CATALOG DOCUMENTATION
NATIONAL LAKE ASSESSMENT DATABASE
NORTHEAST REGION 2007
WATER QUALITY DATA: PHYSICAL AND NUTRIENT

TABLE OF CONTENTS

1. DATASET IDENTIFICATION

1.1 Title of Catalog document

National Lake Assessment (NLA) Database
Northeast Region 2007
Water Quality Data: Physical and Nutrient

1.2 Author of the Catalog entry

Melissa Hughes, Raytheon MOS

1.3 Catalog revision date

July 2010

1.4 Dataset name

Water Quality Data

1.5 Task Group

National Lake Assessment

1.6 Dataset identification code

NA

1.7 Version

NA

1.8 Request for Acknowledgment

EPA requests that all individuals who download National Lake Assessment 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 National Lake Assessment (NLA) Program".

2. INVESTIGATOR INFORMATION

2.1 Principal Investigators

Hal Walker, U.S. EPA NHEERL-AED
Bryan Milstead, U.S. EPA NHEERL-AED
John Kiddon, U.S. EPA NHEERL-AED
Jeff Hollister, U.S. EPA NHEERL-AED

2.2 Sample Collection Investigators
NA

2.3 Sample Processing Investigators
NA

3. DATASET ABSTRACT

3.1 Abstract of the Dataset

The Water Quality data set reports physical water quality parameters measured in the field and concentrations of nutrients measured from samples collected from lakes in the National Lake Assessment program during the summer of 2007. Water samples reflect lake conditions from an 'index site' located at the deepest point of a lake (≤50 meters, and near the center if sampling a reservoir). Data reported include dissolved oxygen at 2 m or less, depth, conductivity, acid neutralizing capacity, turbidity, total organic carbon, dissolved organic carbon, total ammonium, nitrate + nitrite, total nitrogen, total potassium, color, chloride, nitrate, sulfate, calcium, magnesium, sodium, silica, chlorophyll a, Secchi depth (mean), and phosphorus. Dissolved oxygen was measured with a probe on a vertical profiler. Secchi depth was recorded from a Secchi disk, while nutrients were measured from samples taken from the upper 2 m of the water column with a depth integrated water sampler.

3.2 Keywords for the Dataset

dissolved oxygen, depth, conductivity, acid neutralizing capacity, turbidity, total organic carbon, dissolved organic carbon, total ammonium, nitrate + nitrite, total nitrogen, total potassium, color, chloride, nitrate, sulfate, calcium, magnesium, sodium, silica, chlorophyll a, Secchi depth, phosphorus, physical measurements, nutrient concentrations, National Lakes Assessment, Lakes Ecosystem Services

4. OBJECTIVES AND INTRODUCTION

4.1 Program Objective

The U.S. Environmental Protection Agency (EPA), in partnership with state and tribal organizations, has designed the Survey of the Nation’s Lakes to periodically assess the condition of the Nation's surface waters. The National Lake Assessment is a statistical assessment of the condition of our Nation’s lakes, ponds, and reservoirs and is designed to: 1) Assess the condition of the Nation’s Lakes; 2) Establish a baseline to compare future surveys for trends assessment and evaluate trends since the 1970’s National Eutrophication Survey Study and 3) Help build State and Tribal capacity for monitoring and assessment and promote collaboration across jurisdictional boundaries. This survey will generate a statistically-valid report on the condition of our Nation’s water resources and identify key stressors to this system. The goal of the Nation's Lakes project is to address two key questions about the quality of the Nation’s lakes, ponds, and reservoirs: 1) What percent of the Nation’s lakes are in good, fair, and poor condition for key indicators of trophic state, ecological health, and recreation? and 2) What is the relative importance of key stressors such as nutrients and pathogens?

The Survey is designed to be completed during the summer growing season before lake turnover (June through September). Field crews will collect a variety of measurements and indicators from an “index site” located at the deepest point of the lake (≤50 meters, and near the center if sampling a reservoir), and document conditions of the littoral zone and shoreline from stations around the lake.

EPA selected sampling locations using a probability based survey design. Sample Surveys have been used to determine the status of a population or resources of interest using a representative sample of a relatively few members or sites. Using this survey design allows data from the subset of sampled lakes to be applied to the larger target population and assessments with known confidence bounds to be made.

4.2 Dataset Objective

The objective of the Water Quality data set is to characterize physical and nutrient water quality parameters, measured during the summer of 2007 from an index site at the deepest part of a randomly-selected lake.

4.3 Dataset Background Discussion

The data set contains data collected in 2007 from Northeast region lakes from the states of Maine to West Virginia.

The water quality parameters include dissolved oxygen at 2 m or less, depth, conductivity, acid neutralizing capacity, turbidity, total organic carbon, dissolved organic carbon, total ammonium, nitrate + nitrite, total nitrogen, total potassium, color, chloride, nitrate, sulfate, calcium, magnesium, sodium, silica, chlorophyll a, Secchi depth (mean), and phosphorus.

Lakes are classified according to their trophic state. Trophic means nutrition or growth. A eutrophic (well-nourished) lake has high nutrients and high plant growth. An oligotrophic lake has low nutrient concentrations and low plant growth. Mesotrophic lakes fall somewhere in between eutrophic and oligotrophic lakes.

Three variables, chlorophyll, Secchi disk depth, and total phosphorus, are most often used to estimate biomass and define trophic state of a lake. Other variables are measured in conjunction with the trophic state variables to supplement and enhance understanding of lake processes that affect primary productivity.

Depth profiles for dissolved oxygen were taken with a calibrated water quality probe meter or multi-probe sonde from the index station in each lake. This information was used to determine the extent of stratification and the level of dissolved oxygen necessary to support aquatic life. A Secchi disk, a black and white patterned disk, was used to measure the clarity of water in visibility distance. The Secchi disk measurement helps make an estimate of the euphotic zone depth in the field. Water chemistry measurements were used to determine the acidic conditions, trophic state and nutrient enrichment, and classification of water chemistry type. The measurement of Chlorophyll a is used to determine algal biomass in the water and estimate trophic status.

4.4 Summary of Dataset Parameters

Physical and nutrient water quality parameters plus secchi depth are recorded to reflect lake conditions from an “index site” located at the deepest point of a lake (≤50 meters, and near the center if sampling a reservoir).

5. DATA ACQUISITION AND PROCESSING METHODS

5.1 Data Acquisition

The sample collection methods used by USEPA NLA trained field crews will be described here.

5.1.1 Sampling Objective
Obtain in situ physical measurements and samples for nutrient concentrations from the deepest point of a lake. Lake water was sampled from the upper 2 m of the water column (depth-integrated) at the index site which was located at the deepest point up to 50 m.

5.1.2 Sample Collection: Methods Summary
Depth profiles for dissolved oxygen (D.O.) were taken with a calibrated water quality probe meter or multi-probe sonde at predefined depth intervals by determining the site depth and measurement intervals. The sonde is then lowered in the water and the team measures the vertical profile of temperature, dissolved oxygen, and pH at the predetermined depth intervals.

A Secchi disk (black and white patterned disk) was used to measure water clarity. Readings were taken on the shady side of the boat, without sunglasses or view aids. Measurements are recorded at the depth that the disk disappears and again when it reappears.

Nutrient samples were collected using an integrated water sampler device: a PVC tube 6.6 feet (2 meters) long with an inside diameter of 1.24 inches (3.2 centimeters) fitted with a stopper plug on one end and a valve on the other. The device allows collection of water from the upper two meters of the water column (within the euphotic zone). If the euphotic zone is < 2.0 m deep (as calculated from Secchi Disk Transparency), the integrated sampler was lowered only to the depth of the euphotic zone, and additional draws were taken to collect the volume needed for the samples.

To sample, the rubber stopper is removed and the sampler rinsed by submerging it three times in the lake. With the valve open and the stopper off, the sampler is slowly lowered into the water as vertically as possible until the upper end is just below the surface. Cap and slowly raise the sampler. Close the valve when the bottom is near the surface. Empty the sample into a 4 L cubitainer.

5.1.3 Beginning Sampling Dates
5/8/2007

5.1.4 Ending Sampling Dates
10/18/2007

5.1.5 Sampling Platform
Samples were collected from gasoline or diesel powered boats.

5.1.6 Sampling Equipment
Each field team must test and calibrate instruments prior to sampling. Calibration can be conducted prior to departure for the lake site or at the lake, with the exception of dissolved oxygen calibration. Because of the potential influence of altitude, dissolved oxygen calibration is to be performed only at the lake site. Field instruments include a multiprobe unit for measuring temperature, dissolved oxygen, and pH and a Global Positioning System (GPS) receiver. Field teams should have access to backup instruments if any instruments fail the manufacturer performance tests or calibrations.

5.1.7 Manufacturer of Sampling Equipment
Not applicable

5.1.8 Key Variables
Not applicable

5.1.9 Sample Collection: Calibration
Test and precalibrate the multi-probe meter prior to departure from base using manufacturer's calibration and maintenance procedures. All dissolved oxygen meters should be calibrated according to manufacturer specifications provided with the meter. A QC check of the conductivity meter calibration should be made using a stock solution:

Dissolve 3.4022 g KH2PO4 and 3.5490 g Na2HPO4 (analytical grade; dried at 120 °C for 3 h and stored desiccated) in 1000.0 g (1.0018 L at 20 °C, 1.0029 L at 25 °C) reagent water.

5.1.10 Sample Collection: Quality Control
Once the profile is completed, another dissolved oxygen measurement is taken at the surface and compared to the initial reading. Additional transparency measurements for comparison can be taken using a viewscope.

5.1.11 Sample Collection: References
USEPA. 2007. Survey of the Nation's Lakes. Field Operations Manual. EPA 841-B-07-004. US Environmental Protection Agency, Washington, DC. (http://water.epa.gov/type/lakes/lakessurvey_index.cfm#CP_JUMP_474534)

5.1.12 Sample Collection: Alternate Methods
NA

5.2 Data Preparation and Sample Processing
Physical data did not require analytical processing.

The processing procedures of the NLA nutrient parameters are described in the Reference cited under Section 5.2.5.

5.2.1 Sample Processing Objective
Water samples were analyzed to measure the concentrations of water column nutrients and chlorophyll a.

5.2.2 Sample Processing: Methods Summary
Nutrient filtrates were delivered cold from sampling locations. Within 48 hours of arrival at the laboratory, aliquots were filtered through 0.4 µm pore size polycarbonate filters; ultra-pure acid (HNO_3 or H_2SO_4) was added depending on the analyte; Aliquots were stored at 4°C. Chlorophyll a filters were stored frozen.

As an alternative to specifying laboratory methods for sample analysis, a performance-based approach was utilized defining a set of laboratory method performance requirements for data quality. Method performance requirements for this project identified lower reporting limit, precision, and bias objectives for each parameter. Precision and bias objectives were based on a two-tiered approach following Hunt and Wilson (1986). Participating laboratories chose which analytical methods to use for each target analyte to achieve performance requirements.

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

5.2.4 Sample Processing: Quality Control

All participating laboratories provided internal Quality Assurance Documentation (e.g., Quality Management Plan, Quality Assurance Project Plan) and Standard Operating Procedures (SOPs) for external review by Lakes Survey Program staff.

5.2.5 Sample Processing: References

USEPA. 2007. Survey of the Nation's Lakes. Laboratory Methods Manual. EPA841-B-07-005. U.S. Environmental Protection Agency, Washington, DC.

Hunt, D.T.E. and A.L. Wilson. 1986. The Chemical Analysis of Water: General Principles and Techniques. 2nd ed.. Royal Society of Chemistry, London, England.

5.2.6 Sample Processing: Alternate Methods

Not Applicable

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Value

Not Applicable

6.2 Data Manipulation Description

Not Applicable

7. DATA DESCRIPTION

7.1 Description of Parameters

7.1.1 Components of the Dataset

Attribute Name	Format	Description
WB ID	NUMBER(10)	Unique Waterbody ID
NLA ID	VARCHAR2(60 BYTE)	National Lake Assessment study unique ID for each lake
NLA LAKE NAME	VARCHAR2(125 BYTE)	National Lake Assessment lake name
EPA REGION	VARCHAR2(50 BYTE)	EPA Region
STATE CODE	VARCHAR2(50 BYTE)	State assigned by US EPA-AED within which the greater percentage of lake area falls
COUNTY	VARCHAR2(50 BYTE)	County assigned by US EPA-AED within which the greater percentage of lake area falls
LATITUDE	NUMBER(12,6)	Latitude (decimal degrees) recorded from the field form
LONGITUDE	NUMBER(12,6)	Longitude (decimal degrees) recorded from the field form
SAMPLING YEAR	NUMBER(4)	Sampling year
SAMPLE COLLECTION DATE	DATE	Date of sample collection
VISIT NUMBER	NUMBER(1)	Sequential visit number within year
DISSOLVED OXYGEN @2 M OR LESS	NUMBER(6,2)	Mean Dissolved oxygen concentration (mg/L) in upper 2 m (or upper 50% if depth < 4 m)
CONDUCTIVITY	NUMBER(8,2)	Conductivity (uS/cm @ 25 C)
TURBIDITY	NUMBER(9,3)	Turbidity (NTU)
TOTAL ORGANIC CARBON	NUMBER(8,2)	Total Organic Carbon (mg/L)
ACID NEUTRALIZING CAPACITY	NUMBER(9,3)	Gran acid neutralizing capacity (ueq/L)

DISSOLVED ORGANIC CARBON	NUMBER(8,2)	Dissolved Organic Carbon (mg/L)
AMMONIUM	NUMBER(9,3)	Ammonium (mg N/L)
NITRATE+NITRITE	NUMBER(9,3)	Nitrate + Nitrite (mg N/L) by Flow Injection Analysis
TOTAL NITROGEN	NUMBER(6)	Total Nitrogen (ug/L)
TOTAL PHOSPHORUS	NUMBER(6)	Total Phosphorus (ug/L)
CHLORIDE	NUMBER(9,3)	Chloride (mg/L)
NITRATE	NUMBER(9,3)	Nitrate (mg N/L)
SULFATE	NUMBER(9,3)	Sulfate (mg/L)
CALCIUM	NUMBER(9,3)	Calcium (mg/L)
MAGNESIUM	NUMBER(9,3)	Magnesium (mg/L)
SODIUM	NUMBER(9,3)	Sodium (mg/L)
POTASSIUM	NUMBER(9,3)	Potassium (mg/L)
COLOR	NUMBER(6)	Color (PCU)
SILICA	NUMBER(9,3)	Silica (mg/L SiO2)
CHLOROPHYLL A	NUMBER(9,3	Chlorophyll a (µg/L);
SECCHI (MEAN)	NUMBER(9,2)	Secchi transparency (m); avg. disk disappearance/reappearance depths
CLEAR TO BOTTOM	VARCHAR2(2 BYTE)	'Y': disk visible on lake bottom

7.1.2 Precision of Reported Values

NA

7.1.3 Minimum Value in Dataset / 7.1.4 Maximum Value in Dataset

PARAMETER	MIN	MAX
DISSOLVED OXYGEN @<=2M	1.35	16.20
CONDUCTIVITY	15.73	746.20
TURBIDITY	0.33	35.60
TOTAL ORGANIC CARBON	0.79	16.66
ACID NEUTRALIZING CAPACITY	-40.89	3274.10
DISSOLVED ORGANIC CARBON	1.18	14.01
AMMONIUM	0.01	0.28
NITRATE+NITRITE	0.01	3.43
TOTAL NITROGEN	63.00	4222.00
TOTAL PHOSPHORUS	1.00	315.00
CHLORIDE	0.18	135.59
NITRATE	0.01	3.17
SULFATE	1.04	35.54
CALCIUM	0.31	44.87
MAGNESIUM	0.17	22.89
SODIUM	0.52	87.19
POTASSIUM	0.10	8.22
COLOR	0.00	140.00
SILICA	0.03	20.59
CHLOROPHYLL A	0.69	216.00
SECCHI (MEAN)	0.25	9.60

7.2 Data Record Example

7.2.1 Column Names for Example Records

WB ID,NLA ID,NLA LAKE NAME,EPA REGION,STATE,COUNTY,LATITUDE,LONGITUDE,
SAMPLING YEAR,SAMPLE COLLECTION DATE,VISIT NUMBER,
DISSOLVED OXYGEN @ 2M OR LESS,CONDUCTIVITY,TURBIDITY,
TOTAL ORGANIC CARBON,ACID NEUTRALIZING CAPACITY,DISSOLVED ORGANIC CARBON,
AMMONIUM,NITRATE+NITRITE,TOTAL NITROGEN,TOTAL PHOSPHORUS,CHLORIDE,NITRATE,

SULFATE,CALCIUM,MAGNESIUM,SODIUM,POTASSIUM,COLOR,SILICA,CHLOROPHYLL A,
SECCHI (MEAN),CLEAR TO BOTTOM

7.2.2 Example Data Records

4599159,NLA06608-0038,Island Pond,Region_1,Vermont,Essex,44.81,-71.87,2007,
08/27/2007,2,8.30,62.84,0.65,3.69,354.17,3.34,0.01,0.01,113,3,4.13,
0.01,3.50,6.82,0.79,3.28,0.82,11,3.09,2.07,5.95

22221219,NLA06608-0177,Silver Lake,Region_1,Vermont,Addison,43.90,-73.05,
2007,08/22/2007,1,8.63,56.16,1.28,3.75,443.56,3.59,0.01,0.01,177,6,0.50,0.01,
3.68,6.81,2.04,0.64,0.37,19,2.16,3.58,2.75,

4586134,NLA06608-0369,Caspian Lake, Region_1,Vermont,Orleans,44.58,-72.30,
2007,07/26/2007,1,7.90,153.00,0.53,2.50,1256.53,2.67,0.01,0.03,163,1,5.22,
0.05,5.72,22.94,2.18,2.86,0.60,7,2.59,1.74,6.00

4577134,NLA06608-0806,Marshfield Pond,Region_1,Vermont,Washington,44.33,
-72.33, 2007,09/07/2007,1,8.37,39.13,3.31,7.89,172.32,7.26,0.01,0.01,427,20,
3.13,0.01,2.81,3.69,0.47,2.66,0.28,39,4.57,8.32,1.25

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude (Westernmost)

-79.2277 decimal degrees

8.2 Maximum Longitude (Easternmost)

-67.6993 decimal degrees

8.3 Minimum Latitude (Southernmost)

36.8415 decimal degrees

8.4 Maximum Latitude (Northernmost)

47.1778 decimal degrees

8.5 Name of area or region

The National Lake Assessment Northeast Region covers the northeastern US from Maine to West Virginia.

9. QUALITY CONTROL AND QUALITY ASSURANCE

9.1 Measurement Quality Objectives

Laboratories were required to provide additional Demonstration of Capability information for each analytical method. The information demonstrated the Lab's capability to achieve method performance objectives established for the Lakes Survey.

9.2 Data Quality Assurance Procedures

NELAC certified labs operate independently, following their own QAPP and NELAC requirements if they allow the lab to meet the reporting limits for each analyte. Each lab provided a summary of their internal QA/QC information with data submittal. Laboratories that are not NELAC-certified will also operate independently following their own internal QAPP, however, they may need to implement additional QA/QC procedures specific to the Lakes Survey.

All labs were required to participate in an "internal" performance evaluation (PE) program during the sampling and analysis period. In the PE program, EPA or another centralized lab provided single-blind samples with multiple concentrations of each analyte to all participating labs for analysis. Approximately three low level concentration, three intermediate concentration, and three high level concentration samples will analyzed by each lab to provide adequate sample sizes to assess performance (i.e., precision and bias) within and across laboratories.

9.3 Actual Measurement Quality
NA

10. DATA ACCESS
10.1 Data Access Procedures
Access data at: http://www.epa.gov/aed/lakesecoservices by clicking on the Database link.

10.2 Data Access Restrictions
None

10.3 Data Access Contact Persons
John Kiddon, U.S. EPA NHEERL-AED, Narragansett, RI
401-782-3034, 401-782-3030 (FAX), kiddon.john@epa.gov

Harry Buffum, Data Manager, Raytheon, Narragansett, RI
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

10.4 Dataset Format
Comma-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
USEPA. 2007. Survey of the Nation's Lakes. Laboratory Methods Manual. EPA841-B-07-005. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2007. Survey of the Nation's Lakes. Field Operations Manual. EPA 841-B-07-004. US Environmental Protection Agency, Washington, DC. (http://water.epa.gov/type/lakes/lakessurvey_index.cfm#CP_JUMP_474534)

USEPA. 2009. Survey of the Nation's Lakes: Integrated Quality Assurance Project Plan. EPA/841-B-07-003. US Environmental Protection Agency, Washington, DC. (http://water.epa.gov/type/lakes/lakessurvey_index.cfm#CP_JUMP_474534)

USEPA. 2006. Survey of the Nation's Lakes. Lake Evaluation Guidelines. EPA 841-B-06-003. US Environmental Protection Agency, Washington, DC.

12. TABLE OF ACRONYMS

EPA	Environmental Protection Agency
NLA	National Lakes Assessment
QA/QC	Quality Assurance/Quality Control
WWW	World Wide Web

13. PERSONNEL INFORMATION
John Kiddon, AED Oceanographer
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3044, 401-782-3030 (FAX), kiddon.john@epa.gov

Hal Walker, AED Analyst
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3134, 401-782-3030 (FAX), walker.henry@epa.gov

Bryan Milstead, AED Analyst
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3050, 401-782-3030 (FAX), milstead.bryan@epa.gov

Jeff Hollister, AED Analyst
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-9655, 401-782-3030 (FAX), Hollister.jeff@epa.gov

Harry Buffum, Database Manager, Raytheon
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3183, 401-782-3030 (FAX), buffum.harry@epa.gov

Melissa Hughes, Data Librarian, Raytheon
U.S. Environmental Protection Agency, NHEERL-AED
27 Tarzwell Drive, Narragansett, RI 02882-1197
401-782-3184, 401-782-3030 (FAX), hughes.melissa@epa.gov