CATALOG DOCUMENTATION
EMAP-ESTUARIES PROVINCE LEVEL DATABASE
CAROLINIAN PROVINCE 1993-1997
STATION LOCATION AND INFORMATION DATA

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1. DATA SET IDENTIFICATION

1.1 Title of Catalog Document

EMAP-Estuaries Province Level Database
Carolinian Province
Station Location and Information Data

1.2 Authors of the Catalog entry

Timothy R. Snoots,
Dr. Jeffrey L. Hyland

1.3 Catalog Revision Date

February 20, 1998

1.4 Data Set Name

CP_STAT.DAT

1.5 Task Group

Estuaries

1.6 Data set identification codes

1

1.7 Version

001

1.8 Requested Acknowledgment

If you plan to publish these data in any way, EPA requires a standard statement for work it has supported:

"Although the data described in this article have been funded wholly or in part by the U. S. Environmental Protection Agency through its EMAP-Estuaries Program, it has not been subjected to Agency review, and therefore does not necessarily reflect the views of the Agency and no official endorsement should be inferred."

2. INVESTIGATOR INFORMATION

2.1 Principal Investigator

J. Hyland (NOAA/NOS/ORCA) - Carolinian Province Manager
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3. DATA SET ABSTRACT

3.1 Abstract of the Data set

The CP_STAT.DAT data set contains station names, geographic location, surface area, and other information about all stations sampled in the EMAP Carolinian Province from 1993-1997.

The following reports are products of these and other data collected during the 1993-1997 Sampling period in the Carolinian Province. These reports may contain additional information and summary statistics that are not contained in this data set catalog or its respective data sets. We therefore recommend referring to them when using these data.

Ringwood, A.H., A.F. Holland, R.T. Kneib, and P.E. Ross. 1996. EMAP/NS&T Pilot studies in the Carolinian Province: Indicator testing and evaluation in the southeastern estuaries. NOAA Technical Memorandum NOS ORCA 102. NOAA/NOS, Office of Ocean Resources Conservation and Assessment, Silver Spring, MD. 113 p.

Hyland, J.L., T.J. Herrlinger, T.R. Snoots, A.H. Ringwood, R.F. Van Dolah, C.T. Hackney, G.A. Nelson, J.S. Rosen, and S.A. Kokkinakis. 1996. Environmental quality of estuaries of the Carolinian Province: 1994. Annual statistical summary for the 1994 EMAP-Estuaries Demonstration Project in the Carolinian Province. NOAA Technical Memorandum NOS ORCA 97. NOAA/NOS, Office of Ocean Resources Conservation and Assessment, Silver Spring, MD. 102 p.

Hyland, J.L., L. Balthis, C.T. Hackney, G. McRae, A.H. Ringwood, T.R. Snoots, R.F. Van Dolah, and T.L. Wade. 1998. Environmental quality of estuaries of the Carolinian Province: 1995. Annual statistical summary for the 1995 EMAP-Estuaries Demonstration Project in the Carolinian Province. NOAA Technical Memorandum NOS ORCA 123 NOAA/NOS, Office of Ocean Resources Conservation and Assessment, Silver Spring, MD. 143 p.

3.2 Keywords for the Data Set

sampling sites, station location, estuary, latitude, longitude, state, station, area, EMAP Carolinian Province

4. OBJECTIVES AND INTRODUCTION

4.1 Program Objective

EMAP has three primary objectives:

1. To estimate the current status, extent, changes, and trends in indicators of the Nation's ecological resources on a regional basis;

2. To monitor indicators of pollutant exposure and habitat condition, and to seek correlative relationships between human-induced stresses and ecological condition that identify possible causes of adverse effects; and

3. To provide periodic statistical summaries and interpretive reports on ecological status and trends to the EPA Administrator and to the public.

4.2 Data Set Objective

The CP_STAT.DAT data set contains station names, geographic location, surface area, and other information about all stations sampled in the EMAP Carolinian Province from 1993-1997.

4.3 Data Set Background Information

An overall goal of EMAP is to make statistically unbiased estimates of ecological condition with known confidence. To approach this goal, a probabilistic sampling framework was established among the overall population of estuaries comprising the Carolinian Province. Under this design, each sampling point is a statistically valid probability sample. Thus, percentages of estuarine area with values of selected indicators above or below suggested environmental guidelines can be estimated based on the conditions observed at individual sampling points.

Statistical confidence intervals around these estimates also can be calculated. Moreover, these estimates can be combined with those for other regions that were sampled in a consistent manner to yield national estimates of estuarine condition.

As in other EMAP-E provinces (Strobel et al. 1994, Summers et al. 1993), the sampling design for base sites in the Carolinian Province was stratified based foremost on physical dimensions of an estuary. Estuaries were divided into three classes: large estuaries (area > 260 km2 and length/width aspect ratio < 20), small estuaries (area 2.6-260 km2), and large tidal rivers (tidally influenced portion of a river with detectable tides > 2.5 cm, area > 260 km2 and length/width aspect ratio > 20). The estuary class for each station is reported in the variable STRATA as LR (Large Estuary), SR (Small Estuary), SP (Replicate of Small Estuary), RR (Large Tidal River), and RP (Replicate of Large Tidal River). This classification scheme resulted in the identification of 200 estuaries with an overall surface area of 11,622 km2. The total is composed of three large estuaries, three large tidal rivers, and 194 small estuaries with corresponding subpopulation areas of 5,581 km2, 1,134 km2, and 4,907 km2, respectively. Currituck, Albemarle, and Pamlico Sounds (all in North Carolina) are the three large estuaries. The three large tidal rivers are the Neuse and Pamlico Rivers in North Carolina and the Indian River in Florida.

Stratification of the overall sampling area into classes of estuaries with similar attributes is necessary in order to minimize within-class sampling variability. Also, it is not feasible to sample all of the different types of estuaries that exist within a broad geographic region at the same spatial scale. Stratification by physical dimensions of an estuary was adopted because: (1) such attributes usually show minimal change over extended periods; (2) alternative classification variables such as salinity, sediment type, depth, and extent of pollutant loadings would result in the definition of classes for which areal extents could vary widely from year to year; (3) data for physically based classes can be aggregated into geographic units that are meaningful from a regulatory or general-interest perspective; and (4) estuarine boundaries can be delineated more readily and accurately from maps or charts of the physical dimensions of coastal areas than from maps of sediment or water-column characteristics.

Base sites in large estuaries were selected at random using a sampling grid approach similar to the one used in the EMAP Louisianian Province (Summers et al. 1993). A triangular lattice was placed initially over the study region and the resulting grid shifted randomly. A tessellation of the grid cells was performed next to partition the province into a series of contiguous hexagonal quadrats each with a surface area of 280 km2. A station was then selected randomly from each of the hexagons coinciding with large estuaries.

Base sites in large tidal rivers were selected randomly using a "spine and rib" approach, also similar to the one used in the EMAP Louisianian Province (Summers et al. 1993). The design is basically a linear analog of the sampling grid for large estuaries. Segments of equal length (25 km) were established within the tidally influenced estuarine portions of the rivers (river mouths inland to salinities of ~ 0.5 ppt). Because the Indian River (a bar-built estuary with several inlets along its axis) is tidally influenced throughout its length, ten segments were established along this 250-km large tidal river. For the Neuse and Pamlico Rivers, two segments were established between the mouth of each river and the inland boundary of saltwater influence. A minimum of one sampling station was then selected randomly within each segment of each river.

Base sites in small estuaries were selected using a random list-frame approach. Prior to the first year of sampling, a list frame of all 194 small estuaries was constructed with the individual estuaries ordered from north to south. A random starting point among the estuaries was selected. Beginning with that point, the estuaries were partitioned into spatial strata each composed of four neighboring small estuaries. This process continued until all estuaries on the list frame were partitioned. According to the design, each year over a four-year cycle, a new small estuary is chosen at random from the remaining unsampled estuaries comprising each group of four. An individual sampling site is then selected randomly for each estuary in a given year. A similar list-frame approach was used in the EMAP

Louisianian Province (Summers et al. 1993), except that in the latter case the starting position for grouping estuaries was not randomized.

Under the sampling design, a new set of random stations in each of the estuarine classes should be selected and sampled each year over a four-year cycle. The same stations sampled in any given year also are intended to be resampled every four years to facilitate unbiased estimates of temporal trends.

Four types of stations are included in the CP_STAT data set. The variable CLASCODE can be used to distinguish between the following stations types:

Randomly Selected Base stations (CLASCODE = Random-Base) were randomly selected sites that made up the probability-based EMAP monitoring design as described above. Data collected from these sites were used to produce unbiased estimates of estuarine condition throughout the province based on the various synoptically measured indicators of environmental quality.

Supplemental stations (CLASCODE = Supplement) were sites selected non-randomly in areas for which there was some prior knowledge of the ambient environmental conditions. These sites, which represented pristine areas and places with histories of anthropogenic disturbance, were used to test the discriminatory power of various ecological indicators included in the program. NOTE: Because these stations were not randomly selected, they must not be used in any probability-based statistical analyses that require data from a random sample of Carolinian Province estuaries (e.g., these stations cannot be used in Cumulative Distribution Function [CDF] calculations of percent estuarine area).

Revisited sites (CLASCODE = Revisit) were former random base stations (sampled in previous years) representative of degraded and undegraded conditions in key types of habitat throughout the province. This re-sampling of former sites was conducted to confirm the existence of prior anthropogenic impacts in these specific systems, examine the degree to which the conditions have changed with time, and to provide a basis for understanding and predicting levels of impacts in different types of southeastern estuarine habitats.

Site-intensive stations (CLASCODE = Intensive) were sites selected to assess conditions within a specific estuary. NOTE: Because these stations were not randomly selected, they must not be used in any probability-based statistical analyses that require data from a random sample of Carolinian Province estuaries (e.g., these stations cannot be used in Cumulative Distribution Function [CDF] calculations of percent estuarine area).

4.4 Summary of Data Set Parameters

The CP_STAT.DAT data set contains the name, latitude, longitude, depth, state, statistical strata information, and statistical area of all stations sampled in the Carolinian Province from 1993-1997.

4.5 Year-Specific Information about Data

In 1993, sampling took place at a limited number of nonrandom stations as part of a preliminary Carolinian Province Pilot Study. This data was used to evaluate and select techniques to be used over the next 4 years of EMAP sampling in the Carolinian Province. Although station information for these sites is given in the CP_STAT.DAT data set, most other data sets do not contain data from 1993. Station location data was included for these stations because data from 1993 is reported in a few data sets that were used for the development and application of indicators of estuarine health such as the Index of Biotic Integrity for the Carolinian Province.

In 1994 and 1995, province-wide random sampling was completed in the Carolinian Province. Many supplemental stations of interest were sampled as well.

In 1996 and 1997, random sampling was completed in the North Carolina portion of the Carolinian Province only, due to

funding constraints. In addition, in 1997 several stations of interest in the Carolinian Province that had been sampled in prior years were re-visited to confirm the existence of anthropogenic impacts, examine the degree to which the conditions have changed with time, and provide a basis for comparing impacts in different environmental regimes. Also in 1997, 10 stations in the Chowan River were sampled as an intensive assessment of the conditions within that estuary.

The following tables summarize station sampling efforts in the Carolinian Province from 1993-1997.

Random Base Stations - Entire 4 year EMAP Statistical Design

	Large	Small	Tidal R.	Province
- ALL YEARS -				
Number of Estuaries	3	194	3	200
Actual Area (km2)	5,581.1	4,907	1,134	11,622.1

Random Base Stations - Actually Sampled in Carolinian Province

	Large	Small	Tidal R.	Total
- 1994 -				
Number of Stations	20	47	14	81
Number of Replicates	0	0	3	3
Total Stations Sampled	20	47	17	84
Statistical Area (km2)	5,600	1,243.4	1,134	6,857.4
- 1995 -				
Number of Stations	16	49	14	79
Number of Replicates	0	6	3	9
Total Stations Sampled	16	55	17	88
Statistical Area (km2)	4,480	1,377.8	1,134	6,991.8
- 1996 -				
Number of Stations	17	21	4	42
Number of Replicates	0	0	0	0
Total Stations Sampled	17	21	4	42
Statistical Area (km2)	4,760	625.4	771.2	6,156.6
- 1997 -				
Number of Stations	18	22	4	44
Number of Replicates	0	0	0	0
Total Stations Sampled	18	22	4	44
Statistical Area (km2)	5,040	533.7	771.2	6,344.9
- Four Year Totals -				
Number of Stations	71	139	36	246
Number of Replicates	0	6	6	12
Total Stations Sampled	71	145	42	258

Note: 1) The full Carolinian Province statistical sampling design was sampled in 1994 and 1995. However, in 1996 and 1997 base station sampling was limited to stations in NC only.
2) Statistical area reported for Large estuaries is 280 km2 per hexagon.
3) Statistical areas of replicated stations are only included once in totals.

Total Sampling Effort (Number of Stations Sampled)

	Year					
Station Type	1993	1994	1995	1996	1997	Total
Random-Base	0	81	79	42	44	246
Replicate	0	3	9	0	0	12
Supplemental	24	13	21	0	0	58
Revisited	0	0	0	0	16	16
Intensive	0	0	0	0	10	10
Total	24	97	109	42	70	342

5. DATA ACQUISITION AND PROCESSING METHODS

5.1 Data Acquisition

5.1.1 Sampling Objective

See section 4.3 (Data Set Background Information)

5.1.2 Sample Collection Method Summary

See section 4.3 (Data Set Background Information)

5.1.3 Beginning Sampling Dates

30 June 1994
05 July 1995
09 July 1996
07 July 1997

5.1.4 Ending Sampling Dates

31 August 1994
14 September 1995
19 September 1996
25 August 1997

5.1.5 Platform

Samples were collected from various gasoline or diesel powered boats equipped with at least the following equipment: "A" frame boom or davit, winch, LORAN-C or GPS for location, and a depth finder.

5.1.6 Sampling Equipment

GPS and LORAN-C receivers for determining location and distance from planned station coordinates.

5.1.7 Manufacturer of Sampling Equipment

Differed by sampling vessel.

5.1.8 Key Variables

5.1.9 Sample Collection Method Calibration

Crews were expected to periodically validate navigational readings by comparing instrument readings against a fixed point with a known latitude and longitude.

See: Hyland et al. (1996),
Hyland et al. (1998),
Kokkinakis et al. (1994b)

5.1.10 Sample Collection Quality Control

A 0.05 nautical mile proximity standard was used to ensure that samples were collected as close as possible to the planned station location. If for certain reasons sampling could not take place within 0.05 nautical miles of the planned location (e.g., due to inadequate depth or safety concerns), an attempt was made to move the station to the nearest sampleable point in a random direction within the estuary. When a station was moved in this manner, the Carolinian Province Manager was notified of the new station location and the reason for its relocation. If a new station location could not be found, then the estuary was classified as unsampleable.

GPS and LORAN-C coordinates recorded in the field were compared to proposed station coordinates to assure that sample collection occurred within an acceptable distance of the proposed station location.

Field site audits were conducted during sampling seasons by the QA Officer to determine compliance with the Quality Assurance Plan and Field Operations Manual.

See: Hyland et al. (1996),
Hyland et al. (1998),
Kokkinakis et al. (1994a)

5.1.11 Sample Collection Method References

See: Hyland et al. (1996),
Hyland et al. (1998),
Kokkinakis et al. (1994b)

5.1.12 Sample Collection Method Deviations

None

5.2 Data Preparation and Sample Processing

5.2.1 Sample Processing Objective

NA

5.2.2 Sample Processing Methods Summary

5.2.2.1 Field Summary

NA

5.2.2.2 Laboratory Summary

NA

5.2.3 Sample Processing Method Calibration

NA

5.2.4 Sample Processing Quality Control

NA

5.2.5 Sample Processing Method Reference

NA

5.2.6 Sample Processing Method Deviations

NA

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Value

STA_AREA

6.2 Data Manipulation Description

STA AREA is the statistical area of a station. Stations located in large estuaries each represent a fixed area of 280 km2 (the area of the hexagon that the station represents in the sampling design for large estuaries). Stations in large tidal rivers represent the actual area of the river segment that they represent. Stations in small estuaries represent the actual area of the entire small estuary. Actual area of tidal river segments and small estuaries were determined using GIS analysis.

6.3 Data Manipulation Examples

NA

7. DATA DESCRIPTION

7.1 Description of Parameters

Variable	Type	Format	Label
STA_NAME	Char	7	Carolinian Province Office Station Name
CLASCODE	Char	11	Carolinian Province Office Station Type
STRATA	Char	2	Estuary Class Code
STA_AREA	Num	5.1	Statistical Area of Station (km2)
ESTUARY	Char	30	Estuary Name
LATDEG	Num	7.4	Latitude (decimal degrees)
LNGDEG	Num	9.4	Longitude (decimal degrees)
DEPTH	Num	4.1	Depth (m) at Time of WQ Profile
STATE	Char	2	State of Estuary (2 Letter Postal Code)
EMAPSTAT	Char	8	EMAP Station Name
SEGMENT	Char	3	EMAP River Segment Number (SPUNIT)
MAIASTAT	Char	10	MAIA Station Code

Note the conventions used in the Format column above:

For character (Char) variables, the number given is the maximum width (number of characters) for that variable.

For numeric (Num) variables, the format is given in W.D format, where W = maximum width (number of characters) for the number (including all digits and the decimal point), and D = number of digits to the right of the decimal point.

7.1.6 Precision to which values are reported

Variables STA_AREA and DEPTH are reported to, and are valid to 0.1 units. Variables LATDEG and LNGDEG are reported to, and are valid to 0.0001 units.

7.1.7 Minimum Value in Data Set

Variable	Minimum
STA_AREA	2.7
DEPTH	0.1
LATDEG	27.2012
LNGDEG	-81.7305

7.1.8 Maximum Value in Data Set

Variable	Maximum
STA_AREA	280.0
DEPTH	13.0
LATDEG	36.7238
LNGDEG	-75.5637

7.2 Data Record Example

7.2.1 Column Names for Example Records

STA_NAME;CLASCODE;STRATA;STA_AREA;ESTUARY;LATDEG;LNGDEG;DEPTH;ST
ATE;EMAPSTAT;SEGMENT;MAIASTAT

7.2.2 Example Data Records

CP93BKY;Supplement; ;.;Brickyard Creek;32.8348;-80.0035;.;SC; ; ;
CP93BRU;Supplement; ;.;Brunswick River;31.1893;-81.5218;.;GA; ; ;
CP93WKY;Supplement; ;.;Whiskey Creek;34.1567;-77.8500;.;NC; ; ;
CP94015;Random-Base;SR;5.7;GuanaRiver;30.0362;-81.3317;.;FL;CA94SR47; ;
CP94017;Random-Base;SR;6.2;TroutRiver;30.3975;-81.6453;1.0;FL;CA94SR45; ;
CP94018;Random-Base;SR;9.3;NassauSound;30.5155;-81.4435;7.0;FL;CA94SR44; ;

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude

-81 Degrees, 43.83 Minutes West Longitude

8.2 Maximum Longitude

-75 Degrees, 33.82 Minutes West Longitude

8.3 Minimum Latitude

27 Degrees, 12.07 Minutes North Latitude

8.4 Maximum Latitude

36 Degrees, 43.43 Minutes North Latitude

8.5 Name of area or region

Coastal distribution of sampling is along the southeastern US from Cape Henry, VA, through St. Lucie Inlet, FL. States represented: Virginia, North Carolina, South Carolina, Georgia, and Florida.

9. QUALITY CONTROL/QUALITY ASSURANCE

9.1 Measurement Quality Objectives

See section 5.1.9 (Sample Collection Method Calibration) and section 5.1.10 (Sample Collection Quality Control) above.

9.2 Quality Assurance/Control Methods

See section 5.1.9 (Sample Collection Method Calibration) and section 5.1.10 (Sample Collection Quality Control) above.

9.3 Quality Assessment Results

NA

10. DATA ACCESS

10.1 Data Access Procedures

Data can be downloaded from the WWW site.

10.2 Data Access Restrictions

Data can only be accessed from the WWW site.

10.3 Data Access Contact Persons

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10.4 Data file Format

Delimited ASCII Text

10.5 Information Concerning Anonymous FTP

Not accessible

10.6 Information Concerning Gopher and WWW

Data can be downloaded from the WWW.

10.7 EMAP CD-ROM Containing the Data file

Data not available on CD-ROM.

11. REFERENCES

Hyland, J.L., T.J. Herrlinger, T.R. Snoots, A.H. Ringwood, R.F. Van Dolah, C.T. Hackney, G.A. Nelson, J.S. Rosen, and S.A. Kokkinakis. 1996. Environmental quality of estuaries of the Carolinian Province: 1994. Annual statistical summary for the 1994 EMAP-Estuaries Demonstration Project in the Carolinian Province. NOAA Technical Memorandum NOS ORCA 97. NOAA/NOS, Office of Ocean Resources Conservation and Assessment, Silver Spring, MD. 102 p.

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U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses. U.S. Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/620/R-95/008.

12. TABLE OF ACRONYMS

BVA	Barry A. Vittor & Associates, Inc., Mobile, Alabama
C	Degrees Celsius
cm2	Square centimeters
CMBAD	Coastal Monitoring and Bioeffects Assessment Division
CU	Clemson University
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
EPA-AED	EPA-Atlantic Ecology Division
EPA-GED	EPA-Gulf Ecology Division
EPA-RTP	EPA-Research Triangle Park, NC
FLDEP	Florida Dept. of Environmental Protection
FMRI	Florida Marine Research Institute
FTP	File Transfer Protocol
GIS	Geographical Information System
JCWS	Johnson Controls Word Services
km2	Square kilometers
m2	Square meters
mg/L	Milligrams per liter
mS/cm	MilliSiemens per centimeter (equiv. to millimhos/cm)
MRRI	Marine Resources Research Institute
NCNERR	North Carolina National Estuarine Research Reserve
NCSU	North Carolina State University, NC
NA	Not Applicable
ng/g	Nanograms per gram
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
ORCA	Office of Ocean Resources Conservation and Assessment
QA/QC	Quality Assurance/Quality Control
ppb	Parts per billion (equiv. to ng/g)
ppm	Parts per million (equiv. to ug/g)
ppt	Parts per thousand
SAIC	Science Applications International Corporation
SCDNR	South Carolina Dept. of Natural Resources
TOC	Total Organic Carbon
TAMU/GERG	Texas A&M University, Geochemical and Environmental Research Group
TPMC	Technology Planning and Management Corporation
ug/g	Micrograms per gram
um	Micrometers
UC	University of Charleston, SC
UGA	University of Georgia, GA
UNC-W	University of North Carolina - Wilmington, NC
USGS-GB	US Geological Survey - Gulf Breeze, FL
wt.	Weight
WWW	World Wide Web -Internet

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