue blender and returned to their respective sample jars. As described below, the clam homogenates were extracted and purified using the methods of Kucklick et al. (1996):

1. A subsample of clam homogenate, 2 g wet weight, is removed and ground with anhydrous sodium sulfate (~50 g). A perdeuterated PAH cocktail (d_8-napthalene, d_{10}-fluorene, d_{10}-fluoranthene, d_{12}-perylene) and a noncommercial PCB solution (IUPAC #'s 14, 65, 166) are added as surrogates to each sample to track extraction efficiency;

2. The mixture is then extracted in a Soxhlet apparatus with 250 mL of dichloromethane (DCM) for 24 hours;

3. The extracts are then concentrated to 10 mL using a vacuum rotary evaporator;

4. Each sample is transferred to graduated centrifuge tubes and concentrated to 6 mL under a gentle stream of nitrogen;

5. Gravimetric lipid analysis is performed on each sample (Kucklick et al. 1996);

6. Lipids are then removed through gel permeation chromatography, eluting DCM through Phenogel 50 x 7.8 mm guard, 250 x 22.5 mm Phenogel 10 ul 100 A, and 250 x 21.5 mm Phenogel 10 ul 100 A columns, in series, respectively. Samples are again concentrated in similar fashion as above, then solvent exchanged to hexane.

7. The extracts are then eluted with 35 mL petroleum ether over deactivated Alumina [6% (w/w) water];

8. After concentrating, the extracts are spiked with a perdeuterated PAH mixture (d_{10}-acenapthene, d_{10}-phenanthrene, d_{12}-benz[*a*]anthracene, d_{12}-benzo[*a*]pyrene, d_{12}-benzo[*g,h,I*]perylene) for quantification of PAHs;

9. The samples are then analyzed using a Hewlett Packard 5890 gas chromatograph (GC) with a HP-5MS (cross linked 5% phenyl methyl siloxane) capillary column (30m x 0.25mm x 0.25um film thickness) and an HP-5972 series mass spectrometer (MS) for PAHs (Ko and Baker, 1995);

10. Each sample is separated after GC/MS analysis into two fractions with 35 mL of petroleum ether and 50 mL of DCM/PET (1:1), respectively, over 8 g of deactivated Florisil (2% (w/w) water, Kucklick *et al.*1996); and

11. The first fraction (F-1) contains PCBs and 1-100%, by weight of the less polar organochlorine pesticides [heptachlor (100%), 4,4-DDT (40%), 4,4-DDE (100%), t-nonachlor (24%), heptachlor (1%), 4,4-DDT(44%)]. The second fraction, (F-2), contains 56-100% of the more polar organochlorine pesticides [a-HCH (100%), g-HCH (100%), c-chlordane (100%), t-chlordane (100%), t-nonachlor (76%), heptachlor (99%), heptachlor epoxide (100%), dieldrin (100%), 4,4-DDD (100%), 4,4-DDT (56%)]. Both fractions are solvent exchanged to hexane and concentrated to approximately 1 mL.

PCBs and remaining organochlorine pesticides (OCs) are analyzed by GC using a J&W Scientific DB-5 capillary column (60m x 0.32mm x 0.25um film thickness) coupled with an electron capture detector (ECD). PCBs are quantified on an individual congener basis following Mullins et al. (1985), using noncommercial PCB congeners (IUPAC#'s 30 and 204 added to each extract after purification) as internal standards. OCs are also quantified using PCB congeners 30 and 204 in both Florisil fractions.

Quality Assurance/Quality Control

1. Metals

For the samples processed, two blanks were carried throughout the entire sample preparation and analytical process for both metals and mercury. One field replicate was taken and two lab duplicates (sample splits) were prepared to measure reproducibility of replicate samples. The lab replicate consisted of a split homogenized sample that was digested and then analyzed separately. Digestates were often analyzed twice, in addition to the replicates described above. Reported values are the average if duplicate analyses were performed. Figure 4-2 shows a plot of the results of duplicate analyses (i.e., the field and lab replicates) for all metals analyzed. Overall, duplicate agreement is excellent ($r^2 = 0.973$) and the slope is very close to one, indicating there is no bias.

Laboratory measured values were compared to certified values for target metals in standard reference materials (SRM) 1566a oyster tissue and in a sediment SRM 1646a (Figure 4-3). Overall, our measured values agree with the SRM certified values for both sediment and tissue. For Pb, our value for the oyster tissue was slightly higher than the SRM, while the opposite was true for the sediment SRM. Lead measurements overall had the highest variability [this metal is considered to be the most difficult to measure by Atomic Absorbtion (AA)]. The analysis of Pb by other available techniques (e.g. ICP-ES) is less sensitive. The only reasonable alternative method is ICP-MS, which is currently unavailable. The Cr value was somewhat higher for the tissue SRM, while the agreement for all the other metals was excellent. For the sediment SRM, agreement was not as good as for the tissue SRM and our values are more often lower than the SRM accepted value. One possibility for the differences between our values, especially for the low concentration elements such as Pb, Cr and Cd is that the blanks associated with our methods are significantly lower than those typically associated with these type of measurements, leading to a better and slightly lower estimate for the SRM value. As discussed above, measurements using ICP-ES are less sensitive. Additionally, by preparing samples in an environment designed for trace metal analysis, blank values are less that those reported in the previous HMI project reports due to the decreased background contamination of samples. The importance of a "clean" working environment, even for tissue and sediment sample preparation, has been only recently appreciated and many pre-1990 samples therefore are likely compromised by high blank values. The data in Figure 4-3 tend to support this assertion.

2. Organic Contaminants

Method detection limits were calculated from the minimum quantity detectable either by the analytical instrumentation or by the quantity significantly greater than analyte masses in field blanks. Instrument detection limits were calculated as the mass of each analyte required to generate a signal three times greater than the background noise. Blank-based detection limits were calculated as three times the mass of analyte detected in the field matrix blank. Therefore, the overall method limit is determined either by the sensitivity of the instrument's detector or by the cleanliness of the sampling and analytical procedure. In this report, we present only those concentrations of target organic analytes that exceed the method detection limit.

Method precision for organic contaminant analysis is determined by quantification of target analytes in the NIST SRMs. Recently, we verified the methods used in this study by analyzing NIST SRM 1974a (Mussel Tissue). As shown in Figure 4-4, our results agree well with certified values for organochlorine pesticides and PAHs. Several of the PCB congeners in our analysis are lower than the certified values, which is likely due both to losses during sample processing and to systematic differences between PCB congener standards. These results suggest that the PCB congener data presented here are conservative, especially for the lower molecular weight congeners, because the results were not corrected for surrogate recoveries. Additionally, NIST reports each analyte separately, where some analytes and PCB congeners coelute in our methods, accounting for some discrepancy between our lab and NIST SRM numbers.

Overall method efficiency of each sample is assessed by adding surrogate PAHs and PCB congeners to the samples prior to extraction. A suite of surrogate compounds with different volatilities allows us to assess the overall method efficiency for each class of analytes. In this study, recoveries of all surrogates were low in *Rangia* samples S3, S6, and HM-12. PCB surrogate recoveries were also low in *Rangia* samples S2 and G-84. Reported concentrations in these samples are likely underestimated by no more than a factor of two. Recoveries of d_{10}-fluorene, d_{10}-fluoranthene, and d_{12}-perylene averaged 68, 73, and 75% from the sediment samples. The procedure did not quantitatively recover the more volatile analyte naphthalene (43% recovery) and reported concentrations of this analyte are qualitative.

RESULTS AND DISCUSSION

The concentrations of each metal at the sampling sites are gathered in Table 4-1 for the clams and in Table 4-2 for the sediments. The comparable data for organics are given in Tables 4-3 and 4-4. The data quality is discussed above. Interpretation of the data is contained in the corresponding *Year 15 Technical Report*. It should be noted that there is overlap between Projects II and IV to the extent that some stations were sampled by both groups and the sediments analyzed for a similar suite of metals. These stations and their identities under the different projects are as follows:

Project IV	Project II
HM12	25
HM16	19
HM22	22
HM26	23
G5	5
G25	7
G84	309

Because of the way the data for sediment metals is presented in Project II it is not simple to compare the results of the two groups. Additionally, even though samples were collected at the same sites there is likely to be variability on the small spatial scale and thus only properly normalized data should be compared. This could be done but is not part of the current Project IV design. The analysis of sediments collected in conjunction with the clams is to enable direct comparison between the clam tissue content and that of its associated sediment, and not to specifically compare results between Projects II and IV.

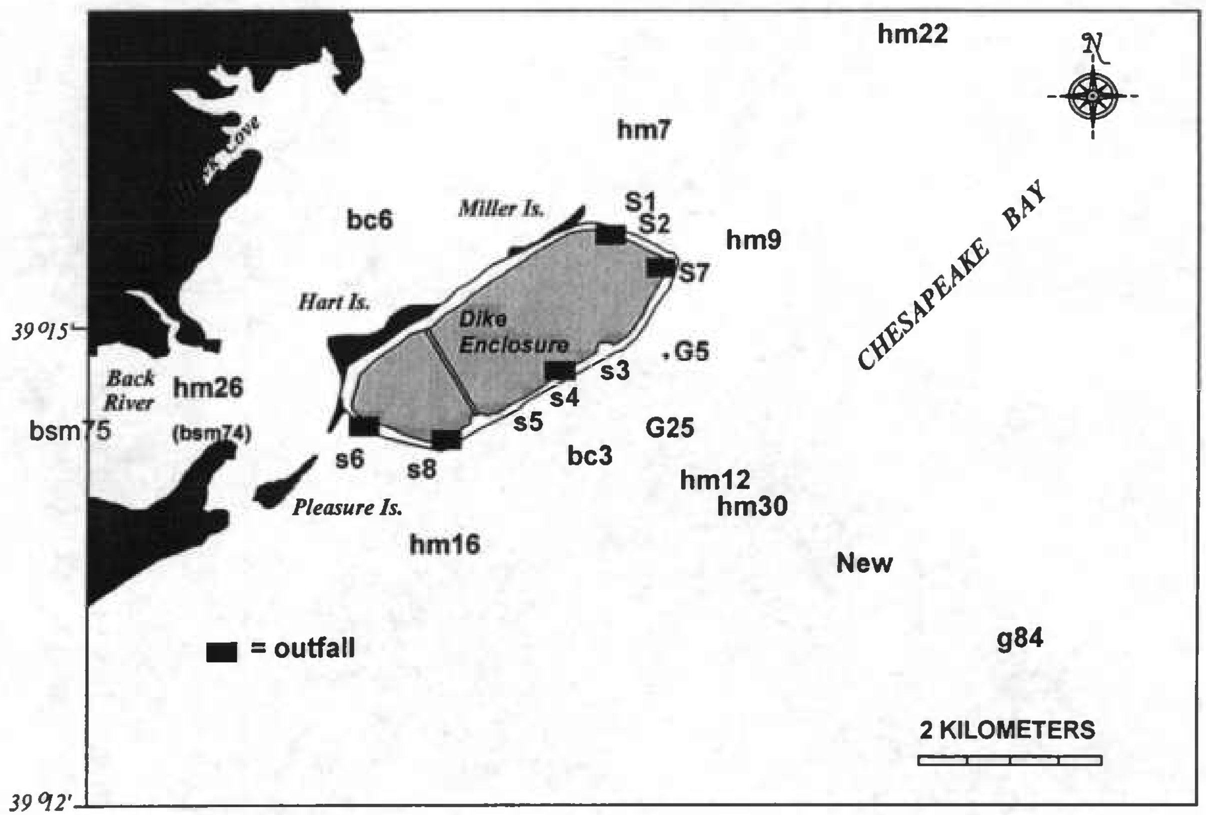

Figure 4-1: Tissue sampling stations at HMI for Year 15.

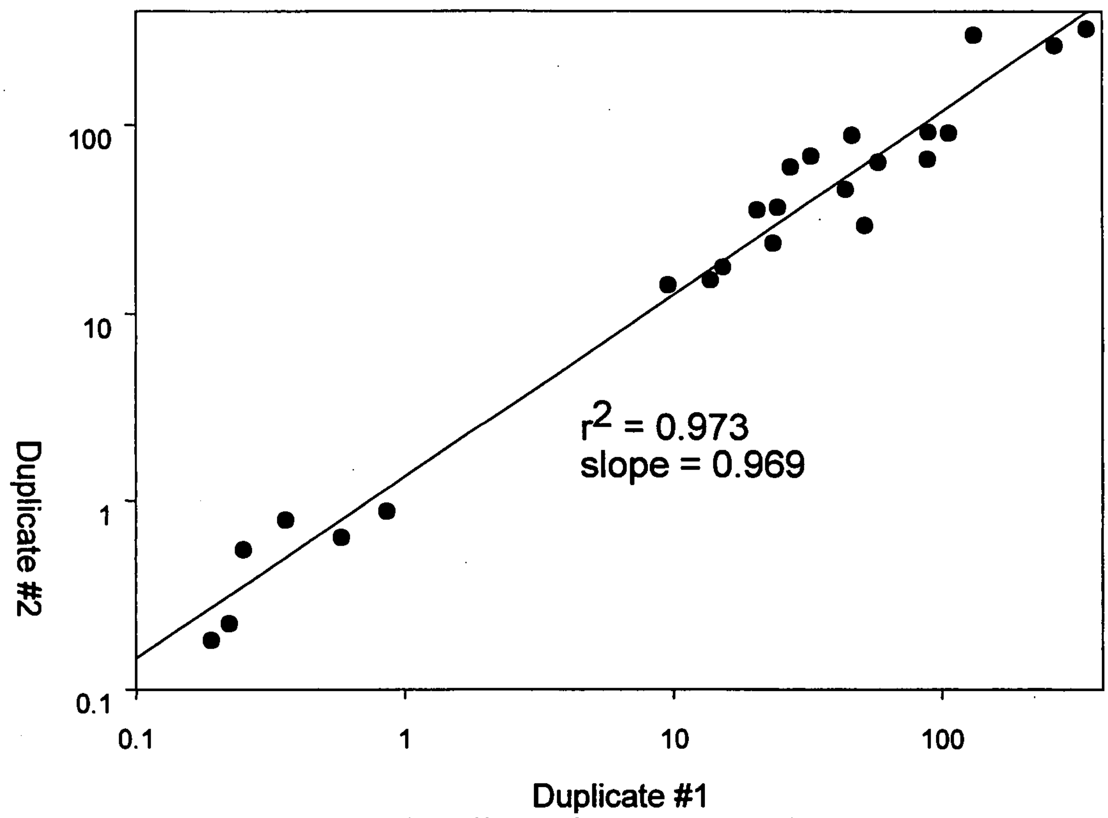

Figure 4-2: Plot of duplicates from analyses of clams from the HMI region for all metals.

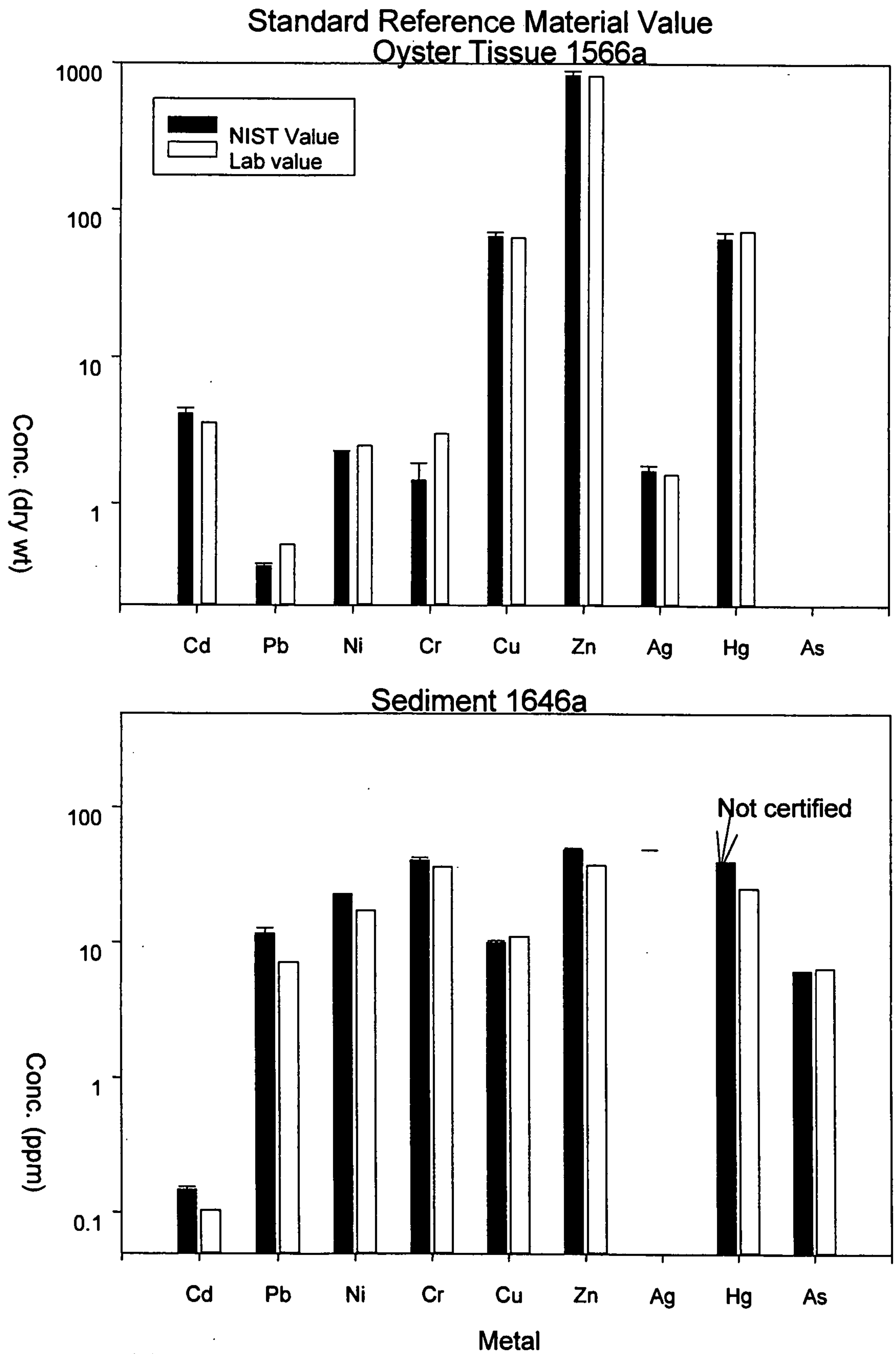

Figure 4-3: Comparison of determined values for metals in standard reference materials compared to certified values.

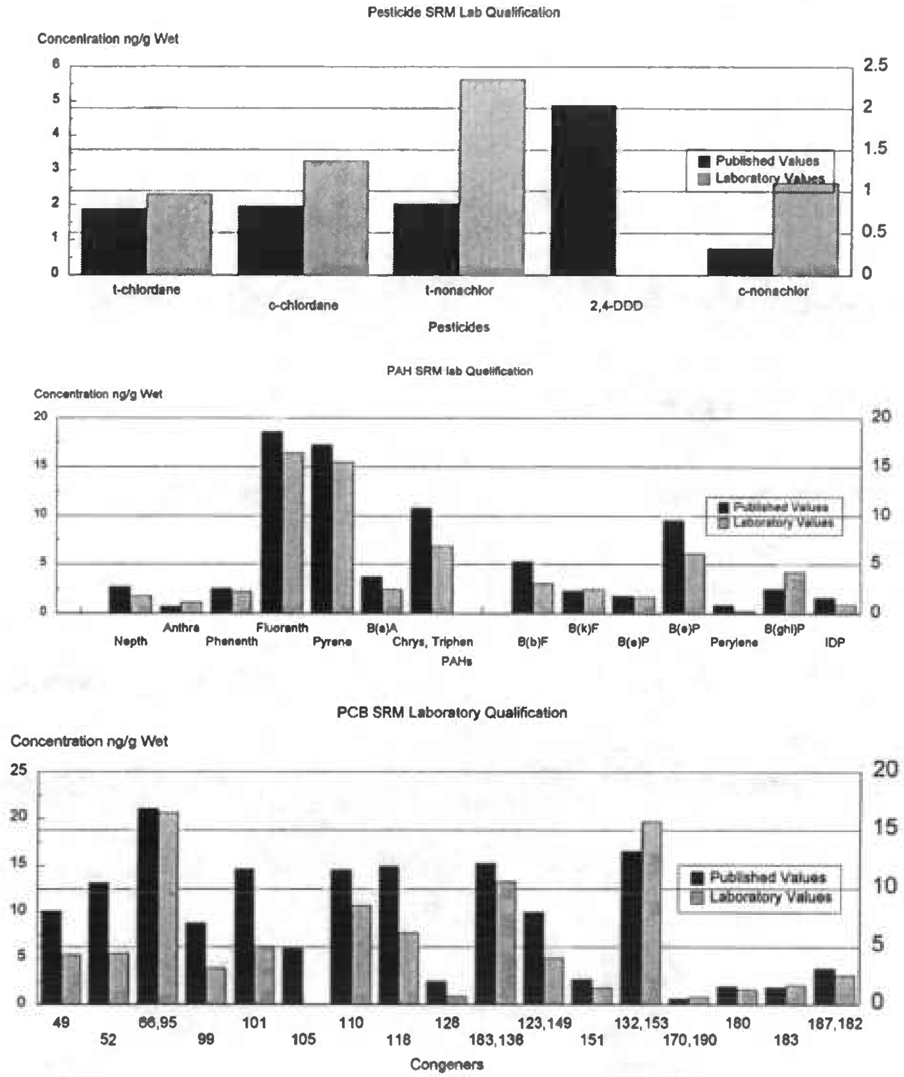

Figure 4-4: Measured organic contaminant concentrations in standard reference material 1974M compared to certified values.

Table 4-1: Metals in Hart-Miller Island Clams - Summer 1996

All metal concentrations reported in ug/g dry weight, except Hg which is in ng/g dry weight.

Sample#	Site	Cd conc	Pb conc	Ni conc	Cr conc	Cu conc	Zn conc	Ag conc	As conc	Hg conc
1	Site 30	0.74	1.56	15.06	1.47	15.82	114.54	2.46	2.04	30.63
2	G-25	0.61	0.65	17.49	1.14	16.47	103.29	3.22	1.32	16.34
3	BC-6	0.83	0.70	20.90	1.11	22.46	140.18	1.95	1.56	27.91
4	G-5	0.50	0.59	26.03	1.03	17.97	134.87	2.80	1.45	24.34
5	HM-7	1.11	1.24	22.99	1.67	19.17	146.36	6.30	2.10	65.50
6	HM-22	1.03	1.06	17.19	1.27	15.39	170.82	0.74	1.76	39.46
7	HM-9	0.69	0.82	19.08	1.10	15.99	113.95	3.12	1.86	24.72
8	HM-12	0.68	0.84	21.78	1.30	16.78	121.88	5.65	1.90	20.85
9	HM-16	0.95	1.08	15.09	1.35	15.13	125.79	2.33	1.02	24.83
10	G-84	0.66	1.04	19.25	1.26	14.93	106.37	2.66	0.84	21.10
11	G-84 lab duplic.	0.71	1.17	18.45	1.40	15.48	116.40	2.54	0.97	12.10
12	S-2	0.82	0.62	18.97	1.52	15.89	109.53	3.97	1.25	15.92
13	BC-3	0.63	0.38	30.13	1.28	15.83	134.06	5.86	0.88	41.76
14	S-6	0.86	0.88	29.52	1.47	16.31	195.06	0.73	0.50	54.01
15	S-3	0.63	1.03	14.55	1.32	17.90	137.24	1.16	1.35	28.66
16	S-3 field duplic.	0.64	1.04	23.17	1.36	14.25	208.06	0.32	0.85	42.38
17	Blank	0.01	0.02	0.04	0.01	0.00	0.85	0.00	0.00	
	SRM 1566a: Oyst	3.55	0.52	2.49	2.99	64.59	818.09	1.58	5.27	72.17
	NIST val	**4.15±0.38**	**.371±.014**	**2.25±.044**	**1.43±0.46**	**66.3±4.3**	**830±57**	**1.68±0.15**		**64.2±6.7**

Table 4-2: Hart-Miller Island Sediment- Total Metal Concentrations - Summer 1996

All concentrations reported in ug/g dry weight, except Hg is in ng/g.

Sample #	Site	Cd conc	Pb conc	Ni conc	Cr conc	Cu conc	Zn conc	Ag conc	As conc	Hg conc
1	Site 30	0.635	46.71	80.2	53.32	46.39	288.03	0.751	25.90	151.20
2	New	0.356	36.35	74.28	40.27	16.32	219.82	0.505	17.52	141.29
3	BC 6	0.249	27.45	46.55	32.87	20.63	133.01	0.359	5.63	89.13
4	BC 6 field dup.	0.548	58.54	88.05	68.5	35.26	298.88	0.795	14.51	65.96
5	HM 7	0.559	47.35	67.68	60.71	38.99	257.42	0.624	20.28	180.82
6	HM 22	0.512	46.4	97.67	55.22	44.26	261.66	0.648	21.95	175.65
7	HM 9	0.19	13.77	23.65	15.35	9.6	107.17	0.221	4.63	89.69
8	HM 9 lab dup.	0.18	15.04	23.75	17.7	14.14	90.92	0.221	4.99	91.66
9	HM 26	0.566	34.69	32.38	29.02	20.52	154.76	0.639	7.07	173.80
10	G 84	0.578	43.91	58.25	24.59	51.82	266.98	0.854	21.04	352.29
11	G 84 lab dup.	0.634	45.44	63.51	36.45	29.5	263.21	0.876	19.00	321.18
12	S 2	0.255	18.59	24.63	16.09	15.09	112.63	0.248	5.37	57.05
13	S 3	0.205	16.3	19.15	13.99	14.89	86.47	0.21	5.16	146.15
14	Blank	0.001	0.028	0.07	0.14	0.98	3.4	0.005	0.00	
15	SRM 1646a	0.104	7.19	17.3	36.46	11.08	37.6	0.048	7.08	25.30
	NIST value	**.148±.007**	**11.7±1.2**	**23**	**40.9±1.9**	**10.01±.34**	**48.9±1.6**	**None**	**6.23±0.21**	**40***

* not certified

Table 4-3: Polycyclic Aromatic Hydrocarbons (PAH) - Rangia Concentrations (ng/g wet weight)

sample name		bc6		g25		g84		hm07		hm09		hm12	
tissue wet weights (g)		5.67		5.24		4.99		5.58		5.15		4.99	
corrected w/w after subsample		5.22		4.82		4.59		5.13		4.74		4.59	
% lipid		1.60		1.00		1.00		1.60		1.00		0.80	
g of lipid extracted		0.08		0.05		0.05		0.08		0.05		0.04	
ND' = sample mass < 3 * blank													
Instrumental Detection Limit (IDL) = Area Count < 20													
Polycyclic Aromatic Hydrocarb		ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL
Napthalene	128	5.25	0.04	5.41	0.06	3.81	0.06	0.82	0.04	5.02	0.06	5.07	0.06
Azulene	128	ND	0.42	ND	0.06	ND	0.07	ND	0.43	0.92	0.06	ND	0.07
2MeNapthalene	142	10.35	0.72	2.37	0.09	1.69	0.09	2.33	0.73	8.43	0.09	2.36	0.09
1MeNapthalene	142	1.95	0.08	0.89	0.06	0.68	0.06	0.69	0.09	1.65	0.06	0.88	0.06
Acenapthylene	152	2.63	0.05	0.65	0.08	1.06	0.08	2.03	0.05	1.05	0.08	12.20	0.08
Biphenyl	154	2.63	0.12	0.69	0.05	0.60	0.06	2.13	0.12	1.19	0.06	0.82	0.06
Acenapthene	154	1.48	0.12	0.33	0.10	0.47	0.10	3.68	0.13	1.95	0.10	0.53	0.10
Fluorene	166	1.48	0.17	0.28	0.07	0.27	0.08	ND	0.18	0.79	0.08	ND	0.08
Phenanthrene	178	2.07	0.07	0.49	0.03	0.63	0.03	3.89	0.07	3.10	0.03	0.67	0.03
Anthracene	178	5.21	0.15	0.86	0.17	1.50	0.18	3.16	0.15	2.47	0.18	1.04	0.18
1MeFluorene	180	2.43	0.89	0.34	0.45	0.63	0.47	ND	0.90	ND	0.46	ND	0.47
4,5-Methylenephenanthrene	190	1.54	0.12	0.27	0.17	0.62	0.18	1.17	0.12	0.85	0.17	0.59	0.18
2Mephenanthrene	192	2.79	0.31	0.46	0.18	9.91	0.19	2.51	0.31	2.29	0.18	18.85	0.19
2Meanthracene	192	0.50	0.12	ND	0.29	0.67	0.30	ND	0.12	ND	0.29	ND	0.30
1Meantracene	192	0.55	0.15	0.19	0.08	0.31	0.08	2.44	0.16	0.82	0.08	ND	0.08
1Mephenanthrene	192	1.00	0.20	ND	0.20	ND	0.20	0.59	0.21	ND	0.20	ND	0.20
9Meanthracene	192	0.71	0.37	ND	0.37	ND	0.37	2.09	0.38	0.96	0.37	ND	0.37
Fluoranthene	202	7.07	0.08	2.62	0.09	3.77	0.09	4.01	0.08	4.91	0.09	3.54	0.09
Pyrene	202	8.39	0.08	2.56	0.09	3.38	0.09	4.04	0.08	5.07	0.09	3.31	0.09
3,6-Dimethylphenanthrene	206	0.57	0.15	0.09	0.15	0.21	0.16	0.31	0.15	0.25	0.15	0.19	0.16
9,10-Dimethylanthracene	206	ND	0.38	ND	0.51	ND	0.53	1.86	0.38	ND	0.52	1.07	0.53
Benzo[a]fluorene	216	0.59	0.13	ND	0.15	0.52	0.16	0.28	0.13	0.81	0.15	0.51	0.16
Benzo[b]fluorene	216	0.98	0.25	0.19	0.37	0.39	0.39	0.44	0.26	0.37	0.37	0.37	0.39
Benz[a]anthracene	228	1.96	0.20	0.41	0.19	0.95	0.20	0.80	0.20	1.12	0.19	0.99	0.20
Chrysene	228	1.49	0.03	0.50	0.02	0.69	0.03	0.87	0.03	1.27	0.02	0.54	0.03
Triphenylene	228	1.43	0.02	0.48	0.02	0.66	0.02	0.84	0.02	1.22	0.02	0.68	0.02
Napthacene	228	0.27	0.25	ND	1.52	ND	1.60	ND	0.26	ND	1.55	ND	1.60
Benzo[b]fluoranthene	252	2.72	0.23	1.15	0.19	0.88	0.20	1.12	0.24	1.43	0.20	0.88	0.20
Benzo[k]fluoranthene	252	ND	0.12	0.60	0.16	0.38	0.17	ND	0.12	0.50	0.17	0.35	0.17
Benzo[e]pyrene	252	2.71	0.13	ND	0.11	0.71	0.11	0.97	0.14	0.81	0.11	0.73	0.11
Benzo[a]pyrene	252	2.41	0.32	ND	0.35	0.52	0.37	0.90	0.32	0.74	0.36	0.83	0.37
perylene	252	5.72	0.09	1.53	0.18	1.86	0.19	1.93	0.09	0.95	0.19	1.62	0.19
Dimethylbenz[a]anthracene	256	ND	0.90	ND	1.26	ND	1.33	ND	0.91	ND	1.29	ND	1.33
3-Methylcholanthrene	268	ND	0.98	ND	2.24	ND	2.36	ND	1.00	ND	2.28	ND	2.36
Indeno[1,2,3-c,d]perylene	276	1.83	0.45	ND	0.43	ND	0.45	0.53	0.45	ND	0.44	ND	0.45
Benzo[g,h,i]perylene	276	1.97	0.25	ND	0.18	0.53	0.19	ND	0.25	ND	0.19	0.53	0.19
Anthanthrene	276	ND	0.25	ND	0.72	ND	0.76	ND	0.26	ND	0.73	ND	0.76
Dibenz[ah]anthracene	278	0.10	0.07	ND	0.06	ND	0.07	ND	0.07	ND	0.06	ND	0.07
Dibenz[ac]anthracene	278	0.06	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02
Pentacene	278	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00
Coronene	300	ND	0.38	ND	0.76	ND	0.80	ND	0.39	ND	0.77	ND	0.80
Retene	234	ND	101.89	ND	100.92	ND	105.97	ND	101.89	ND	102.68	ND	105.97
Total [PAH] (ng/g)		**82.87**		**23.37**		**38.30**		**46.42**		**50.94**		**59.16**	
Percent Surrogate Recoveries													
d8 napthalene		37.21		26.69		24.48		17.99		24.59		28.06	
d10 fluorene		74.18		126.22		86.52		85.46		103.27		79.12	
d10 Fluoranthene		64.18		57.99		41.26		71.83		47.97		29.90	
d12 Perylene		58.53		86.55		57.74		63.22		72.21		43.87	

sample name	hm16		hm22		hm30		g05		s2		s3		s3sml		s6	
tissue wet weights (g)	5.83		5.56		6.13		5.28		5.19		4.85		5.26		4.70	
corrected w/w after subsample	5.36		5.12		5.64		4.86		4.77		4.46		4.84		4.32	
% lipid	1.10		1.30		1.40		1.10		1.20		1.00		0.90		1.00	
g of lipid extracted	0.06		0.07		0.08		0.05		0.06		0.04		0.04		0.04	
Polycyclic Aromatic Hydrocarb	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL
Napthalene	3.34	0.04	ND	0.04	4.07	0.04	3.08	0.05	2.24	0.06	4.60	0.07	ND	0.06	ND	0.07
Azulene	ND	0.41	ND	0.43	ND	0.39	0.59	0.45	0.43	0.06	ND	0.07	ND	0.06	ND	0.07
2MeNapthalene	1.65	0.70	ND	0.73	1.61	0.66	4.64	0.77	6.86	0.09	2.06	0.09	ND	0.09	ND	0.10
1MeNapthalene	0.58	0.08	ND	0.09	0.59	0.08	0.84	0.09	1.42	0.06	0.76	0.07	ND	0.06	ND	0.07
Acenapthylene	0.35	0.05	ND	0.05	ND	0.05	ND	0.05	1.73	0.08	1.01	0.08	ND	0.08	ND	0.08
Biphenyl	0.62	0.11	ND	0.12	0.65	0.11	1.43	0.13	2.15	0.05	0.64	0.06	ND	0.05	ND	0.06
Acenapthene	0.21	0.12	ND	0.13	0.33	0.11	0.48	0.13	1.49	0.10	0.36	0.10	ND	0.10	ND	0.11
Fluorene	0.17	0.17	ND	0.18	0.27	0.16	0.52	0.19	1.30	0.08	0.30	0.08	ND	0.07	ND	0.08
Phenanthrene	0.29	0.07	ND	0.07	0.62	0.06	2.31	0.07	3.68	0.03	0.68	0.03	ND	0.03	ND	0.03
Anthracene	0.52	0.15	ND	0.16	1.00	0.14	5.16	0.16	3.76	0.18	1.21	0.19	ND	0.17	ND	0.20
1MeFluorene	0.25	0.86	ND	0.90	ND	0.82	ND	0.95	6.08	0.45	0.38	0.49	ND	0.45	7.01	0.50
4,5-Methylenephenanthrene	0.20	0.12	ND	0.12	0.50	0.11	7.24	0.13	0.88	0.17	0.45	0.18	ND	0.17	0.94	0.19
2Mephenanthrene	0.29	0.30	ND	0.31	11.01	0.29	13.12	0.33	2.87	0.18	0.67	0.20	ND	0.18	1.21	0.20
2Meanthracene	ND	0.11	ND	0.12	0.87	0.11	1.30	0.12	0.28	0.29	0.21	0.31	ND	0.28	ND	0.32
1Meantracene	0.12	0.15	ND	0.16	0.51	0.14	1.54	0.16	1.08	0.08	0.34	0.09	ND	0.08	1.19	0.09
1Mephenanthrene	ND	0.20	ND	0.21	ND	0.19	2.84	0.22	1.27	0.20	ND	0.20	ND	0.20	ND	0.20
9Meanthracene	ND	0.36	ND	0.38	ND	0.34	14.43	0.40	0.71	0.37	ND	0.37	ND	0.37	ND	0.37
Fluoranthene	1.78	0.07	ND	0.08	3.66	0.07	6.18	0.08	5.01	0.09	4.65	0.09	ND	0.09	ND	0.10
Pyrene	1.71	0.08	ND	0.08	3.36	0.08	7.31	0.09	5.13	0.09	4.86	0.10	ND	0.09	ND	0.10
3,6-Dimethylphenanthrene	ND	0.14	ND	0.15	0.18	0.13	0.31	0.16	0.41	0.15	0.15	0.16	ND	0.15	ND	0.16
9,10-Dimethylanthracene	ND	0.37	ND	0.39	1.07	0.35	0.41	0.41	ND	0.51	1.03	0.55	ND	0.51	ND	0.57
Benzo[a]fluorene	ND	0.13	ND	0.13	0.57	0.12	1.63	0.14	0.94	0.15	0.76	0.16	ND	0.15	ND	0.17
Benzo[b]fluorene	ND	0.25	ND	0.26	0.39	0.23	1.33	0.27	0.57	0.37	0.45	0.40	ND	0.37	ND	0.41
Benz[a]anthracene	0.49	0.20	ND	0.21	1.02	0.19	2.10	0.22	1.25	0.19	1.74	0.21	ND	0.19	ND	0.21
Chrysene	0.37	0.02	ND	0.03	0.68	0.02	1.35	0.03	1.22	0.02	1.04	0.03	ND	0.02	ND	0.03
Triphenylene	0.36	0.02	ND	0.02	0.65	0.02	1.30	0.03	1.16	0.02	1.00	0.02	ND	0.02	ND	0.02
Napthacene	ND	0.25	ND	0.26	ND	0.23	ND	0.27	ND	1.53	ND	1.64	ND	1.51	ND	1.69
Benzo[b]fluoranthene	0.36	0.23	ND	0.24	1.00	0.22	ND	0.25	1.71	0.19	1.47	0.21	ND	0.19	ND	0.21
Benzo[k]fluoranthene	ND	0.12	ND	0.12	ND	0.11	ND	0.13	0.93	0.17	ND	0.18	ND	0.16	ND	0.18
Benzo[e]pyrene	0.21	0.13	ND	0.14	0.80	0.12	2.00	0.14	1.65	0.11	1.24	0.12	ND	0.11	0.81	0.12
Benzo[a]pyrene	ND	0.31	ND	0.32	0.93	0.29	2.26	0.34	1.35	0.36	1.44	0.38	ND	0.35	ND	0.39
perylene	ND	0.09	ND	0.09	1.54	0.09	2.70	0.10	2.26	0.19	2.94	0.20	ND	0.18	ND	0.21
Dimethylbenz[a]anthracene	ND	0.87	ND	0.92	ND	0.83	ND	0.96	ND	1.28	ND	1.37	ND	1.26	ND	1.41
3-Methylcholanthrene	ND	0.96	ND	1.00	ND	0.91	0.44	1.06	ND	2.27	ND	2.43	ND	2.24	ND	2.50
Indeno[1,2,3-c,d]perylene	ND	0.43	ND	0.46	ND	0.41	ND	0.48	1.19	0.44	ND	0.47	ND	0.43	ND	0.48
Benzo[g,h,i]perylene	ND	0.24	ND	0.25	0.62	0.23	ND	0.27	0.37	0.18	0.70	0.20	ND	0.18	0.48	0.20
Anthanthrene	ND	0.25	ND	0.26	ND	0.23	ND	0.27	ND	0.73	ND	0.78	ND	0.72	ND	0.80
Dibenz[ah]anthracene	ND	0.06	ND	0.07	ND	0.06	ND	0.07	ND	0.06	ND	0.07	ND	0.06	ND	0.07
Dibenz[ac]anthracene	ND	0.02	ND	0.02	ND	0.02	ND	0.03	ND	0.02	ND	0.03	ND	0.02	ND	0.03
Pentacene	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00
Coronene	ND	0.37	ND	0.39	ND	0.35	ND	0.41	ND	0.77	ND	0.82	ND	0.76	ND	0.85
Retene	ND	101.89	ND	101.89	ND	101.89	ND	101.89	ND	101.89	ND	109.03	ND	100.53	ND	112.51
Total [PAH] (ng/g)	**13.85**		**0**		**38.50**		**88.86**		**63.35**		**37.16**		**0.00**		**11.63**	
Percent Surrogate Recoveries																
d8 napthalene	30.93		0.815		50.55		45.37		24.64		24.20		24.09		22.54	
d10 fluorene	91.27		70.412		100.67		89.94		90.39		91.26		96.84		64.41	
d10 Fluoranthene	67.45		68.292		76.34		77.92		46.49		36.42		47.12		22.98	
d12 Perylene	73.78		53.414		78.78		47.60		71.83		35.96		70.36		31.62	

IDL < 10: ND = not detected or < 3 blank (ng), NQ = < IDL

Table 4-4: PCB Congeners - Rangia Concentrations (ng/g wet weight)

sample name	bc6		g25		g84		hm07		hm09		hm12		hm16		hm22		hm30		g05		s2		s3		s3sml		s6	
congener	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL
1	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	0.95	0.005	1.37	0.006	ND	NQ	1.87	0.006
3	ND	NQ			ND	0.020	ND	0.017	ND	0.018	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	0.018	ND	NQ	ND	0.018	ND	0.020
4,10	ND	NQ			ND	NQ	ND	NQ	0.10	NQ	ND	NQ	0.09	0.000	ND	NQ	ND	0.000	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
7,9	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
6	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	0.08	0.001	ND	NQ	ND	NQ	ND	NQ	ND	NQ
8,5	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
19	ND	NQ			ND	NQ	ND	NQ	ND	0.000	ND	NQ	ND	NQ	ND	NQ	0.04	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
12,13	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
18	ND	NQ			ND	0.001	ND	0.001	ND	0.001	ND	NQ	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
17	ND	NQ			ND	NQ	ND	0.000	0.03	NQ	0.03	NQ	0.02	0.000	0.02	0.000	ND	0.000	0.17	0.000	ND	NQ	ND	NQ	ND	NQ	ND	NQ
24+27	ND	NQ			ND	NQ	ND	0.000	ND	NQ	ND	NQ	ND	NQ	0.02	NQ	ND	NQ	ND	NQ	0.01	0.000	ND	NQ	ND	NQ	ND	NQ
16+32	ND	NQ			ND	NQ	ND	0.001	ND	NQ	ND	NQ	0.04	NQ	0.07	NQ	ND	0.001	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
29	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
26	ND	NQ			ND	NQ	ND	NQ	0.01	NQ	ND	NQ	0.05	0.001	ND	NQ	ND	0.001	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
25	0.33	0.001			0.32	0.001	0.20	0.001	0.66	0.001	0.71	0.001	0.87	0.001	0.88	0.001	0.45	0.001	0.37	0.001	0.26	0.001	0.59	0.001	0.20	0.001	0.34	0.001
31+28	0.01	0.001			ND	NQ	ND	0.001	0.08	NQ	0.09	NQ	0.10	0.000	0.27	0.001	ND	0.000	ND	NQ	ND	NQ	0.26	0.001	ND	NQ	ND	NQ
21+33+53	0.19	0.001			0.24	0.001	0.12	0.001	0.50	0.001	0.56	0.001	0.55	0.001	0.63	0.001	0.30	0.001	0.44	0.001	0.14	0.001	0.78	0.001	0.15	0.001	0.17	0.001
51	ND	NQ			ND	NQ	ND	NQ	ND	0.000	ND	NQ	ND	NQ	ND	NQ	0.05	NQ	ND	NQ	0.00	NQ	ND	NQ	ND	NQ	ND	NQ
22	ND	NQ			ND	NQ	ND	0.001	0.24	NQ	0.11	NQ	0.26	0.001	0.48	0.001	0.00	0.001	ND	NQ	0.04	0.001	ND	NQ	ND	NQ	ND	NQ
45	ND	NQ			ND	NQ	ND	NQ	0.03	0.000	0.21	NQ	0.09	0.000	ND	0.000	0.03	0.000	0.19	0.000	0.01	0.000	ND	NQ	ND	NQ	ND	NQ
46	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	0.01	NQ	ND	NQ	ND	0.000	ND	NQ	ND	NQ	0.20	0.000	ND	NQ	ND	NQ
52+43	0.19	0.001			0.14	0.001	0.07	0.001	0.40	0.001	0.17	0.001	0.44	0.001	0.53	0.001	0.21	0.001	0.25	0.001	0.10	0.001	0.27	0.001	0.17	0.001	0.14	0.001
49	0.17	0.000			0.10	0.001	0.06	0.000	0.30	0.001	0.13	0.001	0.33	0.000	0.32	0.000	0.13	0.000	0.09	0.001	0.06	0.001	0.15	0.001	0.12	0.001	0.10	0.001
47+48	0.14	0.000			0.05	0.000	0.04	0.000	0.21	0.000	0.15	0.000	0.29	0.000	0.25	0.000	0.12	0.000	0.09	0.000	0.04	0.000	0.10	0.000	0.07	0.000	0.06	0.000
44	0.32	0.001			0.14	0.001	0.16	0.001	0.50	0.001	0.28	0.001	0.46	0.001	0.71	0.001	0.80	0.001	0.36	0.001	0.23	0.001	0.19	0.001	0.21	0.001	0.15	0.001
37+42	0.05	0.000			ND	NQ	ND	0.000	0.09	0.000	0.02	NQ	0.14	0.000	0.29	0.000	0.38	0.000	0.12	0.000	0.03	0.000	0.00	NQ	0.05	0.000	0.00	NQ
41+71+64	0.10	0.000			0.08	0.000	0.06	0.000	0.15	0.000	0.14	0.000	0.25	0.000	0.37	0.000	0.24	0.000	0.09	0.000	0.04	0.000	0.05	0.000	0.06	0.000	0.06	0.000
40	ND	NQ			ND	NQ	ND	0.001	0.03	NQ	ND	NQ	ND	0.000	0.21	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
100	ND	NQ			0.06	0.001	0.10	0.001	ND	0.001	ND	0.001	0.01	NQ	0.21	NQ	0.07	0.001	ND	NQ	0.07	0.001	ND	NQ	0.17	0.001	ND	NQ
63	ND	NQ			ND	NQ	ND	NQ	ND	NQ	0.12	NQ	0.10	NQ	ND	0.001	ND	0.001	0.33	0.001	ND	NQ	ND	NQ	ND	NQ	ND	NQ
74	ND	NQ			0.18	0.001	ND	0.001	0.03	0.001	0.04	NQ	0.12	0.001	0.28	0.001	0.01	0.001	ND	NQ	ND	NQ	ND	NQ	0.23	0.001	ND	NQ
70+76	0.11	0.001			0.12	0.001	0.24	0.001	0.10	0.001	0.20	0.001	0.52	0.001	0.69	0.001	0.14	0.001	0.34	0.001	0.24	0.001	0.13	0.001	0.50	0.001	0.20	0.001
66+95	1.43	0.001			0.86	0.001	0.78	0.001	1.75	0.001	1.31	0.001	2.19	0.001	2.15	0.001	1.15	0.001	0.87	0.001	0.78	0.001	0.76	0.001	1.24	0.001	0.79	0.001

IDL < 10: ND = not detected or < 3 blank (ng), NQ = < IDL

Table 4-4: Continued	bc6		g25		g84		hm07		hm09		hm12		hm16		hm22		hm30		g05		s2		s3		s3sml		s6	
	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL	ng/g	IDL
91	0.13	0.000			0.09	0.000	0.11	0.000	0.20	0.000	0.12	0.000	0.25	0.000	0.25	0.000	0.13	0.000	0.11	0.000	0.09	0.000	0.08	0.000	0.13	0.000	0.09	0.000
56+60	ND	NQ			ND	NQ	ND	NQ	0.31	NQ	0.33	NQ	ND	0.001	ND	0.001	ND	NQ	0.28	0.001	ND	NQ	ND	NQ	ND	NQ	ND	NQ
92+84+89	1.34	0.002			0.72	0.002	0.46	0.002	0.98	0.002	ND	0.002	2.44	0.002	1.73	NQ	1.09	0.002	0.33	0.002	0.59	0.002	0.67	0.002	0.71	0.002	0.67	0.002
89	0.04	0.000			0.02	0.000	0.01	0.000	0.05	0.000	0.05	0.000	0.06	0.000	0.04	0.000	0.03	0.000	0.02	0.000	0.01	0.000	0.02	0.000	0.02	0.000	0.02	0.000
101	0.46	0.000			0.36	0.001	0.22	0.000	0.67	0.000	0.46	0.001	0.79	0.000	0.54	0.000	0.39	0.000	0.24	0.000	0.20	0.000	0.28	0.001	0.32	0.000	0.28	0.001
99	0.51	0.001			0.27	0.001	0.19	0.001	0.85	0.001	0.42	0.001	0.81	0.001	0.66	0.001	0.36	0.001	0.22	0.001	0.21	0.001	0.27	0.001	0.27	0.001	0.29	0.001
83	ND	NQ			ND	NQ	ND	0.000	0.05	0.000	ND	NQ	0.02	0.000	0.02	0.000	0.01	0.000	ND	NQ	0.01	0.000	ND	NQ	ND	NQ	ND	NQ
119	ND	NQ			ND	NQ	ND	NQ	ND	0.001	ND	NQ	ND	NQ	ND	NQ	ND	0.001	ND	NQ	ND	0.001	ND	NQ	ND	NQ	ND	NQ
97	ND	NQ			0.05	0.001	ND	0.001	0.10	0.001	0.05	NQ	0.08	0.001	0.06	0.001	0.04	0.001	ND	NQ	0.02	0.001	ND	NQ	0.03	0.001	0.04	0.001
81+87	0.27	0.001			0.14	0.001	0.10	0.001	0.33	0.001	0.22	0.001	0.45	0.001	0.35	0.001	0.20	0.001	0.13	0.001	0.12	0.001	0.13	0.001	0.15	0.001	0.18	0.001
85	5.79	0.001			3.96	0.001	2.90	0.001	8.75	0.001	5.92	0.001	11.84	0.001	12.05	0.001	6.38	0.001	0.71	0.001	3.28	0.001	4.92	0.001	4.80	0.001	3.56	0.001
136	0.16	0.001			0.13	0.001	0.08	0.001	0.28	0.001	0.24	0.001	0.33	0.001	0.23	0.001	0.14	0.001	0.07	0.001	0.09	0.001	0.11	0.001	0.10	0.001	0.10	0.001
110+77	1.91	0.002			1.00	0.003	0.62	0.002	2.32	0.003	1.19	0.003	3.06	0.002	2.10	0.002	1.26	0.002	0.70	0.003	0.78	0.003	0.92	0.003	0.96	0.003	1.07	0.003
82	0.04	0.000			ND	NQ	ND	0.000	0.07	0.000	ND	NQ	0.09	0.000	0.09	NQ	0.04	0.000	ND	NQ	0.02	0.000	ND	NQ	0.01	0.000	0.00	NQ
151	0.37	0.000			0.35	0.001	0.19	0.000	0.64	0.000	0.36	0.000	0.68	0.000	0.50	0.000	0.34	0.000	0.17	0.000	0.18	0.000	0.33	0.000	0.22	0.000	0.19	0.001
135+144+147+124	0.27	0.000			0.24	0.001	0.12	0.000	0.48	0.000	0.29	0.000	0.49	0.000	0.36	0.000	0.24	0.000	0.12	0.000	0.14	0.000	0.24	0.000	0.16	0.000	0.14	0.001
107	0.15	0.002			0.08	0.002	0.00	0.002	0.25	0.002	ND	NQ	0.34	0.002	0.24	NQ	0.10	0.002	ND	NQ	0.08	0.002	ND	NQ	0.08	0.002	ND	NQ
149	1.45	0.001			1.23	0.001	0.70	0.001	2.20	0.001	1.50	0.001	2.32	0.001	1.84	0.001	1.19	0.000	0.77	0.001	0.68	0.001	1.21	0.001	0.88	0.001	0.79	0.001
118	ND	NQ			ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
134	0.24	0.003			0.13	0.003	0.00	0.003	0.24	0.003	0.09	NQ	0.53	0.002	0.38	0.003	0.27	0.002	ND	NQ	0.09	0.003	ND	NQ	0.18	0.003	ND	NQ
146	0.55	0.001			0.40	0.001	0.23	0.001	0.88	0.001	0.62	0.001	0.87	0.001	0.70	0.001	0.47	0.001	0.25	0.001	0.26	0.001	0.44	0.001	0.29	0.001	0.26	0.001
153+132+105	2.24	0.001			1.86	0.001	1.09	0.001	3.50	0.001	2.38	0.001	3.47	0.001	2.69	0.001	1.97	0.001	1.20	0.001	1.15	0.001	2.00	0.001	1.37	0.001	1.29	0.001
141	0.30	0.000			0.28	0.000	0.16	0.000	0.54	0.000	0.36	0.000	0.34	0.000	0.38	0.000	0.28	0.000	0.15	0.000	0.16	0.000	0.27	0.000	0.18	0.000	0.16	0.000
137+176+130	0.23	0.000			0.14	0.001	0.10	0.000	0.32	0.001	0.10	0.001	0.32	0.000	0.23	0.000	0.16	0.000	0.10	0.001	0.09	0.001	0.19	0.001	0.11	0.001	0.10	0.001
163+138	2.00	0.001			1.69	0.001	0.91	0.001	3.17	0.001	2.01	0.001	3.14	0.001	2.36	0.001	1.74	0.001	1.10	0.001	1.00	0.001	1.73	0.001	1.17	0.001	1.14	0.001
158	0.18	0.001			ND	NQ	0.08	0.001	ND	0.001	ND	0.001	0.32	NQ	0.21	NQ	0.15	0.001	ND	NQ	0.08	0.001	ND	NQ	0.10	0.001	0.10	0.001
178+129	0.33	0.001			0.25	0.001	0.13	0.001	0.44	0.001	0.23	0.001	0.50	0.001	0.41	0.001	0.31	0.001	0.15	0.001	0.17	0.001	0.26	0.001	0.19	0.001	0.16	0.001
187+182+175	1.69	0.001			1.48	0.001	0.84	0.001	2.67	0.001	1.67	0.001	2.71	0.001	2.16	0.001	1.65	0.001	0.89	0.001	0.97	0.001	1.55	0.001	1.08	0.001	0.94	0.001
183	0.60	0.001			0.56	0.001	0.27	0.001	0.99	0.001	0.63	0.001	1.17	0.001	0.78	0.001	0.61	0.001	0.30	0.001	0.34	0.001	0.50	0.001	0.38	0.001	0.35	0.001
128	0.41	0.002			0.16	0.002	0.06	0.002	0.38	0.002	0.18	0.002	0.68	0.002	0.39	0.002	0.20	0.001	0.11	0.002	0.12	0.002	0.16	0.002	0.18	0.002	0.22	0.002
185	0.09	0.001			0.07	0.001	0.07	0.001	0.16	0.001	0.10	0.001	0.21	0.001	0.11	0.001	0.08	0.000	ND	NQ	0.05	0.001	0.11	0.001	0.05	0.001	0.04	0.001
174	0.65	0.001			0.53	0.001	0.32	0.001	1.06	0.001	0.70	0.001	1.11	0.001	0.80	0.001	0.60	0.001	0.30	0.001	0.34	0.001	0.54	0.001	0.40	0.001	0.34	0.001
177	0.48	0.001			0.37	0.001	0.22	0.001	0.84	0.001	0.50	0.001	0.76	0.001	0.60	0.001	0.44	0.001	0.20	0.001	0.25	0.001	0.38	0.001	0.28	0.001	0.24	0.001
202+171+156	0.57	0.001			0.51	0.001	0.31	0.001	0.98	0.001	0.66	0.001	0.92	0.001	0.73	0.001	0.58	0.001	0.29	0.001	0.32	0.001	0.51	0.001	0.37	0.001	0.30	0.001
157+200	ND	NQ			ND	NQ	ND	NQ	0.43	NQ	ND	NQ	ND	0.001	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
172+197	0.20	0.001			0.17	0.001	0.11	0.001	0.32	0.001	0.21	0.001	0.33	0.001	0.25	0.001	0.20	0.001	ND	NQ	0.13	0.001	0.18	0.001	0.11	0.001	0.11	0.001
180	1.78	0.001			1.76	0.001	1.16	0.001	2.81	0.001	2.35	0.001	3.14	0.001	2.25	0.001	2.13	0.001	1.26	0.001	0.99	0.001	1.60	0.001	1.57	0.001	1.19	0.001
193	0.13	0.001			ND	NQ	ND	0.001	ND	0.001	ND	NQ	0.22	NQ	0.16	NQ	0.15	0.001	ND	NQ	0.07	0.001	ND	NQ	ND	NQ	ND	NQ
191	0.05	0.002			ND	NQ	ND	0.002	ND	0.002	ND	NQ	0.09	NQ	0.05	NQ	0.04	0.002	ND	NQ	0.02	0.002	ND	NQ	ND	NQ	ND	NQ
199	0.05	0.000			0.04	0.000	0.03	0.000	0.07	0.000	0.06	0.000	0.09	0.000	0.06	0.000	0.05	0.000	ND	NQ	0.03	0.000	0.05	0.000	0.03	0.000	0.03	0.000
170+190	0.99	0.001			0.91	0.002	2.72	0.001	1.56	0.001	1.10	0.001	1.90	0.001	1.32	0.001	8.18	0.001	0.52	0.001	0.71	0.001	0.78	0.001	10.55	0.001	0.85	0.002
198	0.09	0.002			0.06	0.002	0.37	0.002	0.13	0.002	0.10	0.002	0.22	0.002	0.14	0.002	1.26	0.002	0.00	NQ	0.09	0.002	ND	NQ	ND	NQ	0.10	0.002
201	1.41	0.001			1.32	0.001	1.26	0.001	2.16	0.001	1.76	0.001	2.38	0.001	2.00	0.001	3.37	0.001	0.73	0.001	0.93	0.001	1.30	0.001	3.14	0.001	0.83	0.001
203+196	1.35	0.001			1.37	0.001	1.05	0.001	2.14	0.001	1.69	0.001	2.42	0.001	1.96	0.001	4.04	0.001	0.74	0.001	0.93	0.001	1.28	0.001	4.96	0.001	0.85	0.001
195+208	3.35	0.002			3.64	0.002	2.43	0.002	5.31	0.002	4.59	0.002	5.77	0.002	5.09	0.002	4.10	0.001	1.95	0.002	2.44	0.002	3.37	0.002	2.34	0.002	1.96	0.002
207	0.66	0.002			0.40	0.002	0.32	0.002	0.71	0.002	0.59	0.002	1.13	0.002	0.92	0.002	0.58	0.002	0.26	0.002	0.45	0.002	0.38	0.002	0.32	0.002	0.38	0.002
194	0.22	0.001			0.24	0.001	0.19	0.001	0.41	0.001	0.34	0.001	0.48	0.001	0.37	0.001	0.30	0.001	0.12	0.001	0.20	0.001	0.28	0.001	0.15	0.001	0.20	0.001
205	0.02	0.002			0.02	0.002	0.00	NQ	0.04	0.002	ND	NQ	0.05	0.002	ND	NQ	ND	0.002	ND	NQ	ND	NQ	ND	NQ	ND	NQ	ND	NQ
206	2.82	0.001			3.31	0.001	2.11	0.001	3.68	0.001	4.03	0.001	4.77	0.001	4.42	0.001	4.08	0.001	1.50	0.001	2.17	0.001	2.98	0.001	1.94	0.001	1.69	0.001
total	35.95				29.86		21.89		53.56		38.47		63.53		51.78		49.17		19.79		21.61		30.83		39.63		22.48	
Percent Surrogate Recoveries																														
14	54.3%				49.7%		92.5%		80.4%		23.0%		92.7%		68.3%		69.4%		97.0%		28.3%		51.2%		59.5%		48.9%	
65	84.7%				44.1%		94.0%		229.6%		68.0%		93.8%		65.4%		100.4%		194.3%		66.3%		45.3%		77.3%		45.7%	
166	66.7%				46.8%		77.2%		55.5%		29.9%		88.8%		56.8%		81.9%		81.5%		29.6%		46.9%		54.7%		41.2%	

IDL < 10: ND = not detected or < 3 blank (ng), NQ = < IDL

Table 4-5: Pesticides - Rangia Concentrations (ng/g wet weight)

sample name	bc6	g25	g84	hm07	hm09	hm12	hm16	hm22	hm30	hmg05	s2	s3	s3sml	s6
Pesticide	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)	(ng/g)
2,4,5,6-tetrachloro-m-xylene	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
alpha-HCH	0.066	0.046	0.047	0.120	0.039	0.047	0.123	0.143	0.128	0.023	0.042		0.017	0.007
HexachloroBenzene (HCB)	0.007	0.009	0.002	0.009	0.007	0.005	0.011	0.010	0.011	0.006	0.005		0.006	0.002
gama-HCH	0.081	0.093	0.050	0.178	0.054	0.037	0.186	0.206	0.201	0.044	0.046		0.032	0.052
Heptachlor	0.078	0.064	0.032	0.088	0.098	0.030	0.068	0.095	0.071	0.029	0.039		0.057	0.031
Aldrin	0.067	0.073	0.045	0.087	0.325	0.121	0.070	0.074	0.077	0.223	0.098		0.066	0.106
HeptachlorEpoxide	0.244	0.156	0.032	0.331	0.149	0.080	0.296	0.632	0.172	0.034	0.091		0.026	0.053
trans-Chlordane	0.182	0.126	0.166	0.237	0.000	0.093	0.236	0.137	0.296	0.070	0.082		0.059	0.104
2,4-DDE	0.052	0.016	0.104	0.064	0.024	0.067	0.048	0.023	0.180	0.014	0.061		0.017	0.074
Endosulfan I	0.037	0.028	0.031	0.039	0.039	0.012	0.076	0.036	0.045	0.018	0.017		0.000	0.021
Cis-chlordane	0.507	0.468	0.285	0.615	0.348	0.219	0.520	0.529	0.698	0.232	0.205		0.221	0.261
trans-Nonachlor	0.016	0.047	0.055	0.053	0.072	0.029	0.034	0.071	0.096	0.016	0.044		0.038	0.018
Dieldrin	0.682	0.532	0.305	0.775	0.401	0.279	0.734	0.809	0.826	0.289	0.227		0.282	0.266
4,4-DDE	0.074	0.088	0.045	0.050	0.067	0.050	0.106	0.104	0.134	0.036	0.045		0.029	0.020
2,4-DDD	0.113	0.136	0.139	0.202	0.191	0.092	0.214	0.233	0.393	0.048	0.087		0.094	0.066
Endrin	0.070	0.109	0.091	0.142	0.075	0.039	0.050	0.163	0.164	0.024	0.033		0.028	0.033
Endosulfan II	0.020	0.034	0.023	0.000	0.026	0.018	0.000	0.000	0.000	0.006	0.027		0.006	0.018
4,4-DDD + Cis-Nonachlor	1.322	0.768	0.406	1.477	0.975	0.516	0.814	1.208	1.713	0.518	0.529		0.631	0.573
2,4-DDT	0.028	0.024	0.048	0.024	0.035	0.020	0.373	0.058	0.133	0.008	0.029		0.018	0.000
4,4-DDT	1.101	1.061	0.828	0.781	1.085	1.560	0.000	0.944	0.976	1.345	1.232		2.209	0.000
Methoxychlor	0.184	0.000	0.000	0.046	0.136	0.045	0.000	0.138	0.174	0.047	0.000		0.716	0.000
Mirex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
IDL < 10: ND = not detected or < 3 blank (ng), NQ = < IDL														

Table 4-6: Polycyclic Aromatic Hydrocarbons (PAH) - Sediment Concentrations (ng/g dry weight)

sample		bc6s		bc6sdup		g25s		g84s		hm7s		hm9s		hm12s		hm16s		hm22s		hm26s		hm30s	
sediment dry weights (g)		0.85		0.90		1.16		1.78		0.84		1.00		1.19		1.15		0.99		2.24		1.07	
% water content		76.40		77.00		68.90		64.50		74.30		61.80		69.70		70.00		72.90		55.70		69.90	
%OC								11.61		10.94		7.35								7.55			
% sand								4.12		7.04		12.81								31.35			
g OC extracted								0.21		0.09		0.07								0.17			
ND' = sample mass < 3 * blank																							
Instrumental Detection Limit (IDL) = Area Count < 20																							
Polycyclic Aromatic Hydrocarbons	MW	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL
Napthalene	128	196.41	0.05	235.40	0.04	183.92	0.03	42.17	0.02	211.76	0.04	372.12	0.02	322.71	0.03	305.25	0.04	157.96	0.04	82.28	0.02	282.53	0.04
Azulene	128	NQ	0.09	NQ	0.08	NQ	0.07	NQ	0.03	NQ	0.06	NQ	0.02	NQ	0.06	NQ	0.07	NQ	0.08	NQ	0.02	NQ	0.07
2MeNapthalene	142	184.21	0.16	203.80	0.15	159.23	0.12	37.07	0.06	168.22	0.14	293.51	0.06	266.69	0.11	236.36	0.12	143.14	0.14	68.34	0.05	224.86	0.13
1MeNapthalene	142	59.09	0.11	67.15	0.10	52.46	0.08	13.00	0.04	64.20	0.09	100.68	0.04	89.32	0.08	76.77	0.08	47.87	0.09	24.29	0.03	77.46	0.09
Acenapthylene	152	28.46	0.10	32.89	0.09	25.70	0.07	17.97	0.03	29.14	0.06	49.05	0.02	52.51	0.07	40.12	0.07	28.67	0.08	NQ	0.02	48.53	0.08
Biphenyl	154	45.69	0.10	47.90	0.10	37.42	0.08	14.04	0.04	47.96	0.09	76.24	0.04	59.01	0.07	54.84	0.08	34.81	0.09	20.66	0.03	49.85	0.08
Acenapthene	154	10.34	0.14	10.40	0.13	8.13	0.10	7.30	0.09	18.76	0.18	32.10	0.08	15.04	0.10	13.88	0.10	8.89	0.12	8.86	0.07	12.63	0.11
Fluorene	166	22.17	0.31	24.16	0.29	18.88	0.23	23.47	0.07	41.81	0.15	6.69	0.06	33.64	0.22	27.12	0.23	20.88	0.27	194.37	0.06	27.93	0.25
Phenanthrene	178	13.39	0.00	13.49	0.00	10.54	0.00	78.81	0.02	110.99	0.04	33.62	0.02	17.81	0.00	14.77	0.00	11.51	0.00	49.43	0.02	86.14	0.00
Anthracene	178	17.55	0.00	18.39	0.00	14.37	0.00	59.47	0.04	83.24	0.09	14.91	0.04	24.03	0.00	20.81	0.00	15.62	0.00	35.54	0.03	116.32	0.00
1MeFluorene	180	23.58	0.11	22.66	0.10	17.70	0.08	12.09	0.19	24.50	0.41	24.92	0.18	31.06	0.08	26.36	0.08	19.65	0.09	11.27	0.16	27.35	0.08
4,5-Methylenephenanthrene	190	36.39	0.04	36.40	0.04	28.44	0.03	26.25	0.04	28.53	0.08	46.47	0.04	65.93	0.03	42.91	0.03	33.83	0.03	16.05	0.03	48.39	0.03
2Mephenanthrene	192	67.95	0.23	73.87	0.22	57.71	0.17	51.38	0.08	68.31	0.17	79.60	0.07	96.48	0.17	75.11	0.17	59.36	0.20	30.29	0.06	91.94	0.18
2Meanthracene	192	NQ	0.80	9.51	0.75	7.43	0.58	19.62	0.11	22.71	0.23	24.29	0.10	14.57	0.57	12.43	0.59	9.05	0.68	9.57	0.09	13.14	0.63
1Meantracene	192	17.79	0.10	19.74	0.09	15.42	0.07	40.14	0.06	44.86	0.13	78.39	0.05	24.58	0.07	24.14	0.07	19.51	0.08	20.44	0.05	23.61	0.08
1Mephenanthrene	192	39.83	0.23	37.83	0.22	29.56	0.17	30.81	0.07	45.29	0.15	41.71	0.07	55.80	0.16	48.73	0.17	34.90	0.20	17.70	0.06	52.53	0.18
9Meanthracene	192	NQ	0.38	NQ	0.36	NQ	0.28	NQ	0.11	NQ	0.23	NQ	0.10	NQ	0.27	66.53	0.28	NQ	0.33	NQ	0.09	NQ	0.30
Fluoranthene	202	218.80	0.19	223.60	0.18	174.70	0.14	264.79	0.04	251.71	0.08	402.61	0.03	335.94	0.14	240.13	0.14	207.45	0.16	199.88	0.03	296.53	0.15
Pyrene	202	227.21	0.10	233.08	0.09	182.10	0.07	307.77	0.04	259.23	0.08	408.71	0.04	373.76	0.07	254.09	0.07	226.42	0.09	188.42	0.03	341.86	0.08
3,6-Dimethylphenanthrene	206	NQ	0.36	NQ	0.34	NQ	0.26	64.03	0.52	24.86	1.09	38.12	0.47	22.79	0.26	NQ	0.27	NQ	0.31	12.16	0.41	NQ	0.29
9,10-Dimethylanthracene	206	NQ	0.67	NQ	0.63	NQ	0.49	NQ	0.18	NQ	0.37	NQ	0.16	NQ	0.48	NQ	0.49	NQ	0.57	NQ	0.14	NQ	0.53
Benzo[a]fluorene	216	52.45	0.00	52.64	0.00	41.13	0.00	67.20	0.05	54.75	0.10	83.24	0.04	85.74	0.00	60.69	0.00	54.15	0.00	31.83	0.04	78.47	0.00
Benzo[b]fluorene	216	32.93	0.00	32.91	0.00	25.71	0.00	48.59	0.10	33.50	0.21	65.11	0.09	65.31	0.00	39.91	0.00	36.81	0.00	21.22	0.08	53.25	0.00
Benz[a]anthracene	228	105.43	0.12	109.62	0.11	85.64	0.09	143.70	0.06	96.01	0.13	134.40	0.06	171.99	0.08	125.23	0.09	109.18	0.10	56.77	0.05	175.79	0.09
Chrysene	228	57.66	0.14	59.25	0.13	46.29	0.10	82.84	0.01	67.98	0.02	86.07	0.01	84.51	0.10	62.49	0.10	56.06	0.12	46.05	0.01	84.71	0.11
Triphenylene	228	55.22	0.27	56.74	0.25	44.33	0.20	79.34	0.01	65.11	0.02	82.43	0.01	80.94	0.19	59.85	0.20	53.69	0.23	44.10	0.01	81.13	0.21
Napthacene	228	NQ	0.84	19.36	0.79	15.13	0.61	NQ	0.08	11.30	0.16	NQ	0.07	32.18	0.60	22.80	0.62	19.48	0.72	NQ	0.06	32.84	0.67
Benzo[b]fluoranthene	252	143.91	0.22	151.11	0.21	118.06	0.16	169.25	0.10	143.37	0.22	189.84	0.09	204.29	0.16	155.87	0.16	121.45	0.19	95.30	0.08	201.54	0.18
Benzo[k]fluoranthene	252	95.22	0.55	101.33	0.52	79.17	0.41	115.46	0.06	NQ	0.13	NQ	0.06	139.37	0.40	106.81	0.41	101.11	0.47	NQ	0.05	143.81	0.44
Benzo[e]pyrene	252	76.05	0.41	80.32	0.38	62.75	0.30	98.40	0.06	86.01	0.13	108.50	0.06	111.07	0.29	82.86	0.30	71.63	0.35	54.48	0.05	110.94	0.32
Benzo[a]pyrene	252	109.04	0.05	121.01	0.05	94.55	0.04	146.43	0.10	116.05	0.21	141.43	0.09	189.22	0.03	132.94	0.04	116.78	0.04	65.86	0.08	196.22	0.04
perylene	252	220.99	0.04	210.33	0.04	164.33	0.03	277.27	0.05	262.34	0.11	293.48	0.05	343.88	0.03	246.34	0.03	262.90	0.04	115.67	0.04	320.49	0.04
Dimethylbenz[a]anthracene	256	3.59	1.96	NQ	1.84	NQ	1.44	4.00	0.35	3.56	0.75	4.35	0.32	NQ	1.40	4.44	1.45	NQ	1.67	3.94	0.28	4.90	1.56
3-Methylcholanthrene	268	NQ	0.59	NQ	0.55	NQ	0.43	NQ	0.27	NQ	0.57	1.62	0.25	NQ	0.42	NQ	0.43	NQ	0.50	NQ	0.22	NQ	0.47
Indeno[1,2,3-c,d]perylene	276	192.83	0.00	193.87	0.00	151.47	0.00	121.89	0.16	116.19	0.33	138.44	0.14	260.42	0.00	196.30	0.00	170.39	0.00	72.88	0.12	271.98	0.00
Benzo[g,h,i]perylene	276	109.76	0.00	108.69	0.00	84.92	0.00	113.93	0.11	99.29	0.24	128.59	0.10	144.02	0.00	115.99	0.00	95.88	0.00	59.18	0.09	155.18	0.00
Anthanthrene	276	23.21	0.71	19.29	0.67	15.07	0.52	14.54	0.12	14.44	0.26	22.76	0.11	46.02	0.51	33.05	0.53	25.61	0.61	8.18	0.10	49.02	0.57
Dibenz[ah]anthracene	278	8.01	0.48	7.36	0.45	5.75	0.35	10.54	0.03	1.73	0.06	12.96	0.03	12.25	0.34	5.25	0.35	6.45	0.41	4.83	0.02	12.35	0.38
Dibenz[ac]anthracene	278	4.87	0.38	4.48	0.36	3.50	0.28	6.41	0.01	1.05	0.02	7.88	0.01	7.45	0.27	3.19	0.28	3.93	0.33	2.94	0.01	7.51	0.30
Pentacene	278	0.00	0.80	0.00	0.75	0.00	0.59	NQ	0.00	NQ	0.00	NQ	0.00	0.00	0.57	0.00	0.59	0.00	0.69	NQ	0.00	0.00	0.64
Coronene	300	39.38	0.37	38.01	0.34	29.69	0.27	57.57	0.47	37.01	1.00	102.60	0.43	40.08	0.26	32.29	0.27	27.82	0.31	20.84	0.38	55.29	0.29
Retene	234	NQ	2.74	NQ	2.57	NQ	2.01	36.69	275.33	371.54	582.07	52.40	251.36	NQ	1.95	NQ	2.02	NQ	2.33	NQ	219.32	NQ	2.18
Total [PAH] (ng/g)		**2539.39**		**2676.57**		**2091.20**		**2704.25**		**3127.33**		**3779.85**		**3920.43**		**3066.68**		**2412.85**		**1693.63**		**3857.03**	
Percent Surrogate Recoveries																							
d8 napthalene		49.03		52.98		37.65		5.01		43.50		53.98		55.62		51.44		39.54		47.98		51.09	
d10 fluorene		70.55		69.54		66.39		26.37		69.90		75.00		77.94		62.74		72.67		79.11		69.63	
d10 Fluoranthene		72.77		63.46		62.91		65.32		85.00		72.03		71.41		56.66		70.76		98.70		61.36	
d12 Perylene		75.16		70.62		70.21		65.74		80.46		78.19		72.48		63.75		76.92		89.22		68.23	

Figure 4-6: Continued

hmbc3s		hmg5s		hminews		hms2s		hms3s		s6s		srm1		srm2		srm3	
3.36		4.57		1.79		2.16		3.38		1.39		1.00		0.97		1.03	
27.40		25.60		66.50		45.70		52.00		65.20							
NA		NA		9.72		4.94		3.49									
6.95		4.08		2.67		84.64		81.03									
NA		NA		0.17		0.11		0.12									
ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL	ng/g dry	IDL
87.36	0.01	107.86	0.01	377.85	0.02	65.44	0.02	91.93	0.01	75.97	0.03	105.22	0.04	17.68	0.04	607.40	0.04
NQ	0.01	NQ	0.01	NQ	0.03	NQ	0.02	NQ	0.01	NQ	0.06	NQ	0.08	NQ	0.08	NQ	0.07
81.20	0.03	86.15	0.03	286.38	0.06	53.66	0.05	70.41	0.03	96.37	0.10	133.47	0.14	47.71	0.14	253.52	0.13
NQ	0.02	29.51	0.02	96.24	0.04	18.66	0.03	24.95	0.02	32.97	0.07	45.67	0.09	20.59	0.10	93.99	0.09
NQ	0.01	16.29	0.01	55.79	0.03	9.20	0.02	11.65	0.01	22.54	0.06	31.22	0.08	34.15	0.09	43.82	0.08
21.92	0.02	214.62	0.02	68.38	0.04	14.66	0.04	18.20	0.02	28.57	0.06	39.57	0.09	29.73	0.09	78.51	0.08
9.90	0.05	10.18	0.03	30.77	0.09	12.73	0.07	8.20	0.05	8.38	0.08	11.61	0.12	12.55	0.12	19.90	0.11
23.52	0.04	135.29	0.03	66.18	0.07	15.31	0.06	17.35	0.04	18.21	0.19	25.22	0.26	19.26	0.27	24.19	0.26
11.85	0.01	56.99	0.01	168.69	0.02	44.35	0.02	47.23	0.01	10.67	0.00	14.77	0.00	104.38	0.00	108.59	0.00
NQ	0.02	41.11	0.02	123.63	0.04	20.03	0.03	24.34	0.02	15.23	0.00	21.09	0.00	187.12	0.00	201.29	0.00
9.12	0.10	11.40	0.08	33.08	0.19	8.50	0.16	6.63	0.10	18.79	0.07	26.02	0.09	31.16	0.09	34.06	0.09
NQ	0.02	15.74	0.02	48.17	0.04	11.22	0.03	13.06	0.02	32.08	0.02	44.43	0.03	68.93	0.03	65.24	0.03
4.60	0.04	35.11	0.03	97.89	0.08	17.67	0.06	22.80	0.04	58.44	0.14	80.94	0.20	122.95	0.20	111.98	0.19
NQ	0.06	12.34	0.04	35.75	0.11	5.54	0.09	6.52	0.06	9.27	0.49	12.84	0.67	21.21	0.69	20.93	0.65
NQ	0.03	23.68	0.02	66.32	0.06	16.11	0.05	20.46	0.03	16.42	0.06	22.74	0.08	26.18	0.08	26.04	0.08
16.01	0.04	20.31	0.03	56.88	0.07	8.27	0.06	11.25	0.04	35.30	0.14	48.89	0.19	73.32	0.20	68.04	0.19
NQ	0.06	NQ	0.04	NQ	0.11	NQ	0.09	NQ	0.06	NQ	0.23	NQ	0.32	NQ	0.33	NQ	0.31
139.50	0.02	137.68	0.01	355.38	0.04	92.19	0.03	108.68	0.02	210.44	0.12	291.47	0.16	795.79	0.17	712.75	0.16
150.07	0.02	144.22	0.02	390.30	0.04	89.68	0.03	107.79	0.02	219.70	0.06	304.29	0.08	703.74	0.09	639.22	0.08
10.37	0.27	10.27	0.20	24.38	0.51	8.05	0.43	10.18	0.27	NQ	0.22	NQ	0.30	40.18	0.31	NQ	0.30
NQ	0.09	NQ	0.07	NQ	0.17	NQ	0.14	NQ	0.09	NQ	0.41	NQ	0.57	NQ	0.59	NQ	0.55
34.81	0.02	29.35	0.02	84.41	0.05	18.02	0.04	21.59	0.02	49.62	0.00	68.73	0.00	157.24	0.00	142.33	0.00
NQ	0.05	19.08	0.04	56.26	0.10	15.55	0.08	14.62	0.05	35.66	0.00	49.38	0.00	119.93	0.00	100.04	0.00
60.07	0.03	59.28	0.02	157.64	0.06	42.62	0.05	39.41	0.03	105.79	0.07	146.52	0.10	477.84	0.10	397.35	0.10
36.35	0.01	37.77	0.00	90.67	0.01	21.28	0.01	24.25	0.01	52.57	0.09	72.81	0.12	218.95	0.12	208.43	0.11
34.81	0.01	36.17	0.00	86.84	0.01	20.38	0.01	23.22	0.01	50.34	0.16	69.73	0.23	209.69	0.23	199.61	0.22
NQ	0.04	NQ	0.03	NQ	0.08	NQ	0.06	NQ	0.04	20.69	0.51	28.65	0.71	NQ	0.73	NQ	0.69
NQ	0.05	82.23	0.04	192.01	0.10	52.08	0.09	54.09	0.05	123.29	0.14	170.76	0.19	836.86	0.19	722.61	0.18
NQ	0.03	55.03	0.02	27.38	0.06	NQ	0.05	NQ	0.03	99.21	0.34	137.41	0.47	545.72	0.48	549.88	0.46
NQ	0.03	46.66	0.02	110.82	0.06	28.46	0.05	31.21	0.03	71.10	0.25	98.47	0.34	427.38	0.35	398.83	0.33
74.46	0.05	68.51	0.04	176.11	0.10	35.27	0.08	43.07	0.05	114.29	0.03	158.29	0.04	603.99	0.04	539.53	0.04
NQ	0.03	124.55	0.02	382.42	0.05	67.67	0.04	96.11	0.03	173.54	0.03	240.36	0.04	255.07	0.04	247.34	0.04
NQ	0.19	1.98	0.14	4.86	0.35	1.15	0.29	1.33	0.19	3.20	1.20	4.43	1.66	13.61	1.71	13.37	1.61
NQ	0.14	0.70	0.11	1.67	0.27	NQ	0.22	NQ	0.14	NQ	0.36	NQ	0.50	NQ	0.51	NQ	0.48
NQ	0.08	62.56	0.06	88.48	0.15	39.10	0.13	40.43	0.08	180.04	0.00	249.37	0.00	998.88	0.00	903.64	0.00
NQ	0.06	56.64	0.04	84.10	0.11	33.13	0.09	36.65	0.06	98.56	0.00	136.51	0.00	577.50	0.00	506.94	0.00
NQ	0.06	10.38	0.05	18.08	0.12	5.49	0.10	6.01	0.06	28.42	0.44	39.37	0.60	187.51	0.62	172.83	0.59
NQ	0.02	5.74	0.01	8.49	0.03	2.87	0.02	3.42	0.02	8.67	0.29	12.00	0.40	62.34	0.42	43.01	0.39
NQ	0.01	3.49	0.00	5.16	0.01	1.75	0.01	2.08	0.01	5.27	0.23	7.30	0.32	37.92	0.33	26.16	0.31
NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00	0.00	0.49	0.00	0.68	0.00	0.70	0.00	0.66
NQ	0.25	20.93	0.18	29.43	0.47	14.69	0.39	14.50	0.25	31.73	0.22	43.95	0.31	161.69	0.32	126.19	0.30
NQ	145.97	204.96	107.41	542.37	273.77	97.83	227.04	195.49	144.99	NQ	1.68	NQ	2.32	NQ	2.39	NQ	2.25
805.92		**2034.74**		**4529.26**		**1008.60**		**1269.10**		**2161.31**		**2993.50**		**8248.73**		**8407.56**	
27.73		40.64		47.80		51.55		50.51		21.43		49.02		1.04		48.98	
59.66		59.34		67.83		83.43		72.13		70.77		76.20		48.13		69.94	
66.58		70.36		76.87		92.48		91.00		71.60		72.30		60.21		64.67	
64.29		68.35		77.11		87.64		86.36		75.39		76.84		67.04		71.22	

Table 4-7: PCB Congeners - Sediment Concentrations (ng/g dry weight)

sample	bc6s	bc6sdup	g25s	g84s	hm7s	hm9s	hm12s	hm16s	hm22s	hm26s	hm30s
congener											
1				0.000	0.000	0.000				0.000	
3				0.000	0.000	0.000				0.000	
4,10				0.054	0.000	0.000				0.000	
7,9				0.000	0.129	0.066				0.015	
6				0.000	0.000	0.076				0.000	
8,5				1.774	0.186	0.573				0.179	
19				8.861	1.903	0.366				0.000	
12,13				0.689	0.000	1.245				2.677	
18				0.437	0.000	1.003				0.000	
17				1.942	7.915	3.052				9.381	
24+27				0.430	0.104	0.127				0.309	
16+32				2.348	0.000	0.000				0.000	
29				0.000	0.000	1.139				0.494	
26				0.000	0.000	0.000				0.000	
25				0.341	0.338	0.314				0.298	
31+28				0.441	0.497	0.466				1.033	
21+33+53				0.634	1.060	0.252				0.368	
51				0.000	0.000	0.000				0.000	
22				0.111	0.139	0.266				0.127	
45				0.304	0.131	0.199				0.053	
46				0.301	0.418	0.345				0.099	
52+43				0.090	0.487	0.665				0.383	
49				0.083	0.378	0.525				0.494	
47+48				0.000	0.000	0.524				0.431	
44				0.406	0.724	1.973				1.258	
37+42				0.000	0.141	0.713				1.161	
41+71+64				3.483	7.765	9.982				8.509	
40				0.000	19.660	0.000				8.246	
100				1.646	0.000	0.000				0.000	
63				0.407	0.000	0.000				0.213	
74				1.370	1.515	2.159				0.631	
70+76				0.548	2.699	6.107				1.308	
66+95				0.742	1.790	8.208				2.112	
91				0.111	0.123	0.537				0.169	
56+60				0.000	0.359	5.312				1.338	
92+84+89				2.765	2.504	4.606				1.229	
89				0.282	0.469	2.641				0.509	
101				0.468	0.828	3.860				0.795	
99				1.890	0.000	3.276				0.963	
83				0.572	0.804	0.784				0.000	
119				0.047	0.034	0.316				0.000	
97				0.117	0.255	1.381				0.273	
81+87				0.345	0.587	2.789				0.515	
85				0.820	1.835	3.294				1.453	
136				0.054	0.070	0.546				0.145	
110+77				0.673	1.248	7.455				1.510	
82				1.157	1.423	1.617				0.549	
151				2.394	0.414	1.759				0.382	
135+144+147+124				0.180	0.185	1.141				0.278	

Table 4-7: Continued											
congener	bc6s	bc6sdup	g25s	g84s	hm7s	hm9s	hm12s	hm16s	hm22s	hm26s	hm30s
107				0.050	0.000	0.825				0.318	
149				0.671	1.137	4.896				1.232	
118				0.439	1.039	4.385				0.973	
134				0.403	0.324	2.449				0.279	
146				0.138	0.485	1.564				0.521	
153+132+105				1.930	2.704	7.146				3.937	
141				0.528	0.000	0.000				0.000	
137+176+130				0.551	0.000	0.000				0.000	
163+138				1.075	2.961	7.455				2.400	
158				0.122	0.488	1.356				0.298	
178+129				0.076	0.223	0.437				0.162	
187+182+175				0.408	1.129	1.863				0.759	
183				0.113	0.000	1.086				0.347	
128				0.311	0.000	1.578				0.520	
185				0.621	0.149	0.556				0.069	
174				0.490	0.630	1.437				0.490	
177				0.335	0.417	0.836				0.354	
202+171+156				0.300	0.437	0.796				0.276	
157+200				0.097	0.000	0.400				0.137	
172+197				0.000	0.290	0.471				0.151	
180				2.926	6.851	9.818				2.625	
193				1.213	0.000	0.000				0.000	
191				0.000	0.000	0.000				0.061	
199				0.012	0.033	0.104				0.024	
170+190				0.773	1.138	1.587				1.293	
198				0.236	0.139	0.000				0.000	
201				1.161	1.471	1.787				0.806	
203+196				0.761	1.321	1.488				0.732	
195+208				0.713	3.696	3.847				1.446	
207				0.000	0.469	0.346				0.209	
194				0.109	0.449	0.337				0.185	
205				0.000	0.466	0.000				0.000	
206				0.000	4.262	4.144				1.467	
total				55.88	91.82	144.65				71.95	
Percent Surrogate Recoveries											
14 [30]				19.05%	65.69%	57.25%				78.82%	
65				70.34%	126.08%	121.65%				170.25%	
166 [204]				57.13%	95.25%	79.55%				93.20%	

Table 4-7: Continued								
sample	bc3s	g5	hminews	s2s	s3s	s6s	srm1	srm2
congener								
1			0.000	0.000	0.000			
3			0.000	0.000	0.000			
4,10			0.000	0.041	0.000			
7,9			0.095	0.000	0.000			
6			0.218	0.000	0.049			
8,5			0.868	0.736	0.502			
19			0.801	0.883	0.538			
12,13			0.000	2.704	0.279			
18			0.000	3.479	0.232			
17			7.887	3.246	0.000			
24+27			0.316	0.000	0.000			
16+32			0.000	1.908	0.000			
29			0.000	0.000	0.278			
26			0.000	0.000	0.007			
25			0.302	0.162	0.000			
31+28			1.126	0.363	0.183			
21+33+53			1.183	0.322	0.356			
51			0.018	0.016	0.000			
22			0.356	0.000	0.033			
45			0.220	0.042	0.044			
46			0.163	0.195	0.144			
52+43			0.892	0.041	0.123			
49			0.373	0.043	0.098			
47+48			0.373	0.696	0.000			
44			0.566	0.160	0.242			
37+42			0.202	0.092	0.054			
41+71+64			11.383	0.000	1.634			
40			0.000	0.000	0.000			
100			0.000	1.119	0.704			
63			0.310	0.296	0.234			
74			0.897	0.927	0.509			
70+76			2.199	0.368	0.376			
66+95			2.749	0.559	0.522			
91			0.190	0.045	0.040			
56+60			1.631	0.000	0.000			
92+84+89			0.890	2.040	0.527			
89			0.569	0.164	0.122			
101			0.987	0.273	0.247			
99			0.525	1.428	0.831			
83			0.602	0.374	0.391			
119			0.039	0.080	0.023			
97			0.327	0.079	0.116			
81+87			0.519	0.218	0.217			
85			2.190	0.322	0.455			
136			0.149	0.023	0.038			
110+77			1.532	0.381	0.438			
82			0.834	0.900	0.552			
151			0.497	0.000	0.000			
135+144+147+124			0.304	0.089	0.117			

Table 4-7: Continued

congener	bc3s	g5	bmluews	s2s	s3s	s6s	srm1	srm2	srm
107			0.429	0.020	0.047				
149			1.664	0.292	0.411				
118			1.169	0.231	0.326				
134			0.849	0.230	0.387				
146			0.705	0.110	0.123				
153+132+105			4.743	0.933	1.152				
141			0.768	0.070	0.063				
137+176+130			0.000	0.117	0.000				
163+138			3.041	0.452	0.734				
158			0.432	0.023	0.090				
178+129			0.329	0.023	0.061				
187+182+175			0.986	0.177	0.221				
183			0.394	0.077	0.100				
128			0.296	0.162	0.133				
185			0.209	0.341	0.227				
174			0.852	0.234	0.241				
177			0.458	0.099	0.129				
202+171+156			0.428	0.127	0.136				
157+200			0.000	0.028	0.061				
172+197			0.234	0.055	0.050				
180			4.297	1.749	2.577				
193			0.000	0.775	0.380				
191			0.068	0.000	0.023				
199			0.000	0.000	0.000				
170+190			1.570	0.514	0.470				
198			0.070	0.120	0.057				
201			1.704	0.457	0.437				
203+196			1.426	0.251	0.298				
195+208			4.777	0.784	0.989				
207			0.360	0.042	0.035				
194			0.425	0.074	0.125				
205			0.072	0.000	0.000				
206			0.000	0.990	0.000				
total			78.04	34.37	21.34				
Percent Surrogate Recoveries									
14 [30]			67.93%	51.23%	30.39%				
65			115.91%	73.95%	46.94%				
166 [204]			90.75%	73.12%	43.99%				

Table 4-8: Year 15 sediment pesticide concentrations (ng/g dry weight)

Pesticide	bc6s	IDL	bc6sDUP	IDL	g25s	IDL	g84s	IDL	hm7s	IDL
2,4,5,6-tetrachloro-m-xylene	NQ	0.02	NQ	0.02	NQ	0.01	NQ	0.01	NQ	0.02
alpha-HCH	NQ	0.30	NQ	0.28	NQ	0.22	NQ	0.14	NQ	0.30
HexachloroBenzene (HCB)	0.02	0.00	0.02	0.00	0.04	0.00	0.02	0.00	0.02	0.00
gama-HCH	NQ	15.22	NQ	14.37	NQ	11.15	NQ	7.27	NQ	15.40
Heptachlor	NQ	0.29	NQ	0.27	0.88	0.21	0.28	0.14	0.35	0.29
Surr 65 + Aldrin	NQ	2.73	NQ	2.57	NQ	2.00	NQ	1.30	NQ	2.76
HeptachlorEpoxide	NQ	0.00	0.68	0.00	NQ	0.00	0.24	0.00	0.74	0.00
trans-Chlordane	0.15	0.00	0.50	0.00	0.15	0.00	NQ	0.00	0.32	0.00
2,4-DDE	NQ	0.22	NQ	0.21	0.55	0.16	NQ	0.10	NQ	0.22
Endosulfan I	0.18	0.03	0.11	0.03	NQ	0.02	0.69	0.02	0.18	0.03
Cis-chlordane	0.05	0.05	1.44	0.04	0.40	0.03	0.28	0.02	0.58	0.05
trans-Nonachlor	NQ	0.39	NQ	0.37	NQ	0.28	0.46	0.18	0.50	0.39
Dieldrin	0.51	0.21	2.09	0.20	0.53	0.16	NQ	0.10	0.51	0.22
4,4-DDE	NQ	0.07	0.25	0.07	0.12	0.05	0.85	0.04	0.09	0.08
2,4-DDD	0.65	0.47	NQ	0.44	1.24	0.34	0.38	0.22	NQ	0.47
Endrin	0.25	0.00	0.22	0.00	0.26	0.00	1.12	0.00	0.60	0.00
Endosulfan II	NQ	0.70	NQ	0.67	NQ	0.52	NQ	0.34	1.10	0.71
4,4-DDD + Cis-Nonachlor	4.26	0.03	7.45	0.03	9.90	0.02	1.15	0.01	0.20	0.03
2,4-DDT	NQ	0.19	0.32	0.18	0.30	0.14	0.25	0.09	NQ	0.20
4,4-DDT	8.00	1.81	4.82	1.71	NQ	1.33	NQ	0.86	NQ	1.83
Methoxychlor	NQ	1.17	NQ	1.10	0.91	0.86	NQ	0.56	NQ	1.18
Mirex	NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00	0.07	0.00

Table 4-8: Continued

Pesticide	hm9s	IDL	hm12s	IDL	hm16s	IDL	hm22s	IDL	hm26s	IDL
2,4,5,6-tetrachloro-m-xylene	NQ	0.01	NQ	0.01	NQ	0.01	NQ	0.01	NQ	0.01
alpha-HCH	NQ	0.25	NQ	0.21	NQ	0.22	NQ	0.26	NQ	0.11
HexachloroBenzene (HCB)	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
gama-HCH	NQ	12.93	NQ	10.87	NQ	11.25	NQ	13.06	NQ	5.77
Heptachlor	0.47	0.25	0.31	0.21	0.72	0.21	NQ	0.25	NQ	0.11
Surr 65 + Aldrin	NQ	2.32	NQ	1.95	NQ	2.02	NQ	2.34	NQ	1.03
HeptachlorEpoxide	0.35	0.00	0.02	0.00	0.01	0.00	NQ	0.00	NQ	0.00
trans-Chlordane	NQ	0.00	0.17	0.00	0.18	0.00	0.04	0.00	0.06	0.00
2,4-DDE	0.34	0.19	0.44	0.16	0.33	0.16	0.30	0.19	NQ	0.08
Endosulfan I	1.86	0.03	0.35	0.02	0.27	0.02	0.10	0.03	0.08	0.01
Cis-chlordane	0.72	0.04	0.30	0.03	0.34	0.03	0.06	0.04	0.10	0.02
trans-Nonachlor	1.15	0.33	NQ	0.28	NQ	0.29	NQ	0.33	NQ	0.15
Dieldrin	0.26	0.18	0.39	0.15	0.43	0.16	NQ	0.18	0.18	0.08
4,4-DDE	0.59	0.06	NQ	0.05	NQ	0.06	NQ	0.06	0.11	0.03
2,4-DDD	0.98	0.40	0.55	0.33	0.71	0.34	NQ	0.40	NQ	0.18
Endrin	1.24	0.00	0.11	0.00	0.03	0.00	0.04	0.00	NQ	0.00
Endosulfan II	NQ	0.60	NQ	0.50	NQ	0.52	NQ	0.61	NQ	0.27
4,4-DDD + Cis-Nonachlor	5.50	0.03	2.68	0.02	3.82	0.02	1.18	0.03	0.21	0.01
2,4-DDT	NQ	0.17	NQ	0.14	NQ	0.14	NQ	0.17	0.77	0.07
4,4-DDT	NQ	1.54	NQ	1.29	NQ	1.34	NQ	1.55	NQ	0.69
Methoxychlor	NQ	0.99	2.60	0.83	NQ	0.86	NQ	1.00	NQ	0.44
Mirex	NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00

Table 4-8: Continued

Pesticide	hm30s	IDL	bc3s	IDL	g5s	IDL	hminews	IDL	s2s	IDL
2,4,5,6-tetrachloro-m-xylene	NQ	0.01	0.01	0.00	NQ	0.00	0.01	0.01	NQ	0.01
alpha-HCH	NQ	0.24	NQ	0.08	NQ	0.06	NQ	0.14	NQ	0.12
HexachloroBenzene (HCB)	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
gama-HCH	NQ	12.09	NQ	3.85	NQ	2.83	NQ	7.23	NQ	5.99
Heptachlor	0.24	0.23	0.17	0.07	0.13	0.05	0.24	0.14	0.13	0.11
Surr 65 + Aldrin	NQ	2.17	NQ	0.69	NQ	0.51	NQ	1.29	NQ	1.07
HeptachlorEpoxide	NQ	0.00	0.00	0.00	NQ	0.00	0.35	0.00	0.51	0.00
trans-Chlordane	0.17	0.00	0.16	0.00	0.17	0.00	0.16	0.00	0.19	0.00
2,4-DDE	0.32	0.17	0.97	0.06	0.19	0.04	NQ	0.10	NQ	0.09
Endosulfan I	0.42	0.03	0.50	0.01	0.25	0.01	0.09	0.02	0.04	0.01
Cis-chlordane	0.32	0.04	0.22	0.01	0.24	0.01	0.38	0.02	0.45	0.02
trans-Nonachlor	NQ	0.31	NQ	0.10	NQ	0.07	0.29	0.18	0.19	0.15
Dieldrin	0.42	0.17	0.24	0.05	0.27	0.04	0.28	0.10	0.09	0.08
4,4-DDE	NQ	0.06	NQ	0.02	NQ	0.01	0.06	0.04	NQ	0.03
2,4-DDD	0.60	0.37	0.28	0.12	0.31	0.09	NQ	0.22	NQ	0.18
Endrin	1.61	0.00	1.08	0.00	0.68	0.00	0.40	0.00	0.37	0.00
Endosulfan II	NQ	0.56	NQ	0.18	NQ	0.13	0.51	0.33	0.44	0.28
4,4-DDD + Cis-Nonachlor	3.37	0.02	1.20	0.01	1.51	0.01	1.22	0.01	0.08	0.01
2,4-DDT	0.35	0.15	0.08	0.05	0.11	0.04	NQ	0.09	1.47	0.08
4,4-DDT	NQ	1.44	3.30	0.46	7.83	0.34	NQ	0.86	NQ	0.71
Methoxychlor	NQ	0.93	NQ	0.30	NQ	0.22	NQ	0.55	NQ	0.46
Mirex	NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00	NQ	0.00

Table 4-8: Continued

Pesticide	s3s	IDL	s6s	IDL	SRM1	IDL	SRM2	IDL	SRM3	IDL
2,4,5,6-tetrachloro-m-xylene	NQ	0.00	NQ	0.01	NQ	0.01	NQ	0.02	NQ	0.01
alpha-HCH	NQ	0.07	NQ	0.18	NQ	0.25	NQ	0.26	NQ	0.25
HexachloroBenzene (HCB)	0.01	0.00	0.05	0.00	1.46	0.00	0.68	0.00	1.22	0.00
gama-HCH	NQ	3.83	NQ	9.30	NQ	12.93	NQ	13.33	NQ	12.56
Heptachlor	0.13	0.07	NQ	0.18	3.04	0.25	1.55	0.25	3.28	0.24
Surr 65 + Aldrin	NQ	0.69	NQ	1.67	NQ	2.32	NQ	2.39	NQ	2.25
HeptachlorEpoxide	0.34	0.00	0.01	0.00	0.05	0.00	0.09	0.00	0.06	0.00
trans-Chlordane	0.14	0.00	0.18	0.00	1.19	0.00	1.67	0.00	1.25	0.00
2,4-DDE	NQ	0.05	0.56	0.13	1.39	0.19	1.65	0.19	2.15	0.18
Endosulfan 1	0.06	0.01	0.35	0.02	1.68	0.03	1.25	0.03	1.63	0.03
Cis-chlordane	0.47	0.01	0.47	0.03	3.37	0.04	1.63	0.04	3.82	0.04
trans-Nonachlor	0.20	0.10	NQ	0.24	NQ	0.33	NQ	0.34	NQ	0.32
Dieldrin	0.25	0.05	0.48	0.13	1.77	0.18	2.55	0.19	1.99	0.18
4,4-DDE	0.03	0.02	NQ	0.05	NQ	0.06	0.18	0.07	NQ	0.06
2,4-DDD	NQ	0.12	0.30	0.29	0.79	0.40	0.50	0.41	0.65	0.38
Endrin	0.21	0.00	0.11	0.00	0.09	0.00	0.26	0.00	0.11	0.00
Endosulfan II	0.30	0.18	NQ	0.43	NQ	0.60	NQ	0.62	NQ	0.58
4,4-DDD + Cis-Nonachlor	0.07	0.01	3.25	0.02	27.86	0.03	27.54	0.03	34.14	0.02
2,4-DDT	1.41	0.05	0.44	0.12	1.07	0.17	0.97	0.17	2.09	0.16
4,4-DDT	NQ	0.46	NQ	1.11	19.54	1.54	15.24	1.59	16.99	1.49
Methoxychlor	NQ	0.29	NQ	0.71	NQ	0.99	NQ	1.02	NQ	0.96
Mirex	NQ	0.00	NQ	0.00	0.09	0.00	0.03	0.00	NQ	0.00

GLOSSARY

Accuracy: The ability to obtain a true value; determined by the degree of agreement between an observed value and an accepted reference value.

Acid volatile sulfide (AVS): The sulfides removed from sediment by cold acid extraction, consisting mainly of H2S and FeS. AVS is a possible predictive tool for divalent metal sediment toxicity.

Acute: Having a sudden onset, lasting a short time.

Acute toxicity: Short-term toxicity to organism(s) that have been affected by the properties of a substance, such as contaminated sediment. The acute toxicity of a sediment is generally determined by quantifying the mortality of appropriately sensitive organisms that are put into contact with the sediment, under either field or laboratory conditions, for a specified period.

Adjacent: Bordering, contiguous or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are "adjacent wetlands".

Amphipod: A large group usually - an order of crustaceans - comprising the beach fleas and related forms - being mainly of small size with laterally compressed body, four anterior pairs of thoracic limbs directed forward - and three posterior pairs directed backward - and upward - the thoracic limbs bearing gills-aquatic in fresh or salt water.

Application factor (AF): A numerical, unitless value, calculated as the threshold chronically toxic concentration of a test substance divided by its acutely toxic concentration. The AF is usually reported as a range and is multiplied by the median lethal concentration as determined in a short-term (acute) toxicity test to estimate an expected no- effect concentration under chronic exposure.

Benchmark organism: Test organism designated by USACE and EPA as appropriately sensitive and useful for determining biological data applicable to the real world. Test protocols with such organisms are published, reproducible and standardized.

Bioaccumulation: The accumulation of contaminants in the tissue of organisms through any route, including respiration, ingestion, or direct contact with contaminated water, sediment, pore water or dredged material. [The regulations require that bioaccumulation be considered as part of the environmental evaluation of dredged material proposed for disposal. This consideration involves predicting whether there will be a cause-and-effect relationship between an organism's presence in the area influenced by the dredged material and an environmentally important elevation of its tissue content or body burden of contaminants above that in similar animals not influenced by the disposal of the dredged material].

Bioaccumulation factor: The degree to which an organism accumulates a chemical compared to the source. It is a dimensionless number or factor derived by dividing the concentration in the organism by that in the source.

Bioassay: A bioassay is a test using a biological system. It involves exposing an organism to a test material and determining a response. There are two major types of bioassays differentiated by response: toxicity tests which measure an effect (e.g., acute toxicity, sublethal/chronic toxicity) and bioaccumulation tests which measure a phenomenon (e.g., the uptake of contaminants into tissues).

Bioavailable: Can affect organisms.

Bioconcentration: Uptake of a substance from water.

Biomagnification: Bioaccumulation up the food chain, e.g., the route of accumulation is solely through food. Organisms at higher trophic levels will have higher body burdens than those at lower trophic levels.

Biota sediment accumulation factor: Relative concentration of a substance in the tissues of an organism compared to the concentration of the same substance in the sediment.

Bryozoan: A small phylum of aquatic animals that reproduce by budding - that usually form branching, flat or mosslike colonies -permanently attached on stones or seaweed and enclosed by an external cuticle soft and gelatinous or rigid and chitinous or calcareous - that consist of complex zooids (polyps) each having alimentary canal with separate mouth and anus.

Bulk sediment chemistry: Results of chemical analyses of whole sediments (in terms of wet or dry weight), without normalization (e.g., to organic carbon, grain-size, acid volatile sulfide).

Chronic: Involving a stimulus that is lingering or which continues for a long time.

Chronic toxicity: See sublethal/chronic toxicity.

Comparability: The confidence with which one data set can be compared to others and the expression of results consistent with other organizations reporting similar data. Comparability of procedures also implies using methodologies that produce results comparable in terms of precision and bias.

Completeness: A measure of the amount of valid data obtained versus the amount of data originally intended to be collected.

Confined disposal: A disposal method that isolates the dredged material from the environment. Confined disposal is placement of dredged material within diked confined disposal facilities via pipeline or other means.

Confined disposal facility (CDF): A diked area, either in-water or upland, used to contain dredged material. The terms confined disposal facility (CDF), dredged material containment area, diked disposal facility, and confined disposal area are used interchangeably.

Constituents: Chemical substances, solids, liquids, organic matter, and organisms associated with or contained in or on dredged material.

Contaminant: A chemical or biological substance in a form that can be incorporated into, onto or be ingested by and that harms aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment, and includes but is not limited to the substances on the 307(a)(1) list of toxic pollutants promulgated on January 31, 1978 (43 FR 4109). [Note: A contaminant that causes actual harm is technically referred to as a pollutant, but the regulatory definition of a "pollutant" in the Guidelines is different, reflecting the intent of the CWA.]

Contaminant of concern: A contaminant present in a given sediment thought to have the potential for unacceptable adverse environmental impact due to a proposed discharge.

Control sediment: A sediment essentially free of contaminants and which is used routinely to assess the acceptability of a test. Control sediment may be the sediment from which the test organisms are collected or a laboratory sediment, provided the organisms meet control standards. Test procedures are conducted with the control sediment in the same way as the reference sediment and dredged material. The purpose of the control sediment is to confirm the biological acceptability of the test conditions and to help verify the health of the organisms during the test. Excessive mortality in the control sediment indicates a problem with the test conditions or organisms, and can invalidate the results of the corresponding dredged material test.

Data quality indicators: Quantitative statistics and qualitative descriptors which are used to interpret the degree of acceptability or utility of data to the user; include bias (systematic error), precision, accuracy, comparability, completeness, representativeness, detectability and statistical confidence.

Data quality objectives (DQOs): Qualitative and quantitative statements of the overall uncertainty that a decision maker is willing to accept in results or decisions derived from environmental data. DQOs provide the framework for planning environmental data operations consistent with the data user's needs.

Dendrogram: A branching diagrammatic representation of the interrelations of a group of items sharing some common factors (as of natural groups connected by ancestral forms).

Discharge of dredged material: Any addition of dredged material into waters of the United States. [Dredged material discharges include: open water discharges; discharges resulting from unconfined disposal operations (such as beach nourishment or other beneficial uses); discharges from confined disposal facilities which enter waters of the United States (such as effluent, surface runoff, or leachate); and, overflow from dredge hoppers, scows, or other transport vessels]. Material resuspended during normal dredging operations is considered "de minimus" and is not regulated under Section 404 as a dredged material discharge. See 33 CFR 323.2 for a detailed definition. The potential impact of resuspension due to dredging can be addressed under NEPA.

Disposal site: That portion of the "waters of the United States" where specific disposal activities are permitted and consist of a bottom surface area and any overlying volume of water. In the case of wetlands on which surface water is not present, the disposal site consists of the wetland surface area. [Note: upland locations, although not mentioned in this definition in the Regulations, can also be disposal sites].

District: A USACE administrative area.

Dredged material: Material that is excavated or dredged from waters of the United States. [A general discussion of the nature of dredged material is provided by Engler et al. (1991a)].

EC50: The median effective concentration. The concentration of a substance that causes a specified effect (generally sublethal rather than acutely lethal) in 50% of the organisms tested in a laboratory toxicity test of specified duration.

Elutriate: Material prepared from the sediment dilution water and used for chemical analyses and toxicity testing. Different types of elutriates are prepared for two different procedures as noted in this manual.

Evaluation: The process of judging data in order to reach a decision.

Factual determination: A determination in writing of the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical and biological components of the aquatic environment.

Federal Standard: The dredged material disposal alternative(s) identified by the U.S. Army Corps of Engineers that represent the least costly, environmentally acceptable alternative(s) consistent with sound engineering practices and which meet the environmental standards established by the Clean Water Act under Section 404(b)(1).

Fill material: Any material used for the primary purpose of replacing an aquatic area with dry land or changing the bottom elevation of a water body for any purpose. The term does not include any pollutant discharged into the water primarily to dispose of waste, as that activity is regulated under Section 402 of the Clean Water Act. [Note: dredged material can be used as fill material].

Grain-size effects: Mortality or other effects in laboratory toxicity tests due to sediment granulometry, not chemical toxicity. [It is clearly best to use test organisms which are not likely to react to grain-size but, if this is not reasonably possible, then testing must account for any grain-size effects.]

Guidelines: Substantive environmental criteria by which proposed discharges of dredged material are evaluated. Clean Water Act Section 404(b)(1) final rule (40 CFR 230) promulgated December 24, 1980.

Hydroid: An order of Hydrozoan coelenterates - comprising forms that alternate a well developed asexual polyp generation with a generation of free medusa or of an abortive medusoid reproductive structure on the polyps - resembling a polyp.

LC50: The median lethal concentration. The concentration of a substance that kills 50% of the organisms tested in a laboratory toxicity test of specified duration.

Leachate: Water or any other liquid that may contain dissolved (leached) soluble materials, such as organic salts and mineral salts, derived from a solid material.

Lethal: Causing death.

Loading density: The ratio of organism biomass or numbers to the volume of test solution in an exposure chamber.

Management actions: Those actions considered necessary to rapidly render harmless the material proposed for discharge (e.g., non-toxic, non-bioaccumulative) and which may include containment in or out of the waters of the U.S. (see 40 CFR Subpart H). Management actions are employed to reduce adverse impacts of proposed discharges of dredged material.

Management unit: A manageable, dredgeable unit of sediment which can be differentiated by sampling and which can be separately dredged and disposed within a larger dredging area. Management units are not differentiated solely on physical or other measures or tests but are also based on site- and project-specific considerations.

Method detection limit (MDL): The minimum concentration of a substance which can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero.

Mixing zone: A limited volume of water serving as a zone of initial dilution in the immediate vicinity of a discharge point where receiving water quality may not meet quality standards or other requirements otherwise applicable to the receiving water. [The mixing zone may be defined by the volume and/or the surface area of the disposal site or specific mixing zone definitions in State water quality standards].

Open water disposal: Placement of dredged material in rivers, lakes or estuaries via pipeline or surface release from hopper dredges or barges.

Pathway: In the case of bioavailable contaminants, the route of exposure (e.g., water, food).

Pollution: The man-made or man-induced alteration of the chemical, physical, biological or radiological integrity of an aquatic ecosystem. [See definition of contaminant].

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Practical quantitation limit (PQL): The lowest concentration that can be reliably quantified with specified limits of precision and accuracy during routine laboratory operating conditions.

Precision: The ability to replicate a value; the degree to which observations or measurements of the same property, usually obtained under similar conditions, conform to themselves. Usually expressed as standard deviation, variance or range.

QA: Quality assurance, the total integrated program for assuring the reliability of data. A system for integrating the quality planning, quality control, quality assessment, and quality improvement efforts to meet user requirements and defined standards of quality with a stated level of confidence.

QC: Quality control, the overall system of technical activities for obtaining prescribed standards of performance in the monitoring and measurement process to meet user requirements.

Reason to believe: Subpart G of the 404(b) (1) guidelines requires the use of available information to make a preliminary determination concerning the need for testing of the material proposed for dredging. This principle is commonly known as "reason to believe", and is contained in Tier I of the tiered testing framework. The decision to not perform additional testing based on prior information must be documented, in order to provide a "reasonable assurance that the proposed discharge material is not a carrier of contaminants" (230.60(b)).

Reference sediment: Point of comparison for evaluating test sediment. Testing requirements in the Section 404(b)(1) Guidelines regarding the point of comparison for evaluating proposed discharges of dredged material are being updated to provide for comparison to a "reference sediment" as opposed to sediment from the disposal site. Because subsequent discharges at a disposal site could adversely impact the point of comparison, adoption of a reference sediment that is unimpacted by previous discharges of dredged material will result in a more scientifically sound evaluation of potential individual and cumulative contaminant-related impacts. This change to the Guidelines was proposed in the Federal Register in January 1995, public comments have been received, and a final rule Notice is being prepared. It is expected that the final rule will be published prior to July 1, 1998, and as a result the reference sediment approach will be implemented in the ITM.

Reference site: The location from which reference sediment is obtained.

Region: An EPA administrative area.

region: A geographical area.

Regulations: Procedures and concepts published in the Code of Federal Regulations for evaluating the discharge of dredged material into waters of the United States.

Representativeness: The degree to which sample data depict an existing environmental condition; a measure of the total variability associated with sampling and measuring that includes the two major error components: systematic error (bias) and random error. Sampling representativeness is accomplished through proper selection of sampling locations and sampling techniques, collection of sufficient number of samples, and use of appropriate subsampling and handling techniques.

Sediment: Material, such as sand, silt, or clay, suspended in or settled on the bottom of a water body.

Standard operating procedure (SOP): A written document which details an operation, analysis, or action whose mechanisms are thoroughly prescribed and which is commonly accepted as the method for performing certain routine or repetitive tasks.

Standardized: In the case of methodology, a published procedure which has been peer reviewed (e.g., journal, technical report), and generally accepted by the relevant technical community of experts.

Sublethal: Not directly causing death; producing less obvious effects on behavior, biochemical and/or physiological function, histology of organisms.

Sublethal/chronic toxicity: Biological tests which use such factors as abnormal development, growth and reproduction, rather than solely lethality, as end-points. These tests involve all or at least an important, sensitive portion of an organism's life-history. A sublethal endpoint may result either from short-term or long-term (chronic) exposures.

Target detection limit: A performance goal set by consensus between the lowest, technically feasible, detection limit for routine analytical methods and available regulatory criteria or guidelines for evaluating dredged material. The target detection limit is, therefore, equal to or greater than the lowest amount of a chemical that can be reliably detected based on the variability of the blank response of routine analytical methods. However, the reliability of a chemical measurement generally increases as the concentration increases. Analytical costs may also be lower at higher detection limits. For these reasons, a target detection limit is typically set at not less than 10 times lower than available dredged material guidelines.

Tests/testing: Specific procedures which generate biological, chemical, and/or physical data to be used in evaluations. The data are usually quantitative but may be qualitative (e.g., taste, odor, organism behavior). Testing for discharges of dredged material in waters of the United States is specified at 40 CFR 230.60 and 230.61 and is implemented through the procedures in this manual.

Tiered approach: A structured, hierarchical procedure for determining data needs relative to decision-making, which involves a series of tiers or levels of intensity of investigation. Typically, tiered testing involves decreased uncertainty and increased available information with increasing tiers. This approach is intended to ensure the maintenance and protection of environmental quality, as well as the optimal use of resources. Specifically, least effort is required in situations where clear determinations can be made of whether (or not unacceptable adverse impacts are likely to occur based on available information. Most effort is required where clear determinations cannot be made with available information.

Toxicity: see Acute toxicity; Sublethal/chronic toxicity, Toxicity test.

Toxicity test: A bioassay which measures an effect (e.g., acute toxicity, sublethal/chronic toxicity). Not a bioaccumulation test (see definition of bioassay).

Water quality certification: A state certification, pursuant to Section 401 of the Clean Water Act, that the proposed discharge of dredged material will comply with the applicable provisions of Sections 301, 303, 306 and 307 of the Clean Water Act and relevant State laws. Typically this certification is provided by the affected State. In instances where the State lacks jurisdiction (e.g., Tribal Lands), such certification is provided by EPA or the Tribe (with an approved certification program).

Water quality standard: A law or regulation that consists of the beneficial designated use or uses of a water body, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular water body, and an anti- degradation statement.

Waters of the U.S.: In general, all waters landward of the baseline of the territorial sea and the territorial sea. Specifically, all waters defined in Section 230.3 (s) of the Guidelines. [See Appendix A].

Whole sediment: The sediment and interstitial waters of the proposed dredged material or reference sediment that have had minimal manipulation. For purposes of this manual, press-sieving to remove organisms from test sediments, homogenization of test sediments, compositing of sediment samples, and additions of small amounts of water to facilitate homogenizing or compositing sediments may be necessary to conducting bioassay tests. These procedures are considered unlikely to substantially alter chemical or toxicological properties of the respective whole sediments except in the case of AVS (acid volatile sulfide) measurements (EPA, 1991a) which are not presently required. Alternatively, wet sieving, elutriation, or freezing and thawing of sediments may alter chemical and/or toxicological properties, and sediment so processed should not be considered as whole sediment for bioassay purposes.

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