CATALOG DOCUMENTATION
NATIONAL COASTAL ASSESSMENT DATABASE
NORTHEAST REGION 2000-2006
WATER QUALITY MEASUREMENTS: PHYSICAL AND NUTRIENT DATA

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1. DATASET IDENTIFICATION

1.1 Title of Catalog document

National Coastal Assessment Database
Northeast Region 2000-2006
Water Quality Measurements: Physical and Nutrient Data

1.2 Authors of the Catalog entry

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1.3 Catalog revision date

June 2010

1.4 Dataset name

Water Quality Measurements

1.5 Task Group

National Coastal Assessment-Northeast

1.6 Dataset identification code

003

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)

2.1 Principal Investigators

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3. DATASET ABSTRACT

3.1 Abstract of the Dataset

The Water Quality Measurements data set reports physical water quality parameters measured in the field and concentrations of nutrients measured from samples collected for the National Coastal Assessment during the summers of 2000-06. Included is information regarding dissolved oxygen, pH, salinity, temperature, secchi depth (transparency), light attenuation coefficient, ammonium, nitrate and nitrite, nitrite, nitrate, orthophosphate, chlorophyll a, and total suspended solids. Physical parameters were generally measured in the surface and bottom layers of the water column, while nutrients were generally reported for three water layers, surface, mid-depth, and bottom, except for shallow stations (< 2m). At shallow stations, measurements were performed at only one intermediate water depth and values reported identically in both surface-layer and bottom-layer parameters. One record is presented for each analyte measured per level per sampling event.

3.2 Keywords for the Dataset

temperature, dissolved oxygen, pH, depth, salinity, secchi depth, ammonium, nitrate, nitrite, orthophosphate, total suspended solids, chlorophyll a, nitrate and nitrite, light attenuation coefficient

4. OBJECTIVES AND INTRODUCTION

4.1 Program Objective

The National Coastal Assessment (NCA) is a national monitoring and assessment program with the primary goal of providing a consistent evaluation of the estuarine condition in U.S. estuaries. It is an initiative of the Environmental Monitoring and Assessment Program (EMAP), and is a partnership of several federal and state environmental agencies, including: EPA's Regions, Office of Research and Development, and Office of Water; state environmental protection agencies in the 24 marine coastal states and Puerto Rico; and the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Agency (NOAA). The NCA program was initiated in 2000 and completed in 2006.

Stations were randomly selected using EMAP's probabilistic sampling framework and were sampled once during a summer index period (June to October). A consistent suite of indicators was used to measure conditions in the water, sediment, and in benthic and fish communities. The measured data may be used by the states to meet their reporting requirements under the Clean Water Act, Section 305(b). The data were also used to generate a series of national reports characterizing the condition of the Nation’s estuaries http://www.epa.gov/nccr/.

4.2 Dataset Objective

The objective of the Water Quality Measurements data set is to characterize physical and nutrient water quality parameters, measured during 2000-06 in surface, mid-depth and bottom water layers of Northeastern U.S. estuaries.

4.3 Dataset Background Discussion

This database contains data collected in 2000-06 from the Northeast component of the NCA, measured in the estuaries of the states Maine through Virginia. Nine federal-state cooperative agreements were formed to conduct the NCA program in Northeast U.S. Samples were analyzed either by a national lab under contract to the EPA or by in-state labs.

The physical water quality parameters include dissolved oxygen, pH, salinity, temperature, phytosynthetically active radiation (PAR) and secchi depth. A continuous profile of these parameters (except secchi depth) was measured with a CTD or Licor light meter (PAR). A Secchi disk was lowered and raised through the water column. Only the surface and bottom measurements are reported. At some shallow stations, measurements were performed only at one intermediate water depth and values reported are identical in both surface-layer and bottom-layer parameters. If the secchi disk hit bottom, the reading may have been inaccurate (true secchi depth may have been deeper). These conditions are associated with a Quality Assurance code. The bottom-layer measures represent the deepest water that could be measured. At some very deep stations (over 25 meters), measures may not be from near the bottom, due to instrumental limitations.

Some of the measured nutrient values are smaller than the Method Detection Limit (MDL). Such 'non-detects' are reported as zero, and the record is associated with a QA Code. The user may wish to substitute values other than zero for the result, e.g., set the non-detect value to the MDL value, half the MDL value, etc.

Massachusetts did not participate in the NCA program in 2002-04. Rhode Island conducted fish trawls only in 2002-4, and collected water parameters in conjunction with the trawls in 2002-04. Connecticut collected all parameters, but at an abbreviated group of in-shore stations in 2002. Connecticut visited only the in-shore stations planned for sampling in 2003-04; no nutrient parameters were measured. Total Nitrogen (TN) and Total Phosphorus (TP) were not measured in the first three years of the program.

4.4 Summary of Dataset Parameters

Surface, mid-depth and bottom physical and nutrient water quality parameters plus secchi depth are recorded to reflect estuarine conditions in the Northeast United States. The light attenuation coefficients were calculated from PAR measurements.

5. DATA ACQUISITION AND PROCESSING METHODS

5.1 Data Acquisition

The sample collection methods used by USEPA trained field crews will be described here. Any significant variations by NCA partners are noted in Section 5.1.12.

5.1.1 Sampling Objective

Obtain in situ measurements of temperature, salinity, dissolved oxygen, pH, PAR and secchi depth in the surface and bottom layers.

Seawater was collected and filtered for use in the measurement of nutrient, phytoplankton and total suspended solids concentrations. Samples were collected in the surface, mid, and bottom water layers, except at some shallow stations (water depth < 2m) where a single mid-depth sample was taken.

5.1.2 Sample Collection: Methods Summary

Temperature, salinity, conductivity, dissolved oxygen, and pH were measured with a Hydrolab Datasonde or similar instrument, and water clarity was measured using a secchi disk. The Hydrolab was lowered through the water column, and parameter values were recorded every meter for the first five meters and every two meters thereafter, including a value one meter above the bottom. Only the parameter values measured one meter below the surface and one meter above the bottom are reported. At some shallow stations (water depth less than 2m), measurements were performed at only one intermediate water depth and the values reported identically in both surface-layer and bottom-layer parameters.

A seawater sample was collected from surface, mid-depth, and bottom water layers with a 5L Go-Flo sampling bottle for nutrient analysis. At some shallow locations (water depth < 2m) only one mid-depth water sample was taken. Duplicate water samples from the same cast were filtered aboard ship with 0.7-micron glass-fiber filter pads (not all duplicates were analyzed), and both the filtered water and filter were immediately frozen. Replicate field samples were also taken from separate casts at approximately 10% of the stations to evaluate the repeatability of the sampling procedure.

PAR was measured with a LICOR sensor separately or attached to a Hydrolab Datasonde, CTD or similar instrument. A deck sensor, if available, was located on the boat deck in an unshaded location. The PAR sensor was lowered on the sunny (or at least unshaded) side of the boat to a depth of about 0.5 meters, and PAR values were allowed to stabilize. PAR levels were recorded from both the in situ and surface sensors (if a deck sensor was present), along with the water depth of the PAR meter. Measurement intervals were as follows:

Shallow sites (< 2 m): every 0.5 m interval;
Moderate depths (>2 to <10 m): 0.5 m (near-surface) and every 1-m interval to near-bottom (0.5 m off-bottom);
Deep sites (>10 m): 0.5 m (near-surface) and every 1-m interval to 10 m, then at 5-m intervals, thereafter, to near-bottom (0.5 m off-bottom).

Measurements were recorded at the same intervals on the upcast. If the meter hit the bottom, 2-3 minutes were allowed for the disturbed conditions to settle before taking subsequent readings.

5.1.3 Beginning Sampling Dates

7 July 2000
25 June 2001
2 May 2002
1 May 2003
16 April 2006
20 June 2005
1 June 2006

5.1.4 Ending Sampling Dates

20 October 2000
31 October 2001

31 October 2002
7 November 2003
4 November 2006
22 November 2005
24 November 2006

5.1.5 Sampling Platform
Samples were collected from gasoline or diesel powered boats, 18 to 133 feet in length.

5.1.6 Sampling Equipment
Hydrolab DataSonde 3 multi-probe data logging units were generally used. The Software program Procomm was used to set up and download profile logging runs to a laptop computer. A YSI dissolved oxygen meter (Model M58) was used to check the Hydrolab DO and temperature readings. Hand-held refractometers were used to QC the Hydrolab salinity measurements. A 20 cm diameter secchi disk was used with a line marked in 0.2 m intervals. A 5 L Go-Flo® sampling bottle was employed to collect water samples for nutrient analysis. Quantum sensors measured PAR in the 400-700 nm waveband.

5.1.7 Manufacturer of Sampling Equipment
Data logger: Hydrolab Corp., Austin, TX.
Dissolved Oxygen probe: YSI Inc.
LICOR L1400 light meter, LI-COR, Inc.

5.1.8 Key Variables
Not applicable

5.1.9 Sample Collection: Calibration
Calibration of the Hydrolab dissolved oxygen sensor was performed using the air calibration method as described by the manufacturer. The pH probe was calibrated using pH 7 and 10 standard buffer solutions. The salinity sensor was calibrated against a standard whose salinity was measured by a laboratory salinometer (Guildline AutoSal Model 8400) calibrated with IAPSO Standard Seawater ("Copenhagen water"). The salinity measurements were also checked in the field against a hand-held refractometer. The YSI dissolved oxygen meters were calibrated immediately prior to each station using the water-saturated air calibration procedure recommended by the manufacturer. The refractometers were calibrated using deionized water and a higher salinity standard traceable to "Copenhagen water". LICOR light meters were calibrated at the beginning of the season using the manufacturer’s calibration kit.

5.1.10 Sample Collection: Quality Control
Surface values of temperature, salinity and dissolved oxygen measured by the Hydrolab were routinely compared with independent measurements performed on a bucket of surface water. The Hydrolab values were considered acceptable if the following criteria were met: the two temperature values agree to within two degrees Celsius, salinity values agree to within three ppt, and dissolved oxygen values agree to within 0.5 mg/L. The secchi depth values were measured by different crew members until values agreed within 0.1 meter.

There are several field QC measures to help ensure taking accurate measurements of light penetration. The "deck" sensor was situated in full sunlight (i.e., out of any shadows). Likewise, the submerged sensor was deployed from the sunny side of the vessel and care was taken to avoid

positioning the sensor in the shadow of the vessel. To minimize effects of a disturbed water column, only data collected on the downcast were used in calculations.

Duplicate field samples for nutrients from independent casts were taken, representing about 10% of all events. All nutrients were measured on these duplicates.

5.1.11 Sample Collection: References

Strobel, C.J. 2000. Coastal 2000-Northeast Component: Field Operations Manual U. S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI. EPA/620/R-00/002.

D'Elia, C.F., Connor, E.E., Kaumeyer, N.L., Keefe, C.W., Wood, K.V., and Zimmermann, C.F. (1997). Nutrient Analytical Services Laboratory Standard Operating Procedures. Technical Report Series 158-97. Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, Solomons, MD: 77 pp.

U.S. EPA. 2001. Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan 2001-2006. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA/620/R-01/002. 189 p.

Welschmeyer, N.A. 1994. Fluorometer analysis of chlorophyll a in the presence of chlorophyll b and pheopigments. Limnology and Oceanography 39:1985-1992.

5.1.12 Sample Collection: Alternate Methods

The different partners used the following equipment:

Partner	Water Profile Equipment
CT	Sea-bird SBE-19
CT-FSH	Hydrolab Datasonde; Sea-bird SBE-19
DB	
DE	Hydrolab Datasonde
DI	Hydrolab Datasonde
MA	Hydrolab Datasonde; Quanta
MD	Unknown
ME	Hydrolab Datasonde
NH	YSI model 6600_M
NJ	Hydrolab Datasonde
NJ-C	Hydrolab Datasonde
NJ-DB	Hydrolab Datasonde
NY	YSI model 6600_M; YSI 85; Seabird model 25
RI	Hydrolab Datasonde
RI-FSH	Hydrolab Datasonde
VA	Unknown

2002: Connecticut, Long Island Sound and Connecticut, LIS Fish Survey: no pH or secchi depth measurements.

2003-06 : Connecticut and RI-Fish Surveys: no pH or secchi depth

measurements; Delaware: no pH measurements. Several crews did not provide surface and bottom layer depth measures.

5.2 Data Preparation and Sample Processing
No analytical processing was involved for the physical data.

The processing procedures of the core NCA nutrient parameters described here are the methods of the national contract laboratory.

5.2.1 Sample Processing Objective
Water samples were analyzed to measure the concentrations of water column nutrients, total suspended solids and phytoplankton pigments.

5.2.2 Sample Processing: Methods Summary
Filters and filtrate were delivered frozen from sampling locations following a filtration operation using a 0.7 micron glass-fiber. NH4, PO4, NO23, and NO2 were measured by analyzing filtered water with a segmented continuous flow analyzer.

Chlorophyll a pigments were extracted from filter with 90% acetone and measured without acidification, using the Welschmeyer method. TSS was measured by drying filters at 103-105 deg C followed by weighing.

5.2.3 Sample Processing: Calibration
Standard laboratory procedures were followed to assure analytical instruments were calibrated.

5.2.4 Sample Processing: Quality Control
Approximately 5% of all filtered water samples were reanalyzed by the analytical laboratory to determine analytical repeatability of the analytical procedure. Another 5% of dissolved water samples were spiked with a known quantity of constituent and reanalyzed as a test for recovery efficiency. For particulate constituents, 10% of all samples were reanalyzed (particulate samples cannot be spiked). Processing quality was considered acceptable if duplicate analyses were consistent within 10% and spiked analyses were as expected within 15%.

5.2.5 Sample Processing: References
D'Elia, C.F., Connor, E.E., Kaumeyer, N.L., Keefe, C.W., Wood, K.V., and Zimmermann, C.F. (1997). Nutrient Analytical Services Laboratory Standard Operating Procedures. Technical Report Series 158-97. Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science, Solomons, MD: 77 pp.

U.S. EPA. 2001. Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan 2001-2006. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA/620/R-01/002. 189 p.

Welschmeyer, N.A. 1994. Fluorometer analysis of chlorophyll a in the presence of chlorophyll b and pheopigments. Limnology and Oceanography 39:1985-1992.

5.2.6 Sample Processing: Alternate Methods
Not Applicable

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Value

Surface and bottom measurements, light attenuation coefficient

6.2 Data Manipulation Description

Surface and bottom measurements were extracted from continuous water profile data files by (1) sorting all records from the same water profile by depth;(2) selecting the first (minimum depth) record for all surface values;(3) selecting the last (maximum depth) for all bottom measures.

Nutrient concentrations smaller than the method detection limit were reported as zero.

Attenuation coefficients were extracted from discrete PAR water profile data files by first sorting the PAR records from the same water profile by downcast and upcast, then selecting the downcast records for analysis. The attenuation coefficient (k) is related to the PAR readings at surface (Io) and depth (Iz) by the expression: $Iz/Io = \exp(-kz)$, where z is depth in meters. The attenuation coefficient k is calculated as the slope obtained via regression of $\{-\ln(Iz/Io)$ vs $z\}$. The ratio (Iz/Io) was calculated using simultaneous readings from respective PAR sensors (time intervals agreeing to within 1 second). PAR data collected deeper than the 1% light level was excluded to yield a more accurate attenuation coefficient.

In some cases, surface PAR values (Io) were not measured. The attenuation coefficient was then taken to be the slope obtained via regression of $\{-\ln(Iz)$ vs $z\}$. A QA code of WQ-EE is associated with these attenuation coefficient values.

7. DATA DESCRIPTION

7.1 Description of Parameters

7.1.1 Components of the Dataset

Attribute Name	Format	Description
Data Group Code	VARCHAR2(4)	Data Group Conducting Sampling
Sampling Year	NUMBER(4.0)	Year of Data Collection
Station Name	VARCHAR2(20)	The Station Identifier
Sampling Collection Date	DATE	Date of Sample Collection
Latitude Decimal Degrees	NUMBER(9.3)	Decimal degrees of latitude
Longitude Decimal Degrees	NUMBER(9.3)	Decimal degrees (-) of longitude
Water Column Sampled	VARCHAR2(8)	Location of collection (i.e., surface, bottom)
Water Measurement Name	VARCHAR2(40)	Name of measurement
Water Measurement Value	NUMBER(13.6)	Measurement or concentration
Measurement Units	VARCHAR2(15)	Units of measure
Measurement Depth	NUMBER(5.1)	Measurement Depth
Depth Units	VARCHAR2(15)	Units of measure
Type Measurement	VARCHAR2(40)	Vertical profile or ambient
Method Used	VARCHAR2(40)	Analysis or collection method

7.1.2 Precision of Reported Values

The values are accurate to no more than three significant digits; however more significant digits may be reported.

PARAMETER	PRECISION	MIN	MAX	UNITS
secchi depth	0.1	0.1	9.5	meter
Temperature (surface)	0.01	6.9	34.5	deg C
Salinity (surface)	0.01	0.0	34.8	ppt
Dissolved oxygen (surface)	0.01	0.4	16.4	mg/L
pH (surface)	0.01	4.03	9.5	pH unit
Temperature (bottom)	0.01	4.55	34.6	deg C
Salinity (bottom)	0.01	0.01	34.8	ppt
Dissolved oxygen (bottom)	0.01	0.00	15.6	mg/L
pH (bottom)	0.01	0.00	9.5	pH unit
Depth	0.1	0.1	49.5	meter
Dissolved Silica as Si	0.01	0.01	7.11	mg/L
Dissolved Ammonia as N	0.001	0.00	2.28	mg N/L
Dissolved Nitrite and Nitrate as N	0.0001	0.00	4.61	mg N/L
Dissolved Nitrite as N	0.0001	0.00	0.683	mg N/L
Dissolved Phosphate as P	0.001	0.00	0.586	mg/P/L
Chlorophyll a	0.01	0.00	124.0	ug/L
Total Suspended Solids	0.1	0.72	302	mg/L
Light attenuation coefficient		0.0	6.5	
Dissolved Nitrite as N		0.00	4.58	mg N/L
Total Nitrogen		0.02	0.62	mg N/L
Total Phosphate		0.00	0.65	mg P/L

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 Records

Data Group,Sampling Year,Station Name,Sampling Collection Date,
Latitude Decimal Degrees,Longitude Decimal Degrees,Water Column Sampled,
Water Measurement Name,Water Measurement Value,Measurement Units,
Measurement Depth,Depth Units,Type Measurement,Method Used,QA Code

7.2.2 Example Data Records

National Coastal Assessment-Northeast/Connecticut,2000,CT00-0001-A,
17-AUG-2000,41.151,-73.22,bottom,Dissolved oxygen,4.77,mg/L,1.6,m,
Vertical profile,CTD,,
National Coastal Assessment-Northeast/Connecticut,2000,CT00-0001-A,
17-AUG-2000,41.151,-73.22,bottom,Salinity,25.56,ppt,1.6,m,
Vertical profile,CTD,,
National Coastal Assessment-Northeast/Connecticut,2000,CT00-0001-A,
17-AUG-2000,41.151,-73.22,bottom,Temperature,21.36,deg C,1.6,m,
Vertical profile,CTD,,
National Coastal Assessment-Northeast/Connecticut,2000,CT00-0001-A,
17-AUG-2000,41.151,-73.22,Mid-depth,Ammonium NH4,0.027,mg/L,1.6,m,ambient,
Go-Flo bottle,,

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude (Westernmost)
-77.306 1 decimal degrees

8.2 Maximum Longitude (Easternmost)
-66.9562 decimal degrees

8.3 Minimum Latitude (Southernmost)
36.5637 decimal degrees

8.4 Maximum Latitude (Northernmost)
45.1848 decimal degrees

8.5 Name of area or region
The National Coastal Assessment Northeast Region covers the northeastern US coastline from Maine to Virginia.

9. QUALITY CONTROL AND QUALITY ASSURANCE

9.1 Measurement Quality Objectives
The measurement quality objectives of the EMAP-Estuaries program specify accuracy and precision requirements of 10% in the water physical parameters. Reference: U.S. EPA. 2001. Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan 2001-2006. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL. EPA/620/R-01/002. 189 p.

9.2 Data Quality Assurance Procedures
The physical data were reviewed to assure consistency among partners regarding sampling procedures, reporting format, etc. All measurements were performed in the field.

QA procedures for nutrients included running blanks, spiked samples, and standard reference materials with each batch of samples. Any batch failing to meet the specifications presented in Section 9.1 was reanalyzed or rejected.

9.3 Actual Measurement Quality
No field replicates were measured for the physical parameters. All of the nutrient data reported met the QA specifications listed in Section 9.1.

10. DATA ACCESS

10.1 Data Access Procedures
Data can be accessed at: http://www.epa.gov/emap/nca/html/data/

10.2 Data Access Restrictions
None

10.3 Data Access Contact Persons
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10.4 Dataset Format
Tab-delimited ASCII files

10.5 Information Concerning Anonymous FTP
Not available

10.6 Information Concerning WWW
See Section 10.1 for WWW access

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

11. REFERENCES

Strobel, C.J. 2000. Environmental Monitoring and Assessment Program: Coastal 2000 - Northeast component: field operations manual. Narragansett (RI): U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division. EPA/620/R-00/002. 68 p.

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12. TABLE OF ACRONYMS

AED Atlantic Ecology Division
EMAP Environmental Monitoring and Assessment Program
EPA Environmental Protection Agency
NCA National Coastal Assessment
NHEERL National Health and Environmental Effects Research Laboratory
QA/QC Quality Assurance/Quality Control

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