

CATALOG DOCUMENTATION  
MAIA-ESTUARIES SUMMARY DATABASE  
1997 and 1998 STATIONS  
BENTHIC SUMMARY DATA: "BENSUMRY"

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**1. DATASET IDENTIFICATION**

1.1 Title of Catalog document

MAIA-Estuaries Summary Database  
1997 and 1998 Stations  
Benthic Summary Data

1.2 Authors of the Catalog entry

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1.3 Catalog revision date

April 30, 2000

1.4 Dataset name

BENSUMRY

1.5 Task Group

MAIA Estuaries

1.6 Dataset identification code

011

1.7 Version

001

1.8 Request for Acknowledgment

EMAP requests that all individuals who download EMAP data acknowledge the source of these data in any reports, papers, or presentations. If you publish these data, please include a statement similar to: "Some or all of the data described in this article were produced by the U. S. Environmental Protection Agency through its Environmental Monitoring and Assessment Program (EMAP)".

## **2. INVESTIGATOR INFORMATION** (for full addresses see Section 13)

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## **3. DATASET ABSTRACT**

### **3.1 Abstract of the Dataset**

The BENSUMRY file presents a summary of selected benthic abundance and biomass data that were collected in MAIA estuaries during the Summers of 1997 and 1998. Seventeen summary parameters are reported for each sampling event at a station. The parameters include the mean abundances per grab of infaunal species, epifaunal species, spionid polychaetes, and tubificid oligochaetes (calculated separately); the mean biomass per grab of all species; the total and mean numbers per grab of infaunal species and epifaunal species (calculated separately); and three indices characterizing the condition at the site: the Shannon-Weiner, Gleason's D, and EMAP VA Province Benthic indices. One record is presented for each site visit. The complete records of benthic abundance and biomass data are contained in the BEN\_ABUN and BEN\_BIOM files, respectively.

### **3.2 Keywords for the Dataset**

Benthic species, invertebrates, epifaunal, infaunal, spionid polychaetes, tubificid oligochaetes, Shannon-Weiner, Gleason's D, EMAP VA Province Benthic Index, mean abundance per grab, mean biomass per grab

## **4. OBJECTIVES AND INTRODUCTION**

### **4.1 Program Objective**

The main objectives of the MAIA-Estuaries program are: (1) to evaluate the ecological condition of the Mid-Atlantic estuaries by measuring key properties of the water, sediment, and the community of organisms; (2) to focus attention on small estuaries in order to develop better monitoring approaches for these critical systems; and (3) to develop partnerships among federal and state environmental organizations.

The Environmental Monitoring and Assessment Program (EMAP) is an EPA research and monitoring program designed to provide unbiased assessments of the condition of selected resources over a wide region. A key feature of the program is a probabilistic sampling strategy that randomly selects sampling sites and assigns weighting factors based on area to all measured results. EMAP's strategy was adopted by the Mid-Atlantic Integrated Assessment (MAIA) program, which was designed to assess the conditions of the estuaries, forests, streams and lakes, and

agricultural lands in the eight-state Mid-Atlantic region. This file contains data measured in MAIA estuaries during the Summers of 1997 and 1998. Samples were collected for water and sediment analyses primarily in 1997, with a few additional sites sampled in 1998. Fish samples were collected only in 1998. Several estuaries were designated as intensive sites and were sampled in greater detail (see STATIONS file).

The partners in MAIA-Estuaries program are: (1) The U.S. Environmental Protection Agency (USEPA), including both the Atlantic Ecology Division (AED) and the Gulf Ecology Division (GED); (2) National Park Service (NPS) under their project "Maryland Coastal Bays Monitoring"; (3) National Oceanographic and Atmospheric Administration (NOAA) which conducted sampling both in the Delaware Bay (DB) under their "National Status and Trends Program" and in the Carolinian Province (CP); and (4) The Chesapeake Bay Program (CBP), which is a consortium of federal, state, and local governments and nongovernmental organizations. Each partner was responsible for collecting, processing, and reviewing data. The USEPA Atlantic Ecology Division was responsible for final assembly and review of all data. Laboratories contracted to process samples are specified by the parameter LABCODE included in all data files (Section 4.4). Details regarding use of partner and LABCODE information are presented in the EVENTS metadata file.

#### 4.2 Dataset Objective

This file presents summary parameters and indices calculated from benthic abundance and biomass data collected in MAIA estuaries in during the Summers of 1997 and 1998.

#### 4.3 Dataset Background Discussion

The data files BEN\_ABUN and BEN\_BIOM contain extensive records reporting the abundance and biomass of benthic invertebrate organisms in MAIA sediments. However, it is often useful to summarize some of this information to aid in its interpretation. This file reports several simple averages of abundance and biomass data, as well as three indices that express the diversity of species in a community. Infaunal species refer to organisms living within the sediments. Epifaunal organisms live at the sediment/water interface. The summary parameters include the mean abundances per grab of infaunal species, epifaunal species, spionid polychaetes, and tubificid oligochaetes (calculated separately); the mean biomass per grab of all species; and the total and mean numbers per grab of infaunal species and epifaunal species (calculated separately). The three indices are the Shannon-Weiner index, Gleason's D index, and the EMAP VA Province Benthic index. The expressions used to calculate these indices are presented in Section 6.2.

The Shannon-Weiner index,  $H'$ , is a standard measure of species diversity that ranges from zero to positive values, representing progressively increasing diversity (Krebs, 1989). Gleason's D index is an expression of species diversity, also ranging from near zero to positive values, with larger values signifying greater diversity. The EMAP Virginian Province Benthic Index is a combination of three metrics into a single index (the metrics are: salinity-adjusted Gleason's index, the salinity-adjusted abundance of tubificids, and the abundance of spionids). This Benthic Index was developed with data compiled during the 1990-1993 EMAP effort in the Virginian Province (Paul *et al.* 1999). The majority of values range from -5 to +5, with positive values signifying healthy conditions and negative values indicating degraded conditions.

#### 4.4 Summary of Dataset Parameters

|           |  |
|-----------|--|
| *STATION  | Station name   |
| *EVNTDATE | Event date   |
| A_SAMPS   | Number of grabs with abundance data                              |
| INF_ABU   | Mean abundance per grab, all infauna                             |
| EPI_ABU   | Mean abundance per grab, all epifauna                            |
| SPIONID   | Spionid polychaetes (infaunal species only), mean abundance/grab |
| TUBIFIC   | Tubificid oligochaetes, mean abundance/grab                      |
| B_SAMPS   | Number of grabs with biomass data                                |

#### 4.4 Summary of Dataset Parameters, continued

|          |  |
|----------|--|
| MN_BIOM  | Mean biomass per grab, all species   |
| TSINFCNT | Total number of infaunal species   |
| TSEPICNT | Total number of epifaunal species  |
| MSINFCNT | Mean number of infaunal species per grab   |
| MSEPICNT | Mean number of epifaunal species per grab  |
| SHANNON3 | Shannon-Wiener Index - all species   |
| GLEASON3 | Gleason's D - all species  |
| BOT_SAL  | Bottom salinity used in calculating benthic index. Most values are as reported in the WATRPHYS file, but some missing values in Delaware Bay were interpolated from data at neighboring sites. The interpolated data are denoted with a QACODE = BI-A. |
| PEXP_GL3 | Salinity normalized Gleason's D  |
| PEXP_TUB | Salinity normalized tubificid abundance  |
| B_IND94B | EMAP VA province benthic index   |
| QACODE   | QA qualifier<br><blank> No qualification<br>BI-A Salinity values used in calculating Benthic Index are interpolated  |
| LABCODE  | Contract / lab identifier<br>BEN-1 USEPA contractor: Versar, Inc.<br>BEN-2 NOAA Carolinian Province contractor<br>BEN-3 Chesapeake Bay Program contractor: Versar, Inc.<br>BEN-4 NOAA Delaware Bay contractor  |
| YEAR     | Year of Sampling: 1997 or 1998   |

\* denotes parameters that should be used as key fields when merging data files

### 5. DATA ACQUISITION AND PROCESSING METHODS

All values in this data file were calculated from data presented in the BEN\_ABUN and BEN\_BIOM data files. Refer to the metadata for those files for details regarding sampling and processing methods.

### 6. DATA ANALYSIS AND MANIPULATIONS

#### 6.1 Name of New or Modified Values

|          |   |
|----------|---|
| SHANNON3 | Shannon-Wiener Index - all species      |
| GLEASON3 | Gleason's D - all species               |
| PEXP_GL3 | Salinity normalized Gleason's D         |
| PEXP_TUB | Salinity normalized tubificid abundance |
| B_IND94B | EMAP VA province benthic index          |

#### 6.2 Data Manipulation Description

The Shannon-Wiener Index, SHANNON3, was calculated as:

$$H' = -3\sum P_i \log_{10}(P_i)$$

where  $P_i$  is the fraction of the total abundance attributed to the  $i$ th species, and  $\log_{10}$  denotes log base 10. All species reported at a station (infaunal and epifaunal) were included.

The Gleason's D Index, GLEASON3, for infaunal and epifaunal species was calculated as:

$$D = (\text{total \# species}) / (\text{natural log of total abundance})$$

All species reported at a station were included.

The salinity-normalized Gleason's Index was calculated as the ratio of the *measured* and

expected Gleason's D indices, reported as a percent (Paul *et al.*, 1999). The expected index is calculated:

$$\text{PEXP\_GL3} = \text{GLEASON3} / (4.283 - 0.498 * \text{sal} + 0.0542 * \text{sal}^2 - 0.00103 * \text{sal}^3) * 100$$

where 'sal' is the bottom water salinity.

The salinity-normalized tubificid abundance was calculated as (Paul *et al.*, 1999):

$$\text{PEXP\_TUB} = \text{measured tubificid abundance} - 500 * \exp(-15 * \text{sal})$$

where 'sal' is the bottom water salinity.

The EMAP VA Province Benthic Index, B\_IND94B, was developed as described by Paul *et al.*, (1999). The coefficients of the expression differ depending on the number of grabs analyzed at a station. Where one grab sample was analyzed, the benthic index (BI) was calculated as:

$$\text{BI} = 1.389 * (\text{PEXP\_GL3} - 51.5) / 28.4 - 0.651 * (\text{PEXP\_TUB} - 28.2) / 119.5 - 0.375 * (\text{spionid abundance} - 20.0) / 45.4;$$

Where either 2 or 3 grabs samples were analyzed, the BI was calculated as :

$$\text{BI} = 1.246 * (\text{PEXP\_GL3} - 40.5) / 25.3 - 0.555 * (\text{PEXP\_TUB} - 29.1) / 124.7 - 0.344 * (\text{spionid abundance} - 20.0) / 52.0;$$

PEXP\_GL3 is the salinity-normalized Gleason's D index, and PEXP\_TUB is the salinity-normalized tubificid abundance.

## 7. DATA DESCRIPTION

### 7.1 Description of Parameters

#### 7.1.1 Components of the Dataset

|          |  |
|----------|--|
| STATION  | Station name   |
| EVNTDATE | Event date   |
| A_SAMPS  | Number of grabs with abundance data                              |
| INF_ABU  | Mean abundance per grab, all infauna                             |
| EPI_ABU  | Mean abundance per grab, all epifauna                            |
| SPIONID  | Spionid polychaetes (infaunal species only), mean abundance/grab |
| TUBIFIC  | Tubificid oligochaetes, mean abundance/grab                      |
| B_SAMPS  | Number of grabs with biomass data                                |
| MN_BIOM  | Mean biomass per grab, all species                               |
| TSINFCNT | Total number of infaunal species                                 |
| TSEPICNT | Total number of epifaunal species                                |
| MSINFCNT | Mean number of infaunal species per grab                         |
| MSEPICNT | Mean number of epifaunal species per grab                        |
| SHANNON3 | Shannon-Wiener Index - all species                               |
| GLEASON3 | Gleason's D - all species  |
| BOT_SAL  | Bottom water salinity  |
| PEXP_GL3 | Salinity normalized Gleason's D                                  |
| PEXP_TUB | Salinity normalized tubificid abundance                          |
| B_IND94B | EMAP VA province benthic index                                   |
| QACODE   | QA qualifier   |
| LABCODE  | Contract / lab identifier  |
| YEAR     | Year of sampling   |

#### 7.1.2 Precision of Reported Values

| PARAMETER | PRECISION | MIN | MAX  | UNITS              |
|-----------|-----------|-----|------|--------------------|
| A_SAMPS   | unit      | 1   | 3    | number of grabs    |
| INF_ABU   | 0.1       | 0   | 2720 | organisms per grab |
| EPI_ABU   | 0.1       | 0   | 928  | organisms per grab |
| SPIONID   | 0.1       | 0   | 296  | organisms per grab |

### 7.1.2 Precision of Reported Values

| PARAMETER | PRECISION | MIN   | MAX  | UNITS              |
|-----------|-----------|-------|------|--------------------|
| TUBIFIC   | 0.1       | 0     | 1860 | organisms per grab |
| B_SAMPS   | unit      | 1     | 3    | number of grabs    |
| MN_BIOM   | 0.0001    | 0     | 10.8 | gram per grab      |
| TSINFCNT  | unit      | 0     | 55   | number of species  |
| TSEPICNT  | unit      | 0     | 33   | number of species  |
| MSINFCNT  | 0.1       | 0     | 35   | species per grab   |
| MSEPICNT  | 0.1       | 0     | 19.5 | species per grab   |
| SHANNON3  | 0.001     | 0     | 1.42 | no units           |
| GLEASON3  | 0.01      | 0     | 11.5 | number of species  |
| BOT_SAL   | 0.1       | 0     | 35   | ppt                |
| PEXP_GL3  | 0.1       | 0     | 124  | no units           |
| PEXP_TUB  | 0.1       | -493  | 1860 | organisms per grab |
| B_IND94B  | 0.01      | -8.87 | 5.01 | no units           |

### 7.1.3 Minimum Value in Dataset

See Section 7.1.2.

### 7.1.4 Maximum Value in Dataset

See Section 7.1.2.

## 7.2 Data Record Example

### 7.2.1 Column Names for Example Record

See Section 7.2.2.

### 7.2.2 Example Data Records

| STATION   | EVNTDATE | A_SAMPS | INF_ABU | EPI_ABU | SPIONID | TUBIFIC |
|-----------|----------|---------|---------|---------|---------|---------|
| MA97-0001 | 8/25/97  | 2       | 141.5   | 1.0     | 52.0    | 0.0     |
| MA97-0003 | 8/26/97  | 2       | 58.0    | 6.5     | 11.5    | 0.0     |
| MA97-0004 | 8/26/97  | 2       | 59.5    | 4.5     | 7.5     | 0.0     |
| MA97-0005 | 8/27/97  | 2       | 136.0   | 6.0     | 10.5    | 0.0     |

  

| B_SAMPS | MN_BIOM | TSINFCNT | TSEPICNT | MSINFCNT | MSEPICNT | SHANNON3 |
|---------|---------|----------|----------|----------|----------|----------|
| 2       | 0.1051  | 16       | 1        | 12.0     | 0.5      | 0.788    |
| 2       | 0.0623  | 26       | 6        | 16.5     | 3.0      | 1.305    |
| 2       | 0.0307  | 14       | 1        | 10.5     | 1.0      | 0.944    |
| 2       | 0.0445  | 27       | 6        | 18.5     | 3.0      | 1.034    |

  

| GLEASON3 | BOT_SAL | PEXP_GL3 | PEXP_TUB | B_IND94B | QACODE | YEAR |
|----------|---------|----------|----------|----------|--------|------|
| 3.01     | 30.1    | 29.2     | 0.0      | -1.20    |        | 1997 |
| 6.58     | 27.2    | 65.1     | 0.0      | 0.89     |        | 1997 |
| 3.09     | 26.0    | 31.3     | 0.0      | -0.73    |        | 1997 |
| 5.84     | 28.3    | 57.0     | 0.0      | 0.50     |        | 1997 |

## **8. GEOGRAPHIC AND SPATIAL INFORMATION**

### **8.1 Minimum Longitude (Westernmost)**

-77.4339 decimal degrees

### **8.2 Maximum Longitude (Easternmost)**

-74.7230 decimal degrees

### **8.3 Minimum Latitude (Southernmost)**

34.9670 decimal degrees

### **8.4 Maximum Latitude (Northernmost)**

40.1470 decimal degrees

### **8.5 Name of area or region**

MAIA estuary region, consisting of Delaware Bay, Chesapeake Bay, the Delmarva coastal bays, Albemarle-Pamlico Sound, and contiguous estuaries.

## **9. QUALITY CONTROL AND QUALITY ASSURANCE**

All values in this data file were calculated from data presented in the BEN\_ABUN and BEN\_BIOM data files. Refer to the metadata for those files for details regarding sampling and processing methods.

### **9.1 Measurement Quality Objectives**

Not applicable

### **9.2 Data Quality Assurance Procedures**

Not applicable

### **9.3 Actual Measurement Quality**

Not applicable

## **10. DATA ACCESS**

### **10.1 Data Access Procedures**

Data can be downloaded from the web

### **10.2 Data Access Restrictions**

None

### **10.3 Data Access Contact Persons**

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### **10.4 Dataset Format**

ASCII (CSV) and SAS Export files

10.5 Information Concerning Anonymous FTP  
Not available

10.6 Information Concerning WWW  
No gopher access, see Section 10.1 for WWW access

10.7 EMAP CD-ROM Containing the Dataset  
Data not available on CD-ROM

## 11. REFERENCES

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Paul, J.F., J.H. Gentile, K.J. Scott, S.C. Schimmel, D.E. Campbell, and R.W. Latimer. 1999. EMAP-Virginian Province Four-Year Assessment Report (1990-93). EPA 600/R-99/004. U.S. Environmental Protection Agency, Atlantic Ecology Division, Narragansett, Rhode Island.

Strobel, C.J. 1998. Mid Atlantic Integrated Assessment / Environmental Monitoring and Assessment Program - Estuaries: Virginian Province Quality Assurance Project Plan. U.S. EPA, Office of Research and Development, NHEERL-AED, Narragansett, RI. June 1998.

## 12. TABLE OF ACRONYMS

|        |   |
|--------|---|
| AED    | Atlantic Ecology Division                                     |
| BI     | Benthic Index   |
| CP     | Carolinian Province   |
| CBP    | Chesapeake Bay Program  |
| D      | Gleason's D Index   |
| DB     | Delaware Bay  |
| EMAP   | Environmental Monitoring and Assessment Program               |
| EPA    | U.S. Environmental Protection Agency                          |
| GED    | Gulf Ecology Division   |
| GERG   | Geochemical and Environmental Research Group                  |
| H'     | Shannons-Weiner Index   |
| MAIA   | Mid-Atlantic Integrated Assessment                            |
| NHEERL | National Health and Environmental Effects Research Laboratory |
| NOAA   | National Oceanic and Atmospheric Administration               |
| NOS    | National Ocean Service  |
| NPS    | National Park Service   |
| ODU    | Old Dominion University                                       |
| ORCA   | Office of Ocean Resources Conservation and Assessment         |
| ORD    | Office of Research and Development                            |
| QA/QC  | Quality Assurance/Quality Control                             |
| TAMU   | Texas A&M University  |
| TOC    | Total Organic Carbon  |
| USEPA  | United States Environmental Protection Agency                 |
| VER    | Versar, Inc.  |
| WWW    | World Wide Web  |



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