

US EPA ARCHIVE DOCUMENT

CATALOG DOCUMENTATION
NATIONAL LAKE ASSESSMENT DATABASE
NORTHEAST REGION 2007
PREDICTED LAKE DEPTH AND VOLUME

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1. DATASET IDENTIFICATION
 - 1.1 Title of Catalog document
National Lake Assessment (NLA) Database
Northeast Region 2007
Predicted Lake Depth and Volume
 - 1.2 Author of the Catalog entry
Melissa Hughes, Raytheon MOS
 - 1.3 Catalog revision date
July 2011
 - 1.4 Dataset name
Predicted Lake Depth and Volume
 - 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

Lake volume aids understanding of the physical and ecological dynamics of lakes, yet is often not readily available. The data needed to calculate lake volume (i.e. bathymetry) are usually collected on a lake by lake basis and are difficult to obtain across broad regions. To span the gap between studies of individual lakes where detailed data exist and regional studies where access to useful data on lake volume is unavailable, a method was developed to predict maximum lake depth from the slope of the topography surrounding a lake and to use these predictions to estimate lake volume. The National Elevation Dataset and the National Hydrography Dataset-Plus was used to estimate the percent slope of surrounding lakes and this information was used to predict maximum lake depth and estimate lake volume. Field measured maximum lake depths were also used from the US EPA's National Lakes Assessment to empirically adjust the predictions. The final predictions were tested with maximum lake depth data from on-line sources. Maximum depth was predicted for ~28,000 lakes in the Northeastern United States with an average percent difference of 4%.

3.2 Keywords for the Dataset

lake bathymetry, lake morphology, National Lakes Assessment, lake volume, geographic information systems (GIS), NHD Plus, 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 Predicted Lake Depth and Volume data is to present depths and volumes for NLA lakes which can be utilized with sufficient accuracy for regional scale studies of nutrient cycling and ecosystem services.

4.3 Dataset Background Discussion

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

The importance of lake morphometry (e.g. lake depth and lake volume) in understanding the ecology of lake systems has long been recognized. Scientists and managers use this information to describe a lake's residence time, build predictive models of nutrients, pollutants, and ecological populations, and to understand lake productivity. For individual lakes that are the focus of research and management, bathymetry surveys are some of the first data collected. From these data, volume is usually calculated using bathymetric contour maps and planimeters. Lake volume can also be estimated with modern GIS methods if maximum depth is known. Calculating depth and volume of lakes is a simple task provided bathymetry surveys exist; however, gaining access to these data is often difficult as they are frequently only available as unpublished tables or paper maps. This is especially true in regional studies that include a large number of lakes. As part of the US Environmental Protection Agency's Lakes Ecosystem Services program (LES), how changes in nutrient loads impact the delivery of ecosystem services in lakes in the Northeastern Region of the United States is being evaluated. Obtaining bathymetry data for even a small percentage of the lakes within this region can be difficult and modelling lake depth and volume using existing, publically available datasets was conducted. One key source of information that provides insight into lake depth is the National Elevation Dataset (NED). With this information it is possible to calculate changes in elevation surrounding lakes, which is likely similar to the change in depth within lakes as the same processes formed the surrounding topography and the lake basin. Thus, the assumption is made that lake basins surrounded by steep topography are likely to have a steeper slope and greater changes in depth than do lake basins with lower topographic relief. This dataset contains an estimated maximum lake depth for all National Hydrography Dataset Plus (NHDPlus) lake polygons in the Northeast US (USGS Major River Basin 1) with sufficient accuracy for regional scale studies of nutrient cycling and ecosystem services. These estimates of lake depth are used to estimate lake volume.

4.4 Summary of Dataset Parameters

Predicted lake depth and volume data are reported.

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

Find the deepest point in the lake using sonar.

5.1.2 Sample Collection: Methods Summary

To find the location of the index site for natural lakes, find the deepest point in the lake ≤ 50 meters by using sonar and/or a bathymetric map and by observing the lake shape and surrounding topography.

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

Hand-held sonar unit, a calibrated sounding line, or a calibrated pole for very shallow lakes

5.1.7 Manufacturer of Sampling Equipment

Not applicable

5.1.8 Key Variables

Not applicable

5.1.9 Sample Collection: Calibration

NA

5.1.10 Sample Collection: Quality Control

NA

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.

5.2.1 Sample Processing Objective

NA

5.2.2 Sample Processing: Methods Summary

NA

5.2.3 Sample Processing: Calibration

NA

5.2.4 Sample Processing: Quality Control

NA

5.2.5 Sample Processing: References

NA

5.2.6 Sample Processing: Alternate Methods

Not Applicable

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Value

PREDICTED_DEPTH_M, PREDICTED_VOLUME_M3

6.2 Data Manipulation Description

Methods were developed with elevation and lake data from Major River Basin 1 (MRB1) which correspond to NHD HUC regions 01 and 02. Depth predictions were generated using lake shoreline data from the NHDPlus, reach catchments from NHDPlus, and elevation from the NED. For this study, the 10 meter resolution NED (Data available from U.S. Geological Survey at <http://ned.usgs.gov>) was used and resampled that data to a 30 meter resolution. Additionally, existing sources of field collected lake depth data were used to test some key assumptions, and correct and assess the accuracy of the depth predictions. Maximum lake depth measurements from the USEPAs National Lake Assessment (NLA) were used to adjust the initial depth predictions. Predictions of maximum depth were assessed by comparison with maximum depth values for Northeastern lakes collected from internet sources. All data used in this study use the North American 1983 datum and are in an Albers Equal Area Conic projection.

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
EPA_REGION	VARCHAR2(50 BYTE)	EPA Region
STATE	VARCHAR2(50 BYTE)	State name
LATITUDE_DD	NUMBER(12,6)	Field Calculator in ARC GIS used to calculate latitude (decimal degrees) values for point features.
LONGITUDE_DD	NUMBER(12,6)	Field Calculator in ARC GIS used to calculate longitude (decimal degrees) values for point features.
PREDICTED_DEPTH_M	NUMBER(11,8)	Predicted Depth (m)
PREDICTED_VOLUME_M3	NUMBER(9,3)	Predicted Volume (m3)

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
LONGITUDE_DD	-80.208767	-66.99852
LATITUDE_DD	36.702015	47.416054
PREDICTED_DEPTH_M	0.0	82.81831685
PREDICTED_VOLUME_M3	0.0	3502058720

7.2 Data Record Example

7.2.1 Column Names for Example Records

WB_ID, NLA_ID, STATE, COUNTY, EPA_REGION, LONGITUDE_DD, LATITUDE_DD, LAKE_NAME, PREDICTED_DEPTH_M, PREDICTED_VOLUME_M3

7.2.2 Example Data Records

1701064, NLA06608-1110, Maine, Piscataquis, Region_1, -69.22944, 45.81763,
Little Kelly Pond, 1, 50507
1701184, NLA06608-NELP-3586, Maine, Piscataquis, Region_1, -69.07735, 45.75283,
Fourth Debsconeag Lake, 20, 6593353
1701190, NLA06608-EMAP:ME011L, Maine, Piscataquis, Region_1, -69.22256, 45.74832,
Female Pond, 7, 1203681

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude (Westernmost)

-80.208767 decimal degrees

8.2 Maximum Longitude (Easternmost)

-66.99852 decimal degrees

8.3 Minimum Latitude (Southernmost)

36.702015 decimal degrees

8.4 Maximum Latitude (Northernmost)

47.416054 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

NA

9.2 Data Quality Assurance Procedures

NA

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

J. W. Hollister, Milstead, B.W. and Urrutia, A.M. In press. Predicting Maximum Lake Depth and Estimating Lake Volume from Surrounding Topography.

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