

US EPA ARCHIVE DOCUMENT

CATALOG DOCUMENTATION  
EMAP-GREAT LAKES PROGRAM LEVEL DATABASE  
1994 LAKE MICHIGAN NEARSHORE  
CHLOROPHYLL DATA

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1. DATA SET IDENTIFICATION

1.1 Title of Catalog document

EMAP-Great Lakes Program Level Database  
1994 Lake Michigan Nearshore  
Chlorophyll Data

1.2 Authors of the Catalog entry

Jenny Kysely, ILS

1.3 Catalog revision date

29 November 1996

1.4 Data set name

LMCHL94

1.5 Task Group

Great Lakes

1.6 Data set identification code

501

## 1.7 Version

001

## 1.8 Requested Acknowledgment

These data were produced as part of the U.S. EPA's Environmental Monitoring and Assessment Program (EMAP). 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 has been funded wholly or in part by the U.S. Environmental Protection Agency through its EMAP-Great Lakes 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

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### 2.5 Investigation Participant - Sample Processing

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U.S. Environmental Protection Agency  
NHEERL-MED

## 3. DATA SET ABSTRACT

### 3.1 Abstract of the Data Set

The Lake Michigan Chlorophyll data set provides chlorophyll concentrations at thirty-nine sampling stations located in the nearshore region of Lake Michigan. Chlorophyll analysis was conducted on water samples collected from the surface, approximately at the 1 meter depth.

Samples were filtered and pigments were solvent extracted with an acetone-DMSO solvent. Spectrophotometric analysis was performed using the monochromatic method for determination of chlorophyll a.

### 3.2 Keywords for the Data Set

Chlorophyll, nearshore region, spectrophotometric analysis, Great Lakes, Lake Michigan

## 4. OBJECTIVES AND INTRODUCTION

### 4.1 Program Objective

The Environmental Monitoring and Assessment Program (EMAP) was designed to periodically estimate that status and trends of the Nation's ecological resources on a regional basis. EMAP provides a strategy to identify and bound the extent, magnitude and location of environmental degradation and improvement on a regional scale based on station sites randomly located in the Great Lakes. Base grid and three-fold enhanced sampling sites from the nearshore region of Lake Michigan are included in this data set.

### 4.2 Data Set Objective

The primary objective of the chlorophyll data set is to characterize the trophic status endpoint by providing estimates of phytoplankton biomass and serving as an indicator of aquatic productivity in the Great Lakes. Chlorophyll measurements were also used to calibrate an in situ fluorometer and interpret remotely-sensed AVHRR data.

### 4.3 Background Discussion

Condition indicators provide important information about ecological condition of a sampling site. Chlorophyll a is an important factor addressing the trophic status of an ecosystem. Chlorophyll a is the primary photosynthetic pigment of algae and provides an estimate of algal biomass, which can be used as an indication of productivity. Consequently, its absorbance is measured most frequently.

The amount of chlorophyll in an algal cell can change depending on ambient conditions. It readily responds to natural and anthropogenic influenced stressors such as nutrient levels and light attenuation characteristics. Turbidity levels, particularly from increases in suspended solids, can affect light penetration depth and intensity. This can cause an effect on the algal community to carry out photosynthesis. Since algal abundance and productivity is the energy base for an autochthonous system, any changes can have impacts on the food web dynamics. Other water chemistry and abiotic parameters were measured which will be helpful with chlorophyll a data interpretation.

### 4.4 Summary of Data Set Parameters

Chlorophyll a using the monochromatic method is reported for surface (1 meter) conditions for each sampling station.

## 5. DATA ACQUISITION AND PROCESSING METHODS

### 5.1 Data Acquisition

#### 5.1.1 Sampling Objective

To collect water samples from 39 sampling sites from the nearshore region of Lake Michigan. A sampler was used to collect water samples from the surface, approximately at the 1 meter depth.

#### 5.1.2 Sample Collection Methods Summary

At all stations, an 8 L sampler was used to collect water samples.

The water samples were subsampled for chlorophyll measurements by obtaining a 9 L liter sample from the surface and placing the subsample into separate opaque polyethylene bottles and refrigerated for filtration. Each sample was filtered through a 0.45 membrane filter (Millipore type HA, 47 mm diameter). Using a vacuum filtration apparatus, pressure was maintained at no more than 0.5 atms. The filters were folded into quarters, wrapped in aluminum foil, and frozen for storage until laboratory analysis.

### 5.1.3 Beginning Sampling Date

18 July 1994

### 5.1.4 Ending Sampling Date

5 August 1994

### 5.1.5 Platform

Sampling was conducted from a 28 meter research vessel, the R/V Explorer, owned and operated by the U.S. EPA, NHEERL-MED.

### 5.1.6 Sampling Equipment

An 8 L water sampler was used to collect water samples. Opaque polyethylene containers were used for subsamples. A 2000 Liter graduated cylinder was used for measuring subsample volume for filtering. A filtering apparatus with a vacuum pump was used for filtering samples. Millipore type HAWP (0.45 membrane filters, 47 mm diameter) were used for collecting the algal biomass.

### 5.1.7 Manufacturer of Instrument

### 5.1.8 Key Variables

This data set contains surface (1 meter) water sample values. Replicate samples were taken from each site and averaged values are reported.

### 5.1.9 Collection Method Calibration

The sampling gear required no calibration.

### 5.1.10 Collection Quality Control

### 5.1.11 Sample Collection Method Reference

Strobel, C.J. and S.C. Schimmel, 1991. Environmental Monitoring and Assessment Program-Near Coastal. 1991 Virginian Province, Field Operations and Safety Manual. U.S. EPA, NHEERL-AED, Narragansett, RI. June 1991.

## 5.2 Data Processing and Sample Processing

### 5.2.1 Sample Processing Objective

To process chlorophyll samples to characterize algal biomass in terms of chlorophyll a.

### 5.2.2 Sample Processing Methods Summary

The chlorophyll samples were stored as frozen filters wrapped in aluminum foil until analysis. Spectrophotometric analysis was used for chlorophyll determination, and the monochromatic method was used for detection of chlorophyll a. The filters were placed in 20 ml scintillation vials and solvent extracted for 20-24 hours. The solvent used was an acetone-DMSO mixture. Analysis was performed in subdued light using a Perkin Elmer Lambda 2S Spectrophotometer with 5 cm path length cell. Blanks and standards were run prior to and at the end of analysis for background correction. Samples were acidified with 1 N HCL for phaeophytin correction.

### 5.2.3 Sample Processing Method Calibration

Analysis of chlorophyll samples, standards, and blanks were performed in subdued light. Samples were allowed to warm to room temperature. An initial

blank was analyzed prior to sample analysis for background correction. Solvent absorbances were read to verify zero readings. If zero readings were not obtained, the sequence was repeated. If zero readings were obtained, solvent was drawn into the cell and read to verify a stable reading of zero.

#### 5.2.4 Sample Processing Quality Control

Blanks and standards were analyzed before, during, and at end of analysis.

#### 5.2.5 Sample Processing Method Reference

Standard methodology was used with DMSO extraction procedure. Reference follows:

Shoaf, W.T. and B.W. Lium. 1976. Improved extraction of chlorophyll a and b from algae using dimethyl sulfoxide. *Limnol. Oceanogr.* 21:926-928.

#### 5.2.6 Sample Processing Method Deviations

### 6. DATA ANALYSIS AND MANIPULATIONS

#### 6.1 Name of New or Modified Values

#### 6.2 Data Manipulation Description

The formulas used for calculating chlorophyll a using the monochromatic procedure follows:

Monochromatic Method (Lorenzen, 1967):

$$\text{Chl a ( g/L or mg/m )} = \frac{(k) (F) (E6650 - E665a) (v)}{(V) (Z)}$$

where

E6650 = turbidity-corrected absorption at 665 nm before acidification  
= A6650 - A7500, where A = the absorption value

E665a = turbidity-corrected absorption at 665 nm after acidification  
= A665a - A750a

k = absorption coefficient of chlorophyll a, = 11.0

F = factor to equate the reduction in absorbency to initial chlorophyll concentration, 1.7:0.7, or = 2.43

R = maximum ratio of E6650:E665a in the absence of phaeopigments, = 1.7

v = volume of extract in ml

V = volume of water filtered in liters

Z = length of light path through cuvette or cell in cm.

#### 6.3 Data Manipulation Examples

### 7. DATA DESCRIPTION

#### 7.1 Description of Parameters

#	Name	Type	Length	Format	Parameter Label
1	STA_NAME	Char	8	8.	Station Name
2	DATE	Num	8	YYMMDD8.	Date the sample was collected
3	DEPTH_C	Char	1	1.	Depth category of sample (S-surface)
4	DEPTH	Num	5	5.	Depth (m)
5	AVG CHLA_M	Num	6	6.2	Average chlorophyll a ( g/L), monochromatic method

##### 7.1.1 Precision to which values are reported

The number of decimal places for each value reflects the precision of the spectrophotometer.

### 7.1.2 Minimum Value in Data Set

AVG CHLA\_M 0.67

### 7.1.3 Maximum Value in Data Set

AVG CHLA\_M 9.81

## 7.2 Data Record Example

### 7.2.1 Column Names for Example Records

STA\_NAME, DATE, DEPTH\_C, DEPTH, AVG CHLA\_M

### 7.2.2 Example Data Records

STA_NAME	DATE	DEPTH_C	DEPTH	AVG CHLA_M
LM94-73452	940725	S	1	2.61
LM94-73472	940725	S	1	1.27
LM94-73492	940726	S	1	0.74

## 8. GEOGRAPHIC AND SPATIAL INFORMATION

### 8.1 Minimum Longitude

-79 deg 21' 17"

### 8.2 Maximum Longitude

-76 deg 20' 04"

### 8.3. Minimum Latitude

42 deg 27' 29"

### 8.4 Maximum Latitude

43 deg 53' 49"

### 8.5 Name of Area or Region

Nearshore Lake Michigan

Stations were located within the Nearshore resource class of Lake Michigan.  
The nearshore sites were located within the 85 meter contour.

## 9. QUALITY CONTROL/QUALITY ASSURANCE

### 9.1 Measurement Quality Objectives

### 9.2. Data Quality Assurance Procedures

### 9.3 Actual Measurement Quality

## 10. DATA ACCESS

### 10.1 Data Access Procedures

Data can be downloaded from the EMAP Website.

### 10.2 Data Access Restrictions

Not applicable.

### 10.3 Data Access Contact Persons

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### 10.4 Data Set Format

Data from the Website are in ASCII fixed format.

### 10.5 Information Concerning Anonymous FTP

Not accessible.

### 10.6 Information Concerning WWW

Data can be downloaded from the EMAP Website.

### 10.7 EMAP CD-ROM Containing the Data Set

Data are not available on CD-ROM.

## 11. REFERENCES

Lorenzen, C.J. 1967 Determination of chlorophyll and pheopigments: spectrophotometric equations, *Limnol. Oceanogr.* 12:343-346.

Hedtke, S., A. Pilli, D. Dolan, G. McRae, B. Goodno, R. Kreis, G. Warren, D. Swackhamer, and M. Henry. 1992. Great Lakes Monitoring and Research Strategy: Environmental Monitoring and Assessment Program. USEPA, Office of Research and Development, ERL-Duluth, Duluth, Minnesota. EPA/602/R-92/001. 204 p.

## 12. TABLE OF ACRONYMS

NA

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