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Fago, Don

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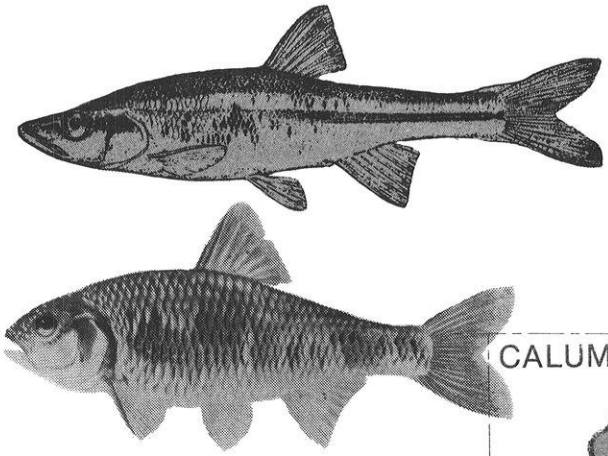

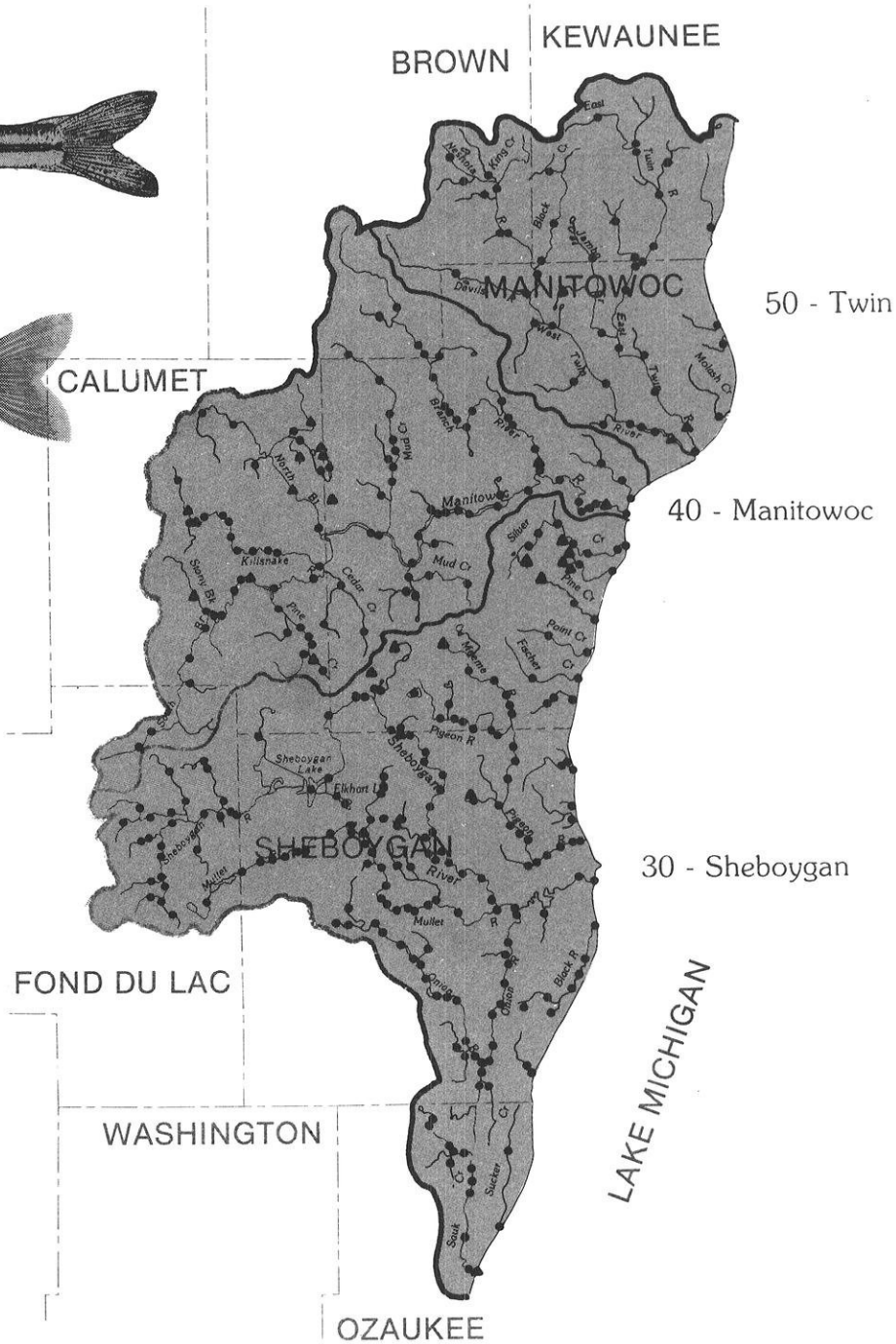

DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN

VI. Sheboygan, Manitowoc, and Twin River Basins

Technical Bulletin No. 155
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Cover: *Redside dace and striped shiner*

This report is dedicated to the nongame fish, whose interrelationships in the aquatic ecosystem is generally not well documented or appreciated.

PREFACE

Little attention has been given to nongame fish species which comprise over 75% of the 150 fish species in Wisconsin waters. Yet many of those species play a major role in maintenance of sport fish populations so vital to recreational and economic interests in the state. In essentially disregarding these species, their right to exist and their role in maintaining community stability through species diversity have been overlooked. The nongame fish not only make up the majority of fish species in Wisconsin but are also more abundant than sport fish species in both total number and total biomass.

Further attention by either research or management to nongame fish species must be preceded by an inventory of what we have and where we have it. In 1974 the Bureau of Research of the Wisconsin Department of Natural Resources (DNR), with inputs from field fish management personnel, began a statewide assessment of the distribution and relative abundance of fish species, emphasizing but not limited to nongame species. This assessment was begun using a basin approach to delineate location of sampling stations on the over 7,200 lakes (over 350,000 ha) and 11,000 streams (over 68,000 km) within the state. The 3 major basins (Mississippi River, Lake Michigan, and Lake Superior) were further divided into 30 minor basins.

The last report on the distribution of fish species throughout the state was made by C. W. Greene (1935) for the 1900-31 period. He covered about 1,400 sampling stations. Since then, other collectors, notably Dr. George Becker (1959, 1964*a*, 1964*b*, 1966, 1983), Professor Marlin Johnson (Johnson and Becker 1970), and students at the University of Wisconsin at Madison (including McNaught 1963) and Stevens Point, have added appreciably to knowledge of regional distribution of Wisconsin fishes.

The need to update our knowledge of statewide fish distribution is most clearly evident from the dearth of information available on nongame species in most watersheds for preparing environmental impact assessments and reports and department master plans. In addition, both federal and state law now require the establishment of an endangered and threatened species list. Furthermore, the Wisconsin Department of Natural Resources has been directed to "conduct research on endangered and threatened species of this state and shall implement programs directed at conserving, protecting, restoring, and propagating selected state endangered and threatened species to the maximum extent practicable" (Chap. 29.415, Wis. Statutes).

Field collecting under the research study initiated in 1974 was essentially terminated in 1980 due to reduced funding, with only limited sampling after that time. Of the 30 river basins in the state, sampling has now been completed in 17 and nearly completed in 1. Only scattered samples were taken in the other 12 basins. These samples inventoried about 45% of the state.

The results of the work so far completed on fish distribution are being published in a series of separate bulletins dealing with one or more minor basins. The following reports are now available: The Greater Rock River basin (Fago 1982), Black, Trempealeau, and Buffalo river basins (Fago 1983), Red Cedar River basin (Fago 1984*a*), Root, Milwaukee, Des Plaines, and Fox river basins (Fago 1984*c*), and Grant & Platte, Coon & Bad Axe, and La Crosse river basins (Fago 1985). The bulk of the data presented refers primarily to collections made during the Bureau of Research study. However, other fishery biologists and managers have made numerous collections over the years, and their published and unpublished records, when available to us, are included. Therefore, data from as early as 1900 are available for some basins, permitting comparisons between historical and current records.

This series of reports, however, constitutes only an overview of a voluminous mass of data now permanently stored in computer files. For the field manager or investigator, the greatest value of this study lies in the availability of fish data on specific waters or on waters in close proximity to those of immediate concern. Data now in computer files (over 17,000 collections) have already, in over 300 cases, proven to be very useful to DNR personnel in several bureaus and to other state and federal agencies, environmental consultants, and students. They have used the data for various purposes; e.g., to make assessments on past as well as potential changes in the aquatic environment, indicate water quality through fish species composition, and determine ranges in Wisconsin for particular fish species.

Sufficient data were collected during the research study to recommend the revision of Wisconsin's endangered and threatened fish species lists in 1979 and again in 1982. The first revision added 15 species to both lists and removed 3 from the endangered list. The second revision added 2 to the endangered list, and removed 1 from the endangered and 3 from the threatened list.

The bulk of the preserved fish collections are curated at the Milwaukee Public Museum, further enhancing the value and significance of this study. There they are used by scientists and educators interested in taxonomy, systematics, and natural history. They also are serving as a baseline collection from which to determine changes in fish community structure and environmental loads of pollutants and toxicants.

This report deals with 3 separate basins in east central Wisconsin, the Sheboygan, Manitowoc, and Twin river basins.

DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN

VI. SHEBOYGAN, MANITOWOC, AND TWIN RIVER BASINS

By
Don Fago

Technical Bulletin No. 155
Department of Natural Resources
Box 7921, Madison, Wisconsin 53707
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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. The Sheboygan, Manitowoc, and Twin river basins were sampled from 1974 through 1983 at 229 stations by research personnel, at 128 stations by fish management personnel, and at 5 stations by Dr. George Becker. An additional 43 stations were partially sampled by fish management personnel.

A total of 67 species, excluding the grass carp, was collected from the Sheboygan River basin, 58 from the Manitowoc River basin, and 61 from the Twin River basin. Included were the endangered striped shiner and also the redside dace, lake chubsucker, greater redhorse, and least darter which are on the Department's watch list.

Data from recent collections for the Sheboygan, Manitowoc, and Twin river basins were compared to those from the 1900-24 and the 1950-73 periods. Seventeen species were collected which had not been previously reported from the Sheboygan River basin, 27 from the Manitowoc River basin, and 32 from the Twin River basin. Five species have apparently been extirpated from the Sheboygan River basin, 2 from the Manitowoc River basin, and 3 from the Twin River basin.

This report includes numerous tables, distribution maps of the species, and discussion on many aspects of fish distribution in the 3 basins. The continued use of this data base for the preparation of environmental impact assessments, for the development of master plans for the aquatic resource, and for research on nongame species, fish communities, and ecosystems is therefore recommended.

CONTENTS

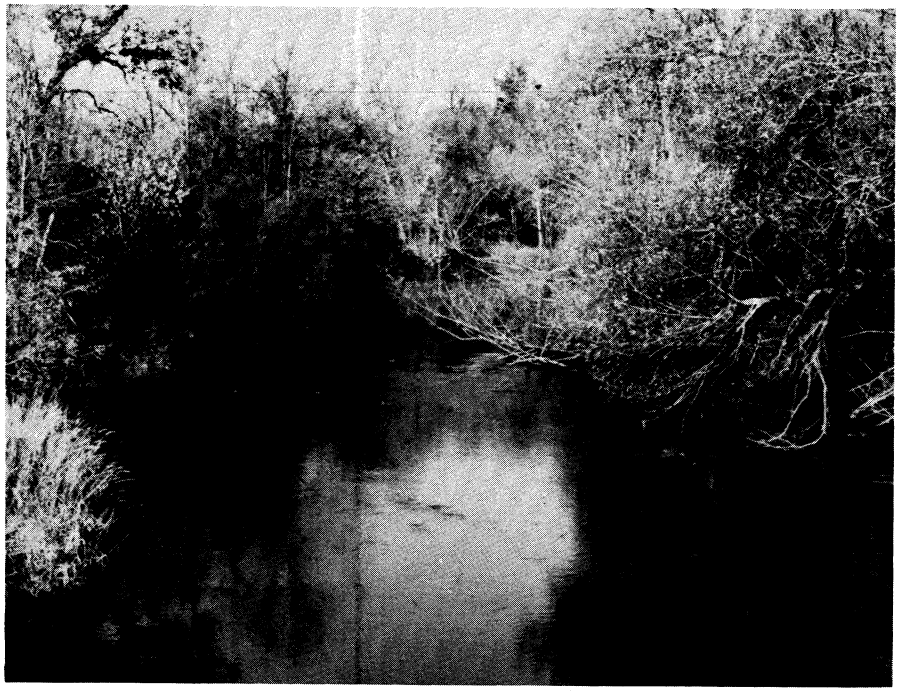
STUDY AREA

Sheboygan River Basin

The Sheboygan River basin (30) is located in the east central portion of Wisconsin (Fig. 1). It is part of the Lake Michigan basin and encompasses parts of the following counties: Calumet, Fond du Lac, Manitowoc, Ozaukee, and Sheboygan. This basin includes the Sheboygan River, Sauk Creek, Sucker Creek, Barr Creek, Black River, Pigeon River, Fourmile Creek, Sevenmile Creek, Centerville Creek, Fischer Creek, Point Creek, Pine Creek, Calvin Creek, Silver Creek, and 1 unnamed creek, all of which flow directly into Lake Michigan. The watershed contains an area of approximately 1,769 km^2 (Holmstrom 1982). Within this area, we have defined 107 streams with a total length of 788 km (Table 1)*. Of these, 75 are unnamed creeks and ditches. There are 98 lakes** in the basin, with a total area of 1,207 ha. However, only 6 lakes are over 40 ha in size.

The average annual precipitation within the Sheboygan River basin is 74 cm (Wis. Dep. Nat. Resour. 1970). The average gradient for the Sheboygan River (130 km in length) is 110 cm/km. The average discharge of the Sheboygan River at Sheboygan, which includes 98% of its drainage area and 61% of the entire basin (including 11 sub-basins), is 6.8 m^3/sec (U.S. Geol. Surv. 1982).

We determined from the data collected at our sampling stations that the Sheboygan River bottom is composed primarily of rubble, sand, gravel, and silt, with lesser amounts of clay, boulder, and detritus.



Sheboygan River at County Trunk AA near Rockville 43 miles from Lake Michigan looking upstream (above) and downstream (below).

*These were defined through a water mileage system that divided the state into 3 major and 30 minor basins (Fago 1984*b*).

**Lakes in this report refer to naturally occurring lakes as well as impoundments (bodies of water with dams at their outlets) unless otherwise specified.

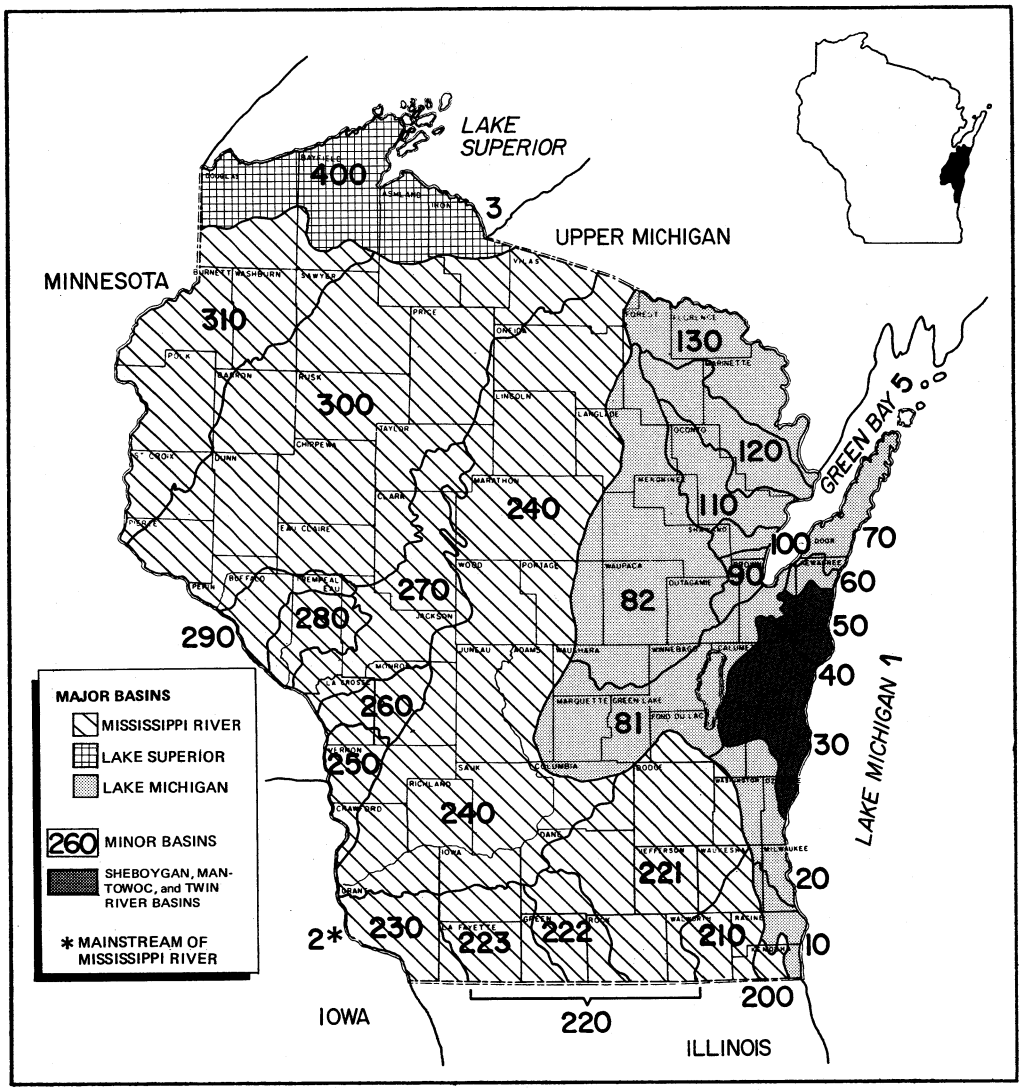


FIGURE 1. Major and minor river basins in Wisconsin.

The dominant land use (65%) in the Sheboygan River basin is agriculture (cropland and pasture). Population within the basin in 1977 was estimated at 112,000 which has increased 26% since 1950 (Jarmuz 1980).

Manitowoc River Basin

The Manitowoc River basin (40) is located adjacent to the northern edge of the Sheboygan River basin (Fig. 1). It encompasses parts of the following Wisconsin counties: Brown, Calumet, Fond du Lac, and Manitowoc. The basin includes the Manitowoc River and the Little Manitowoc River; both flow directly into Lake Michigan. It contains an area of approximately 1,427 km^2 (Holmstrom 1982). Within this area we have defined 68 streams with a total length of 541 km (Table 1). Of these, 52 are unnamed creeks or ditches. There are 60 lakes with a total area of 231 ha, the largest being 49 ha in size.

The average annual precipitation is the same as for the Sheboygan River basin (Wis. Dep. Nat. Resour. 1977). The average gradient for the Manitowoc River (58 km in length) is 63 cm/km and for the South Branch of the Manitowoc River (60 km in length) is 76 cm/km. The average discharge of the Manitowoc River at Manitowoc, which includes 98% of its drainage area and 95% of the entire basin (including the Little Manitowoc River sub-basin), is 8.6 m^3/sec (U.S. Geol. Surv. 1982). We determined from our sam-

Manitowoc River at County Trunk JJ near Manitowoc Falls, looking upstream at habitat of the greater redhorse.

Manitowoc River at Clark Mills, 21 miles upstream from Lake Michigan.

pling stations that the Manitowoc River has a stream bottom composed primarily of gravel, rock, and muck (Weber et al. 1968).

The major land use (89%) is agriculture which is dominated by cropland (Wis. Dep. Nat. Resour. 1977). Population within the basin in 1975 was approximately 69,200, an increase of 22% since 1950 (Wis. Dep. Nat. Resour. 1977).

Twin River Basin

The Twin River basin (50) is located adjacent to the northern edge of the Manitowoc River basin (Fig. 1). It encompasses parts of the following Wisconsin counties: Brown, Kewaunee, and Manitowoc. The basin includes the East Twin River, West Twin River, Molash Creek, and 4 unnamed creeks all of which flow directly into Lake Michigan. This watershed contains an area of approximately 951 km^2 (Wis. Dep. Nat. Resour. 1980). Within this area we have defined 48 streams with a total length of 352 km (Table 1). Of these, 33 are unnamed creeks or ditches. There are only 21 lakes with a total area of 127 ha, the largest being 21 ha in size.

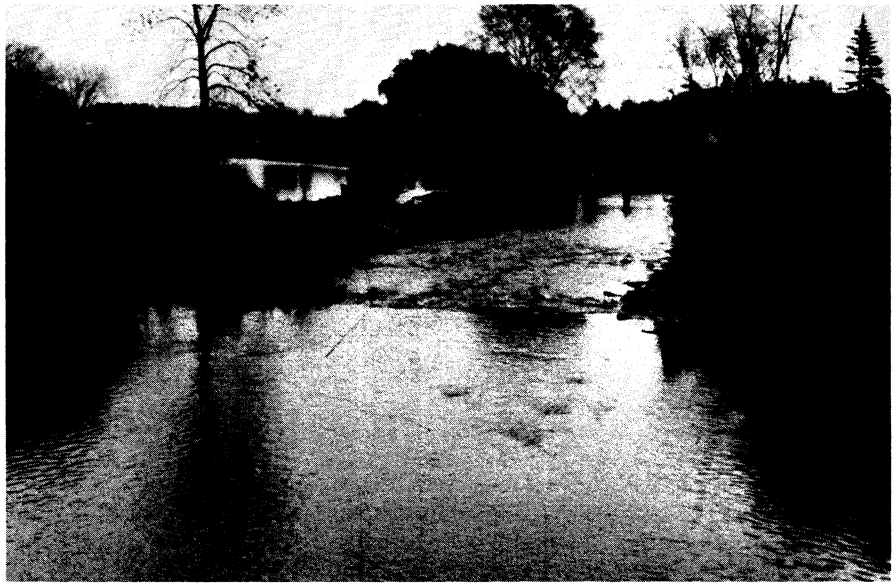
The average annual precipitation within the Twin River basin varies between 67 and 71 cm (Wis. Stat. Rep. Serv. 1967). The average gradient for the East Twin River (68 km in length) is 122 cm/km. The average gradient of the West Twin River (31 km in length) is 70 cm/km and for the Neshota River, headwaters for West Twin River (27 km in length), is 201 cm/km. The average discharge of the East Twin River at Mischicot is 2.0 m^3/sec. This measurement encompasses 83% of the East Twin's watershed and 12% of the entire Twin River basin (U.S. Geol. Surv. 1982). We determined from our sampling stations that the East Twin's bottom is composed primarily of sand, silt, muck, and rubble with lesser amounts of gravel, and that the West Twin's bottom was primarily rubble, sand, peat, detritus, and gravel.

The major land uses are cropland (56%), woodland (19%), and grassland (17%) (Wis. Dep. Nat. Resour. 1980). Population within the basin of approximately 29,700 has shown a 25% increase since 1950 (Wis. Dep. Nat. Resour. 1980).

TABLE 1. *Land area, streams, and lakes of the Sheboygan, Manitowoc, and Twin river basins.*

	Sheboygan River Basin	Manitowoc River Basin	Twin River Basin
Land area (km^2)	1,769	1,427	951
Streams			
Total number	107	68	48
Unnamed creeks or ditches	75	52	33
Total length (km)	788	541	352
Lake/impoundments*			
Total number	98	60	21
Area (ha)	1,207	231	127
No. dams	22	11	4

*Impoundments are bodies of water with dams at their outlets.



West Twin River at Shoto 5.8 miles from Lake Michigan, looking upstream (above) and downstream (below) at habitat of the greater redhorse.

Branch River at Highway 10, 1.6 miles from its confluence with the Manitowoc River.

METHODS

Data Sources and Time Periods

All collections are divided into 3 time periods: 1900-24, 1950-73, and 1974-83. The earlier records provide the basis for assessment of changes over time in distribution of fish species within the basins of the Sheboygan, Manitowoc, and Twin rivers.

If a location was sampled within a time period more than once, only 1 collection is used in the counts of number of stations sampled and number of stations at which a species was taken.

Stations were classified in one of two ways, except for the 1900-24 period, depending on how the samples were taken: complete (those in which all species collected were recorded and identified), and partial (those in which sampling effort and/or species identification were incomplete and therefore did not yield adequate assessment of total species composition).

1900-24 Period. All collections were made between 1900-24 except for 2 stations in the Sheboygan River basin (1 in 1941 and 1 in 1945), with 81% taken between 1903-09. Collections from this time period had been made at 12 stations in the Sheboygan River basin, 3 in the Manitowoc River basin, and 1 in the Twin River basin, by a number of collectors. They included G. Wagner, C. L. Turner, and H. V. Ogden (names taken from original field notes). Most specimens from these collections were verified by Dr. Carl Hubbs or Dr. C. W. Greene and cited by Greene (1935).

The stations sampled were located on 7 streams and 3 lakes in the Sheboygan River basin, 3 streams in the Manitowoc River basin, and 1 stream in the Twin River basin (Table 2). Thoroughness of sampling effort was unknown, and therefore calculation of percent occurrence of each species was not attempted (Table 5).

1950-73 Period. Complete collections from this period were made at 24 stations on 16 streams in the Sheboygan River basin; 4 stations on 4 streams in the Manitowoc River basin; and 7 stations on 3 streams in the Twin River basin (Table 2). An additional 25 partial collections in the Sheboygan River basin, 19 in the Manitowoc River basin, and 10 in the Twin River basin increased the number of streams sampled by 1, 1, and 4 and lakes by 15, 9, and 4 in the Sheboygan, Manitowoc, and Twin river basins, respectively. The data from these partial samples were kept separate in Table 2 and not included in the percentages of total stations sampled presented in Table 5. Fifty-three of these additional stations came from written records provided by fish management and 1 from fish research.

The complete samples from the Sheboygan, Manitowoc, and Twin river basins (74% collected between 1962-67) were collected by the following: Dr. George Becker and his students (unpubl. data) - 7 stations; Prof. Marlin Johnson (unpubl. data) - 19 stations; Milwaukee Public Museum (unpubl. data) - 9 stations.

Total occurrences are defined as the sum of the number of species taken at each station. For example, if a collector took 10 species at one station, 20 at another, and 30 at another, the total species occurrences would be 60. This information has been calculated for collections since 1950, and reveals the volume of data from both complete and partial samples used (Table 3). For the earliest period, only a grand total of occurrences was calculated (Table 5). Total occurrences increased from 112 for the 1900-24 period to 468 for the 1950-73 period for the Sheboygan, Manitowoc, and Twin river basins. During 1950-73, 39% and 34% of the grand total of occurrences for the Sheboygan, Manitowoc, and Twin river basins were accounted for by fish management personnel and Marlin Johnson, respec-

TABLE 2. *Summary of stream and lake sampling efforts in the Sheboygan, Manitowoc, and Twin river basins, 1900-83.*

	Sheboygan (30)			Manitowoc (40)			Twin (50)		
	1900-24	1950-73	1974-83	1900-24	1950-73	1974-83	1900-24	1950-73	1974-83
Streams									
No. sampled	7	16*(1)**	54(0)	3	4(1)	30(1)	1	3(4)	23(0)
No. stations	9	24 (9)	202(6)	3	4(10)	102(17)	1	7(6)	45(4)
Lakes/impoundments									
No. sampled	3	0 (15)	8(12)	0	0(9)	5(3)	0	0(4)	0(1)
No. stations	3	0 (16)	8(12)	0	0(9)	5(3)	0	0(4)	0(1)
Total no. stations	12	24 (25)	210(18)	3	4(19)	107(20)	1	7(10)	45(5)

*Complete samples.
**Partial samples.

TABLE 3. *List of collectors with number of species collected and total occurrences for samples from the Sheboygan, Manitowoc, and Twin river basins.*

	Sheboygan (30)				Manitowoc (40)				Twin (50)			
	1950-73		1974-83		1950-73		1974-83		1950-73		1974-83	
Source Of Data*	No. Species	Total Occurrences	No. Species	Total Occurrences	No. Species	Total Occurrences	No. Species	Total Occurrences	No. Species	Total Occurrences	No. Species	Total Occurrences
Research 0	4	4(1)**	58	1,018(54)	0	—	55	628(65)	0	—	55	411(77)
Fish Mgt. 1	16	89(32)	56	872(46)	12	59(62)	41	301(31)	8	33(35)	47	125(23)
Becker 2	7	7(3)	4	4(t)[a]	8	8(8)	17	33(4)	17	38(40)	0	—
Johnson 3	28	108(39)	0	—	22	28(30)	0	—	18	24(25)	0	—
Milw. Public Museum 5	27	7(25)	0	—	0	—	0	—	0	—	0	—
Grand total of occurrences		278		1,894		95		962		95		536

*Collectors identified at end of Appendix A Table 17.
**Percent of total occurrences in parentheses.
[a]t = less than 0.5%.

tively. (Table 3 and Append. A Table 17).

1974-83 Period. Complete collections from this period were made at 210 stations (88% sampled in 1976-80) on 54 streams and 8 lakes in the Sheboygan River basin; 107 stations (79% in 1979-80) on 30 streams and 5 lakes in the Manitowoc River basin; and 45 stations (82% in 1979-80) on 23 streams in the Twin River basin. There were an additional 18 partial collections in the Sheboygan River basin, 20 in the Manitowoc River basin, and 5 in the Twin River basin which increased the number of streams by 0, 1, and 0 and lakes by 13, 3, and 1 in the Sheboygan, Manitowoc, and Twin river basins, respectively.

For the Sheboygan, Manitowoc, and Twin river basins, the number of complete samples increased an average of 1,298% over the 1950-73 period with 362 stations sampled (Table 2). DNR research personnel sampled 229 (63%) of the complete samples, fish management personnel sampled 128 (35%), and Dr. Becker sampled 5 (2%). The 43 partial samples were collected by fish management personnel.

Total occurrences increased from 468 for the 1950-73 period to 3,392 for the Sheboygan, Manitowoc, and Twin river basins; 61% of these were recorded by research personnel (Table 3). We also collected 72 of the 79 species found in the Sheboygan, Manitowoc, and Twin river basins (for a list of species taken by all other collectors see Append. A. Table 17).

Collection Methods and Gear*

We used five types of electrofishing gear, depending on the size of the body of water. The types of gear and percentage of stations where each was used were: boom shocker (3%), minishocker (1%), stream shocker (41%), battery-powered backpack (38%), and longline shocker (11%). Small mesh seines were used at 6% of the stations, primarily in lakes and large rivers.

All generators produced direct current, with the boom shocker and minishocker permitting a choice of several pulse rates and frequencies. The boom shocker also produced alternating current and it was used occassionally when the DC unit was inoperative. For more information concerning the boom and stream shocking equipment, see Novotny and Priegel (1971, 1974). The minishocker consisted of a 5 meter flat bottom boat with one boom in the bow and used the same 5 hp T&J gasoline-powered generator as the stream shocker. One person sitting on a chair in the bow collected the fish in contrast to 2 people standing in the boom shocker. The battery-powered backpack uses a 12-volt deep cycle battery and pulses the DC at several frequency and pulse rates. The development and production of this unit, like all the electric fishing gear used, was a joint project between Wisconsin DNR and Instrumentation Systems Center - University of Wisconsin-Madison. The seines were 1.2-m and 9.1-m bag seines with 4.8-mm delta mesh.

Sampling Effort

We established sampling locations based on habitat diversity, the distance between stations, and accessibility. The length of a sampling station was approximately 100 m for all electrofishing gear except for the boom shocker and minishocker. Boom shocker and minishocker stations averaged 4.1 km. Areas seined averaged 725 m^2. Distance between stations on the main stems of the Sheboygan, Manitowoc, East Twin, and West Twin rivers averaged 6.5 km. There was an average of 1 station/4.1 km of the total length of all sampled streams with one or more complete stations.

Complete collections were made on 50% of the streams and 8% of the lakes in the Sheboygan River basin; 44% of the streams and 8% of the lakes in the Manitowoc River basin; and 48% of the streams and none of the lakes in the Twin River basin (Tables 1 and 2). While these percentages are relatively low, the streams that were sampled comprised 90%, 84%, and 83% of the total length of all streams in the Sheboygan, Manitowoc, and Twin river basins, respectively. The sampled lakes comprised only 51%, 36%, and 0%, respectively, of the total surface area for all lakes in each basin. This was due to the fact that most lakes were small, averaging only 17 ha, 6 ha, and 8 ha, respectively.

Figure 2 shows the locations of 325 of the 362 complete and 30 of the 43 partial stations. Only one dot per lake was shown and dots were eliminated that would overlap another dot.

Data Handling

Data collected at the sampling stations were recorded in pencil on Form 8100-46 (Append. A Fig. 5), and included station and species information, and ecological data. This form is made of polyethylene paper, is virtually unaffected by salt and fresh water, and is resistant to tearing, discoloration, and rotting.

In order to handle the data on over 580 collections from the Sheboygan, Manitowoc, and Twin river basins, dating from 1900, Cobol and Mark IV computer programs were developed through a cooperative effort with the DNR's Bureau of Information Management to organize, store, and retrieve the data. Some programs are used to update the Fish Master File which contains all data on the stations in the 3 basins as well as on 16,420 additional stations throughout the state.

Other programs are used to help in the analysis of the data. One analysis uses a Cobol program to organize the data by species, and lists all stations for each species. This listing, based on a water mileage system developed for this study, was organized in 2 ways (Fig. 3a and b):

(1) All stations on a river are listed until a tributary of the river is reached (Fig. 3a). All stations on the 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 first tributary before going back to the original river.

(2) All stations on a river are listed before going back to the first tributary of the original river and listing all stations on the tributary (Fib. 3b). This procedure is followed for all tributaries in the basin of the first tributary before going to the second tributary of the original river.

The program for both of these methods 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 Appendix A 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 are 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 (Append. A Fig. 7).

Another type of analysis uses a Mark IV program to organize 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 the same two ways (Fig. 3). 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 the Mark IV listing is shown in Appendix A Figure 8.

A water mileage system was devised to permit computer analysis of the data and still allow easy recognition of the location by persons wishing to use the data. This was accomplished by using the town, range, section, 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 has been generated by this study for most streams and lakes in Wisconsin. Mark IV computer programs are available to obtain a variety of listings such as streams and/or lakes in each basin listed alphabetically.

*Only the methods and gear employed by DNR research personnel are described; fish management personnel used similar equipment.

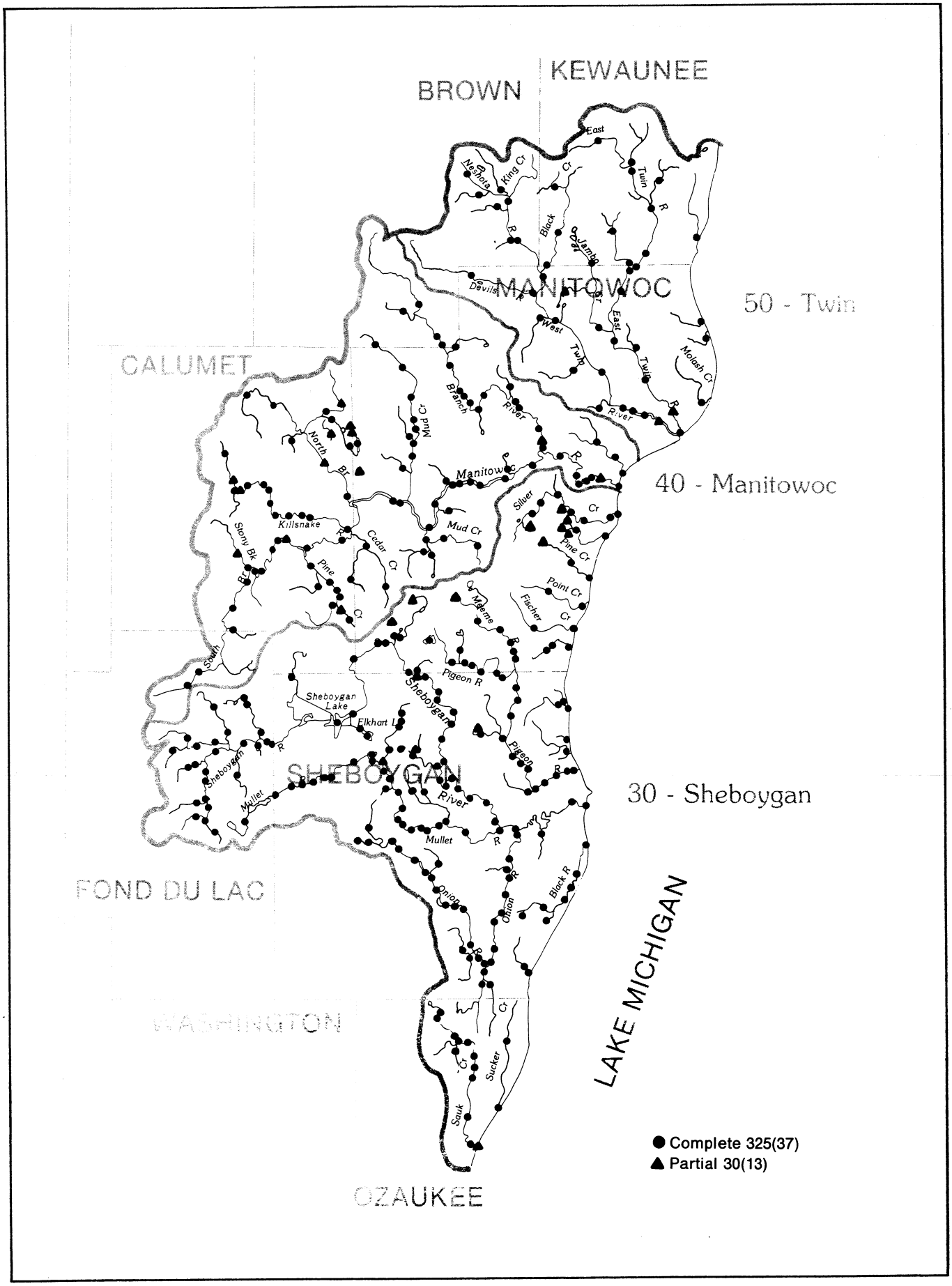


FIGURE 2. Location of 355 stations in the Sheboygan, Manitowoc, and Twin river basins. (Due to lack of space, 37 complete stations and 13 partial stations are not shown.)

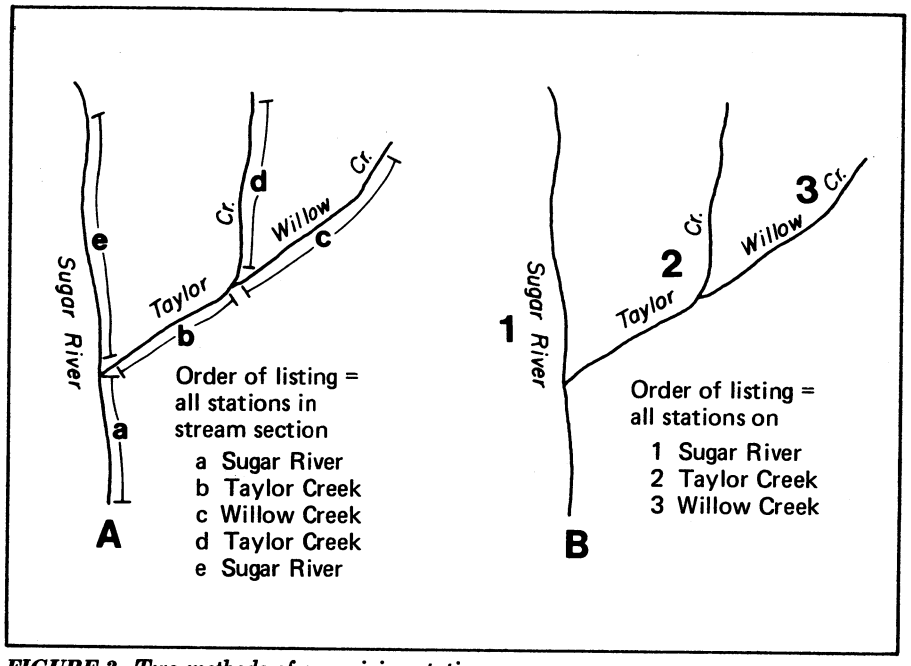


FIGURE 3. Two methods of organizing stations on computer printouts.

An example of a page of the water mileage system from a computer printout of the Master Stream and Lake File is shown in Appendix A Figure 9. An example of a page of the Master Fish File which uses the water mileage system to organize the biological and environmental data is included in Appendix A Figure 8. A detailed explanation of the data storage system as exemplified in these figures is presented in Fago (1984*b*).

Fish Identification and Enumeration

In order to reduce the volume of specimens taken back to the laboratory, larger fish were identified to species in the field and were usually returned to the water. Generally all others were preserved in 10% Formalin for later identification in the laboratory (using the unpublished keys of Dr. G. Becker).

At least a few stonerollers from all but 4 stations were keyed to species. The remainder were left as stonerollers (*Campostoma* spp.). Research personnel identified all fish for the 1974-83 period except for those collected by Dr. Becker and some specimens of 22 species (indicated by an asterisk in Append. A Table 17), collected by fish management personnel. For the 1950-73 period, species records are based upon the collectors' identification. The common and scientific names of fish species cited in this report (Table 4) follow names established by the American Fisheries Society's Committee on Names of Fishes (Robins 1980). All hybrids and specimens not keyed to species, except stonerollers, were not dealt with in this report.

At each station, the number of specimens for each species was counted to 98 and recorded on Form 8100-46 (Append. A Fig. 5). However, at many stations there were more than 98 specimens taken for certain species. They were recorded as 99. Therefore, the number of specimens recorded in Tables 6, 11, and 12 for some species is substantially lower than the number actually captured. Furthermore, there were up to 3 stations for certain species at which the number taken was unknown, further underestimating the total number of specimens.

Questionable specimens were sent to Dr. George Becker at the University of Wisconsin-Steven Point for verification.

Endangered, Threatened, and Watch Species

The State of Wisconsin currently has 8 fish species on its endangered list*, 6 on its threatened list*, and 18 on its unofficial watch list. These three categories are defined as follows:

Endangered: Any species or subspecies in danger of becoming extirpated. Its continued existence as part of the state's wildlife resources is in jeopardy.

Threatened: Any species or subspecies which appears likely, within the foreseeable future, to become endangered.

Watch: Species or subspecies that may or may not be holding their own at the present time. They will be under special observation to identify conditions that could cause further decline, or any factors that could help to insure their survival in the state.

*Chap. NR 27, Wis. Admin. Code.

TABLE 4. *List of common and scientific names of all fish species cited in this report.*

Computer No.	Common Name	Scientific Name
	Lampreys	Petromyzontidae
A03	Northern brook lamprey	*Ichthyomyzon fossor*
A05	American brook lamprey	*Lampetra appendix*
A06	Sea lamprey	*Petromyzon marinus*
	Bowfins	Amiidae
E01	Bowfin	*Amia calva*
	Herrings	Clupeidae
G01	Alewife	*Alosa pseudoharengus*
G02	Gizzard shad	*Dorosoma cepedianum*
	Trouts	Salmonidae
I04	Cisco or lake herring	*Coregonus artedii*
I05	Lake whitefish	*Coregonus clupeaformis*
I06	Bloater	*Coregonus hoyi*
I12	Pink salmon	*Oncorhynchus gorbuscha*
I14	Coho salmon	*Oncorhynchus kisutch*
I16	Chinook salmon	*Oncorhynchus tshawytscha*
I19	Rainbow trout	*Salmo gairdneri*
I21	Brown trout	*Salmo trutta*
I22	Brook trout	*Salvelinus fontinalis*
I23	Lake trout	*Salvelinus namaycush namaycush*
	Smelts	Osmeridae
J01	Rainbow smelt	*Osmerus mordax*
	Mudminnows	Urbridae
K01	Central mudminnow	*Umbra limi*
	Pikes	Esocidae
L01	Grass pickerel	*Esox americanus vermiculatus*
L02	Northern pike	*Esox lucius*
L03	Muskellunge	*Esox masquinongy*
	Minnows and Carps	Cyprinidae
M06	Central stoneroller	*Campostoma anomalum*
M07	Largescale stoneroller	*Campostoma oligolepis*
M08	Goldfish	*Carassius auratus*
M09	Redside dace	*Clinostomus elongatus*
M10	Lake chub	*Couesius plumbeus*
M12	Common carp	*Cyprinus carpio*
M14	Brassy minnow	*Hybognathus hankinsoni*
M19	Hornyhead chub	*Nocomis biguttatus*
M20	Golden shiner	*Notemigonus chrysoleucas*
M23	Emerald shiner	*Notropis atherinoides*
M27	Striped shiner	*Notropis chrysocephalus*
M28	Common shiner	*Notropis cornutus*
M31	Blackchin shiner	*Notropis heterodon*
M32	Blacknose shiner	*Notropis heterolepis*
M33	Spottail shiner	*Notropis hudsonius*
M35	Rosyface shiner	*Notropis rubellus*
M36	Spotfin shiner	*Notropis spilopterus*
M37	Sand shiner	*Notropis stramineus*
M40	Mimic shiner	*Notropis volucellus*
M42	Northern redbelly dace	*Phoxinus eos*
M43	Southern redbelly dace	*Phoxinus erythrogaster*
M44	Finescale dace	*Phoxinus neogaeus*
M45	Bluntnose minnow	*Pimephales notatus*
M46	Fathead minnow	*Pimephales promelas*
M48	Blacknose dace	*Rhinichthys atratulus*
M49	Longnose dace	*Rhinichthys cataractae*
M50	Creek chub	*Semotilus atromaculatus*
M51	Pearl dace	*Semotilus margarita*
	Suckers	Catostomidae
N08	Longnose sucker	*Catostomus catostomus*
N09	White sucker	*Catostomus commersoni*
N12	Lake chubsucker	*Erimyzon sucetta*
N13	Northern hog sucker	*Hypentelium nigricans*
N18	Silver redhorse	*Moxostoma anisurum*
N21	Golden redhorse	*Moxostoma erythrurum*
N22	Shorthead redhorse	*Moxostoma macrolepidotum*
N23	Greater redhorse	*Moxostoma valenciennesi*
	Bullhead catfishes	Ictaluridae
O05	Black bullhead	*Ictalurus melas*
O06	Yellow bullhead	*Ictalurus natalis*
O07	Brown bullhead	*Ictalurus nebulosus*
O08	Channel catfish	*Ictalurus punctatus*
O10	Stonecat	*Noturus flavus*
O11	Tadpole madtom	*Noturus gyrinus*
	Trout-perches	Percopsidae
Q01	Trout-perch	*Percopsis omiscomaycus*
	Killifishes	Cyprinodontidae
S01	Banded killifish	*Fundulus diaphanus*
	Sticklebacks	Gasterosteidae
U01	Brook stickleback	*Culaea inconstans*
U02	Ninespine stickleback	*Pungitius pungitius*
	Temperate basses	Percichthyidae
V01	White bass	*Morone chrysops*
	Sunfishes	Centrarchidae
W04	Rock bass	*Ambloplites rupestris*
W05	Green sunfish	*Lepomis cyanellus*
W06	Pumpkinseed	*Lepomis gibbosus*
W07	Warmouth	*Lepomis gulosus*
W09	Bluegill	*Lepomis macrochirus*
W11	Smallmouth bass	*Micropterus dolomieui*
W12	Largemouth bass	*Micropterus salmoides*
W14	Black crappie	*Pomoxis nigromaculatus*
	Perches	Percidae
X09	Iowa darter	*Etheostoma exile*
X10	Fantail darter	*Etheostoma flabellare*
X11	Least darter	*Etheostoma microperca*
X12	Johnny darter	*Etheostoma nigrum*
X15	Yellow perch	*Perca flavescens*
X16	Logperch	*Percina caprodes*
X18	Blackside darter	*Percina maculata*
X22	Walleye	*Stizostedion vitreum vitreum*
	Sculpins	Cottidae
Z01	Mottled sculpin	*Cottus bairdi*
Z02	Slimy sculpin	*Cottus cognatus*

RESULTS AND DISCUSSION

Findings are presented individually for the Sheboygan, Manitowoc, and Twin river basins followed by a discussion of differences between the basins for selected species, including those on the Wisconsin DNR endangered, threatened, or watch lists. Unless otherwise indicated, findings refer only to the 1974-83 period.

SHEBOYGAN RIVER BASIN (30)

Species Found

Over 37,000 specimens representing 67 species were identified in samples from the Sheboygan River basin (Tables 5 and 6). This includes the endangered striped shiner, and the bloater and lake chubsucker on the watch list. Distribution maps for all species are presented in Appendix B. Each map shows the location of stations where the species was collected. An index to the maps is contained in Table 5 and at the back of this report, after Appendix B.

Reproducing Populations

In the Sheboygan River basin 64 species are believed to have reproducing populations; however, the only documented natural reproduction of the walleye is in Wolf Lake. The presence of reproducing populations of 3 other species (coho salmon*, chinook salmon, and rainbow trout*) is questionable since all collections can be attributed to stocking (P. Schultz, pers. comm.). Another species captured, the grass carp (*Ctenopharyngodon idella*) was illegally imported into the state and chemically removed from an unnamed pond. The grass carp is not listed in any table in this report since all specimens are believed to have been destroyed.

*Limited reproduction was documented in 1971 in Fischer Creek (Avery 1974).

Common and Rare Species

The 5 most common species (caught at the highest percentage of complete stations) were white sucker (76%), common shiner (54%), bluntnose minnow (50%), Johnny darter (50%), and creek chub (49%) (Table 5). The 6 most numerous species (most specimens caught) were white sucker (5,000), common shiner (4,400), creek chub (3,700), Johnny darter (2,100), central mudminnow (2,000), and bluntnose minnow (2,000) (Table 6).

Of the 24 rarest species (those caught at 5 or fewer of all the stations, Table 7), all but 3 (alewife, lake chub, and mimic shiner) were also represented by the smallest total number of specimens (Table 6).

Differences Between Time Periods

Seventeen species of fish collected during the 1974-83 period have not been previously reported for this basin (Table 8).

The rosyface shiner, white bass, warmouth, and least darter are apparently no longer present in the Sheboygan River basin, for they were last taken before 1924 (Table 9). The fantail darter (1 specimen) was taken only in 1973. All of these 5 species had been reported from only 1 station and were considered rare in those years.

Five species that we collected had not been reported between 1924 and 1974 from this basin (Table 10).

One of the most important results of this study was the documentation of changes in the known distribution of species within the Sheboygan River basin in 1974-83 as compared to previous periods (Table 5). These changes have ranged from decreases in the number of stations for 6 species to increases for 44 species, and no change for 5 others. The decreases ranged from 100% for 5 species to 50% for the spottail shiner. The increases ranged from 33% for the alewife to 2,800% for the stonecat (average = 747%), and were due primarily but perhaps not entirely to increased sampling effort in 1974-83. There were 38 more streams and 8 more lakes with at least 1 complete station compared to 1950-73 and 47 more streams and 5 more lakes compared to 1900-24 (Table 2). When the total number of complete stations sampled in the 1974-83 period was compared with the 1950-73 and 1900-24 periods, there were increases of 775% and 1,650%, respectively.

Species Diversity

Three stations (3%) sampled by research personnel in the Sheboygan River basin had 20 or more species (Fig. 4). The average number of species taken per station was 9.

MANITOWOC RIVER BASIN (40)

Species Found

Over 18,000 specimens representing 58 species were identified in samples from the Manitowoc River basin (Tables 5 and 11). This included the greater redhorse which is on the watch list. Distribution maps for all species are presented in Appendix B.

Reproducing Populations

In the Manitowoc River basin 53 species are believed to have reproducing populations; however, the only documented natural reproduction for the walleye is in Bullhead Lake. The presence of reproducing populations of 5 other species (pink salmon, chinook salmon, rainbow trout, brown trout, and brook trout) is questionable since all collections can be attributed to stocking (P. Peters, pers. comm.).

Common and Rare Species

The 5 most common species (caught at the highest percentage of complete stations) were white sucker (67%), central mudminnow (50%), northern pike (50%), Johnny darter (48%), and fathead minnow (46%) (Table 5). The 5 most numerous species (most specimens caught) were white sucker (2,500), central mudminnow (1,800), common shiner (1,700), creek chub

(1,000), and black bullhead (1,000) (Table 11). The northern pike, fathead minnow, and Johnny darter were the 15th, 6th, and 7th most numerous species, respectively.

Of the 23 rarest species (those caught at 5 or fewer of all the stations, Table 7), all but 4 (alewife, northern redbelly dace, trout-perch, and walleye) were also represented by the smallest number of species (Table 11).

Differences Between Time Periods

Twenty-seven species of fish that we collected have not been previously reported for this basin (Table 8).

The bowfin and brassy minnow are apparently no longer present in the Manitowoc River basin (Table 9). The bowfin was only taken in Brillion Quarry in 1966 by fish management and the brassy minnow was taken at 1 station in 1962 by students of Dr. Becker.

The largescale stoneroller, tadpole madtom, and blackside darter were not taken between 1924 and 1974 (Table 10).

As in the Sheboygan River basin, one of the most important results of this study was documentation of changes in the known distribution of species within the Manitowoc River basin in 1974-83 as compared to previous periods (Table 5). These changes ranged from decreases in the number of stations for 2 species to increases for 31 species, and no change for 1 other. The decreases were 100% for the bowfin and brassy minnow. The increases ranged from 33% for the yellow perch to 4,700% for the black bullhead (average = 1,236%). The reasons for the increases are the same as for the Sheboygan River basin. In 1974-83 there were 26 more streams and 5 more lakes with at least 1 complete station compared to 1950-73, and 27 more streams and 5 more lakes compared to 1900-24 (Table 2). When the total number of complete stations sampled in the 1974-83 period was compared with the 1950-73 and 1900-24 periods, there were increases of 2,575% and 3,467%, respectively.

Species Diversity

There were only 2 stations (3%) sampled by research personnel that had 20 or more species (Fig. 4). The average number of species taken per sample was 8.

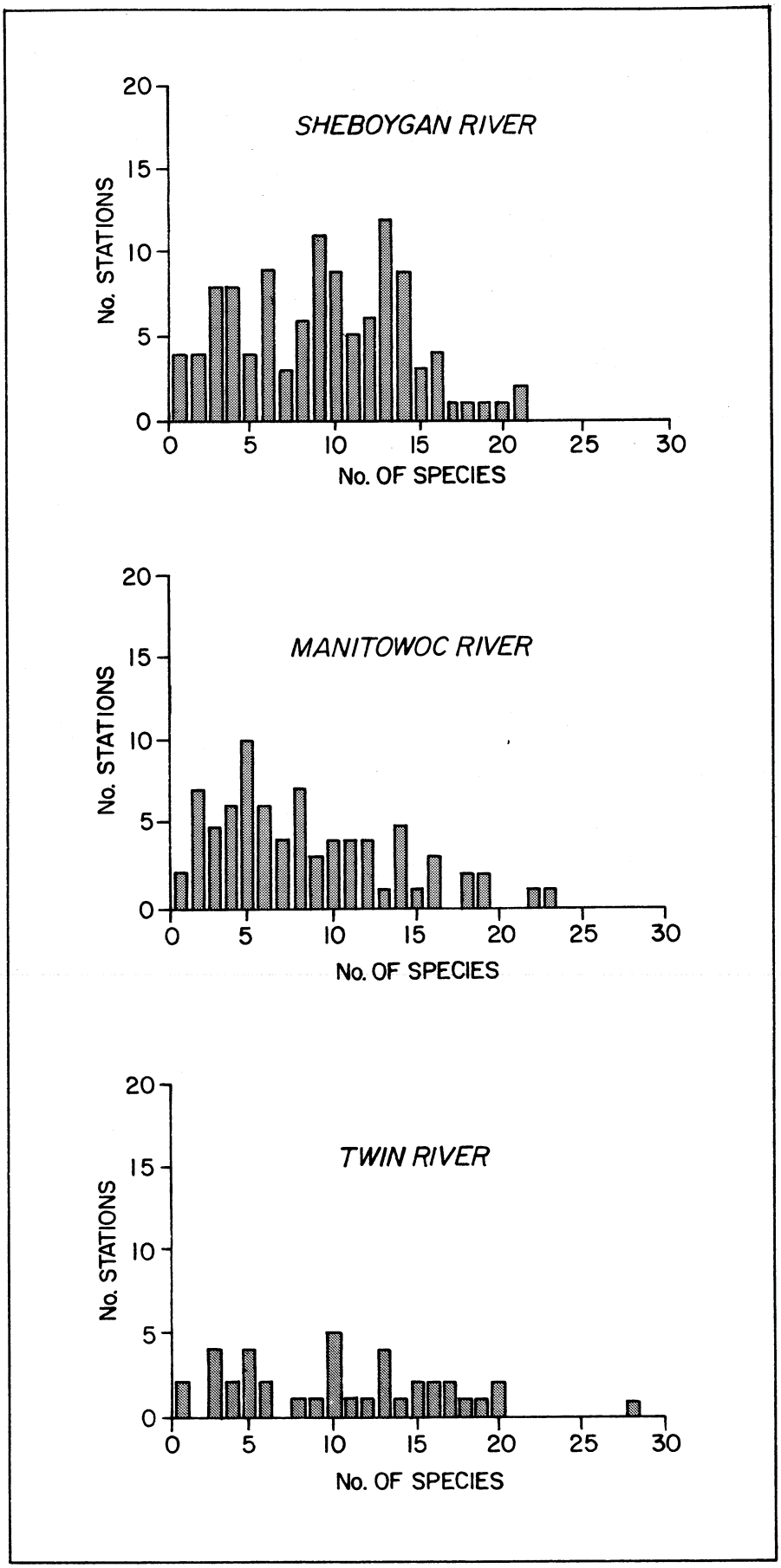


FIGURE 4. Number of stations at which varying numbers of species were taken in the Sheboygan, Manitowoc, and Twin river basins.

TABLE 5. *Number of stations and percent of total stations at which each species was collected and percent change in occurrence in the Sheboygan, Manitowoc, and Twin river basins, 1900-1983.*

Map No.	Species	Sheboygan (30) 1900-24 No. Stn.	Sheboygan (30) 1950-73 No. Stn.	Sheboygan (30) 1950-73 Percent Total	Sheboygan (30) 1974-83 No. Stn.	Sheboygan (30) 1974-83 Percent Total	Sheboygan (30) Percent Change In Occurrence[2]	Manitowoc (40) 1900-24 No. Stn.	Manitowoc (40) 1950-73 No. Stn.	Manitowoc (40) 1950-73 Percent Total	Manitowoc (40) 1974-83 No. Stn.	Manitowoc (40) 1974-83 Percent Total	Manitowoc (40) Percent Change In Occurrence[2]	Twin (50) 1900-24 No. Stn.	Twin (50) 1950-73 No. Stn.	Twin (50) 1950-73 Percent Total	Twin (50) 1974-83 No. Stn.	Twin (50) 1974-83 Percent Total	Twin (50) Percent Change In Occurrence[2]
1	American brook lamprey	0	0	-	0	-	-	0	0	-	1	1	-	0	0	-	4(1)	9	-
2	Sea lamprey	0	0	-	0	-	-	0	0	-	0	-	-	0	0	-	0(2)	-	-
-	Bowfin	0	0	-	0	-	-	0	0(1)*	-	0	-	-100	0	0	-	0	-	-
3	Alewife	0	1(2)	4	3(1)	1	33	0	0	-	2	2	-	0	0	-	4(3)	9	-
3	Gizzard shad	0	0	-	0	-	-	0	0	-	0	-	-	0	0	-	2(1)	4	-
4	Cisco or lake herring	1	0(1)	-	1	t**	0	0	0	-	0	-	-	0	0	-	0	-	-
4	Lake whitefish	0	0	-	0	-	-	0	0	-	0(1)	-	-	0	0	-	0	-	-
5	Bloater (W)[1]	0	0	-	1	t	-	0	0	-	0	-	-	0	0	-	0	-	-
5	Pink salmon	0	0	-	0	-	-	0	0	-	1	1	-	0	0	-	0	-	-
6	Coho salmon	0	0(1)	-	2	1	100	0	0	-	0	-	-	0	0	-	0(1)	-	-
6	Chinook salmon	0	0	-	5(1)	2	-	0	0	-	2	2	-	0	0	-	2	4	-
7	Rainbow trout	1	1(4)	4	10(2)	5	140	0	0(1)	-	3(2)	3	400	0	0	-	6(3)	13	-
8	Brown trout	0	2(5)	8	8(2)	4	43	0	0	-	3(1)	3	-	0	0(4)	-	7(3)	16	150
9	Brook trout	1	0(6)	-	22(7)	10	380	0	0	-	2	2	-	0	0	-	5(2)	11	-
-	Lake trout	0	0	-	0	-	-	0	0	-	0	-	-	0	0	-	0	-	-
10	Rainbow smelt	0	0	-	0	-	-	0	0	-	0	-	-	0	0	-	2(2)	4	-
11	Central mudminnow	3	5(2)	21	71(5)	34	990	2	0(3)	-	54(10)	50	2,000	1	1(3)	14	14(1)	31	280
12	Grass pickerel	0	0	-	1	t	-	0	0	-	0	-	-	0	0	-	0	-	-
13	Northern pike	1	1(4)	4	65(13)	31	420	0	0(13)	-	53(14)	50	420	0	1(6)	14	11(5)	24	130
14	Stonerollers	0	5	21	1(1)	t	-	0	1	25	2	2	-	0	1	29	0	-	-
15	Central stoneroller	0	0	-	27	13	-	0	0	-	3	3	-	0	0	-	0	-	-
16	Largescale stoneroller	1	0	-	11	5	1,000	1	0	-	15(1)	14	1,500	0	3	43	14	31	370
17	Goldfish	0	0	1	0(1)	-	-	0	0	-	1(1)	1	-	0	0	-	0(1)	-	-
17	Redside dace (W)	0	0	-	0	-	-	0	0	-	0	-	-	0	1	14	2	4	100
18	Lake chub	0	1	4	3	1	200	0	0	-	0	-	-	0	1	14	1	2	0
19	Common carp	2	4(11)	17	44(11)	21	270	0	1(10)	25	29(9)	27	250	0	1(2)	14	10(3)	22	330
20	Brassy minnow	0	2	8	14	7	600	1	1	25	0	-	100	0	0	-	0	-	-
21	Hornyhead chub	0	5	21	47	22	840	1	1	25	23(1)	22	2,300	0	4	57	15	33	280
22	Golden shiner	0	3	13	26(3)	12	870	0	0	-	6	6	-	0	2	29	1	2	-50
23	Emerald shiner	0	1	4	1(1)	t	100	0	0	-	3	3	-	0	0	-	1	2	-
23	Striped shiner (E)	1	0	-	1	t	0	0	0	-	0	-	-	0	0	-	0	-	-
24	Common shiner	5	13	54	113	54	770	2	2	50	46(1)	43	2,300	0	6	86	25(1)	56	330
25	Blackchin shiner	0	1	4	2	1	100	0	0	-	0	-	-	0	0	-	0	-	-
26	Blacknose shiner	0	1	4	16	8	1,500	0	0	-	0	-	-	0	0	-	2	4	-
27	Spottail shiner	0	2	8	1	t	-50	0	0	-	0	-	-	0	1	14	4	9	300
28	Rosyface shiner	1	0	-	0	-	-100	0	1	25	15(1)	14	1,500	0	4	57	9	20	130
28	Spotfin shiner	0	0	-	0(1)	-	-	0	0	-	0	-	-	0	0	-	0	-	-
29	Sand shiner	0	2	8	38	18	1,800	0	1	25	3	3	200	0	0	-	2	4	-
30	Mimic shiner	0	0	-	4	2	-	0	0	-	15	14	-	0	1	14	1	2	0
31	Northern redbelly dace	2	1	4	27	13	2,600	2	1	25	5	5	400	0	0	-	3(1)	7	-
32	Southern redbelly dace	1	5	21	19	9	280	1	1	25	9	8	800	0	5	71	14	31	180
32	Finescale dace	0	0	-	1	t	-	0	0	-	0	-	-	0	0	-	0	-	-
33	Bluntnose minnow	6	15	63	104	50	600	2	3	75	32	30	970	0	5	71	23(2)	51	400
34	Fathead minnow	4	13	54	74(1)	35	480	0	3	75	49(1)	46	1,600	0	3	43	14	31	370
35	Blacknose dace	5	7	29	52	25	640	2	1	25	12	11	1,100	0	0	-	13	29	-
36	Longnose dace	0	2	8	52(1)	25	2,600	0	1	25	15(1)	14	1,500	0	2	29	13	29	550

TABLE 5. *(Cont.)*

Map No.	Species	Sheboygan (30) 1900-24 No. Stn.	Sheboygan (30) 1950-73 No. Stn.	Sheboygan (30) 1950-73 Percent Total	Sheboygan (30) 1974-83 No. Stn.	Sheboygan (30) 1974-83 Percent Total	Sheboygan (30) Percent Change In Occurrence[2]	Manitowoc (40) 1900-24 No. Stn.	Manitowoc (40) 1950-73 No. Stn.	Manitowoc (40) 1950-73 Percent Total	Manitowoc (40) 1974-83 No. Stn.	Manitowoc (40) 1974-83 Percent Total	Manitowoc (40) Percent Change In Occurrence[2]	Twin (50) 1900-24 No. Stn.	Twin (50) 1950-73 No. Stn.	Twin (50) 1950-73 Percent Total	Twin (50) 1974-83 No. Stn.	Twin (50) 1974-83 Percent Total	Twin (50) Percent Change In Occurrence[2]
37	Creek chub	6	14	58	103(1)	49	640	3	2	50	33	31	1,600	0	4	57	24(1)	53	530
38	Pearl dace	1	5	21	50	24	900	1	2	50	8	7	300	0	1	14	5	11	400
-	Longnose sucker	0	0	-	0	-	-	0	0	-	0	-	-	1	0	-	0	-	-
39	White sucker	8	18(15)	75	159(18)	76	440	3	3(12)	75	72(12)	67	460	0	3(7)	43	35(4)	78	290
40	Lake chubsucker (W)	0	0(1)	-	0(1)	-	0	0	0	-	0	-	-	0	0	-	0	-	-
40	Northern hog sucker	0	0	-	1	t	-	0	0(4)	-	8	7	100	0	0	-	0	-	-
41	Silver redhorse	0	0	-	0	-	-	0	0	-	7	7	-	0	0	-	1	2	-
42	Golden redhorse	0	0	-	9	4	-	0	1	25	11(1)	10	1,100	0	1	14	11(2)	24	1,200
43	Shorthead redhorse	0	0	-	3	1	-	0	0	-	1	1	-	0	0	-	4(1)	9	-
44	Greater redhorse (W)	0	0	-	0	-	-	0	0	-	10	9	-	0	0	-	9(2)	20	-
45	Black bullhead	2	5	21	74	35	1,400	0	1	25	47(1)	44	4,700	0	1	14	12(2)	27	1,300
46	Yellow bullhead	1	1	4	20	10	1,900	0	0	-	7	7	-	0	0	-	1(1)	2	-
47	Brown bullhead	0	0	-	9	4	-	0	0	-	15	14	-	0	0	-	0	-	-
48	Channel catfish	0	0(1)	-	0(1)	-	0	0	0	-	0(1)	-	-	0	0	-	2(3)	4	-
49	Stonecat	0	1	4	29	14	2,800	0	0	-	15(1)	14	-	0	0	-	12	27	-
50	Tadpole madtom	1	0	-	1	t	0	1	0	-	4	4	300	0	0	-	2(1)	4	-
51	Trout-perch	0	0	-	1	t	-	0	0	-	4	4	-	0	0	-	0(2)	-	-
51	Banded killifish	0	0	-	1	t	-	0	0	-	0	-	-	0	1	14	0	-	-100
52	Brook stickleback	4	10(1)	42	85(4)	40	710	3	2(1)	50	28(4)	26	970	1	1	14	15	33	1,400
53	Ninespine stickleback	0	0	-	1	t	-	0	0	-	0	-	-	0	0	-	0	-	-
53	White bass	1	0	-	0	-	-100	0	0	-	0	-	-	0	0	-	0(1)	-	-
54	Rock bass	3	3	13	51	24	1,600	0	1	25	36(1)	34	3,600	0	2	29	15(1)	33	700
55	Green sunfish	3	5	21	40	19	700	0	1	25	19	18	1,800	0	0	-	4	9	-
56	Pumpkinseed	0	7	29	35(1)	17	410	0	0	-	21	20	-	0	0	-	9(1)	20	-
-	Warmouth	1	0	-	0	-	-100	0	0	-	0	-	-	0	0	-	0	-	-
57	Bluegill	1	3	13	19(1)	9	570	0	1	25	9	8	800	0	1	14	0	-	-100
58	Smallmouth bass	0	0(1)	-	2(1)	1	200	0	1(3)	25	14(2)	13	300	0	0	-	7(3)	16	-
59	Largemouth bass	1	1(10)	4	23(15)	11	250	0	0(4)	-	5(3)	5	100	0	0(3)	-	2(3)	4	67
60	Black crappie	1	3	13	27(1)	13	830	0	0	-	2	2	-	0	0	-	2	4	-
61	Iowa darter	0	0	-	15(2)	7	-	0	0	-	5	5	-	0	1	14	2	4	100
62	Fantail darter	0	1	4	0	-	-100	0	0	-	1	1	-	0	0	-	0	-	-
-	Least darter (W)	1	0	-	0	-	-100	0	0	-	0	-	-	0	0	-	0	-	-
63	Johnny darter	6	14	58	104(1)	50	650	2	3	75	51(1)	48	1,600	0	0	-	24(1)	53	-
64	Yellow perch	1	0(11)	-	23(9)	11	190	0	0(6)	-	3(5)	3	33	0	0(6)	-	3(4)	7	16
65	Logperch	1	0	-	6	3	500	0	0	-	4	4	-	0	4	57	10(1)	22	180
66	Blackside darter	0	0	-	9	4	-	1	0	-	33(1)	31	3,300	0	0	-	16(1)	36	-
67	Walleye	0	0(7)	-	3(7)	1	43	0	0(1)	-	0(1)	-	0	0	0(2)	-	0(3)	-	50
68	Mottled sculpin	2	1	4	7	3	600	0	0	-	7	7	-	0	0	-	13	29	-
69	Slimy sculpin	1	0	-	3	1	200	0	0	-	0	-	-	0	0	0	2	4	-
	No. of species	35	47		67			16	32		58			3	32		61		
	Total of Occurrences (sum of number of species taken at each station)	81	278		1,894			28	95		962			3	95		536		

*Number in parentheses indicates partial stations. They were kept separate since not all the fish from the stations were adequately keyed to species.

**t = less than 0.5%.

[1]E = Endangered, W = watch.

[2]Percent change over next most recent period in which it was taken (partial stations are included in calculations).

TABLE 6. *Number of specimens and number of stations for each species collected in the Sheboygan River basin, 1974-83.*

Common Name	No. Specimens*	No. Stations** <99	>98	"Unknown"
White sucker	5,000	154	20	3
Common shiner	4,400	92	21	
Creek chub	3,700	92	12	
Johnny darter	2,100	97	8	
Central mudminnow	2,000	65	9	2
Bluntnose minnow	2,000	98	6	
Brook stickleback	1,900	83	5	1
Fathead minnow	1,800	67	8	
Blacknose dace	1,400	46	6	
Longnose dace	1,300	49	4	
Common carp	1,200	46	7	2
Hornyhead chub	1,000	45	2	
Pearl dace	980	47	3	
Black bullhead	950	71	3	
Sand shiner	780	36	2	
Rock bass	720	48	3	
Largemouth bass	610	35	2	1
Yellow perch	590	27	2	3
Southern redbelly dace	510	16	3	
Northern redbelly dace	370	26	1	
Brook trout	340	28	1	
Northern pike	330	78		
Blacknose shiner	280	15	1	
Golden shiner	270	29		
Stonecat	230	28	1	
Brassy minnow	210	14		
Bluegill	200	19	1	
Iowa darter	190	16	1	
Yellow bullhead	190	20		
Pumpkinseed	170	36		
Brown trout	160	10		
Golden redhorse	160	9		
Alewife	150	2	1	1
Mimic shiner	150	3	1	
Green sunfish	150	40		
Central stoneroller	140	27		
Mottled sculpin	140	7		
Logperch	130	5	1	
Walleye	110	10		
Rainbow trout	88	12		
Black crappie	71	28		
Largescale stoneroller	65	11		
Lake chub	56	3		
Blackchin shiner	41	2		
Shorthead redhorse	31	3		
Brown bullhead	25	9		
Blackside darter	18	9		
Spotfin shiner	15	1		
Bloater	14	1		
Smallmouth bass	9	3		
Chinook salmon	7	6		
Northern hog sucker	7	1		
Slimy sculpin	6	3		
Tadpole madtom	5	1		
Coho salmon	4	2		
Emerald shiner	4	2		
Spottail shiner	3	1		
Banded killifish	3	1		
Stonerollers	2	1		1
Grass pickerel	2	1		
Striped shiner	2	1		
Cisco or lake herring	1	1		
Goldfish	1	1		
Finescale dace	1	1		
Channel catfish	1	1		
Trout-perch	1	1		
Ninespine stickleback	1	1		
Lake chubsucker	-			1
TOTAL	37,494	1,744	135	15

*Rounded to 2 significant figures for each species.
** <99 = 98 or fewer specimens taken/station.
>98 = 99 or more specimens taken/station.
Unknown = counts of specimens were not made.

TABLE 7. *List of species collected at 5 or fewer stations from the Sheboygan and Manitowoc river basins and at 3 or fewer stations from the Twin River basin, 1974-83.*

Sheboygan (30)	Manitowoc (40)	Twin (50)
Alewife	American brook lamprey	Sea lamprey
Cisco or lake herring	Alewife	Gizzard shad
Bloater	Lake whitefish	Coho salmon*
Coho salmon*	Pink salmon	Chinook salmon*
Grass pickerel	Chinook salmon*	Goldfish
Goldfish	Rainbow trout*	Redside dace
Lake chub	Brown trout*	Lake chub
Emerald shiner	Brook trout*	Golden shiner
Striped shiner	Central stoneroller	Emerald shiner
Blackchin shiner	Goldfish	Blacknose shiner
Spottail shiner	Emerald shiner	Sand shiner
Spotfin shiner	Sand shiner	Mimic shiner
Mimic shiner	Northern redbelly dace	Silver redhorse
Finescale dace	Shorthead redhorse	Yellow bullhead
Lake chubsucker	Channel catfish	Tadpole madtom
Northern hog sucker	Tadpole madtom	Trout-perch
Shorthead redhorse	Trout-perch	White bass
Channel catfish	White bass	Black crappie
Tadpole madtom	Black crappie	Iowa darter
Trout-perch	Iowa darter	Walleye*
Banded killifish	Fantail darter	Slimy sculpin
Ninespine stickleback	Logperch	
Smallmouth bass	Walleye	
Slimy sculpin		

*Naturally reproducing population questionable.

TABLE 8. *Fish species reported for the first time during the 1974-83 period for the Sheboygan, Manitowoc, and Twin river basins.*

Sheboygan (30)	Manitowoc (40)	Twin (50)
Bloater	American brook lamprey	American brook lamprey
Chinook salmon*	Alewife	Sea lamprey
Grass pickerel	Lake whitefish	Alewife
Central stoneroller	Pink salmon*	Gizzard shad
Goldfish	Chinook salmon*	Coho salmon*
Spotfin shiner	Brown trout*	Chinook salmon*
Mimic shiner	Brook trout*	Rainbow trout*
Finescale dace	Central stoneroller	Brook trout*
Northern hog sucker	Goldfish	Rainbow smelt
Golden redhorse	Golden shiner	Goldfish
Shorthead redhorse	Emerald shiner	Emerald shiner
Brown bullhead	Mimic shiner	Blacknose shiner
Trout-perch	Silver redhorse	Sand shiner
Banded killifish	Shorthead redhorse	Northern redbelly dace
Ninespine stickleback	Greater redhorse	Blacknose dace
Iowa darter	Yellow redhorse	Silver redhorse
Blackside darter	Brown bullhead	Shorthead redhorse
	Channel catfish	Greater redhorse
	Stonecat	Yellow bullhead
	Trout-perch	Channel catfish
	White bass	Stonecat
	Pumpkinseed	Tadpole madtom
	Black crappie	Trout-perch
	Iowa darter	White bass
	Fantail darter	Green sunfish
	Logperch	Pumpkinseed
	Mottled sculpin	Smallmouth bass
		Black crappie
		Johnny darter
		Blackside darter
		Mottled sculpin
		Slimy sculpin

*Naturally reproducing population questionable.

TABLE 9. *Fish species apparently no longer present in the Sheboygan, Manitowoc, and Twin river basins.*

Last Period Recorded	Sheboygan (30)	Manitowoc (40)	Twin (50)
1900-24	Rosyface shiner White bass Warmouth Least darter	—	Longnose sucker
1950-73	Fantail darter	Brassy minnow Bowfin	Banded killifish Bluegill

TABLE 10. *Fish species reported prior to 1925 but not collected again until 1974-83.*

Sheboygan (30)	Manitowoc (40)
Largescale stoneroller	Largescale stoneroller
Striped shiner	Tadpole madtom
Tadpole madtom	Blackside darter
Logperch	
Slimy sculpin	

TABLE 11. *Number of specimens and number of stations for each species collected in the Manitowoc River basin, 1974-83.*

Common Name	No. Specimens*	No. of Stations** <99	>98	"Unknown"
White sucker	2,500	74	9	1
Central mudminnow	1,800	52	10	2
Common shiner	1,700	35	11	1
Creek chub	1,000	28	5	
Black bullhead	1,000	43	4	1
Fathead minnow	920	47	2	1
Johnny darter	810	50	1	1
Rock bass	770	35	1	1
Brook stickleback	740	25	5	2
Bluntnose minnow	700	29	3	
Rosyface shiner	680	12	3	1
Hornyhead chub	660	20	3	1
Common carp	650	35	2	1
Blackside darter	570	33	1	
Northern pike	360	65		2
Blacknose dace	330	10	2	
Southern redbelly dace	280	6	2	
Mimic shiner	280	14	1	
Longnose dace	270	15		1
Pumpkinseed	240	21		
Silver redhorse	170	6	1	
Pearl dace	170	8		
Yellow perch	150	6	1	1
Bluegill	140	8	1	
Golden redhorse	140	11		1
Trout-perch	130	3	1	
Brown bullhead	100	15		
Mottled sculpin	100	7		
Walleye	99		1	
Greater redhorse	94	10		
Largescale stoneroller	83	16		
Northern redbelly dace	77	5		
Stonecat	77	15		1
Smallmouth bass	63	15		1
Largemouth bass	60	8		
Alewife	51	2		
Green sunfish	47	19		
Chinook salmon	46	2		
Logperch	40	4		
Channel catfish	34	1		
Brook trout	32	2		
Fantail darter	30	1		
Sand shiner	27	3		
Brown trout	24	4		
Emerald shiner	24	3		
Yellow bullhead	24	7		
Goldfish	22	2		
Rainbow trout	15	5		
American brook lamprey	14	1		
Central stoneroller	14	3		
Iowa darter	14	5		
Northern hog sucker	13	8		
Stonerollers	11	2		
Golden shiner	11	6		
Tadpole madtom	6	4		
Black crappie	2	2		
Lake whitefish	1	1		
Pink salmon	1	1		
Shorthead redhorse	1	1		
White bass	1	1		
TOTAL	18,517	872	71	20

*Round to 2 significant figures for each species.
** < 99 = 98 or fewer specimens taken/station.
> 98 = 99 or more specimens taken/station.
Unknown = counts of specimens were not made.

TWIN RIVER BASIN (50)

Species Found

Over 10,000 specimens representing 61 species were identified in samples from the Twin River basin (Tables 5 and 12). This included 2 species (redside dace and greater redhorse) on the watch list. Distribution maps for all species are presented in Appendix B.

Reproducing Populations

In the Twin River basin 55 species are believed to have reproducing populations. The presence of reproducing populations of the coho salmon, chinook salmon, rainbow trout, brown trout, brook trout, and walleye is questionable since all records can be attributed to stocking (P. Peters, pers. comm.).

Common and Rare Species

The 5 most common species (caught at the highest percentage of complete stations) were white sucker (78%), common shiner (56%), creek chub (53%), Johnny darter (53%), and bluntnose minnow (51%) (Table 5). The 5 most numerous species (most specimens caught) were white sucker (1,400), common shiner (1,100), Johnny darter (860), common carp (640), and creek chub (620) (Table 12). The bluntnose minnow was the 7th most numerous species.

Of the 21 rarest species (those caught at 3 or fewer of all the stations, Table 7), all but 5 (redside dace, blacknose shiner, trout-perch, walleye, and slimy sculpin) were also represented by the smallest total number of specimens (Table 12).

Differences Between Time Periods

Thirty-two species of fish that we collected had not been previously reported for this basin (Table 8).

Three species are apparently no longer present in the Twin River basin (Table 9). The longnose sucker was taken only before 1924, and the banded killifish and bluegill were most recently collected in the 1950-73 time period.

These species were apparently rare in earlier years, for they had been reported at only 1 station.

Again, one of the most important results of this study was documentation of changes in the known distribution of species within the Twin River basin in 1974-83 as compared to previous periods (Table 5). These changes ranged from decreases in the number of stations for 3 species to increases for 26 species, and no change for 2 others. The decreases ranged from 100% for 2 species to 50% for the golden shiner. The increases ranged from 16% for the yellow perch to 1,400% for the brook stickleback (average = 390%). The reasons for the increases are the same as for the other 2 basins. In 1974-83 there were 20 more streams with at least 1 complete station compared to 1950-73, and 22 more streams compared to 1900-24 (Table 2). When the total number of complete stations sampled in the 1974-83 period was compared with the 1950-73 and 1900-24 periods, there were increases of 543% and 4,400%, respectively.

Species Diversity

There were only 3 stations (8%) sampled by research personnel that had more than 20 species, 1 of which had 28 species (Fig. 4). The average number of species taken per station was 10.

DIFFERENCES BETWEEN BASINS (30, 40, 50)

Of the 67 species found in the Sheboygan River basin, 11 were not found in the Manitowoc or Twin river basins (Table 13). Of the 58 species found in the Manitowoc River basin, 3 were not captured in the other 2. Of the 61 species found in the Twin River basin 4 were not found in the Sheboygan or Manitowoc river basins.

ENDANGERED SPECIES

Only 1 species on the state's endangered species list was found in the Sheboygan River basin and none were found in the 2 other basins. Two specimens of the **striped shiner** were taken at a station on Otter Creek (Table 14 and Append. B Map 23).

TABLE 12. *Number of specimens and number of stations for each species collected in the Twin River basin, 1974-83.*

Common Name	No. Specimens*	No. of Stations** <99	>98	"Unknown"
White sucker	1,400	34	5	
Common shiner	1,100	19	7	
Johnny darter	860	22	3	
Common carp	640	7	6	
Creek chub	620	22	3	
Alewife	590		6	1
Bluntnose minnow	570	22	3	
Logperch	380	10	1	
Mottled sculpin	350	12	1	
Longnose dace	340	12	1	
Hornyhead chub	330	13	2	
Rainbow trout	300	7	2	
Blackside darter	270	16	1	
Brook stickleback	260	13	2	
Southern redbelly dace	260	14		
Black bullhead	230	14		
Rock bass	160	16		
Rainbow smelt	140	2	1	1
Central mudminnow	140	15		
Golden redhorse	130	13		
Largescale stoneroller	91	14		
Rosyface shiner	90	9		
Fathead minnow	89	14		
Greater redhorse	81	11		
Smallmouth bass	72	10		
Blacknose dace	69	13		
Northern pike	62	16		
Brown trout	55	10		
Trout-perch	48	2		
Slimy sculpin	48	2		
Pearl dace	41	5		
Northern redbelly dace	29	4		
Stonecat	29	12		
American brook lamprey	28	5		
Blacknose shiner	27	2		
Pumpkinseed	27	10		
Brook trout	25	7		
Redside dace	24	2		
Walleye	24	3		
Yellow perch	23	7		
Largemouth bass	22	5		
Sand shiner	20	2		
Shorthead redhorse	20	5		
Gizzard shad	19	3		
Lake chub	13	1		
Tadpole madtom	12	3		
Spottail shiner	11	4		
Channel catfish	11	5		
Green sunfish	11	4		
Chinook salmon	10	2		
Sea lamprey	6	2		
Black crappie	5	2		
Coho salmon	4	1		
Yellow bullhead	4	2		
Iowa darter	4	2		
Golden shiner	2	1		
Goldfish	1	1		
Emerald shiner	1	1		
Mimic shiner	1	1		
Silver redhorse	1	1		
White bass	1	1		
TOTAL	10,231	490	44	2

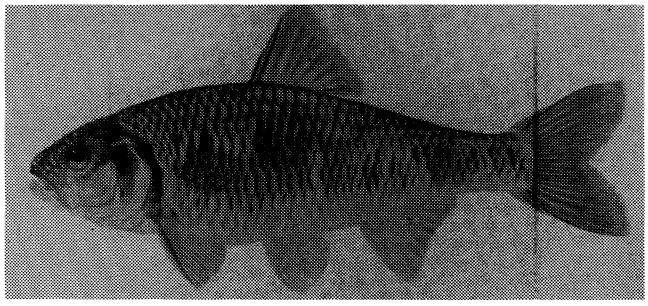
*Rounded to 2 significant figures for each species.
**<99 = 98 or fewer specimens taken/station.
>98 = 99 or more specimens taken/station.
Unknown = counts of specimens were not made.

TABLE 13. *Fish species collected in only one of the three basins, 1974-83.*

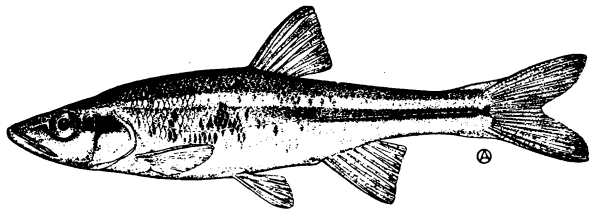
Sheboygan (30)	Manitowoc (40)	Twin (50)
Cisco or lake herring	Lake whitefish	Sea lamprey
Bloater	Pink salmon*	Gizzard shad
Grass pickerel	Fantail darter	Rainbow smelt
Brassy minnow		Redside dace
Striped shiner		
Blackchin shiner		
Spotfin shiner		
Finescale dace		
Lake chubsucker		
Banded killifish		
Ninespine stickleback		

*Naturally reproducing population questionable.

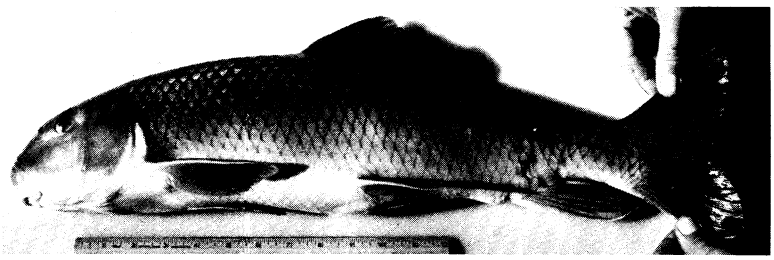
In the 3 basins, 4 watch species were collected (Table 15). The **bloater** was captured at one station near the mouth of Centerville Creek in the Sheboygan River basin (Append. B Map 5). This species rarely migrates out of the Great Lakes. The **redside dace** was captured at 2 stations in 2 streams in the Twin River basin (Append. B Map 17). Previously there was a single record from the West Twin River; however, our sampling failed to find it. The **lake chubsucker** was collected from Grass Lake in the Sheboygan River basin (Append. B Map 40). Previously, this species had been reported from Hartlaub Lake in this same basin. The **greater redhorse** was taken at 21 stations in 6 streams in the Manitowoc and Twin river basins (Append. B Map 44). There were no previous records of this species in any of these 3 basins. Habitat characteristics of the greater redhorse are shown in Table 16.



Striped shiner, an endangered species in Wisconsin, prefers small- to medium-sized rivers.



Redside dace, a species presently on the watch list, prefers clear pools in small- to medium-sized streams.



Greater redhorse, presently on the watch list, inhabits larger rivers and lakes. When this study began, it was on Wisconsin's endangered list.

TABLE 14. *Endangered species captured in the Sheboygan River basin during 1974-83 and records from stations in other Wisconsin basins since 1974.*

Species	Basin	Body of Water	County	No. Stations	No. Fish	Avg. No. Fish/Station	No. Records From Other Basins*
Striped shiner	30	Otter Creek	Sheboygan	1	2	2	12 (20,210,221)

*Basin numbers shown in parentheses (see Fig. 1).

TABLE 15. *Watch species caught in the Sheboygan (30), Manitowoc (40), and Twin (50) river basins during 1974-83 and records from stations in other Wisconsin basins since 1974.*

Species	Basin	Body of Water	County	No. Stations	No. Fish	Avg. No. Fish/Station	No. Records From Other Basins*
Bloater	30	Centerville Cr.	Manitowoc	1	14	14	2(1,3)
Redside dace	50	Francis Cr.	Manitowoc	1	16		116(90,222,223,
	50	Twin Hill Cr.	Brown	1	8	12	240,270,300)
			TOTAL	2	24		
Lake chubsucker	30	Gass L.	Manitowoc	1	—**		94(10,20,81,82, 200,210,221)
Greater redhorse	40	Manitowoc R.	Manitowoc	5	88		75(5,20,82,100,
		Branch R.	Manitowoc	4	5		110,221,240)
		South Branch Manitowoc R.	Calumet	1	1		
	50	E. Twin R.	Manitowoc	4	25		
		W. Twin R.	Manitowoc	6	52		
		Neshoto R.	Manitowoc	1	4		
			TOTAL	21	175	8	

*Basin numbers shown in parentheses (see Fig. 1).
**Unknown number taken.

TABLE 16. *Characteristics of stream habitat for the greater redhorse taken in the Manitowoc and Twin river basins, 1974-83.*

Stream Width (m)	Stream Depth (m)	Velocity	Turbidity*	Cond. (μ mhos)	Temp. (F)
5-90	0.3-2.5	moderate	slightly to moderately turbid	550-700	55-75

*Terms are defined in Fago (1984*b*).

RECOMMENDATIONS

CONTINUING USE OF FISH DISTRIBUTION DATA

The data in both the Master Fish and Master Stream and Lake Files* are available and should be used by interested persons when preparing environmental impact assessments, forming master plans, and planning future research studies.

FUTURE RESEARCH STUDIES

This series of reports on fish distribution does not deal generally with the ecological data collected since 1974. Analysis of these data should be the subject of another study. The species composition of fish communities and their relationship to the ecological data collected are two other subjects for study.

The potential integration of the data compiled by the study with data collected by other researchers on, for example, water quality, open up further areas for study and analysis.

PROTECTION OF ENDANGERED AND WATCH SPECIES AND THEIR HABITATS

Striped Shiner. Any proposed manipulation of the aquatic environment in the Otter Creek watershed where the endangered striped shiner was captured (Append. B Map 23) should recognize the presence of this population.

Redside Dace. This watch species was taken at a total of 2 stations from Francis Creek and Twin Hill Creek in the Twin River basin. Since the early 1960s this fish has only been reported from 1 other stream in the entire Lake Michigan basin (Wisconsin portion) (Append. B Map 17). The maintenance of good water quality in the stream is needed for the protection of this beautiful species.

UPDATING PRESENT RECORDS

District fish management personnel should in the course of routine surveys preserve at least 1 specimen of each endangered, threatened, and watch species they observe (except paddlefish, lake sturgeon, and American eel) and notify the Bureau of Research. Such collections will permit continuing reassessment of the endangered and threatened species list as required by law and of the watch list as well.

COMPLETION OF THIS SURVEY

Completion of the statewide survey has not been achieved due to funding reduction; only 45% of the state has been covered. When additional funds become available for investigations of endangered, threatened, and/or nongame species, high priority should be accorded to completion of the surveys in compliance with the legislative mandate.

*See section on Data Handling in this report and Fago (1984*b*) for explanation of these files.

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APPENDIX A. Supplementary Data.

TABLE 17. *List of species reported from the Sheboygan, Manitowoc, and Twin river basins by collectors other than DNR research personnel.*

Species	Sheboygan (30)		Manitowoc (40)		Twin (50)	
	1950-73	1974-83	1950-73	1974-83	1950-73	1974-83
American brook lamprey	-	-	-	-	-	1
Sea lamprey	-	-	-	-	-	1
Bowfin*	-	-	1	-	-	-
Alewife*	1,2	1	-	-	-	1
Gizzard shad	-	-	-	-	-	1
Cisco or lake herring*	1	1	-	-	-	-
Lake whitefish	-	-	-	1	-	-
Bloater	-	1	-	-	-	-
Coho salmon	-	-	-	-	-	1
Chinook salmon	-	1	-	-	-	-
Rainbow trout*	1,5	1	1	1	-	1
Brown trout*	1,5	1	-	1	1	1
Brook trout*	1	1	-	-	-	1
Rainbow smelt*	-	-	-	-	-	1
Central mudminnow*	1,3,5	1	1	1	1,3	1
Grass pickerel	-	-	-	-	-	
Northern pike*	1,5	1	1	1,2	1,3	1
Stonerollers	3,5	1	3	2	3	-
Central stoneroller	-	1	-	-	-	-
Largescale stoneroller	-	1	-	1,2	2	-
Goldfish*	-	1	-	1	-	1
Redside dace	-	-	-	-	2	-
Lake chub	3	1,2	-	-	3	-
Common carp*	1,3,5	1	1,3	1	1,3	1
Brassy minnow	3,5	1	2	-	-	-
Hornyhead chub	2,3	1	3	1,2	2	1
Golden shiner	3,5	1		2	2,3	-
Emerald shiner	2	1		1	-	-
Common shiner	2,3,5	1	3	1,2	2,3	1
Blackchin shiner	3	-	-	-	-	-
Blacknose shiner	3	1	-	-	-	-
Spottail shiner	3	1	-	-	2	1
Rosyface shiner	-	-	3	1,2	2	1
Spotfin shiner	-	1	-	-	-	-
Sand shiner	5	1	3	-	-	-
Mimic shiner	-	1	-	1	2	-
Northern redbelly dace	3	1	2	2	-	1
Southern redbelly dace	3,5	1	3	1	2,3	1
Bluntnose minnow	2,3,5	1	2,3	1,2	2,3	1
Fathead minnow	2,3,5	1,2	2,3	1,2	3	-
Blacknose dace	3,5	1	3	1	-	1
Longnose dace	5	1,2	3	1,2	2,3	1
Creek chub	3,5	1	3	1	2,3	1
Pearl dace	3,5	1	2,3	1	2	1
White sucker*	1,2,3,5	1,2	1,2,3	1	1,2,3	1
Lake chubsucker*	1	1	-	-	-	-
Northern hog sucker*	-	-	1	1	-	-
Silver redhorse	-	-	-	2	-	-
Golden redhorse	-	1	3	1	2	1
Shorthead redhorse	-	-	-	-	-	1
Greater redhorse	-	-	-	1	-	1
Black bullhead	3,5	1	3	1,2	3	1
Yellow bullhead	5	1	-	2	-	1
Brown bullhead	-	1	-	1	-	-
Channel catfish*	1	1	-	1	-	1
Stonecat	5	1	-	1	-	1
Tadpole madtom	-	-	-	1	-	1
Trout-perch*	-	-	-	-	-	1
Banded killifish	-	-	-	-	3	-
Brook stickleback*	1,3,5	1	1,2,3	1,2	3	1
Ninespine stickleback	-	1	-	-	-	-
White bass*	-	-	-	-	-	1
Rock bass	3	1	3	1,2	2	1

TABLE 17. *Continued*

Species	Sheboygan (30)		Manitowoc (40)		Twin (50)	
	1950-73	1974-83	1950-73	1974-83	1950-73	1974-83
Green sunfish	3,5	1	3	1	-	-
Pumpkinseed	3,5	1	-	1,2	-	1
Warmouth	-	-	-	-	-	-
Bluegill	3	1	3	1	3	-
Smallmouth bass*	1	1	1,3	1	-	1
Largemouth bass*	1,3	1	1	1	1	1
White crappie	-	-	-	-	-	-
Black crappie	3	1	-	-	-	-
Iowa darter	-	1	-	-	3	1
Fantail darter	5	-	-	-	-	-
Johnny darter	3,5	1	2,3	1,2	-	1
Yellow perch*	1	1	1	1	1	1
Logperch	-	-	-	-	2	1
Blackside darter	-	1	-	1	-	1
Walleye*	1	1	1	1	1	1
Mottled sculpin	5	1		1	-	1

*Records of this species collected by fish management, students, and sport and commercial fishermen are based upon their identification.

KEY TO COLLECTOR'S CODE

1 = All Fish Management collectors
2 = Dr. George Becker and his students
3 = Professor Marlin Johnson and his students
[4 = Dr. George Seeburger and his students]
5 = Milwaukee Public Museum
[6 = UW-Madison students]
[7 = Commercial fishermen]
[8 = Sport fishermen]
[9 = Upper Mississippi River Conservation Commission (UMRCC)]
[10 = N.U.S. Corporation, Pittsburgh, PA]
[11 = U.S. Fish and Wildlife]
[12 = Dr. Carroll Norden and his students]
[13 = Dr. Omar Amin and his students]
[14 = ENCAP, Inc., Dekalb, IL]
[15 = Bio Test, Inc., Chicago, IL]

[ ] = Collector not used in this report.

DEPARTMENT OF NATURAL RESOURCES

FISH OR STREAM DATA INPUT

FORM 8100-58 REV. 4-81

1 ADD
2 CHANGE
3 DELETE

☐ SEQUENCE ___ ___ ___ ___ ___ ___ ___ ☐ F OR S

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 ___ 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 ___

BOTTOM TYPES ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

AQUATIC VEG. ___ ___ ___ ___ ___ ___ ___ ___

STRM. BANK VEG. ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

FISH SPECIES

1) ___ ___ ___ ___ ___ 2) ___ ___ ___ ___ ___ 3) ___ ___ ___ ___ ___ 4) ___ ___ ___ ___ ___
5) ___ ___ ___ ___ ___ 6) ___ ___ ___ ___ ___ 7) ___ ___ ___ ___ ___ 8) ___ ___ ___ ___ ___
9) ___ ___ ___ ___ ___ 10) ___ ___ ___ ___ ___ 11) ___ ___ ___ ___ ___ 12) ___ ___ ___ ___ ___
13) ___ ___ ___ ___ ___ 14) ___ ___ ___ ___ ___ 15) ___ ___ ___ ___ ___ 16) ___ ___ ___ ___ ___

MORE DATA ON BACK: ☐ YES

FISH ONLY

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) ___ ___ ___ ___ ___

***FIGURE 5.* Example of field collection form (8100-46).**

```
MINOR=223SELECTION=223                                    SOURCE=NOT 40 81 94 95 99        MILE ON                    PAGE  43
MIN. MONTH =      MAX. MONTH =      MIN. YEAR = 1950  MAX. YEAR = 1973   COUNTY = OR < 72

X12   JOHNNY DARTER                                      ETHEOSTOMA NIGRUM                                  DATE RUN 11/09/83

                ----------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                                                  139.1  PECATONICA R                  2  2 46 5    6/27/60  2N 3E12SESE33
2 223 1434.8R  156.9L                                                  182.4  PECATONICA R -MIFFLIN         2 11 46 5    8/15/62  5N 1E27SESE25
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   72.8R    27.OR                                   1.8E TWIN GROVE BR                 2    61 5   10/20/64  1N 8E29NWNE23
2 223 1434.8R  156.9L  102.8R    13.8Y                                   1.3  BUCKSKIN SCHOOL CR            2    61 5    7/ 5/65  2N 7E 5SWSW23
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                                           40.3  E BR PECATONICA R             2 27 46      6/30/60  4N 5E 4SENE25
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  105.8R   10.9L                                    .5  WHITESIDE CR                  2  3 46      6/30/60  2N 5E 3SESW33
2 223 1434.8R  156.9L  105.8R   10.9L    1.6R                            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.OR                                    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.O  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.O  UN CR                         2 27 46      6/28/60  4N 5E27NWSE33
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   44.2L    6.1R                            6.3  CONLEY LEWIS CR               2  1 61 5    8/ 1/69  6N 4E34SWNE25
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.OR                                             .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.OR                                            9.9  MINERAL POINT BR              2  3 46 5    8/15/62  4N 2E10  NE25
2 223 1434.8R  156.9L  159.OR                                           13.7  MINERAL POINT BR              2  1 46      8/ 9/62  5N 2E36SWNE25
2 223 1434.8R  156.9L  159.OR    8.8L                                    8.3  SUDAN BR                      2  4 46      8/14/62  5N 2E29SWSE25
2 223 1434.8R  156.9L  159.OR    8.8L   10.6R                             .4  PEDLER CR                     2  2 46      8/14/62  5N 2E21SWNE25
2 223 1434.8R  156.9L  172.9L                                            1.5  JONES BR                      2    45      7/11/62  4N 1E23SWSE33


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, Figure 3, used here).

MINOR=223SELECTION=223 SOURCE=NOT 40 81 94 95 99 MILE ON PAGE 50

A86006 DATE RUN 11/09/83

		NUMBER OF STATIONS	PERCENT OF TOTAL STATIONS
I21	BROWN TROUT	1	2.56
KO1	CENTRAL MUDMINNOW	4	10.26
MO5	STONEROLLERS	13	33.33
MO6	CENTRAL STONEROLLER	19	48.72
MO7	LARGESCALE STONEROLLER	4	10.26
M12	COMMON CARP	5	12.82
M14	BRASSY MINNOW	5	12.82
M19	HORNYHEAD 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
NO2	SUCKERS	1	2.56
NO4	REDHORSES	1	2.56
NO6	QUILLBACK	1	2.56
NO9	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
SO2	BLACKSTRIPE TOPMINNOW	1	2.56
UO1	BROOK STICKLEBACK	12	30.77
WO4	ROCK BASS	5	12.82
WO5	GREEN SUNFISH	6	15.38
WO8	ORANGESPOTTED SUNFISH	5	12.82
WO9	BLUEGILL	10	25.64
W11	SMALLMOUTH BASS	14	35.90
W12	LARGEMOUTH BASS	6	15.38
XO7	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
ZO1	MOTTLED SCULPIN	7	17.95

TOTAL NUMBER OF SPECIES OCCURRENCES 441

STATIONS/SD: SD-11= 0 SD-14,16= 0 SD-15,17,19= 0 SD-23-33= 0 SD-40= 0 SD-45,46= 283 SD-50= 0 SD-55,56= 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 shown in Figure 6.

```
NOV 23, 1983                FISH MASTER FILE                                                                    MILE OFF                PAGE 1
  SEQ. JAR WT  ----------O R D E R  M I L E A G E S---------                                                                        STATION LOCATION
BASIN    MBM        1       2/7      3/8      4/9      5/10     6/11      MILE  ----STREAM OR LAKE NAME----  SD G EF --DATE-- TWNRNGSECQTQTCO


2 222              1N      10E      27      SW 54                              +  SUGAR R -OXBOW                 46 5     8/ 0/63   1N10E27NWSW54

         SP=04 HY=00 UNSP=00  FISH  M20  +  005  +  S02  +  W08  +

2 222  1434.8R  156.9L      .7R     6.9R                                  2.3   E FORK RACCOON CR                 61 5    12/12/65   1N12E31NWSE54

         SP=13 HY=00 UNSP=02  FISH  M04  +  M05  +  M14  +  M28  +  M29  +  M41  +  M43  +  M45  +  M50  +
                                    N09  +  U01  +  X10  +  X12  +  X14  +  X18  +

2 222  1434.8R  156.9L      .7R     6.9R                                  2.4   E FORK RACCOON CR                 11 2 06  5/15/74   1N12E31SWNE54

         SP=15 HY=01 UNSP=01  FISH  A05  4  I21 10  L02  6  L07  1  M05  6  M12  1  M28  1  M29  1  M45 13
                                    M50  2  N09 28  W05  3  W09  1  X10 11  X12 25  X14  2  Z01  6

2 222  1434.8R  156.9L      .7R     6.9R    2.7R                          1.5   UN CR (CHAMBERLIN SPRINGS)        71 5    10/ 5/77   1N12E29SWNW54

         SP=08 HY=00 UNSP=00  FISH  M06  1  M29 27  M43 10  M48 29  M50 99  N09  3  U01  5  X12 11

2 222  1434.8R  156.9L      .7R     6.9R    2.7R                          3.8   UN CR                             11 3 06  5/15/74   1N12E21NWNW54

         SP=07 HY=00 UNSP=01  FISH  M05 99  M43 19  M46  4  M48 75  M50 53  N09 30  U01  8  X12  2

2 222  1434.8R  156.9L      .7R     6.9R                                  3.2   E FORK RACCOON CR                 11 2 05  11/ 5/75  1N12E31NENW54

         SP=17 HY=00 UNSP=01  FISH  A05  2  K01  6  L01  2  M05 33  M28  2  M45 11  M46  3  M48 20  M50 16  (006     030   0      40)
                                    N09 47  W05 10  W09  6  X07  1  X10 30  X12 25  X14  2  X18 10  Z01 27  (1 49       3  0001      )
                                                                                                            (ET F1 G2 H5 I2           )
                                                                                                            (D3 FT K4 M2 01           )

2 222  1434.8R  156.9L      .7R     6.9R                                  3.3   E FORK RACCOON CR                 61 5     6/10/65   1N12E31NENW54

         SP=07 HY=00 UNSP=01  FISH  M05  +  M28  +  M39  +  M43  +  M45  +  M50  +  N09  +  X10  +

2 222  1434.8R  156.9L      .7R     6.9R                                  7.8   E FORK RACCOON CR                 11 2 06  5/15/74   1N11E12SESW54

         SP=16 HY=00 UNSP=01  FISH  I21  2  K01  2  M05 99  M09  1  M43 99  M45 99  M46  5  M48 79  M50 99
                                    N09 99  U01 99  W05  5  W08  1  X10 99  X11 46  X12 61  Z01  2

2 222  1434.8R  156.9L      .7R                                          10.7   RACCOON CR                        11 2 06  7/ 0/74   1N11E35SENW54

         SP=19 HY=00 UNSP=01  FISH  L02  8  M05 15  M12  7  M19  6  M28 32  M36 27  M45 54  M46  6  M50  3
                                    N09 11  005  1  006 13  010  2  U01  2  W04  2  W05  2  W06  1  X12  3
                                    X14  4  X18  4

2 222  1434.8R  156.9L      .7R                                          10.7   RACCOON CR                        61 5     6/10/65   1N11E35SENW54

         SP=12 HY=00 UNSP=00  FISH  K01  +  L02  1  M39  +  M45  +  N09  +  005  +  006  +  S02  +  U01  +
                                    W05  +  X12  +  X18  +
```

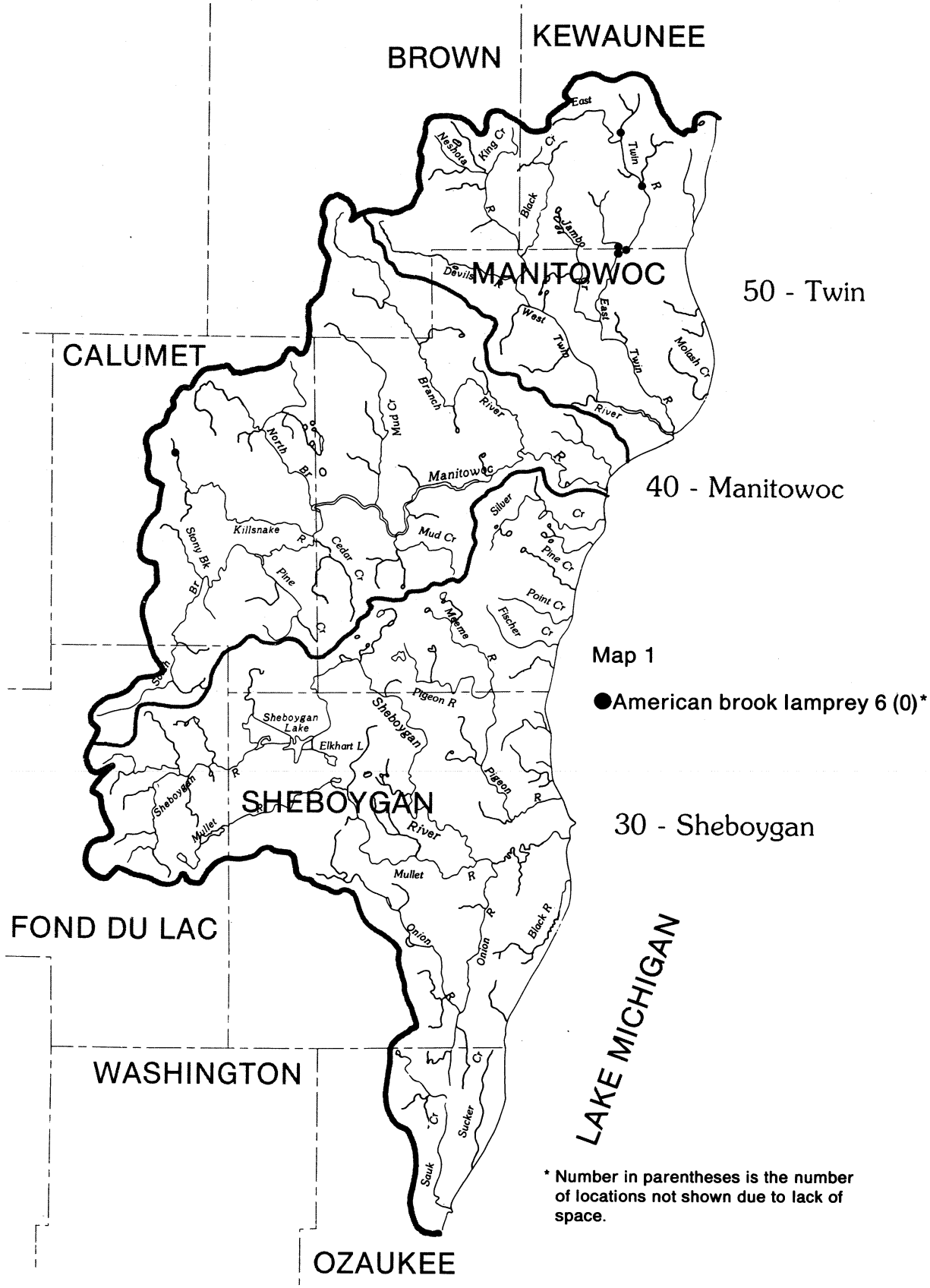
FIGURE 8. Sample page from the Master Fish File using a Mark IV program (listing method A, Figure 3, used here).

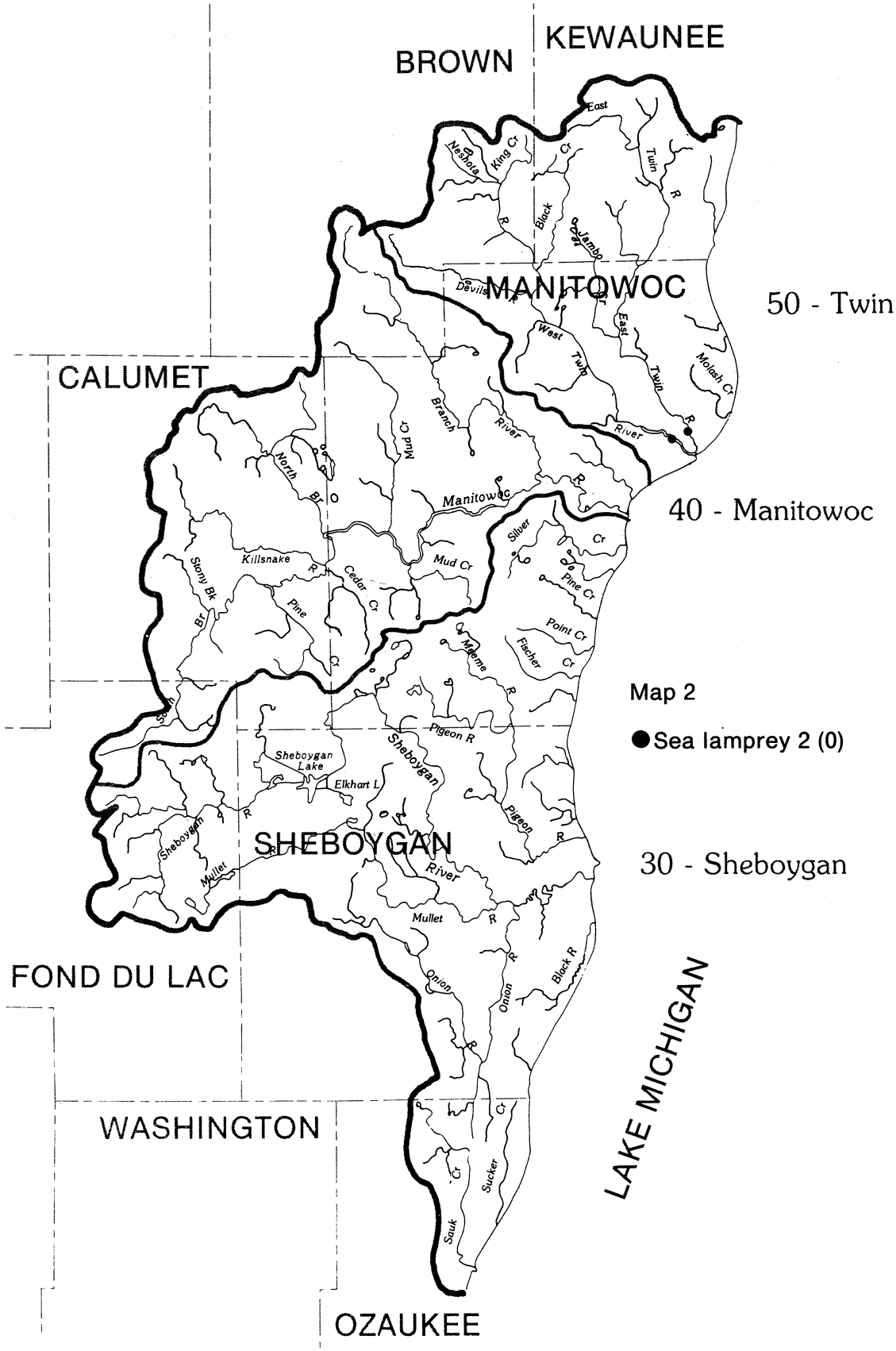
NOV 29, 1983 STREAM & LAKE FILE - MASTER PAGE 1

BASINS MAJ	MIN	MB. MI.	ORDER 1	2	3	MILEAGES 4/8	5/9	6/10	7/11	MI OR ACRES	STREAM OR LAKE NAME	D C	WL TST	TWN	RNG	SEC	QTR	QT64	CO
2	222 62640									17	GOOSE POND	0		6N	8E	13	NENE		13
2	222 62650									33	L HARRIETT	0		5N	9E	9	NWNW		13
2	222 62660									10	MORSE POND	0		6N	8E	3	SESW		13
2	222 62670									12	MORTENSON POND	0		5N	9E	26	NWSE		13
2	222 62680										SUGAR R -OXBOW	0		1N	10E	27	NWSW		54
2	222 62690									8	VERONA GRAVEL PIT #12 (EAST	0		6N	8E	22	SENW		13
2	222 62700	1434.8R	156.9L	.7R						11	RACCOON CR	2	46N		1E	22			80
2	222 62710	1434.8R	156.9L	.7R	6.9R					7	E FORK RACCOON CR	2	46N		1E	8			80
2	222 62720	1434.8R	156.9L	.7R	6.9R	1.4					E FORK RACCOON CR WI-IL BD	6		1N	12E	31	SESW		54
2	222 62730	1434.8R	156.9L	.7R	6.9R	2.7R				4	UN CR (31-3,CHAMBERLIN SPR.	2		1N	12E	31	SWNE		54
2	222 62740	1434.8R	156.9L	.7R	9.5						RACCOON CR WIS-ILL BD	6		1N	11E	35	SESE		54
2	222 62750	1434.8R	156.9L	.7R	11.4						DAM-RACCOON CR-MILLPOND			1N	11E	34	NENE		54
2	222 62760	1434.8R	156.9L	.7R	11.7R					3	UN CR	2		1N	11E	27	SWSE		54
2	222 62770	1434.8R	156.9L	.7R	11.7R	.3R				3	UN CR	2		1N	11E	27	NWSE		54
2	222 62780	1434.8R	156.9L	9.2R						76	SUGAR R	2	28N		11E	11			80
2	222 62790	1434.8R	156.9L	9.2R	10.7						SUGAR R WIS-ILL BD	6		1N	10E	36	SESW		54
2	222 62800	1434.8R	156.9L	9.2R	10.8L					9	GREEN DRAINAGE SYSTEM	2		1N	10E	36	SESW		54
2	222 62810	1434.8R	156.9L	9.2R	10.8L	6.4R				1	UN CR	2		1N	9E	25	SENE		54
2	222 62820	1434.8R	156.9L	9.2R	11.2R					3	UN DITCH	2		1N	10E	36	NWSW		54
2	222 62830	1434.8R	156.9L	9.2R	11.2R	.7R				1	UN DITCH	2		1N	10E	36	NENW		54
2	222 62840	1434.8R	156.9L	9.2R	11.7R					2	UN DITCH	2		1N	10E	35	SENE		54
2	222 62850	1434.8R	156.9L	9.2R	16.0L					6	UN DITCH	2		1N	10E	28	NESW		54
2	222 62860	1434.8R	156.9L	9.2R	18.8L						SUGAR R -W CHANNEL	2		1N	10E	20	SWNE		54
2	222 62870	1434.8R	156.9L	9.2R	18.8L	.5L				1	UN DITCH	2		1N	10E	20	SWNW		54
2	222 62880	1434.8R	156.9L	9.2R	19.8R					13	TAYLOR CR	2		1N	10E	18	SESE		54
2	222 62890	1434.8R	156.9L	9.2R	19.8R	1.8R				10	WILLOW CR (NORTH)	2		1N	10E	7	NESW		54
2	222 62900	1434.8R	156.9L	9.2R	19.8R	1.8R	6.7R			4	UN CR	2		1N	10E	11	SWNE		54

FIGURE 9. Sample page from the Master Stream and Lake File.

APPENDIX B. Distribution Maps For All Species Collected During 1974-83.

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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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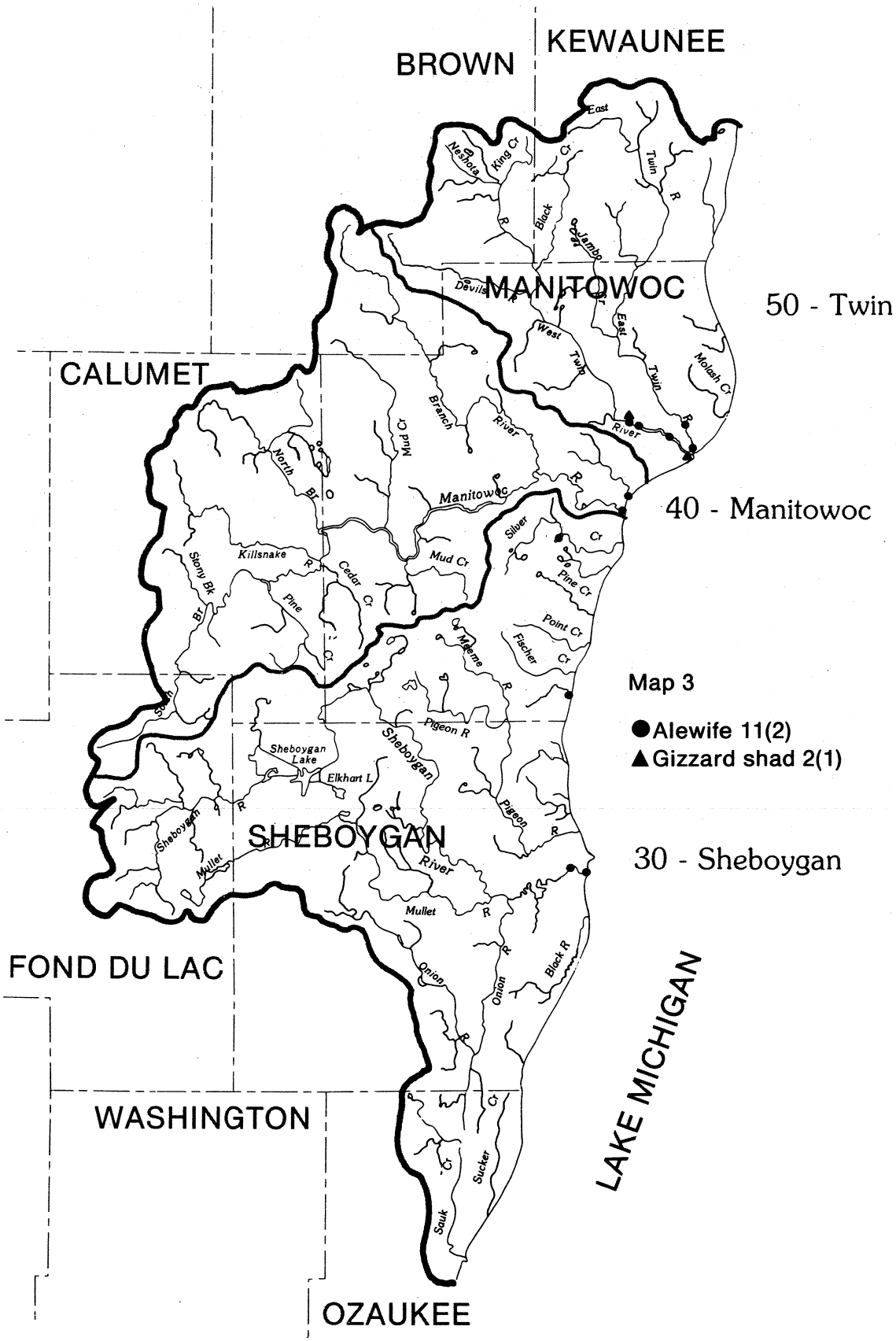
Neshota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mishe R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet R
Onion R
Onion R
Block R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 2
Sea lamprey 2 (0)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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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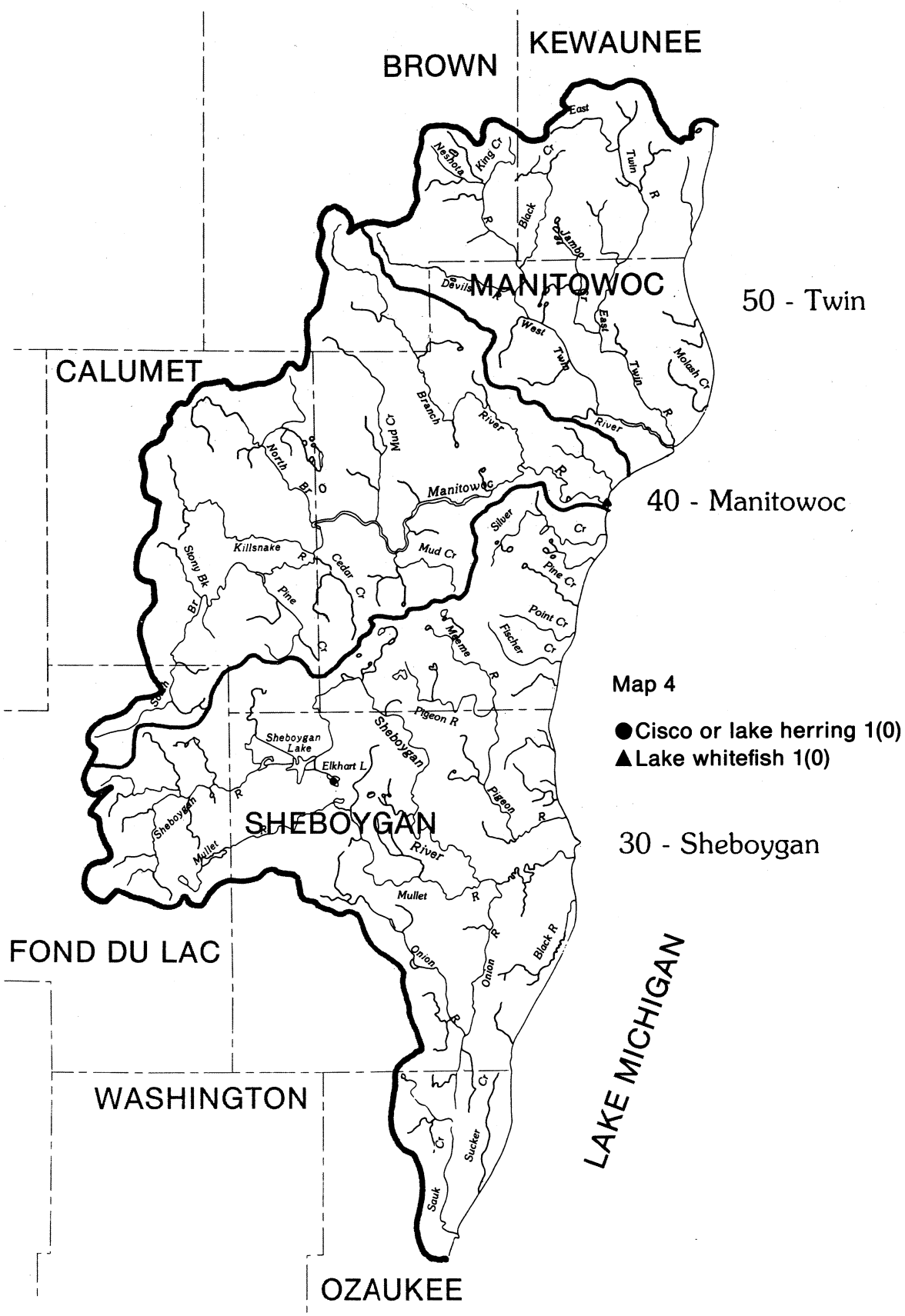
Twin R
Black R
Jambo Cr
King Cr
Nashota R
Devils R
West Twin R
East Twin R
Molash Cr
River
Branch River
Mud Cr
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Silver Cr
Point Cr
Fischer Cr
Maeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Mullet R
River
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 3
Alewife 11(2)
Gizzard shad 2(1)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WASHINGTON
OZAUKEE
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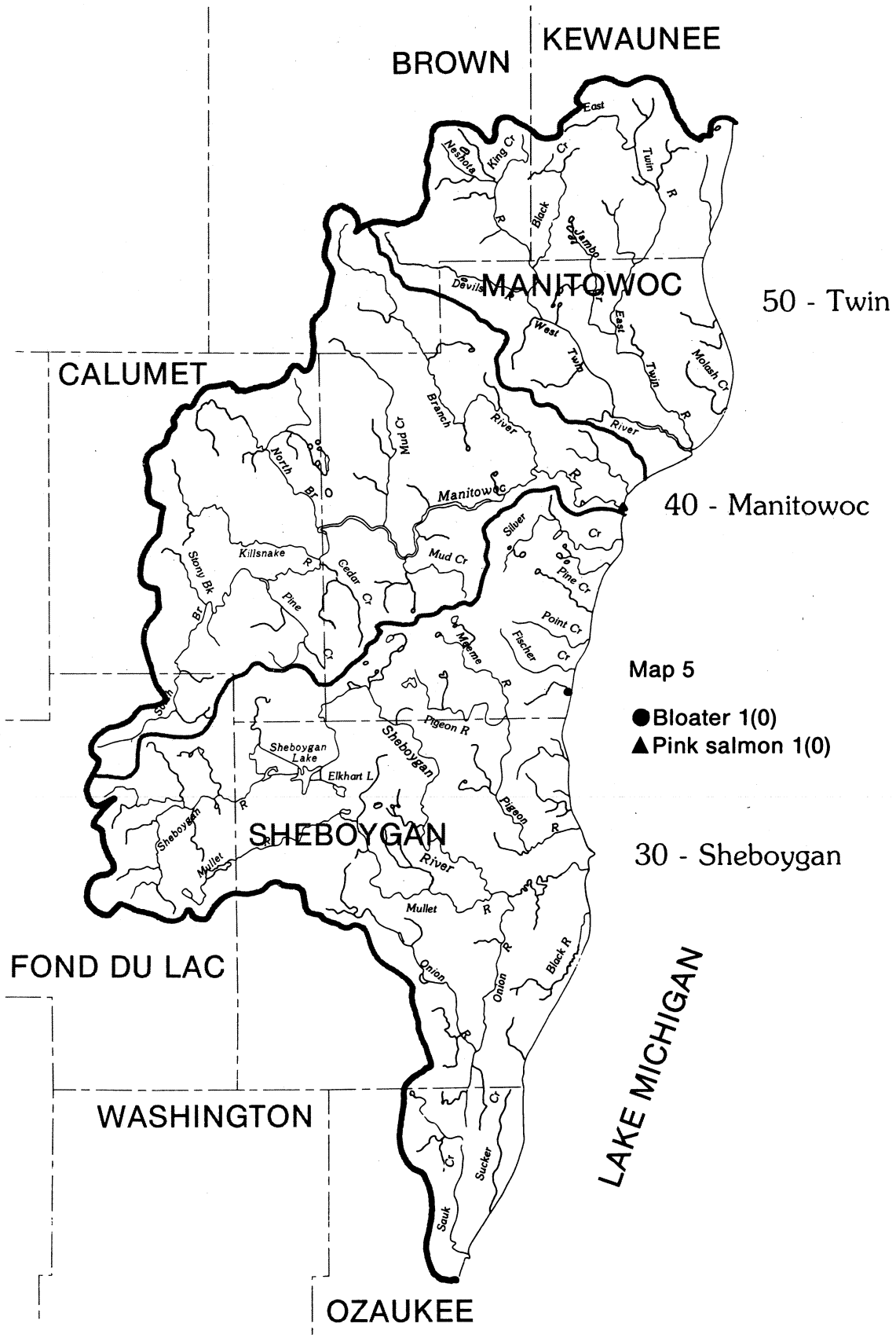
Twin R
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc R
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Mullet R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
River
Mullet R
Onion R
Onion R
Black R
Cr
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 4
●Cisco or lake herring 1(0)
▲Lake whitefish 1(0)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Jambo Cr
Devils R
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Branch River
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Pine Cr
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Silver Cr
Pine Cr
Point Cr
Fischer Cr
Manitowoc R
Pigeon R
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Sheboygan Lake
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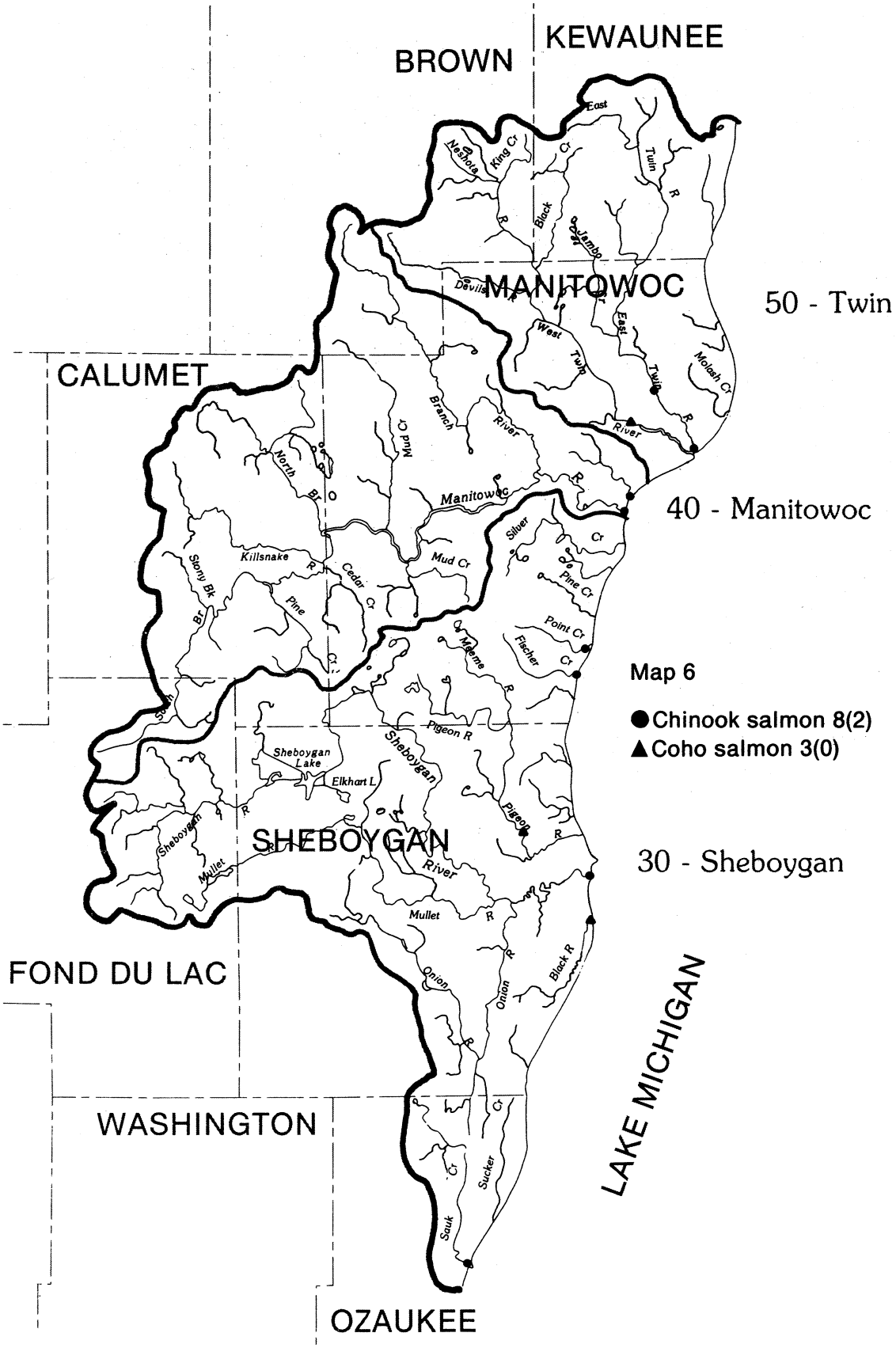
Sheboygan R
Mullet R
Pigeon R
Sheboygan River
Mullet R
Onion R
Onion R
Black R
Cr
Sucker Cr
Sauk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 5
●Bloater 1(0)
▲Pink salmon 1(0)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Jambo Cr
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Silver Cr
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Fischer Cr
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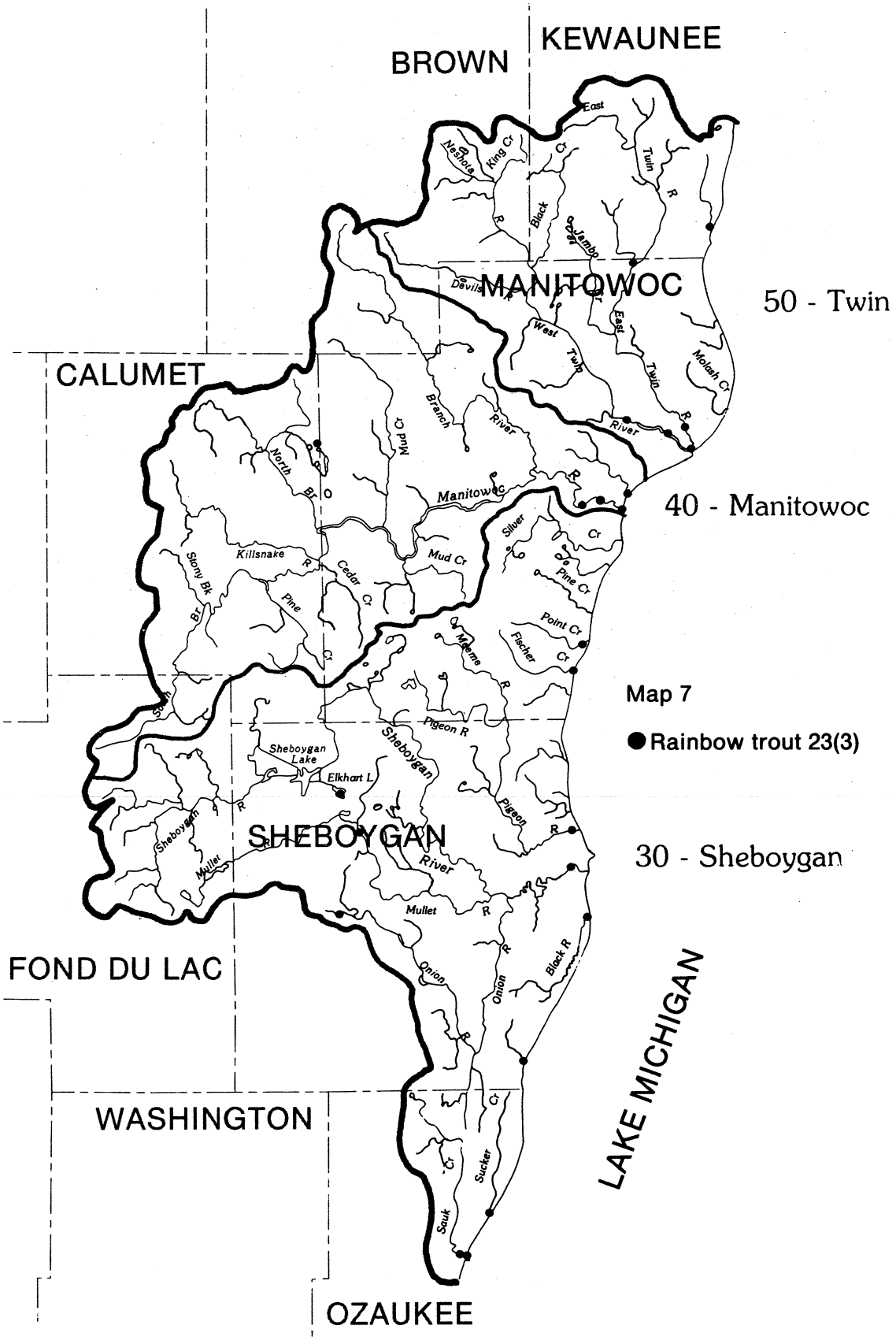
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet River
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 6
● Chinook salmon 8(2)
▲ Coho salmon 3(0)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Black R
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Devils R
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East Twin R
Molash Cr
Mud Cr
Branch River
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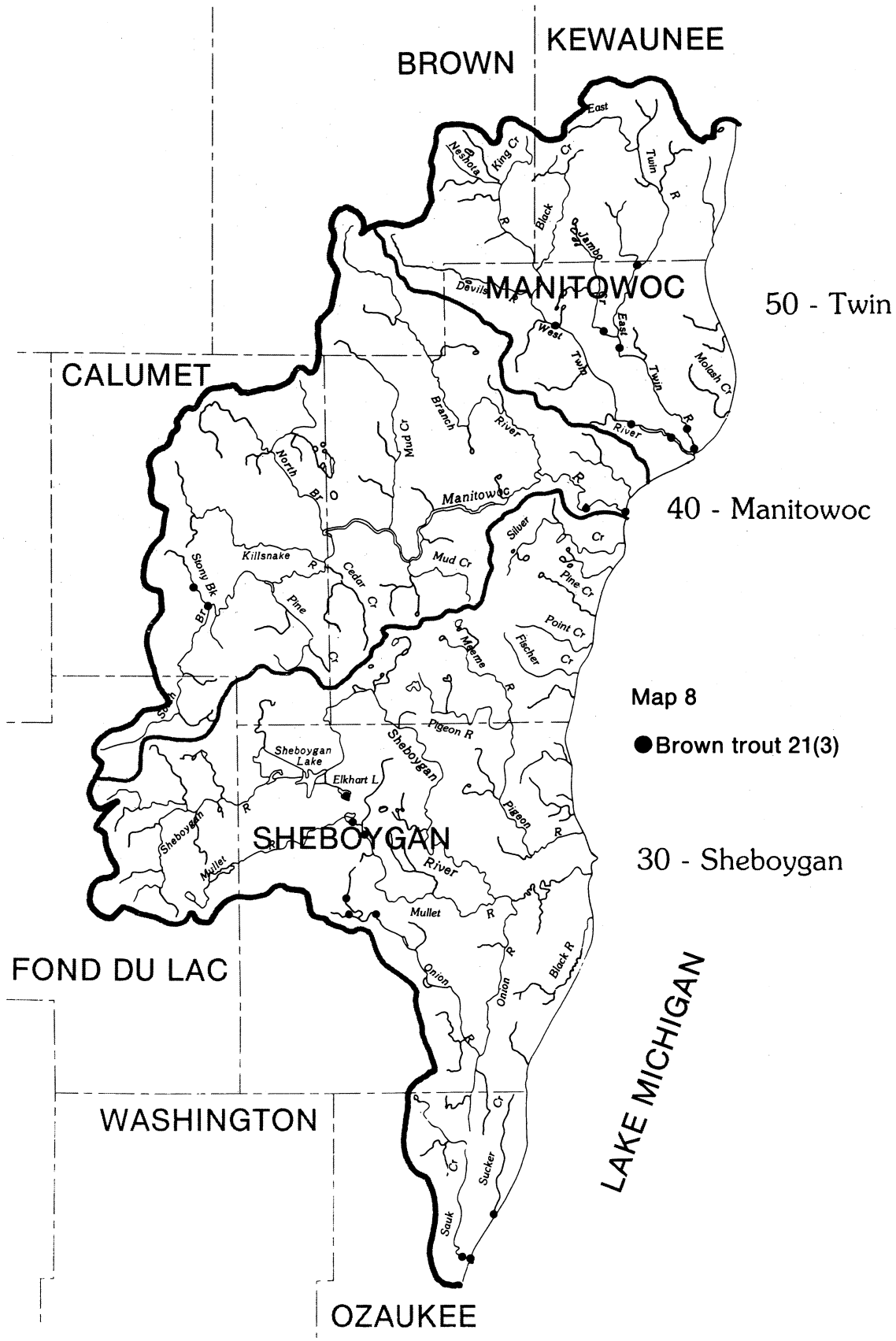
Stony Bk Br
Cedar Cr
Pine Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Meme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Mullet R
Sheboygan River
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 7
Rainbow trout 23(3)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King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
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Killsnake R
Stony Bk
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Pine Cr
Point Cr
Fischer Cr
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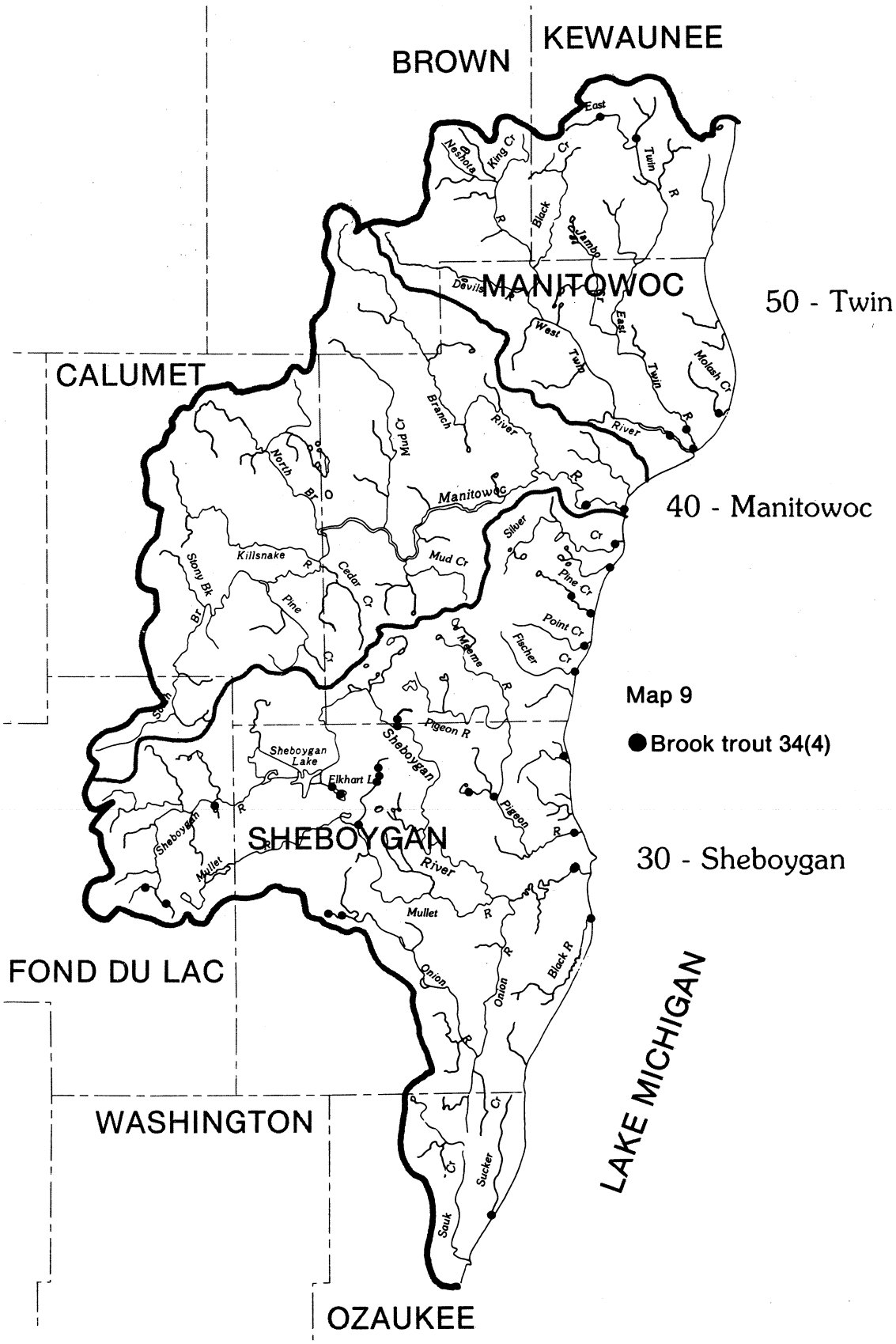
Mullet R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan R
Mullet R
Pigeon R
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 8
Brown trout 21(3)



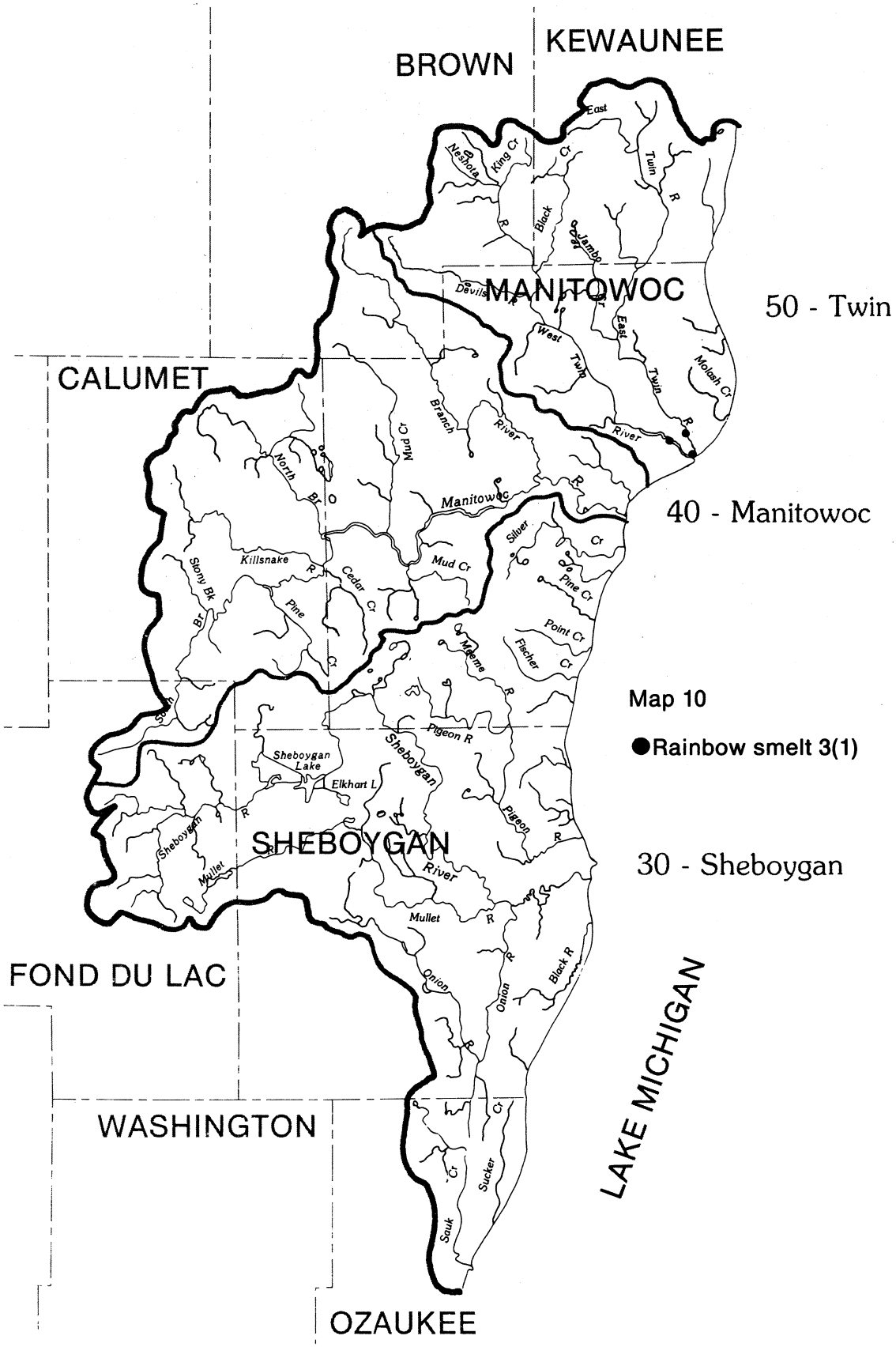
50 - Twin

40 - Manitowoc

30 - Sheboygan

Map 9

● Brook trout 34(4)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Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Point Cr
Fischer Cr
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Pigeon R
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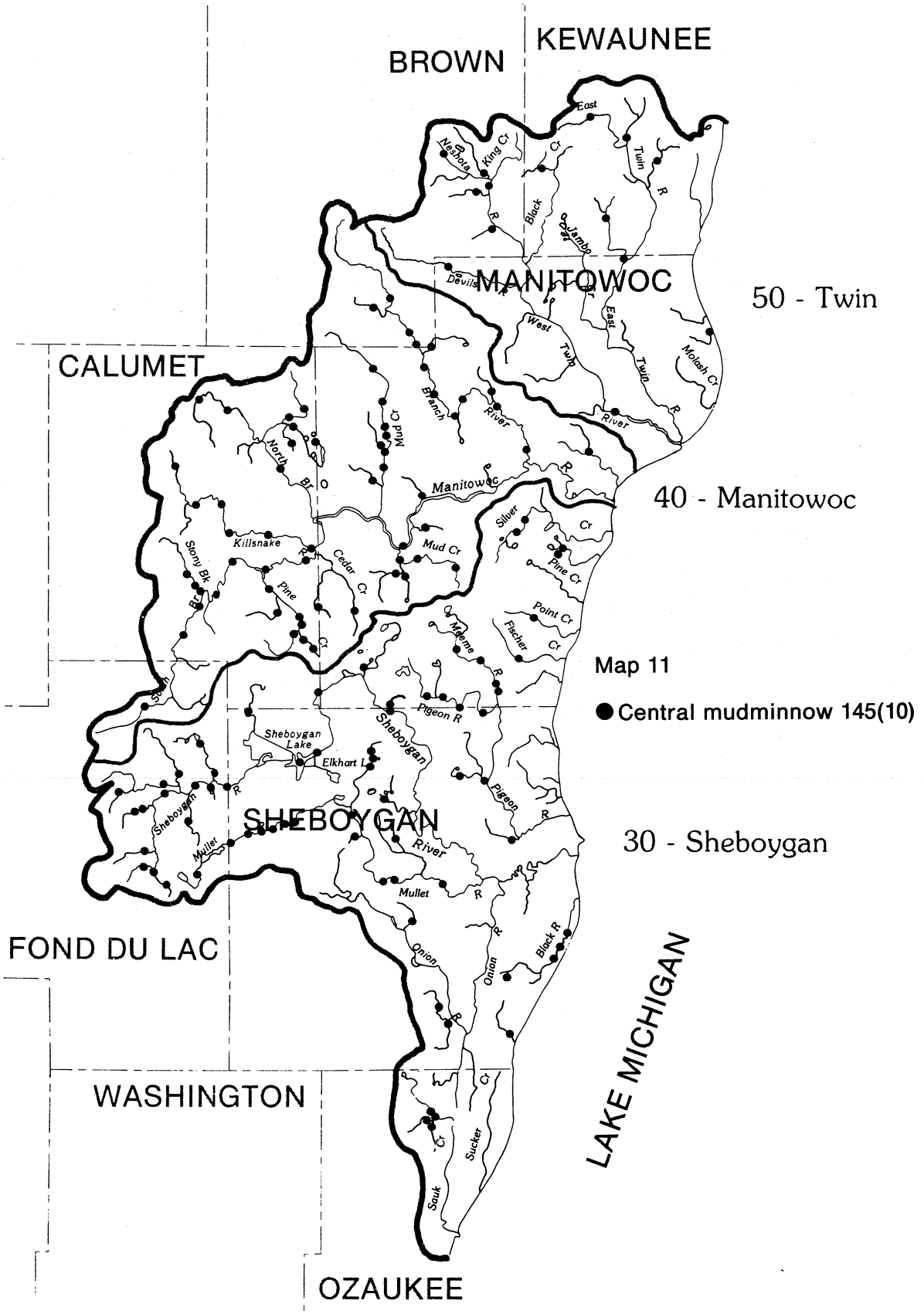
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet R
Onion R
Onion R
Black R
Cr
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 10
●Rainbow smelt 3(1)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Mullet R
Onion R
Black R
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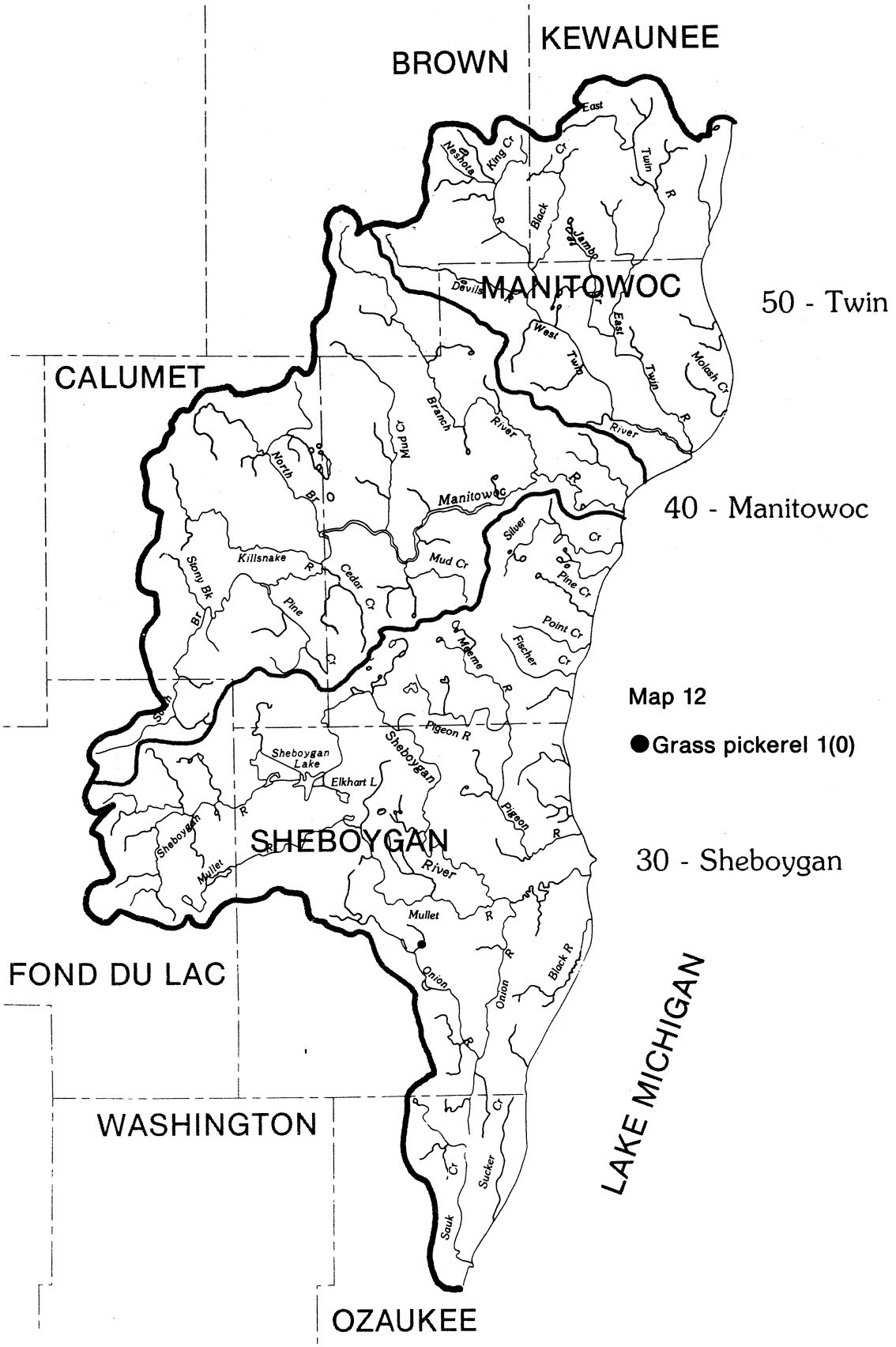
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 11
● Central mudminnow 145(10)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Elkhart L
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Sheboygan River
Mullet R
Onion R
Black R
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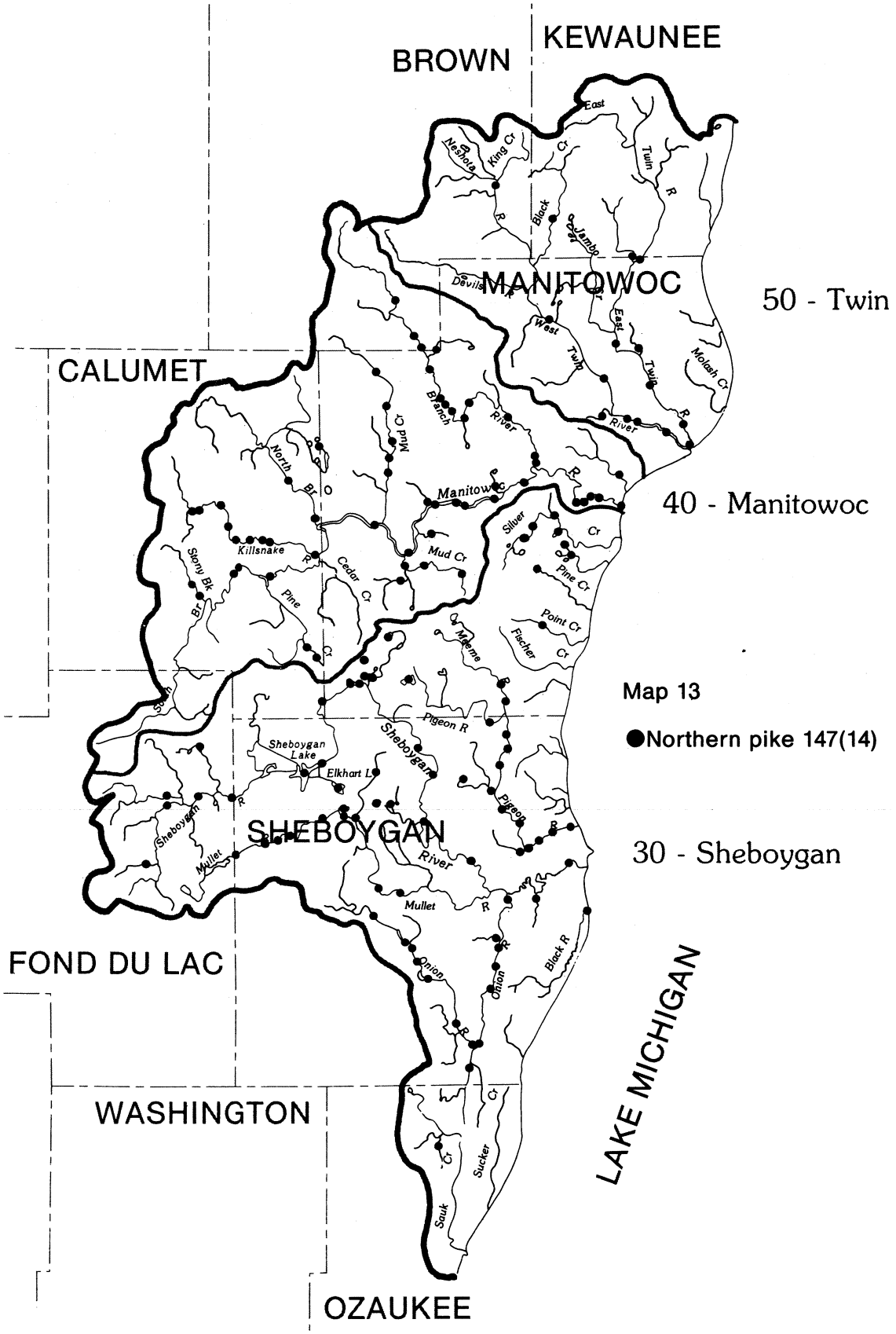
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 12
Grass pickerel 1(0)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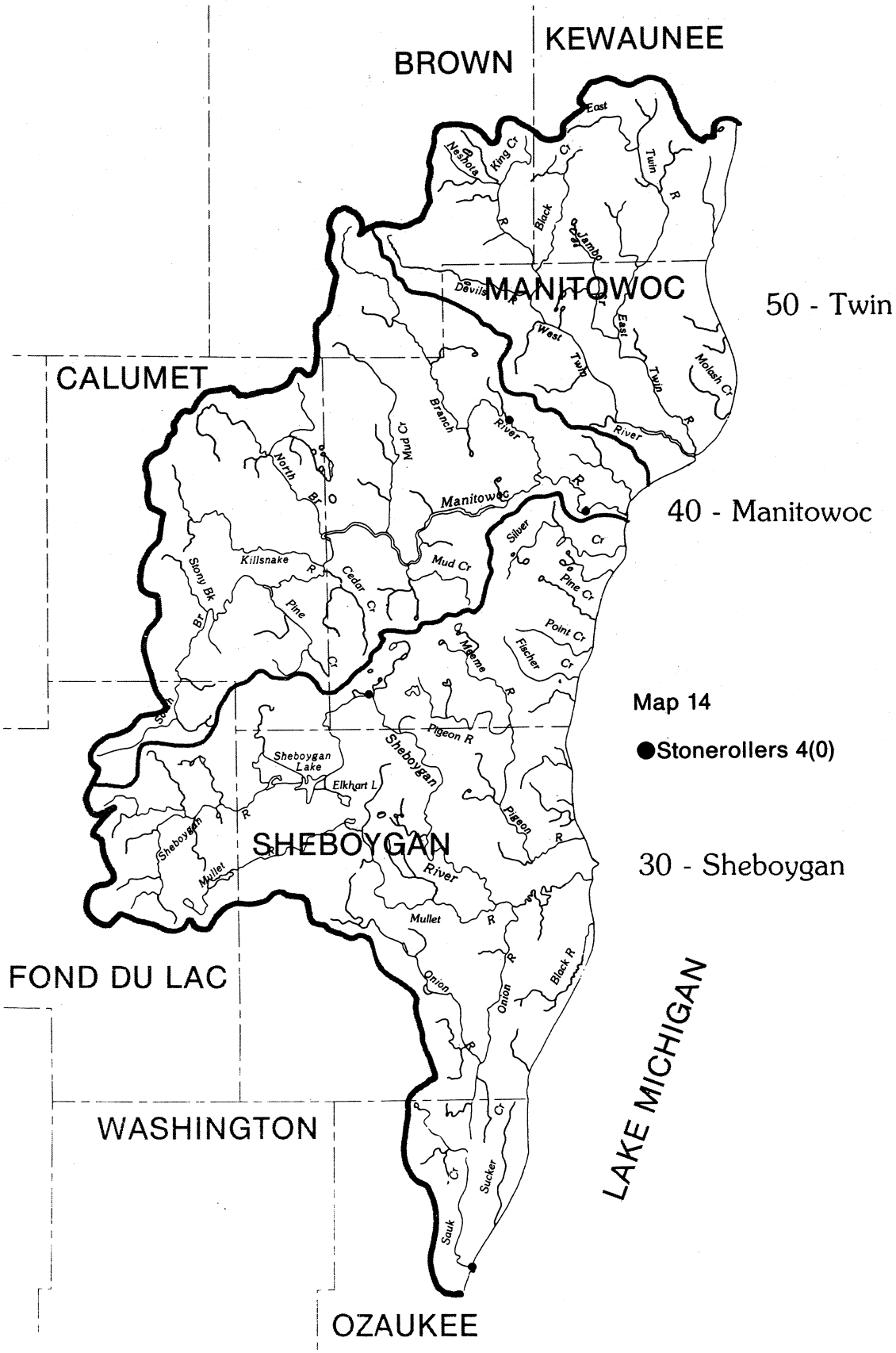
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Mullet River
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 13
Northern pike 147(14)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Killsnake R
Stony Bk Br
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Cedar Cr
Mud Cr
Point Cr
Fischer Cr
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Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan River
Mullet R
Mullet River
Pigeon R
Onion R
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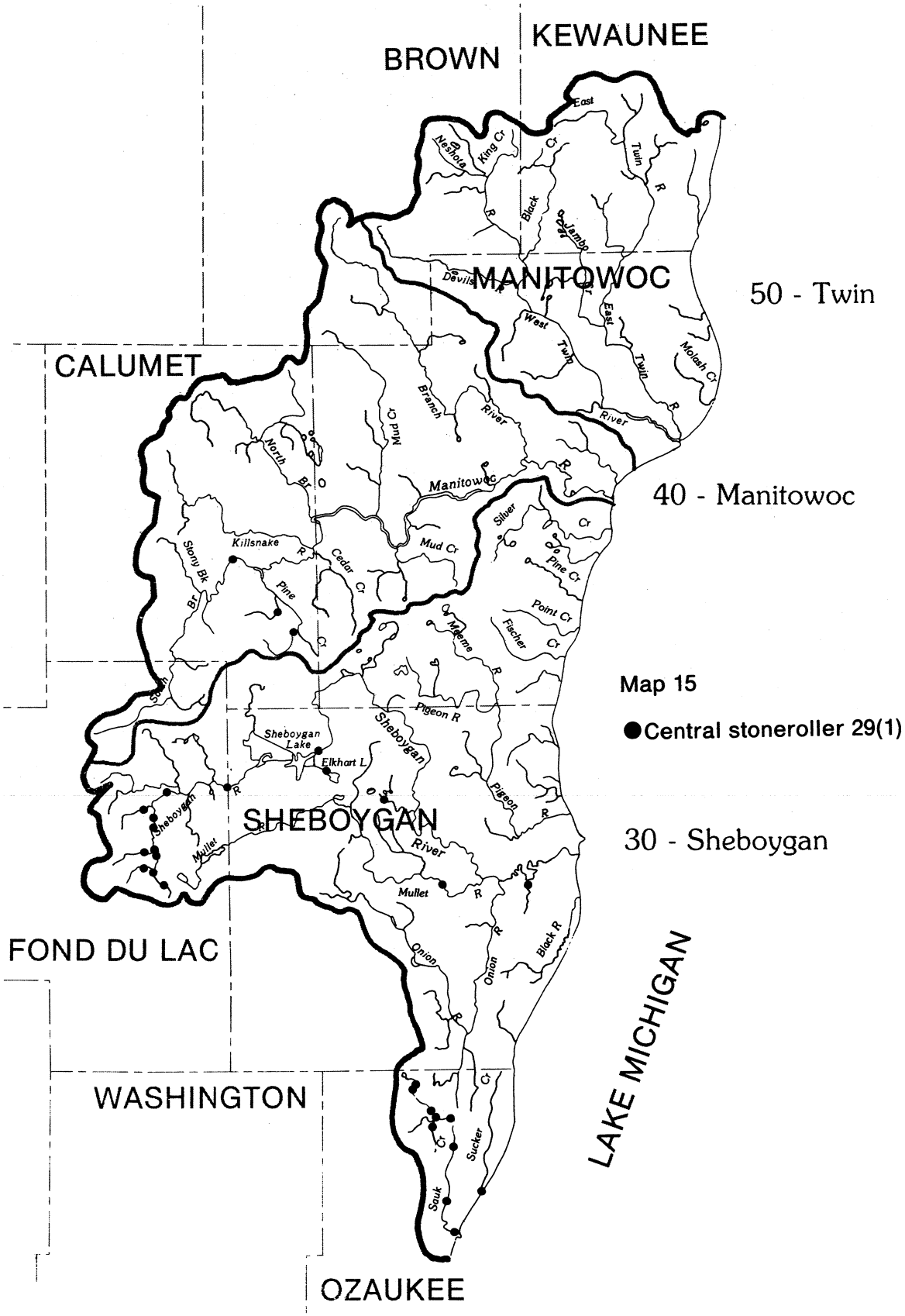
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 14
●Stonerollers 4(0)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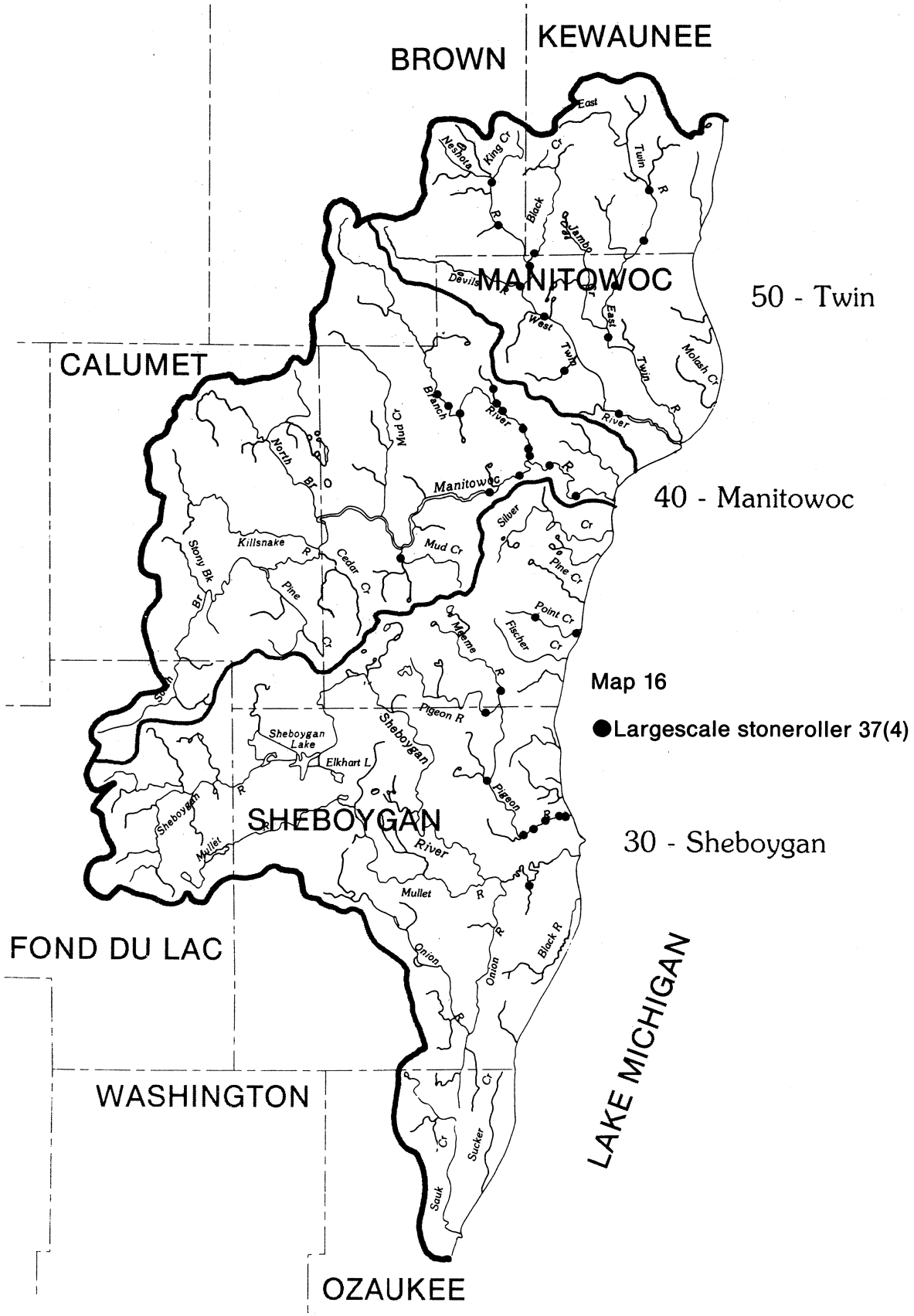
Branch River
River
North Br
Manitowoc R
Manitowoc
Silver Cr
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Pine Cr
Point Cr
Fischer Cr
Mullet R
South Br
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Pigeon R
Mullet River
Onion R
Onion R
Black R
Sucker Cr
South Br
50 - Twin
40 - Manitowoc
Map 15
●Central stoneroller 29(1)
30 - Sheboygan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OZAUKEE
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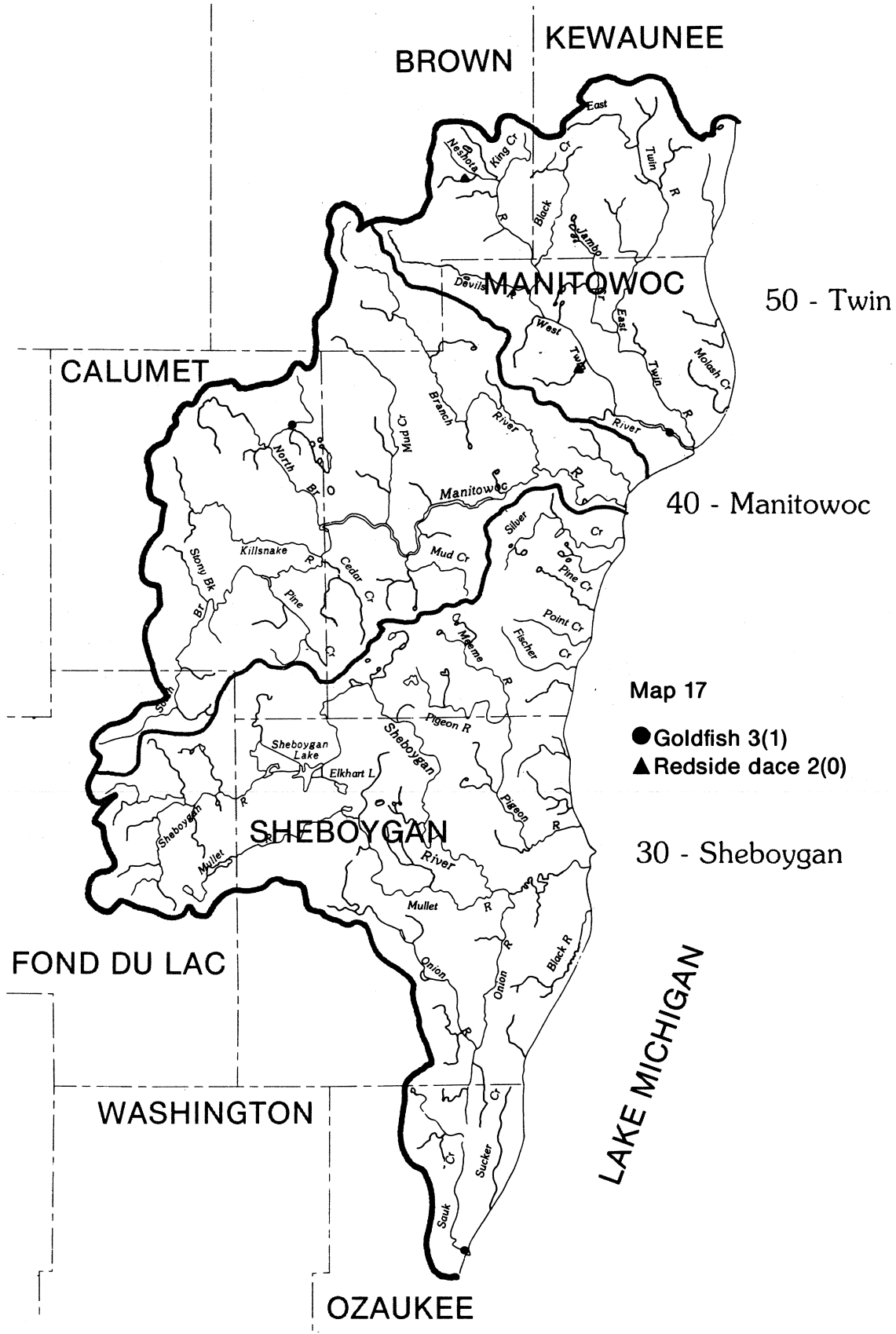
Neshota
King Cr
Black R
Devils
West
Twin R
East
Twin R
Molash Cr
Branch
River
Mud Cr
North Br
Manitowoc
Silver
Cr
Pine Cr
Point Cr
Fischer
Cr
Killsnake R
Cedar Cr
Mud Cr
Stony Bk Br
Pine Cr
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan
Pigeon R
Sheboygan R
Mullet R
River
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Cr
Souk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 16
●Largescale stoneroller 37(4)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MANITOWOC
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FOND DU LAC
WASHINGTON
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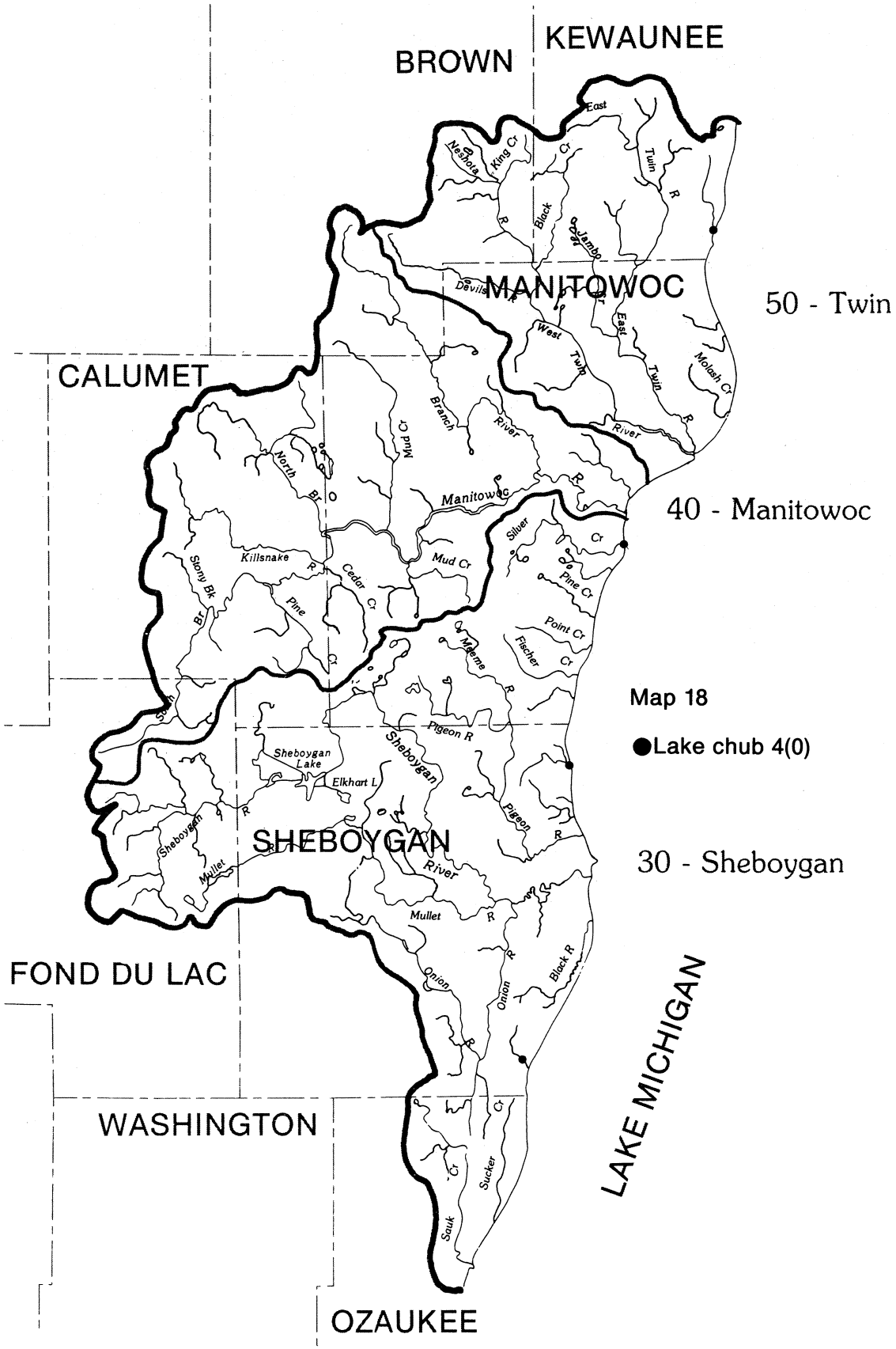
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Point Cr
Fischer Cr
Pine Cr
Mullet R
Sheboygan R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan River
Mullet R
Onion R
Black R
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 17
● Goldfish 3(1)
▲ Redside dace 2(0)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KEWAUNEE
MANITOWOC
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WASHINGTON
OZAUKEE
LAKE MICHIGAN
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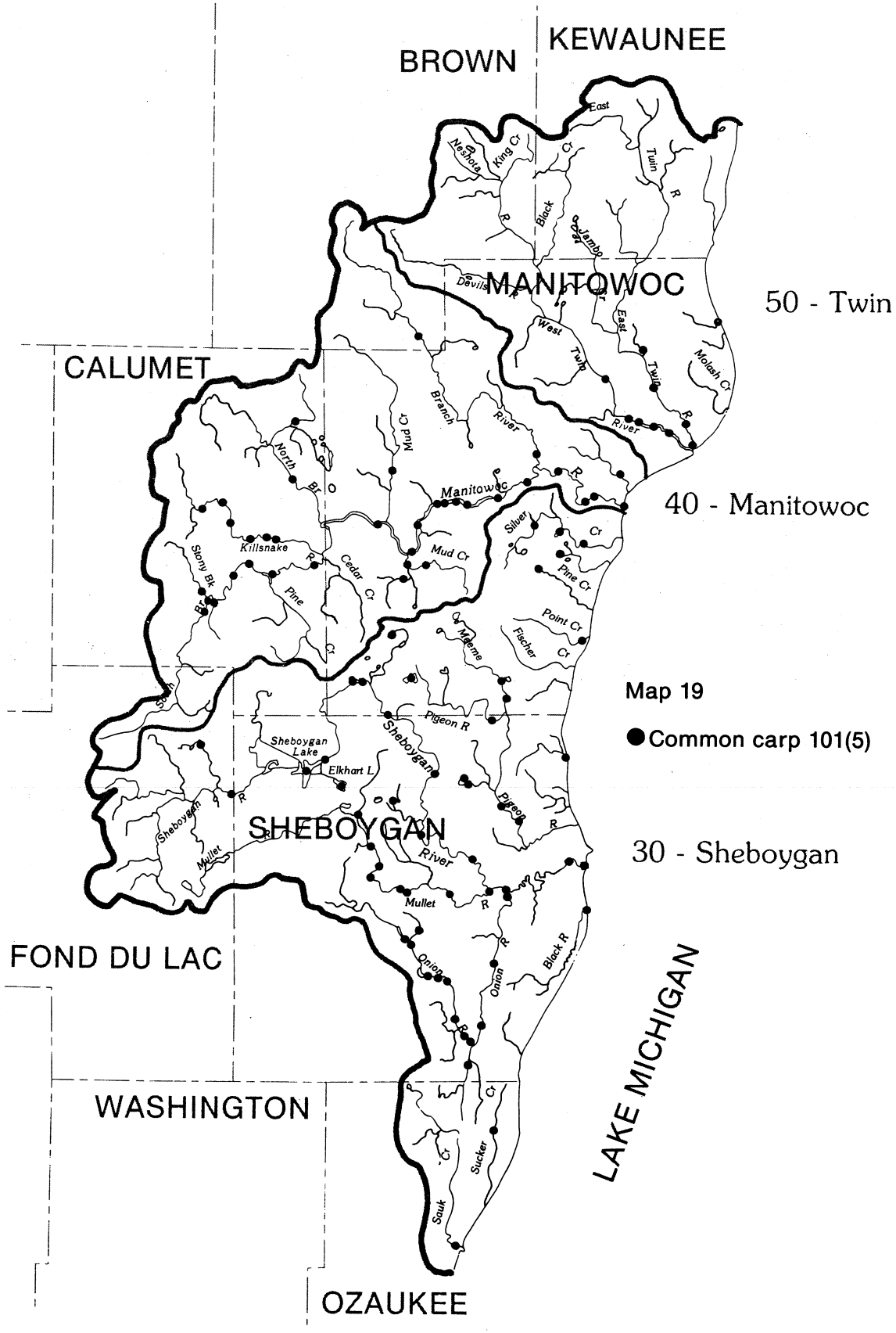
Neshota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mink Cr
Branch River
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Pine Cr
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 18
●Lake chub 4(0)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CALUMET
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SHEBOYGAN
LAKE MICHIGAN
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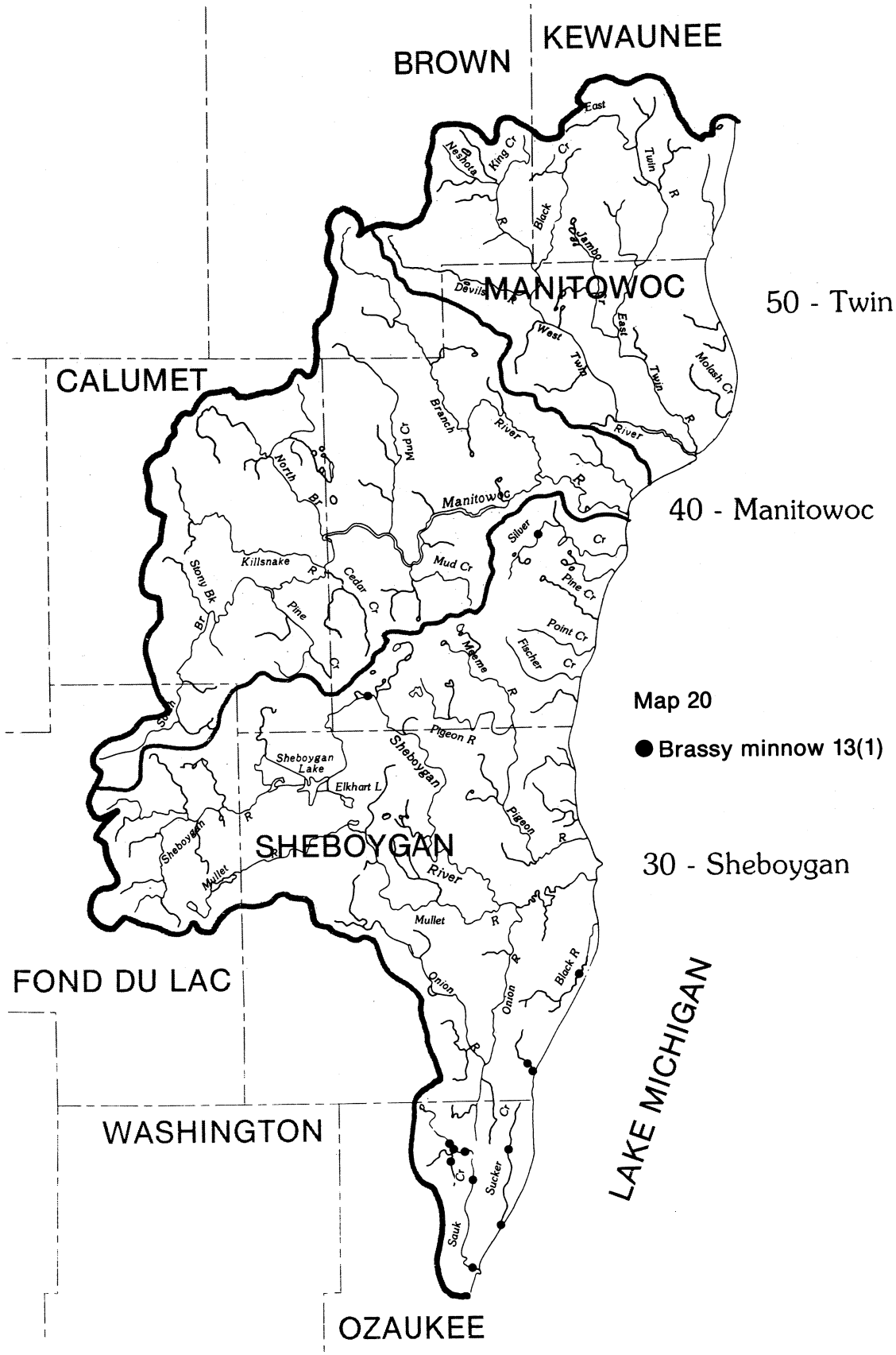
Neshota R
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk
Cedar Cr
Pine Cr
Mud Cr
Pine Cr
Point Cr
Fischer Cr
Meeme
South Br
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan River
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 19
Common carp 101(5)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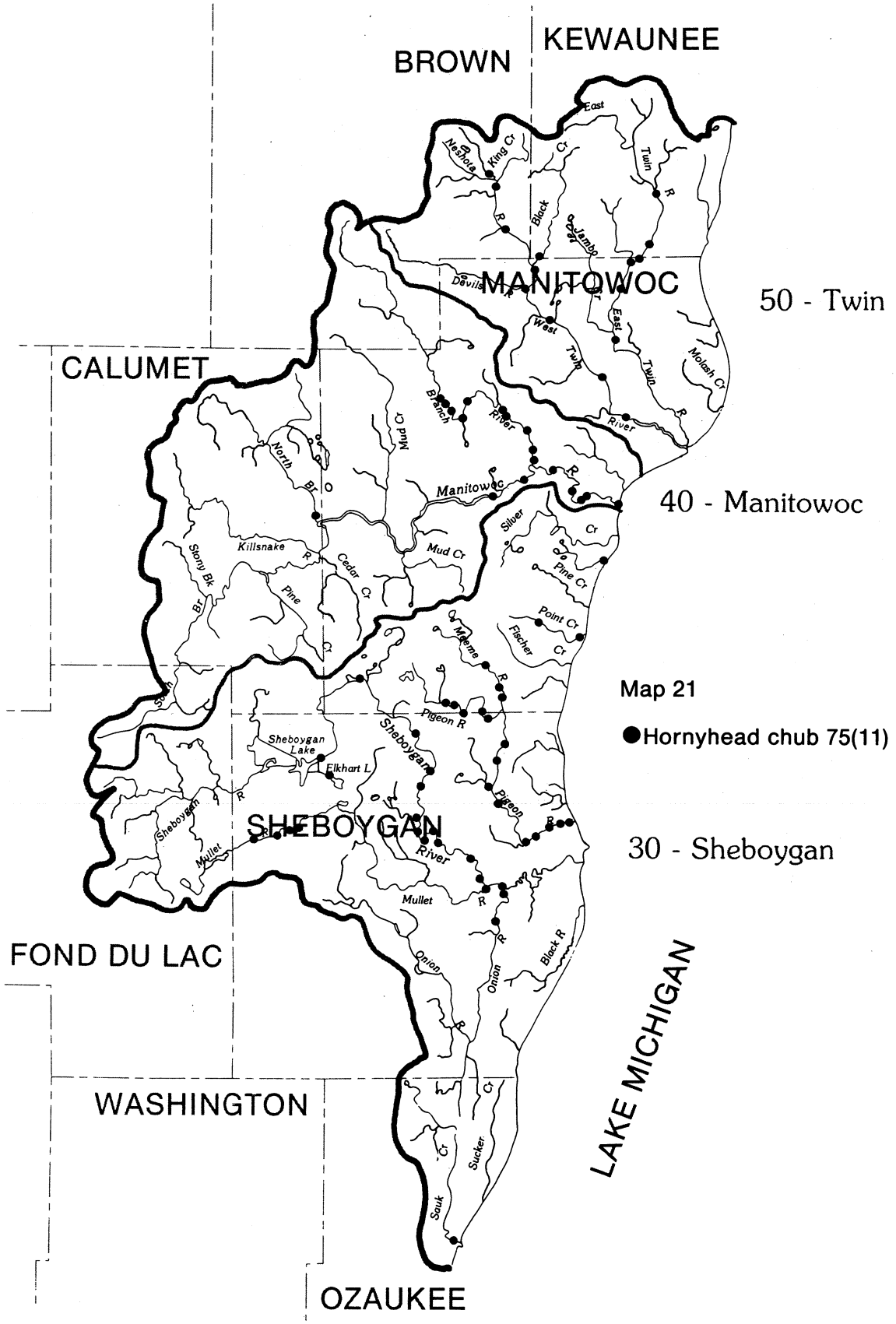
Black R
Jambo Cr
Devils Cr
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Meeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan River
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 20
Brassy minnow 13(1)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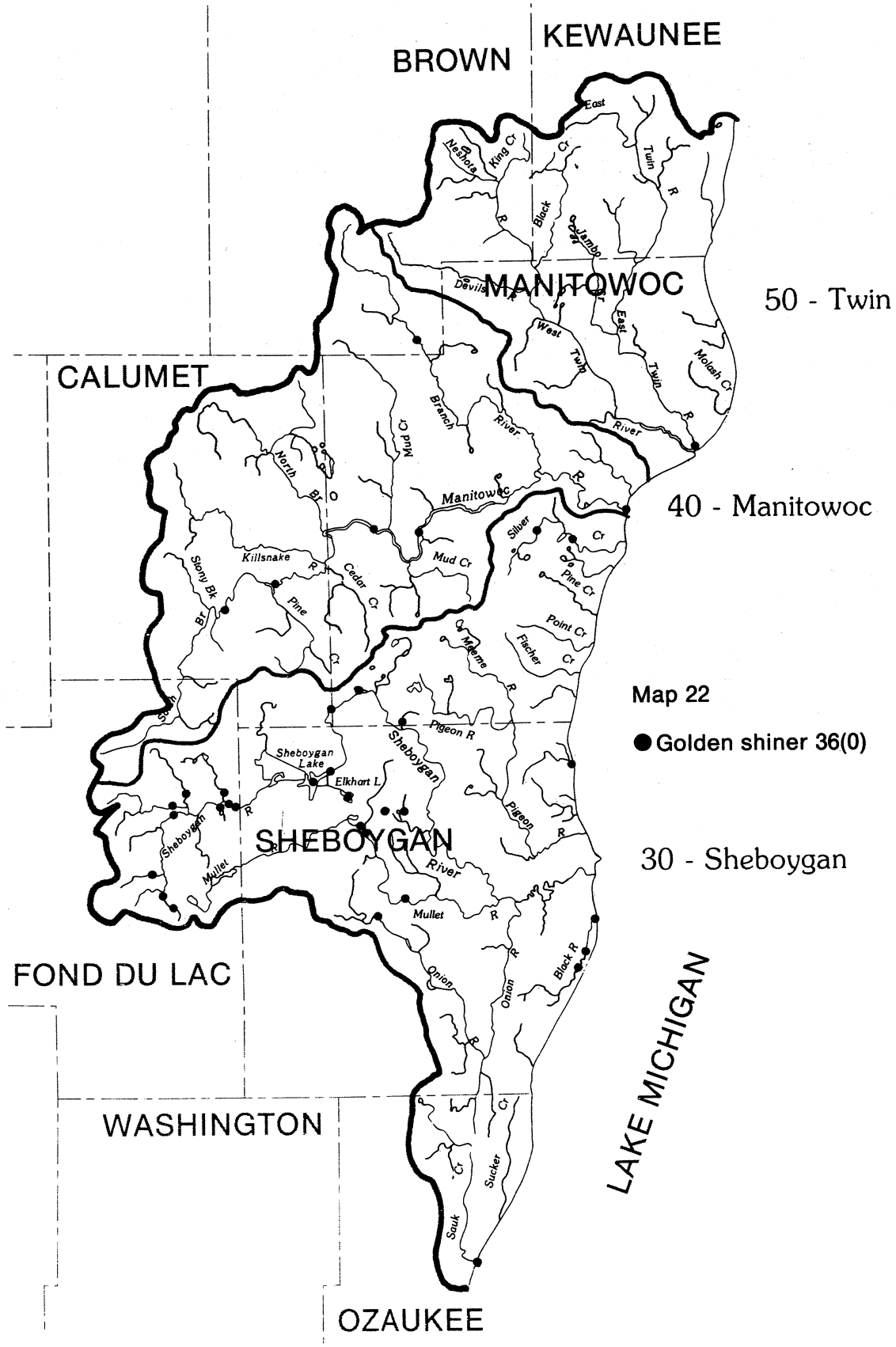
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Meeme R
South Br
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet R
Onion R
Onion R
Black R
Sauk Cr
Sucker Cr
50 - Twin
40 - Manitowoc
Map 21
Hornyhead chub 75(11)
30 - Sheboygan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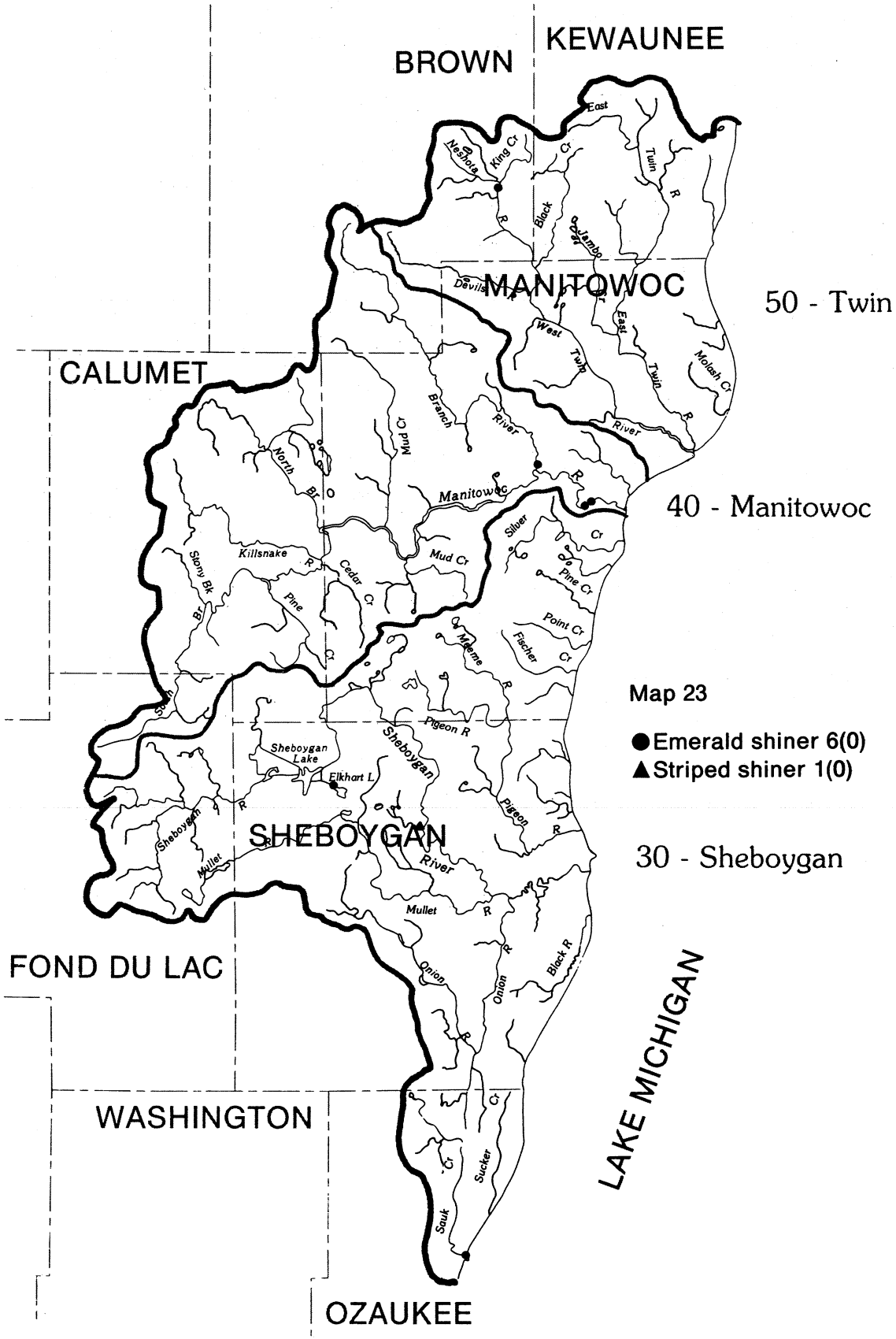
Black R
Jambo
King Cr
Nashota
Devils
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc R
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mullet R
Killsnake R
Stony Bk
Pine Cr
Cedar Cr
Mud Cr
Sheboygan R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan
Pigeon R
Sheboygan R
Mullet
River
Mullet R
Onion R
Onion R
Black R
Cr
Sucker Cr
Souk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 22
● Golden shiner 36(0)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CALUMET
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WASHINGTON
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LAKE MICHIGAN
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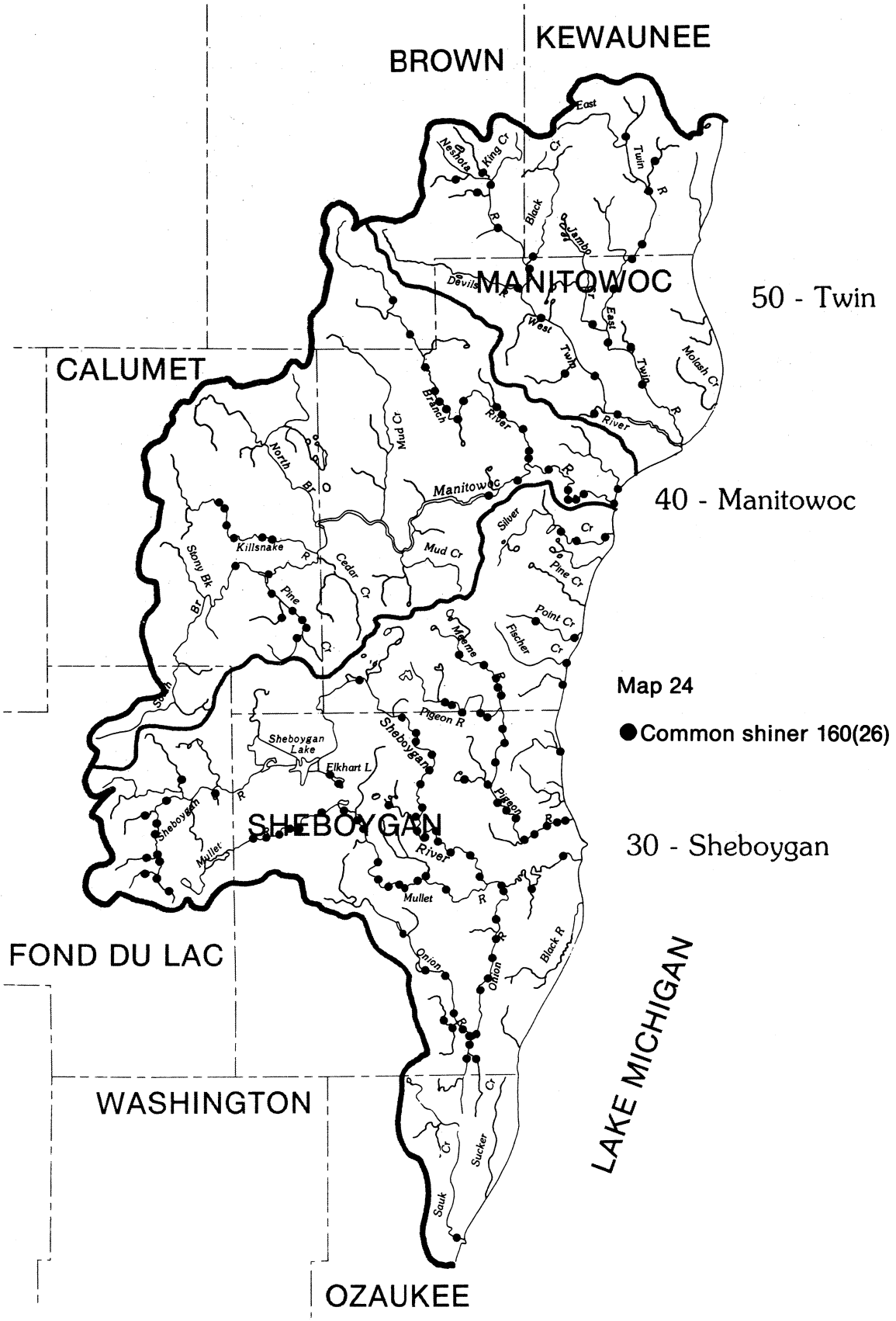
Twin
R
King Cr
Cr
Black
R
Devils R
West
Twin
R
East
Twin
R
Molash Cr
River
Mud Cr
Branch
River
North
Br
Manitowoc
R
Silver
Cr
Pine Cr
Point Cr
Fischer
Cr
Killsnake
R
Stony Bk
Br
Pine
Cr
Cedar Cr
Mud Cr
Meme
R
South
Pigeon R
Sheboygan
Sheboygan
Lake
Elkhart L
Sheboygan
R
Pigeon
R
Mullet
River
Mullet
R
Onion
R
Onion
R
Black R
Cr
Cr
Sucker
Sauk
50 - Twin
40 - Manitowoc
Map 23
● Emerald shiner 6(0)
▲ Striped shiner 1(0)
30 - Sheboygan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MANITOWOC
CALUMET
SHEBOYGAN
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WASHINGTON
OZAUKEE
LAKE MICHIGAN
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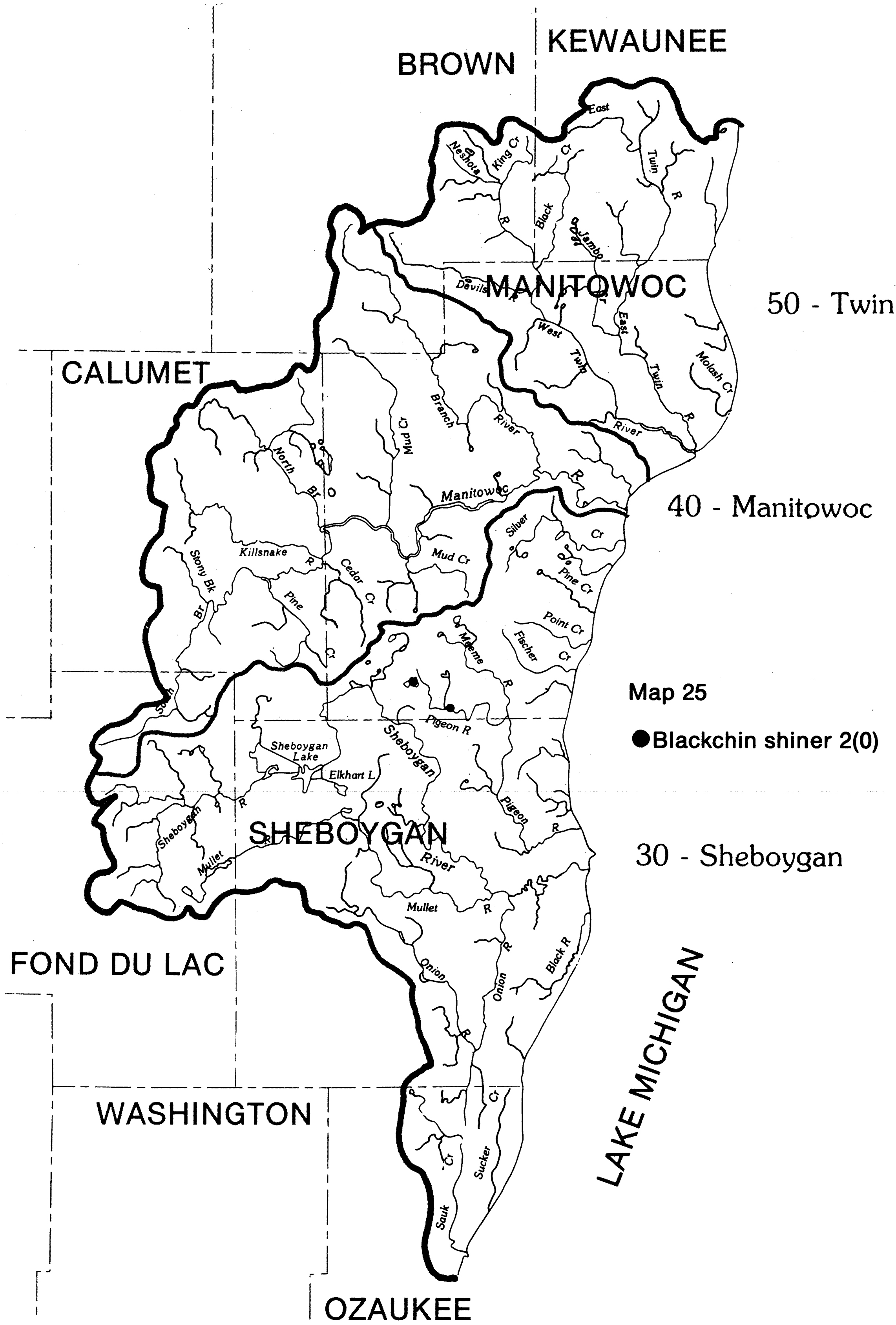
Twin R
Jambo Cr
Black R
Devils Cr
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc R
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mid Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
South Br
Maeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan R
Mullet R
Mullet River
Pigeon R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 24
Common shiner 160(26)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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 25
●Blackchin shiner 2(0)
East
Neshota
King Cr
Cr
Black
R
Twin
R
Jambo
Cr
Devils
R
West
Twin
East
Twin
R
Molash Cr
River
Branch
River
Mud Cr
North
Br
Manitowoc
R
Silver
Cr
Pine Cr
Point Cr
Fischer
Cr
Killsnake
R
Stony Bk
Br
Cedar
Cr
Pine
Cr
Mud Cr
Meeme
R
Pigeon R
South
Sheboygan
Lake
Elkhart L
Sheboygan
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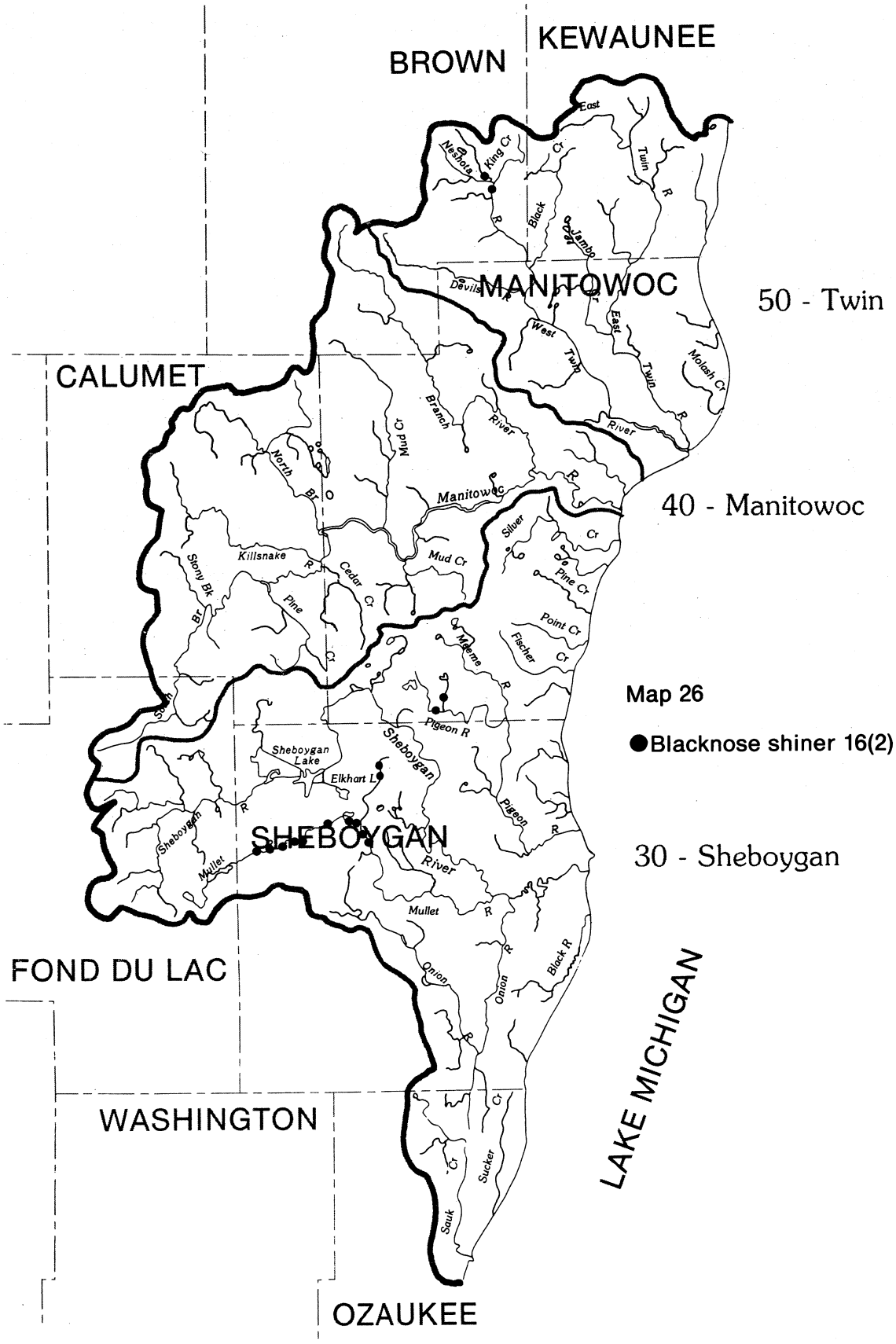
Onion
Black R
Cr
Cr
Sucker
Sauk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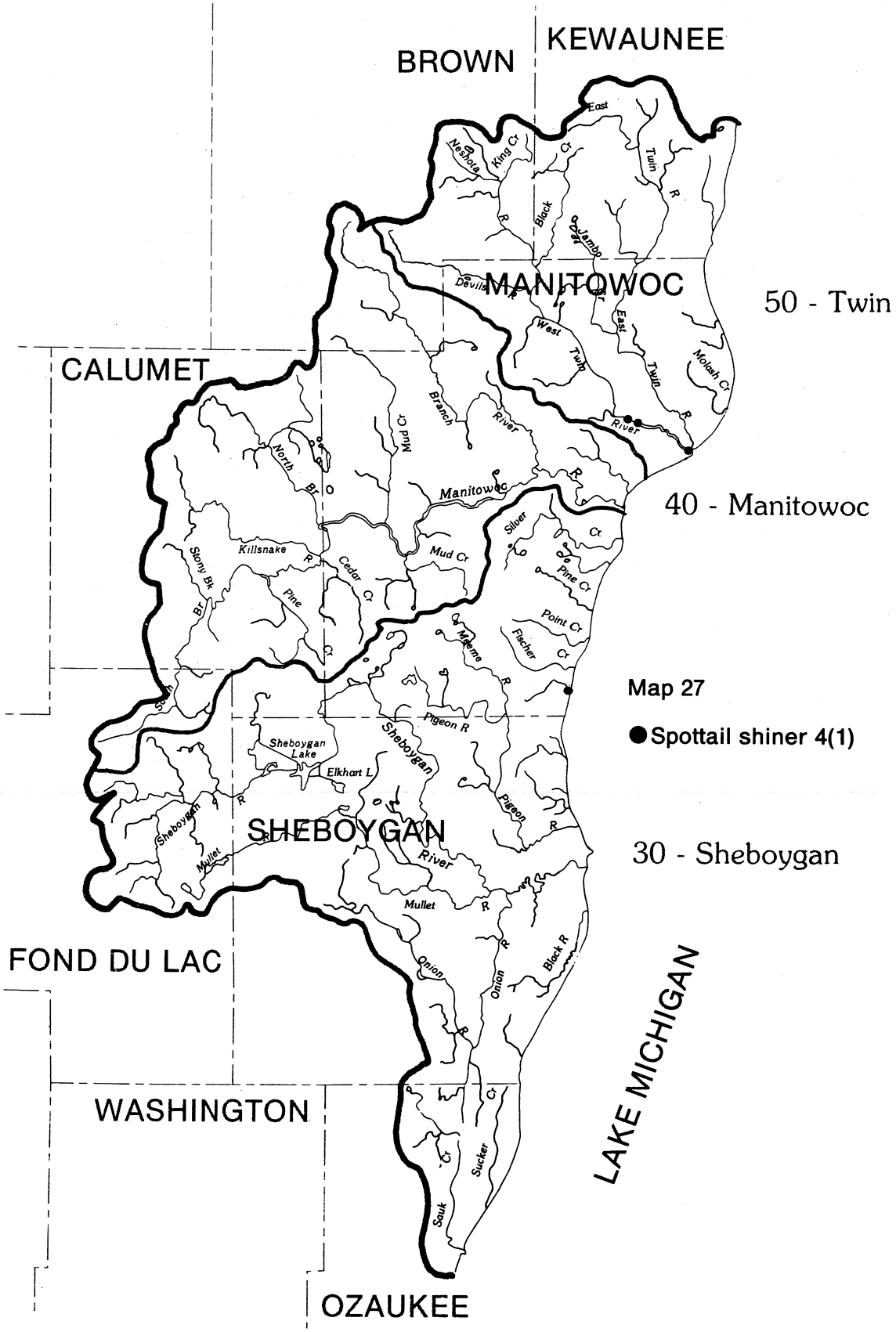
MANITOWOC
CALUMET
FOND DU LAC
WASHINGTON
OZAUKEE
SHEBOYGAN
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 26
Blacknose shiner 16(2)
East Twin R
Twin R
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk
Cedar Cr
Mud Cr
Pine Cr
Pine Cr
Point Cr
Fischer Cr
Meeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr


BROWN
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CALUMET
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FOND DU LAC
WASHINGTON
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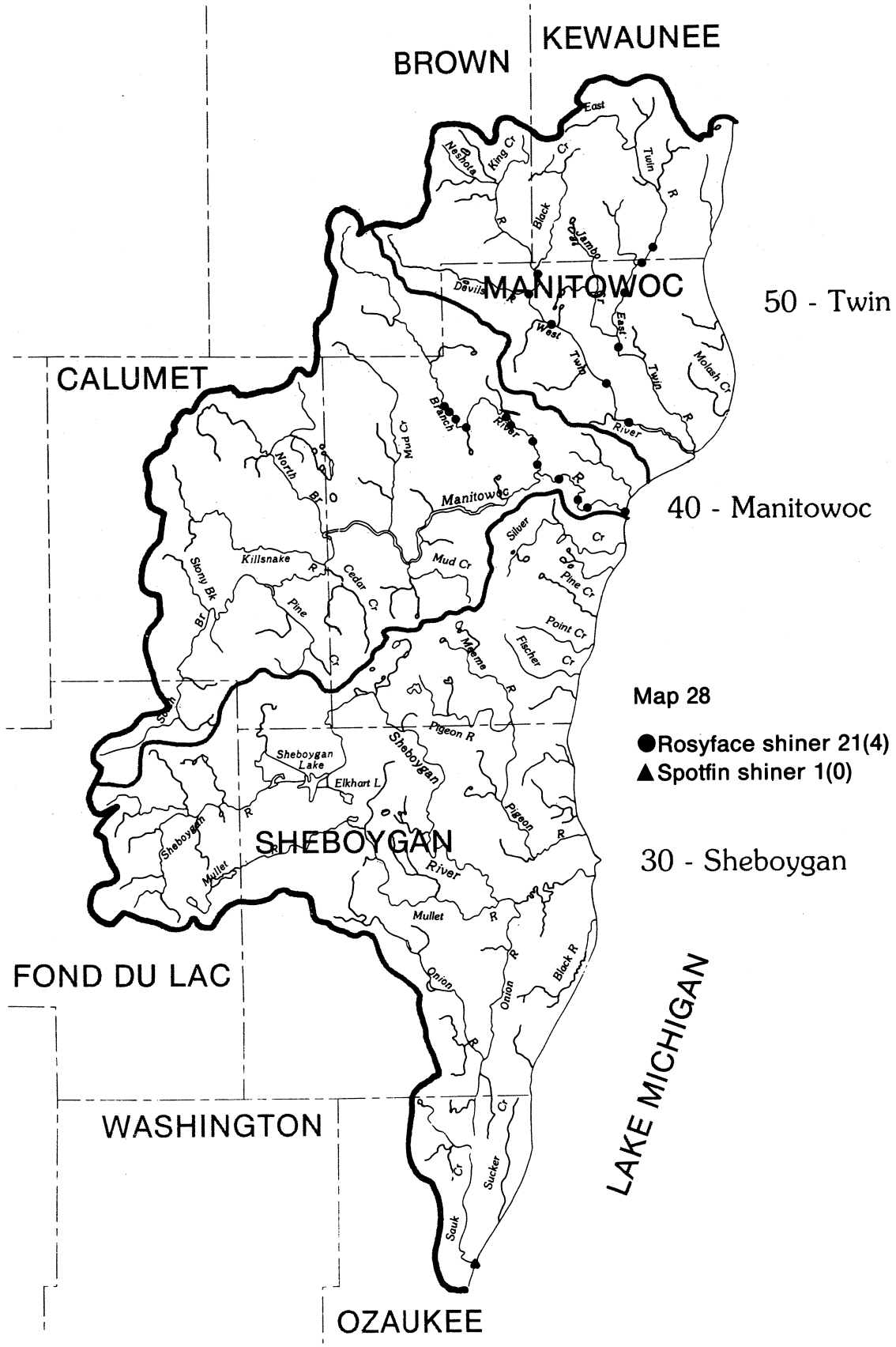
LAKE MICHIGAN
East Twin R
Twin R
Black R
Jambo Cr
King Cr
Neshota R
West Twin R
East Twin R
Molash Cr
Devils Cr
Mud Cr
Branch River
River
North Br
Manitowoc R
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Meeme R
South Br
Pigeon R
Sheboygan R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Pigeon R
Mullet River
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 27
Spottail shiner 4(1)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CALUMET
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LAKE MICHIGAN
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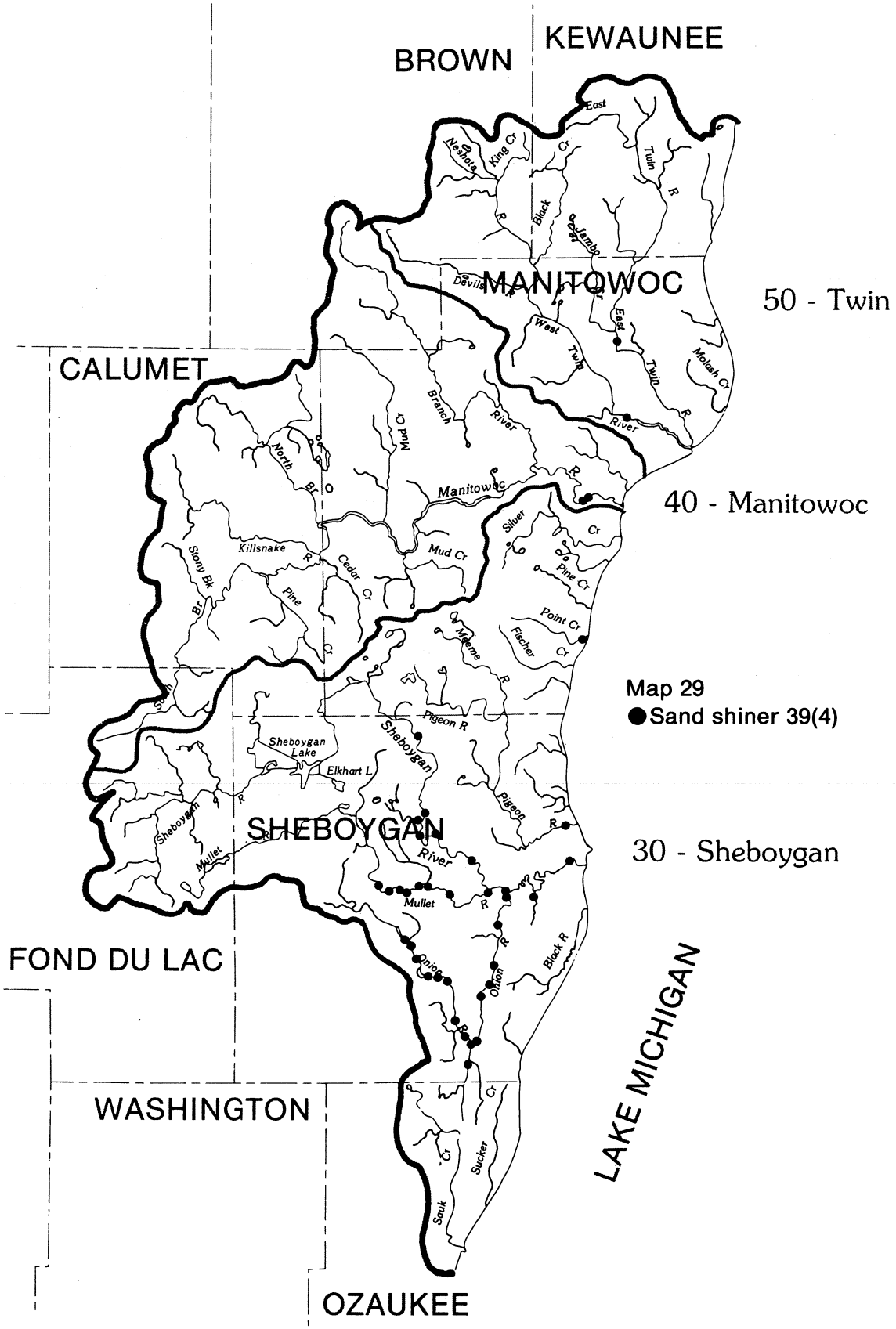
King Cr
Black R
Jambo Cr
Devils Ck
West Twin R
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mlleme R
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
Sheboygan R
Muller R
Mullet River
Mullet R
Pigeon R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
Map 28
●Rosyface shiner 21(4)
▲Spotfin shiner 1(0)
30 - Sheboygan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WASHINGTON
OZAUKEE
LAKE MICHIGAN
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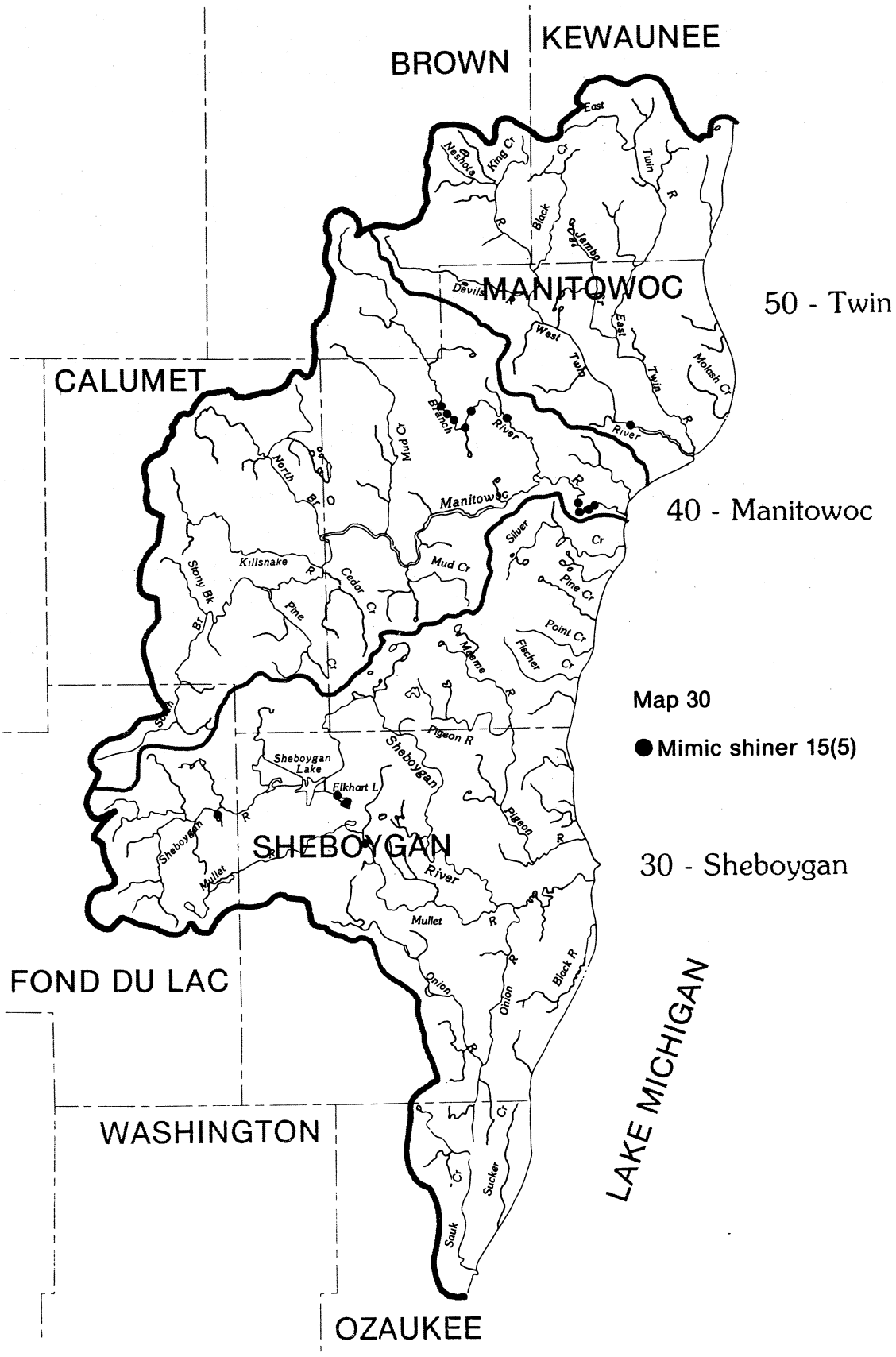
King Cr
Black R
Cedar Cr
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Branch River
River
Mud Cr
North Br
Manitowoc R
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Br
Pine Cr
Cedar Cr
Mud Cr
Mullet R
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet River
Pigeon R
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 29
Sand shiner 39(4)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WASHINGTON
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LAKE MICHIGAN
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King Cr
Black R
Jambo Cr
Devils Lk
West Twin R
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Killsnake R
Stony Bk
Cedar Cr
Pine Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mishicot R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan River
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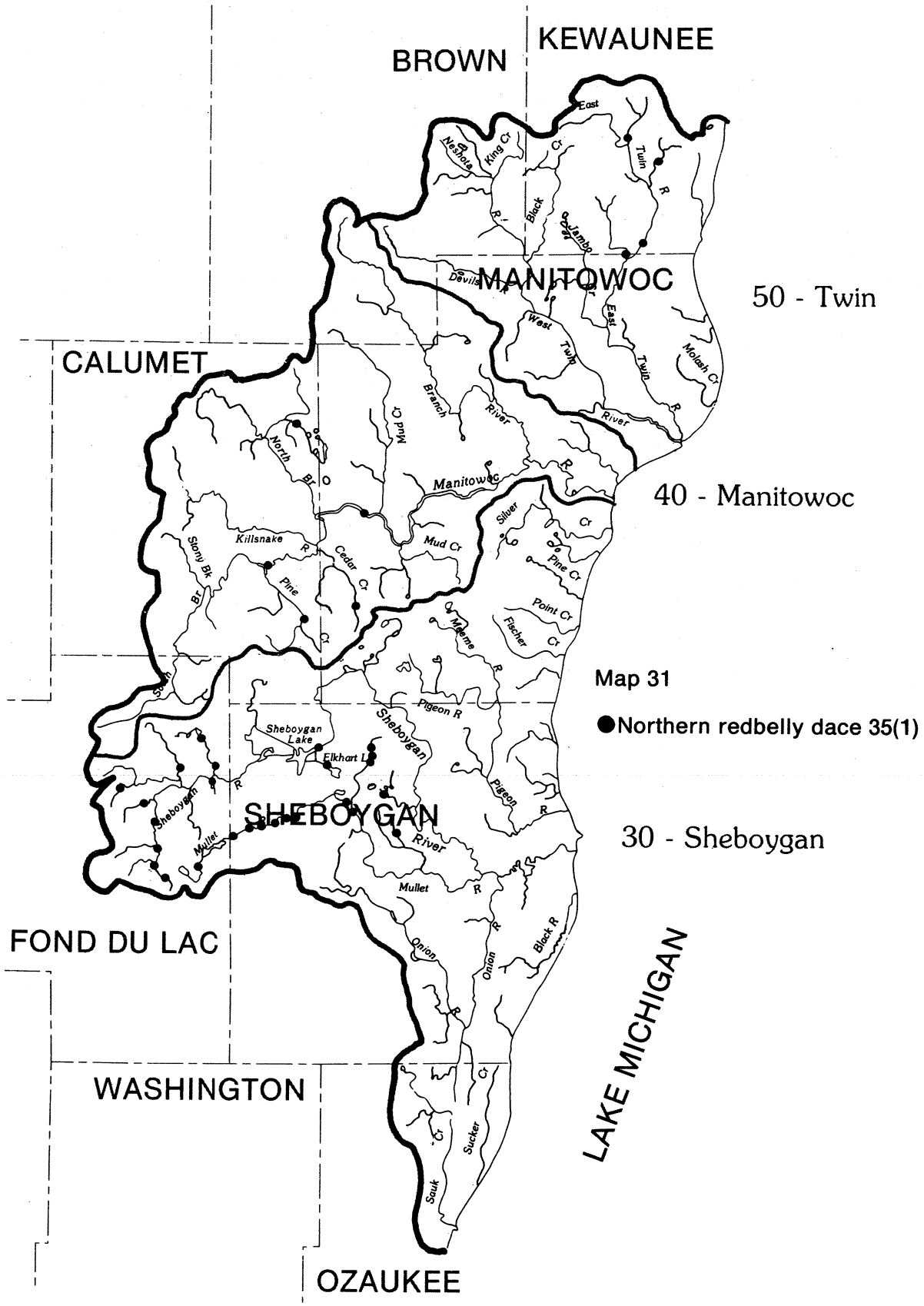
Onion R
Black R
Sucker Cr
South Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 30
Mimic shiner 15(5)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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 31
●Northern redbelly dace 35(1)
East
Twin R
Black R
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Silver Cr
Point Cr
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Pigeon R
Sheboygan Lake
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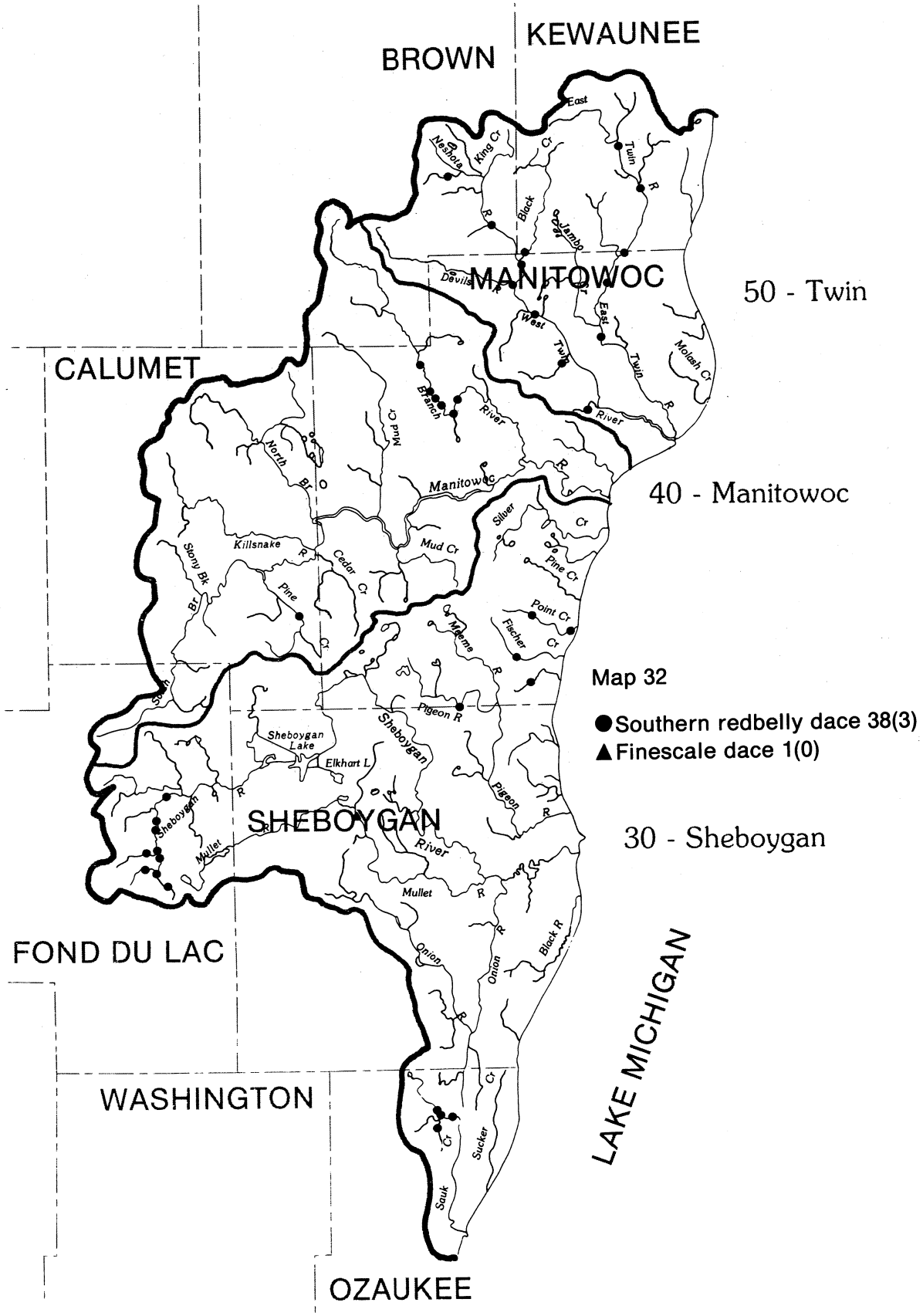
Sheboygan R
Onion R
Black R
Sucker Cr
Sauk Cr


BROWN
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CALUMET
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WASHINGTON
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LAKE MICHIGAN
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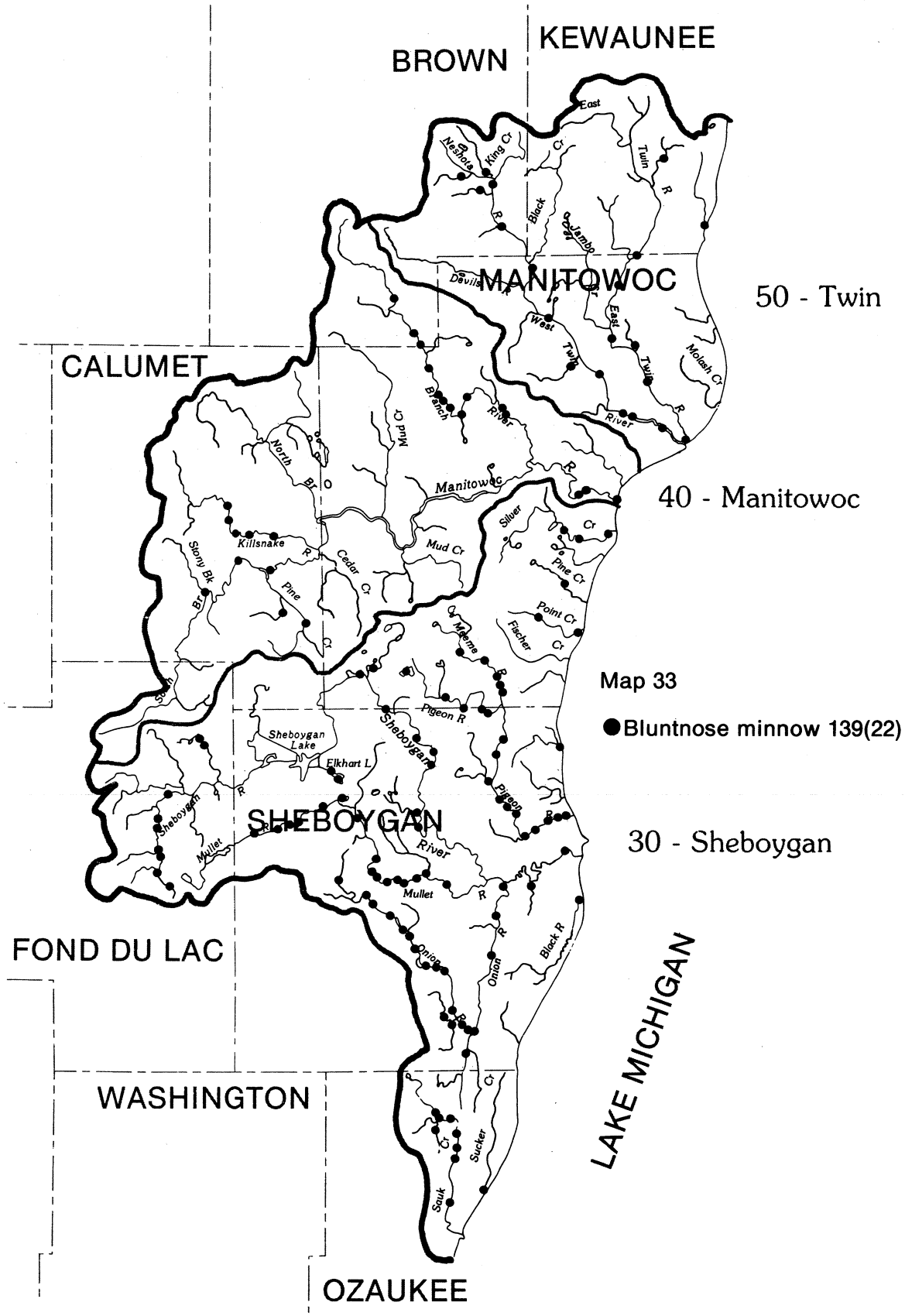
Neshota
King Cr
Cr
Black
R
Jambo
Devils
Cr
West
Twin
East
Twin
Molash Cr
River
River
Branch
Mud Cr
North
Br
Manitowoc
R
Silver
Cr
Pine Cr
Point Cr
Fischer
Cr
Mullet
R
Killsnake
R
Stony Bk
Br
Cedar
Cr
Pine
Cr
South
Br
Pigeon R
Sheboygan
Sheboygan
Lake
Elkhart L
Sheboygan
R
Pigeon
R
Sheboygan
River
Mullet
R
Mullet
Onion
R
Onion
R
Black R
Cr
Sucker
Cr
Sauk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 32
●Southern redbelly dace 38(3)
▲Finescale dace 1(0)


BROWN
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FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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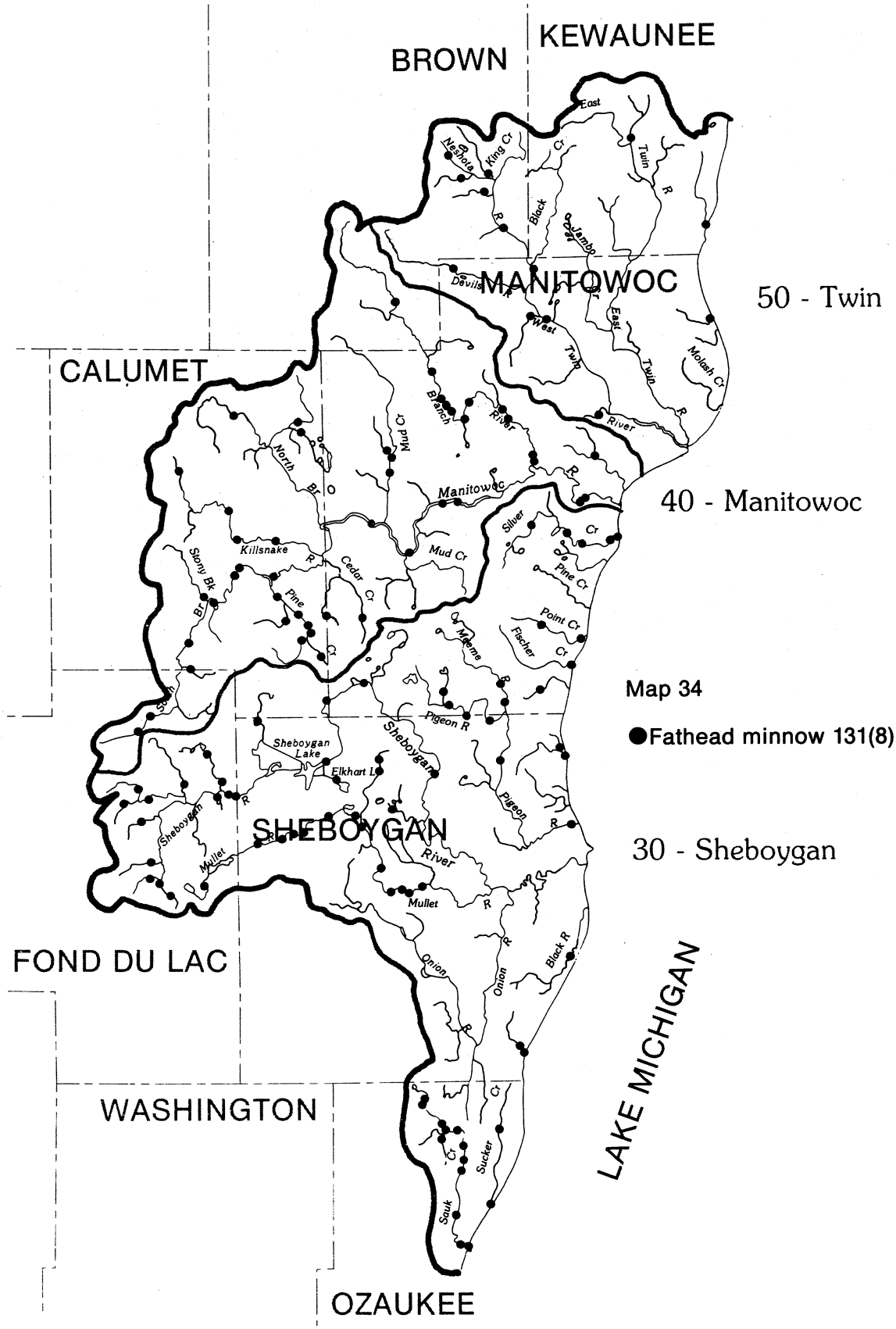
Black
Jambo
Devils
West
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Killsnake R
Stony Bk
Cedar Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Pine
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Mullet R
Mullet River
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 33
Bluntnose minnow 139(22)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CALUMET
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FOND DU LAC
WASHINGTON
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LAKE MICHIGAN
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Black R
Jambo Cr
King Cr
Neshota R
Devils Cr
West Twin R
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Meeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet R
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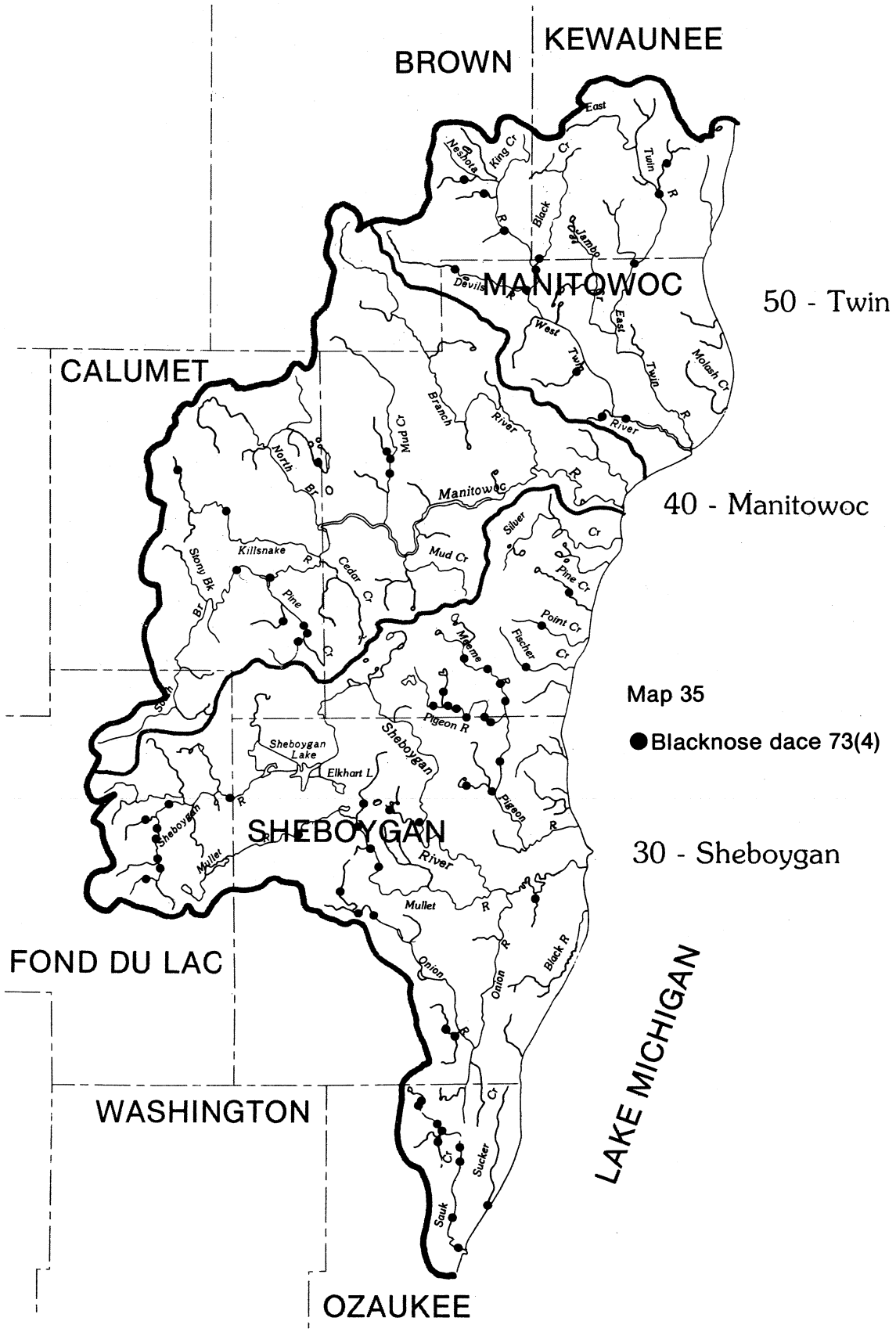
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 34
●Fathead minnow 131(8)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MANITOWOC
CALUMET
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FOND DU LAC
WASHINGTON
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LAKE MICHIGAN
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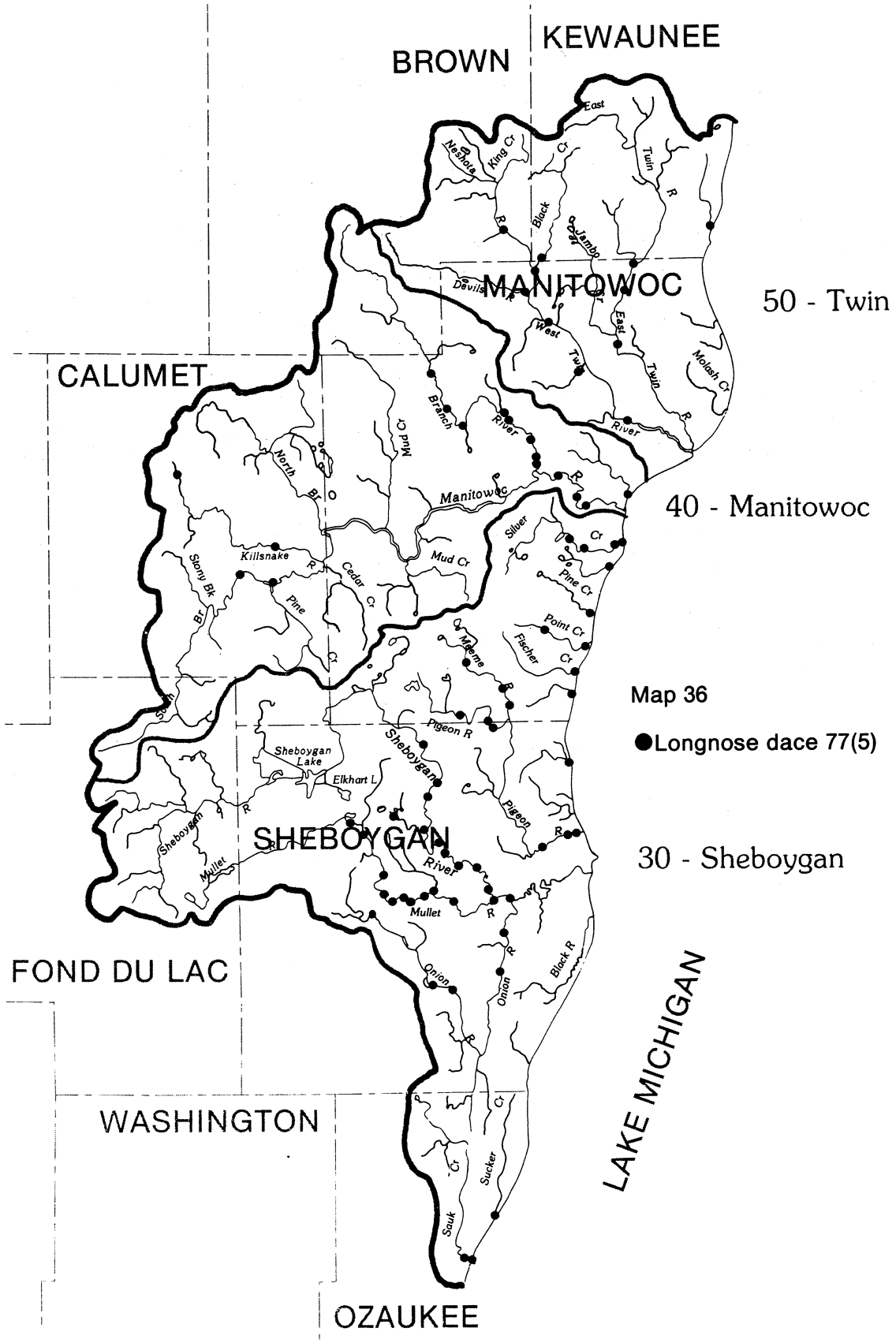
Neshota
King Cr
Black R
Devils R
West Twin R
East Twin R
Molash Cr
Branch River
River
Kiel Cr
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Point Cr
Fischer Cr
Mishne R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan River
Muller
Mullet R
Onion R
Black R
Sucker Cr
Sauk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 35
● Blacknose dace 73(4)


KEWAUNEE
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MANITOWOC
CALUMET
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FOND DU LAC
WASHINGTON
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LAKE MICHIGAN
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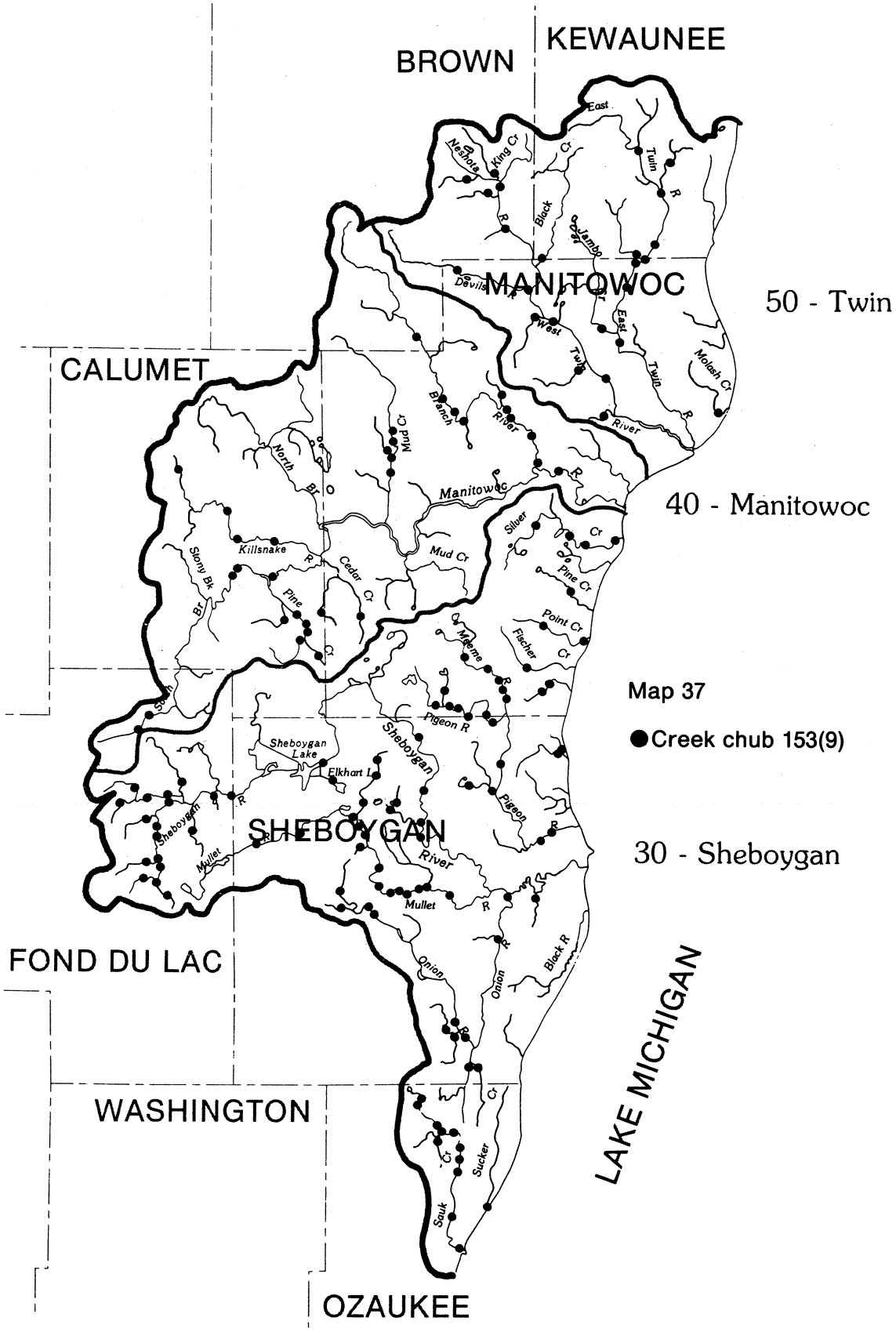
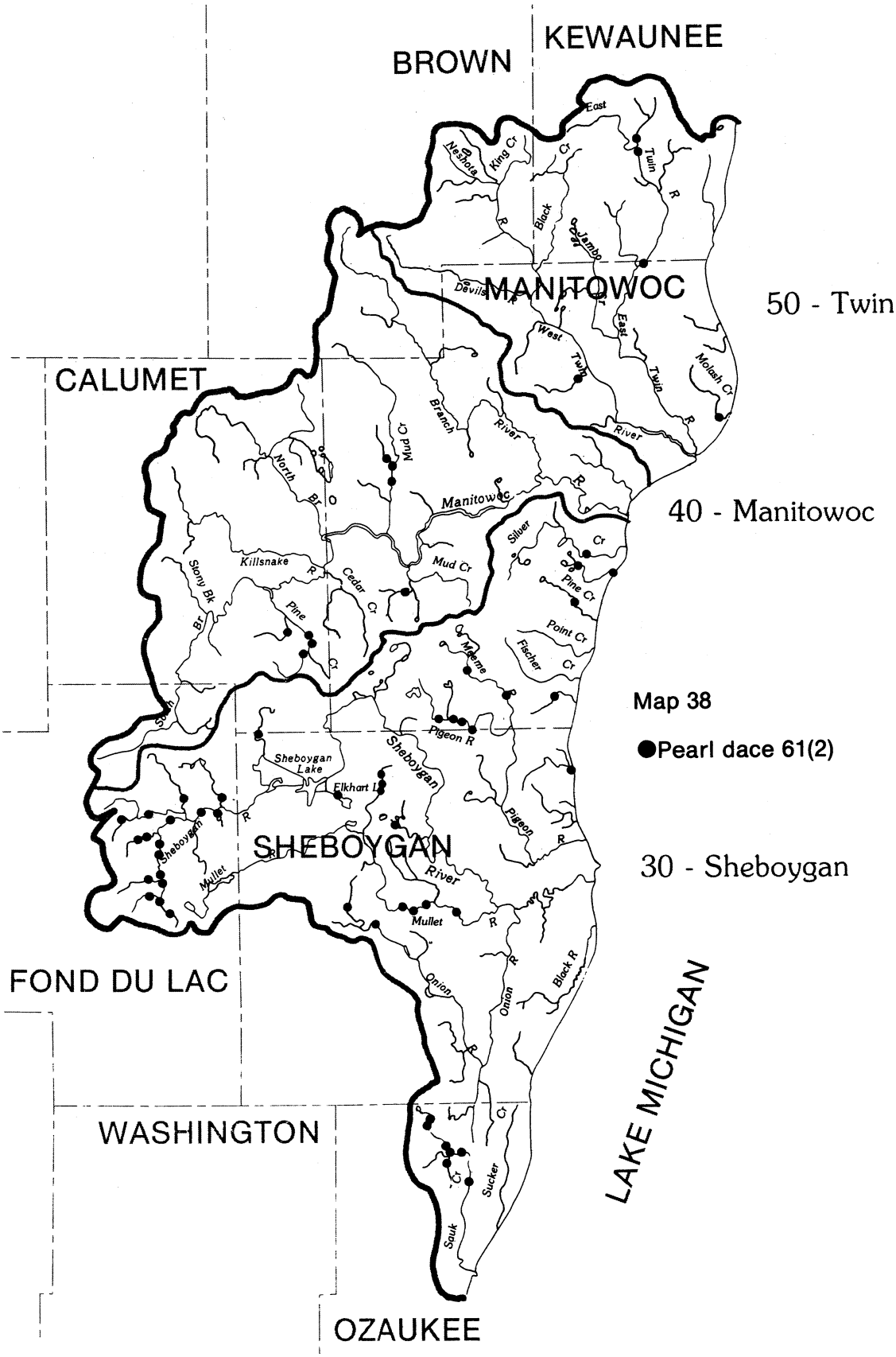
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk
Cedar Cr
Mud Cr
Pine Cr
Pine Cr
Point Cr
Fischer Cr
Meeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
Map 36
●Longnose dace 77(5)
30 - Sheboygan


BROWN
KEWAUNEE
MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 37
Creek chub 153(9)
East Twin R
Neshota R
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Point Cr
Fischer Cr
Meme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr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KEWAUNEE
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CALUMET
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FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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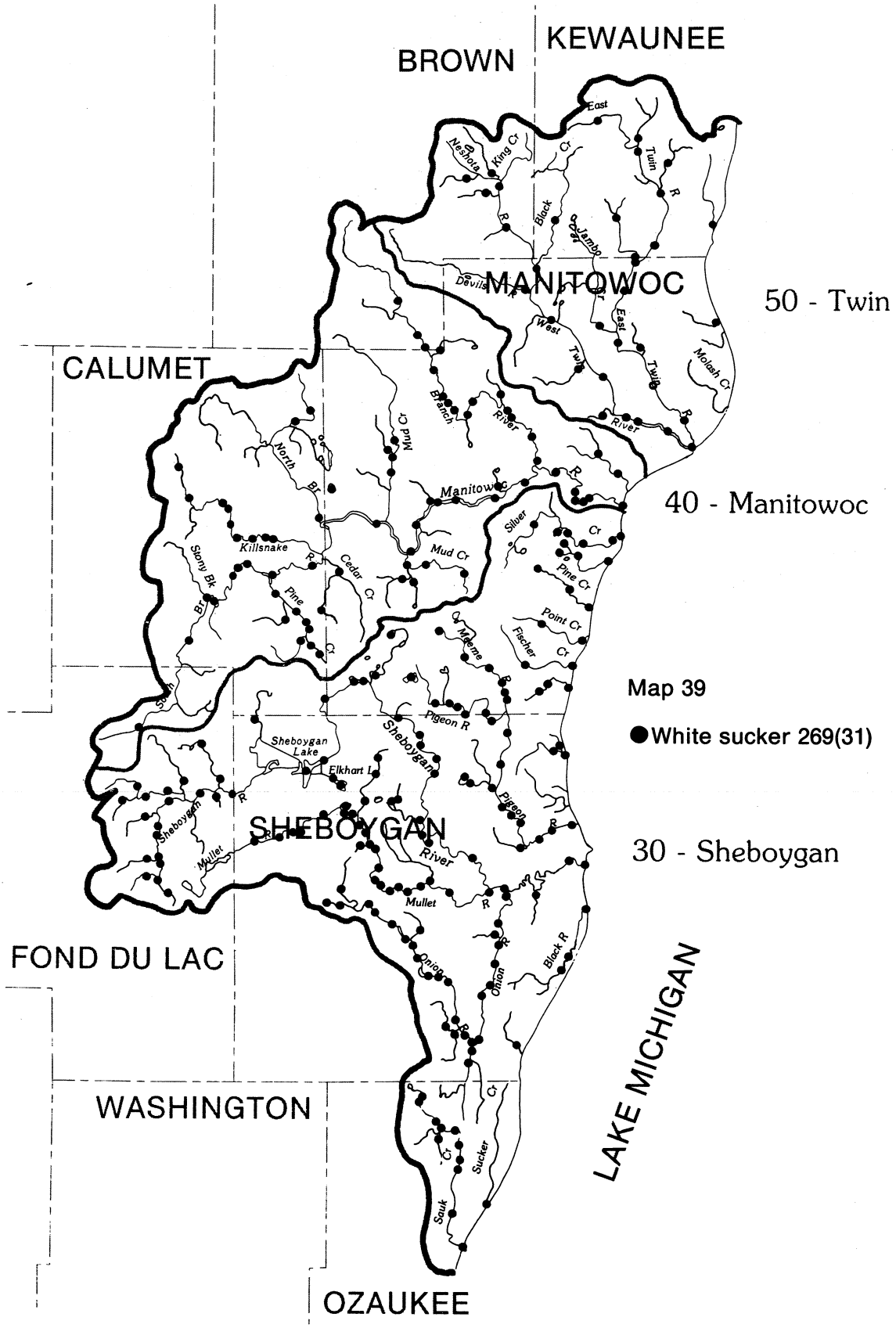
Neshota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Meeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
River
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 38
●Pearl dace 61(2)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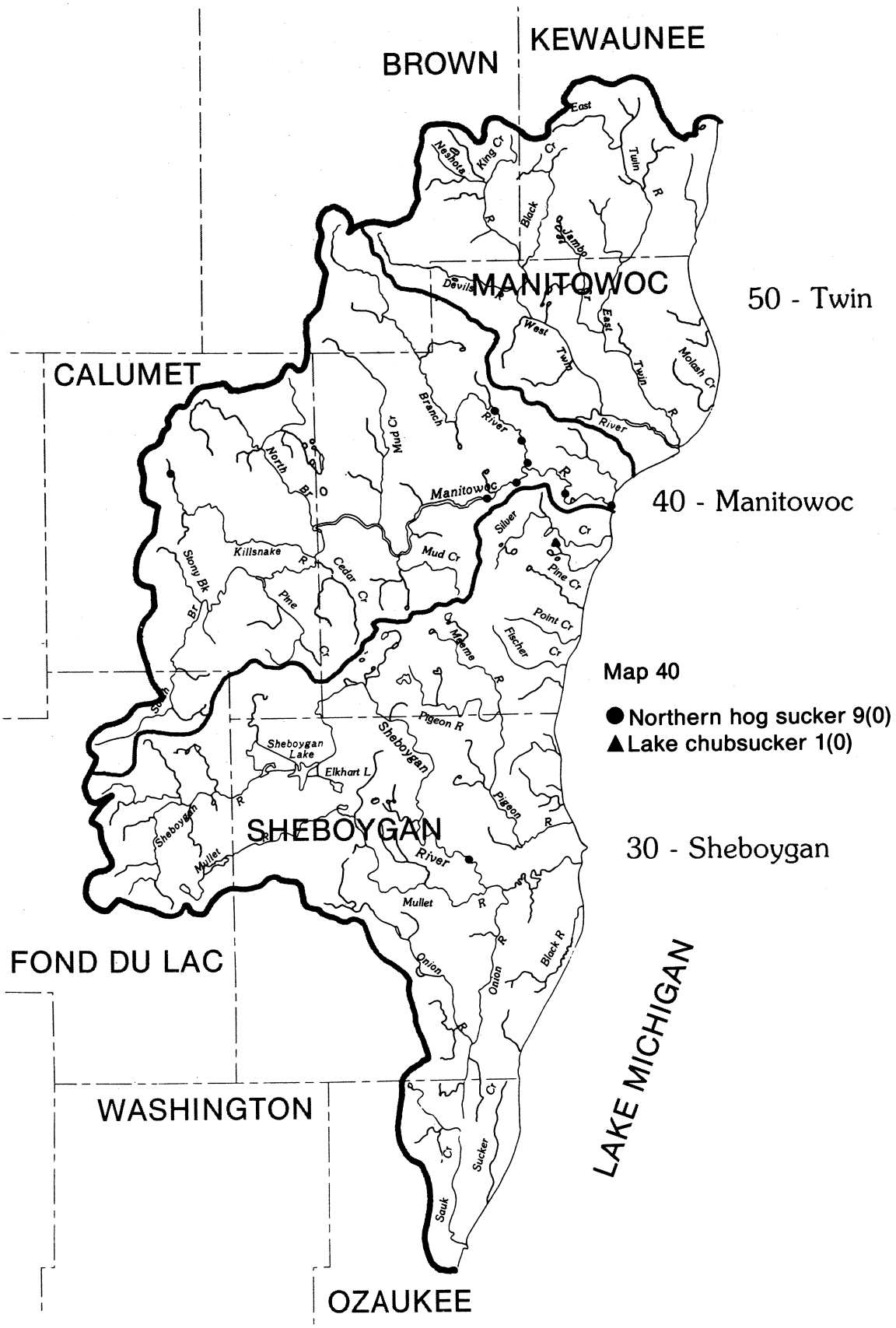
Neshota
King Cr
Black
Lamboi
Devils
West
East Twin R
Molash Cr
Mud Cr
Branch
River
North Br
Manitowoc
Silver Cr
Pine Cr
Killsnake R
Stony Bk
Cedar Cr
Mud Cr
Pine Cr
Point Cr
Fischer Cr
Mlacme
South
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan
Mullet
River
Mullet R
Onion R
Block R
Onion
Sucker Cr
Sauk
50 - Twin
40 - Manitowoc
Map 39
White sucker 269(31)
30 - Sheboygan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LAKE MICHIGAN
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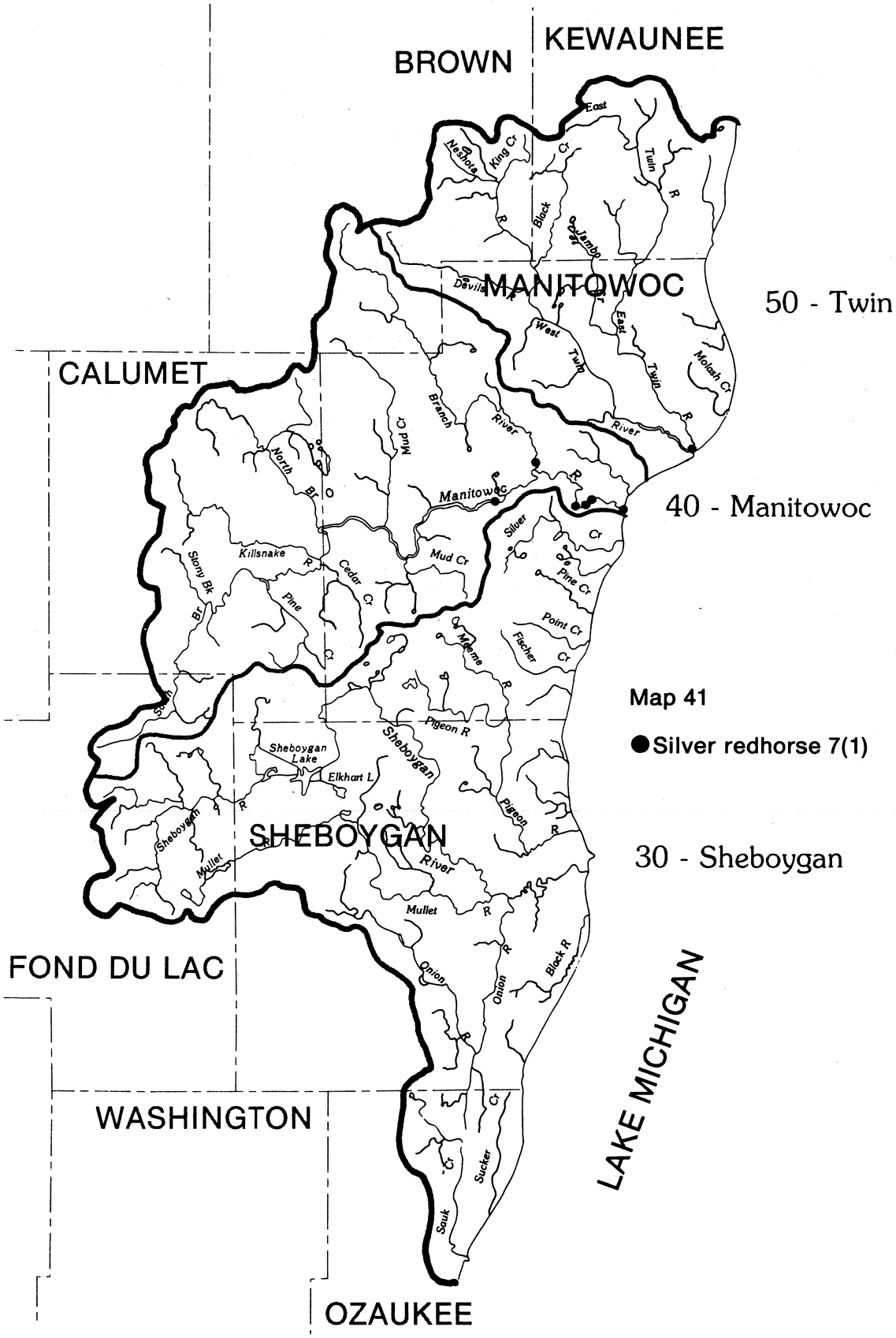
King Cr
Black R
Cedar Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc
Manitowoc River
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Mud Cr
Manne R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan River
Mullet R
Mullet River
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 40
● Northern hog sucker 9(0)
▲ Lake chubsucker 1(0)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MANITOWOC
CALUMET
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WASHINGTON
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LAKE MICHIGAN
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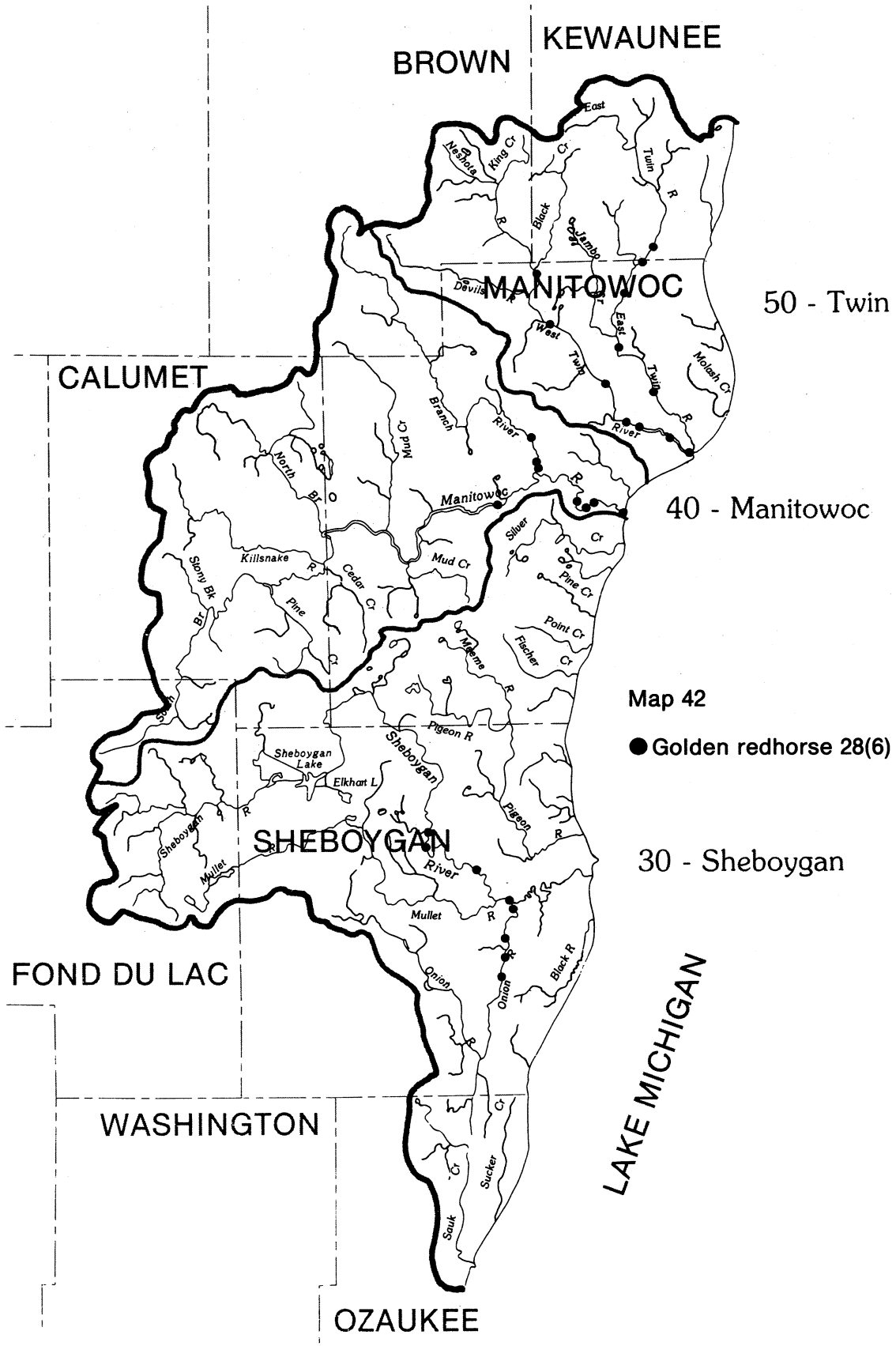
Twin R
Black
Devils R
West
Twin
East
Twin
Molash Cr
Branch
River
Mud Cr
North Br
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Mud Cr
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Black R
Sucker Cr
Souk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 41
Silver redhorse 7(1)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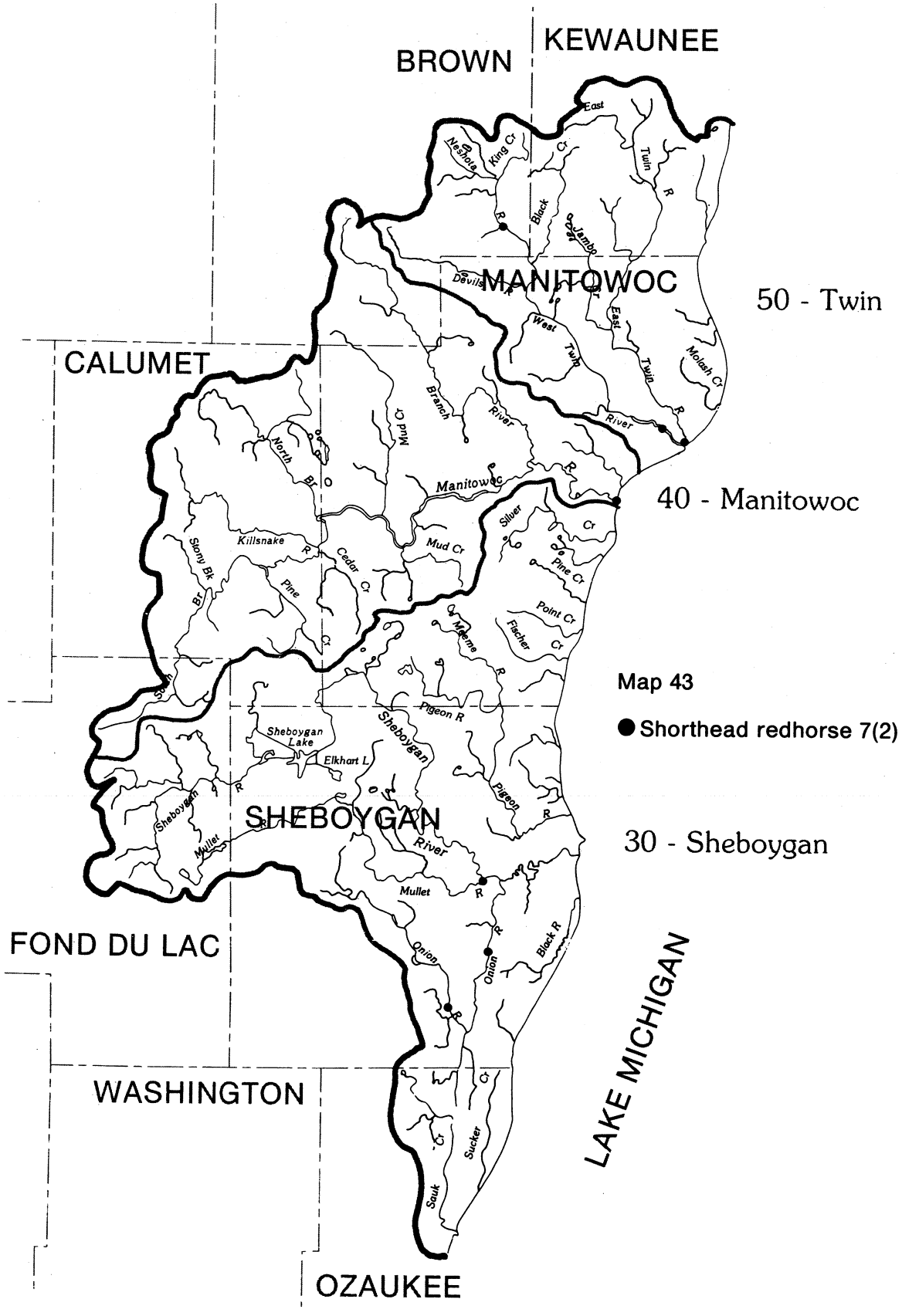
MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 42
Golden redhorse 28(6)
East Twin R
Neshota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Pine Cr
Point Cr
Fischer Cr
Mullet R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
River
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr


BROWN
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MANITOWOC
CALUMET
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WASHINGTON
OZAUKEE
LAKE MICHIGAN
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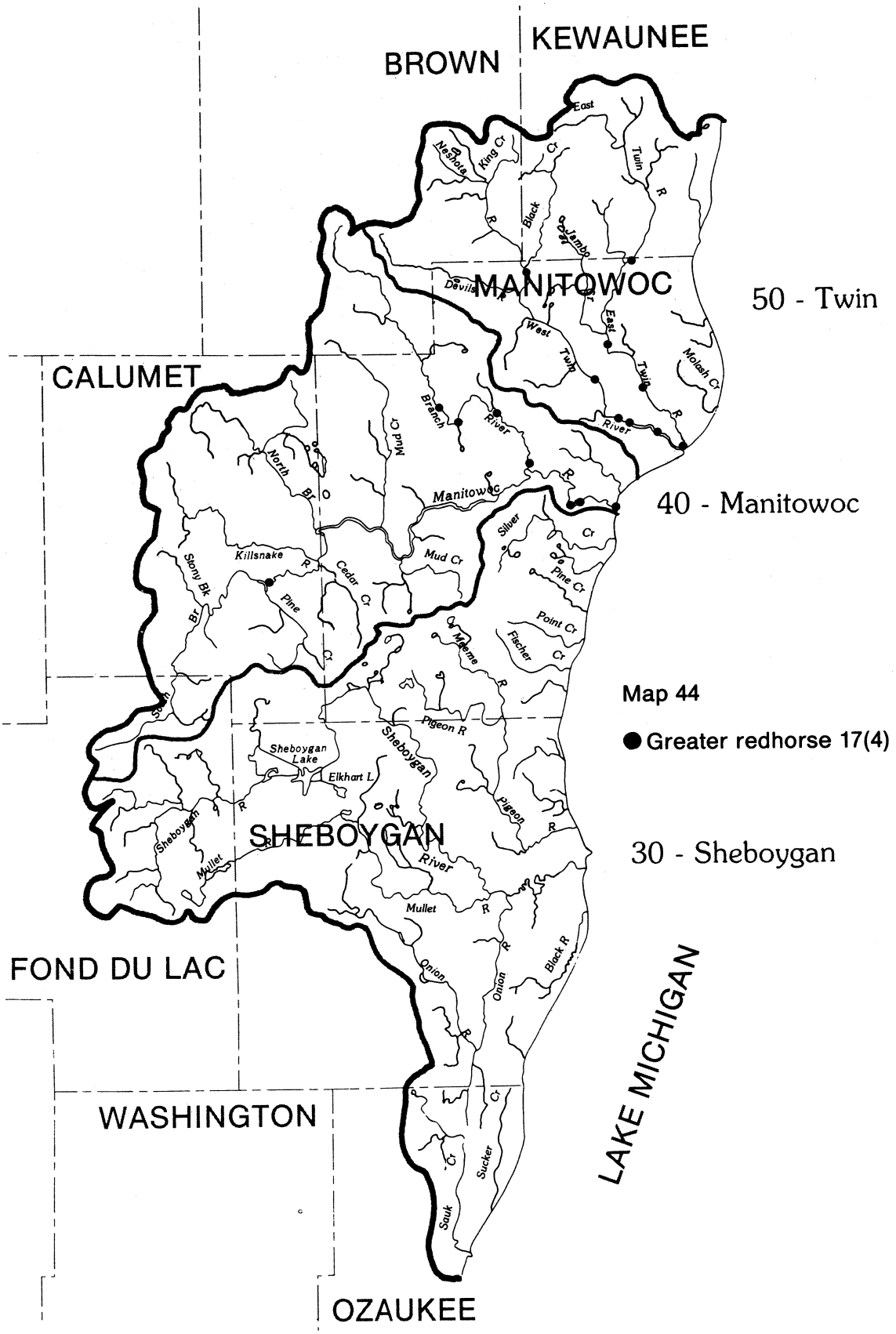
Neshota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Manitowoc
Silver Cr
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Pine Cr
Point Cr
Fischer Cr
Meeme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Sheboygan River
Pigeon R
Mullet R
Mullet River
Onion R
Onion River
Block R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 43
Shorthead redhorse 7(2)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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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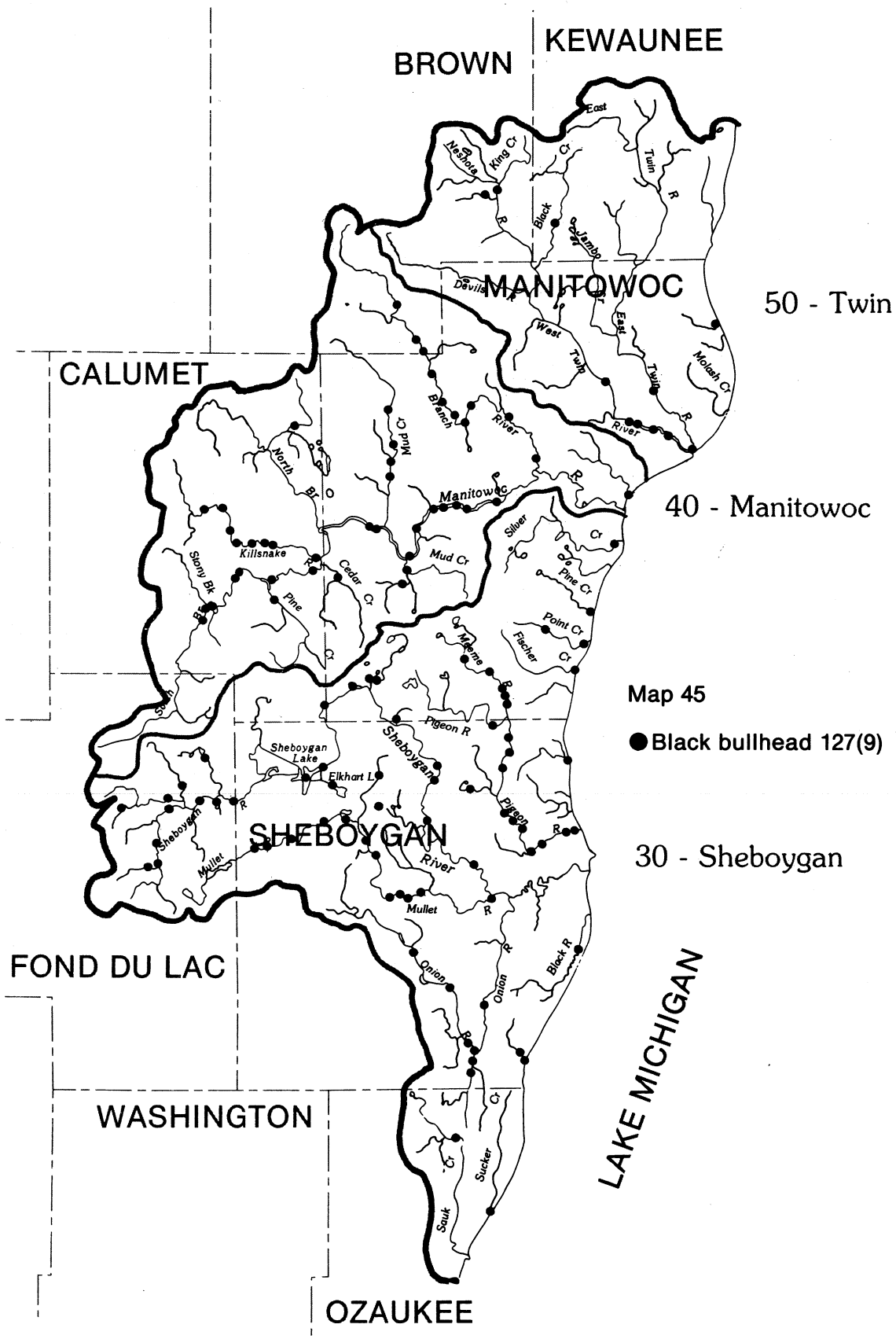
Neshota
King Cr
Black R
Cedar Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Pine Ct
Point Cr
Fischer Cr
Milene R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Black R
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 44
Greater redhorse 17(4)



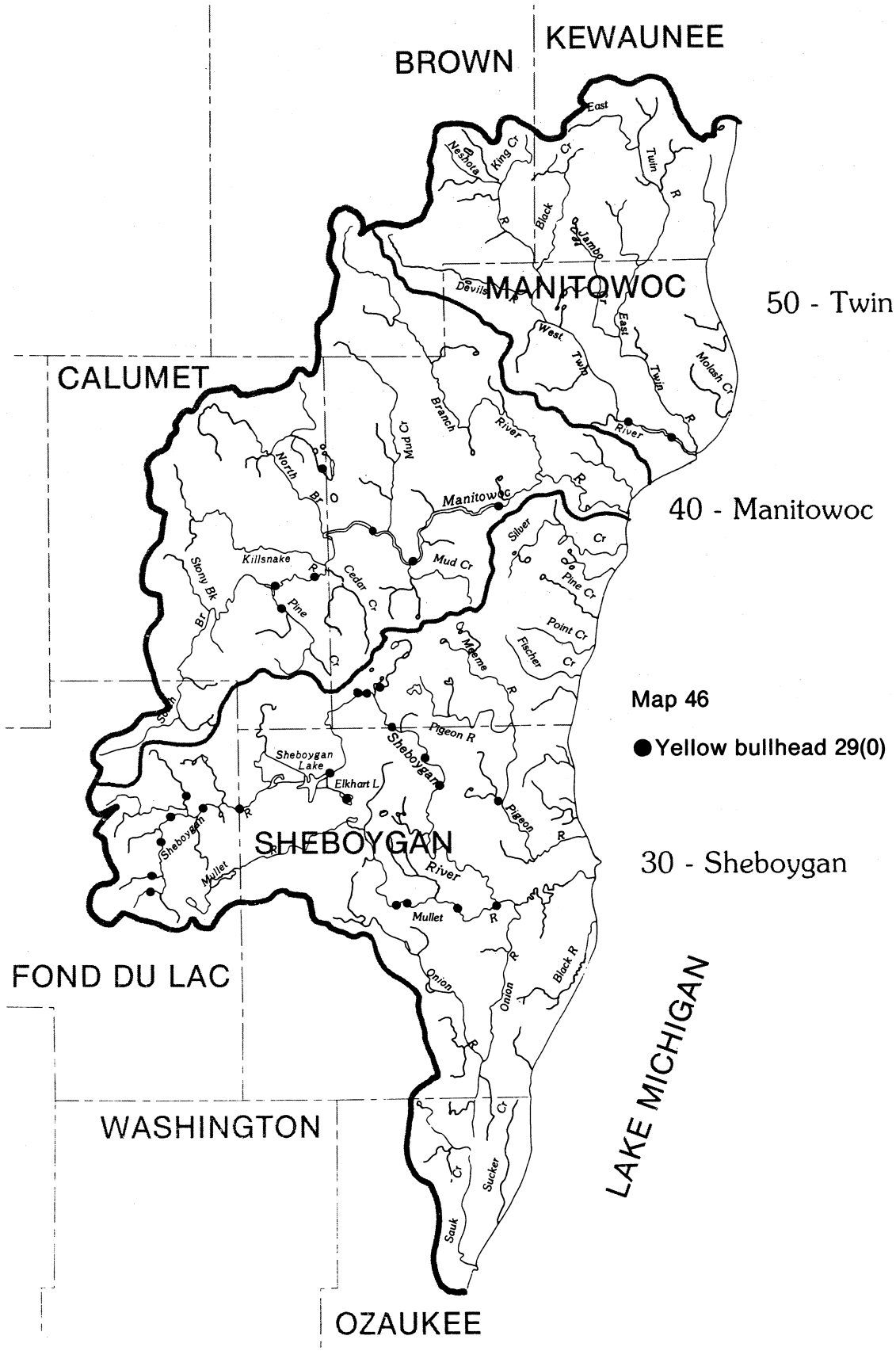
50 - Twin

40 - Manitowoc

30 - Sheboygan

Map 45

● Black bullhead 127(9)


BROWN
KEWAUNEE
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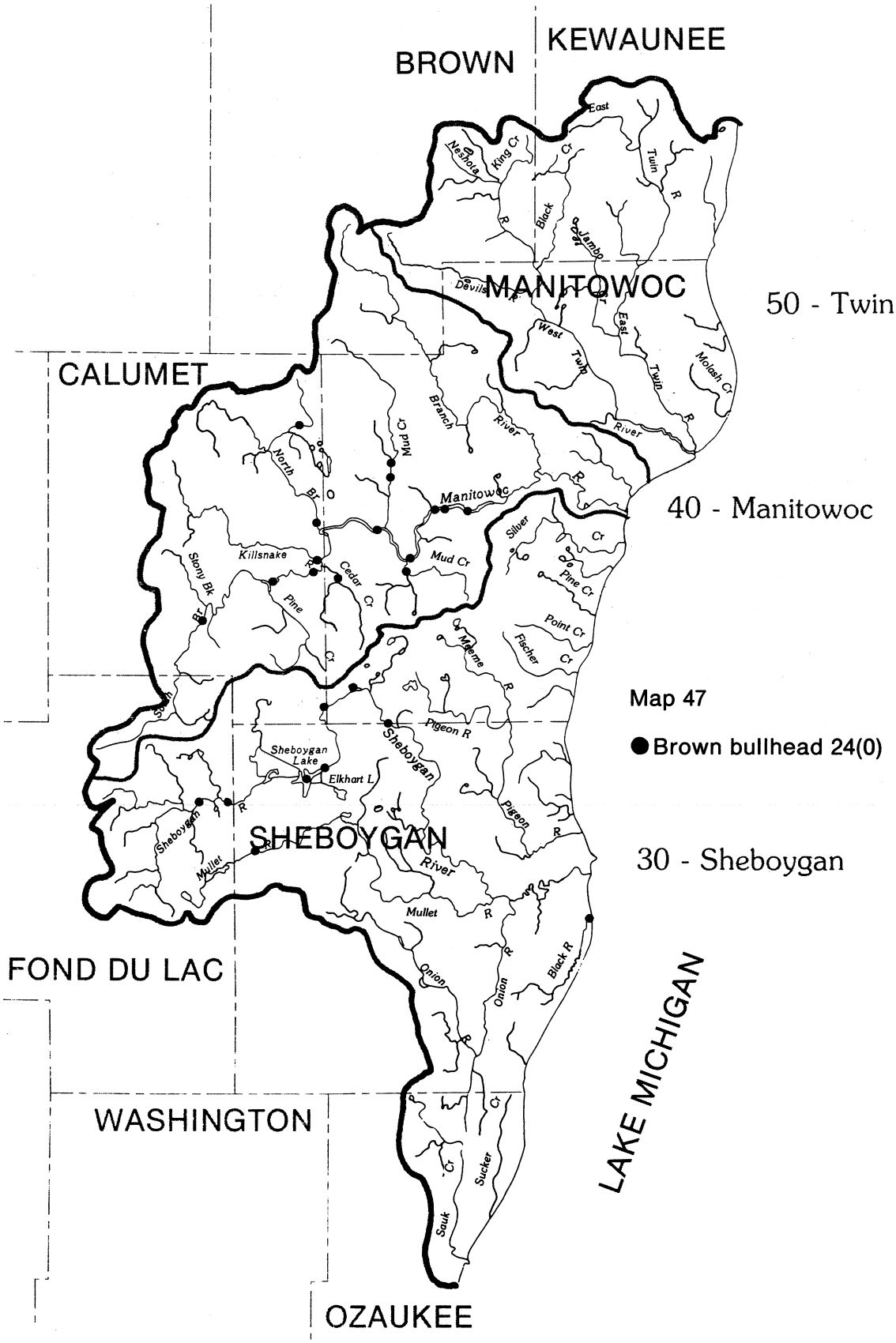
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
East
Twin R
Neshota
King Cr
Black R
Jambo
Devils
West Twin R
East Twin R
Molash Cr
Mud Cr Branch
River
North Br
Manitowoc
Silver Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Point Cr
Fischer Cr
Meme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan
Pigeon R
Sheboygan R
Mullet R
River
Mullet
Onion R
Black R
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 46
Yellow bullhead 29(0)



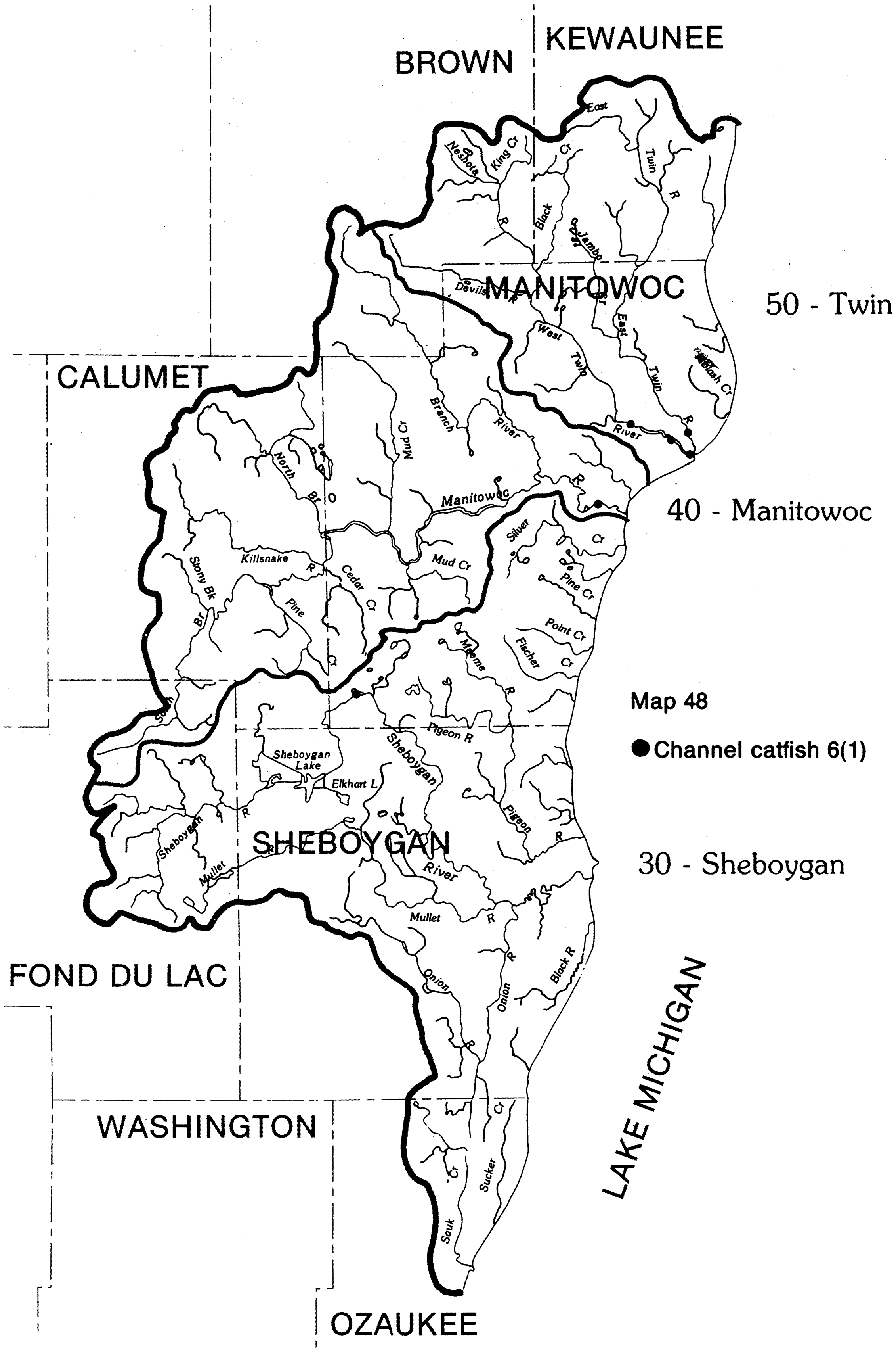
50 - Twin

40 - Manitowoc

30 - Sheboygan

Map 47

● Brown bullhead 24(0)


BROWN
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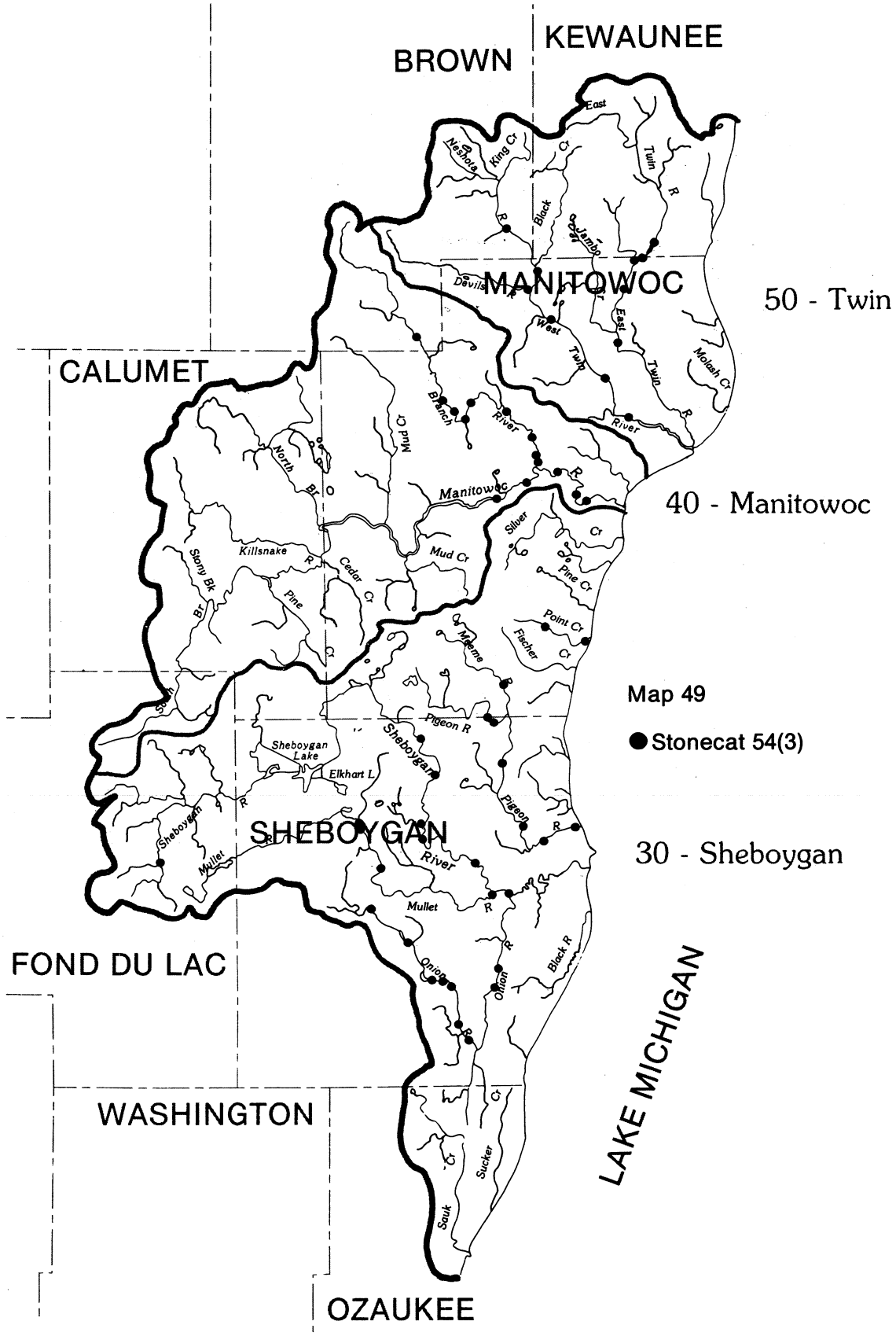
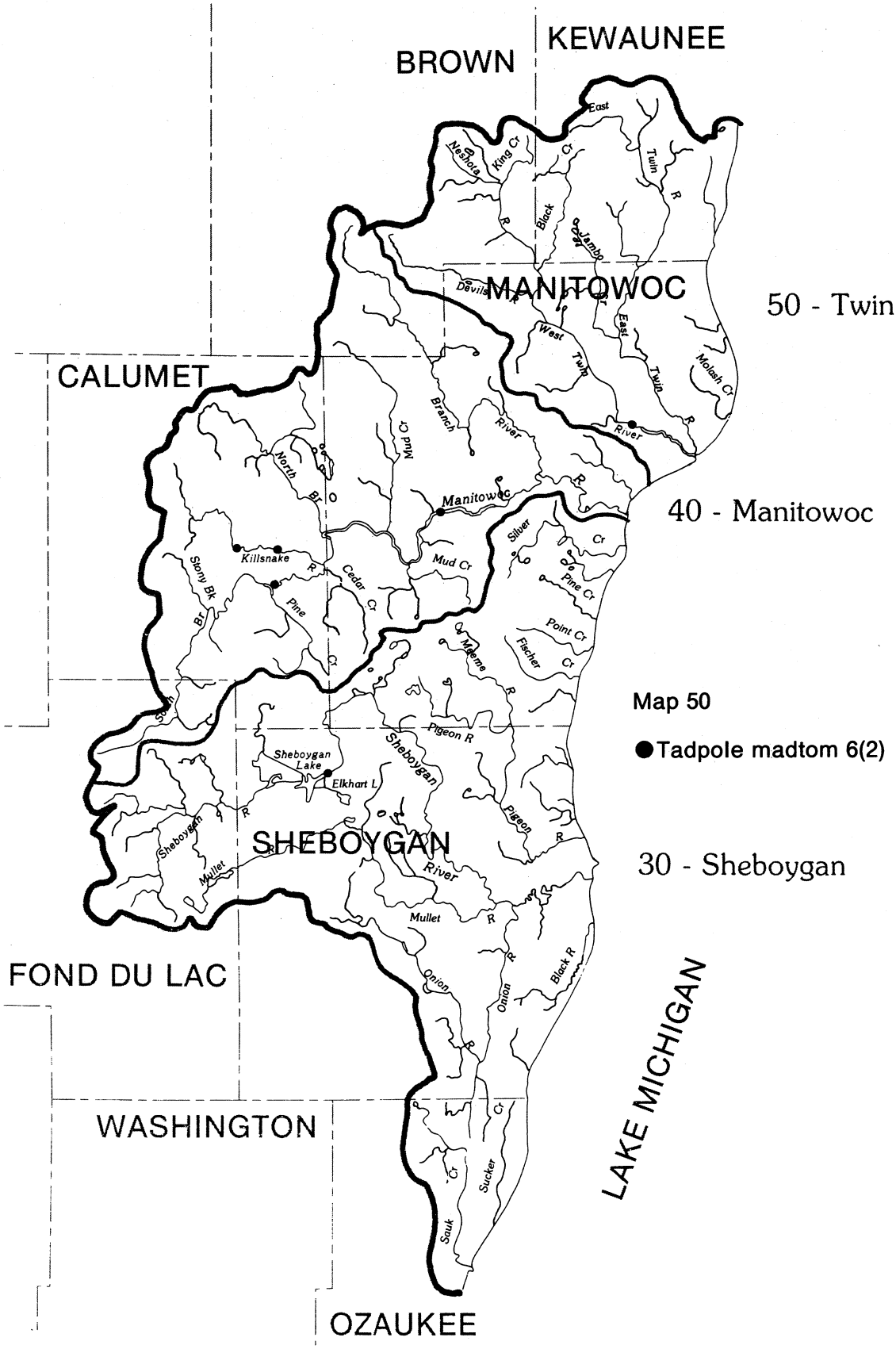
MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 48
Channel catfish 6(1)
East
Neshota
King Cr
Cr
Twin
R
Black
Jambo
Devils
R
West
Twin
East
Twin
R
River
Branch
River
Mud Cr
North
Br
Manitowoc
R
Silver
Cr
Mud Cr
Killsnake
R
Cedar
Cr
Stony Bk
Br
Pine
Cr
Pine Cr
Point Cr
Fischer
Cr
R
South
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
R
Pigeon
R
Sheboygan
Mullet
River
Mullet
R
Onion
R
Onion
Black R
Cr
Sucker
Cr
Sauk


BROWN
KEWAUNEE
MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
East
Twin R
Neshota
King Cr
Black R
Devils Lk
West
East Twin R
Molash Cr
Branch River
Mud Cr
North Br
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mid Cr
Meeme R
South
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 49
Stonecat 54(3)


BROWN
KEWAUNEE
MANITOWOC
CALUMET
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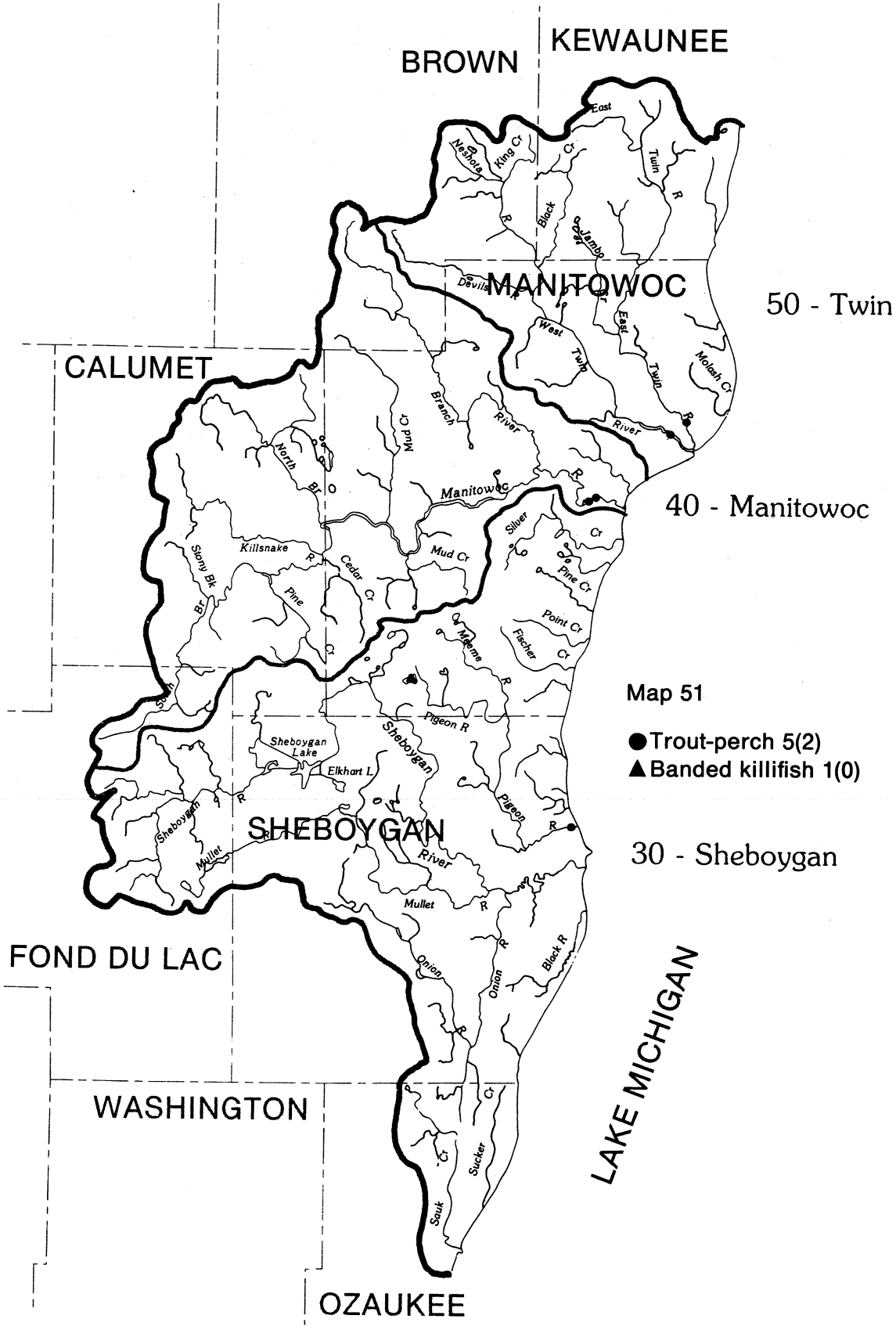
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
East Twin R
Twin R
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Manitowoc River
Mud Cr
North Br
Killsnake R
Stony Bk
Cedar Cr
Pine Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mullet R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan River
Pigeon R
Sheboygan R
Mullet R
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 50
● Tadpole madtom 6(2)


BROWN
KEWAUNEE
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CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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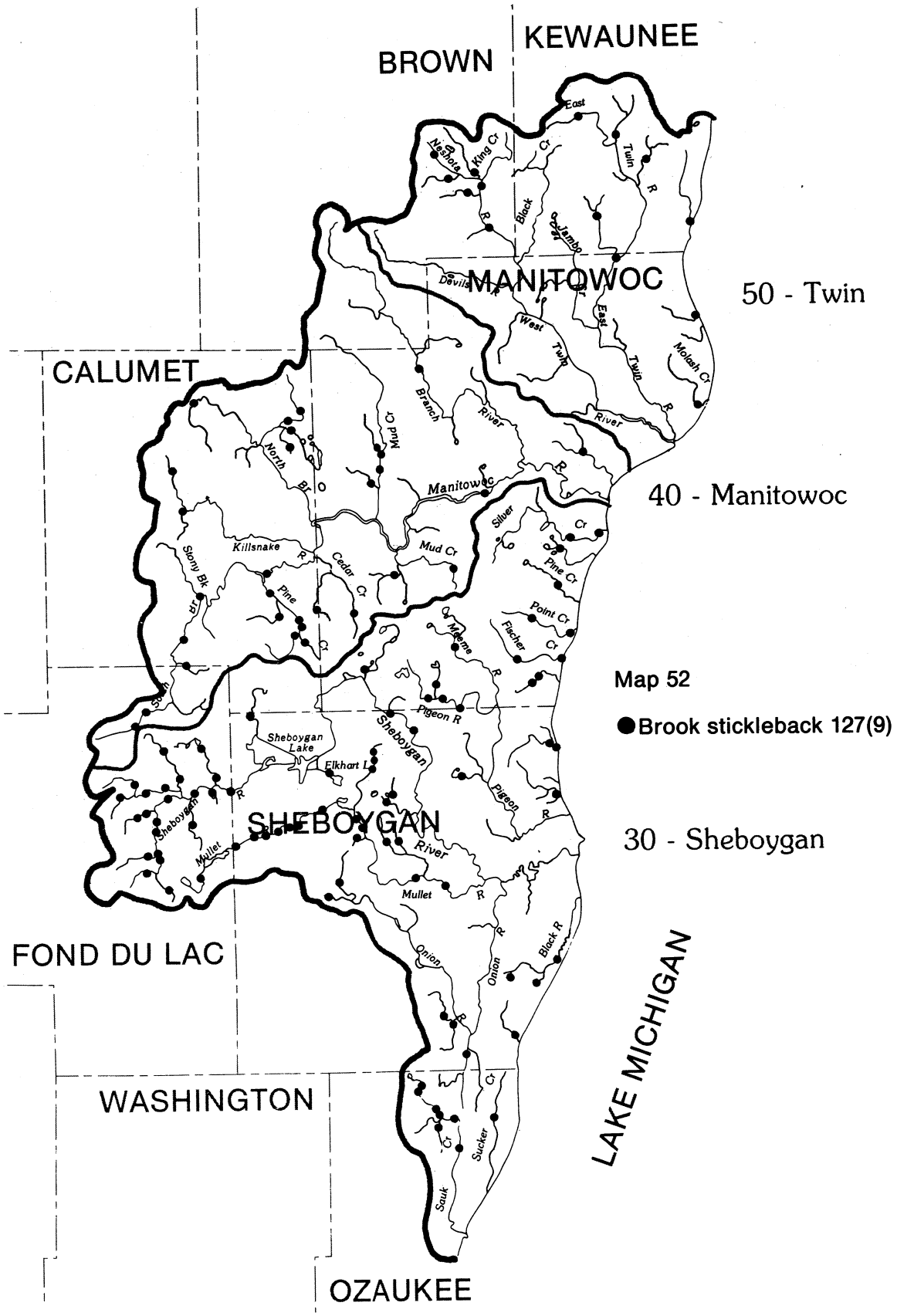
Neshota
King Cr
Twin R
Black R
Devils R
West Twin
East Twin
Molash Cr
Mud Cr
North Br
Manitowoc R
Silver Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Pine Cr
Point Cr
Fischer Cr
Meme R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 51
● Trout-perch 5(2)
▲ Banded killifish 1(0)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WASHINGTON
OZAUKEE
SHEBOYGAN
LAKE MICHIGAN
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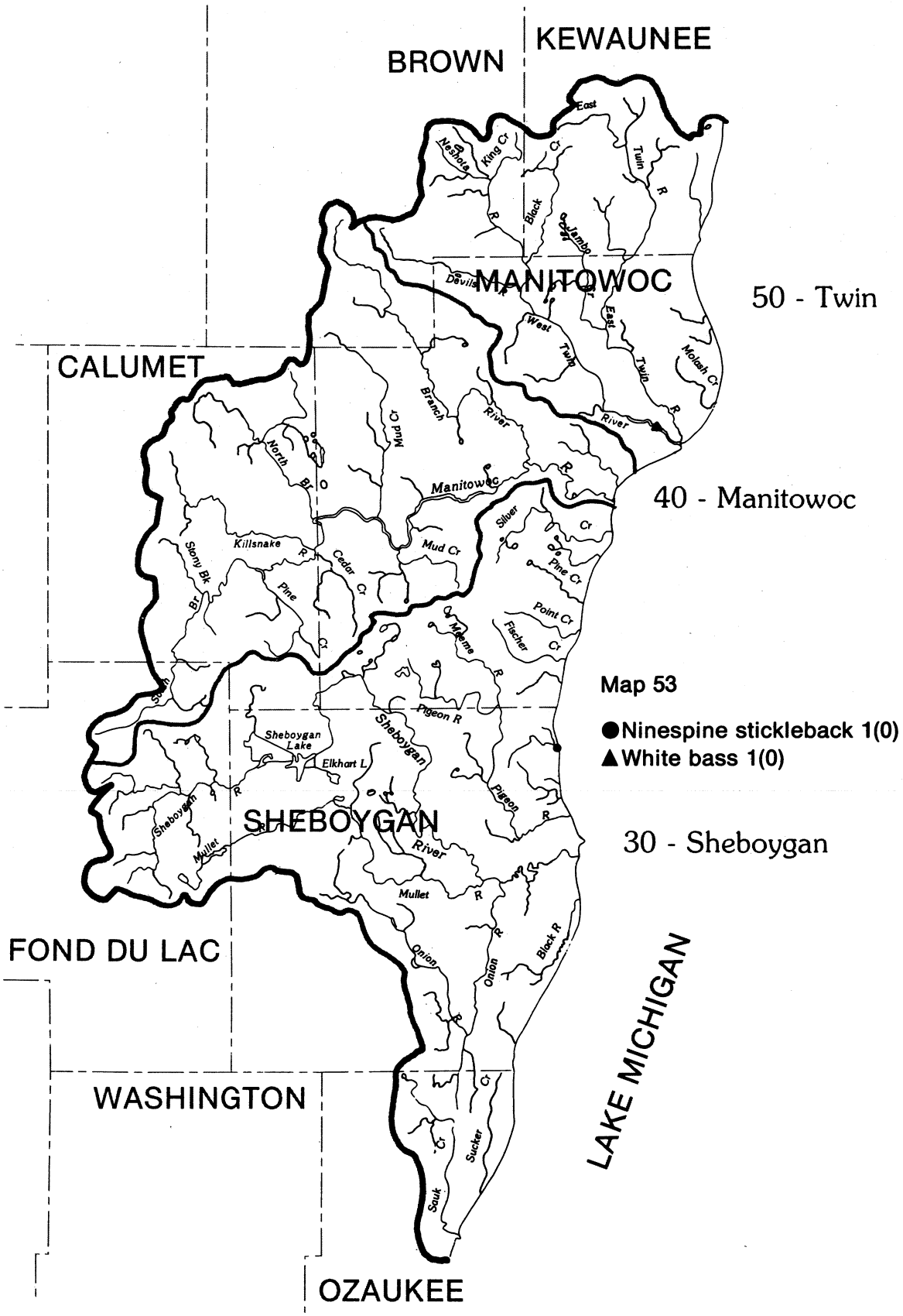
Twin R
Black R
Devils R
West Twin R
East Twin R
Molash Cr
Branch River
River
Mud Cr
North Br
Manitowoc R
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk
Pine Cr
Cedar Cr
Mud Cr
Manitowoc R
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Mullet River
Pigeon R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 52
Brook stickleback 127(9)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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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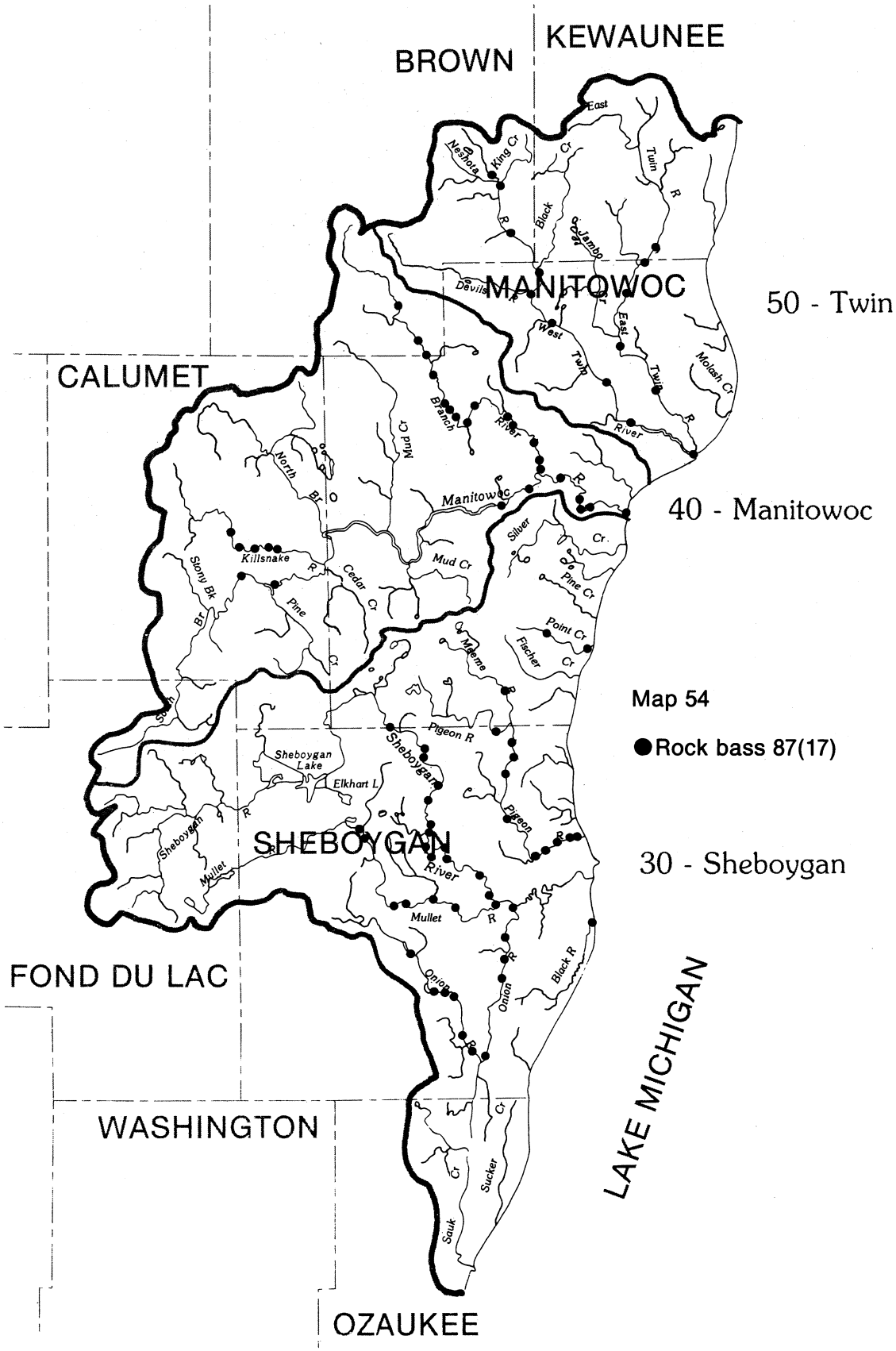
Neshota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
North Br
Manitowoc R
Killsnake R
Stony Bk
Cedar Cr
Pine Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Mullet R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet River
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 53
●Ninespine stickleback 1(0)
▲White bass 1(0)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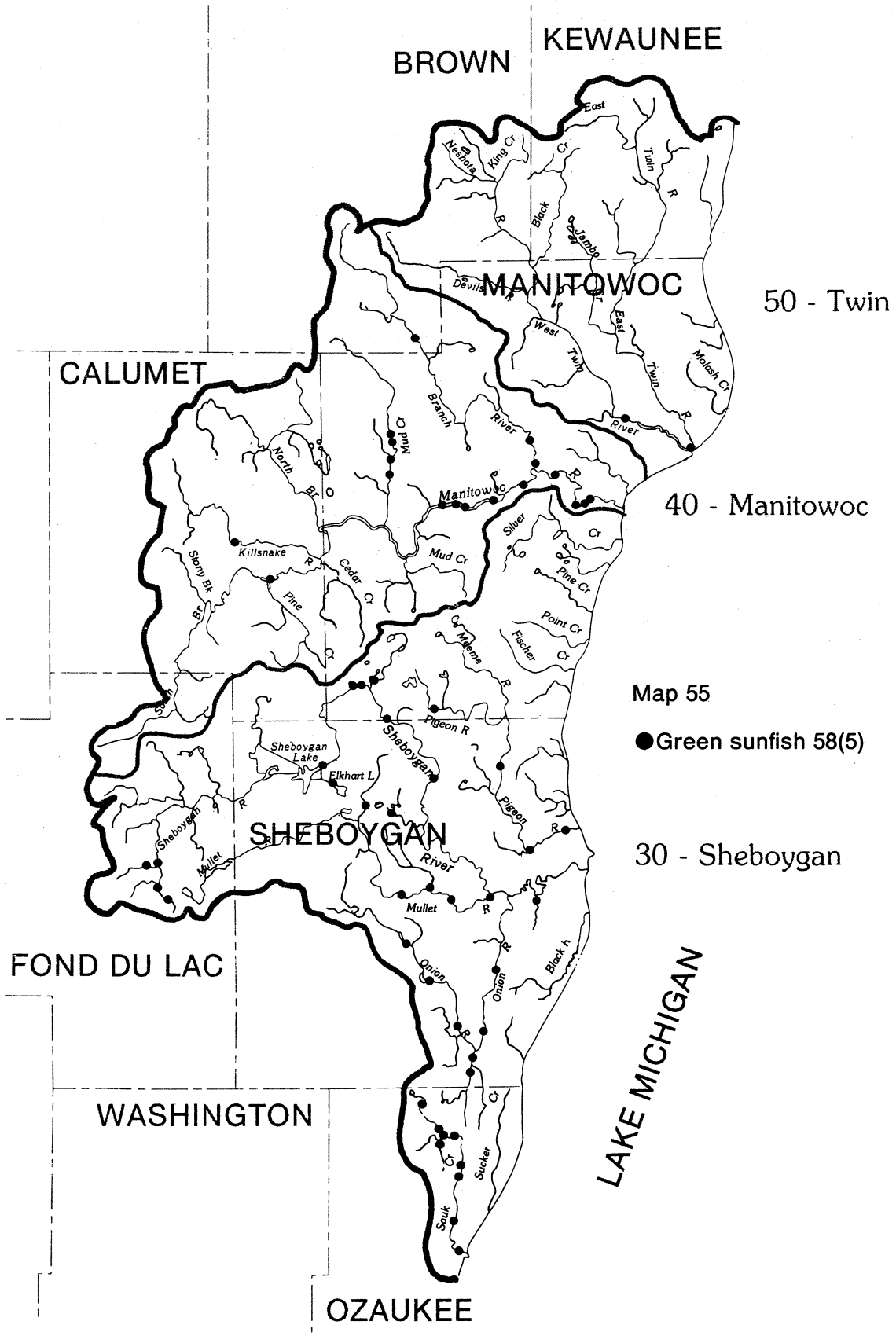
MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 54
●Rock bass 87(17)
East Twin R
Twin R
Black R
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
North Br
Manitowoc R
Killsnake R
Stony Bk Br
Cedar Cr
Pine Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Onion R
Sucker Cr
Sauk Cr


BROWN
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CALUMET
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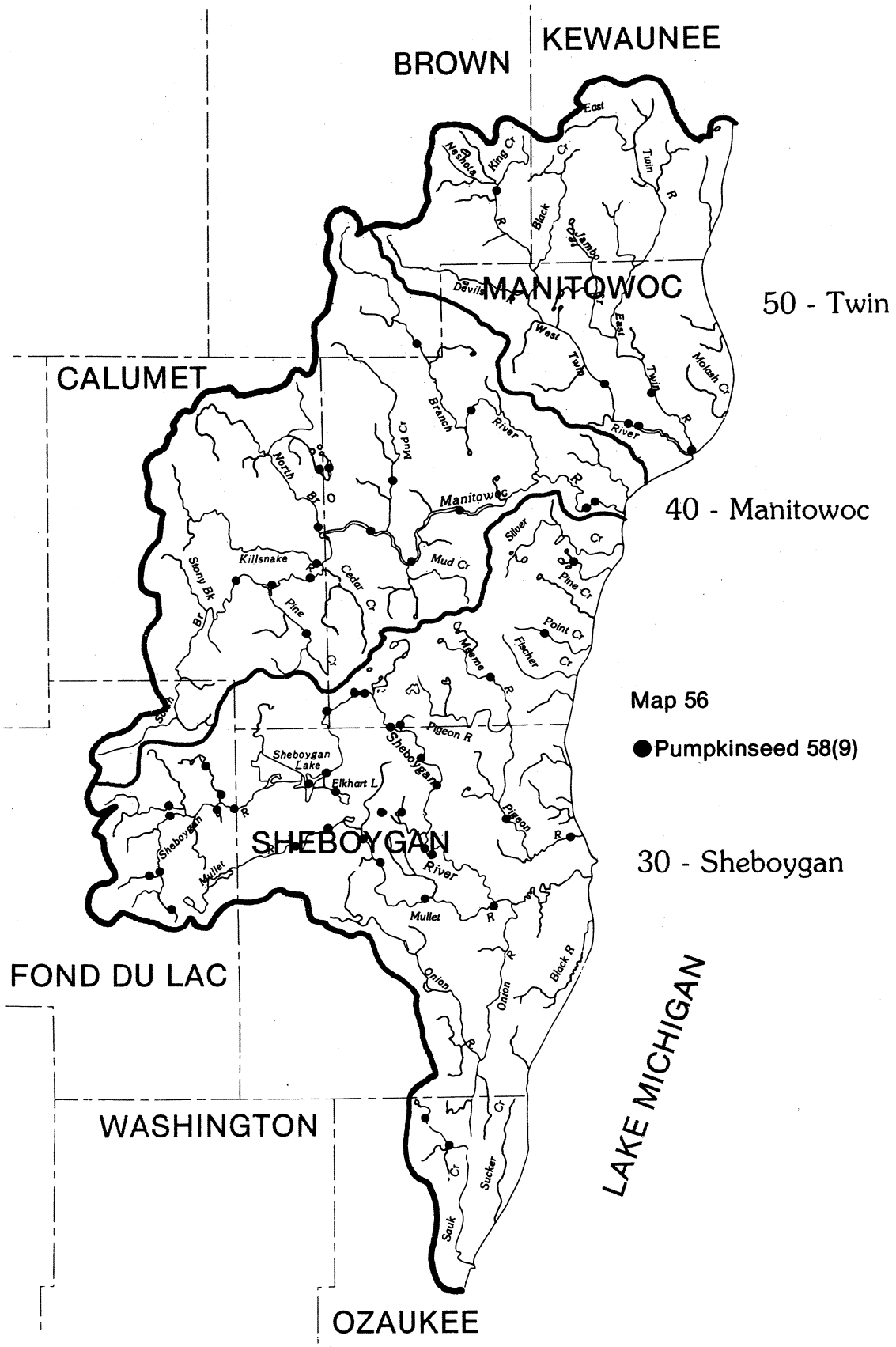
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
East Twin R
Nestota
King Cr
Black R
Jambo Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc
Killsnake R
Stony Bk
Pine Cr
Cedar Cr
Mud Cr
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Meme R
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
River
Pigeon R
Mullet R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 55
●Green sunfish 58(5)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CALUMET
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FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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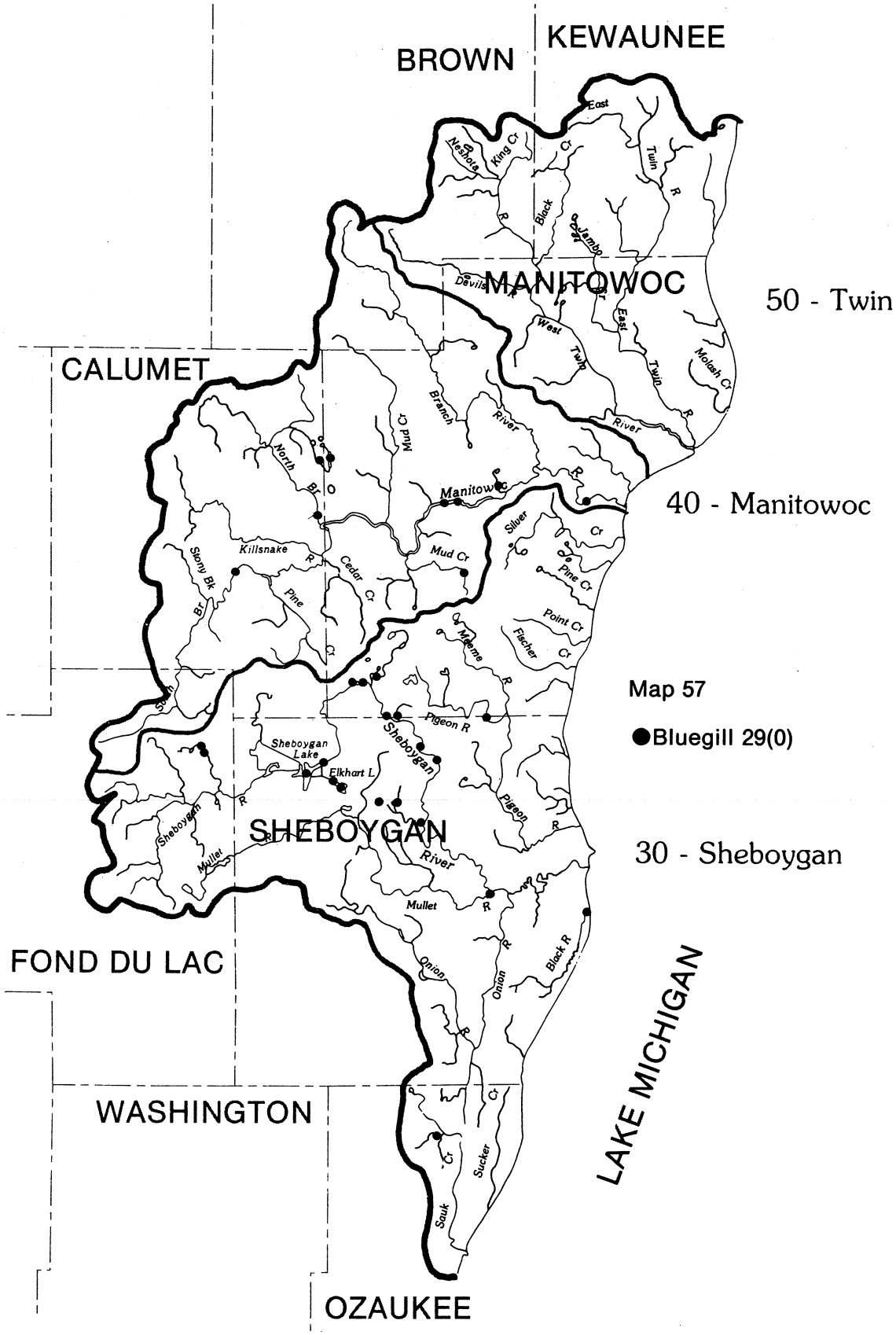
Neshota
King Cr
Black R
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc
Silver Cr
Killsnake R
Stony Bk Br
Cedar Cr
Mud Cr
Pine Cr
Point Cr
Fischer Cr
Pine Cr
Manitowoc R
Pigeon R
Sheboygan Lake
Elkhart L
Sheboygan R
Pigeon R
Sheboygan R
Mullet R
River
Mullet R
Onion R
Onion R
Black R
Sucker Cr
Souk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 56
● Pumpkinseed 58(9)


BROWN
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MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
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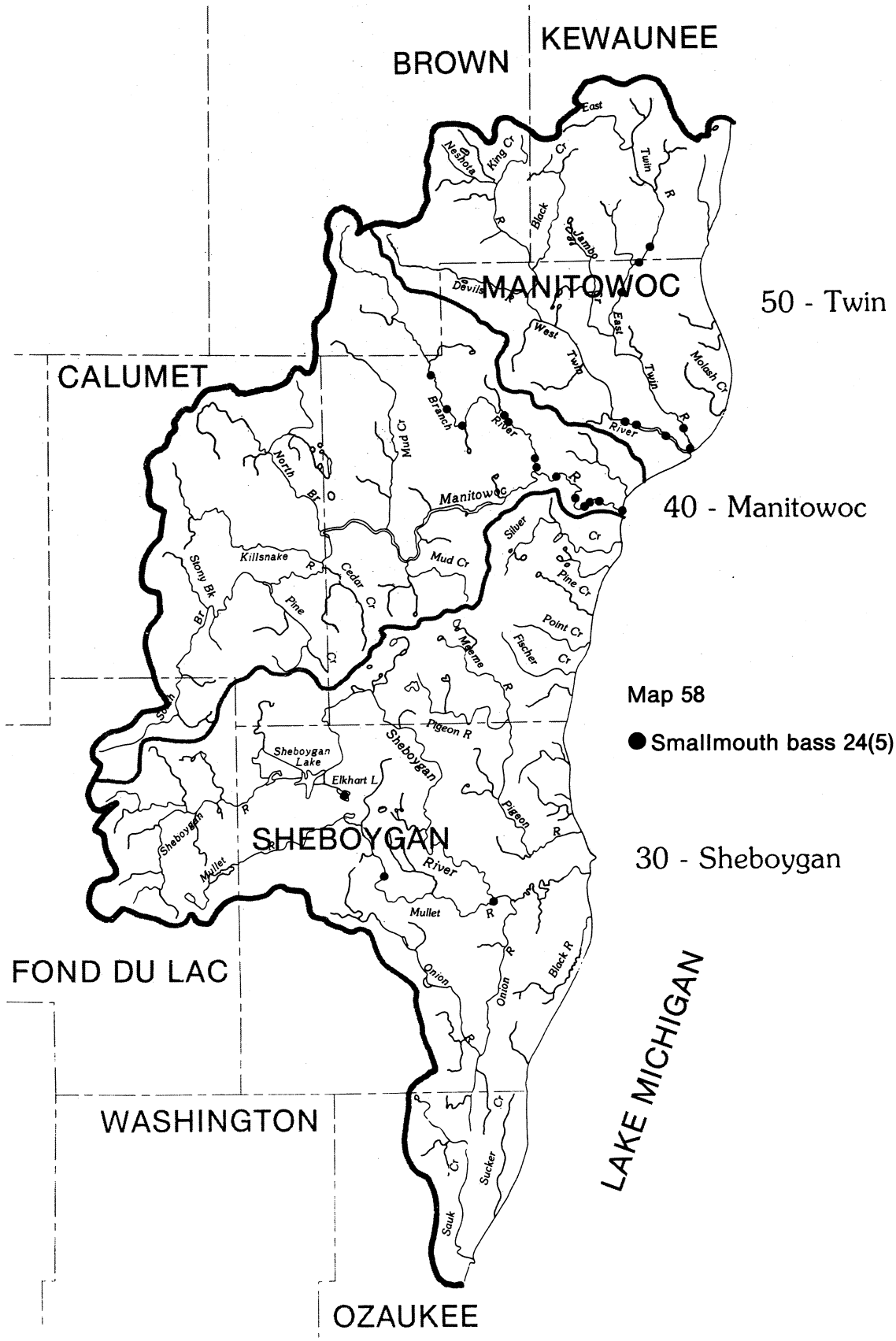
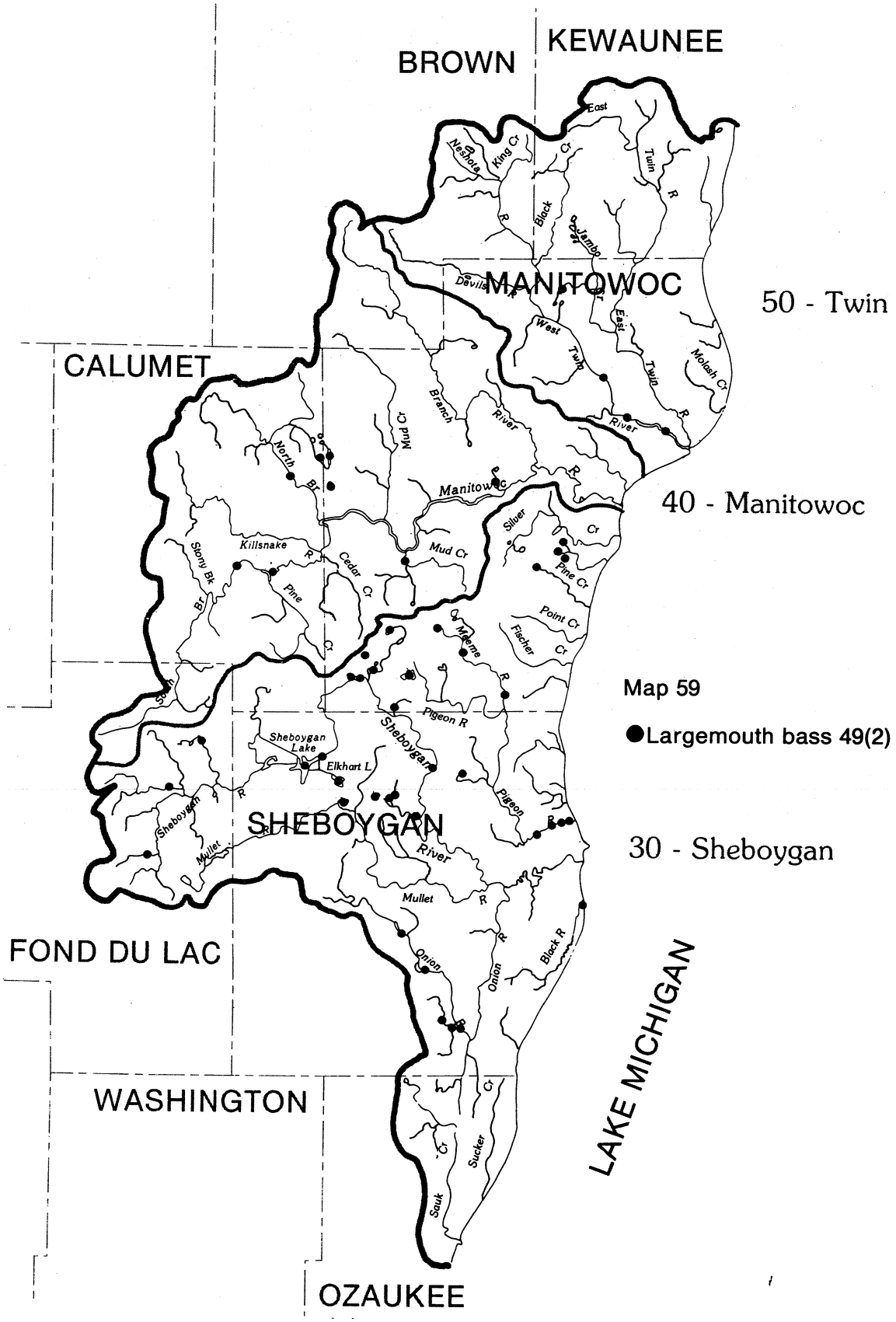
Twin R
Black R
Jambo Cr
King Cr
Nashota Cr
Devils R
West Twin R
East Twin R
Molash Cr
Mud Cr
Branch River
River
North Br
Manitowoc
Silver Cr
Pine Cr
Point Cr
Fischer Cr
Killsnake R
Stony Bk Br
Pine Cr
Cedar Cr
Mud Cr
Manitowoc R
Pigeon R
Sheboygan
Sheboygan Lake
Elkhart L
Sheboygan R
Mullet R
Mullet River
Pigeon R
Onion R
Onion R
Black R
Sucker Cr
Sauk Cr
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 57
●Bluegill 29(0)


BROWN
KEWAUNEE
MANITOWOC
CALUMET
SHEBOYGAN
FOND DU LAC
WASHINGTON
OZAUKEE
LAKE MICHIGAN
East
Twin R
Black
Devils
West
Twin
East
Twin
Molash Cr
Branch
River
Mud Cr
North Br
Manitowoc
Killsnake R
Stony Bk
Br
Cedar Cr
Pine
Cr
Mud Cr
Silver
Cr
Pine Cr
Point Cr
Fischer
Cr
Pigeon R
Sheboygan
Lake
Elkhart L
Sheboygan
River
Mullet
Onion
Onion R
Black R
Cr
Sucker
Sauk
50 - Twin
40 - Manitowoc
30 - Sheboygan
Map 58
Smallmouth bass 24(5)


BROWN
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Killsnake R
Stony Bk Br
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Pine Ck
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Fischer Cr
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Pigeon R
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Elkhart L
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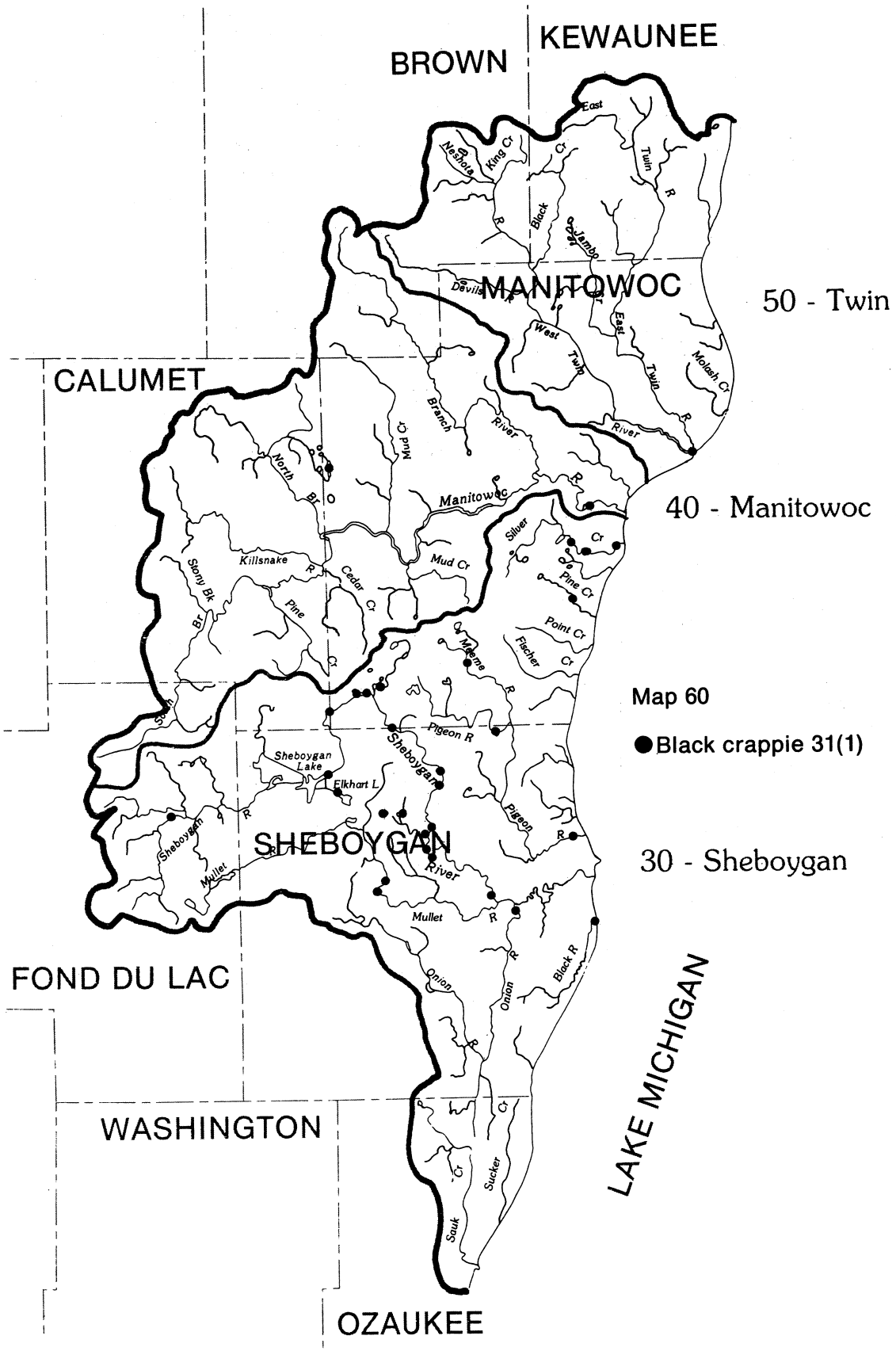
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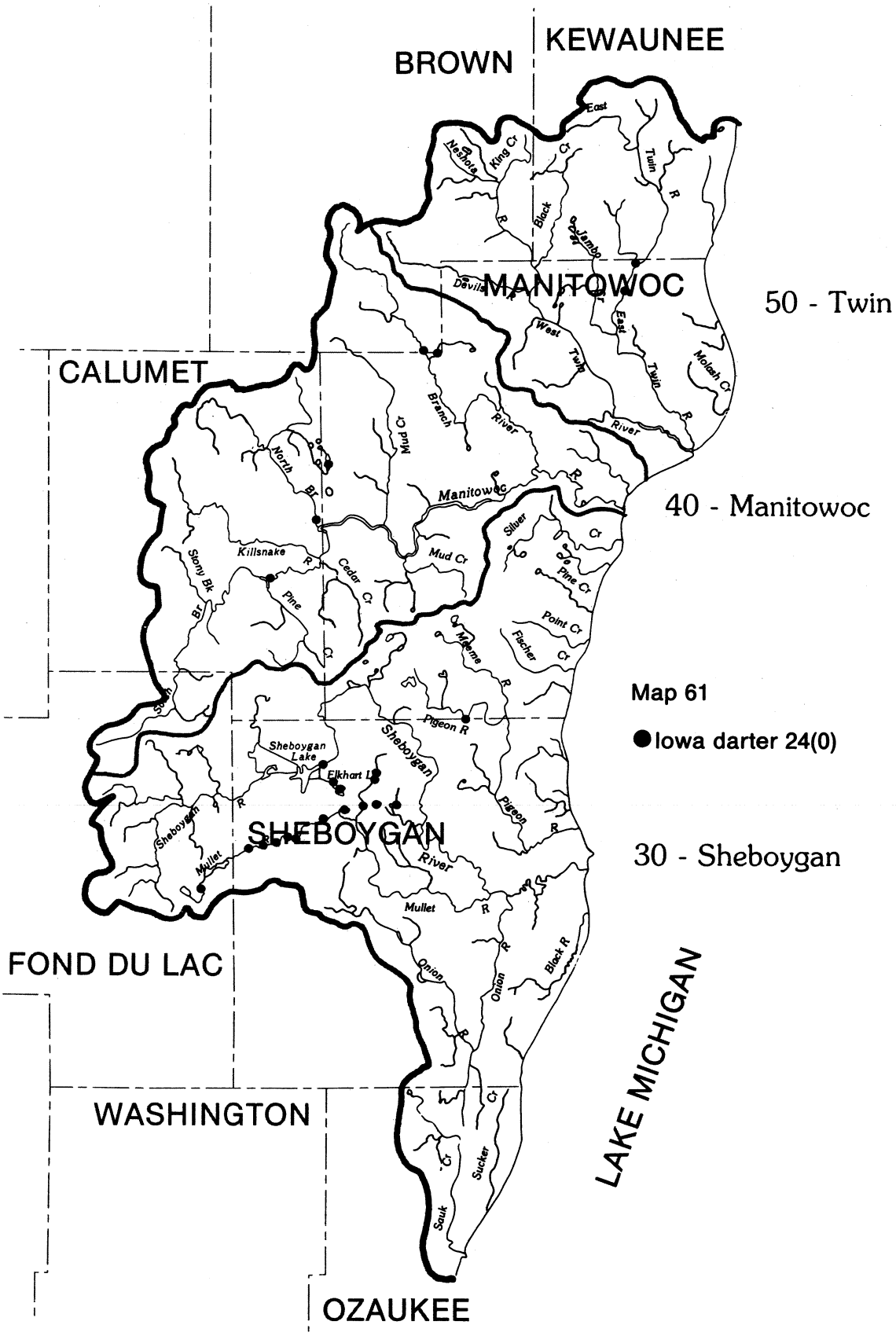
● Black crappie 31(1)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Map 61
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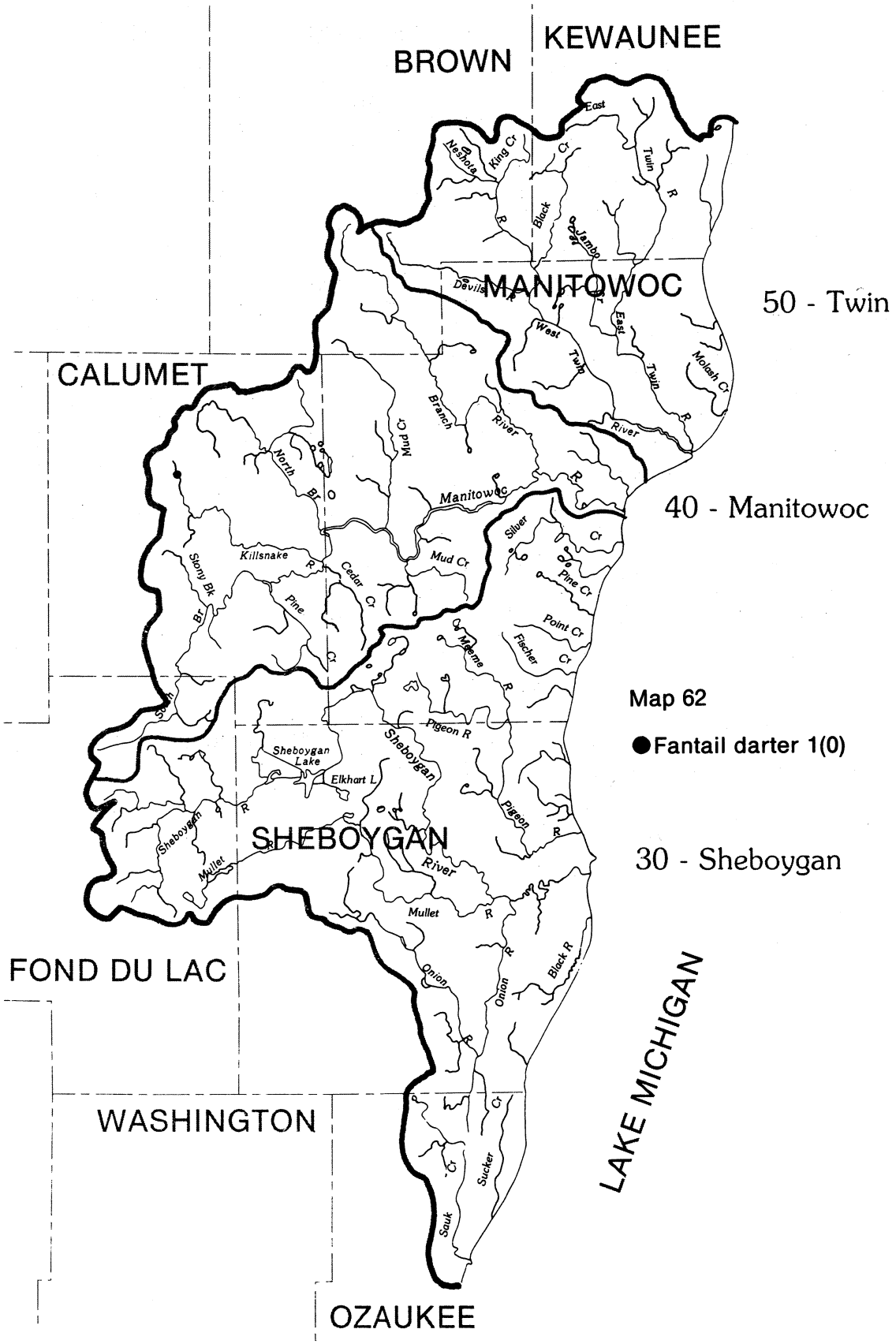
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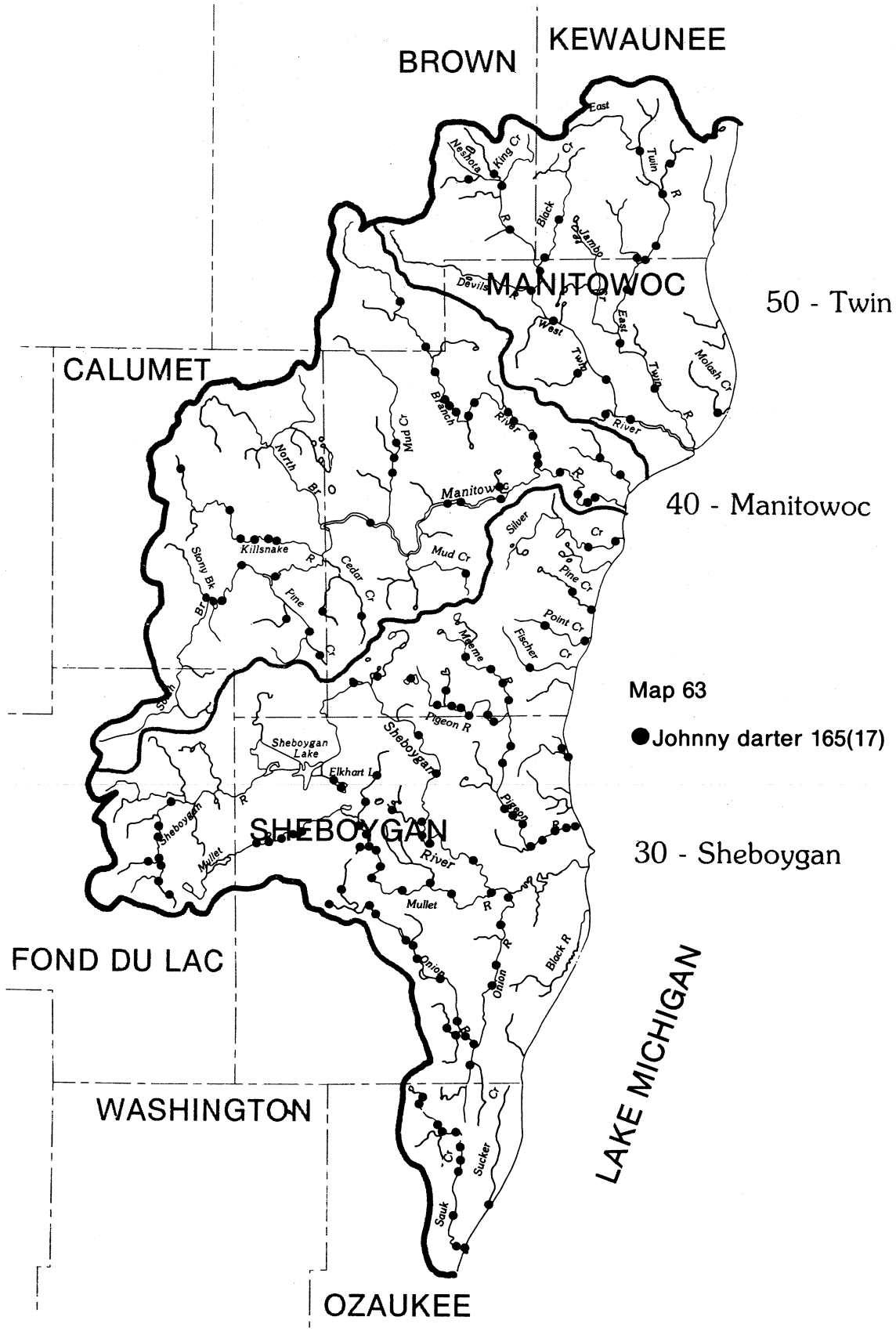
● Fantail darter 1(0)
30 - Sheboygan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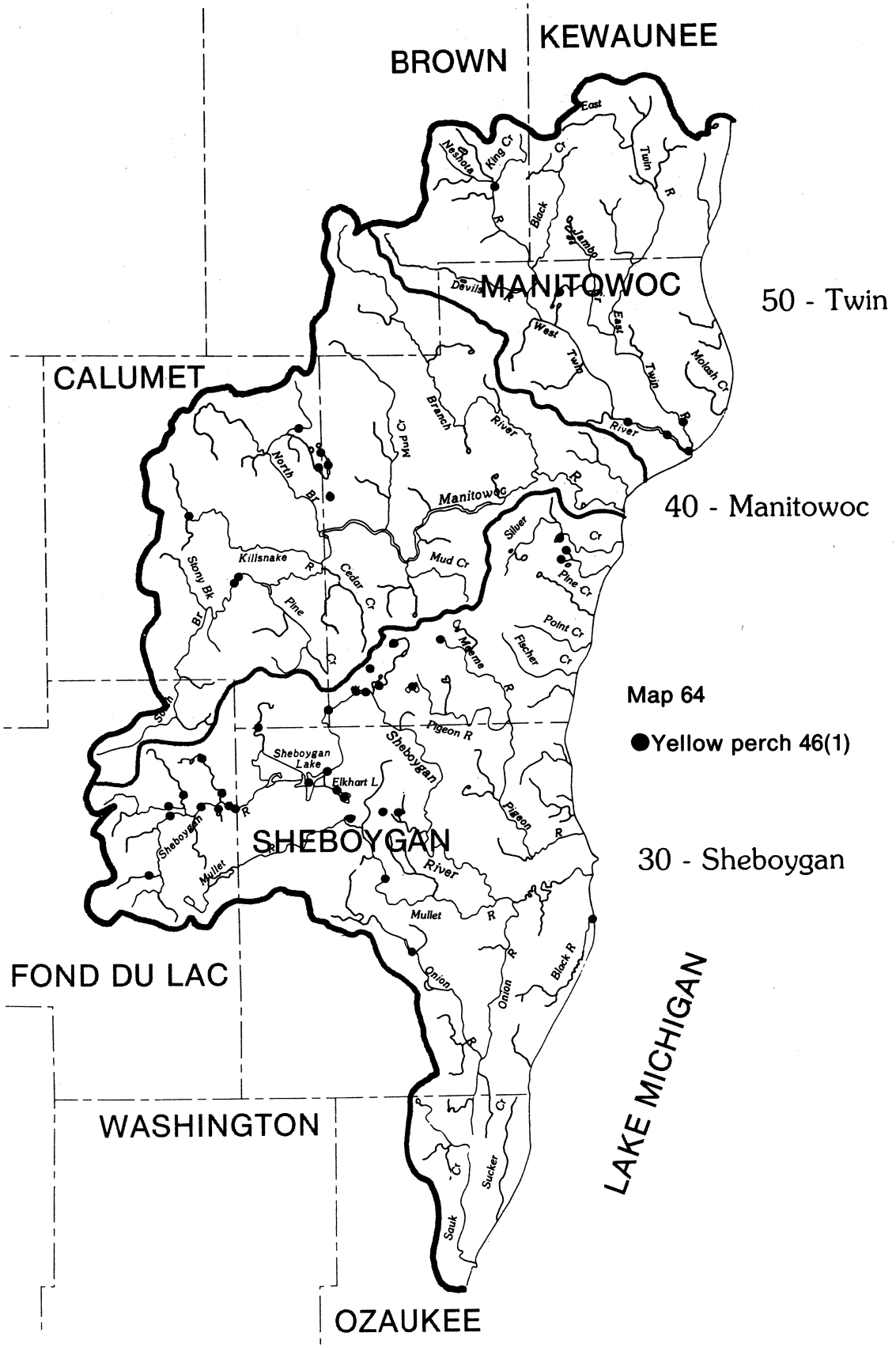
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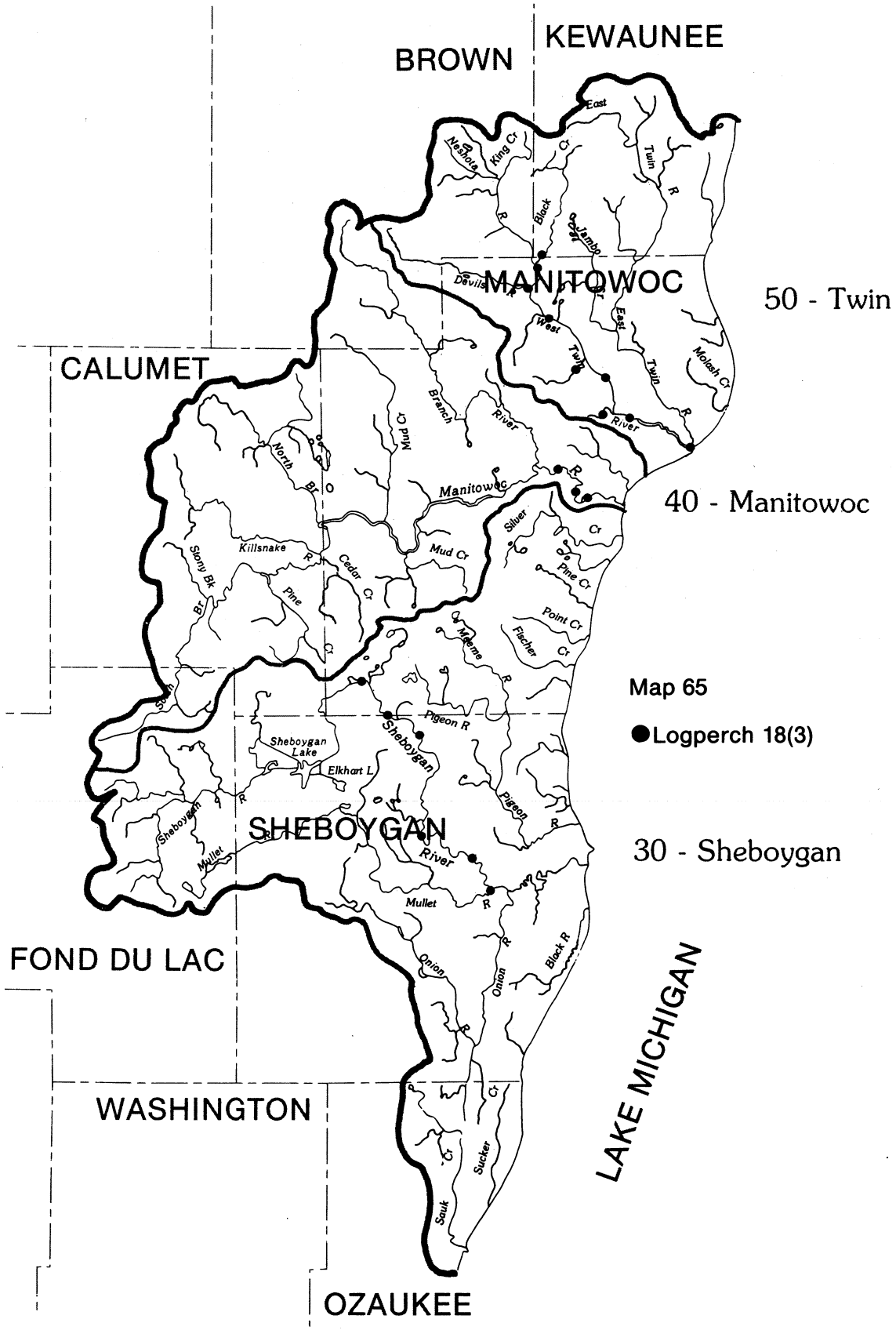
Map 64
Yellow perch 46(1)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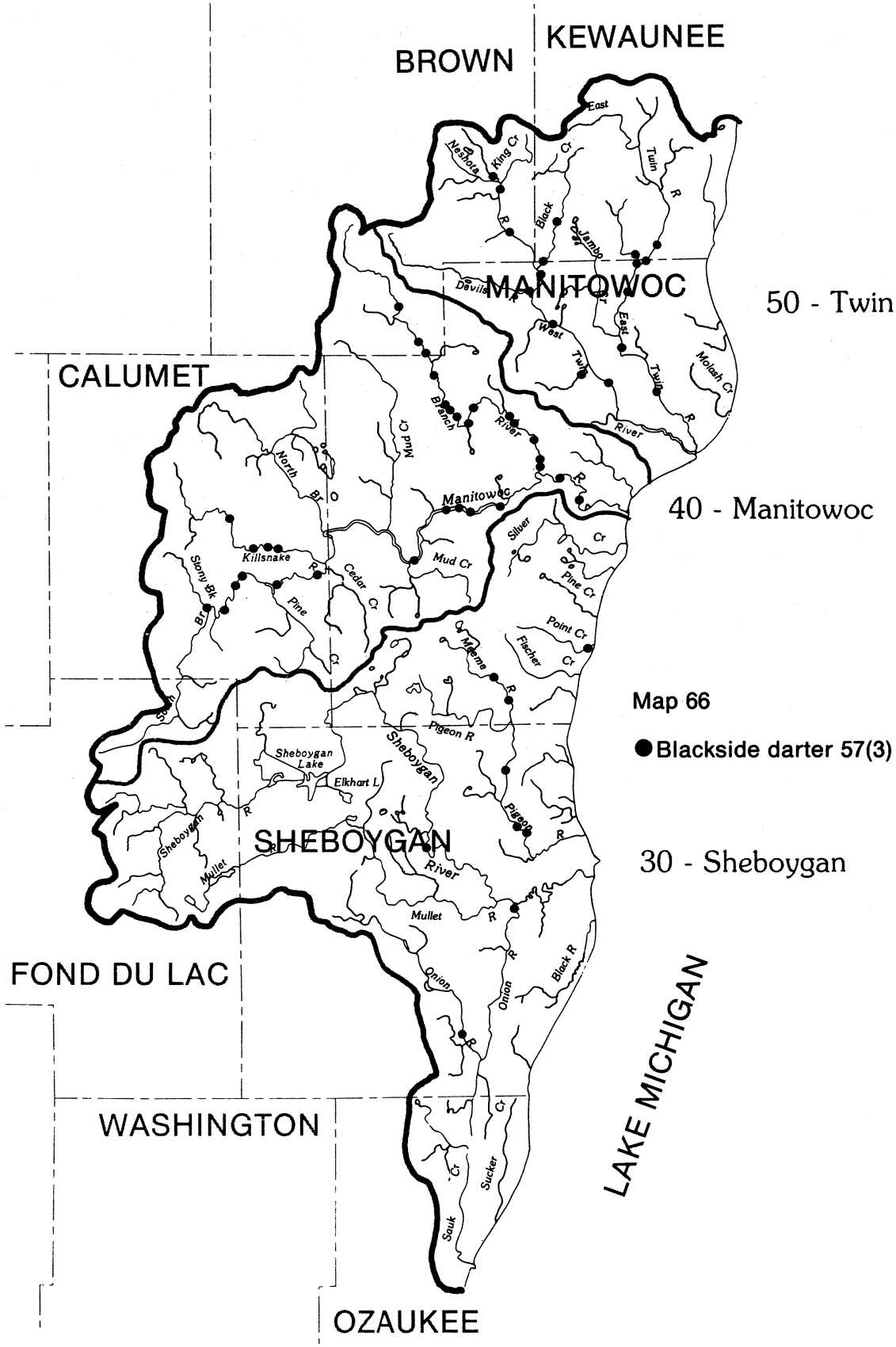
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● Blackside darter 57(3)
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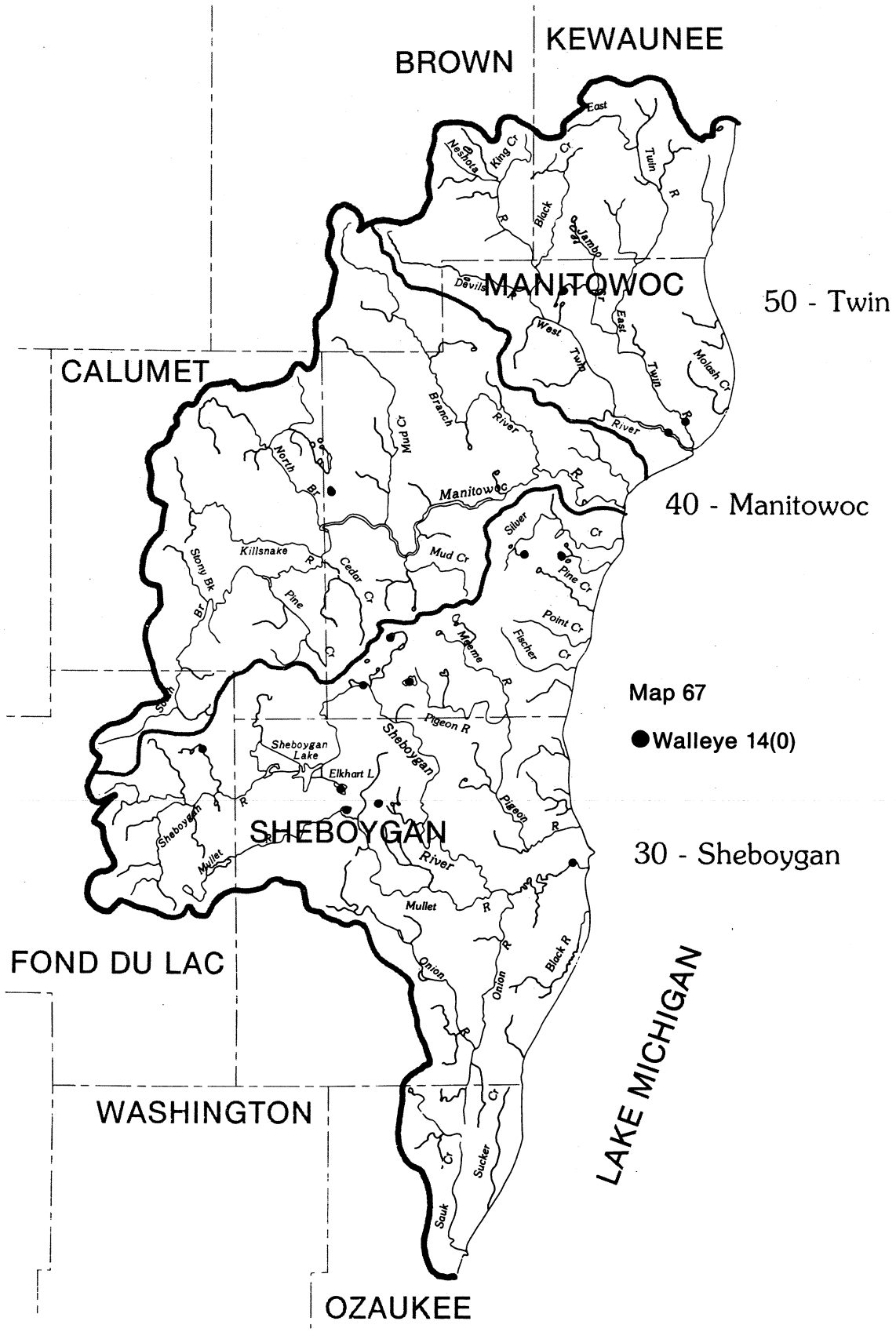
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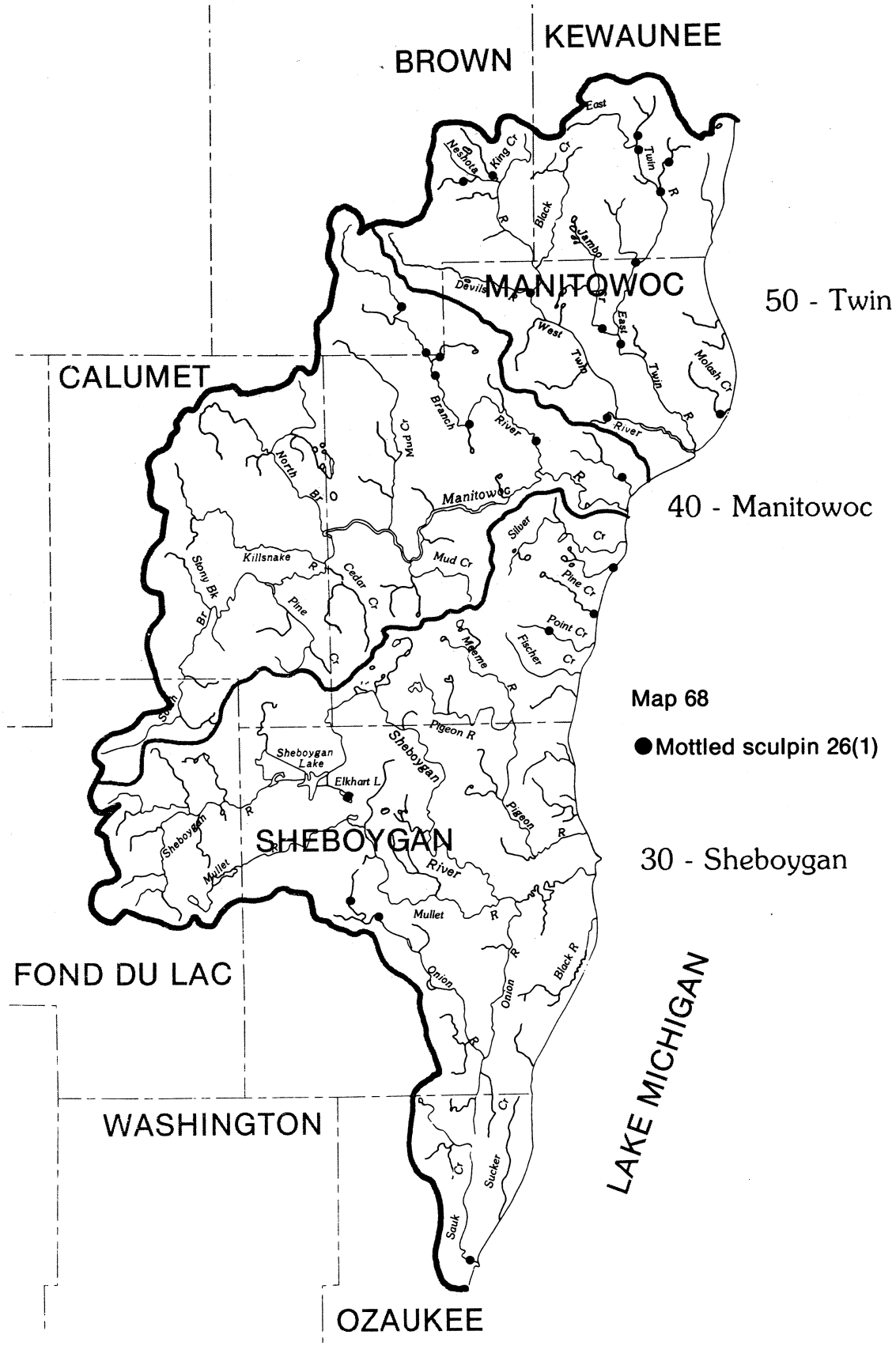
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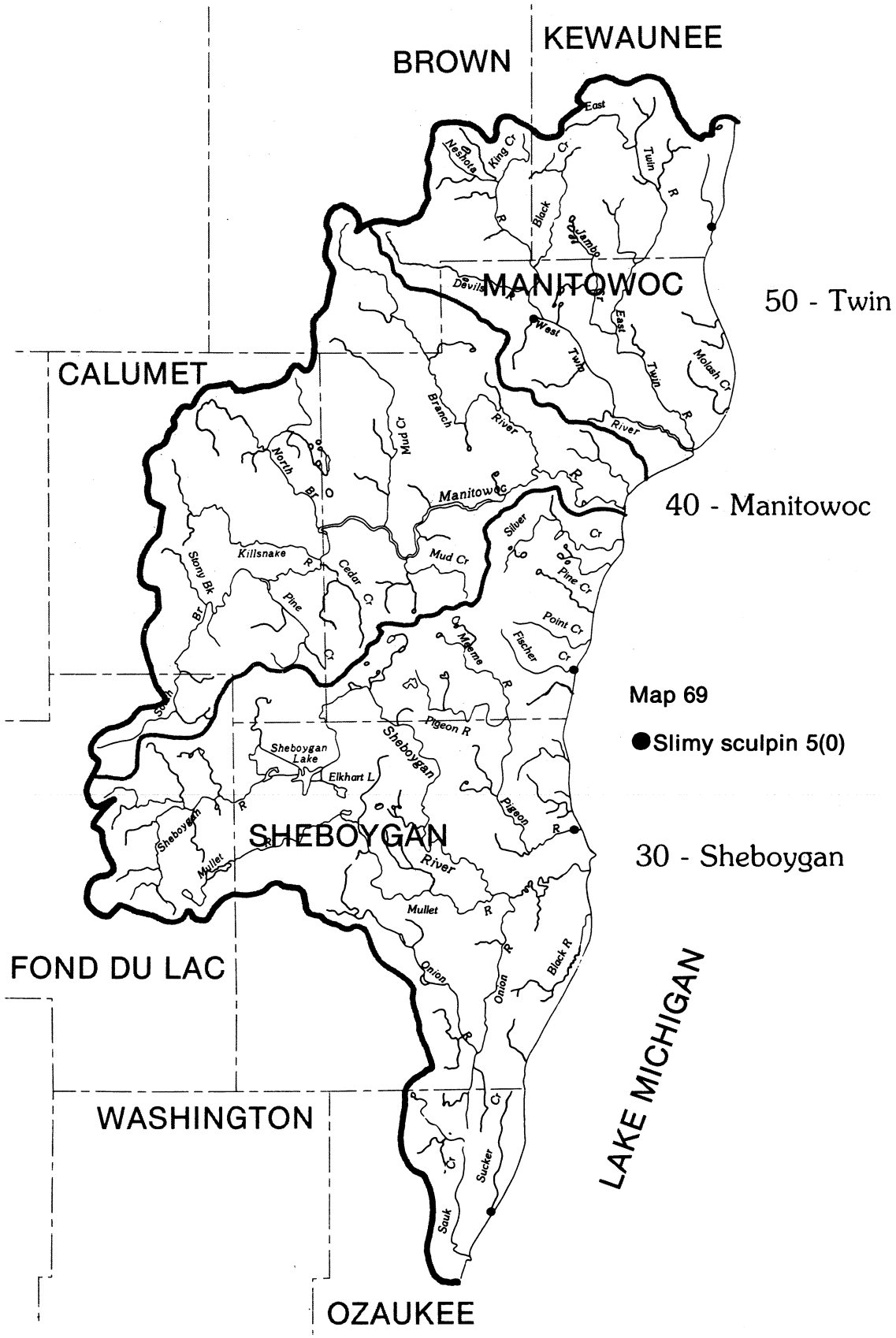
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Slimy sculpin 5(0)

INDEX TO MAPS

METRIC-ENGLISH AND ENGLISH-METRIC CONVERSIONS

1 km = 0.6214 mile
1 km^2 = 0.3861 $miles^2$
1 ha = 2.47 acres
1 cm = 0.3937 inches (0.328 ft)
1 m^3 = 35.21^3

1 ft = 30.48 cm
1 mile = 1.609 km
1 acre = 0.4047 ha

ACKNOWLEDGMENTS

The study of the distribution of fish in the Sheboygan, Manitowoc, and Twin river basins spans six years and represents the efforts and cooperation of a number of people.

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This report was critically reviewed by Anne Forbes and Lyle Christenson.

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About the Author

Don Fago is a fisheries biologist with the Bureau of Research who has been in charge of the statewide fish distribution study since its inception in 1974 (DNR, 3911 Fish Hatchery Road, Madison, Wisconsin 53711).

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