

RETRIEVAL AND ANALYSIS SYSTEM
USED IN WISCONSIN'S STATEWIDE FISH
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ABSTRACT

A statewide survey of the inland waters of Wisconsin was initiated in 1974 by the Bureau of Research, Wisconsin Department of Natural Resources, to establish a comprehensive data base on the distribution and relative abundance of all fish species. A Water Mileage System was devised to permit computer retrieval and analysis, and yet allow easy recognition of location by persons using the data base on over 11,000 streams and over 7,200 lakes. This system divided the state into 3 major basins and 30 minor basins. A unique series of mileages (codes) for each stream and non landlocked lake in Wisconsin was then established and stored in a computer file (landlocked lakes within a basin were organized alphabetically by name). Another file was created using these water mileages to uniquely identify each fish sampling station and to store the data taken for each collection. Data included the collector, gear, effort, date, township description, county, number of specimens (up to 98) for each fish species taken, and various ecological data. There are presently approximately 16,900 collections dating from 1900 to 1983 in this file. Several Cobol and Mark IV computer programs were written to help in the retrieval and analysis of this data.

This report describes the Water Mileage System, the Master Stream File, and the Master Fish File. It is intended as a companion to the published reports on the distribution and relative abundance of fish in 15 Wisconsin basins, as a reference for persons who request computer printouts from the data base, and as a guide for other resource managers who may use the Water Mileage System in their work.

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INTRODUCTION

A statewide survey of the inland water of Wisconsin was initiated in 1974 by the Bureau of Research, Wisconsin Department of Natural Resources, to establish a comprehensive data base on the distribution and relative abundance of all fish species. To identify the location of sampling stations and for storing and retrieving the massive amount of data collected for the statewide study, including published and unpublished data from other sources dating back to 1900, I developed the Water Mileage System, Master Stream and Lake File, and Master Fish File. The purpose of this report is to explain this system, the associated computer files, and available computer listings.

The Water Mileage System was devised to permit computer analysis of over 16,900 fish collections in Wisconsin spanning the period from 1900 to the present and still allow easy recognition of sampling locations by persons wishing to use the data. This was accomplished by using the town, range, section, quarter quarter section, and county along with basin numbers, a series of mileages, and the name of the body of water. A Master Stream and Lake File containing this information was generated for over 11,000 streams and 7,200 lakes in Wisconsin. A Master Fish File, which uses the Water Mileage System to organize the biological and environmental data, was also created.

Mark IV and Cobol computer programs were written to allow the data to be organized into numerous types of listings--for example, an alphabetical listing of streams and/or lakes in any basin or county from the Master Stream and Lake File; a listing of species and numbers of specimens collected in a stream, lake, basin, or county that can be restricted to certain collectors, time periods, or gear from the Master Fish File; a listing of stations also from the Master Fish File that met selected criteria for each species, including a summary table.

Field collecting was essentially terminated in 1980 due to reduced funding, with only limited sampling after that time. Of the 27 minor basins in the state (excluding the Mississippi River and the Great Lakes), sampling was complete in 15 basins and nearly complete in basin 400 (Fig. 1). Only scattered samples were taken in the remaining 11 basins. As of 1980, about 45% of the geographic area of the state was inventoried.

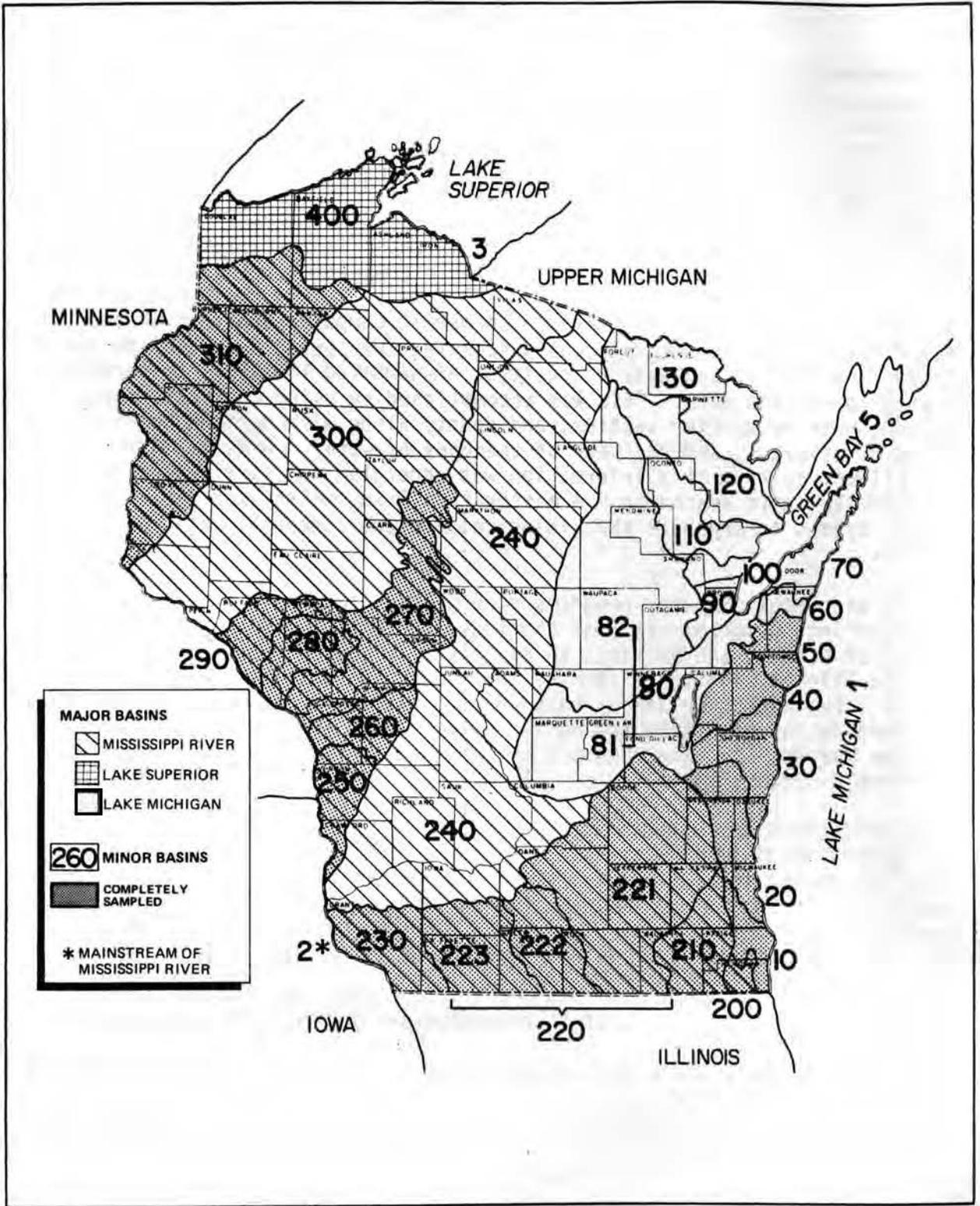


FIGURE 1. Major and minor river basins in Wisconsin.

MASTER STREAM AND LAKE FILE

An example of a page of the Master Stream and Lake File from a computer printout is shown in Figure 2. In the Water Mileage System the location for any river or drainage lake (excluding landlocked lakes or landlocked systems) is designated by a series of numbers (or codes). They specify its major basin, minor basin, and a series of river mileages which indicate the distance (in 10th of miles) that the mouth of a river or lake is upstream from the beginning of the major basin in which it is located.

Mileages were determined through the use of a map wheel on 7 1/2 min (15 min if the 7 1/2 min was not published) U.S. Geological Survey topographical maps.

Major Basin

Wisconsin is divided into 3 major basins (Fig. 1). These 3 major basins and their corresponding code numbers are as follows:

Lake Michigan = 1
Mississippi River = 2
Lake Superior = 3

Under the heading "BASINS/MAJ" in Figure 2, a "2" indicates the Mississippi River basin.

Minor Basin

There are 30 minor basins in Wisconsin. The Lake Michigan basin has 13 (numbered 10 through 130) plus Lake Michigan proper, numbered 1, and Green Bay proper, numbered 5. The Mississippi River basin has 12 (numbered 200 through 310) plus the Mississippi River (Mainstream), numbered 2. The Lake Superior basin has 1 (numbered 400) plus Lake Superior proper, numbered 3 (Fig. 1).

One of Lake Michigan's minor basins (Fox River - 80) is subdivided into 2 sub-basins: 81 - Upper and Lower Fox River and 82 - Wolf River.

One of the Mississippi River's minor basins (Greater Rock River - 220) is subdivided into 3 sub-basins: 221 - Rock River (proper), 222 - Sugar River (includes Raccoon Creek), and 223 - Pecatonica River (Fig. 1).

The minor or sub-basin number is shown just to the right of the major basin number in Figure 2, under the heading "BASINS/MIN". In this example, the "222" indicates the Sugar River basin.

River Mileages

First Order Streams

The major basin mileage, under the heading "MB.MI.", locates the mouth of the 1st order stream (Fig. 2). The major basin mileage is determined in this way:

BASINS MAJ MIN	MB. MI.	ORDER					M I L E A G E S				MI OR ACRES	-- STREAM OR LAKE NAME --	D WL -- C TSTWN	LOCATION --			
		1	2	3	4/8	5/9	6/10	7/11	RNGSEC	QTQT64C0							
2 222 62790										17	GOOSE POND	0	6N	8E	13	NENE	13
2 222 62800										33	L HARRIETT	0	5N	9E	9	NWNW	13
2 222 62810										10	MORSE POND	0	6N	8E	3	SESW	13
2 222 62820										12	MORTENSON POND	0	5N	9E	26	NWSE	13
2 222 62830											SUGAR R - OXBOW	0	1N	10E	27	NWSW	54
2 222 62840										8	VERONA GRAVEL PIT #12 (EAST	0	6N	8E	22	SENW	13
2 222 62850	1434.8R	156.9L	.7R							11	RACCOON CR	2	46N	1E	22		80
2 222 62860	1434.8R	156.9L	.7R	6.9R						7	E FK RACCOON CR	2	46N	1E	8		80
2 222 62870	1434.8R	156.9L	.7R	6.9R	1.4						E FK RACCOON CR -WI-IL BD	6	1N	12E	31	SESW	54
2 222 62880	1434.8R	156.9L	.7R	6.9R	2.7R					4	UN CR (CHAMBERLIN SPRINGS)	2	1N	12E	31	SWNE	54
2 222 62890	1434.8R	156.9L	.7R	9.5							RACCOON CR -WI-IL BD	6	1N	11E	35	SESE	54
2 222 62900	1434.8R	156.9L	.7R	11.4							DAM-RACCOON CR-MILLPOND		1N	11E	34	NENE	54
2 222 62910	1434.8R	156.9L	.7R	11.7R						3	UN CR	2	1N	11E	27	SWSE	54
2 222 62920	1434.8R	156.9L	.7R	11.7R	.3R					3	UN CR	2	1N	11E	27	NWSE	54
2 222 62930	1434.8R	156.9L	9.2R							76	SUGAR R	2	28N	11E	11		80
2 222 62940	1434.8R	156.9L	9.2R	10.7							SUGAR R -WI-IL BD	6	1N	10E	36	SESW	54
2 222 62950	1434.8R	156.9L	9.2R	10.8L						9	GREEN DRAINAGE SYSTEM	2	1N	10E	36	SESW	54
2 222 62960	1434.8R	156.9L	9.2R	10.8L	6.4R					1	UN CR	2	1N	9E	25	SENE	54
2 222 62970	1434.8R	156.9L	9.2R	11.2R						3	UN DITCH	2	1N	10E	36	NWSW	54
2 222 62980	1434.8R	156.9L	9.2R	11.2R	.7R					1	UN DITCH	2	1N	10E	36	NENW	54
2 222 62990	1434.8R	156.9L	9.2R	11.7R						2	UN DITCH	2	1N	10E	35	SENE	54
2 222 63000	1434.8R	156.9L	9.2R	16.0L						6	UN DITCH	2	1N	10E	28	NESW	54
2 222 63010	1434.8R	156.9L	9.2R	18.8L							SUGAR R -W CHANNEL	2	1N	10E	20	SWNE	54
2 222 63020	1434.8R	156.9L	9.2R	18.8L	.5L					1	UN DITCH	2	1N	10E	20	SWNW	54
2 222 63030	1434.8R	156.9L	9.2R	19.8R						13	TAYLOR CR	2	1N	10E	18	SESE	54
2 222 63040	1434.8R	156.9L	9.2R	19.8R	1.8R					10	WILLOW CR (NORTH)	2	1N	10E	7	NESW	54
2 222 63050	1434.8R	156.9L	9.2R	19.8R	1.8R	6.7R				4	UN CR	2	1N	10E	11	SWNE	54

FIGURE 2. Sample page from the Master Stream and Lake File.

- (1) If the river is a tributary to Lake Michigan, its mileage is determined by the number of miles its mouth is up the shore from the Wisconsin-Illinois border. The letter "L" after the mileage indicates the river enters the west (left) shore of Lake Michigan.
- (2) If the river is a tributary to the Mississippi River, as in our example, its mileage is the number of miles its mouth is located upstream from the mouth of the Mississippi River. Figure 3 shows a map (not to scale) of some of the tributaries of the Rock River with water mileages. The "1434.8" in the example locates the mouth of the Rock River (Fig. 2). The letter "R" after this mileage indicates that the 1st order stream flows in on the east (right*) side of the Mississippi River.
- (3) If the river is tributary to Lake Superior, its mileage is determined by the number of miles its mouth is east (to the right) of the mouth of Superior Bay at Superior.

Second Through Twelfth Order Streams or Drainage Lakes

Mouths of 2nd through 12th order streams and drainage lakes are assigned a mileage based on the number of miles their mouths are upstream from the mouth of the river into which they flow. Thus, mileage on a 1st order stream indicates the mouth of a 2nd order stream or lake. These mileages are shown under the heading "ORDER MILEAGES 1 2 3 4/8 5/9 6/10 7/11". In the example under the heading "1", "156.9" locates the mouth of a second order stream, the Pecatonica River, and under "2", "9.2" locates the mouth of a third order stream, the Sugar River (Fig. 3). The 1st through 7th order mileages are located on the 1st line of data for that stream or lake. If more orders are needed, they appear on the 2nd line of data for that body of water under the mileage for the 4th through 7th orders. The last space of each order is used for 1 of 7 reference codes. They are "R", "L", "X", "Y", "A", "O", or a blank.

The letter "R" is used for streams that enter the previous order stream on the right. If the stream enters on the left, the letter "L" is used. When 2 rivers join and form a new river, the tributary (fork) entering the new river on the right is assigned the letter "X" while the letter "Y" is used for the tributary entering on the left. If a lake has a named river flowing through it, tributaries flowing into the lake are given an "R" or "L" designation after their mileage corresponding to their position with respect to the main river flowing through the lake. When no such continuous main stream exists, the lakes were arbitrarily divided into left and right halves. If a river enters the lake at the upper point of division, the letter "A" follows the mileage for this river.

*Right and left sides are determined when facing upstream throughout this system of coding.

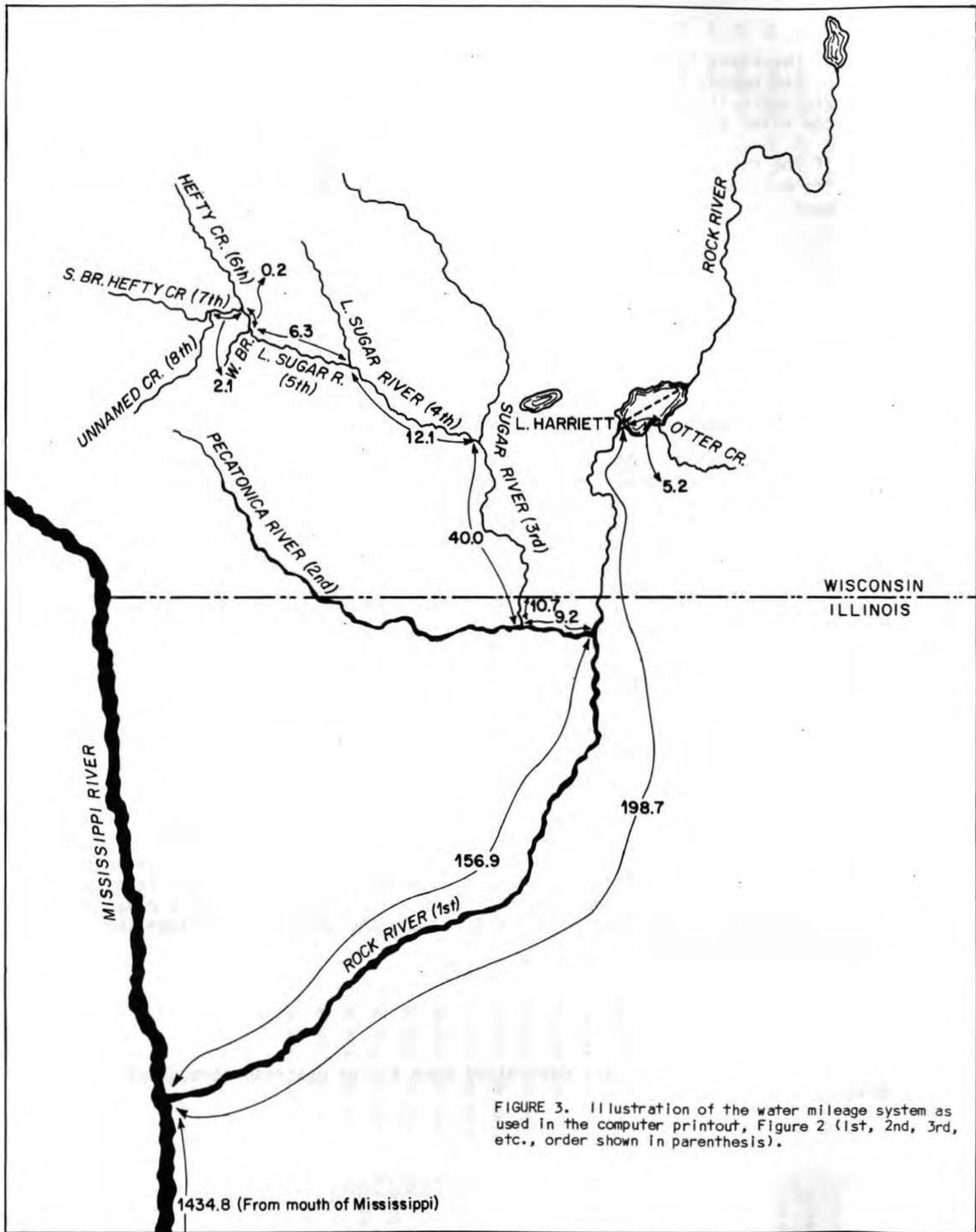


FIGURE 3. Illustration of the water mileage system as used in the computer printout, Figure 2 (1st, 2nd, 3rd, etc., order shown in parenthesis).

The letter "0" is used so that the computer will print out ".0" which is needed in a few instances to designate the mouth of certain rivers or lakes. Superior Bay's major basin mileage "0.00" is an example. The mileage for a dam or lake on a stream has a blank in this column since it is neither left nor right of the stream.

When the mouth of a stream occurs outside the boundaries of Wisconsin, the mileage from its mouth to the Wisconsin border is recorded as if this location were a lake or dam on the stream. Thus, for the Sugar River, "10.7" in the 3rd order (number of miles from mouth of Sugar River to the Wisconsin-Illinois border) is shown in Figures 2 and 3.

If unnamed streams connect 2 or more lakes in succession, the order does not increase for each successive unnamed stream or lake. Instead, the shortest mileage from the mouth of the inlet stream to the mouth of the outlet is added to the mileage of the 1st unnamed stream in the series.

Unnamed ditches connecting 2 or more streams are coded only as a tributary of the lower order stream.

Dams, falls, rapids, and points where streams cross state borders are also listed in the Master Stream and Lake File. All dams are given a mileage as if they were a lake on the stream.

The mileage for the mouth of a stream flowing into a lake is the shortest water mileage from the center of the lake's outlet to the mouth of the stream.

Miles or Acres

The total number of miles of the stream or acres of the lake or impoundment is shown under the heading "MI OR ACRES". The numbers are rounded to the nearest whole number. For streams and lakes that are only partially in Wisconsin, the miles or acres are only for that portion in Wisconsin. For these lakes, the number of acres for the entire lake are shown in parentheses after the name.

Stream or Lake Name

The name of the stream, lake, or dam is taken from U.S. Geological Survey topographic maps (7 1/2 or 15 min), Wisconsin DNR's "Decisions on Names in Wisconsin" (Marsh 1981), and Wisconsin DNR county surface water resources publications (published for 71 of 72 counties), and is shown under the heading "STREAM OR LAKE NAME" (Fig. 2). Secondary and local names are put in parentheses. The following is a list of abbreviations used in the name:

L = Lake	N = North	
R = River	S = South	
BR = Branch	E = East	
CR = Creek	W = West	
FL = Flowage	# = Number	
FK = Fork	Wi = Wisconsin	} for border crossings
P = Pond	IL = Illinois	
BD = Border	MN = Minnesota	} for the river
SP = Spring(s)	Mi = Michigan	
SP P = Spring Pond	Wis = Wisconsin	
M P = Mill Pond	Miss = Mississippi	

Words other than these are truncated if space is limited.

Dam Code

A code for the possibility of fish migrating upstream past a dam is shown under the heading "DC". The code numbers are: 0 = dam no longer in existence, 1 = not possible, 2 = possible (such as spring flood), 3 = highly probable, and 4 = beaver dam.

Water Type Code

All bodies of water are assigned 1 of 10 codes. They are: 0 = landlocked lakes; 1 = lakes or ponds; 2 = rivers, streams, or creeks; 3 = impoundments (any body of water with a dam controlling its water level); 4 = unknown or combination of any of the other types; 5 = backwater (of a stream); 6 = Wisconsin border crossing of a stream; 7 = pools remaining from a "drying-up" stream; 8 = marsh; 9 = a lake (water type code 1 or 3 only) that no longer exists, is contained in another named lake, or which itself contains other named lakes; A = a landlocked lake that no longer exists; B = a stream that no longer exists; a blank = dam or lock. This code is shown under the heading "WT".

C = WI BORDER OR COUNTY BORDER CROSSING OF A LAKE.

Township Description and County

In addition to receiving a series of mileage codes, each river and lake is also described by the town, range, section, quarter quarter section, and county in which its mouth lies. These data are shown in Figure 2, under the heading "LOCATION". All townships in Wisconsin are North. If the range is West, the letter "W" is used, and if East, the letter "E" is used. An example of a quarter quarter section code is "SENE". This code means the southeast 1/4 of the northeast 1/4 of a particular section. If one or more landlocked lakes cannot be uniquely designated by a quarter quarter section, a 64th of a section appears to the right of the quarter quarter. One of 4 letters is used to designate the quarter of the quarter quarter. They are: A = northeast, B = northwest, C = southwest, and D = southeast. The counties are arranged in alphabetical order and given a 2-digit code, e.g., Adams Co. is 1 and Wood Co. is 72 (Table 1). If a river or lake has its mouth outside of the state, the township description is for that state and the county code becomes a state code with the following code numbers: Illinois = 80, Michigan = 85, Minnesota = 90, and Iowa = 95.

TABLE 1. List of counties in Wisconsin arranged alphabetically with codes.

County Code	County Name	County Code	County Name
1	Adams	37	Marathon
2	Ashland	38	Marinette
3	Barron	39	Marquette
4	Bayfield	40	Menominee
5	Brown	41	Milwaukee
6	Buffalo	42	Monroe
7	Burnett	43	Oconto
8	Calumet	44	Oneida
9	Chippewa	45	Outagamie
10	Clark	46	Ozaukee
11	Columbia	47	Pepin
12	Crawford	48	Pierce
13	Dane	49	Polk
14	Dodge	50	Portage
15	Door	51	Price
16	Douglas	52	Racine
17	Dunn	53	Richland
18	Eau Claire	54	Rock
19	Florence	55	Rusk
20	Fond du Lac	56	St. Croix
21	Forest	57	Sauk
22	Grant	58	Sawyer
23	Green	59	Shawano
24	Green Lake	60	Sheboygan
25	Iowa	61	Taylor
26	Iron	62	Trempealeau
27	Jackson	63	Vernon
28	Jefferson	64	Vilas
29	Juneau	65	Walworth
30	Kenosha	66	Washburn
31	Kewaunee	67	Washington
32	LaCrosse	68	Waukesha
33	Lafayette	69	Waupaca
34	Langlade	70	Waushara
35	Lincoln	71	Winnebago
36	Manitowoc	72	Wood

Landlocked Lakes

A landlocked lake is located with its proper major and minor code numbers. However, all other mileages are left blank. The township description and county of the lake are given just as for all other lakes or rivers (Fig. 2). Figure 3 shows Lake Harriett (landlocked) whose center is located in town 5 north, range 9 east, section 26, northwest quarter of the northwest quarter.

Landlocked Systems

A landlocked system is a series of lakes and streams that do not flow above ground into the Mississippi River or Great Lakes. They have a "0.00" in their major basin mileage and a number in the landlocked system space which is located just before the township under the heading "LS".

Organization of File

Each river, lake, and dam in the state is given a permanent six digit number. This sequenced number is assigned in the same order as the Master Stream and Lake File is organized - that is, it starts with the lowest major basin number (1) and goes to the highest (3). Within each major basin the file goes from the lowest minor basin to the highest minor basin. Within each minor basin landlocked lakes are first listed in alphabetical order, and then the streams and other lakes in the basin are listed in increasing mileage orders (Fig. 2). Last within each basin, the landlocked systems, if present, are also listed in increasing mileage order. This nonchangeable number is shown on the second line under the heading "BASINS". It can be used to uniquely designate any stream or lake in the state instead of coding its major and minor basins and its water mileages (township description, county, and lake name for landlocked lakes).

MASTER FISH FILE

When a station is sampled, all data about the station are first recorded onto Form 8100-46 (Fig. 8). After all fish have been identified in the laboratory, the data are coded onto Form 8100-58 (Fig. 9), keyed onto a computer tape, and entered into the Master Fish File through a series of updating programs.

An example of a page from the Master Fish File is shown in Figure 4. The codes for the major and minor basins and the water mileage for a station are similar to those of a stream or lake in the Master Stream and Lake File. However, the data are arranged on the computer printout a little differently and there are also some changes that occur between the name of the stream or lake and its township description as compared to the Master Stream and Lake File. For landlocked lakes in the Master Stream and Lake File (Fig. 1), the mileage orders are left blank; however, for a sampling station (Fig. 4), the township description, which appeared in the Master Stream and Lake File, appears in this space.

The Master Fish File is organized in the same manner as the Master Stream and Lake File, except that all sampling stations on a river are listed until a tributary of the river is reached (Fig. 5a). All stations on that tributary are then listed before going back to the confluence of the tributary with the original river. This procedure is followed for all tributaries in the basin of the 1st tributary before going back to the original river.

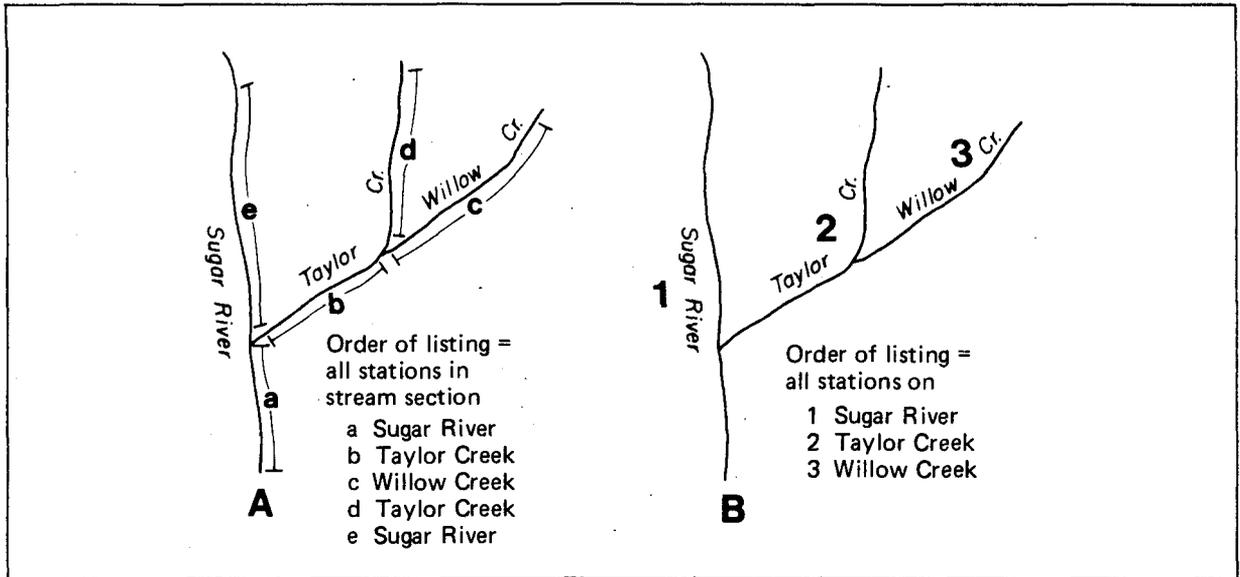


FIGURE 5. Two methods of organizing stations on computer printouts.

Computer Reports

Two types of computer programs were developed to present data from the Master Fish File. One is a Cobol program which presents the data from the Master Fish File in a species listing and shows all stations for each species. This listing can be organized in the same manner as the Master Fish File (Fig. 5a). As an alternative, all stations on a river can be listed before going back to the first tributary of the original river and listing all stations on that tributary (Fig. 5b). This procedure is followed for all tributaries in the basin of the 1st tributary before going to the 2nd tributary of the original river.

Using the Cobol program, both of these methods of organization can be restricted to one or more of the following criteria: particular minor basins, a sub-basin or part of a sub-basin, individual collectors, dates, township and range (by entire township or contiguous townships), counties, water types, and selected species. At each station, the stream name along with water type, number of fish taken, collector, gear, effort, date, township description, and

county are listed. An example of the Cobol listing for one species is shown in Figure 6. At the end of each species listing, the total number of stations, total number of specimens, average number of fish/station, and number of stations for each collector is computed. At the end of the printout, a summary table is given that lists each species, the number of stations at which it was taken, the percent of the total stations possible, grand total of species occurrences, totals for each collector, and totals for number of species and hybrids (Fig. 7).

The second computer program, written in Mark IV, organizes the data by stations and lists for each station all information (number of specimens of each species, and the total number of species, hybrids, and unspecified categories). The program can be restricted to the same criteria cited above for the Cobol program and the listing can be organized in the same 2 ways (Fig. 5a and b). However, only the Mark IV listing can be restricted to gear, or any of the 10 ecological variables. This program can be organized in still different ways, including: (1) by county and then alphabetically by name of stream or lake, (2) by county and then by basin, or (3) by township, range and section. An example of a Mark IV listing is shown in Figure 4.

Station Location

The exact location of the station on the river or drainage lake is given by the station mileage. The exact location on a landlocked lake is given only by the township description located under the heading "STATION LOCATION" (Fig. 4). Station mileages on streams are the number of miles upstream the station is from the stream's mouth. The station's location is that part of the station which is farthest downstream. For stations at bridges, the station mileage is at the bridge unless the station is started more than 0.05 mile (264 ft) downstream or upstream. The station mileage is shown under the heading "MILE". The space immediately following the station mileage can have 1 of 16 codes: "R", "S", "T", or "U" (all = right side of body of water sampled); "L", "M", "N", or "O" (all = left side of body of water sampled)*; "B" (area sampled is 100% downstream of bridge); "C" (area sampled is more than 50% but less than 100% downstream of bridge); "D" (area sampled is more than 50% but less than 100% upstream of bridge); "E" (area sampled is 100% upstream of bridge); "F" (area sampled is 50% upstream and 50% downstream of bridge); blank (no specific information on area sampled is given; however, it is usually mostly upstream of bridge and both sides of the body of water); "+" (area sampled is from a combination of stations usually in lakes under 200 acres); and "?" (station mileage is not precisely known).

Station mileage on a drainage lake is determined in the same way the mileage is determined for a tributary coming into a lake. For a station on a landlocked lake over 200 acres, an arbitrary number ".1" is used for the station mileage of 1 station on the lake and the next station is assigned ".2", etc. Samples normally were combined from all stations in lakes under 200 acres but for lakes over 200 acres are kept separate. A combined sample is recorded as 1 station using the town-range-section system at either the center (for landlocked lakes) or the outlet of the lake for its location and

*Four different codes for right and left are available since several locations on lakes can have the same water mileage from the mouth.

MINOR=223SELECTION=223
 MIN. MONTH = MAX. MONTH =

SOURCE=NOT 40 81 94 95 99
 MIN. YEAR = 1950 MAX. YEAR = 1973 COUNTY = OR < 72

MILE ON

PAGE 43

X12 JOHNNY DARTER

ETHEOSTOMA NIGRUM

DATE RUN 01/04/84

-----O R D E R M I L E A G E S-----										N86006A							
BASIN	MBM	1	2/7	3/8	4/9	5/10	6/11	MILE	LAKE OR STREAM NAME	WT	NO	SD	GEF	--DATE--	TWRRNGSECQTQTCO		
2	223	1434.8R	156.9L	72.8R				1.8E	TWIN GROVE BR	2	61	5		10/20/64	1N 8E29NWNE23		
2	223	1434.8R	156.9L	72.8R				30.5	RICHLAND CR	2	61	5		11/28/65	1N 8E 7SENE23		
2	223	1434.8R	156.9L	102.8R				1.3	BUCKSKIN SCHOOL CR	2	61	5		7/ 5/65	2N 7E 5SWSW23		
2	223	1434.8R	156.9L	105.8R				.5	WHITESIDE CR	2	3	46		6/30/60	2N 5E 3SESW33		
2	223	1434.8R	156.9L	105.8R	10.9L			1.9	APPLE BR	2	61	5		10/ 7/65	3N 5E32 NE33		
2	223	1434.8R	156.9L	105.8R	10.9L	1.6R		3.3E	APPLE BR	2	19	46		6/29/60	3N 5E30SESE33		
2	223	1434.8R	156.9L	105.8R	15.0R			5.3	DOUGHERTY CR	2	61	5		10/ 6/64	3N 6E19NWSE23		
2	223	1434.8R	156.9L	105.8R	19.2L			.3	MUD BR	2	24	46		6/29/60	3N 5E22 SW33		
2	223	1434.8R	156.9L	105.8R	19.2L			3.7	MUD BR	2	61	5		10/ 1/64	3N 5E20NWNW33		
2	223	1434.8R	156.9L	105.8R	19.2L			9.6	MUD BR	2	24	46		6/29/60	3N 4E15NENW33		
2	223	1434.8R	156.9L	105.8R	19.7L			6.1E	YELLOWSTONE R	2	5	46		6/29/60	3N 5E 8SENE33		
2	223	1434.8R	156.9L	105.8R	19.7L			17.0	YELLOWSTONE R	2	9	46		6/28/60	4N 4E23SESE33		
2	223	1434.8R	156.9L	105.8R	25.4R			1.3	SAWMILL CR	2	61	5		10/ 7/64	3N 5E 2NESE33		
2	223	1434.8R	156.9L	105.8R	25.4R			6.5E	SAWMILL CR	2	61	5		10/ 6/64	4N 6E20SESW23		
2	223	1434.8R	156.9L	105.8R	27.5L			1.0	UN CR	2	27	46		6/28/60	4N 5E27NWSE33		
2	223	1434.8R	156.9L	105.8R				30.2	E BR PECATONICA R	2	44	46	5	6/30/60	4N 5E26SESE33		
2	223	1434.8R	156.9L	105.8R	33.5R			.9	GORDON CR	2	61	5		10/ 1/64	4N 5E13NWSW25		
2	223	1434.8R	156.9L	105.8R				40.3	E BR PECATONICA R	2	27	46		6/30/60	4N 5E 4SENE25		
2	223	1434.8R	156.9L	105.8R	44.2L	6.1R		6.3	CONLEY LEWIS CR	2	1	61	5	8/ 1/69	6N 4E34SWNE25		
2	223	1434.8R	156.9L	105.8R				53.4	E BR PECATONICA R	2	61	5		10/15/64	5N 5E 4NWNW25		
2	223	1434.8R	156.9L	105.8R				58.3	E BR PECATONICA R	2	3	61	5	8/ 1/69	6N 5E22 SE25		
2	223	1434.8R	156.9L					139.1	PECATONICA R	2	2	46	5	6/27/60	2N 3E12SESE33		
2	223	1434.8R	156.9L	139.5L				1.2	AMES BR	2	3	46		6/27/60	2N 3E11SESE33		
2	223	1434.8R	156.9L	141.0R				.4	OTTER CR	2	2	46		6/27/60	2N 4E 6SENW33		
2	223	1434.8R	156.9L	153.4L				5.1	BONNER BR	2	7	46		8/15/62	3N 2E11SENW33		
2	223	1434.8R	156.9L	159.0R	8.8L			8.3	SUDAN BR	2	4	46		8/14/62	5N 2E29SWSE25		
2	223	1434.8R	156.9L	159.0R	8.8L	10.6R		.4	PEDLER CR	2	2	46		8/14/62	5N 2E21SWNE25		
2	223	1434.8R	156.9L	159.0R				9.9	MINERAL POINT BR	2	3	46	5	8/15/62	4N 2E10 NE25		
2	223	1434.8R	156.9L	159.0R				13.7	MINERAL POINT BR	2	1	46		8/ 9/62	5N 2E36SWNE25		
2	223	1434.8R	156.9L	172.9L				1.5	JONES BR	2	45			7/11/62	4N 1E23SWSE33		
2	223	1434.8R	156.9L					182.4	PECATONICA R -MIFFLIN	2	11	46	5	8/15/62	5N 1E27SESE25		

NUMBER OF STATIONS WITH FISH = 31 NUMBER OF STATIONS WITH 1-98 FISH = 20 NUMBER OF STATIONS WITH 99 OR MORE FISH = 0
 TOTAL NUMBER OF FISH = 221 AVERAGE NUMBER OF FISH = 11.1 (ESTIMATE)
 PERCENT OF TOTAL NUMBER OF STATIONS = 79.49 NUMBER OF STATIONS WITH A " " = 11
 # STATIONS/SD: SD-11= 0 SD-14,16= 0 SD-15,17,19= 0 SD-23-33= 0 SD-40= 0 SD-45,46= 19 SD-50= 0 SD-55,56= 0
 SD-61= 12 SD-66= 0 SD-72= 0 SD-75= 0 SD-76= 0 SD-77= 0 SD-78= 0 SD-80= 0
 SD-83= 0 SD-86= 0 SD-88= 0 SD-89= 0 SD-94= 0 SD-98= 0 SD-99= 0 SD-36= 0

TOTAL NUMBER OF SPECIES OCCURRENCES 31

FIGURE 6. Sample listing for a species using the Cobol program (listing method B, Fig. 5, used here).

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A86006		NUMBER OF STATIONS	PERCENT OF TOTAL STATIONS	DATE RUN 01/04/84
I21	BROWN TROUT	1	2.56	
K01	CENTRAL MUDMINNOW	4	10.26	
M05	STONEROLLERS	13	33.33	
M06	CENTRAL STONEROLLER	19	48.72	
M07	LARGESCALE STONEROLLER	4	10.26	
M12	COMMON CARP	5	12.82	
M14	BRASSY MINNOW	5	12.82	
M19	HORNHEAD CHUB	21	53.85	
M23	EMERALD SHINER	1	2.56	
M28	COMMON SHINER	28	71.79	
M29	BIGMOUTH SHINER	5	12.82	
M35	ROSYFACE SHINER	17	43.59	
M36	SPOTFIN SHINER	16	41.03	
M37	SAND SHINER	14	35.90	
M41	SUCKERMOUTH MINNOW	8	20.51	
M43	SOUTHERN REDBELLY DACE	18	46.15	
M45	BLUNTNOSE MINNOW	29	74.36	
M46	FATHEAD MINNOW	6	15.38	
M48	BLACKNOSE DACE	2	5.13	
M50	CREEK CHUB	27	69.23	
M76	COMMON SHINER X ROSYFACE SHINER	1	2.56	
N02	SUCKERS	1	2.56	
N04	REDHORSES	1	2.56	
N06	QUILLBACK	1	2.56	
N09	WHITE SUCKER	29	74.36	
N13	NORTHERN HOG SUCKER	10	25.64	
N15	BIGMOUTH BUFFALO	3	7.69	
N18	SILVER REDHORSE	9	23.08	
N21	GOLDEN REDHORSE	8	20.51	
N22	SHORTHEAD REDHORSE	13	33.33	
O08	CHANNEL CATFISH	1	2.56	
O10	STONECAT	5	12.82	
S02	BLACKSTRIPE TOPMINNOW	1	2.56	
U01	BROOK STICKLEBACK	12	30.77	
W04	ROCK BASS	5	12.82	
W05	GREEN SUNFISH	6	15.38	
W08	ORANGESPOTTED SUNFISH	5	12.82	
W09	BLUEGILL	10	25.64	
W11	SMALLMOUTH BASS	14	35.90	
W12	LARGEMOUTH BASS	6	15.38	
X07	RAINBOW DARTER	2	5.13	
X10	FANTAIL DARTER	13	33.33	
X12	JOHNNY DARTER	31	79.49	
X14	BANDED DARTER	5	12.82	
X15	YELLOW PERCH	3	7.69	
X18	BLACKSIDE DARTER	7	17.95	
X19	SLENDERHEAD DARTER	4	10.26	
X22	WALLEYE	1	2.56	
Z01	MOTTLED SCULPIN	7	17.95	

# STATIONS/SD:	SD-11=	SD-14,16=	SD-15,17,19=	SD-23-33=	SD-40=	SD-45,46=	SD-50=	SD-55,56=
	0	0	0	0	0	283	0	0
	SD-61= 158	SD-66= 0	SD-72= 0	SD-75= 0	SD-76= 0	SD-77= 0	SD-78= 0	SD-80= 0
	SD-83= 0	SD-86= 0	SD-88= 0	SD-89= 0	SD-94= 0	SD-98= 0	SD-99= 0	SD-36= 0

TOTAL NUMBER OF SPECIES OCCURRENCES	441
TOTAL NUMBER OF STATIONS	
(WITH MILE RULE)	39
(WITHOUT MILE RULE)	42
TOTAL NUMBER OF SPECIES	45
TOTAL NUMBER OF HYBRIDS	1

FIGURE 7. Sample summary report for species listing.

is shown with a "+" in its station mileage. For boom or mini-shocking stations, a "+" is used when all or most of the lake is sampled. All stations at the exact same location have the same mileage code.

All stations in the Master Fish File have their station mileages recorded on the Fish Distribution's master set of U.S. Geological Survey topographic maps.

Source of the Data

The collector of the fish at a particular station is shown by a 2-digit code under the heading "SD" (Fig. 4). In order to group related collectors, 5 categories were created. They are: Historic (1900-50), Research, Fish Management, University of Wisconsin System, and Miscellaneous (Table 2).

Gear and Effort

Type of gear is shown under the heading "G", and an estimate of the effort is shown under the heading "EF" (Fig. 2 and Table 3). When the effort is unknown, it is left blank. If 99 appears, it means the effort was greater than 98.

Date

The date on which the sample was taken is shown under the heading "DATE". Thus, 6/23/75 would mean 23 June 1975.

Township Description

The town, range, section, quarter quarter section, and county are shown under the heading "STATION LOCATION".

Jar Code

Usually a station jar was kept with a few specimens of each of the species and the remaining specimens were given to the Milwaukee Public Museum for curation. The station jars are temporarily housed at the Nevin Fish Hatchery in Madison. A jar code was used to record information on the fish kept. These codes are shown in Figure 4 under the heading "JAR", which is on the 2nd line of data for a station. When a jar had been kept, a "1" was used. It was left blank, or a zero was used, when no jar was kept. If 1 or more specimens were kept for a synoptic collection, a "2" was used. If both a station jar and a synoptic collection were kept, a "3" was used.

TABLE 2. Fish collectors' codes.

Historic (1900-50) SD 01-10

- 01 - Early Wisconsin fish collections (1900-31) reported by Greene (1935).
- 02 - Greenbank et al. (1940's) (from the University of Wisconsin-Madison Zoology Museum).
- 04 - U. of Wis. Madison's Catalog of Wis. Conserv. Dept. Collections.

Research SD 11-19

- 11 - Fish Distribution Study personnel.
- 12 - Fish Distribution Study's stocking.
- 13 - Research personnel - identified by trained ichthyologist.
- 14 - Fish Research - collecting done for Fish Distribution Study; identification of specimens handled as in SD 33; however, their identification of sunfishes is also accepted.
- 15 - Fish Research - similar to SD 14 except it is a partial* sample.
- 16 - Fish Research - sample identified by Fish Distribution Study personnel, except for same species as SD 14.
- 17 - Fish Research - similar to SD 16 except it is a partial sample.
- 18 - Other Research personnel - sample identified by Fish Distribution Study personnel.
- 19 - Other Research personnel - not identified by Fish Distribution Study personnel.

Fish Management SD 20-39, 94-96

- 23 - Youth Camp - identified by Fish Distribution Study personnel.
- 25 - Rock River Chemical Treatment and Lake Koshkonong Power Plant site - identified by Fish Distribution Study personnel or Dr. G. Becker.
- 32 - All specimens were identified by Fish Distribution Study personnel except for some specimens of 35 species** (depending on each species' distribution in the state) that are assumed to be easily identifiable by Fish Management Personnel.
- 33 - In addition to accepting Fish Management's identification of up to 35 species (mentioned above), their identification of other species is also accepted if at least 1 fish of that species was identified by Fish Distribution Study personnel. Therefore, while species should be accurate, numbers of specimens caught may not be accurate due to fish returned to the water.

36^a - Similar to 33 except that Fish Distribution personnel did not receive specimens of 1 or more species (excluding the 35 accepted species). Therefore, the specimens had to be generalized to family or genus.

- 94 - Fish Management survey - based on reports only.
- 95 - Literature not based on any particular survey - e.g., Surface Water Resource publications.
- 96 - Restocking of fish after chemical treatment.

University of Wisconsin System SD 40-74

- 40 - U.W. Madison students
- 45 - U.W. Stevens Point students
- 46 - Dr. George Becker
- 47 - U.W. Stevens Point, Dr. Coble & students
- 50 - U.W. Milwaukee, Dr. Norden & students
- 55 - Dr. George Seeburger
- 56 - U.W. Whitewater students
- 60 - U.W. Waukesha students
- 61 - Prof. Marlin Johnson & U.W. students
- 65 - U.W. Parkside students
- 66 - U.W. Eau Claire, Dr. Crowe
- 70 - Beloit College students
- 71 - Dr. J. Lutz
- 72 - Prof. Held & U.W. La Crosse students

Miscellaneous SD 75-93, 97-99

- 75 - Milwaukee Public Museum
- 76 - ENCAP, Inc., Dr. Greenfield, Dekalb Univ., Dekalb, Ill.
- 77 - Dairyland Power Cooperative, La Crosse
- 78 - Northern States Power Co.
- 79 - N.U.S. Corp., Pittsburg, Pa.
- 80 - Bio Test, Inc., Chicago, Ill.
- 81 - Dames and Moore, Park Ridge, Ill.
- 82 - Wis. Electric Power Co., Milwaukee
- 83 - Upper Mississippi River Conservation Comm.
- 84 - Illinois Natural History Survey, Urbana, Ill.
- 86 - Commercial Fishermen -- identified by Fish Distribution Study or Dr. G. Becker
- 87 - Dr. Underhill and U. Minnesota students
- 88 - Iowa Coop. Fish Research Unit, Ames, Iowa
- 89 - Minnesota DNR
- 90 - U.S. Fish and Wildlife Service
- 91 - Michigan DNR
- 92 - Michigan DNR--identified by Univ. of Michigan, Ann Arbor, Mich.
- 93 - Miscellaneous collectors
- 97 - U.S. Army Corps of Engineers
- 98 - Commercial fishermen
- 99 - Unknown collector - e.g., sport fisherman

*Partial -- those in which sampling effort and/or species identification were incomplete and therefore did not yield adequate assessment of total species composition.

**Have an asterisk by their species code in Table 4.

^aComputer printouts of the species taken may not be the same as Fish Management's records due to fish returned to the water.

TABLE 3. Gear and effort.

Gear Code Description	Units of Effort
1 = DC boom shocker	Tenths of miles shocked (1 mile = 10)
2 = DC stream shocker	Hundredths of miles shocked (100 yd = 06)
3 = DC backpack shocker	Hundredths of miles shocked
4 = Survey seine	Area covered (acres)
5 = Small-mesh seine	Area covered (ft ² /100) x no. hauls (e.g. 100 ft x 15 ft/ 100 x 1 = 15)
6 = Gill, trammel, or entanglement net	Length of net (ft/ 10) x no. days
7 = Fyke, hoop, trap, or drop net	No. Nets x no. days in water
8 = Mini boom shocker	Tenths of miles shocked
9 = Trawl	Minutes x no. hauls
A = Dip net	Left blank
B = DC long line shocker	Hundredths of miles shocked
C = Poison	Tenths of miles poisoned
D = Hook and line, spear, or arrow	Left blank
E = Minnow trap	No. Traps x no. days
F = Pond net	No. Nets x no. days
G = Miscellaneous (found dead, winterkill, etc.)	Left blank
H = Combination of gear	Left blank
I = Boom shocker & mini boom shocker	Tenths of miles shocked
J = Slat trap	No. Traps x no. days
K = Any type of shocking gear & any type of net	Left blank
L = Any type of shocking gear & any type of seine	Left blank
M = Any type of net & any type of seine	Left blank
N = Combination of any type of net	Left blank
O = Combination of any type of seines	Left blank
P = Combination of any type of shocking gear	Left blank
Q = AC boom shocker	Tenths of miles shocked
R = AC stream shocker	Hundredths of miles shocked
S = AC backpack shocker	Hundredths of miles shocked
T = AC long line shocker	Hundredths of miles shocked

TABLE 4. List of common and scientific names of all fish species, hybrids, and groups* found in Wisconsin.

Species Code	Common Name	Scientific Name	Species Code	Common Name	Scientific Name
LAMPREYS			PETROMYZONTIDAE		
A00*	Lampreys unsp.	<u>Petromyzontidae</u>	111	Shortjaw cisco	<u>Coregonus zenithicus</u>
A01*	Lampreys	<u>Ichthyomyzon spp.</u>	112	Pink salmon	<u>Oncorhynchus gorbuscha</u>
A02	Chestnut lamprey	<u>Ichthyomyzon castaneus</u>	113	Chum salmon	<u>Oncorhynchus keta</u>
A03	Northern brook lamprey	<u>Ichthyomyzon fossor</u>	114	Coho salmon	<u>Oncorhynchus kisutch</u>
A04	Silver lamprey	<u>Ichthyomyzon unicusplis</u>	115	Kokanee (Sockeye salmon)	<u>Oncorhynchus nerka</u>
A05	American brook lamprey	<u>Lampetra appendix</u>	116	Chinook salmon	<u>Oncorhynchus tshawytscha</u>
A06**	Sea lamprey	<u>Petromyzon marinus</u>	117	Pygmy whitefish	<u>Prosopium coulteri</u>
STURGEONS			118	Round whitefish	<u>Prosopium cylindraceum</u>
B00*	Sturgeons unsp.	<u>Acipenseridae</u>	119**	Rainbow trout	<u>Salmo gairdneri</u>
B01**	Lake sturgeon	<u>Acipenser fulvescens</u>	120	Atlantic salmon	<u>Salmo salar</u>
B02**	Shovelnose sturgeon	<u>Scaphirhynchus platyrhynchus</u>	121**	Brown trout	<u>Salmo trutta</u>
PADDLEFISHES			122**	Brook trout	<u>Salvelinus fontinalis</u>
C01**	Paddlefish	<u>Polyodon spathula</u>	123**	Lake trout	<u>Salvelinus namaycush</u>
GARS			124	Siscowet	<u>Salvelinus namaycush siscowet</u>
D00*	Gars unsp.	<u>Lepisosteidae</u>	127	Tiger trout (brook trout x brown trout)	
D01**	Longnose gar	<u>Lepisosteus osseus</u>	128	Splake (brook trout x lake trout)	
D02	Shortnose gar	<u>Lepisosteus platostomus</u>	SMELTS		
BOWFINS			E01**	Bowfin	<u>Amia calva</u>
FRESHWATER EELS			OSMERIDAE		
F01**	American eel	<u>Anguilla rostrata</u>	J01**	Rainbow smelt	<u>Osmerus mordax</u>
HERRINGS			MUDMINNOWS		
G00*	Herrings unsp.	<u>Clupeidae</u>	K01**	Central mudminnow	<u>Umbra limi</u>
G01**	Alewife	<u>Alosa pseudoharengus</u>	PIKES		
G02	Gizzard shad	<u>Dorosoma cepedianum</u>	L00*	Pikes unsp.	<u>Esocidae</u>
G03	Skipjack herring	<u>Alosa chrysochloris</u>	L01	Grass pickerel	<u>sox americanus vermiculatus</u>
MOONEYES			L02**	Northern pike	<u>Esox lucius</u>
H00*	Hiodons unsp.	<u>Hiodontidae</u>	L03**	Muskellunge	<u>Esox masquinongy</u>
H01	Goldeye	<u>Hiodon alosoides</u>	L07	Northern pike x grass pickerel	
H02	Mooneye	<u>Hiodon tergisus</u>	L08	Northern pike x muskellunge	
TROUTS			MINNOWS AND CARPS		
I00*	Salmons	<u>Oncorhynchus spp.</u>	M00*	Minnows and Carps unsp.	<u>CYPRINIDAE</u>
I01*	Trouts	<u>Salvelinus spp. and Salmo spp.</u>	M01*	Chubs, M10, M16-19, M50	<u>Cyprinidae</u>
I02*	Ciscoes & whitefishes	<u>Coregonus spp. and Prosopium spp.</u>	<u>(Couesius plumbeus, Hybopsis spp., Nocomis biguttatus, and Semotilus atromaculatus)</u>		
I03	Longjaw cisco	<u>Coregonus alpenae</u>	M02*	Daces, M09, M42-44, M48, M49, M51	<u>(Clinostomus elongatus, Phoxinus spp., Rhinichthys spp., and Semotilus margarita)</u>
I04**	Cisco or lake herring	<u>Coregonus artedii</u>			
I05	Lake whitefish	<u>Coregonus clupeaformis</u>			
I06	Bloater	<u>Coregonus hoyi</u>			
I07	Deepwater cisco	<u>Coregonus johanna</u>			
I08	Kiyi	<u>Coregonus kiyi</u>			
I09	Blackfin cisco	<u>Coregonus nigripinnis</u>			
I10	Shortnose cisco	<u>Coregonus reighardi</u>			

TABLE 4 (cont.)

Species Code	Common Name	Scientific Name	Species Code	Common Name	Scientific Name
M03	Redbelly dace, M42, M43	<u>(Phoxinus eos and P. erythrogaster)</u>	M49	Longnose dace	<u>Rhinichthys cataractae</u>
M04	Shiners, M20-29, 31-33, 35-40	<u>(Notemigonus crysoleucas and Notropis spp.) exc. Notropis emiliae, Notropis nubilus</u>	M50	Creek chub	<u>Semotilus atromaculatus</u>
M05	Stonerollers	<u>Campostoma spp.</u>	M51	Pearl dace	<u>Semotilus margarita</u>
M06	Central stoneroller	<u>Campostoma anomalum</u>	M52	Red shiner	<u>Notropis lutrensis</u>
M07	Largescale stoneroller	<u>Campostoma oligolepis</u>	M55	Undetermined cyprinid hybrid	
M08 **	Goldfish	<u>Carassius auratus</u>	M56	Stonerollers x unknown	
M09	Redside dace	<u>Clinostomus elongatus</u>	M57	Stonerollers x hornyhead chub	
M10	Lake chub	<u>Couesius plumbeus</u>	M58	Stonerollers x southern redbelly dace	
M11 **	Grass carp	<u>Ctenopharyngodon idella</u>	M59	Stonerollers x longnose dace	
M12 **	Common carp	<u>Cyprinus carpio</u>	M60	Stonerollers x creek chub	
M14	Brassy minnow	<u>Hybognathus hankinsoni</u>	M61	Stonerollers x pearl dace	
M15	Mississippi silvery minnow	<u>Hybognathus nuchalis</u>	M62	Common carp x goldfish	
M16	Speckled chub	<u>Hybopsis aestivalis</u>	M63	Redside dace x unknown	
M17	Silver chub	<u>Hybopsis storeriana</u>	M64	Redside dace x common shiner	
M18	Gravel chub	<u>Hybopsis x-punctata</u>	M65	Redside dace x redbelly dace	
M19	Hornyhead chub	<u>Nocomis biguttatus</u>	M66	Redside dace x southern redbelly dace	
M20	Golden shiner	<u>Notemigonus crysoleucas</u>	M67	Redside dace x creek chub	
M21	Pallid shiner	<u>Notropis amnis</u>	M69	River shiner x emerald shiner	
M22	Pugnose shiner	<u>Notropis anogenus</u>	M70	Pugnose shiner x blackchin shiner	
M23	Emerald shiner	<u>Notropis atherinoides</u>	M71	Common shiner x unknown	
M24	River shiner	<u>Notropis biennis</u>	M72	Common shiner x stonerollers	
M25	Ghost shiner	<u>Notropis buchanani</u>	M73	Common shiner x hornyhead chub	
M26	Ironcolor shiner	<u>Notropis chalybaeus</u>	M74	Common shiner x emerald shiner	
M27	Striped shiner	<u>Notropis chrysocephalus</u>	M75	Common shiner x striped shiner	
M28	Common shiner	<u>Notropis cornutus</u>	M76	Common shiner x rosyface shiner	
M29	Bigmouth shiner	<u>Notropis dorsalis</u>	M77	Common shiner x redfin shiner	
M30	Pugnose minnow	<u>Notropis emiliae</u>	M78	Common shiner x northern redbelly dace	
M31	Blackchin shiner	<u>Notropis heterodon</u>	M79	Common shiner x southern redbelly dace	
M32	Blacknose shiner	<u>Notropis heterolepis</u>	M80	Common shiner x bluntnose minnow	
M33	Spottail shiner	<u>Notropis hudsonius</u>	M81	Common shiner x creek chub	
M34	Ozark minnow	<u>Notropis nubilus</u>	M82	Common shiner x pearl dace	
M35	Rosyface shiner	<u>Notropis rubellus</u>	M86	Sand shiner x bigmouth shiner	
M36	Spotfin shiner	<u>Notropis spilopterus</u>			
M37	Sand shiner	<u>Notropis stramineus</u>			
M38	Weed shiner	<u>Notropis texanus</u>			
M39	Redfin shiner	<u>Notropis umbratilis</u>			
M40	Mimic shiner	<u>Notropis volucellus</u>			
M41	Suckermouth minnow	<u>Phenacobius mirabilis</u>			
M42	Northern redbelly dace	<u>Phoxinus eos</u>			
M43	Southern redbelly dace	<u>Phoxinus erythrogaster</u>			
M44	Finescale dace	<u>Phoxinus neogaeus</u>			
M45	Bluntnose minnow	<u>Pimephales notatus</u>			
M46	Fathead minnow	<u>Pimephales promelas</u>			
M47	Bullhead minnow	<u>Pimephales vigilax</u>			
M48	Blacknose dace	<u>Rhinichthys atratulus</u>			

TABLE 4 (cont.)

Species Code	Common Name	Scientific Name	Species Code	Common Name	Scientific Name
M87	Sand shiner x rosyface shiner			BULLHEAD CATFISHES	ICTALURIDAE
M88	Weed shiner x mimic shiner		000*	Bullhead catfishes unsp.	ictaluridae
M89	Redbelly dace x unknown		001*	Catfishes, 004, 008, 012	(<u>Ictalurus furcatus</u> , <u>I. punctatus</u> , and <u>Pylodictis olivaris</u>)
M90	Northern redbelly dace x finescale dace		002*	Bullheads, 005-07	(<u>Ictalurus melas</u> , <u>I. natalis</u> , and <u>T. nebulosus</u>)
M91	Southern redbelly dace x hornyhead chub		003*	Madtoms	<u>Noturus</u> spp.
M92	Southern redbelly dace x creek chub		004	Blue catfish	<u>Ictalurus furcatus</u>
M93	Northern redbelly dace x pearl dace		005	Black bullhead	<u>Ictalurus melas</u>
M94	Bluntnose minnow x fathead minnow		006	Yellow bullhead	<u>Ictalurus natalis</u>
M95	Bluntnose minnow x bullhead minnow		007	Brown bullhead	<u>Ictalurus nebulosus</u>
M97	Creek chub x unknown		008**	Channel catfish	<u>Ictalurus punctatus</u>
M98	Creek chub x hornyhead chub		009	Slender madtom	<u>Noturus exilis</u>
			010	Stonecat	<u>Noturus flavus</u>
			011	Tadpole madtom	<u>Noturus gyrinus</u>
			012**	Flathead catfish	<u>Pylodictis olivaris</u>
			013	Black bullhead x brown bullhead	
			014	Yellow bullhead x brown bullhead	
				PIRATE PERCHES	APHREDODERIDAE
N00*	Carp suckers	<u>Carpiodes</u> spp.	P01**	Pirate perch	<u>Aphredoderus sayanus</u>
N01*	Carp sucker	<u>Carpiodes carpio</u> and <u>C. vellifer</u>			
N02*	Suckers, N08-N13, N17	(<u>Catostomus</u> spp., <u>Cytleptus elongatus</u> , <u>Erismyzon</u> spp., <u>Hypentelium nigricans</u> , and <u>Minytrema melanops</u>)		TROUT-PERCHES	PERCOPSIDAE
			Q01**	Trout-perch	<u>Percopsis omiscomaycus</u>
				CODFISHES	GADIDAE
			R01**	Burbot	<u>Lota lota</u>
				KILLIFISHES	CYPRINODONTIDAE
N03*	Buffalos	<u>Ictalobus</u> spp.	S00*	Killifishes unsp.	Cyprinodontidae
N04*	Redhorses	<u>Moxostoma</u> spp.	S01	Banded killifish	<u>Fundulus diaphanus</u>
N05	River carpsucker	<u>Carpiodes carpio</u>	S02	Blackstripe topminnow	<u>Fundulus notatus</u>
N06	Quillback	<u>Carpiodes cyprinus</u>	S03	Starhead topminnow	<u>Fundulus notti</u>
N07	Highfin carpsucker	<u>Carpiodes vellifer</u>			
N08**	Longnose sucker	<u>Catostomus catostomus</u>		SILVERSIDES	ATHERINIDAE
N09**	White sucker	<u>Catostomus commersoni</u>	T01**	Brook silverside	<u>Labidesthes sicculus</u>
N10	Blue sucker	<u>Cytleptus elongatus</u>			
N11	Creek chubsucker	<u>Erismyzon oblongus</u>		STICKLEBACKS	GASTEROSTEIDAE
N12**	Lake chubsucker	<u>Erismyzon sucetta</u>	U00*	Sticklebacks unsp.	Gasterosteidae
N13**	Northern hog sucker	<u>Hypentelium nigricans</u>	U01**	Brook stickleback	<u>Culaea inconstans</u>
			U02	Ninespine stickleback	<u>Pungitius pungitius</u>
N14	Smallmouth buffalo	<u>Ictalobus bubalus</u>			
N15	Bigmouth buffalo	<u>Ictalobus cyprinellus</u>		TEMPERATE BASSES	PERCICHTHYIDAE
N16	Black buffalo	<u>Ictalobus niger</u>	V00*	Temperate basses unsp.	Percichthyidae
N17	Spotted sucker	<u>Minytrema melanops</u>	V01	White bass	<u>Morone chrysops</u>
N18	Silver redhorse	<u>Moxostoma anisurum</u>	V02	Yellow bass	<u>Morone mississippiensis</u>
N19	River redhorse	<u>Moxostoma carinatum</u>			
N20	Black redhorse	<u>Moxostoma duquesnei</u>			
N21	Golden redhorse	<u>Moxostoma erythrurum</u>			
N22	Shorthead redhorse	<u>Moxostoma macrolepidotum</u>			
N23	Greater redhorse	<u>Moxostoma valenciennesi</u>			
N27	Quillback x highfin carpsucker				

TABLE 4 (cont.)

Species Code	Common Name	Scientific Name	Species Code	Common Name	Scientific Name
	SUNFISHES	CENTRARCHIDAE		PERCHES	PERCIDAE
W00*	Sunfishes unsp.	<u>Centrarchidae</u>	X00*	Perches unsp.	<u>Percidae</u>
W01*	Bassess	<u>Micropterus spp.</u>	X01*	Darters, X03-14, X16-20	(<u>Ammocrypta spp.</u> , <u>Etheostoma spp.</u> , and <u>Percina spp.</u>)
W02*	Crappies	<u>Pomoxis spp.</u>	X02*	Stizostedions	<u>Stizostedion spp.</u>
W03*	Sunfishes	<u>Lepomis spp. and</u> <u>Ambloplites</u> <u>rupestris</u>	X03	Crystal darter	<u>Ammocrypta asprella</u>
W04	Rock bass	<u>Ambloplites</u> <u>rupestris</u>	X04	Western sand darter	<u>Ammocrypta clara</u>
W05	Green sunfish	<u>Lepomis cyanelus</u>	X05	Mud darter	<u>Etheostoma</u> <u>asprigene</u>
W06	Pumpkinseed	<u>Lepomis gibbosus</u>	X06	Greenside darter	<u>Etheostoma</u> <u>blennioides</u>
W07	Warmouth	<u>Lepomis gulosus</u>	X07	Rainbow darter	<u>Etheostoma</u> <u>caeruleum</u>
W08	Orangespotted sunfish	<u>Lepomis humilis</u>	X08	Bluntnose darter	<u>Etheostoma</u> <u>chlorosomum</u>
W09	Bluegill	<u>Lepomis macrochirus</u>	X09	Iowa darter	<u>Etheostoma exile</u>
W10	Longear sunfish	<u>Lepomis megalotis</u>	X10	Fantail darter	<u>Etheostoma</u> <u>flabellare</u>
W11**	Smallmouth bass	<u>Micropterus</u> <u>dolomieu</u>	X11	Least darter	<u>Etheostoma</u> <u>microperca</u>
W12***	Largemouth bass	<u>Micropterus</u> <u>salmoides</u>	X12	Johnny darter	<u>Etheostoma nigrum</u>
W13	White crappie	<u>Pomoxis annularis</u>	X13	Orangethroated darter	<u>Etheostoma</u> <u>spectabile</u>
W14	Black crappie	<u>Pomoxis</u> <u>nigromaculatus</u>	X14	Banded darter	<u>Etheostoma zonale</u>
W18	Undetermined Centrarchidae hybrid		X15**	Yellow perch	<u>Perca flavescens</u>
W19	Green sunfish x unknown		X16	Logperch	<u>Percina caprodes</u>
W20	Green sunfish x pumpkinseed		X17	Gilt darter	<u>Percina evides</u>
W21	Green sunfish x warmouth		X18	Blackside darter	<u>Percina maculata</u>
W22	Green sunfish x orangespotted sunfish		X19	Slenderhead darter	<u>Percina</u> <u>phoxocephala</u>
W23	Green sunfish x bluegill		X20	River darter	<u>Percina shumardi</u>
W24	Green sunfish x longear sunfish		X21	Sauger	<u>Stizostedion</u> <u>canadense</u>
W25	Green sunfish x pumpkinseed x bluegill		X22**	Walleye	<u>Stizostedion</u> <u>vitreum vitreum</u>
W27	Pumpkinseed x unknown		X23	Blackside darter x Iowa darter	
W28	Pumpkinseed x warmouth		X24	Blackside darter x logperch	
W29	Pumpkinseed x orangespotted sunfish		Y01	Freshwater drum	SCIENIDAE <u>Aplodinotus</u> <u>grunniens</u>
W30	Pumpkinseed x bluegill		Z00*	Sculpin, Z01, Z02	COTTIDAE (<u>Cottus bairdi</u> and <u>C. cognatus</u>)
W31	Pumpkinseed x longear sunfish		Z01	Mottled sculpin	<u>Cottus bairdi</u>
W34	Warmouth x unknown		Z02	Slimy sculpin	<u>Cottus cognatus</u>
W35	Warmouth x orangespotted sunfish		Z03	Spoonhead sculpin	<u>Cottus ricei</u>
W36	Warmouth x bluegill		Z04	Deepwater sculpin	<u>Myoxocephalus</u> <u>thompsoni</u>
W37	Warmouth x longear sunfish		Z08	Mottled sculpin x slimy sculpin	
W40	Orangespotted sunfish x unknown		Z96	Unknown species	
W41	Orangespotted sunfish x bluegill		Z97	Panfish Includes: White bass, Yellow bass, Rock bass, Sunfishes (<u>Lepomis</u> spp.), Black crappie, White crappie, and Yellow perch.	
W42	Orangespotted sunfish x longear sunfish		Z98	No fish captured at station	
W45	Bluegill x unknown		Z99	Invalid fish species code	
W46	Bluegill x longear sunfish				

TABLE 4 (cont.)

*Group name (plural) followed by "unsp." (abbreviation for unspecified). It is used only to refer to all members of a family and was developed in order to distinguish between groups of fishes where the name for the family is the same as that for 1 or more genera within that family. Thus, for computer codes A00 and A01, "Lampreys unsp." means all members of the family, Petromyzontidae, whereas just "Lampreys" is used to refer only to members of the Ichthyomyzon genus. Similarly, "Sunfishes unsp." means all Centrarchidae and "Sunfishes" means Lepomis spp. (see W00 and W03).

Group name (plural) not followed by "unsp.". This category is used mainly to refer to all species in a genus. All species of a particular genus are designated by the abbreviation "spp." which follows the genus name; this abbreviation stands for species. Thus "Trouts" (101) refers to all species in the genera Salvelinus and Salmo.

Occasionally this category {group name (plural) not followed by "unsp."} may also include a single species from 1 genus along with all members of 1 or more other genera. These single species may be the sole representative in Wisconsin of a particular genus. Thus the category, "Shiners" (M04), includes all members of the genus Notropis (except N. emiliae and N. nubilus) plus Notemigonus crysoleucas which is also a shiner and is the only species of Notemigonus in the state. The single species included in a group category may also be part of a genus split between groups. For example, the category, "Catfishes" (001), includes 2 species from the genus Ictalurus; all other Ictalurids are included in "Bullheads" (002). "Chubs" (M01) and "Daces" (M02) are other examples; one of these categories includes 1 of the 2 species of Semotilus and the other category includes the other species of Semotilus.

Group name (singular). This category was created for groups of fish in which only certain members are hard to separate. For example, there are 3 species of the genus Carpiodes in Wisconsin. This genus is distinct enough from other groups within the Catostomidae family that it has its own designation as "Carpsuckers" (N00). Persons trying to key out members of the genus Carpiodes should be able to identify Carpiodes cyprinus, but may have trouble distinguishing in juveniles between C. carpio and C. velifer. Thus the category "Carpsucker" (NOT) was created for these 2 species. The same is true for the groups labelled "Redbelly dace" (M03) and "Sculpin" (Z00) which refer to only 2 of 3 members of the genus Phoxinus and Cottus, respectively.

Water Type Code

Stations are given a water type code, which is the same as the codes described in the Master Stream and Lake File. They are shown on the 2nd line of data after the Jar Code under the heading "WT".

Fish Species Data

On the 3rd line of data for a station appears the total number of species ("SP"), hybrids ("HY"), and unspecified categories ("UNSP") captured. The unspecified category is used for specimens not identified to species. On this same line of data, after the heading "FISH", the fish species' codes and number of specimens taken is given. The fish species code is composed of an alphabetical character which is unique for each family and 2 numeric characters which are unique for each species, hybrid, or unspecified category in the family. Table 4 shows the codes for all species, hybrids, and unspecified groups in Wisconsin. If more than 98 fish were captured, a 99 is given. A "+" or blank in this space means the number collected is unknown. Each station can have up to 44 species.

Ecological Data

Ecological data were recorded onto Form 8100-46 (Fig. 8) for most stations sampled by Fish Distribution Study personnel (Bureau of Research). An example of the data appears in Figure 4; on the far right quarter of the printout are located 4 lines in parentheses. Blanks in the listing indicate the data were not taken. Many of the terms and their definitions are similar to those found in the Fish Management Handbook.

First Line

Stream Width. The estimated minimum, mean, and maximum widths of the sampling station are recorded in feet. Three spaces are allowed for each number with a blank between each. In the example (Fig. 4), the mean was not recorded.

Stream Depth. The estimated minimum, mean, and maximum depths of the stream's main channel in the area actually sampled are recorded down to 10ths of feet. Each number has 3 spaces without a decimal point and is separated by a blank. In the example, "40" equals 4.0 and the mean was not recorded.

Second Line

Velocity. The first space on this line is used to record 1 of 4 codes:
"0" - None - No perceptible current.

"1" - Sluggish - Current scarcely perceptible in most of the stream and little turbulence. Current less than 1/2 ft/sec. Sand ripples on bottom not evident; bottom smooth, except for rocks.

"2" - Moderate - Current evident; moderate turbulence from helical movements and deflection. Generally, sand ripples on bottom and little white water evident. Velocity more than 1/2 ft/sec, but not more than 1 1/2 ft/sec.

"3" - Rapid - Strong current evident, strong turbulence from helical movements and deflection, and white water where bottom is covered with coarse materials; strong sand ripples. Velocity more than 1 1/2 ft/sec.

Water Temperature. The water temperature in degrees Fahrenheit was taken just below the surface and is recorded in the 3rd and 4th spaces of the 2nd line.

Conductivity. The conductivity (usually temperature compensated) was measured with a conductivity meter in -umhos and is recorded in spaces 6-9. The conductivity in the example was not recorded.

Turbidity (Visibility). For stations where the water's depth is equal to or over 4 ft, a Secchi disk is lowered to 4 ft and brought up slowly until it becomes visible. A number "1" through "4" is used to record the turbidity in the 12th space.

"1" - Clear - Secchi disk visible at a depth of over 4 ft.

"2" - Slightly turbid - Secchi disk becomes visible between 2 and 4 ft.

"3" - Moderately turbid - Secchi disk becomes visible between 1 and 2 ft.

"4" - Turbid - Secchi disk becomes visible only at a depth of less than 1 ft.

For stations where the water's depth is under 4 ft, the Secchi disk is lowered until it disappears. If it disappears before it reaches the bottom, the appropriate number ("1" through "4") is recorded. If it does not disappear, the appropriate letter ("A" through "H") is used to record the turbidity (Table 5).

Aquatic Vegetation. One of the 4 following code numbers is used to describe each of the 5 types of aquatic vegetation:

"0" - None - None observed.

"1" - Scarce - Occasional plants or only small clumps of plants noted.

"2" - Common - Sizable beds at intervals.

"3" - Abundant - Thick, frequent beds covering more than 50% of the stream bottom.

Description of these 5 types of vegetation are listed below.

Emergent (15th space) - Plants rising above the water surface, usually found growing in shallow water areas or along the shoreline of lakes and ponds. Common examples include cattails, water lilies, arrowhead, water smartweed, or watershield.

TABLE 5. Turbidity measurements when Secchi disk does not disappear.

Station's Water Depth	Letter	Secchi Disk on Bottom
Less than 1 ft	"A"	Not distinct - moderately turbid
	"B"	Distinct - clear
1 to 1.9 ft	"C"	Not distinct - moderately turbid
	"D"	Distinct - clear
2 to 2.9 ft	"E"	Not distinct - slightly turbid
	"F"	Distinct - clear
3 to 3.9 ft	"G"	Not distinct - slightly turbid
	"H"	Distinct - clear

Submergent (16th place) - Plants in which the main portion of the plant is under the water surface. They usually are attached or rooted to the lake or pond bottom. These plants are commonly coontail, milfoil, bladderwort, pondweeds, or waterweed.

Duckweed (17th space) - Plants which float freely on the surface of the water.

Algae (attached) (18th space) - A group of small, primitive chlorophyll-bearing plants distinguished by their lack of true leaves and flowers. Attached to substrate such as rocks.

Algae (free floating) (19th space) - Same as algae (attached) but free floating. It is left blank in this example.

Third Line (Bottom Type).

A combination of up to 8 different bottom type codes each followed by its percent occurrence can be listed. The percent of the bottom type is rounded to the nearest ten without the zero (e.g., F4 = 40% gravel). For less than 5% the letter "T" is used and for 100% the number "0".

"A" - Concrete - Stream has been channelized and bottom is poured concrete.

"B" - Bedrock - Solid rock forming a continuous surface.

"C" - Hardpan - A compacted surface consisting of cemented bottom materials.

"D" - Boulder - Rocks 12 inches in diameter.

"E" - Rubble. Rocks from 3-12 inches in diameter.

"F" - Gravel - Stones from 0.125 to 3 inches in diameter.

"G" - Sand - Particles ranging from 0.0625 mm to 1.9 mm inclusive. Will feel rough between fingers.

"H" - Muck and Silt - Particles from 0.0039 mm to 0.0624 mm. Generally this is fine material which feels greasy between fingers. This includes organic materials.

"I" - Clay - Particles less than 0.0039 mm usually forming a dense gummy surface.

"J" - Marl - Deposits of calcium carbonate. Usually whitish in color. Fizzes profusely when weak hydrochloric acid (muriatic acid) is applied to a sample.

"K" - Detritis - Dead organic matter covering bottom. This would include sticks, leaf skeletons, and other items.

"L" - Rubbish - Items deposited by man, such as tires, bottles, cans, and fencing.

"M" - Peat.

Fourth Line (Streambank Vegetation/Habitat)

This refers to vegetation present generally from the water's edge up to approximately 16 ft on either side of the stream. The 16 ft can be extended somewhat if there is some other habitat that may have a significant effect upon the stream. Since this is a report for a single station, it is descriptive of vegetation for only that station.

The streambank vegetation is listed in the same manner as bottom type. A combination of 8 different streambank vegetation types (code and percent) are possible.

"A" - Cultivated - Presence of row crops such as corn, oats, etc.

"B" - Fallow - Cultivated land that has lain idle one or more growing seasons.

"C" - Upland* pasture - Grazed land.

"D" - Upland meadow - Area supporting only grasslike vegetation or leafy ground cover of nonwoody types, such as reed canary grass.

"E" - Upland hardwood - Area supporting deciduous trees such as hard maple, basswood, oak, black cherry, fruit trees, yellow and white birch, popples, and others over 15 ft in height.

* Upland refers to substrate that is well drained.

- "F" - Upland conifer - Area supporting evergreens such as white pine, red pine, jack pine, spruce, or balsam fir.
- "G" - Upland shrub - Species such as red osier dogwood, spirea, elderberry, other berry bushes, and other woody plants and trees with low total height (under 15 ft), such as tag alder, box elder, willow, and ninebark.
- "H" - Lowland* pasture - Grazed land which becomes hummocky with extended use.
- "I" - Lowland hardwood - Area supporting species such as silver or soft maple, green ash, swamp white oak, river birch, willow, cottonwood, and box elder over 15 ft in height.
- "J" - Lowland conifer - Area supporting species such as tamarack, white cedar, and black spruce.
- "K" - Lowland shrub - Area supporting species such as red osier dogwood, spirea, elderberry, other berry bushes, and other woody plants and trees with low total height (under 15 ft) such as tag alder, box elder, willow, and ninebark.
- "L" - Open marsh - Very wet area supporting only grasslike vegetation such as sedges or leafy ground cover or nonwoody types including cattails and rushes.
- "M" - Cut grasses - Area supporting various types of grasses that are cut periodically by man, such as lawn grasses.
- "N" - Beach - Sandy swimming beaches and gravel parking lots.
- "O" - Lowland Meadow - Same as upland meadow but not well drained.
- "P" - Open water - Such as in the middle of a large river or lake that is away from any shore.

*Lowland refers to substrate that is wet.

FIGURE 8. Example of field collection form (8100-46).

M.B.	M.B.	M.B. MILE	FIRST ORDER MILE	1 1 S.D.	GEAR	EFFORT	UP				
SECOND	THIRD	FOURTH	FIFTH				DOWN		MO.	DAY	YR.
SIXTH	SEVENTH	EIGHTH	NINTH	SPECIES	NO.						
TENTH	ELEVENTH	STATION MILE									
LOCATION											
.....											
.....											
JAR	WTC	TOWN	RANGE	SEC.	1/16	1/4	CO.				
WIDTH			BOTTOM TYPE			STREAM BANK VEGETATION					
L			CONCRETE	A			CULTIVATED	A			
M			BEDROCK	B			FALLOW	B			
U			HARDPAN	C			UPLAND PASTURE	C			
DEPTH			BOULDER			UPLAND MEADOW			D		
L	•		RUBBLE	E			UPLAND HARDWOOD	E			
M	•		GRAVEL	F			UPLAND CONIFER	F			
U	•		SAND	G			UPLAND SHRUB	G			
VELOCITY			SILT & MUCK			LOWLAND PASTURE			H		
—			CLAY			LOWLAND HARDWOOD			I		
WATER TEMP.			MARL			LOWLAND CONIFER			J		
— °F			DETRITUS			LOWLAND SHRUB			K		
CONDUCTIVITY			RUBBISH			OPEN MARSH			L		
— umhos			PEAT			CUT GRASSES			M		
TURBIDITY			AQUATIC VEG.			BEACH			N		
—			EMERGENT			LOWLAND MEADOW			O		
PH			SUBMERGENT			OPEN WATER			P		
—			DUCKWEED								
—			ALGAE (ATT)								
—			ALGAE (FF)								

WIS. DEPARTMENT OF
NATURAL RESOURCES
FORM 8100-46
REV. 2-80

- 1 ADD
- 2 CHANGE
- 3 DELETE

F
OR
S

SEQUENCE _____

MAJOR BASIN _____

MINOR BASIN _____

CC1 MB MILES _____

ORDER MILEAGES 1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

11) _____

REPORT LOCATION

STATION MILEAGE _____

NAME _____

DAM OR
JAR CODE _____

WATERTYPE _____

64th _____

LANDLOCKED SEQUENCE NUMBER _____

STREAM OR
LAKE LOCATION

TOWNSHIP _____

RANGE _____

SEC. _____

1/16 _____

1/4 _____

COUNTY _____

STATION LOCATION

TOWNSHIP _____

RANGE _____

SEC. _____

1/16 _____

1/4 _____

COUNTY _____

SOURCE OF DATA _____

GEAR _____

EFFORT _____

DATE MO / DAY / YR

HOUR _____

WIDTH _____
L M U

DEPTH _____
L M U

VELOCITY _____

TEMPERATURE _____

CONDUCTIVITY _____

TURBIDITY _____

F
I
S
H

BOTTOM TYPES _____

AQUATIC VEG. _____

STRM. BANK VEG. _____

FISH SPECIES

O
N
L
Y

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

11) _____

12) _____

13) _____

14) _____

15) _____

16) _____

MORE DATA ON BACK: YES

17) _____

18) _____

19) _____

20) _____

21) _____

22) _____

23) _____

24) _____

25) _____

26) _____

27) _____

28) _____

29) _____

30) _____

31) _____

32) _____

33) _____

34) _____

35) _____

36) _____

37) _____

38) _____

39) _____

40) _____

41) _____

42) _____

43) _____

44) _____

F
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H

O
N
L
Y

FIGURE 9. Example of Fish and Stream Data Input form (8100-58). (Fishspecies 17-44 are on back of form.)

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