

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-35-R-23

Study No.: 674

Title: Compilation of databases on Michigan lakes

Period Covered: April 1, 1997 to March 31, 1998

Study Objective: To facilitate electronic access to previously collected data on Michigan lakes. In cooperation with Fisheries Division's Information Management Unit, expand the design of the Division's current data management system to enable access to multiple data sets on lakes. Prepare a master list of lake names and locations so that each lake can be uniquely identified and linked to appropriate databases, beginning with lakes at least 100 acres in area and having public access. Compile databases on Michigan lakes in electronic format in a manner that will make them accessible from relational databases and geographic information systems. Begin digitizing maps of lake depth contours.

Summary: During discussions with the head of the Information Management Unit, it was determined that new data sets on lakes can be easily added to Fisheries Division's databases if each lake is assigned a unique identification key. A unique identification key was assigned, first, to each of the 6,502 lakes ³10 acres in area in the compilation by Humphrys and Green (1962), and second, to each of the 3,714 lakes from 5 to 9 acres in area. Several data sets on Michigan lakes were converted to electronic format. The unique lake keys were then added to these lake data sets, providing a way to link the data using a relational database such as Access. Thirteen lake maps have been digitized.

Job 1. Title: Expand data design: plan how to link additional data sets.

Findings: Discussions have been held with the head of the Information Management Unit in Fisheries Division about linking additional data sets to Fisheries Division's databases. New data sets on lakes can be added easily if each lake is assigned a unique identification key.

Job 2. Title: Prepare master list of lake names and geographic locations for lakes at least 100 acres in area.

Findings: Unique identification keys have been assigned by members of Fisheries Division's Information Management Unit to 3,657 water bodies in the master list of inland lakes. This list represents water bodies on which some management activities have been conducted. This list, which includes some duplications, has 89 lakes ³1,000 acres, 479 lakes from 100 to 999 acres, and 683 lakes from 10 to 99 acres; many lakes on the list do not have a value assigned for lake area. For lakes ³10 acres, this list includes 556 lakes in the Upper Peninsula and 695 lakes in the Lower Peninsula.

The compilation by Humphrys and Green (1962) includes more than 35,000 Michigan lakes and ponds as small as 0.1 acre. In the original compilation, lakes on county boundaries were listed in

both counties, with a different number assigned in each county, and lakes were listed on multiple rows if they were found in more than one township and range. A master list was first prepared for the 6,502 lakes ³10 acres, and a unique identification key assigned to each lake. This list has 106 lakes ³1,000 acres, 1,037 lakes from 100 to 999 acres, and 5,359 lakes from 10 to 99 acres. After this list was prepared, unique identification keys were assigned to smaller lakes, the 3,714 lakes with area from 5 to 9 acres.

Table 1.—Number of lakes in different size categories in two compilations of Michigan lakes, a master list of waters managed by Fisheries Division, and the list prepared by Humphrys and Green (1962).

Compilation	Number of lakes		
	≥1,000 acres	100 to 999 acres	10 to 99 acres
Managed waters	89	479	683
Humphrys & Green	106	1,037	5,359

Job 3. Title: Assemble databases: format data; prepare metadata descriptions.

Findings: The following databases have been identified, converted to Excel spreadsheets or Access databases, and a unique lake identification key assigned to all (or most) of the lakes:

- Michigan lakes at least 10 acres in area (Humphrys and Green 1962); *N* = 6,502 lakes.
- Michigan lakes from 5 to 10 acres in area (Humphrys and Green 1962); *N* = 3,714 lakes.
- Michigan coldwater lakes (MDNR Fisheries Division 1976); *N* = 1,346.
- List of official Michigan lake names, obtained from the U.S. Geological Survey, Board of Geographic Names; *N* = 6,906.
- Lakes with public access, at least 50 acres in area (Howard Wandell, Michigan Department of Environmental Quality, Land and Water Management Division, Lansing, personal communication); *N* = 697.
- Compilation of data on lake morphometry and water quality (Schneider 1975); *N* = 387.
- Atlas and gazetteer of Michigan lakes (Fusilier and Fusilier 1994); *N* = 297.

The following databases have been identified, converted to Excel spreadsheets or Access databases, but lake identification keys have not yet been added:

- Lakes in the Michiganme Project (Evans et al. 1991); *N* = 66 lakes.
- The atlas of Michigan lakes (Marsh and Borton 1974); *N* = 872 lakes.
- Lower Peninsula lakes sampled with large seines (Schneider 1981); *N* = 229 lakes.
- Names of Michigan lakes sampled as part of the U.S. Environmental Protection Agency's National Acid Precipitation Assessment Program (Kanciruk et al. 1986); *N* = 172.

Metadata descriptions have not yet been prepared. In the spring of 1998 newly released software was obtained for producing metadata files to accompany each lake database. This data documentation program is called DataLogr, version 2, and is distributed by the nonprofit organization IMAGIN (Improving Michigan's Access to Geographic Information Networks), located in Rochester, Michigan. Version 2 of this software can produce metadata compliant with the recommendations of the Federal Geographic Data Committee.

Job 4. Title: Begin to digitize lake maps. Calculate lake volume and mean depth.

Findings: Options for preparing electronic versions of lake maps are to (1) scan and store lake maps as images, (2) scan lake maps and use software to prepare contour lines, or (3) to digitize contour lines by hand. Digitizing contours by hand has started using the master copies of the maps on file at the Institute for Fisheries Research, Ann Arbor (Taube et al. 1964). Digital maps have been prepared for the following thirteen lakes (counties given in parentheses): Baseline (Livingston, Washtenaw), Big Portage (Livingston, Washtenaw), Black (Cheboygan, Presque Isle), Burt (Cheboygan), Cassidy (Washtenaw), Dead (Washtenaw), Dickerson (Montcalm), Ford (Washtenaw), Gogebic (Gogebic, Ontonagon), Higgins (Roscommon, Crawford), Houghton (Roscommon), Mullet (Cheboygan), Whitmore (Livingston, Washtenaw). For most of these lakes, the original map contains information on bottom types and aquatic vegetation; this information was captured and stored in separate data layers with the digital map. Methods are being evaluated for calculating lake mean depth using the digitized contours.

Special software has been obtained for converting scanned bitmap images into vectors (Adobe Streamline). This software will be installed and evaluated for use in converting scanned lake maps into vectors. It is expected that this will appreciably reduce the effort in creating electronic versions of lake depth contours. I intend to compare the time required to produce electronic lake maps using these two techniques, and to compare the calculated areas and volumes produced by each method.

Job 5. Title: Write reports.

Findings: This progress report was completed on schedule.

Literature Cited:

- Evans, E., M. Wilson, and W. Creal. 1991. Assessment of mercury contamination in selected Michigan lakes, 1987-90: historical trends, environmental correlates, and potential sources. Michigan Department of Natural Resources, Surface Water Quality Division, Staff Report No. MI/DNR/WQ-91/106.
- Fusilier, W. E., and B. Fusilier. 1994. Fusilier's atlas and gazetteer of Michigan lakes participating in the Secchi disk, water quality testing and bottom sediment testing offered by Water Quality Investigators. Volume IV. Water Quality Investigators, Dexter, Michigan.
- Humphrys, C. R., and R. F. Green. 1962. Michigan lake inventory bulletins 1-83. Michigan State University, Department of Resource Development, East Lansing.
- Kanciruk, P., J. M. Eilers, R. A. McCord, D. H. Landers, D. F. Brakke, and R. A. Linthurst. 1986. Characteristics of lakes in the Eastern United States. Volume III: Data compendium of site characteristics and chemical variables. EPA/600/4-86/007c. U. S. Environmental Protection Agency, Washington, D. C. 439 pp.
- Marsh, W. M., and T. E. Borton. 1974. Michigan inland lakes and their watersheds: an atlas. Prepared for Inland Lake Management Group, Water Quality Appraisal Section, Bureau of Water Management. Michigan Department of Natural Resources, Water Resources Commission, Lansing.

Michigan Department of Natural Resources (MDNR), Fisheries Division. 1976. Coldwater lakes of Michigan. Michigan Department of Natural Resources, Fisheries Division (unpublished report).

Schneider, J. C. 1975. Typology and fisheries potential of Michigan lakes. Michigan Academician 8:59-84.

Schneider, J. C. 1981. Fish communities in warmwater lakes. Michigan Department of Natural Resources, Fisheries Research Report 1890, Ann Arbor.

Taube, C. M., P. M. Earl, E. E. Schultz, T. M. Stauffer, and W. C. Wagner. 1964. Lake mapping and lake and stream inventory in Michigan. Michigan Department of Conservation, Report No. 1692, Ann Arbor.

Prepared by: James E. Breck
Date: March 31, 1998