

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-35-R-24

Study No.: 674

Title: Compilation of databases on Michigan lakes

Period Covered: April 1, 1998 to September 30, 1999

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: A unique identification key, based on the county and lake number assigned by Humphrys and Green (1962), has been assigned to each of the 6,559 lakes ≥ 10 acres in area and also to each of the 3,714 lakes from 5 to 9 acres in area in the compilation by Humphrys and Green (1962). Several additional data sets on Michigan lakes were assembled and converted to electronic format. The unique lake keys were added to these lake data sets, providing a way to link the data using a relational database such as Access. Seventeen lake maps have now been digitized.

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

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

- Michigan lakes at least 10 acres in area (Humphrys and Green 1962); $N = 6,559$ lakes. Fifty seven manmade lakes created after Humphrys and Green's compilation were also added to the data set.
- Michigan lakes from 5 to 10 acres in area (Humphrys and Green 1962); $N = 3,714$ lakes.
- Michigan coldwater lakes (MDNR Fisheries Division 1976); $N = 1,346$ lakes.
- List of official Michigan lake names, obtained from the U.S. Geological Survey, Board of Geographic Names; $N = 6,909$. (A few of these names are lake groups, e.g., West Branch Lakes in Alger County.)
- Nutrient status of lakes with public access sites, at least 50 acres in area (Howard Wandell, Michigan Department of Environmental Quality, Land and Water Management Division, Lansing, personal communication); $N = 697$ lakes.
- Compilation of data on lake morphometry and water quality (Schneider 1975); $N = 387$ lakes.
- Lower Peninsula lakes sampled for fishes with large seines (Schneider 1981); $N = 229$ lakes.
- Atlas and gazetteer of Michigan lakes (Fusilier and Fusilier 1994); $N = 297$ lakes.

- Lakes in the Michigamme Project (Evans et al. 1991); $N = 66$ lakes.
- Watershed area and perimeter, and lake area and perimeter for natural lakes at least 100 acres in area (Marsh and Borton 1974); $N = 831$ individual lakes and 40 multi-lake groups.
- Names of Michigan lakes sampled as part of the U.S. Environmental Protection Agency's National Acid Precipitation Assessment Program (Kanciruk et al. 1986); $N = 172$.
- List of MDNR Status of the Fisheries Reports, $N = 25$ lakes (and 30 rivers).

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

- Public boat launch sites in Michigan (mostly on lakes 50 acres and larger); $N = 919$ inland lake sites, 89 Great Lakes sites, 5 Lake St. Clair sites, 294 river sites.
- List of MDNR Fisheries Research Reports, $N = 2060$.
- List of MDNR Fisheries Technical Reports, $N = 204$.
- List of MDNR Fisheries Management Reports, $N = 12$.
- List of MDNR Fisheries Special Reports, $N = 7$.

Formal metadata descriptions have not yet been prepared. However, descriptions of the variables have been added to some of the Access database tables.

In the course of assigning unique identification keys to lakes in the atlas of Marsh and Borton (1974), I found that measurements on one lake had been done twice. Muskrat Lake is mostly in Van Buren County, but extends a little into Allegan County, and a separate entry for this lake appears under each county. This provided a means to estimate the measurement error for the reported values of area and perimeter for this lake and its watershed. I computed percent difference as $100 * (\text{Van Buren value} - \text{Allegan value}) / (\text{Allegan value})$. The percent difference in the two values (and the Allegan value) was 12.7% for watershed area (470.9 acres), 6.9% for watershed perimeter (4.47 miles), 0.7% for watershed shape factor (1.47), -4.5% for lake area (138.6 acres), -41.9% for lake perimeter (4.72 miles), -40.6% for lake shape factor (2.86), and 17.9% for the ratio of watershed area to lake area (3.40).

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

Findings: Digitizing lake depth contours by hand has been done for four additional lakes, bringing the total to seventeen (counties given in parentheses): Baseline (Livingston, Washtenaw), Big Portage (Livingston, Washtenaw), Black (Cheboygan, Presque Isle), Brevoort (Mackinac), Burt (Cheboygan), Cassidy (Washtenaw), Charlevoix (Charlevoix), Crystal (Benzie), Dead (Washtenaw), Dickerson (Montcalm), Fletcher Pond (Alpena, Montmorency), Ford (Washtenaw), Gogebic (Gogebic, Ontonagon), Higgins (Roscommon, Crawford), Houghton (Roscommon), Mullet (Cheboygan), Whitmore (Livingston, Washtenaw). This list includes nine of the eleven largest lakes in Michigan (Laarman 1976). For most of these lakes, the original map contains information on bottom types and aquatic vegetation (Taube et al. 1964). 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 will be evaluated for converting scanned bitmap images of lake maps into vectors (Adobe Streamline). It is expected that this will appreciably reduce the effort in creating electronic versions of lake depth contours.

Job 5. Title: Prepare report.

Findings: This performance report has been prepared.

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.
- Laarman, P. W. 1976. The sport fisheries of the twenty largest inland lakes in Michigan. Michigan Department of Natural Resources, Fisheries Research Report 1843, Ann Arbor.
- 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.

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