

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-3

Study No.: 674

Title: Compilation of databases on Michigan lakes

Period Covered: October 1, 2001 to September 30, 2002

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: Under Job 5, this progress report has been written and a final report is being prepared. The manuscript will be submitted to the Fisheries Division's Editing and Finishing Process for Publication of Research and Technical Reports under Job 8.

Findings: Job 8 was scheduled for 2001-02. Job 5, however was not completed as scheduled, and progress is reported below for both Jobs 5 and 8.

Job 5. Title: Write/prepare final report.—This progress report has been written. A final report is being drafted as the following manuscript, which will be submitted to the Fisheries Division's Editing and Finishing Process for Publication of Research and Technical Reports:

Breck, J. E. 2003. Compilation of databases on Michigan lakes. Michigan Department of Natural Resources, Fisheries Technical Report Draft, Ann Arbor.

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 lake inventory (Humphrys and Green 1962); N = 32,087 lakes. This includes lakes from 0.1 to over 10,000 acres in area as well as approximately fifty seven manmade lakes created after Humphrys and Green's compilation.
- 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 (data retrieved from U.S. Environmental Protection Agency STORET database via the web; original measurements were made and entered by Michigan Department of Environmental Quality, Land and Water Management Division, Lansing); N = 730 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 = 66 lakes and rivers.
- Public boat launch sites in Michigan (Ray Fahlsing, MDNR Parks and Recreation Division, personal communication); N = 919 inland lake sites (mostly on lakes 50 acres and larger).
- Percy Laarman's compilation of fish growth rates, used to compute Michigan average growth rates (Laarman 1963); N = 26,086 records; N = at least 1052 lakes.
- Names of inland lakes with creel survey data and a reference to the report containing the data (Schneider and Lockwood 1979; Ryckman and Lockwood 1985; and references therein; Lockwood 2000); N = 154 lakes; N = 272 lake*year combinations.
- Lake Survey Summary cards from IFR files; N = 549.

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

- Public boat launch sites in Michigan (Ray Fahlsing, MDNR Parks and Recreation Division, personal communication); N = 89 Great Lakes sites, 5 Lake St. Clair sites, 294 river sites.
- Management Record cards from IFR files; N = about 200, with 974 management recommendations.
- List of MDNR Fisheries Research Reports; N = 2060.
- List of MDNR Fisheries Technical Reports; N = 206.
- List of MDNR Fisheries Management Reports; N = 17.
- List of MDNR Fisheries Special Reports; N = 15.

The final report will contain a short description of each database, an abstract describing the original information, a description of the changes made to the original information in conversion to the present form, a list of the original fields, and a list of the added fields. Examples are given for two databases: the Michigan lake inventory of Humphrys and Green (1962), and Lower Peninsula lakes sampled for fishes with large seines (Schneider 1981).

Database: Michigan lake inventory of Humphrys and Green

Database short description.—Michigan lake inventory of Humphrys and Green
Path name: P:_SHARED\Digital_Atlas\Lakes\State\Tables\lakes_020725.mdb
Access table name: Humphrys 1 record per lake
Number of records: 32,087
Number of fields: 50

Abstract.—This Access table contains information from the Michigan lake inventory of Humphrys and Green (1962. Michigan Lake Inventory bulletins 1-83. Michigan State University, Department of Resource Development, East Lansing.). Each bulletin contains the following introduction: “This inventory of lakes brings together some readily available data from maps, reports, and local sources. It is not presented as a complete or detailed inventory. Eventually, as more accurate information is collected, a more complete survey of Michigan’s lakes can be compiled.” The first part of each bulletin contains an alphabetical list of all lakes in the county. “Some lakes are known by more than one name; those names appearing on the United States Geological Quadrangles are given highest precedence.” Lack of information: “In many instances, the information needed to answer questions under some of the columns was unavailable and no

entry was possible.” The Access table now contains 32,087 records and 50 fields, with information on water bodies as small as 0.1 acre.

Description of changes.—This lake information, originally in a series of bulletins, one per county, was keypunched by a contractor under the direction of Chris Larson, Michigan Department of Natural Resources (MDNR), Fisheries Division, Lansing office. The resulting table was edited at the Institute for Fisheries Research by workers under the direction of James E. Breck, MDNR Fisheries Research Biologist. The main editing was to prepare a version of the table containing only one record per lake. The original bulletins and keypunched table had a total of approximately 35,000 records on water bodies as small as 0.1 acres. There was a separate record for each lake-township combination. For example, if a lake occurred in two townships, there were two records for that lake. The first major editing task was, for each county, to delete records to allow only one record per lake. The procedure was to keep the record containing the township, range, and section (TRS) of the lake outlet. The second major editing task was to find lakes that crossed county lines, to allow only one record per lake. In the original bulletins, lakes were listed by TRS, with lakes in the lowest township and range listed first. County lake numbers were then assigned to each lake according to Humphrys and Green (1962). This meant that lakes that crossed county lines were assigned different numbers for the portion in each county. We edited the list to delete all but one record for lakes that crossed county lines. A new unique lake code (New_Key) was assigned to all water bodies by combining the county code and lake code assigned by Humphrys and Green. For example, the portion of Higgins Lake in Crawford County (county number 20) had been assigned lake number 13 in that county list, whereas the portion in Roscommon County (county number 72) had been assigned lake number 117. Because the outlet for Higgins Lake is in Roscommon County, we assigned New_Key the value 72-117. At the same time we updated the lake area field. In the original bulletin, the field AREA contained the lake’s area in that county. For example, in the record for Crawford County, the area of Higgins Lake was given as 22.5 acres (with a note that 9577.5 acres was in Roscommon County for a total of 9600.0 acres), whereas the record for Roscommon County gave the area as 9900.0 acres (a different total number of acres). We created a new field (Acres_total) for the total area of the lake, combining portions from all counties. Similarly, lakes on the State border had been assigned the lake area inside Michigan. When the information was given in the notes, we updated the Acres_total field. As information became available, we added lakes not already on the list, assigning a New_Key according to the outlet county and using the next higher lake number for the county. Several new lakes have been created by flooding one or more smaller lakes. When this situation was identified, a record was added for the new lake and the flooded lakes were assigned an Origin value of minus one. With editing, the total number of records changed from about 35,000 to 32,087.

Original Fields.—The field names in the Access table are given first, with the original field names given in parentheses in capital letters. The following field descriptions that contain quotation marks are quoted directly from Humphrys and Green (1962), from Bulletin No. 1, for Alcona County.

Lake_No (LAKE NUMBER): “Each lake has been assigned a county lake number. This system is based upon the General Land Office township, range, and section number survey. Lakes in the lowest township and range are listed first.”

Lake_Name (LAKE NAME): “Some lakes are known by more than one name; those names appearing on the United States Geological Quadrangles are given highest precedence.”

Origin (ORIGIN): “All bodies of surface water have been arbitrarily classified as to their origin on the basis of available information.” Classes of surface water recognized are given in another table.

Acres (AREA): “Some lakes have been carefully surveyed by civil engineers for platting of lots or for lake level determination reports. These acreages have been accepted as being most accurate.”

Town (TOWNSHIP): Tier number of the township north or south of the base line for Michigan, assigned by the General Land Office. (This numbering system is explained nicely in the book by R. G. Wetzel and G. E. Likens, *Limnological analyses*, published in 1979 by W. B. Saunders Company, Philadelphia.)

Range (RANGE): Range number of the township east or west of the principal meridian for Michigan, assigned by the General Land Office. (This numbering system is explained nicely in the book by R. G. Wetzel and G. E. Likens, *Limnological analyses*, published in 1979 by W. B. Saunders Company, Philadelphia.)

Section1 (SECTION) to Section22: In the original bulletins, this field contained a list of all sections in the specified township containing some portion of the lake. In the keypunched version, these section numbers were individually entered into successive fields: Section1, Section2, Section3, up to Section22. The intention now is to have Section1 list the section number containing the lake outlet, but not all lake records have been checked yet. For lakes with no outlet, Section1 is intended to contain the section number of the center of the lake.

Inlet (INLET): “These terms [INLET and OUTLET] refer to any channels, natural or cultural, permanent or intermittent, that permit the flow of water into or out of the lake basin.”

Outlet (OUTLET): “These terms [INLET and OUTLET] refer to any channels, natural or cultural, permanent or intermittent, that permit the flow of water into or out of the lake basin.”

Max_Depth (MAXIMUM DEPTH): Given in feet. “The maximum depth of many lakes has been investigated. These figures have been listed but must be considered subject to change when more detailed surveys have been complete or when the lake level fluctuates.”

Shoretype (% MINERAL): “Except for those lakes that have been surveyed, the source of shore-type information consists of available soil survey maps.”

[not in Access table] %ORGANIC: “Except for those lakes that have been surveyed, the source of shore-type information consists of available soil survey maps.”

Panfish (PANFISH): X means panfish are present. “FISH SPECIES: The limnological aspects of lakes are extremely complex and subject to considerable change due to management practices, natural changes or pollution. Only three groups have been indicated – trout, pike, and panfish. These designations are general and do not cover the quantitative or qualitative aspects of the fish population present.”

Pike (PIKE): X means pike are present. “FISH SPECIES: The limnological aspects of lakes are extremely complex and subject to considerable change due to management practices, natural changes or pollution. Only three groups have been indicated – trout, pike, and panfish. These designations are general and do not cover the quantitative or qualitative aspects of the fish population present.”

Trout (TROUT): X means trout are present. “FISH SPECIES: The limnological aspects of lakes are extremely complex and subject to considerable change due to management practices, natural changes or pollution. Only three groups have been indicated – trout, pike, and panfish. These designations are general and do not cover the quantitative or qualitative aspects of the fish population present.”

Public_Access (PUBLIC ACCESS): X means there is public access. “Lakes indicated as having public access are limited to those having fishing access points, parks or boat rentals open to the public. Numerous lakes have unimproved public frontage that may eventually become

public access points. “The information presented does not represent an attempt to classify lakes as being public or private in nature. This determination must be left to the discretion of Michigan courts.”

Added Fields.—The following fields were added by James E. Breck to the columns of information in Humphrys and Green (1962).

GLB: Great Lakes Basin: E, H, M, or S, for Erie, Huron, Michigan, or Superior, respectively.

MU: MDNR Fisheries Management Unit (MU): LE, LHN, LHS, LMC, LMN, LMS, LSE, or LSW, for Lake Erie MU, Northern Lake Huron MU, Southern Lake Huron MU, Central Lake Michigan MU, Northern Lake Michigan MU, Southern Lake Michigan MU, Eastern Lake Superior MU or Western Lake Superior MU, respectively.

Humphry_Key: Bulletin number and lake number (e.g., 20-13). A separate Humphry_Key is given for portions of lakes in different counties.

New_Key: Unique code for a given water (e.g., 72-117), based on the county numbers and lake numbers assigned by Humphrys and Green (1962). Portions of a lake in different counties have the same New_Key.

Bulletin: Numeric code for county, based on the number assigned by Humphrys and Green (1962). They numbered counties in standard alphabetical order from Alcona (1) through Saginaw (73), but then used non-standard alphabetical order for Sanilac (74), Schoolcraft (75), Shiawassee (76), St. Clair (77), St. Joseph (78). Tuscola (79) through Wexford (83) are again in standard alphabetical order.

Acres_GIS: Lake area (acres, to three decimal places) as determined by GIS information.

Acres_total: Lake area (acres) from Humphrys and Green (1962), combining portions in different counties or states. In some cases, this number has been updated to the value in Acres_GIS.

Co_Reg_N_Laarman: A unique lake code (County-Region-Lake number) assigned by Percy Laarman for his study of fish average length. (Laarman, P. W. 1963. Average growth rates of fishes in Michigan. Michigan Department of Conservation, Report 1675, Ann Arbor.)

Comment: Text field for comments.

Lk_listN: Field contains a 1 if this lake was on the list sent to each Fisheries Division MU in December 2000 for designation of lake ownership and access for planning lake surveys.

Owner_Code: 1 = public lake; 2 = private lake where Fisheries Division could probably get permission to sample; 3 = private lake where Fisheries Division probably could NOT get permission to sample; 4 = not sure about ownership; 5 = no MU file on this lake. These codes were assigned by Fisheries Division based on readily available information in order to assist in planning lake surveys. Official determination of lake ownership must be left to the discretion of Michigan courts.

Access_Code: 1 = with launch site; 2 = without launch site, but easy access; 3 = without launch site, but difficult access; 4 = not sure about accessibility. These codes were assigned by Fisheries Division based on readily available information in order to assist in planning lake surveys.

Note: Text field for comments.

TRS: Town, Range, Section code, with no spaces, no hyphens, and no preceding zeros (e.g., T23NR4WS10).

Database: Lower Peninsula lakes sampled for fishes with large seines

Database short description.—Lower Peninsula lakes sampled for fishes with large seines.

Path name: P:_SHARED\Digital_Atlas\Lakes\State\Tables\lakes_020725.mdb

Access table name: large-seine data

Number of records: 229

Number of fields: 105

Abstract.—This Access table contains summary information on 229 Lower Peninsula lakes sampled for fishes with very large seines from 1957 to 1964. Details are given in Schneider's report (Schneider, J. C. 1981. Fish communities in warmwater lakes. Michigan Department of Natural Resources, Fisheries Research Report 1890, Ann Arbor). The sampling used seines 800 to 1600 feet long and 15 to 30 feet deep. From 4 to 19 fish species were caught per lake, but data on only 17 species are included in this summary table. For most species, the table summarizes the number and total weight (pounds) of fish caught, pounds per acre, and total weight as a percentage of all species caught.

Description of changes.—This file was converted from an Excel spreadsheet to an Access table. Some field names were modified. Two new fields were added, one to indicate the order of records in the original spreadsheet. A second field was a unique code for each lake (New_Key), based on the numbering system for counties and lakes used by Humphrys and Green (1962).

Original Fields.—The field names in the Access table and their descriptions are given below. They are very similar to the original column names in the original Excel spreadsheet. Information from spreadsheet cell notes is given in the field description.

Lake_name: Lake name

County: County

Twp: Township

Range: Range

Section: Section

Lake_area: Lake surface area (acres)

Max_depth: Maximum depth (feet)

Mean_depth: Mean depth (feet)

Alkalinity: Alkalinity (ppm)

Veg_rank: Vegetation rank; 1 = sparse; 3 = common; 5 = abundant

Secchi: Water transparency as measured by Secchi disk (feet)

Climate: Growing degree days above a base of 55°F; per Van Den Brink et al. 1971. (see Schneider. 1975. Michigan Academician 8:59-84)

O2_type: Mid summer stratification and DO (see Schneider. 1975. Michigan Academician 8:59-84); 1 = 2ppm DO to bottom; 2 = 2 ppm DO hypolimnion; 3 = 2 ppm >5' thermocline; 4 = 2 ppm top thermocline; 5 = unstratified

Fishing: Fishing quality; 1 = poor; 2 = fair; 3 = good; 4 = poor panfish; 5 = poor game fish

Problem: 1 = none; 2 = stunted bluegill; 3 = stunted yellow perch; 4 = common carp; 5 = sucker

Seine_mon: Month in which seining occurred

Seine_yr: Last two digits of year in which seining occurred

Seine_len: Seine length (feet)

Small_mesh: Mesh size (stretch measure) of the seine

Material: Seine material; 1 = cotton; 2 = nylon

Water_T: Water temperature (degrees F) at seining

Wind: Wind conditions; 1 = calm; 2 = moderate; 3 = calm

Sun: Weather conditions; 1 = clear; 2 = partly cloudy; 3 = overcast; 4 = rain

A_seined: Acres seined

Seine_eff: Seine efficiency; 1 = poor; 2 = fair; 3 = good

Tot_n_all: Total number, all fish species

Tot_lb_all: Total weight of all fish species (pounds)

Lb_ac_all: Pounds per acre, all species combined

Pred_pct_wt: Total weight of predators as a percentage of total fish weight; predator weight includes the following strongly piscivorous species: largemouth and smallmouth bass, northern pike, walleye, grass pickerel, gar, and bowfin.

BG_n_per_lb: Number of bluegill per pound of bluegill; (number of bluegill / pounds of bluegill)

BG_number: Number of bluegill

BG_pounds: Pounds of bluegill

BG_pct_wt: Bluegill as percent by weight of all species

BG_pct_gt6: Percent of bluegill greater than 6 inches

BG_pct_gt8: Percent of bluegill greater than 8 inches

BG_lb_acre: Pounds of bluegill per acre

BG_ngt6ac: Number per acre of bluegill greater than 6 inches

BG_grow_in: Growth index of bluegill

PSD_n: Number of pumpkinseed

PSD_lbs: Pounds of pumpkinseed

PSD_pct_wt: Pumpkinseed as percent by weight of all species

PSD_pct_gt6: Percent of pumpkinseed greater than 6 inches

PSD_grow_in: Growth index of pumpkinseed

YP_number: Number of yellow perch

YP_lbs: Pounds of yellow perch

YP_pct_wt: Yellow perch as percent by weight of all species

YP_pct_gt7: Percent of yellow perch greater than 7 inches

YP_grow_in: Growth index of yellow perch

Crappie_n: Number of black crappie

Crappie_lb: Pounds of black crappie

Crap_pct_w: Black crappie as percent by weight of all species
Crap_pctgt7: Percent of black crappie greater than 7 inches
Crap_gro_in: Black crappie growth index
Rockb_n: Number of rock bass
Rockb_lbs: Pounds of rock bass
Rock_pct_wt: Rock bass as percent by weight of all species
Rbass_pctgt6: Percent of rock bass greater than 6 inches
LMB_n: Number of largemouth bass
LMB_lbs: Pounds of largemouth bass
LMB_pct_wt: Largemouth bass as percent by weight of all species
LMB_pctgt10: Percent of largemouth bass greater than 10 inches
LMB_pctgt15: Percent of largemouth bass greater than 15 inches
LMB_gro_in: Growth index of largemouth bass
SMB_n: Number of smallmouth bass
SMB_lbs: Pounds of smallmouth bass
SMB_pct_wt: Smallmouth bass as percent by weight of all species
SMB_pctgt10: Percent of smallmouth bass greater than 10 inches
SMB_pctgt15: Percent of smallmouth bass greater than 15 inches
SMB_gro_in: Growth index of smallmouth bass
Pike_n: Number of northern pike
Pike_lbs: Pounds of northern pike
Pike_pct_w: Northern pike as percent by weight of all species
Pike_pctgt20: Percent of northern pike greater than 20 inches
Pike Growth index: Growth index of northern pike
WAE_n: Number of walleye
WAE_lbs: Pounds of walleye
WAE_pct_w: Walleye as percent by weight of all species
WAE_pctgt13: Percent of walleye greater than 13 inches
WAE_gro_in: Growth index of walleye
Pickerel_n: Number of grass pickerel
Pickrl_lbs: Pounds of grass pickerel
Pickrl_pct_w: Grass pickerel as percent by weight of all species
Bullh_n: Number of bullheads (not distinguished in the seine reports as to yellow, brown or black)
Bullh_lbs: Pounds of bullheads (not distinguished in the seine reports as to yellow, brown or black)

Bullh_p_wt: Bullheads as percent by weight of all species (not distinguished in the seine reports as to yellow, brown or black)

Minnow_n: Number of minnows

Minnow_lbs: Pounds of minnows

Minnow_p_w: Minnows as percent by weight of all species

Carp_n: Number of common carp

Carp_lbs: Pounds of common carp

Carp_pct_w: Carp as percent by weight of all species

Warmouth_n: Number of warmouth

Warmouth_lbs: Pounds of warmouth

Warmth_p_w: Warmouth as percent by weight of all species

Chubsk_n: Number of lake chubsucker

Chubsk_lbs: Pounds of lake chubsucker

Chubsk_p_w: Lake chubsucker as percent by weight of all species

Wsuck_n: Number of white sucker

Wsuck_lbs: Pounds of white sucker

Wsuck_pct_w: White sucker as percent by weight of all species

Bowfin_n: Number of bowfin

Bowfin_lbs: Pounds of bowfin

Bowfin_p_w: Bowfin as percent by weight of all species

Added Fields.—The following fields were added by James E. Breck to the columns of information in the table from Schneider.

New_Key: Unique code for a given water (e.g., 72-117), based on the county numbers and lake numbers assigned by Humphrys and Green (1962)

JCS_Lake_n: Order in the spreadsheet provided by Schneider

Job 8. Title: Publish report through the Fisheries Division's editing and finishing process for Research and Technical reports.—The manuscript will be published as a Fisheries Technical Report during 2002-03, and submitted as a final report December 2003.

Literature Cited:

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