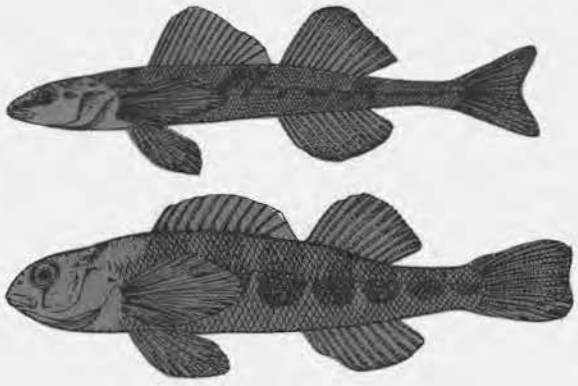

DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN

VII. St. Croix River Basin

Technical Bulletin No. 159
Department of Natural Resources
Madison, Wisconsin
1986

COVER: *Crystal darter and gili darter*

This report is dedicated to the nongame fish, whose interrelationships in the aquatic ecosystem are 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 11,200 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 the 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 DNR 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: 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*), Grant & Platte, Coon & Bad Axe, and La Crosse river basins (Fago 1985*a*), and Sheboygan, Manitowoc, and Twin river basins (Fago 1985*b*). 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 the St. Croix River basin.

DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN

VII. ST. CROIX RIVER BASIN

By
Don Fago

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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 St. Croix River basin was sampled from 1975 through 1983 at 920 stations by research personnel, at 10 stations by Dr. James Underhill and his students from the University of Minnesota, at 10 stations by fish management personnel, and at 1 station by students of Dr. George Becker from UW-Stevens Point. An additional 257 stations were partially sampled by fish management personnel and other collectors.

A total of 93 species was collected from the St. Croix River basin. Included were the endangered crystal darter and the threatened speckled chub, blue sucker, and gilt darter. Six species on the Department's watch list were also collected.

Data from the 1975-83 period for the St. Croix River basin were compared to those from the 1900-43 and the 1944-74 periods. Eleven species were collected which had not been previously reported from the St. Croix River basin. Twelve species have apparently been extirpated from the St. Croix River basin.

This report includes numerous tables, distribution maps of the species, and discussion on many aspects of fish distribution in the St. Croix River basin. 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

The St. Croix River basin is located in the northwestern portion of Wisconsin (Fig. 1). It is part of the Mississippi River basin and encompasses parts of the following Wisconsin counties: Barron, Bayfield, Burnett, Dunn, Douglas, Pierce, Polk, Sawyer, St. Croix, and Washburn. This basin includes those portions of the St. Croix River and its tributaries that are in Wisconsin. The watershed in Wisconsin contains an area of approximately 11,417 km^2 (Holmstrom 1982). Within this area, we have defined 689 streams with a total length of 4,221 km (Table 1)*. Of these, 427 are unnamed creeks and ditches.

There are 2,135 lakes** in the basin, with a total area of 47,074 ha. The average size is 22 ha with only 63 over 120 ha.

The average annual precipitation within the St. Croix River basin is 74 cm (71-79 cm) (Wis. Dep. Nat. Resour. 1972). The average gradient for the St. Croix River (275 km in length) is 38 cm/km. The average discharge at St. Croix Falls, which includes 80% of the drainage area[1], is 119 m^3/sec (U.S. Geol. Surv. 1982). We determined from the data collected at our sampling stations that the St. Croix River's stream bottom is composed primarily of sand, gravel, rubble, muck, and silt with limited areas of boulder and detritus.

The major land uses in this basin are woodland (57%) and cropland (22%) (Wis. Dep. Nat. Resour. 1980). Population within the basin in 1978 was estimated at 112,703 which has increased 32% since 1950.

The Apple River north of Star Prairie.

The Namekagon River north of Spring Brook, 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.

[1]Includes the St. Croix River basin in Minnesota.

TABLE 1. *Land area, streams, and lakes of the St. Croix River basin.*

Land area (km²)	11,417
Streams	
Total number	689
Unnamed creeks or ditches	427
Total length (km)	4,221
Lakes/impoundments*	
Total number	2,135
Area (ha)	47,074
No. dams	136

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

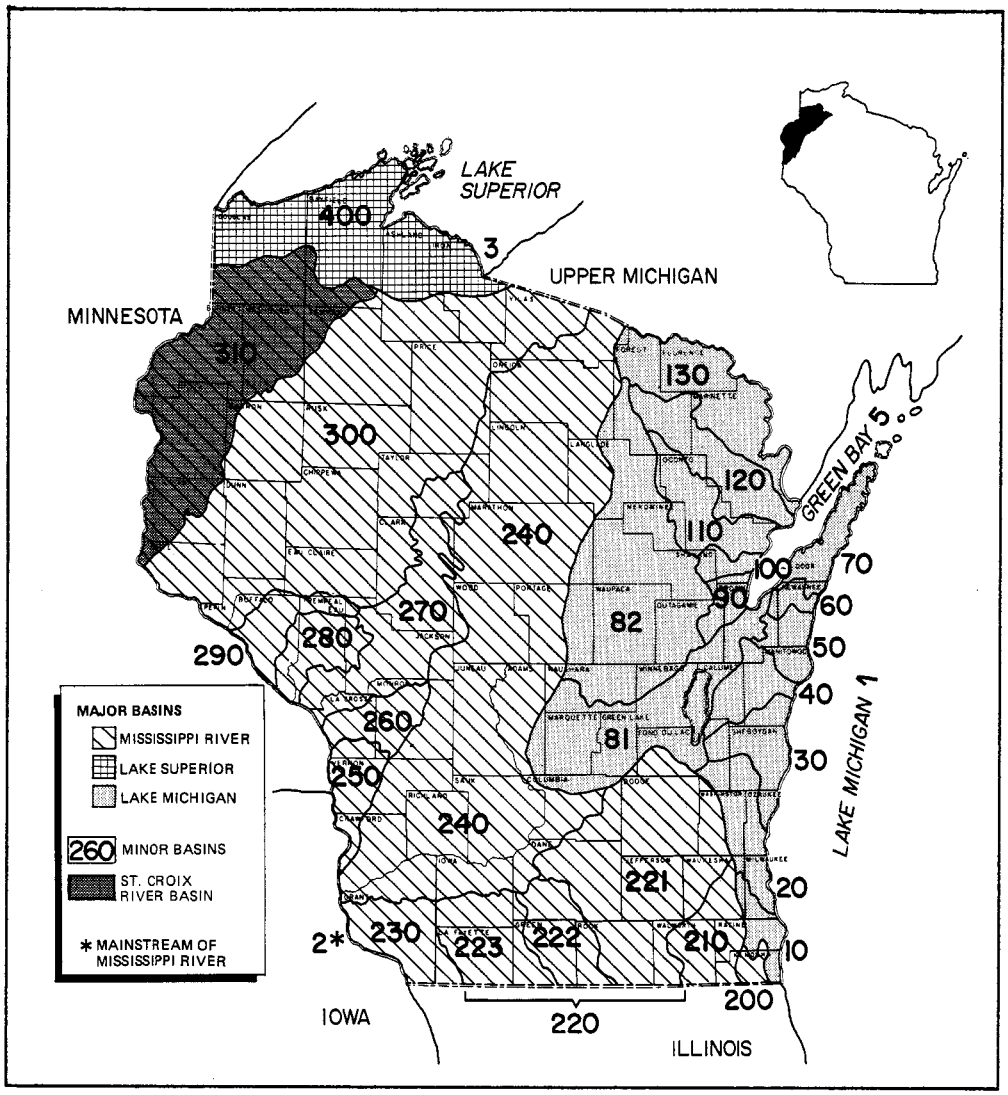
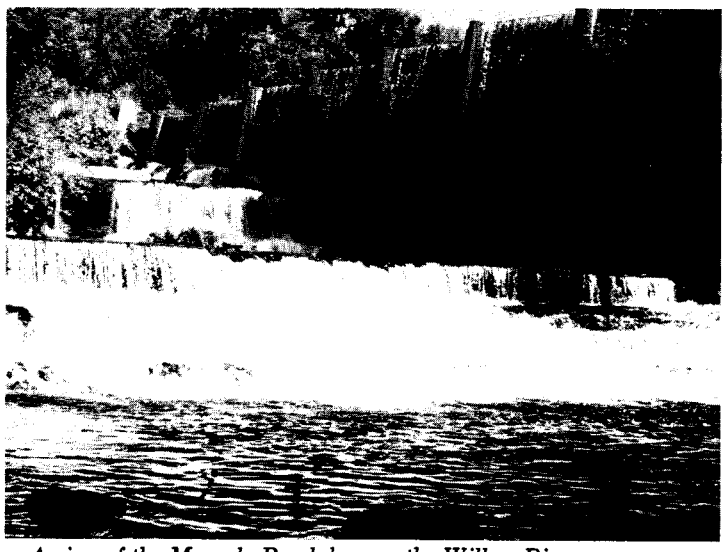
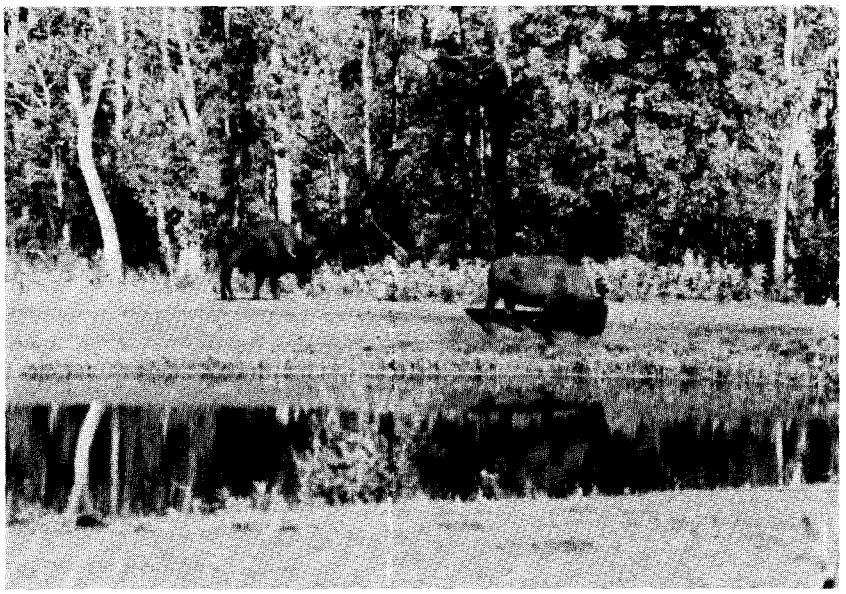


FIGURE 1. *Major and minor river basins in Wisconsin.*

A view of the St. Croix River above the mouth of the Apple River.



A view of the Mounds Pond dam on the Willow River.



Some atypical fauna (yes - buffalo) along Black Brook in St. Croix County.

METHODS

Data Sources and Time Periods

All collections are divided into 3 time periods: 1900-43, 1944-74, and 1975-83. The earlier records provide the basis for assessment of change over time in distribution of fish species within the basin.

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 1900-43 period, depending on how the samples were taken: complete (those in which all species collected were recorded and identified), or partial (those in which sampling effort and/or species identification were incomplete and therefore did not yield adequate assessment of total species composition).

1900-43 Period. Collections from this period were made at 75 stations by a number of collectors. They included E. P. Creaser, S. N. Jones, G. Wagner, Schultz, and C. Tarzwell (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). Seventy-two percent of the stations were sampled between 1925 and 1928. The stations sampled were located on 26 streams and 21 lakes in this basin (Table 2). Thoroughness of sampling effort was unknown, and therefore calculation of percent occurrence of each species was not attempted (Table 5).

1944-74 Period. Complete collections from the period were made at 40 stations on 3 streams and 7 lakes in this basin (Table 2). An additional 399 partial stations increased the number of streams sampled by 100 and lakes by 137. 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. These partial samples came from written records provided by DNR fish management and research personnel.

The complete samples from this basin (47% collected in 1970-74) were collected by the following: Dr. James Underhill and his students (unpubl.

TABLE 2. *Summary of stream and lake sampling effort in the St. Croix River basin, 1900-83.*

	1900-43	1944-74	1975-83
Streams			
No. sampled	26	3*(100)**	176(15)
No. stations	54	33 (260)	462(171)
Lakes/impoundments			
No. sampled	21	7 (137)	165(46)
No. stations	21	7 (139)	479(86)
Total no. stations	75	40 (399)	942(257)

*Complete samples.
**Partial samples.

data) - 18 stations; Dr. George Becker and his students (unpubl. data and 1983) - 16 stations; Wisconsin DNR Bureau of Research - 5 stations; and Upper Mississippi River Conservation Committee personnel (Smith and Lopinot 1967) - 1 station.

Total occurrences are defined as the sum of the number of species captured 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 1943, 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 752 for the 1900-43 period to 1,847 for the 1944-74 period for the St. Croix River basin. During 1944-74, total occurrences for the St. Croix River basin numbered 1,847, 74% of which were accounted for by fish management personnel. Collections by Drs. Underhill and Becker and their students provided 60 species not taken by fish management in the St. Croix River basin (Table 3 and Append. A Table 16).

1975-83 Period. Complete collections from this period were made at 941 sampling stations (72% collected in 1976-79) on 176 streams and 165 lakes in the St. Croix River basin (Table 2). There were an additional 257 partial collections which increased the number of streams by 15 and lakes by 46.

For the St. Croix River basin, the number of complete samples increased more than 2,250% over the 1944-74 period (Table 2). DNR research personnel sampled 920 (98%) of the complete samples, Dr. Underhill and his students sampled 10 (1%), fish management personnel sampled 10 (1%), and students of Dr. Becker sampled 1. The 257 partial samples were collected by fish management personnel, research personnel, sport fishermen, and miscellaneous collectors (Audubon Ecology Camp, unpubl. data).

Total occurrences increased from 1,847 for the 1944-74 period to 8,850 for the St. Croix River basin; 88% of these were recorded by research personnel (Table 3). We also collected 91 out of the 93 total species found in the St. Croix River basin (for list of species taken by all other collectors see Append. A Table 16).

TABLE 3. *List of collectors with number of species taken and total occurrences for samples from the St. Croix River basin.*

Source of Data*	1944-74 No. Species	1944-74 Total Occurrences**	1975-83 No. Species	1975-83 Total Occurrences
Research 0	25	89(5)	91	7,784(88)
Fish Mgt. 1	25	1,367(74)	47	950(11)
Becker 2	40	125(7)	1	2(t)[1]
Sport fishermen 8	—	—	1	2(t)
UMRCC 9	11	11(t)	—	—
Miscellaneous 16	—	—	7	7(t)
Underhill 17	72	255(14)	33	105(1)
Grand total of occurrences		1,847		8,850

*Collectors identified in Appendix A Table 16.
**Total occurrences are defined as the sum of the number of species collected at each station; percent of total occurrences in parentheses.
[1]t = less than 0.5%.

Collection Methods and Gear*

We used 7 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 (6%), minishocker (1%), AC stream shocker (20%), DC stream shocker (3%), AC battery-powered backpack (1%), DC battery-powered backpack (1%), and longline shocker (1%). Small mesh seines were used at 60% of the stations, primarily in lakes and large rivers.

All generators produced direct current, with the boom shocker permitting a choice of several pulse rates and frequencies. The boom shocker also produced alternating current, and it was used occasionally when the DC unit was inoperative. For more information concerning the boom and stream shocking equipment, see Novotny and Priegel (1971, 1974). The AC battery-powered backpack uses a 12-volt deep cycle battery and outputs alternating current at several voltages. The seines were 1.2-m and 9.1-m bag seines with 4.8-mm delta mesh.

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

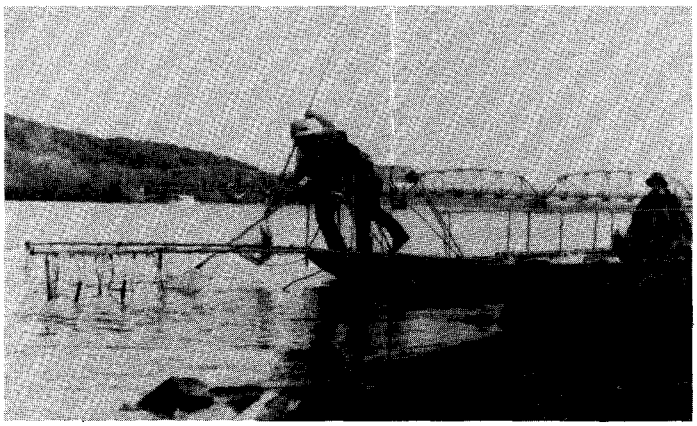
Sampling Effort

We established sampling locations based on habitat diversity, the distance between stations, and accessibility. The length of a sampling station was approximately 78 m for all electrofishing gear except for the boom shocker and minishocker. Boom shocker and minishocker stations averaged 2.5 km. Areas seined averaged 316 m^2. Distance between stations on the main stem of the St. Croix River averaged 2.1 km. There was an average of 1 station/7 km of the total length of all sampled streams with one or more complete stations. On sampled lakes there was an average of 1 station/51 ha of water.

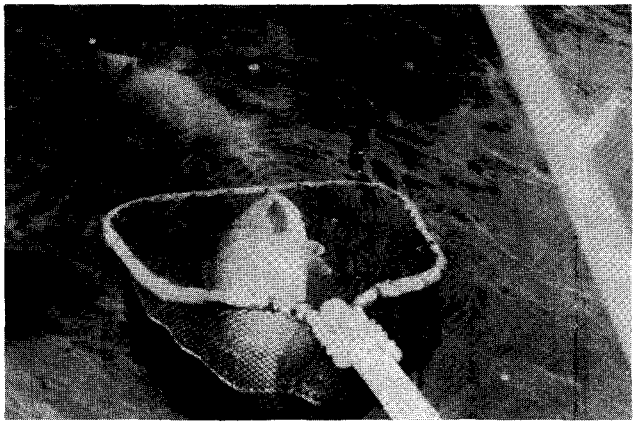
Complete collections were made on 26% of the streams and 8% of the lakes in the St. Croix River basin (Tables 1 and 2). While these percentages are relatively low, the streams that were sampled comprised 76% of the total length of all streams in the St. Croix River basin. The sampled lakes comprised 55% of the total surface area for all lakes in the basin. This was due to the fact that most streams and lakes not sampled were small. The average lake in the St. Croix River basin was only 41 ha.

Figure 2 shows the locations of 586 of the 941 complete and 177 of the 257 partial stations. Only one dot per lake was shown and dots were eliminated that would overlap another dot.

David Siegler



The boom shocker in the St. Croix River near Stillwater.



A good-sized largemouth bass being taken with the minishocker in the Apple River.

The minishocker in the Apple River north of Star Prairie.

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 2,000 collections from the St. Croix River basin, 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 basin as well as 14,980 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 two 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 that tributary are then listed before going back to the confluence of the tributary with the original river. This procedure is followed for all tributaries in the basin of the 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 (Fig. 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 basin, a sub-basin or part of a sub-basin, individual collector, date, township and range (by entire township or contiguous townships), county, water type, 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, percent of 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. 3a and b). However, only the Mark IV listing can be restricted to gear or any of the 10 ecological variables. This program can be organized in still different ways, including: (1) by county and then alphabetically by name of stream or lake, (2) by county and then by basin, or (3) by township, range, and section. An example of the Mark IV listing is shown in Appendix A Figures 8a and 8b. Figure 8a prints the 3-digit alphanumeric code for each fish species collected at that station. Figure 8b gives the common name of the species.

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

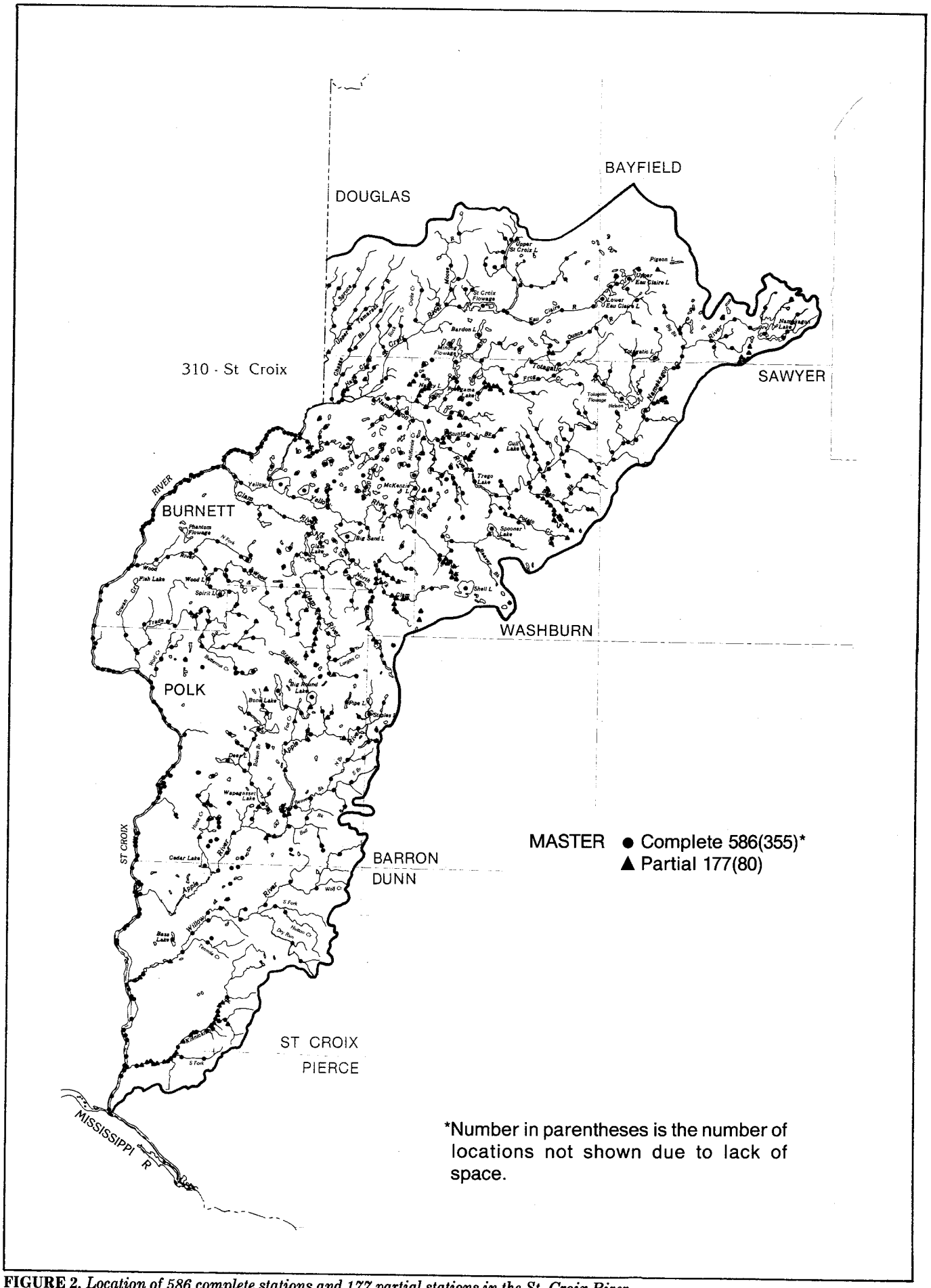


FIGURE 2. *Location of 586 complete stations and 177 partial stations in the St. Croix River basin. (Due to lack of space, 355 complete stations and 80 partial stations are not shown.)*

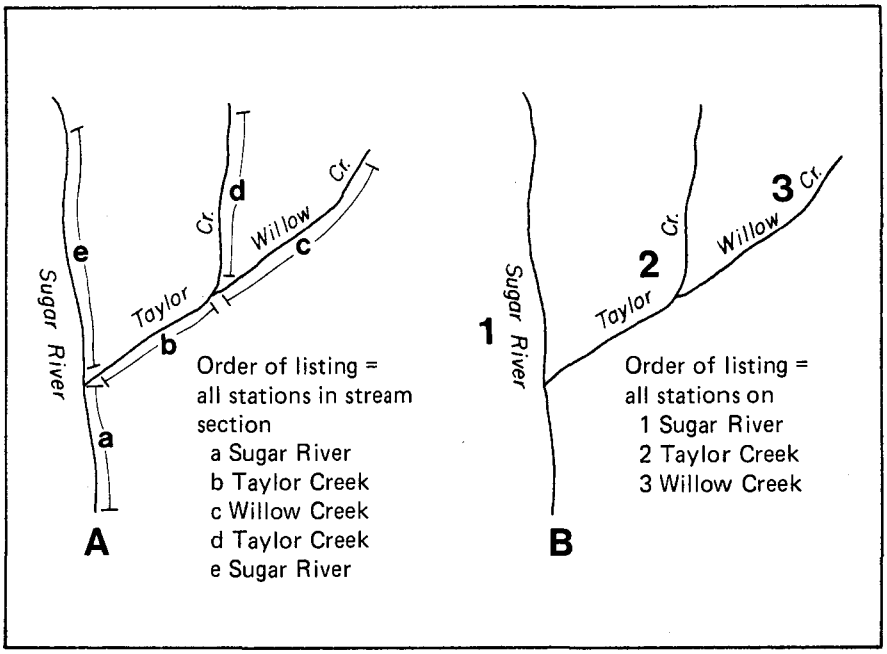


FIGURE 3. *Two methods of organizing stations on computer printouts.*

A large channel catfish held by Peter Segerson.

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.

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. George Becker).

At least a few stonerollers at each station were keyed to species. The remainder were left as stonerollers (*Campostoma* spp.). Research personnel identified all fish for the 1975-83 period except for those collected by Dr. Underhill and students of Dr. Becker, some specimens of 25 species (indicated by an asterisk in Append. A Table 16) collected by fish management personnel and Audubon Ecology Camp, and lake sturgeon caught by sport fishermen. For the 1944-74 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 Table 6 for some species is substantially lower than the number actually captured. Furthermore, there were up to 52 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-Stevens 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 3 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.

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

Computer No.	Common Name	Scientific Name
	Lampreys	Petromyzontidae
A02	Chestnut lamprey	*Ichthyomyzon castaneus*
A03	Northern brook lamprey	*Ichthyomyzon fossor*
A04	Silver lamprey	*Ichthyomyzon unicuspis*
A05	American brook lamprey	*Lampetra appendix*
	Sturgeons	Acipenseridae
B01	Lake sturgeon	*Acipenser fulvescens*
	Gars	Lepisosteidae
D01	Longnose gar	*Lepisosteus osseus*
D02	Shortnose gar	*Lepisosteus platostomus*
	Bowfins	Amiidae
E01	Bowfin	*Amia calva*
	Freshwater eels	Anguillidae
F01	American eel	*Anguilla rostrata*
	Herrings	Clupeidae
G02	Gizzard shad	*Dorosoma cepedianum*
G03	Skipjack herring	*Alosa chrysochloris*
	Mooneyes	Hiodontidae
H01	Goldeye	*Hiodon alosoides*
H02	Mooneye	*Hiodon tergisus*
	Trouts	Salmonidae
I04	Cisco or lake herring	*Coregonus artedii*
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	Umbridae
K01	Central mudminnow	*Umbra limi*
	Pikes	Esocidae
L02	Northern pike	*Esox lucius*
L03	Muskellunge	*Esox masquinongy*
	Minnows and carps	Cyprinidae
M06	Central stoneroller	*Campostoma anomalum*
M07	Largescale stoneroller	*Campostoma oligolepis*
M12	Common carp	*Cyprinus carpio*
M14	Brassy minnow	*Hybognathus hankinsoni*
M16	Speckled chub	*Hybopsis aestivalis*
M17	Silver chub	*Hybopsis storeriana*
M19	Hornyhead chub	*Nocomis biguttatus*
M20	Golden shiner	*Notemigonus chrysoleucas*
M21	Pallid shiner	*Notropis amnis*
M22	Pugnose shiner	*Notropis anogenus*
M23	Emerald shiner	*Notropis atherinoides*
M24	River shiner	*Notropis blennius*
M28	Common shiner	*Notropis cornutus*
M29	Bigmouth shiner	*Notropis dorsalis*
M30	Pugnose minnow	*Notropis emiliae*
M31	Blackchin shiner	*Notropis heterodon*
M32	Blacknose shiner	*Notropis heterolepis*
M33	Spottail shiner	*Notropis hudsonius*
M36	Spotfin shiner	*Notropis spilopterus*
M37	Sand shiner	*Notropis stramineus*
M38	Weed shiner	*Notropis texanus*
M40	Mimic shiner	*Notropis volucellus*
M42	Northern redbelly dace	*Phoxinus eos*
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*

Computer No.	Common Name	Scientific Name
	Suckers	Catostomidae
N05	River carpsucker	*Carpiodes carpio*
N06	Quillback	*Carpiodes cyprinus*
N07	Highfin carpsucker	*Carpiodes velifer*
N09	White sucker	*Catostomus commersoni*
N10	Blue sucker	*Cycleptus elongatus*
N13	Northern hog sucker	*Hypentelium nigricans*
N14	Smallmouth buffalo	*Ictiobus bubalus*
N17	Spotted sucker	*Minytrema melanops*
N18	Silver redhorse	*Moxostoma anisurum*
N19	River redhorse	*Moxostoma carinatum*
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*
O12	Flathead catfish	*Pylodictis olivaris*
	Trout-perches	Percopsidae
Q01	Trout-perch	*Percopsis omiscomaycus*
	Codfishes	Gadidae
R01	Burbot	*Lota lota*
	Killifishes	Cyprinodontidae
S01	Banded killifish	*Fundulus diaphanus*
	Silversides	Atherinidae
T01	Brook silverside	*Labidesthes sicculus*
	Sticklebacks	Gasterosteidae
U01	Brook stickleback	*Culaea inconstans*
	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*
W13	White crappie	*Pomoxis annularis*
W14	Black crappie	*Pomoxis nigromaculatus*
	Perches	Percidae
X03	Crystal darter	*Ammocrypta asprella*
X04	Western sand darter	*Ammocrypta clara*
X05	Mud darter	*Etheostoma asprigene*
X07	Rainbow darter	*Etheostoma caeruleum*
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*
X17	Gilt darter	*Percina evides*
X18	Blackside darter	*Percina maculata*
X19	Slenderhead darter	*Percina phoxocephala*
X20	River darter	*Percina shumardi*
X21	Sauger	*Stizostedion canadense*
X22	Walleye	*Stizostedion vetreum vetreum*
	Drums	Sciaenidae
Y01	Freshwater drum	*Aplodinotus grunniens*
	Sculpins	Cottidae
Z01	Mottled sculpin	*Cottus bairdi*
Z02	Slimy sculpin	*Cottus cognatus*

RESULTS AND DISCUSSION

Findings are presented for the St. Croix River basin followed by a discussion of some of the more interesting species in the St. Croix River basin including those on the Wisconsin DNR endangered, threatened, or watch lists. Unless otherwise indicated, findings refer only to the 1975-83 period.

Species Found

Over 157,000 specimens representing 93 species were identified in samples from the St. Croix River basin (Tables 5 and 6). This includes the endangered crystal darter, 3 threatened species (speckled chub, blue sucker, and gilt darter), and 6 watch species. 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

Of the 93 known species found in the St. Croix River basin, 92 species are believed to have reproducing populations. The presence of reproducing populations of the rainbow trout is questionable since all records can be attributed to stocking.

Stream vs. Lake Habitat

Of all stations sampled in the St. Croix River basin, 53% were in a stream environment and 47% in a lake environment (Table 2). Of the 92 species known to have reproducing populations in this basin, 66 occurred in streams at least 50% of the time (Table 7); 44 of these 66 occurred in streams at least 95% of the time. Of the 26 species collected more than 50% of the time in a lake environment, only 4 were taken 95% or more of the time in lakes.

Common and Rare Species

The 5 most common species (caught at the highest percentage of complete stations) were bluegill (47%), Johnny darter (47%), yellow perch (46%), bluntnose minnow (42%), and largemouth bass (37%) (Table 5). The 5 most numerous species (most specimens caught) were bluntnose minnow (17,000), yellow perch (17,000), bluegill (15,000), white sucker (11,000), and common shiner (8,400) (Table 6). The largemouth bass and Johnny darter were the 6th and 7th most numerous species, respectively.

Of the 20 rarest species (those caught at 5 or fewer of all the stations, Table 8), all but 4 (cisco or lake herring, white crappie, fantail darter, and slimy sculpin) were also represented by the smallest total number of specimens (Table 6).

Differences Between Time Periods

Ten species of fish (excluding the 1959 reported catch of the blue suckers for which confirmation is lacking) collected during the 1975-83 period have not been previously reported for this basin (Table 9).

Twelve species are apparently no longer present in the St. Croix River basin (Table 10). Eight of these were last observed before 1944. In addition, the gizzard shad was not taken during the 1975-83 period but was taken in the lower St. Croix River at 4 stations in 1973. It is therefore probably present in the most recent period but unavailable to our sampling gear.

Five species that we collected had not been reported between 1945 and 1975 from this basin (Table 11).

One of the most important results of this study was the documentation of changes in the known distribution of species within the St. Croix River basin in 1975-83 as compared to previous periods (Table 5). These changes have ranged from decreases in the number of stations for 19 species to increases for 75 species, and no change for the river darter. The decreases ranged from 100% for 13 species to 17% for the rainbow trout. The increases ranged from 14% for the western sand darter to 8,100% for the banded killifish (average = 1,529%), and were due primarily but perhaps not entirely to increased sampling effort in 1975-83. There were 173 more streams and 158 more lakes with at least 1 complete station compared to 1944-74 and 150 streams and 144 lakes compared to 1900-43 (Table 2). When the total number of complete stations sampled in the 1975-83 period was compared with the 1944-74 and 1900-43 periods, there were increases of 2,253% and 1,155%, respectively.

Species Diversity

Twenty-six stations (3%) sampled by research personnel in the St. Croix River basin had 20 or more species and 2 stations had more than 25 species (Fig. 4). The average number of species taken per station was 7.9.

Endangered Species

Only 1 species on the state's endangered species list was found in the St. Croix River basin (Table 12). The crystal darter was taken at 2 stations on the St. Croix River (Append. B Map 68). Previously, this species had not been reported from this basin. This darter, the largest darter species found in Wisconsin, was taken over clean gravel and sand where stream velocity was moderate.

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

Threatened Species

Three threatened species were found in the St. Croix River basin (Table 13). The **speckled chub** was captured from the St. Croix River at a total of 2 stations and 3 specimens (Append. B Map 17). Previously, this species had been collected by Dr. Underhill at 1 station on the St. Croix River. A single specimen of the **blue sucker** was taken from the St. Croix River (Append. B Map 39). Previously, this species had only been reported (but without confirmed identification) in 1959 from 6 stations on the St. Croix River. The **gilt darter** was captured from 6 rivers in the St. Croix River basin at a total of 43 stations and 372 specimens (Append. B Map 76). Previously, this species had been taken by Dr. Underhill at 7 stations on the St. Croix River in the 1944-74 period and 3 stations on the St. Croix River and 1 station on Bean Brook in 1928.

Stream habitat characteristics for this darter and the 6 watch species found in the St. Croix River basin are shown in Table 14.

Watch Species

A total of 6 watch species were captured in the St. Croix River basin (Table 15). **Lake sturgeon** were taken from 8 stations on the St. Croix River and 1 lake (Append. B Map 4). Previously, this species had been reported at 9 stations on the St. Croix River and 4 lakes in the basin. The **pugnose shiner** was captured from a total of 10 stations in 6 lakes and 2 streams (Append. B Map 17); it had previously been reported from the Yellow River in 1974 and 3 other rivers in 1928. The **pugnose minnow** occurred at a total of 6 stations on the St. Croix River (Append. B Map 23). This fish had not been previously reported from the St. Croix River basin. The **river redhorse** was taken at a total of 35 stations in 3 rivers (Append. B Map 42). Previously, this species had been collected by Dr. Underhill from 2 stations in the St. Croix River. The **greater redhorse** was caught at a total of 41 stations in 9 streams and 1 lake (Append. B Map 46). This species had been previously reported in 1928 from the Yellow River. **Least darter** were taken at a total of 10 stations in 5 lakes and 3 streams (Append. B Map 72). The species had been previously collected from 1 station on the Yellow River in 1974 and prior to 1930 from 2 other streams.

Habitat characteristics of the 6 watch species are shown in Table 14.

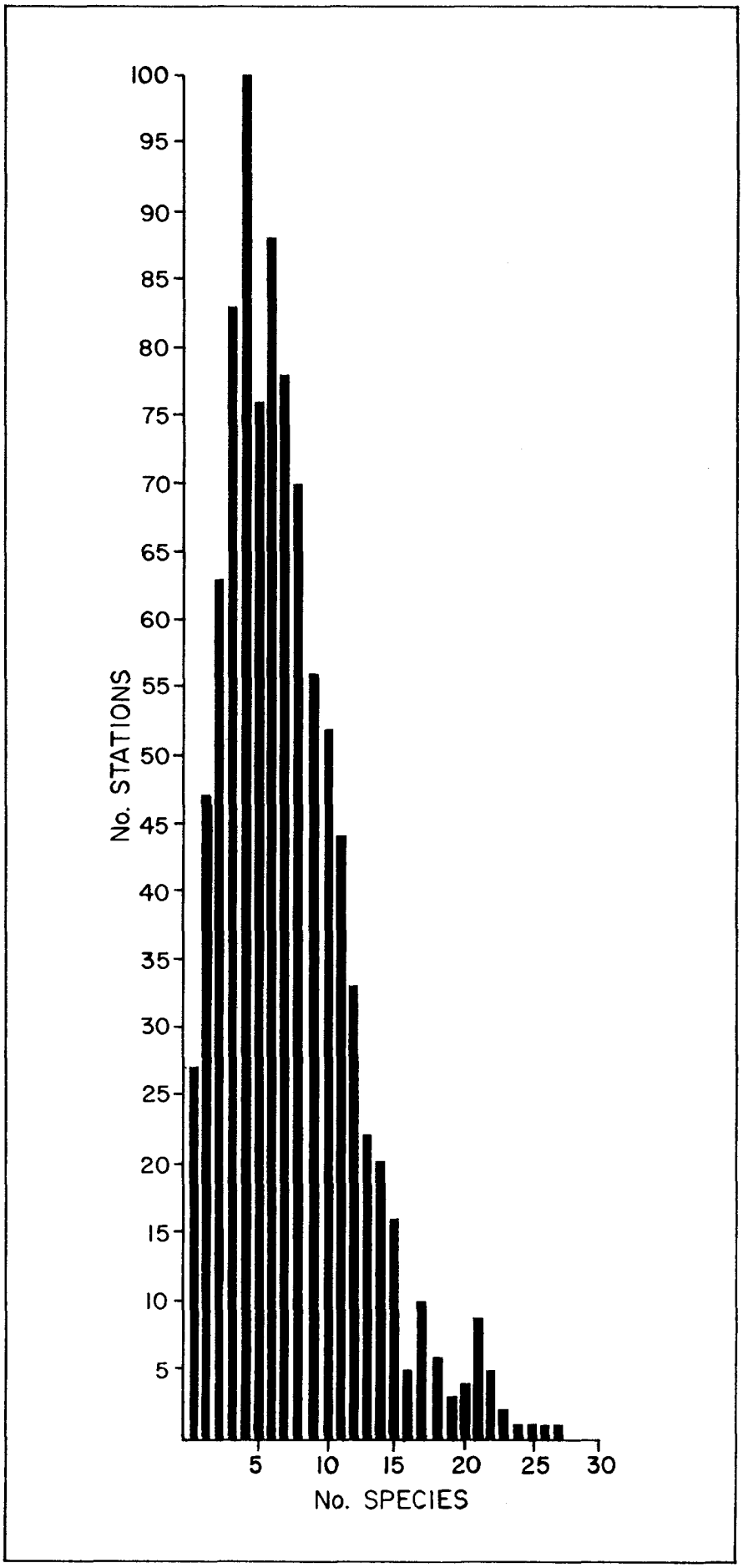
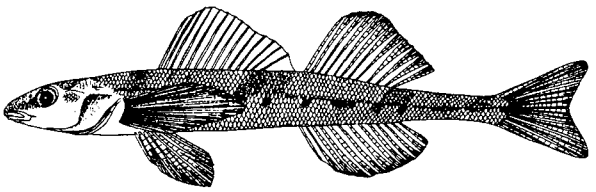
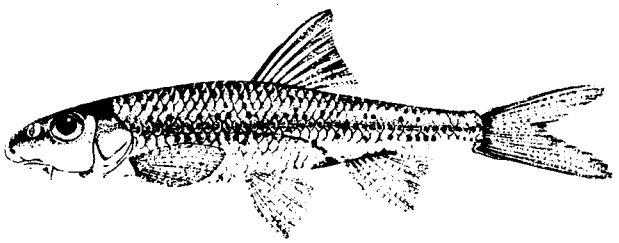


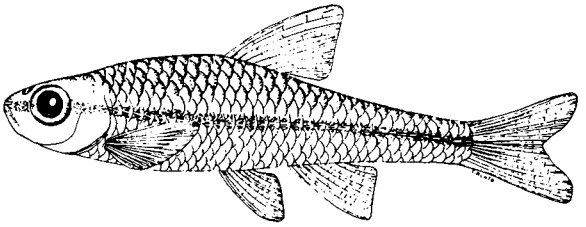
FIGURE 4. *Number of stations at which varying numbers of species were taken in the St. Croix River basin.*



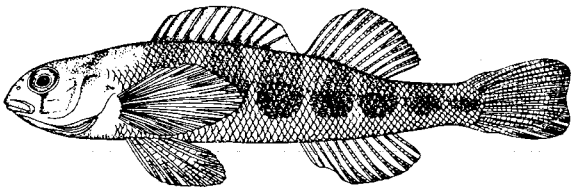
The endangered crystal darter was taken at 2 stations in the St. Croix River.



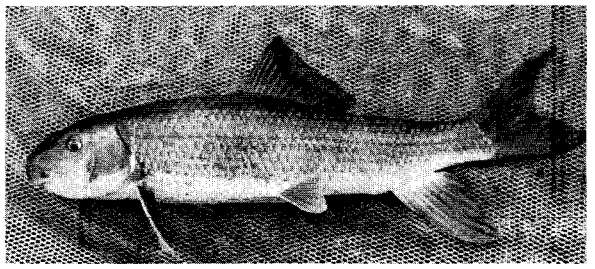
Speckled chub, presently on the threatened list, inhabits sand and gravel riffles in larger rivers.



The pugnose shiner, a species presently on the watch list, prefers clear, weedy lakes. It was on Wisconsin's endangered list when this study began in 1974.

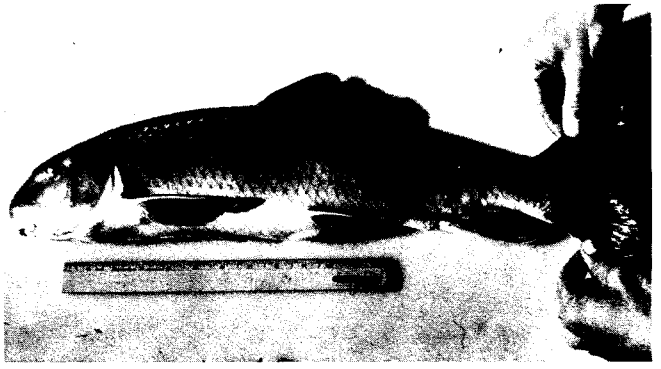


Gilt darter, a species currently on the threatened list, inhabits riffles in large rivers.



River redhorse, presently on the watch list, inhabits fast, larger rivers. When this study began in 1974, it had only been taken at a couple of locations on the St. Croix River by the Minnesota Department of Natural Resources.

Blue sucker is presently on the threatened list. This specimen, held by the author, was the only one taken in the St. Croix River basin.



The greater redhorse, presently on the watch list, inhabits larger rivers and lakes. When this study began in 1974, it was on Wisconsin's endangered list.

TABLE 5. *Number of stations and percent of total stations at which each species was collected and percent change in occurrence in the St. Croix River basin, 1900-83.*

Map No.	Species	1900-43 No. Stn.	1944-74 No. Stn.	1944-74 Percent Total	1975-83 No. Stn.	1975-83 Percent Total	Percent Change In Occurrence[2]
1	Chestnut lamprey	1	0	-	67(4)*	7	7,000
2	Northern brook lamprey	0	0	-	2	t**	-
3	Silver lamprey	0	1	3	5	5	400
2	American brook lamprey	0	0	-	1	t	-
4	Lake sturgeon (W)[1]	0	0(13)	-	6(3)	1	-31
5	Longnose gar	4	0	-	1	t	-75
-	Shortnose gar	3	1	3	0	-	-100
5	Bowfin	0	0(33)	-	7(17)	1	-27
-	American eel (W)	0	1	3	0	-	-100
-	Gizzard shad	1	6	15	0	-	-100
-	Skipjack herring	2	0	-	0	-	-100
-	Goldeye (E)	0	2	5	0	-	-100
6	Mooneye	1	2	5	3	t	50
6	Cisco or lake herring	4	0(4)	-	1(4)	t	25
7	Rainbow trout	0	0(6)	-	0(5)	-	-17
8	Brown trout	3	1(62)	3	47(71)	5	87
9	Brook trout	7	0(129)	-	71(84)	8	20
-	Lake trout	1	0	-	0	-	-100
10	Rainbow smelt	0	0	-	0(1)	-	-
11	Central mudminnow	12	4(86)	10	150(73)	16	150
12	Northern pike	17	9(179)	23	202(125)	21	74
10	Muskellunge	0	0(17)	-	13(20)	1	94
13	Central stoneroller	0	2	5	30(3)	3	1,600
14	Largescale stoneroller	0	2	5	37(5)	4	2,000
15	Common carp	1	2(26)	5	29(16)	3	61
16	Brassy minnow	2	3	8	83(8)	9	2,900
17	Speckled chub (T)	0	1	3	2	t	100
-	Silver chub	0	2	5	0	-	-100
18	Hornyhead chub	15	8(1)	20	153(23)	16	1,900
19	Golden shiner	13	4(1)	10	134(18)	14	2,900
-	Pallid shiner (E)	2	0	-	0	-	-100
17	Pugnose shiner (W)	4	1	3	8(2)	1	900
20	Emerald shiner	2	16	40	29	3	81
-	River shiner	3	1	3	0	-	-100
21	Common shiner	32	11(1)	28	289(32)	31	2,600
22	Bigmouth shiner	6	6	15	23(1)	2	300
23	Pugnose minnow (W)	0	0	-	6	1	-
24	Blackchin shiner	7	4(1)	10	102(6)	11	2,100
25	Blacknose shiner	18	7(1)	18	150(8)	16	1,900
26	Spottail shiner	14	12	30	68(3)	7	490
27	Spotfin shiner	19	17	43	119(5)	13	630
28	Sand shiner	6	18	45	53	6	190
-	Weed shiner (W)	7	1	3	0	-	-100
29	Mimic shiner	16	13	33	117(1)	12	810
30	Northern redbelly dace	0	2	5	84(6)	9	4,400
31	Finescale dace	0	0	-	19(3)	2	-
32	Bluntnose minnow	38	19(1)	48	396(19)	42	2,000
33	Fathead minnow	4	4	10	162(11)	17	4,200
34	Blacknose dace	19	2	5	107(14)	11	6,000
35	Longnose dace	13	6	15	76(10)	8	1,300
36	Creek chub	27	6	15	227(26)	24	4,100
37	Pearl dace	0	0	-	35(2)	4	-
-	River carpsucker	0	1	3	0	-	-100
38	Quillback	0	2	5	18	2	800
39	Highfin carpsucker	0	0	-	2	t	-
40	White sucker	34	14(286)	35	330(198)	35	76
39	Blue sucker (T)	0	0	-	1	t	-
41	Northern hog sucker	12	6(25)	15	103(8)	11	260
-	Smallmouth buffalo	1	1	3	0	-	-100
42	Spotted sucker	1	1	3	2	t	100
43	Silver redhorse	4	1	3	70(4)	7	7,300
42	River redhorse (W)	0	1(1)	3	35	4	1,700
44	Golden redhorse	12	7	18	107(8)	11	1,500
45	Shorthead redhorse	13	2	5	101(4)	11	5,200
46	Greater redhorse (W)	1	0	-	38(3)	4	4,000

TABLE 5. *Continued.*

Map No.	Species	1900-43 No. Stn.	1944-74 No. Stn.	1944-74 Percent Total	1975-83 No. Stn.	1975-83 Percent Total	Percent Change In Occurrence[2]
47	Black bullhead	0	3	8	67(4)	7	2,300
48	Yellow bullhead	19	0(4)	-	29(5)	3	750
49	Brown bullhead	3	1(2)	3	25(2)	3	800
50	Channel catfish	2	1(11)	3	18(1)	2	58
51	Stonecat	0	3	8	15	2	400
52	Tadpole madtom	13	5(1)	13	50(14)	5	970
53	Flathead catfish	0	2(1)	5	1	t	-67
53	Trout-perch	1	5(4)	13	8(3)	1	22
54	Burbot	5	3(35)	8	50(21)	5	87
55	Banded killifish	1	1	3	76(6)	8	8,100
56	Brook silverside	1	4(9)	10	60(5)	6	400
57	Brook stickleback	5	3(36)	8	101(42)	11	270
58	White bass	3	4	10	6	1	50
59	Rock bass	30	10(2)	25	151(17)	16	1,300
60	Green sunfish	3	1	3	33(3)	4	3,500
61	Pumpkinseed	19	8(5)	20	276(22)	29	2,200
62	Warmouth	0	0	-	4(1)	t	-
63	Bluegill	25	13(6)	33	444(33)	47	2,400
64	Smallmouth bass	21	9(43)	23	91(25)	10	120
65	Largemouth bass	30	11(148)	28	350(110)	37	190
66	White crappie	2	0	-	5	1	150
67	Black crappie	10	7(4)	18	118(6)	13	1,000
68	Crystal darter (E)	0	0	-	2	t	-
69	Western sand darter	0	7	18	8	1	14
-	Mud darter (W)	1	0	-	0	-	-100
68	Rainbow darter	0	2	5	6	1	200
70	Iowa darter	15	3(1)	8	197(12)	21	5,100
71	Fantail darter	1	1	3	4	t	300
72	Least darter (W)	2	1	3	9(1)	1	900
73	Johnny darter	54	19(1)	48	445(27)	47	2,300
74	Yellow perch	38	14(146)	35	434(106)	46	240
75	Logperch	20	18	45	135(3)	14	670
76	Gilt darter (T)	3	7	18	42(1)	4	510
77	Blackside darter	2	1	3	56(3)	6	5,800
78	Slenderhead darter	2	5	13	12	1	140
79	River darter	3	12	30	12	1	0
80	Sauger	0	2	5	5	1	150
81	Walleye	7	4(86)	10	95(64)	10	77
82	Freshwater drum	0	1(5)	3	3	t	-50
83	Mottled sculpin	9	0	-	84(9)	9	930
82	Slimy sculpin	0	0	0	2	t	-
	No. of species	73	86		93		
	Total no. occurrences (sum of number of species taken at each station)	752	1,847		8,850		

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

** t = less than 0.5%.

[1] E = Endangered, T = Threatened, W = Watch.

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

TABLE 6. *Number of specimens and number of stations for each species collected in the St. Croix River Basin, 1975-83.*

Common Name	No. Specimens*	No. Stations** <99	>98	"Unknown"	Common Name	No. Specimens*	No. Stations** <99	>98	"Unknown"
Bluntnose minnow	17,000	306	109		River redhorse	320	35		
Yellow perch	17,000	444	92	4	Chestnut lamprey	270	71		
Bluegill	15,000	397	80		Pearl dace	270	37		
White sucker	11,000	433	43	52	Tadpole madtom	250	64		
Common shiner	8,400	291	30		Brown bullhead	240	27		
Largemouth bass	6,800	437	18	5	Yellow bullhead	200	33	1	
Johnny darter	6,000	457	15		Largescale stoneroller	200	42		
Brown trout	4,300	97	21		Blackside darter	200	59		
Creek chub	3,800	245	8		Burbot	180	69	2	
Blacknose shiner	3,600	138	20		Least darter	150	10		
Golden shiner	3,300	131	21		Rainbow darter	140	5	1	
Hornyhead chub	3,200	170	6		Finescale dace	140	22		
Mimic shiner	3,100	100	18		Greater redhorse	130	41		
Brook trout	3,100	147	8		Green sunfish	130	36		
Northern pike	3,100	317	7	3	Bowfin	120	22		2
Walleye	2,800	141	18		Cisco or lake herring	110	4	1	
Fathead minnow	2,800	157	15	1	Fantail darter	100	3	1	
Golden redhorse	2,700	107	8		White bass	74	6		
Iowa darter	2,500	202	7		Trout-perch	67	10		1
Pumpkinseed	2,500	296	2		Quillback	54	18		
Shorthead redhorse	2,400	93	12		Pugnose shiner	48	10		
Spotfin shiner	2,200	116	8		White crappie	48	5		
Blackchin shiner	2,100	98	10		Slimy sculpin	42	2		
Black crappie	1,800	118	6		Stonecat	38	15		
Blacknose dace	1,800	117	4		Channel catfish	29	19		
Brook stickleback	1,700	128	7	8	Western sand darter	23	8		
Central mudminnow	1,500	209	3	11	Slenderhead darter	21	12		
Silver redhorse	1,400	69	5		River darter	17	12		
Logperch	1,300	135	3		American brook lamprey	13	1		
Northern hog sucker	1,200	106	5		Rainbow trout	13	5		
Spottail shiner	1,100	68	3		Pugnose minnow	13	6		
Smallmouth bass	1,100	115	1		Rainbow smelt	11	1		
Brook silverside	1,000	59	5	1	Silver lamprey	10	5		
Sand shiner	1,000	50	3		Freshwater drum	9	3		
Rock bass	1,000	166	2		Lake sturgeon	9	9		
Brassy minnow	990	86	5		Sauger	8	5		
Northern redbelly dace	930	87	3		Warmouth	7	5		
Longnose dace	930	84	2		Northern brook lamprey	6	2		
Mottled sculpin	920	92	1		Spotted sucker	5	2		
Black bullhead	870	67	4		Mooneye	4	3		
Banded killifish	770	82			Speckled chub	3	2		
Emerald shiner	750	25	4		Highfin carpsucker	2	2		
Stonerollers	750	15	2		Crystal darter	2	2		
Common carp	620	34	2	9	Longnose gar	1	1		
Muskellunge	440	31	2		Blue sucker	1	1		
Central stoneroller	410	33			Flathead catfish	1	1	—	—
Bigmouth shiner	370	23	1						
Gilt darter	370	41	1	1	TOTAL	157,449	8,113	654	100

*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. *Percent occurrence of fish species* in the St. Croix River basin for the 1975-83 period arranged by their importance in stream vs. lake environments.*

Common Name	Percent Occurrence In Streams	Percent Occurrence In Lakes	Common Name	Percent Occurrence In Streams	Percent Occurrence In Lakes
Northern brook lamprey	100	0	Burbot	93	7
Silver lamprey	100	0	Central mudminnow	92	8
American brook lamprey	100	0	Brook stickleback	92	8
Longnose gar	100	0	Bigmouth shiner	91	9
Mooneye	100	0	Lake sturgeon	88	12
Central stoneroller	100	0	White bass	83	17
Speckled chub	100	0	Spotfin shiner	80	20
Pugnose minnow	100	0	Northern redbelly dace	80	20
Blacknose dace	100	0	Common carp	76	24
Pearl dace	100	0	Common shiner	76	24
Quillback	100	0	White sucker	72	28
Highfin carpsucker	100	0	Smallmouth bass	70	30
Blue sucker	100	0	Logperch	63	37
Spotted sucker	100	0	Fathead minnow	62	38
River redhorse	100	0	White crappie	60	40
Stonecat	100	0	Rock bass	59	41
Flathead catfish	100	0	Mimic shiner	55	45
Crystal darter	100	0	Trout-perch	55	45
Western sand darter	100	0	Tadpole madtom	54	46
Rainbow darter	100	0	Brook silverside	50	50
Fantail darter	100	0	Walleye	47	53
Gilt darter	100	0	Northern pike	44	56
Slenderhead darter	100	0	Black bullhead	44	56
River darter	100	0	Johnny darter	43	57
Sauger	100	0	Yellow bullhead	41	59
Freshwater drum	100	0	Golden shiner	28	72
Slimy sculpin	100	0	Black crappie	28	72
Brown trout	99	1	Bluntnose minnow	27	73
Longnose dace	99	1	Bowfin	25	75
Silver redhorse	99	1	Muskellunge	24	76
Sand shiner	98	2	Blacknose shiner	24	76
Northern hog sucker	98	2	Yellow perch	24	76
Blackside darter	98	2	Least darter	22	78
Chestnut lamprey	97	3	Green sunfish	18	82
Brook trout	97	3	Bluegill	18	82
Emerald shiner	97	3	Largemouth bass	17	83
Golden redhorse	97	3	Spottail shiner	16	84
Greater redhorse	97	3	Brown bullhead	16	84
Creek chub	96	4	Iowa darter	15	85
Mottled sculpin	96	4	Blackchin shiner	14	86
Largescale stoneroller	95	5	Pumpkinseed	14	86
Brassy minnow	95	5	Pugnose shiner	12	88
Finescale dace	95	5	Banded killifish	1	99
Channel catfish	95	5	Cisco or lake herring	0	100
Shorthead redhorse	94	6	Rainbow smelt	0	100
Hornyhead chub	93	7	Warmouth	0	100

*Known to have reproducing populations in basin.

TABLE 8. *List of species collected at 5 or fewer stations from the St. Croix River basin, 1975-83.*

Northern brook lamprey	Blue sucker
Silver lamprey	Spotted sucker
American brook lamprey	Flathead catfish
Longnose gar	Warmouth
Mooneye	White crappie
Cisco or lake herring	Crystal darter
Rainbow trout	Fantail darter
Rainbow smelt	Sauger
Speckled chub	Freshwater drum
Highfin carpsucker	Slimy sculpin

TABLE 9. *Fish species collected for the first time during the 1975-83 period from the St. Croix River basin.*

Northern brook lamprey	Pearl dace
American brook lamprey	Highfin carpsucker
Rainbow smelt	Blue sucker*
Pugnose minnow	Warmouth
Finescale dace	Crystal darter
Slimy sculpin	

*Reported in 1959 but without confirmed identification.

TABLE 10. *Fish species apparently no longer present in the St. Croix River basin.*

Last Period Recorded	Species
1900-43	Shortnose gar
	Skipjack herring
	Lake trout
	Pallid shiner
	River shiner
	Weed shiner
	Smallmouth buffalo
	Mud darter
1944-74	American eel
	Goldeye
	Silver chub
	River carpsucker

TABLE 11. *Fish species reported prior to 1944 from the St. Croix River basin but not collected again until 1975-83.*

Chestnut lamprey
Longnose gar
Greater redhorse
White crappie
Mottled sculpin

TABLE 12. *Endangered species collected in the St. Croix River basin during 1975-83 and records from stations in other Wisconsin basins since 1974.*

Species	Body of Water	County	No. Stations	No. Fish	Avg. No. Fish/Station	No. Records From Other Basins*
Crystal darter	St. Croix R.	Polk	1	1		17(2,280,300)
	St. Croix R.	St. Croix	1	1		
		TOTAL	2	2	1	

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

TABLE 13. *Threatened species collected in the St. Croix River basin during 1975-83 and records from stations in other Wisconsin basins since 1974.*

Species	Body of Water	County	No. Stations	No. Fish	Avg. No. Fish/Station	No. Records From Other Basins*
Speckled chub	St. Croix R.	Polk	1	2		27(2,240,270)
	St. Croix R.	St. Croix	1	1		
		TOTAL	2	3	2	
Blue sucker	St. Croix R.	Burnett	1	1		53(2,240,270,300)
		TOTAL	1	1	1	
Gilt darter	St. Croix R.	Burnette	21	268		9(2,270,300)
	St. Croix R.	Douglas	1	2		
	St. Croix R.	Polk	4	10		
	St. Croix R.	St. Croix	1	1		
	St. Croix R.	Chicago**	3	56		
	St. Croix R.	Pine**	5	13		
	Apple R.	St. Croix	1	1		
	Wood R.	Burnett	1	1		
	Yellow R.	Burnett	2	14		
	Namekagon R.	Burnett	1	1		
	Namekagon R.	Washburn	2	3		
	Moose R.	Douglas	1	2		
		TOTAL	43	372	9	

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

TABLE 14. *Characteristics of aquatic habitat for selected species* collected in the St. Croix River basin, 1975-83.*

Species	Stream Width(m)	Stream Depth (m)	Velocity**	Turbidity**	Cond. (μmhos)	Temp. (F)
THREATENED						
Gilt darter	75	0.6	moderate	slight	150	65
WATCH						
Lake sturgeon	56	0.5	moderate	slight	130	61
Pugnose shiner (littoral zone with abundant aquatic vegetation)				slight	145	71
Pugnose minnow	75	0.6	sluggish	slight	190	48
River redhorse	87	1.0	moderate	slight	145	60
Greater redhorse	94	1.0	moderate	slight	130	64
Least darter (littoral zone with abundant aquatic vegetation)				slight	190	69

*Endangered, threatened, or watch species for which we have collected data from 3 or more stations.
**Terms are defined in Fago (1984*b*).

TABLE 15. *Watch species collected in the St. Croix River basin during 1975-83 and records from stations in other Wisconsin basins since 1974.*

Species	Body of Water	County	No. Stations	No. Fish	Avg. No. Fish/Station	No. Records From Other Basins*
Lake sturgeon	Pear L.	Washburn	1	1		25(2,5,81,82,110,
	St. Croix R.	Polk	1	1		221,240,300)
	St. Croix R.	Burnett	6	6		
	St. Croix R.	Douglas	1	1		
		TOTAL	9	9	1	
Pugnose shiner	Upper Clam L.	Burnett	1	1		46(20,81,82,210,
	Yellow R.	Burnett	1	2		221,300)
	Falk L.	Burnett	1	1		
	Burlingame L.	Burnett	1	9		
	Twentysix L.	Burnett	1	2		
	Yellow L.	Burnett	2	3		
	Big Sand L.	Burnett	2	27		
	McKenzie Cr.	Washburn	1	3		
		TOTAL	10	48	5	
Pugnose minnow	St. Croix R.	St. Croix	4	10		St. Croix R.
	St. Croix R.	Polk	2	3		221,240,270,280,
		TOTAL	6	13	2	300)
River redhorse	St. Croix R.	Pierce	1	1		38(2,82,210,221,
	St. Croix R.	St. Croix	4	9		222,240,270,300)
	St. Croix R.	Polk	8	82		
	St. Croix R.	Burnett	20	221		
	Apple R.	St. Croix	1	3		
	Yellow R.	Burnett	1	1		
		TOTAL	35	317	9	
Greater redhorse	St. Croix R.	St. Croix	2	3		55(5,20,40,50,82,
	St. Croix R.	Polk	5	9		100,110,221,
	St. Croix R.	Burnett	17	54		240,300)
	St. Croix R.	Douglas	2	2		
	Yellow R.	Burnett	3	19		
	Yellow R.	Washburn	1	3		
	Loon Cr.	Burnett	1	2		
	Chases Brook	Burnett	1	1		
	Namekagon R.	Burnett	1	1		
	Namekagon R.	Washburn	2	3		
	Namekagon R.	Sawyer	1	23		
	Dogtown Cr.	Burnett	1	1		
	McKenzie Cr.	Washburn	1	1		
	Trego L.	Washburn	1	1		
	Spring Cr.	Washburn	1	8		
	Moose R.	Douglas	1	1		
		TOTAL	41	132	3	
Least darter	N.White Ash L.	Polk	1	1		78(20,82,200,210,
	N.Fork Clam R.	Burnett	1	3		221,222,270,300,
	Sand L.	Barron	1	2		400)
	Big Sand L.	Burnett	1	1		
	Fivemile Cr.	Washburn	1	25		
	McKenzie Cr.	Washburn	1	11		
	Lower Eau Claire L.	Douglas	1	38		
	Middle Eau Claire L.	Bayfield	3	66		
		TOTAL	10	147	15	

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

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, for example, on water quality, open up further areas for study and analysis.

PROTECTION OF ENDANGERED AND THREATENED SPECIES AND THEIR HABITAT

The aquatic environment of the St. Croix River should be protected, because the endangered crystal darter and the threatened speckled chub, blue sucker, and gilt darter are found there. Any manipulation of this habitat should recognize the presence of these 4 beautiful and valuable 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 lists as required by law and of the watch list as well.

COMPLETION OF THIS SURVEY

Completion of a 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 16. *List of species reported from the St. Croix River basin by collectors other than DNR research personnel.*

Species	1944-74	1975-83	Species	1944-74	1975-83
Chestnut lamprey	-	1	River carpsucker	17	-
Silver lamprey	17	-	Quillback	2,17	-
Lake sturgeon*	1	8	White sucker*	1,2,17	1,16,17
Shortnose gar	17	-	Northern hog sucker*	1,17	1,17
Bowfin*	1	1	Smallmouth buffalo	17	-
American eel*	17	-	Spotted sucker	17	-
Gizzard shad	2,17	-	Silver redhorse	17	-
Goldeye	17	-	River redhorse	17	-
Mooneye	17	-	Golden redhorse	2,17	1,17
Cisco or lake herring*	1	1	Shorthead redhorse	2,17	-
Rainbow trout*	1	1	Black bullhead	2,17	17
Brown trout*	1,2	1	Brown bullhead	17	1
Brook trout*	1	1,16	Channel catfish*	1,17	-
Rainbow smelt*	-	1	Stonecat	17	17
Central mudminnow*	1,2	1	Tadpole madtom	2,17	1
Northern pike*	1,2,17	1,16	Flathead catfish*	1,17	-
Muskellunge*	1	1	Trout-perch*	1,17	1
Stonerollers	1	-	Burbot*	1,17	1,17
Central stoneroller	17	1	Banded killifish	17	1
Largescale stoneroller	2	1	Brook silverside*	1,17	1,17
Common carp*	1,2,17	1	Brook stickleback*	1,2,17	1,16
Brassy minnow	17	1,17	White bass	2,17	-
Speckled chub	17	-	Rock bass	2,9,17	1,17
Silver chub	17	-	Green sunfish	17	-
Hornyhead chub	2,17	1,17	Pumpkinseed	2	1
Golden shiner	2,17	1,17	Bluegill	2,9,17	1,17
Pugnose shiner	2	-	Smallmouth bass*	1,2,9,17	1,16,17
Emerald shiner	2,9,17	-	Largemouth bass*	1,2,17	1,16
River shiner	17	-	Black crappie	2,9,17	17
Common shiner	2,17	1,17	Western sand darter	17	-
Bigmouth shiner	2,17	17	Rainbow darter	17	-
Blackchin shiner	2,17	17	Iowa darter	2	1,17
Blacknose shiner	1,2,17	1,17	Fantail darter	17	-
Spottail shiner	2,9,17	-	Least darter	2	-
Spotfin shiner	2,9,17	17	Johnny darter	2,9,17	1,17
Sand shiner	2,17	17	Yellow perch*	1,2,9,17	1,16,17
Weed shiner	17	-	Logperch	2,9,17	17
Mimic shiner	2,17	1,17	Gilt darter	17	2,17
Northern redbelly dace	17	1	Blackside darter	17	1,17
Finescale dace	-	1,17	Slenderhead darter	17	17
Bluntnose minnow	2,17	1,17	River darter	9	-
Fathead minnow	17	1	Sauger	17	-
Blacknose dace	17	1	Walleye*	1,17	1,17
Longnose dace	2,17	1,17	Freshwater drum*	1,17	-
Creek chub	2,17	1,17	Mottled sculpin	-	1
Pearl dace	-	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, Pittsburg, 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]
16 = Miscellaneous
17 = Dr. James Underhill and University of Minnesota students
[ ] = Collectors 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

F OR S

☐ SEQUENCE ___ ___ ___ ___ ___ ___ ___ ☐ MAJOR BASIN ___ MINOR BASIN ___ ___ ___

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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

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) ___ ___ ___ ___ ___

FISH ONLY

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

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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                                   17.0  YELLOWSTONE R                 2  9 46      6/28/60  4N 4E23SESE33
2 223 1434.8R  156.9L   105.8R   25.4R                                    1.3  SAWMILL CR                    2    61 5   10/ 7/64  3N 5E 2NESE33
2 223 1434.8R  156.9L   105.8R   25.4R                                    6.5E SAWMILL CR                    2    61 5   10/ 6/64  4N 6E20SESW23
2 223 1434.8R  156.9L   105.8R   27.5L                                    1.0  UN CR                         2 27 46      6/28/60  4N 5E27NWSE33
2 223 1434.8R  156.9L   105.8R   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  O05  1  O06 13  O10  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 8a. *Sample page from the Master Fish File using a Mark IV program (listing method A, Figure 3, used here). This page shows the 3-digit alphanumeric code for each fish species collected at a station.*

```
MAR 19, 1986                FISH MASTER FILE (MARK IV)   -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 NW  SW 54                        +  SUGAR R -OXBOW                46 5     8/ 0/63   1N10E27NWSW54
        0  0
    SP=04 HY=00 UNSP=00  FISH  GOLDEN SHINER  +   BLACK BULLHEAD  +   BLACKSTRIPE TOPMINNOW  +
                               ORANGESPOTTED SUNFISH  +


2 222  1434.8R  156.9L     .7R     6.9R                          2.3   E FK RACCOON CR                61 5    12/12/65   1N12E31NWSE54
           2
    SP=13 HY=00 UNSP=02  FISH  SHINERS  +   STONEROLLERS  +   BRASSY MINNOW  +   COMMON SHINER  +
                               BIGMOUTH SHINER  +   SUCKERMOUTH MINNOW  +   SOUTHERN REDBELLY DACE  +
                               BLUNTNOSE MINNOW  +   CREEK CHUB  +   WHITE SUCKER  +   BROOK
                               STICKLEBACK  +
                               FANTAIL DARTER  +   JOHNNY DARTER  +   BANDED DARTER  +   BLACKSIDE
                               DARTER  +

2 222  1434.8R  156.9L     .7R     6.9R                          2.4   E FK RACCOON CR             11 2 06  5/15/74   1N12E31SWNE54
        3  2
    SP=15 HY=01 UNSP=01  FISH  AMERICAN BROOK LAMPREY  4   BROWN TROUT 10   NORTHERN PIKE  6   NORTHERN
                               PIKE X GRASS PICKEREL  1   STONEROLLERS  6   COMMON CARP  1   COMMON
                               SHINER  1   BIGMOUTH SHINER  1   BLUNTNOSE MINNOW 13   CREEK CHUB  4
                               WHITE SUCKER 28   GREEN SUNFISH  3   BLUEGILL  1
                               FANTAIL DARTER 13   JOHNNY DARTER 31   BANDED DARTER  2   MOTTLED
                               SCULPIN  6

2 222  1434.8R  156.9L     .7R     6.9R   2.7R                   1.5   UN CR (CHAMBERLIN SPRINGS)  71 5    10/ 5/77   1N12E29SWNW54
           2
    SP=08 HY=00 UNSP=00  FISH  CENTRAL STONEROLLER  1   BIGMOUTH SHINER 27   SOUTHERN REDBELLY DACE 10
                               BLACKNOSE DACE 29   CREEK CHUB 99   WHITE SUCKER  3   BROOK STICKLEBACK
                               5
                               JOHNNY DARTER 11

2 222  1434.8R  156.9L     .7R     6.9R   2.7R                   3.8   UN CR                       11 3 06  5/15/74   1N12E21NWNW54
        3  2
    SP=07 HY=00 UNSP=01  FISH  STONEROLLERS 99   SOUTHERN REDBELLY DACE 19   FATHEAD MINNOW  4
                               BLACKNOSE DACE 75   CREEK CHUB 53   WHITE SUCKER 30   BROOK STICKLEBACK
                               8
                               JOHNNY DARTER  2

2 222  1434.8R  156.9L     .7R     6.9R                          3.2   E FK RACCOON CR             11 2 05 11/ 5/75   1N12E31NENW54
        1  2
    SP=17 HY=00 UNSP=01  FISH  AMERICAN BROOK LAMPREY  2   CENTRAL MUDMINNOW  6   GRASS PICKEREL  2       (006     030   0      40)
                               STONEROLLERS 33   COMMON SHINER  2   BLUNTNOSE MINNOW 11   FATHEAD          (1 49       3  0001     )
                               MINNOW  3   BLACKNOSE DACE 20   CREEK CHUB 16   WHITE SUCKER 47   GREEN    (ET F1 G2 H5 I2          )
                               SUNFISH 10   BLUEGILL  6                                                    (D3 FT K4 M2 O1          )
                               RAINBOW DARTER  1   FANTAIL DARTER 30   JOHNNY DARTER 25   BANDED DARTER
                               2   BLACKSIDE DARTER 10   MOTTLED SCULPIN 27

2 222  1434.8R  156.9L     .7R     6.9R                          3.3   E FK RACCOON CR                61 5     6/10/65   1N12E31NENW54
           2
    SP=07 HY=00 UNSP=01  FISH  STONEROLLERS  +   COMMON SHINER  +   REDFIN SHINER  +   SOUTHERN
                               REDBELLY DACE  +   BLUNTNOSE MINNOW  +   CREEK CHUB  +   WHITE SUCKER  +
                               FANTAIL DARTER  +
```

FIGURE 8b. *Sample page from the Master Fish File using a Mark IV program (listing method A, Figure 3, used here). This printout shows the common name for the species.*

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

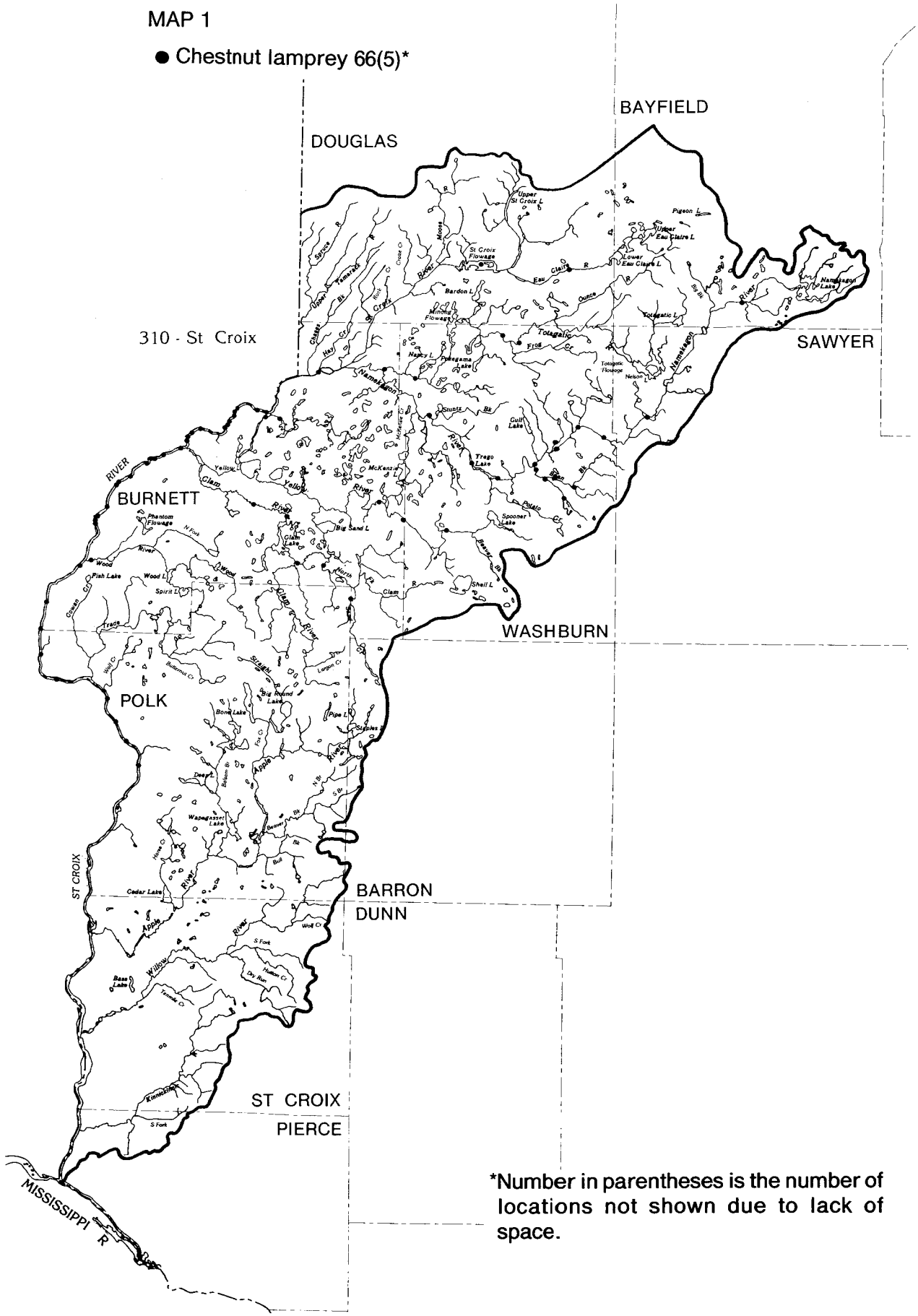
BASINS MAJ	MIN	MB. MI.	ORDER 1	2	3	MILEAGES 4/8	5/9	6/10	7/11	MI OR ACRES	STREAM OR LAKE NAME	D C	WL TST	TWN	RNG	SEC	QTQT	64CO
2	222									17	GOOSE POND	0		6N	8E	13	NENE	13
	62640																	
2	222									33	L HARRIETT	0		5N	9E	9	NWNW	13
	62650																	
2	222									10	MORSE POND	0		6N	8E	3	SESW	13
	62660																	
2	222									12	MORTENSON POND	0		5N	9E	26	NWSE	13
	62670																	
2	222										SUGAR R -OXBOW	0		1N	10E	27	NWSW	54
	62680																	
2	222									8	VERONA GRAVEL PIT #12 (EAST	0		6N	8E	22	SENW	13
	62690																	
2	222	1434.8R	156.9L	.7R						11	RACCOON CR	2		46N	1E	22		80
	62700																	
2	222	1434.8R	156.9L	.7R	6.9R					7	E FORK RACCOON CR	2		46N	1E	8		80
	62710																	
2	222	1434.8R	156.9L	.7R	6.9R	1.4					E FORK RACCOON CR WI-IL BD	6		1N	12E	31	SESW	54
	62720																	
2	222	1434.8R	156.9L	.7R	6.9R	2.7R				4	UN CR (31-3,CHAMBERLIN SPR.	2		1N	12E	31	SWNE	54
	62730																	
2	222	1434.8R	156.9L	.7R	9.5						RACCOON CR WIS-ILL BD	6		1N	11E	35	SESE	54
	62740																	
2	222	1434.8R	156.9L	.7R	11.4						DAM-RACCOON CR-MILLPOND			1N	11E	34	NENE	54
	62750																	
2	222	1434.8R	156.9L	.7R	11.7R					3	UN CR	2		1N	11E	27	SWSE	54
	62760																	
2	222	1434.8R	156.9L	.7R	11.7R	.3R				3	UN CR	2		1N	11E	27	NWSE	54
	62770																	
2	222	1434.8R	156.9L	9.2R						76	SUGAR R	2		28N	11E	11		80
	62780																	
2	222	1434.8R	156.9L	9.2R	10.7						SUGAR R WIS-ILL BD	6		1N	10E	36	SESW	54
	62790																	
2	222	1434.8R	156.9L	9.2R	10.8L					9	GREEN DRAINAGE SYSTEM	2		1N	10E	36	SESW	54
	62800																	
2	222	1434.8R	156.9L	9.2R	10.8L	6.4R				1	UN CR	2		1N	9E	25	SENE	54
	62810																	
2	222	1434.8R	156.9L	9.2R	11.2R					3	UN DITCH	2		1N	10E	36	NWSW	54
	62820																	
2	222	1434.8R	156.9L	9.2R	11.2R	.7R				1	UN DITCH	2		1N	10E	36	NENW	54
	62830																	
2	222	1434.8R	156.9L	9.2R	11.7R					2	UN DITCH	2		1N	10E	35	SENE	54
	62840																	
2	222	1434.8R	156.9L	9.2R	16.0L					6	UN DITCH	2		1N	10E	28	NESW	54
	62850																	
2	222	1434.8R	156.9L	9.2R	18.8L						SUGAR R -W CHANNEL	2		1N	10E	20	SWNE	54
	62860																	
2	222	1434.8R	156.9L	9.2R	18.8L	.5L				1	UN DITCH	2		1N	10E	20	SWNW	54
	62870																	
2	222	1434.8R	156.9L	9.2R	19.8R					13	TAYLOR CR	2		1N	10E	18	SESE	54
	62880																	
2	222	1434.8R	156.9L	9.2R	19.8R	1.8R				10	WILLOW CR (NORTH)	2		1N	10E	7	NESW	54
	62890																	
2	222	1434.8R	156.9L	9.2R	19.8R	1.8R	6.7R			4	UN CR	2		1N	10E	11	SWNE	54
	62900																	

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

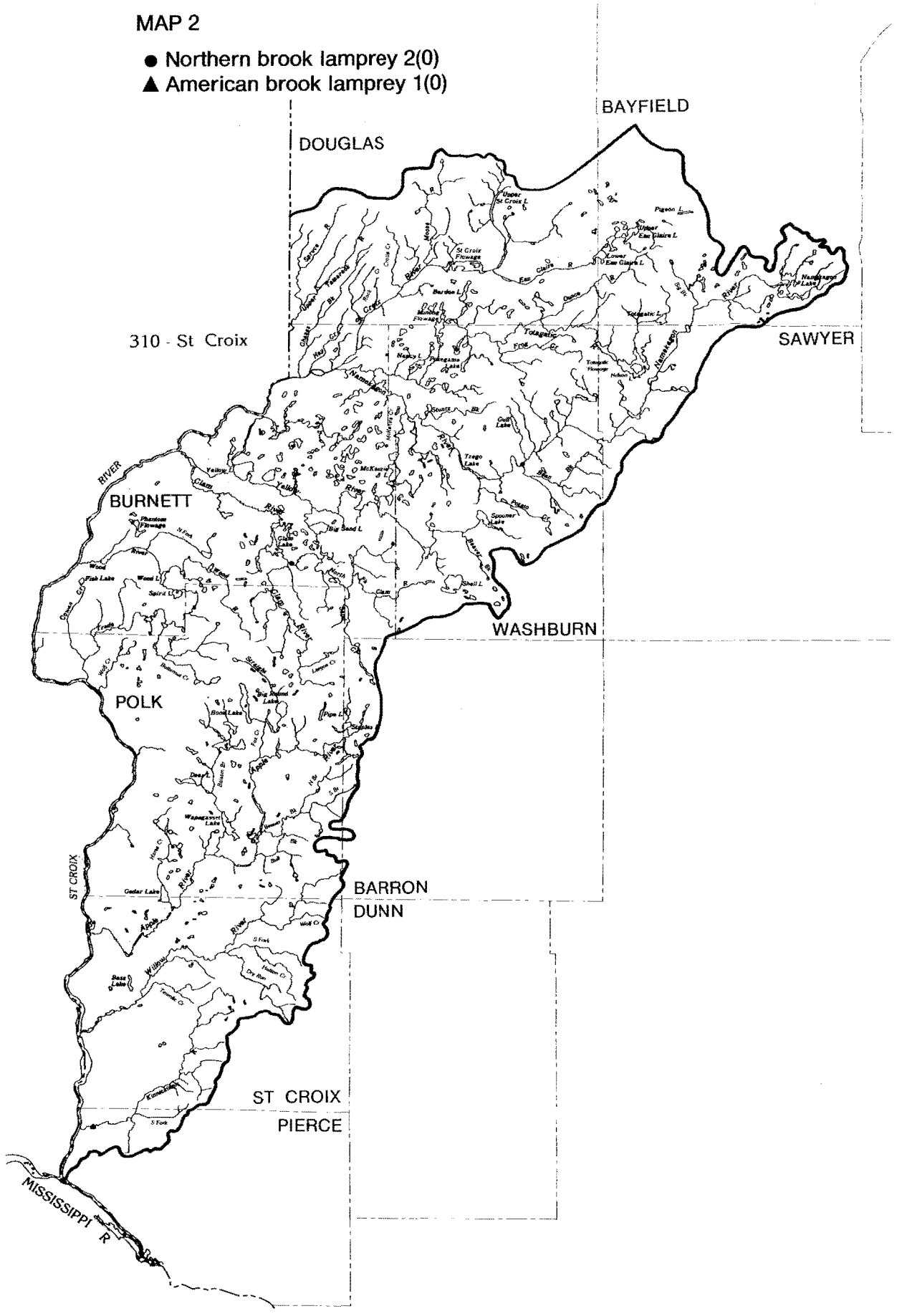
APPENDIX B. Distribution Maps For All Species Collected During 1975-83.

MAP 1

● Chestnut lamprey 66(5)*

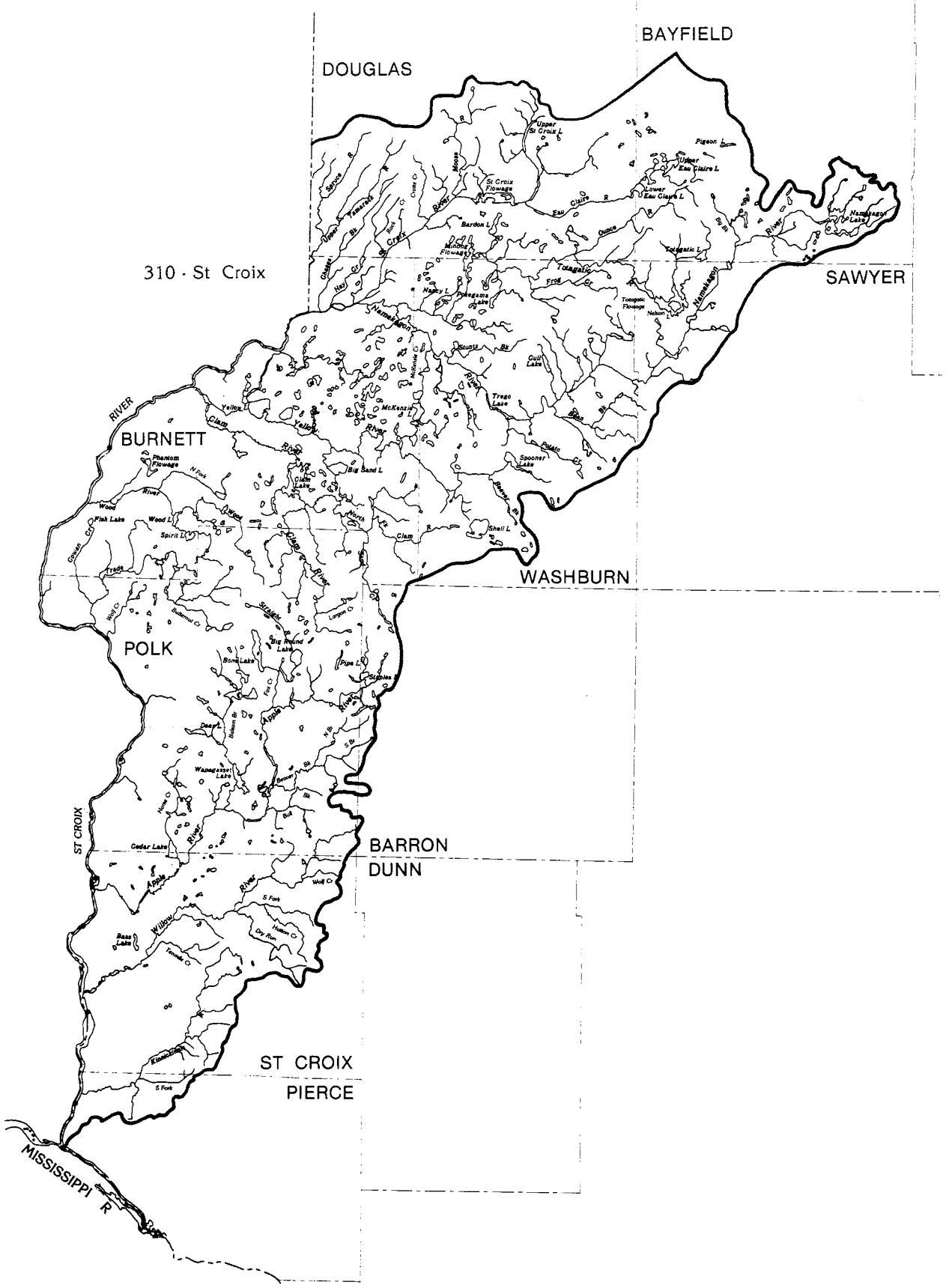


*Number in parentheses is the number of locations not shown due to lack of space.


MAP 2
● Northern brook lamprey 2(0)
▲ American brook lamprey 1(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R.

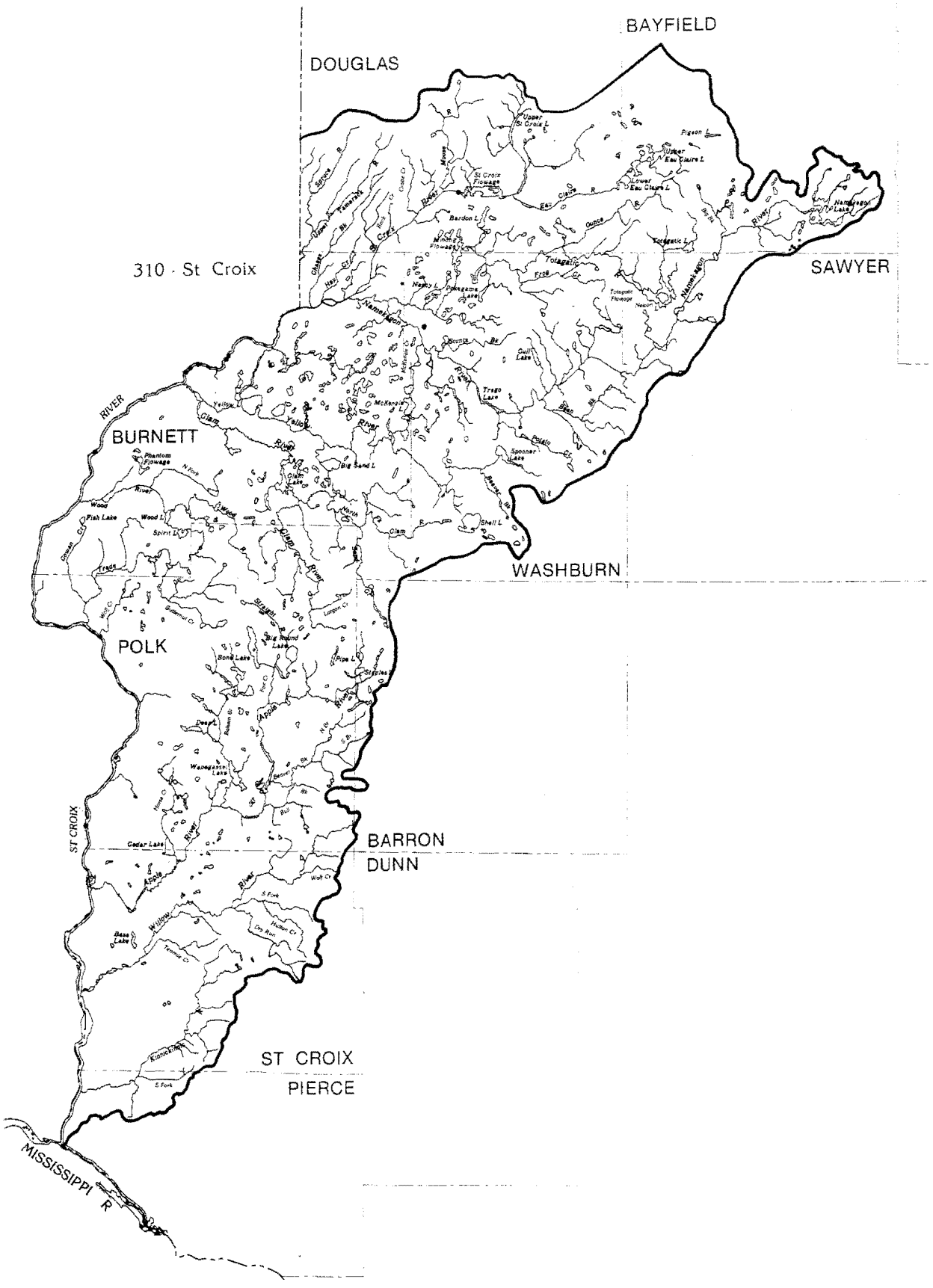
MAP 3

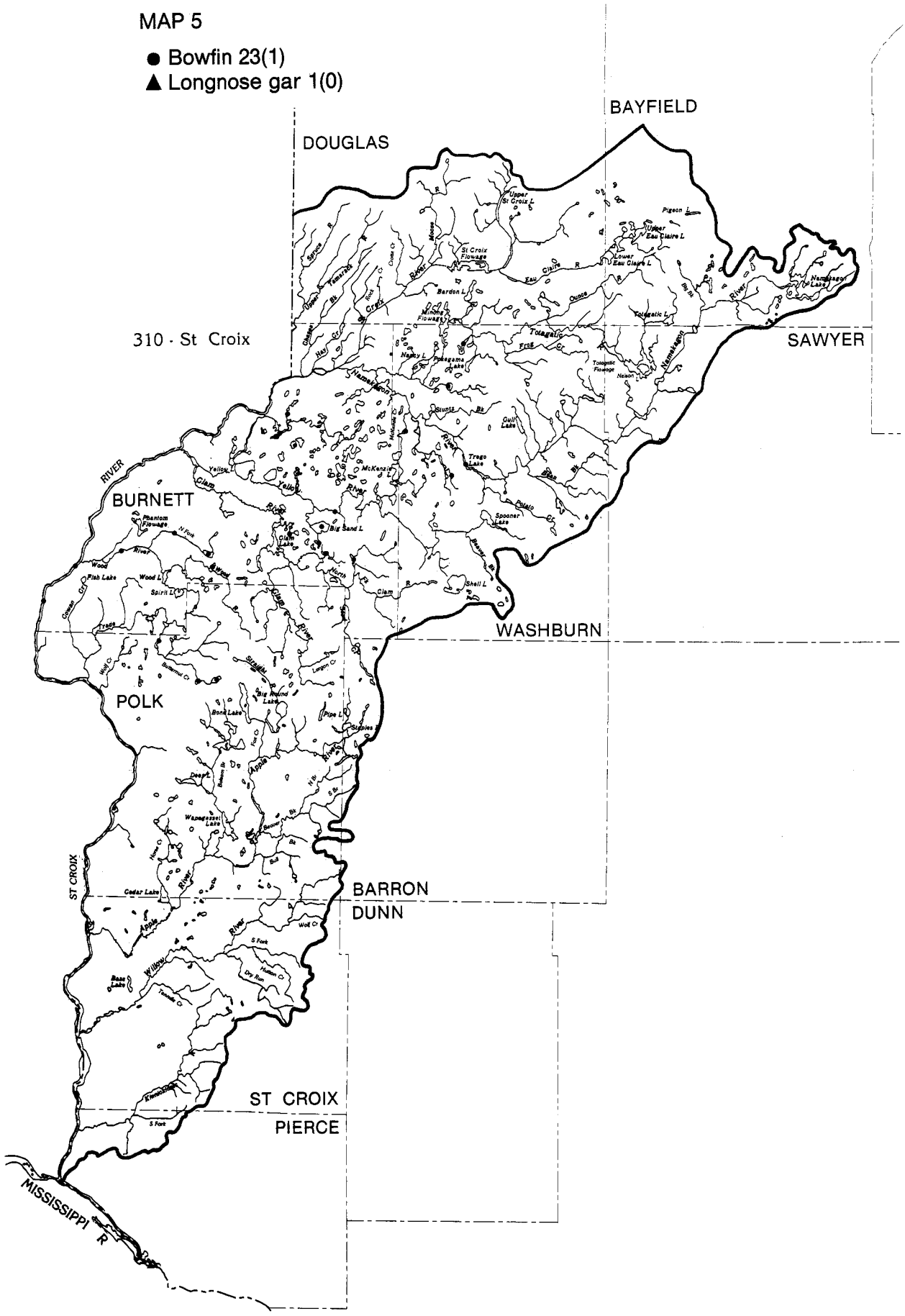
● Silver lamprey 5(0)

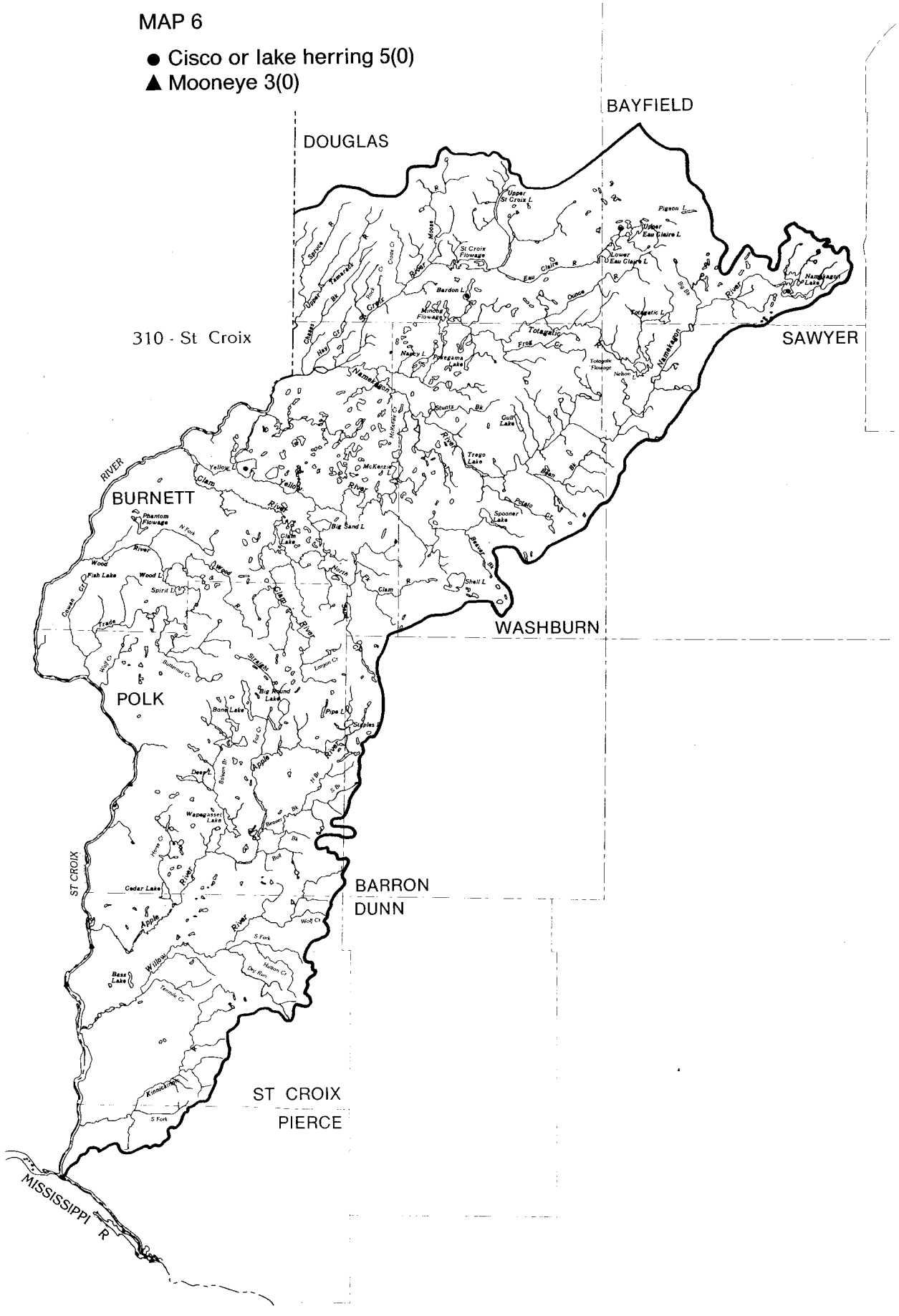


MAP 4

●Lake sturgeon 9(0)

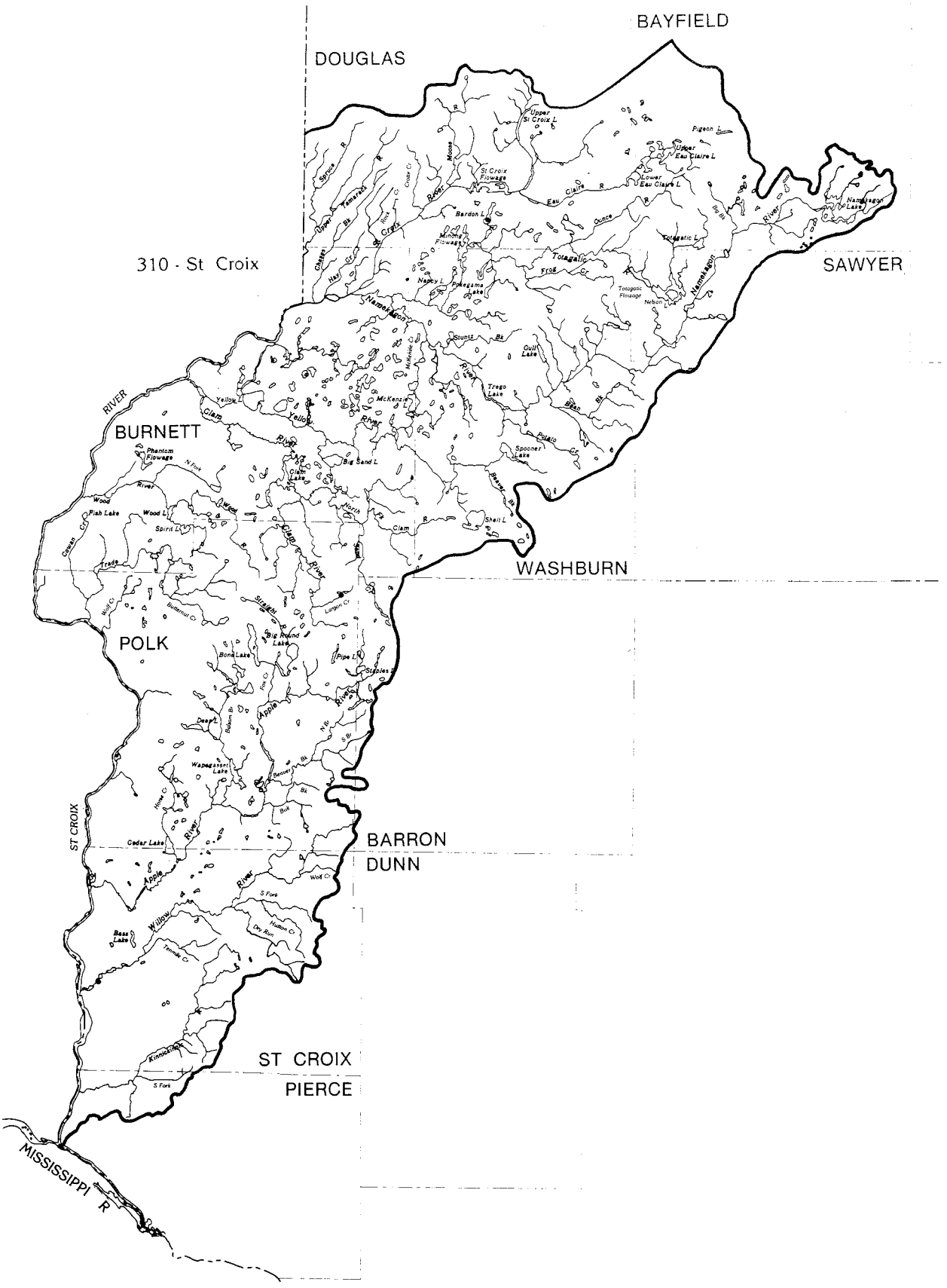



MAP 5
● Bowfin 23(1)
▲ Longnose gar 1(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R


MAP 6
● Cisco or lake herring 5(0)
▲ Mooneye 3(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER

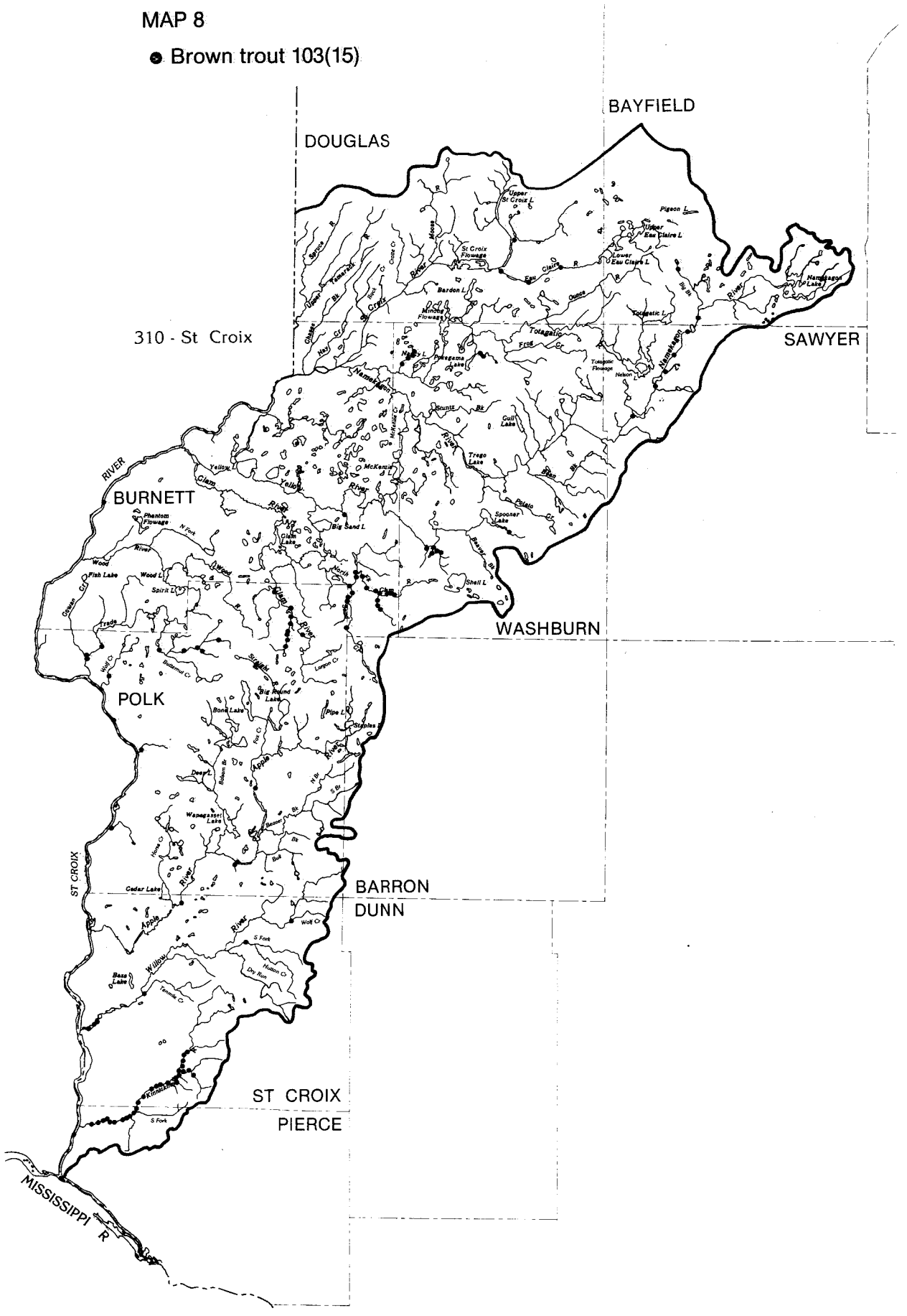
MAP 7

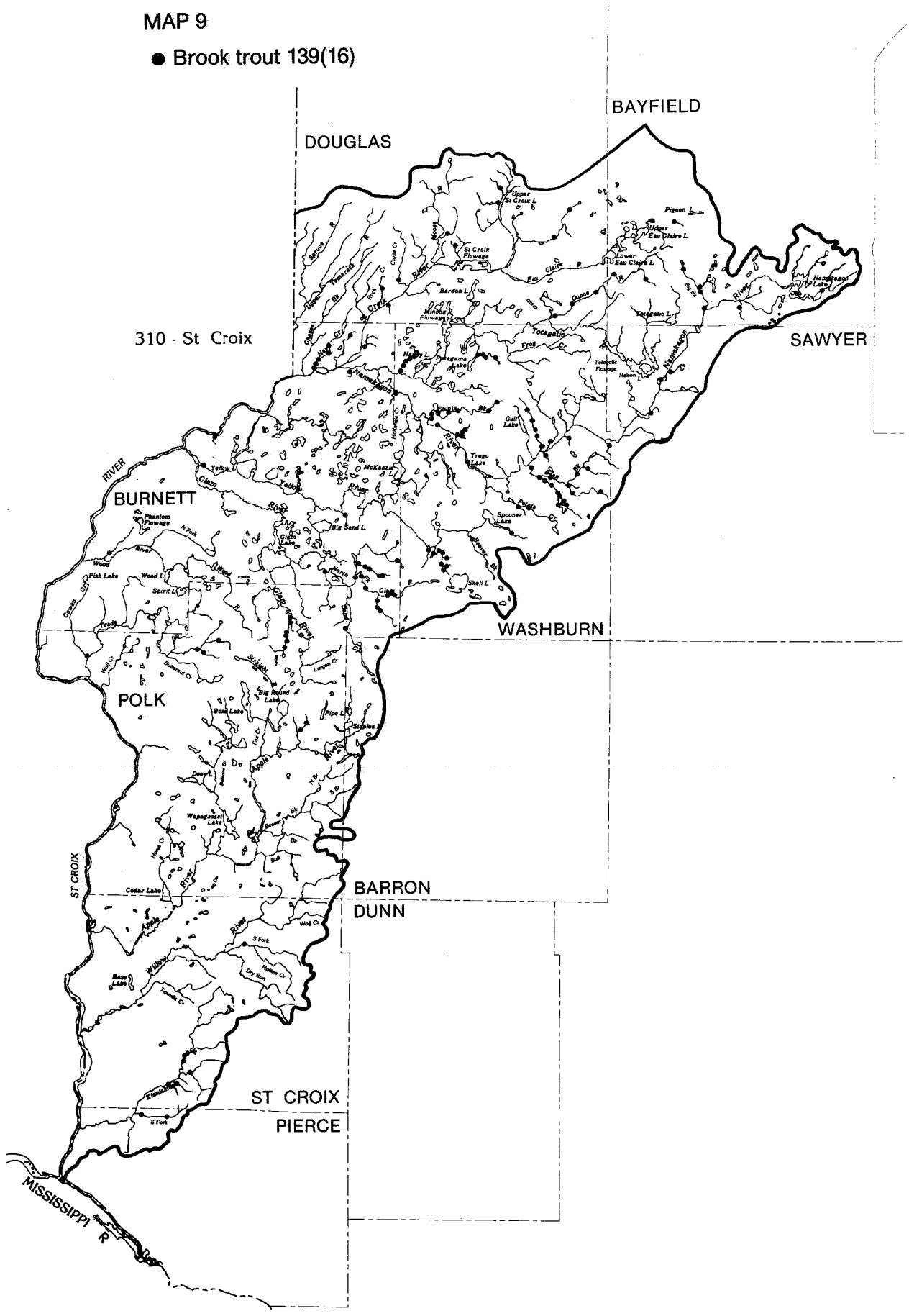
●●Rainbow trout 4(0)

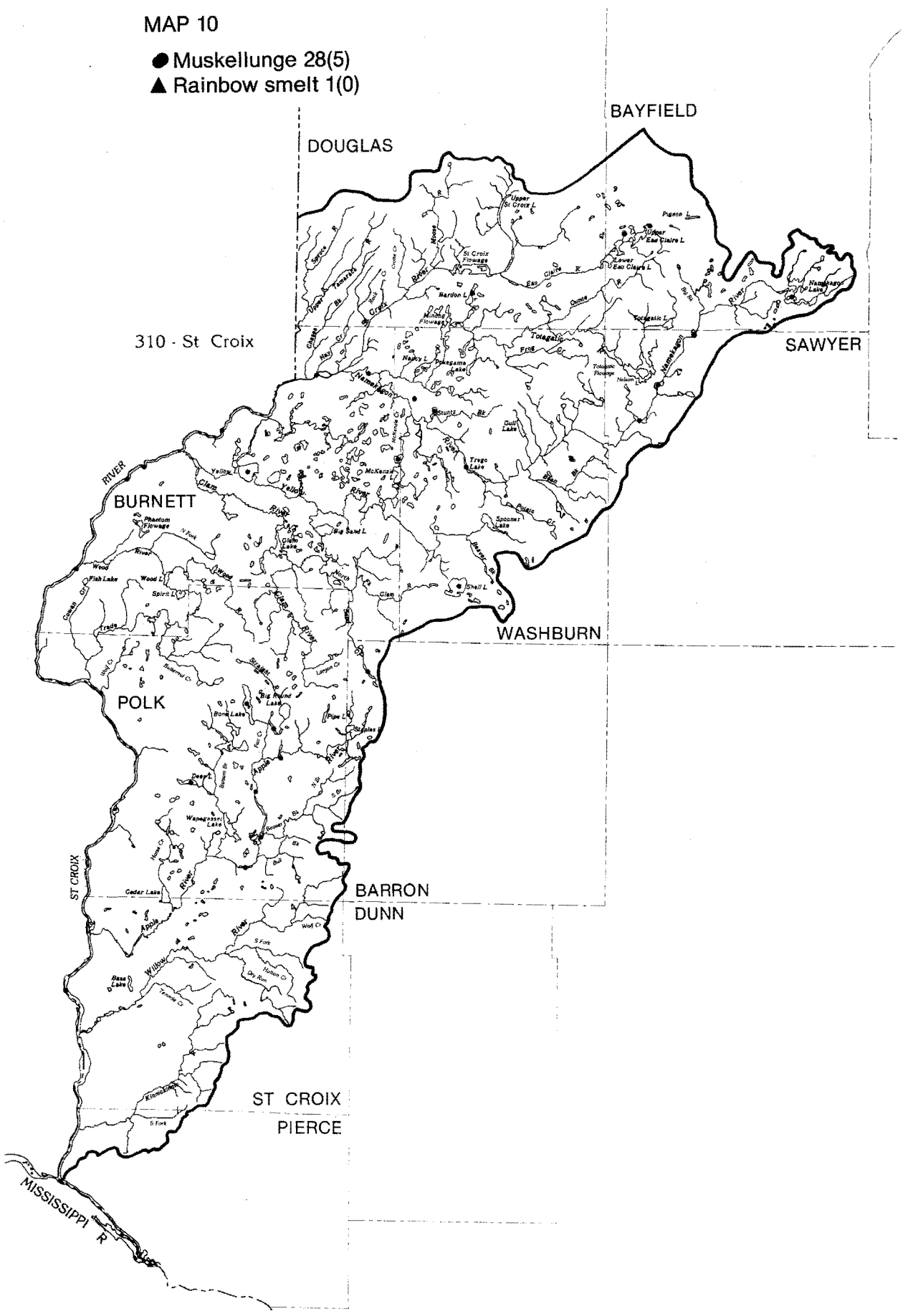


MAP 8

● Brown trout 103(15)

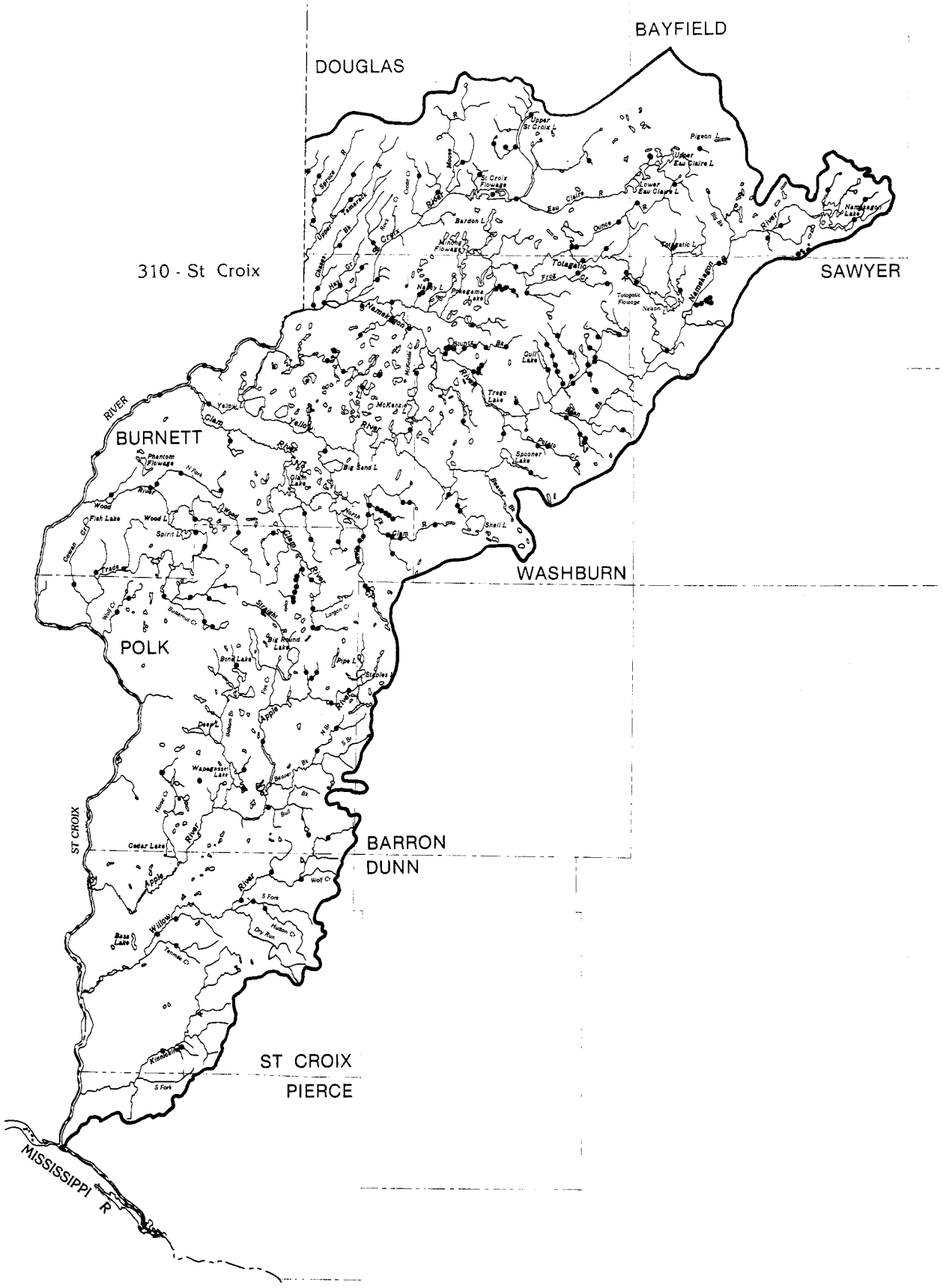



MAP 9
● Brook trout 139(16)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R


MAP 10
Muskellunge 28(5)
Rainbow smelt 1(0)
310 - St Croix
BAYFIELD
DOUGLAS
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
ST CROIX RIVER
MISSISSIPPI R

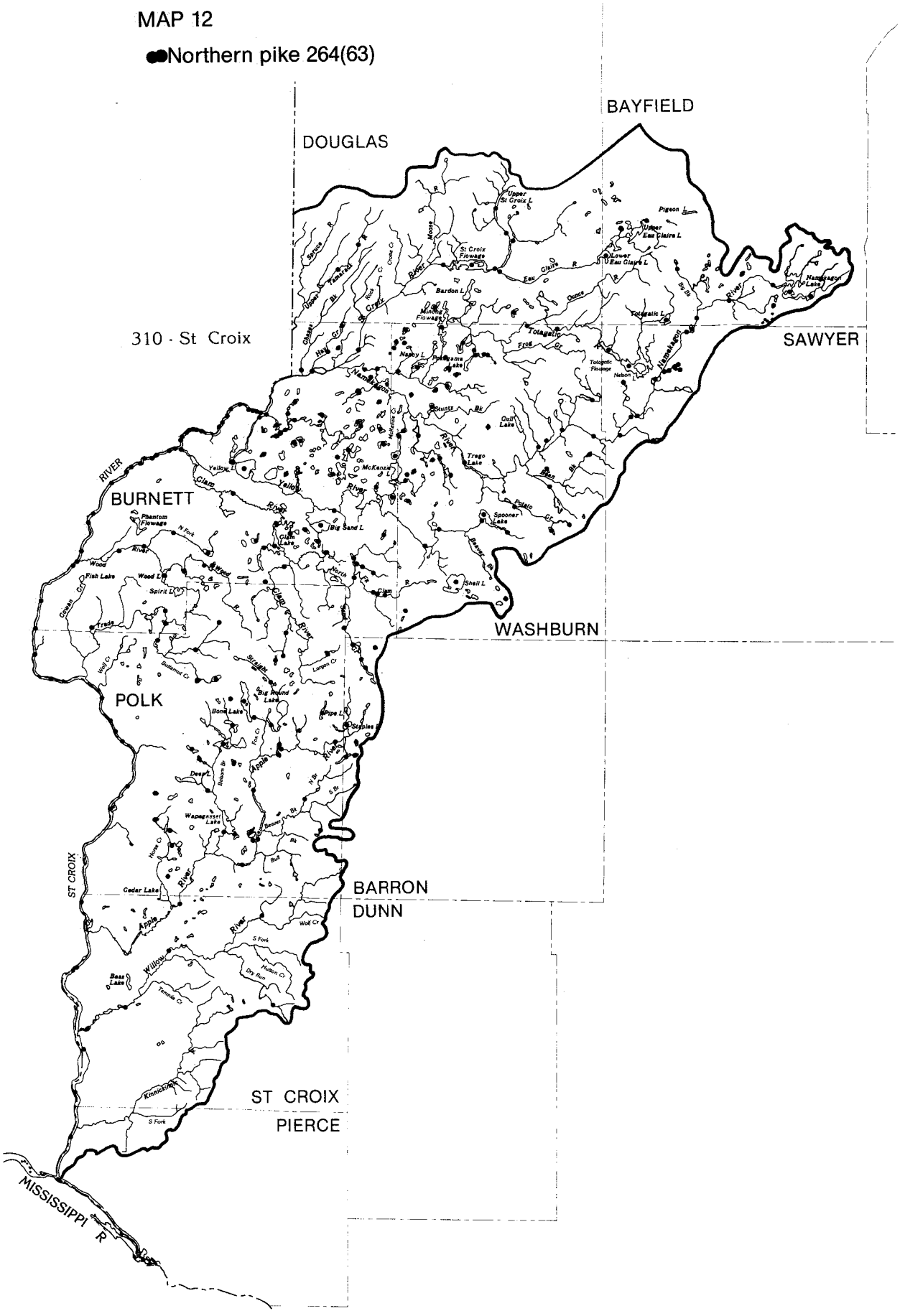
MAP 11

- Central mudminnow 217(6)



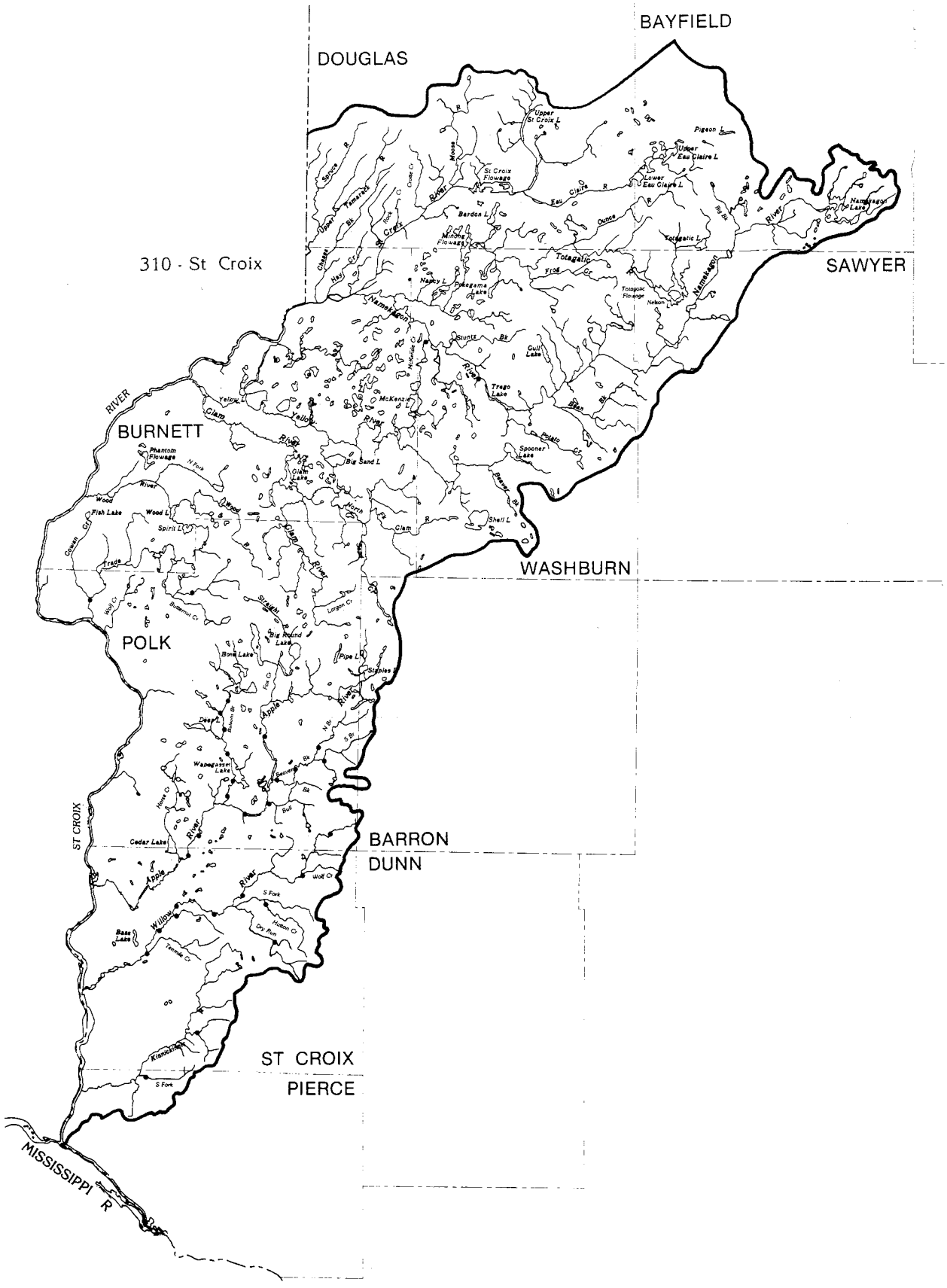
MAP 12

●●Northern pike 264(63)



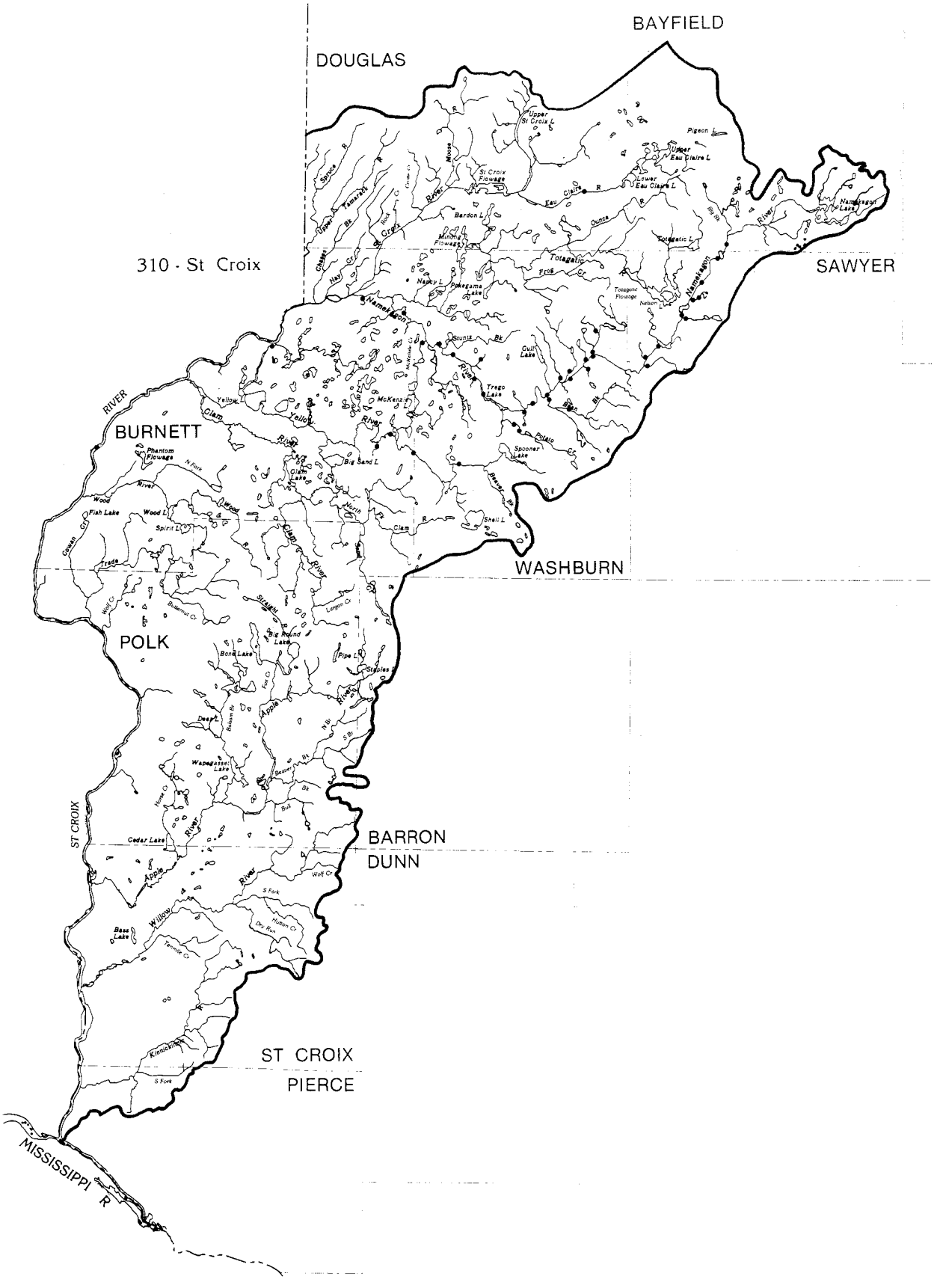
MAP 13

- Central stoneroller 31(2)



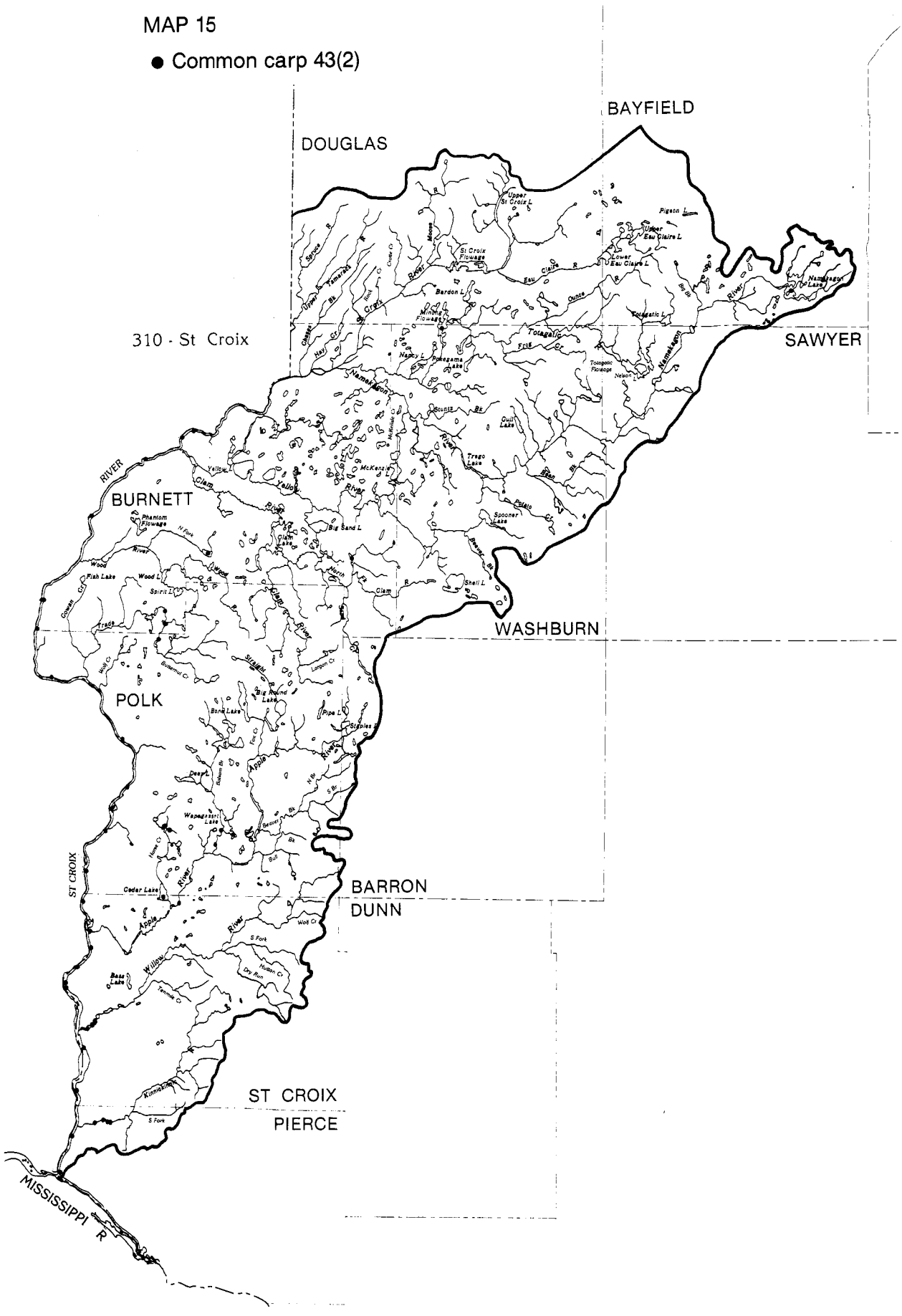
MAP 14

- Largescale stoneroller 40(2)



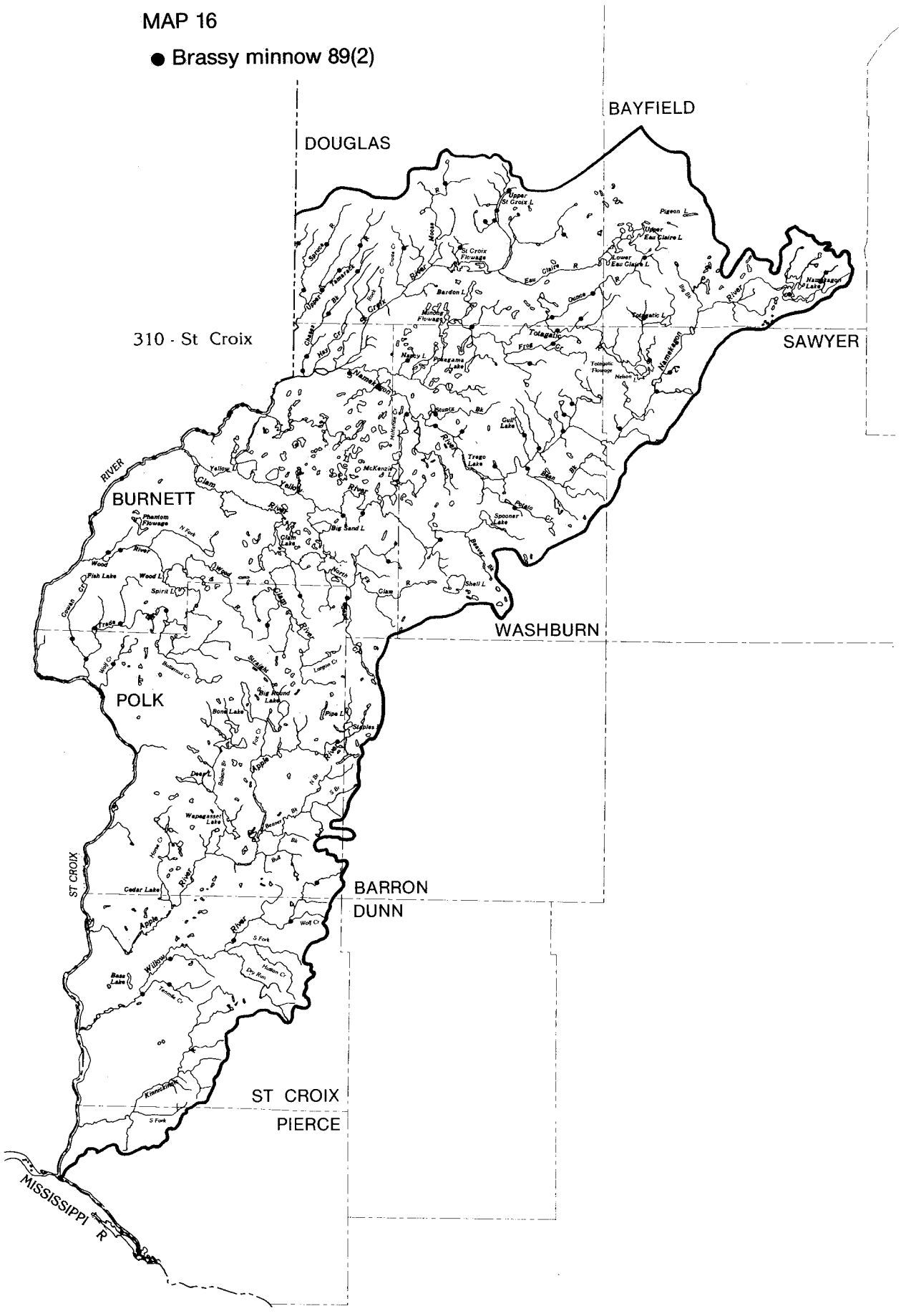
MAP 15

- Common carp 43(2)



MAP 16

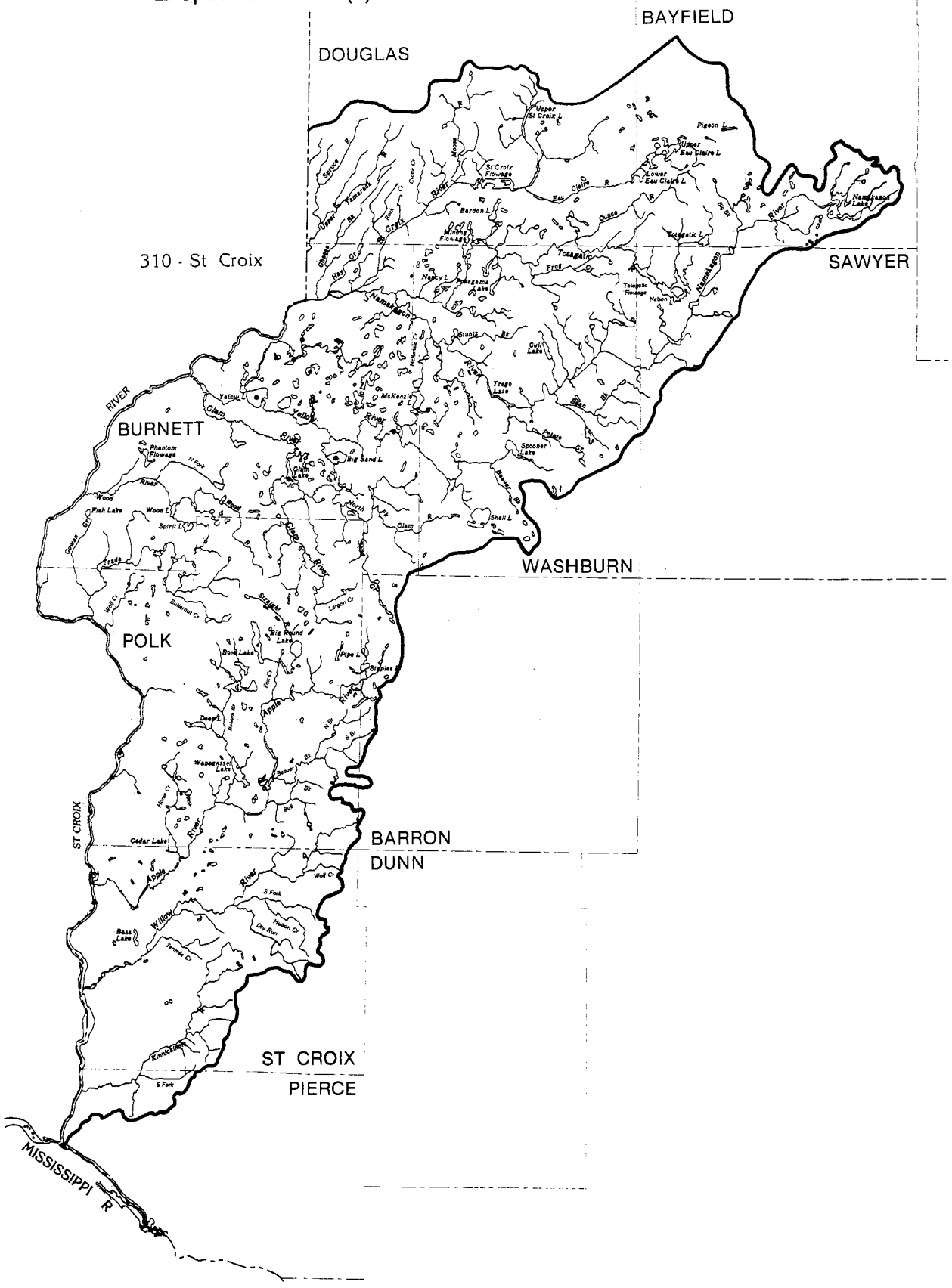
● Brassy minnow 89(2)



MAP 17

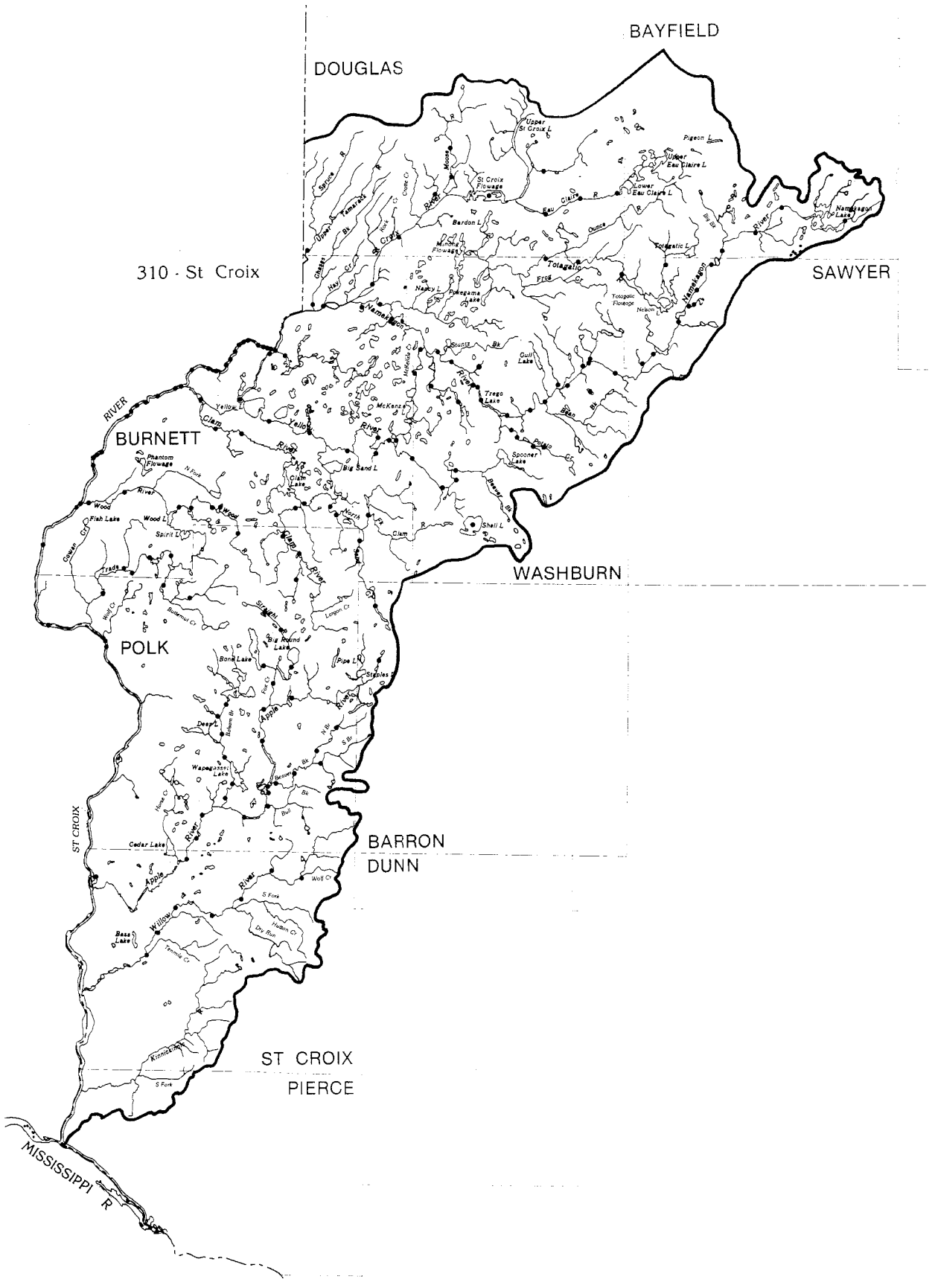
● Pugnose shiner 8(2)

▲ Speckled chub 2(0)



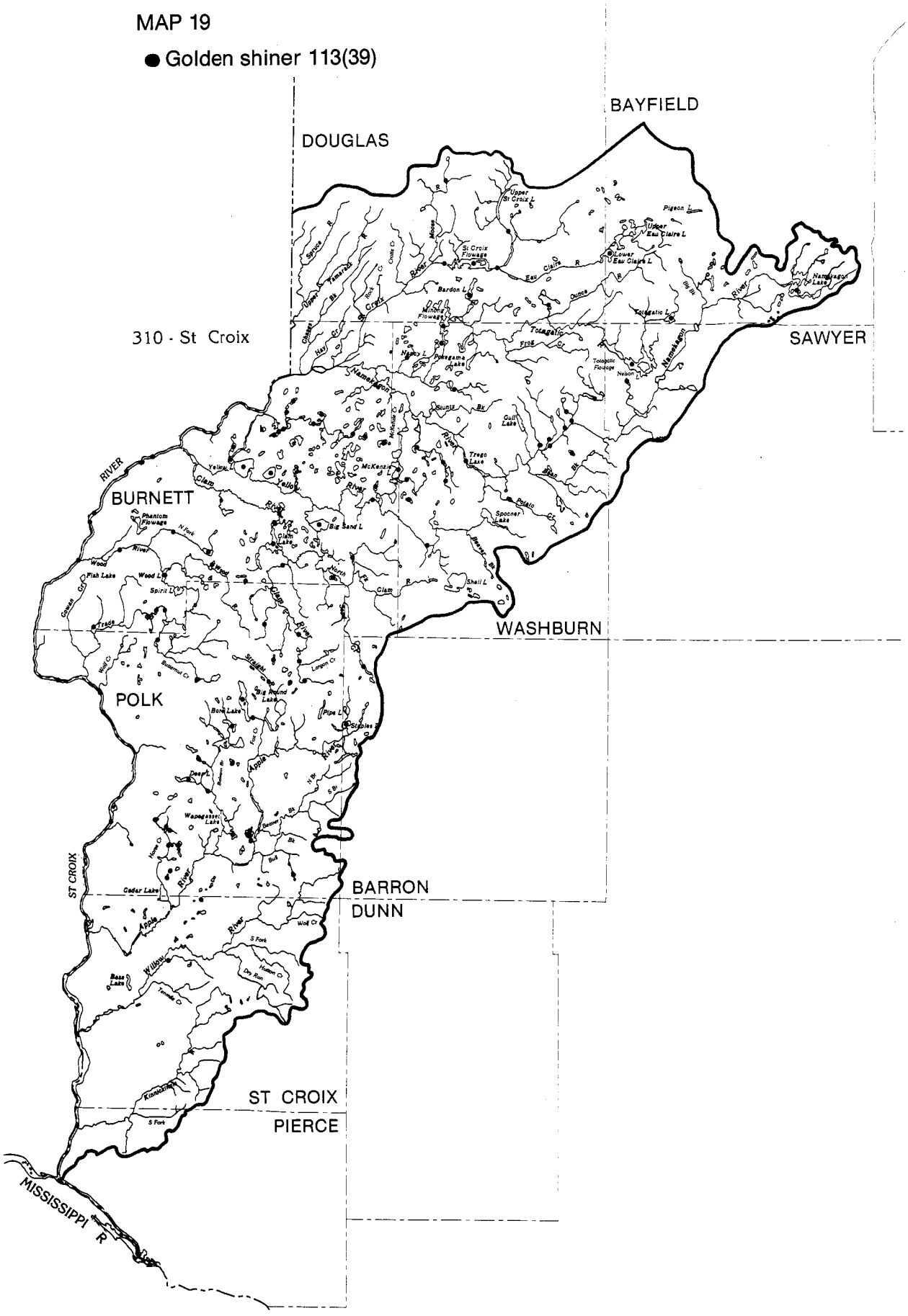
MAP 18

●Hornyhead chub 164(12)



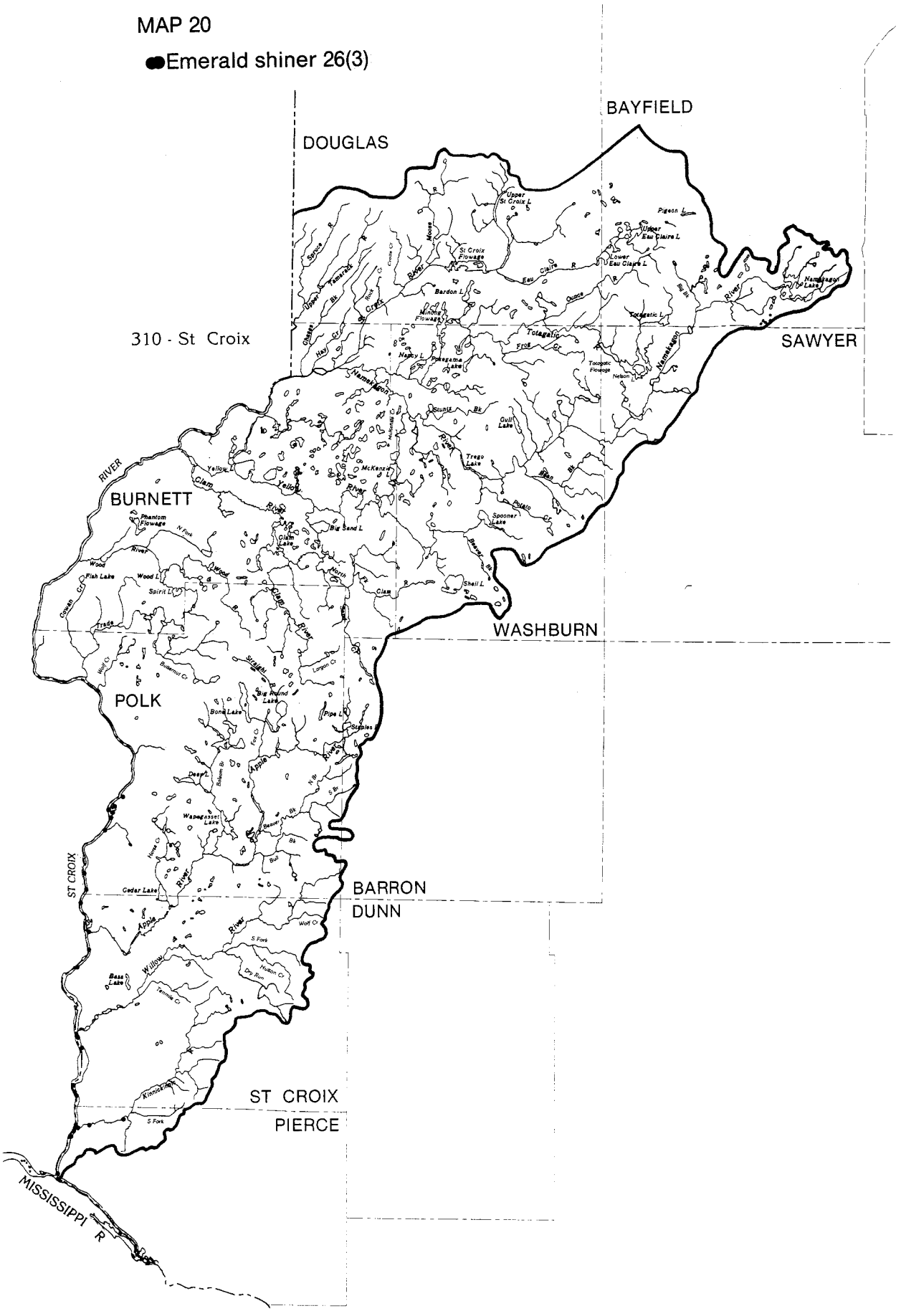
MAP 19

● Golden shiner 113(39)



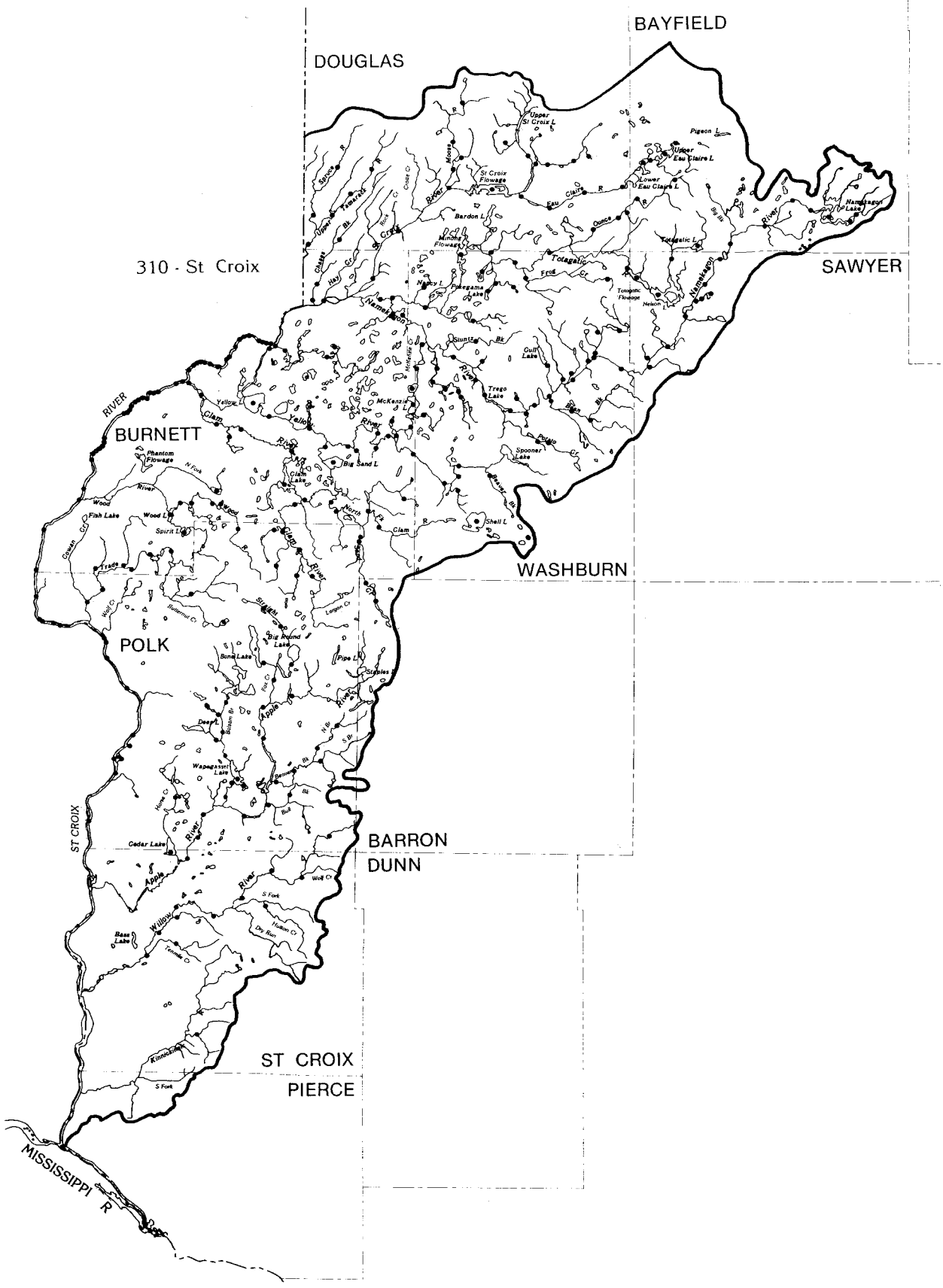
MAP 20

●●Emerald shiner 26(3)



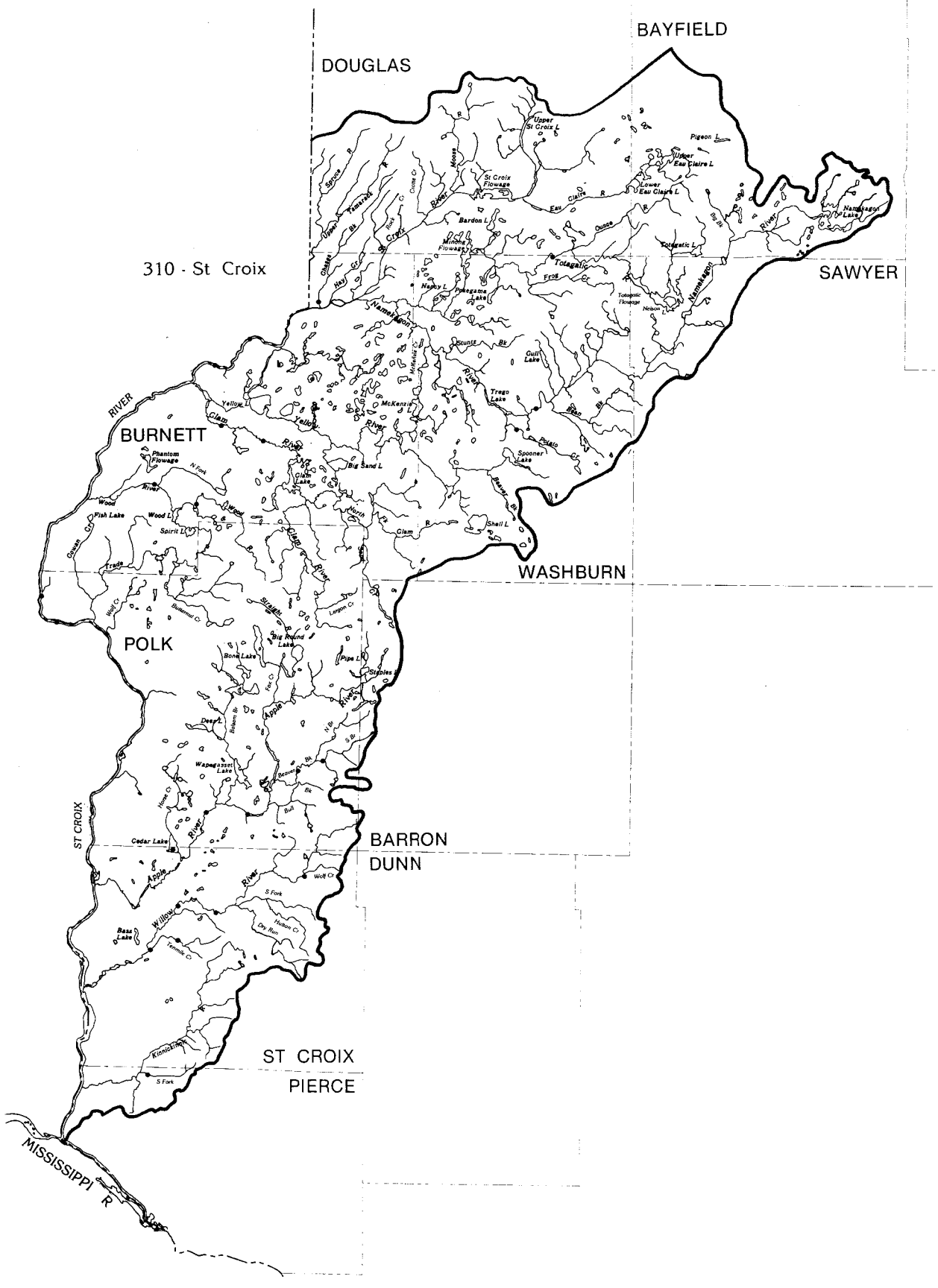
MAP 21

● Common shiner 277(44)



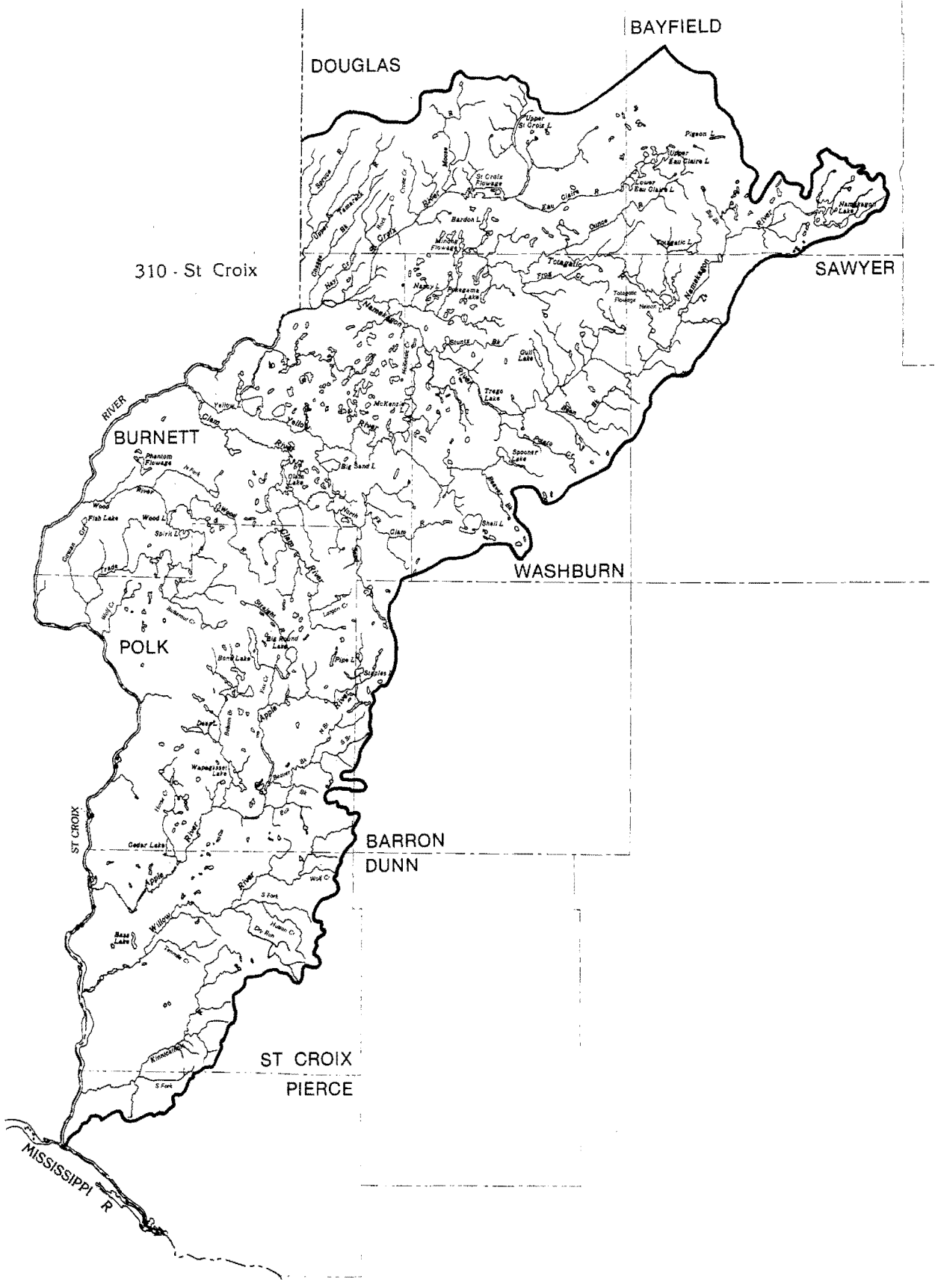
MAP 22

● Bigmouth shiner 23(1)



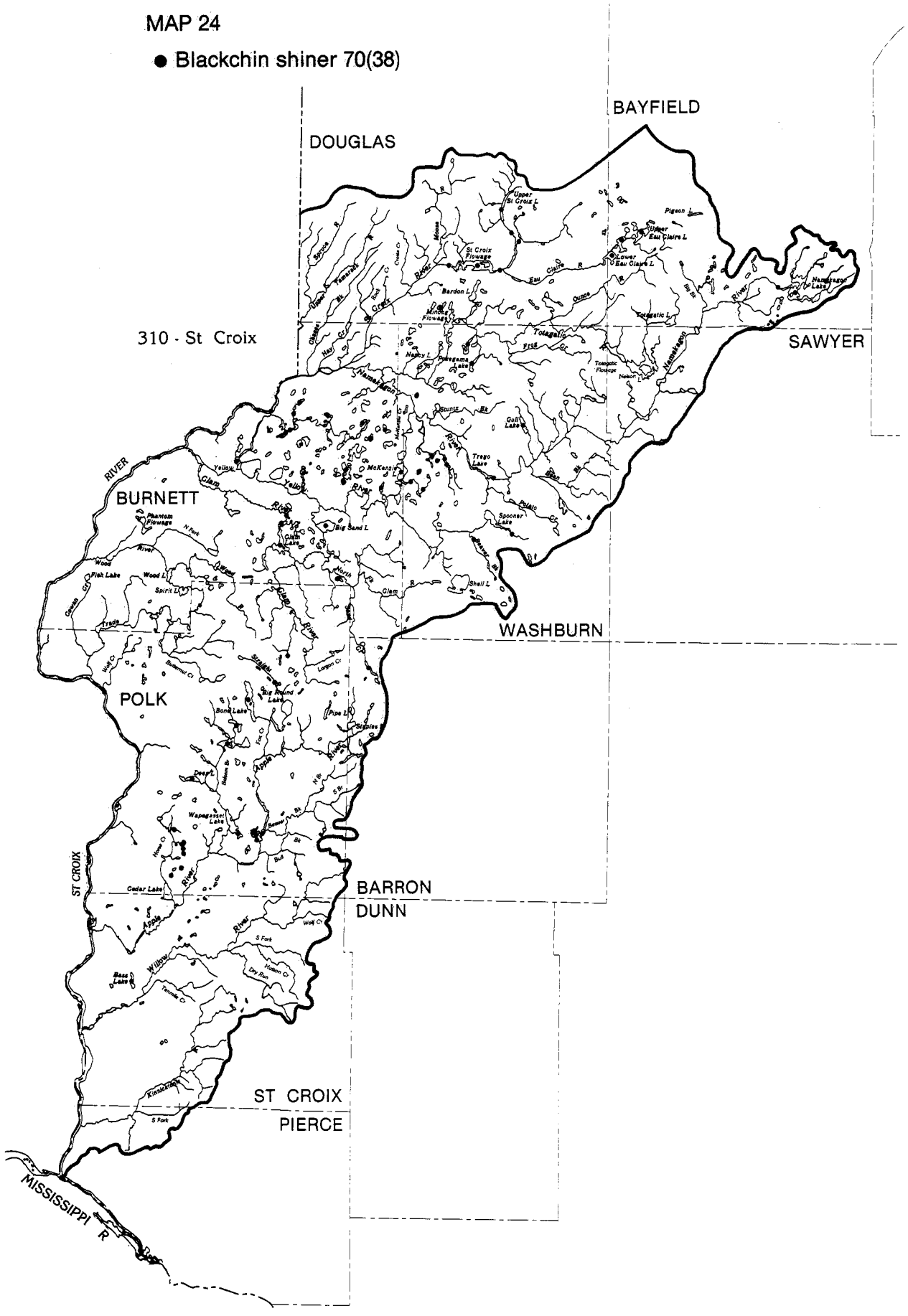
MAP 23

● Pugnose minnow 5(1)



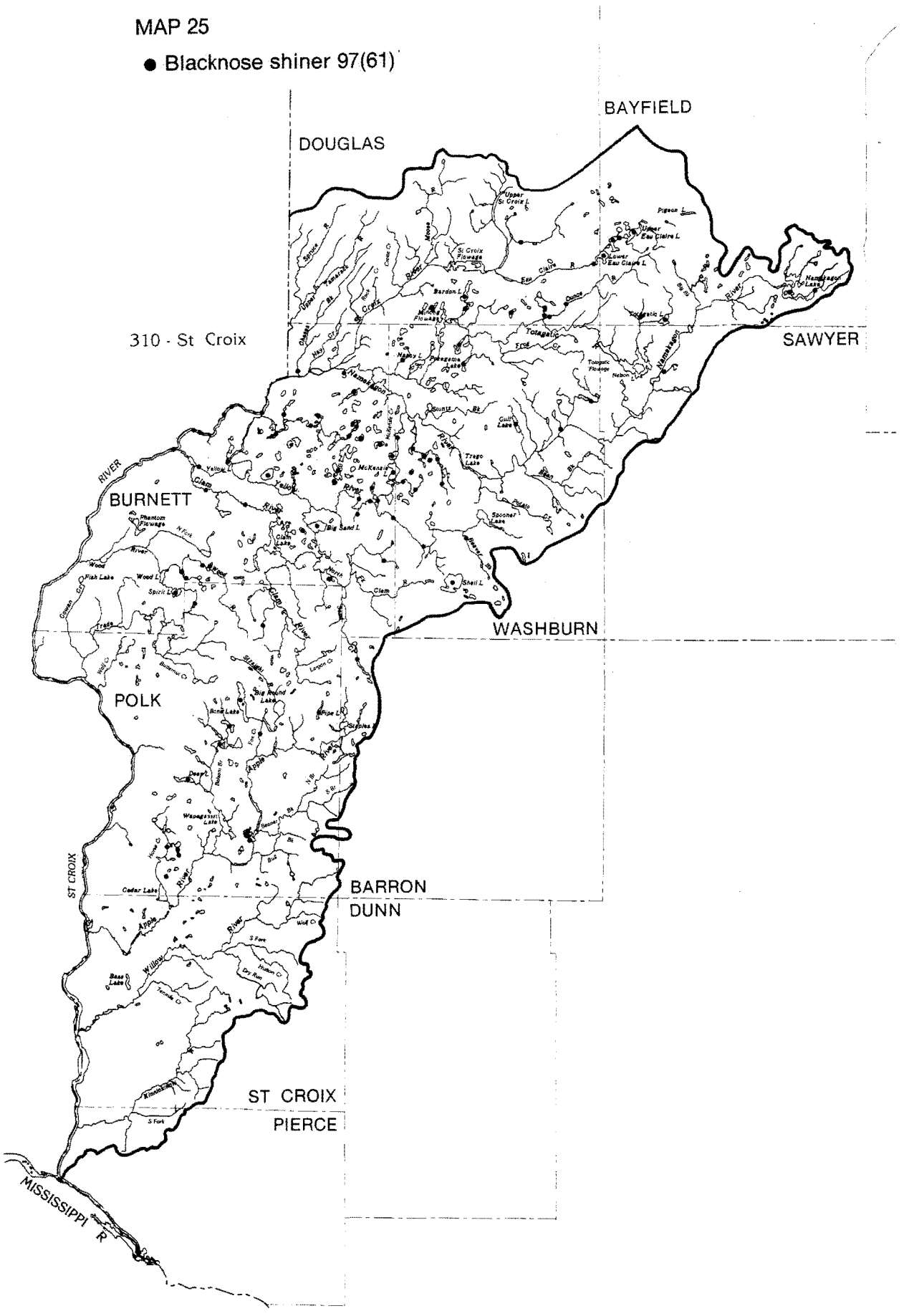
MAP 24

● Blackchin shiner 70(38)



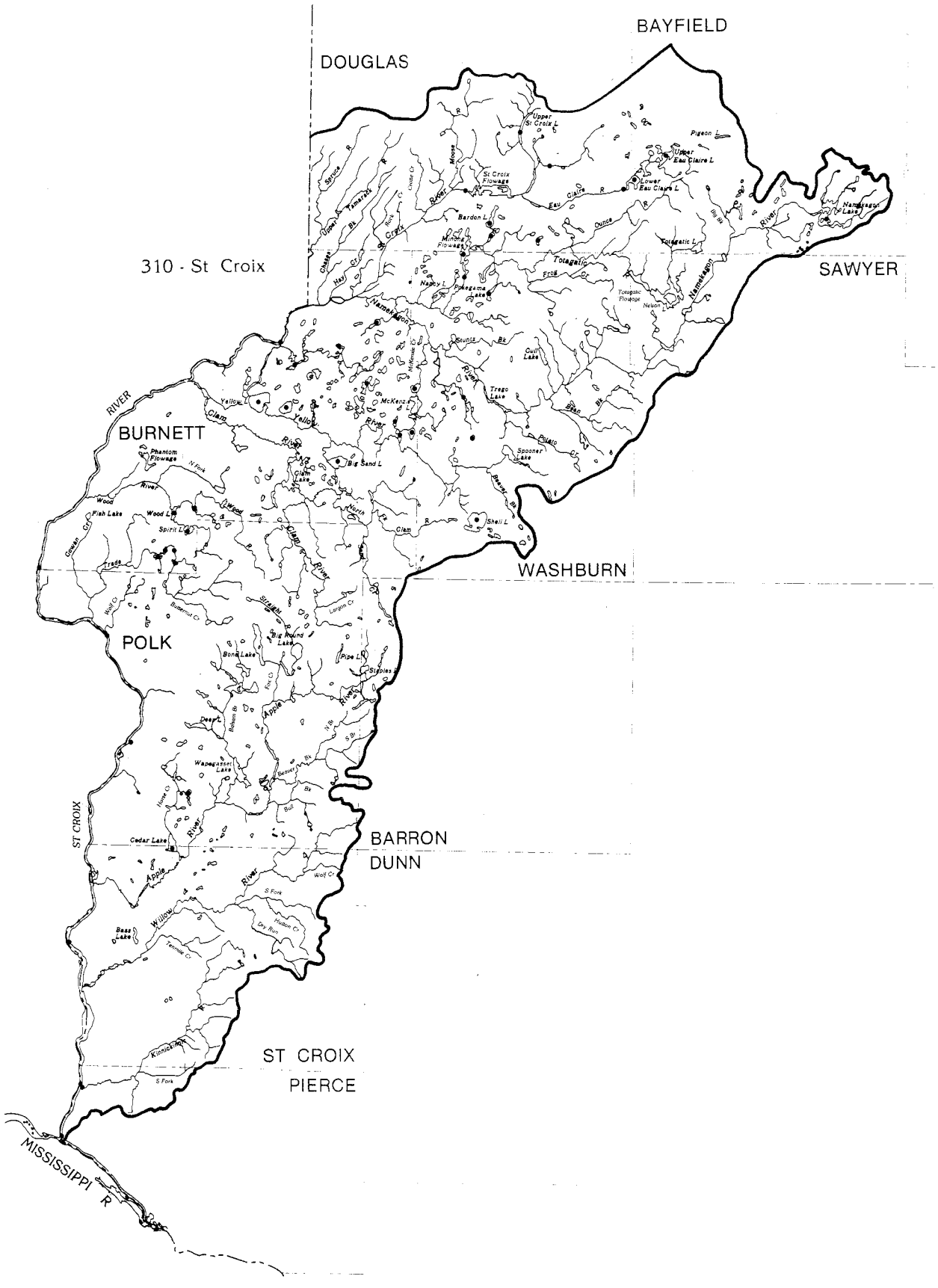
MAP 25

● Blacknose shiner 97(61)



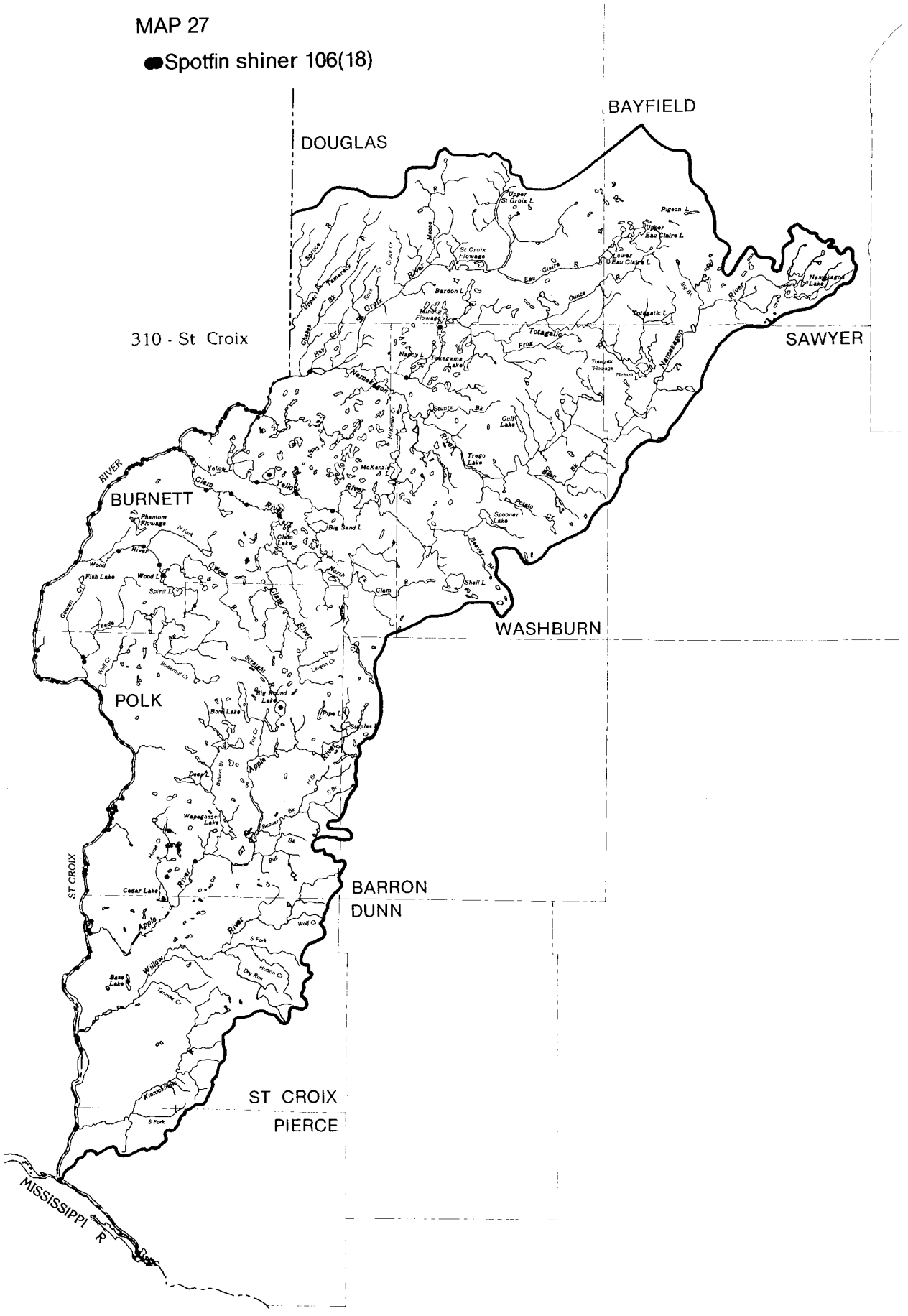
MAP 26

● Spottail shiner 44(27)



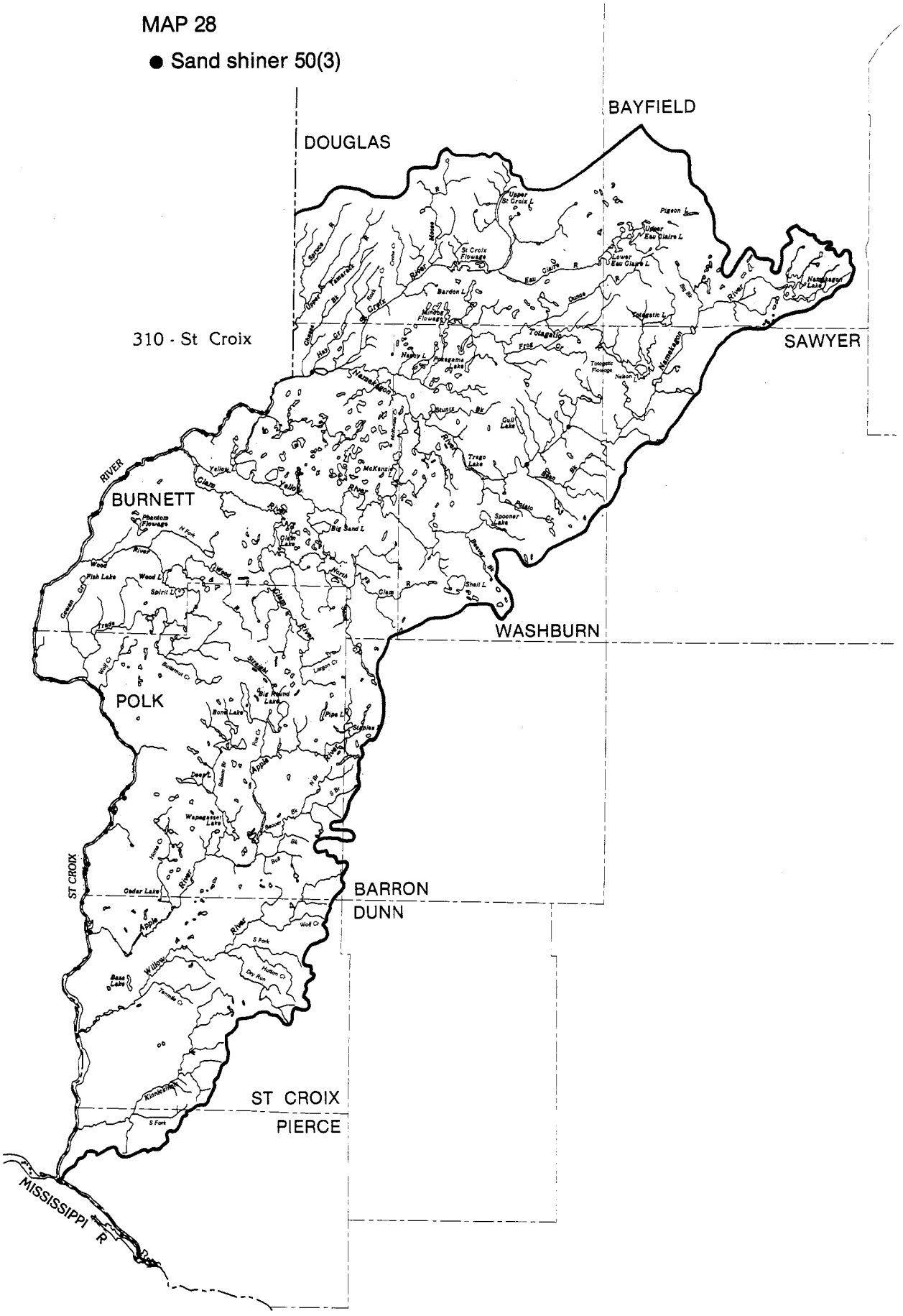
MAP 27

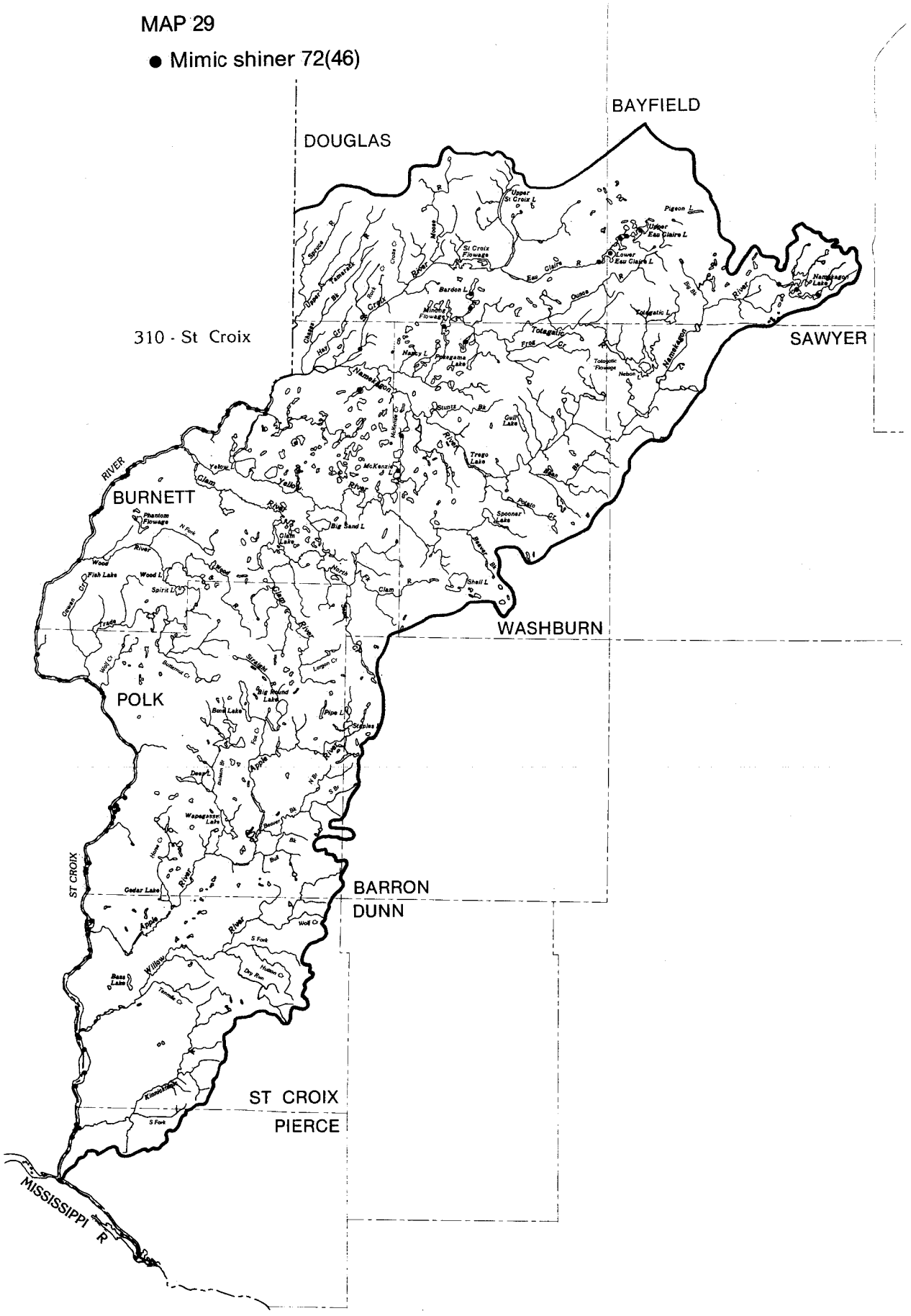
●Spotfin shiner 106(18)



MAP 28

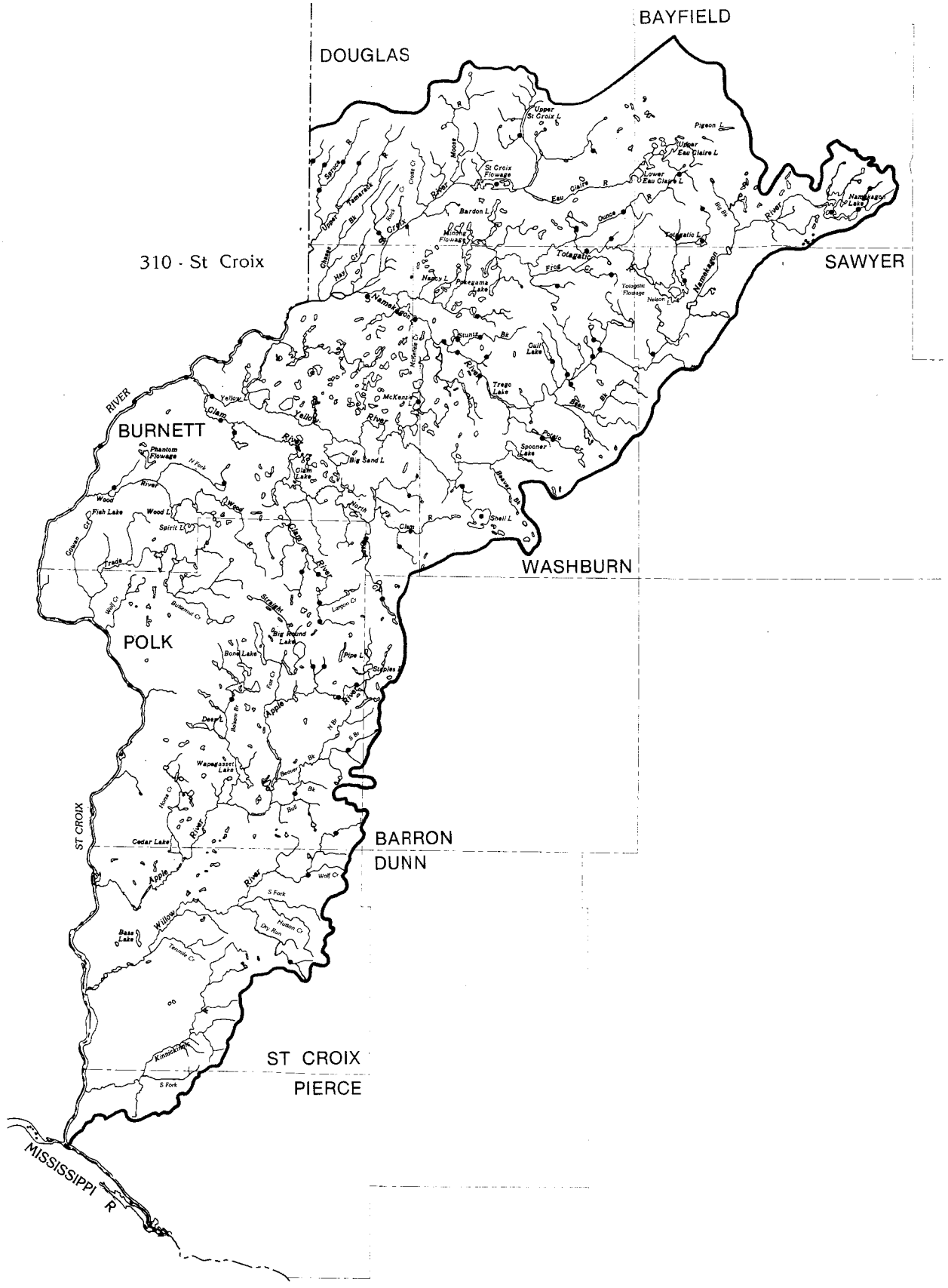
● Sand shiner 50(3)




MAP 29
● Mimic shiner 72(46)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
Upper St Croix L
Pigeon L
Upper Eau Claire L
Lower Eau Claire L
St Croix Flowage
Bardon L
Namekagon Flowage
Totagatic Flowage
Nebish L
Namekagon Lake
Trego Lake
Gull Lake
Spooner Lake
Shell L
Big Sand L
Clam Lake
Phantom Flowage
Fish Lake
Wood L
Spirit L
Big Round Lake
Bone Lake
Pipe L
Wapogasset Lake
Cedar Lake
Bass Lake
Yellow River
Clam River
Wood River
Apple River
Willow River
Namekagon River
St Croix River

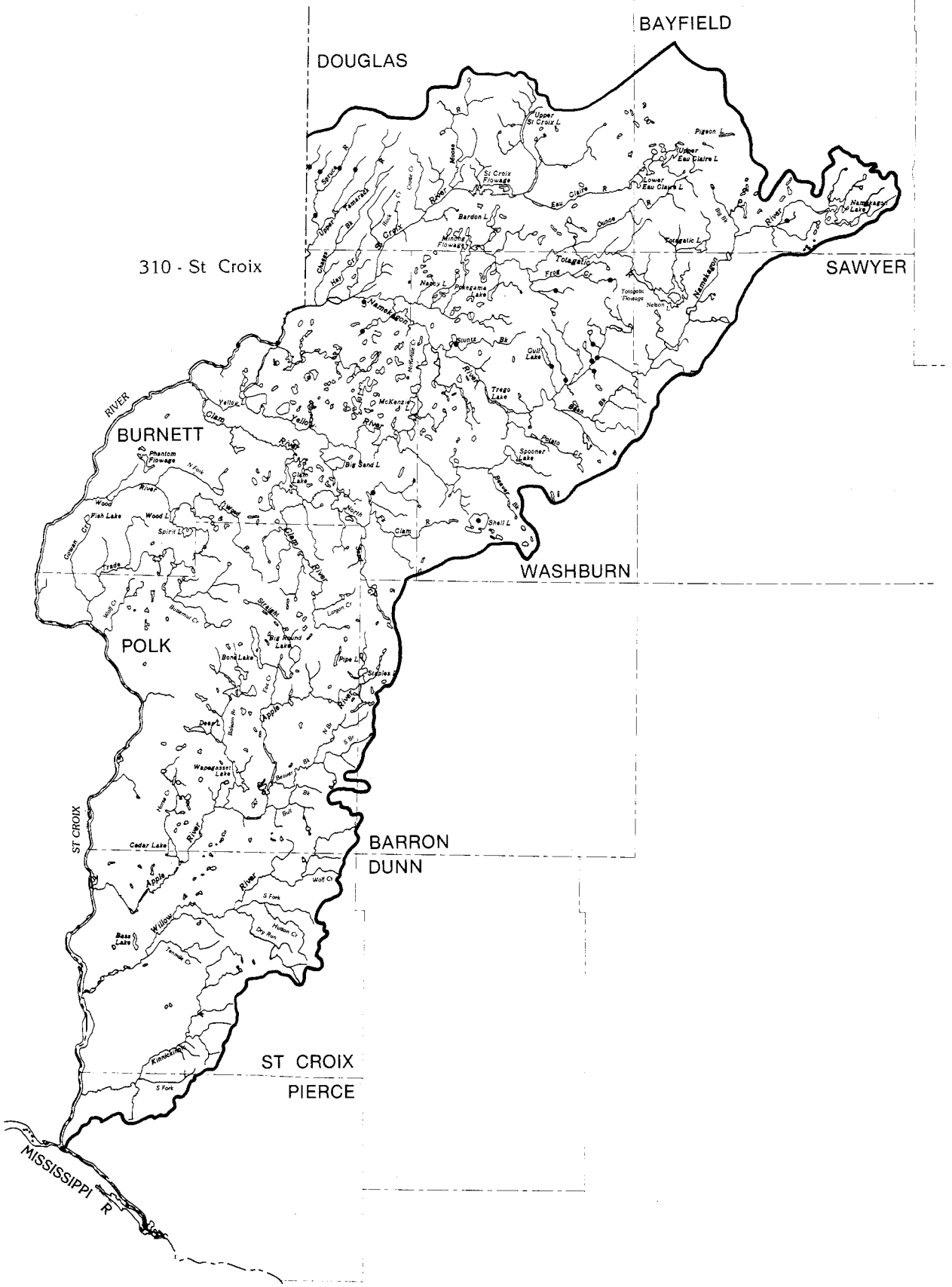
MAP 30

● Northern redbelly dace 77(13)



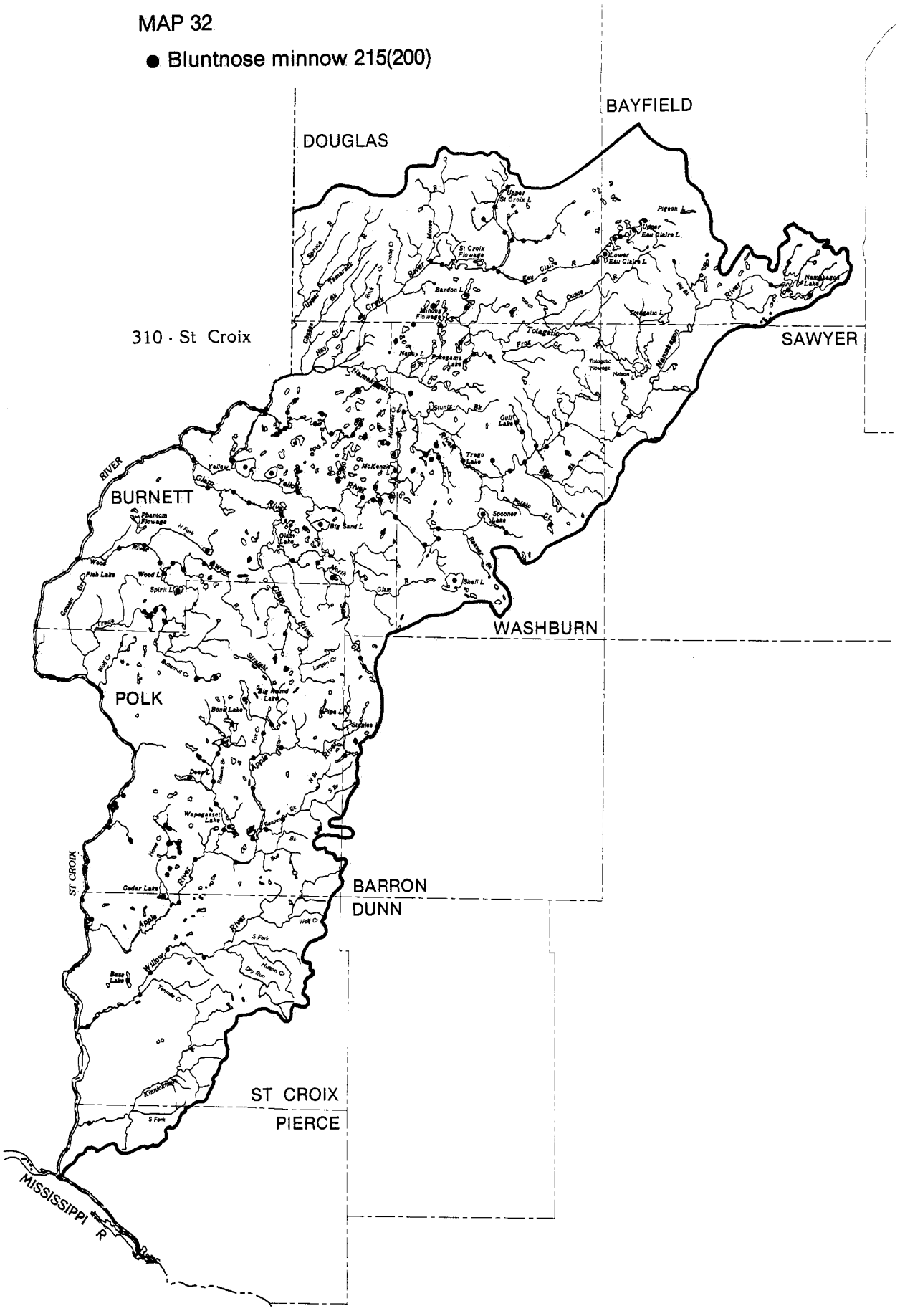
MAP 31

- Finescale dace 21(1)



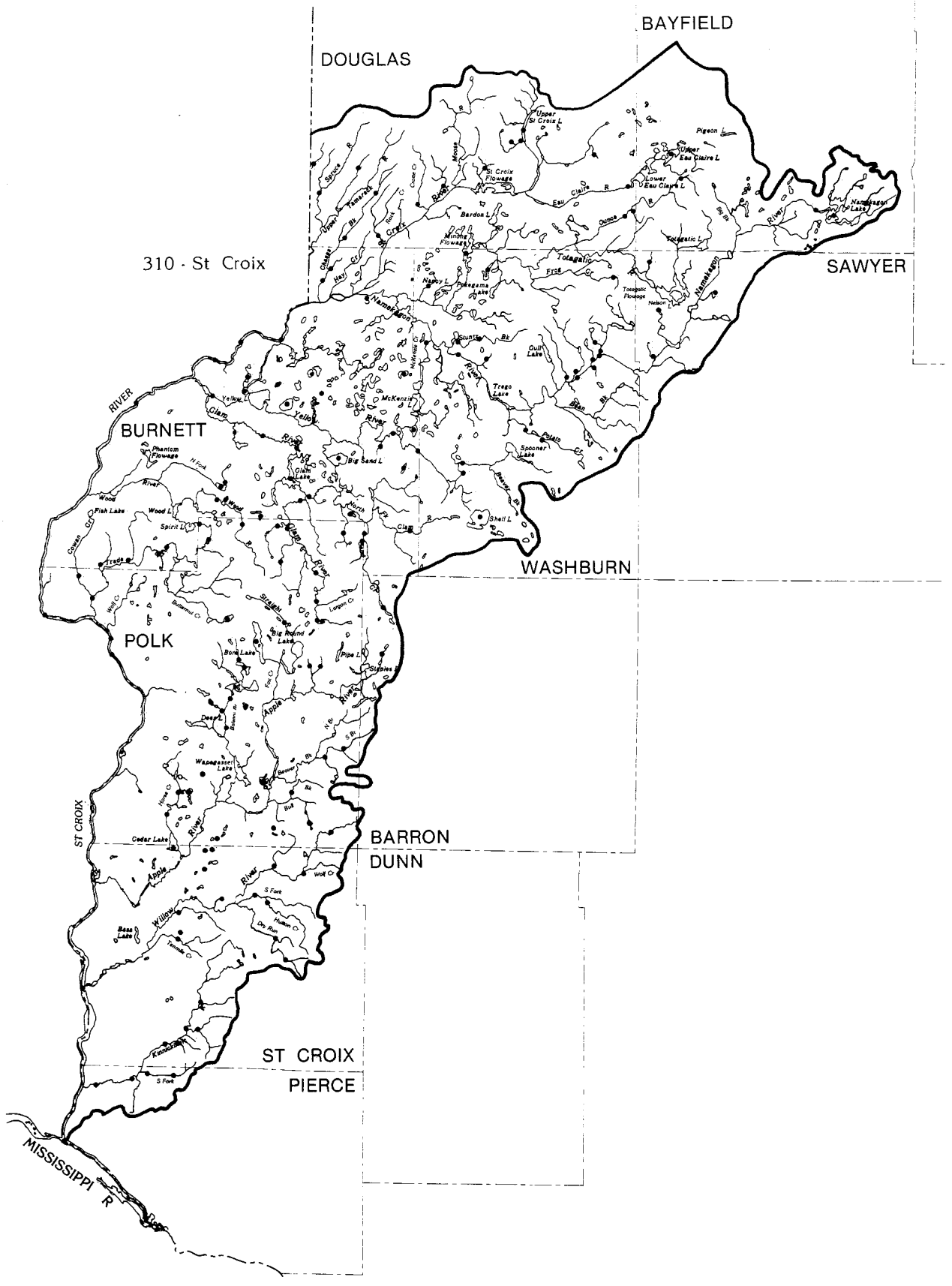
MAP 32

● Bluntnose minnow 215(200)



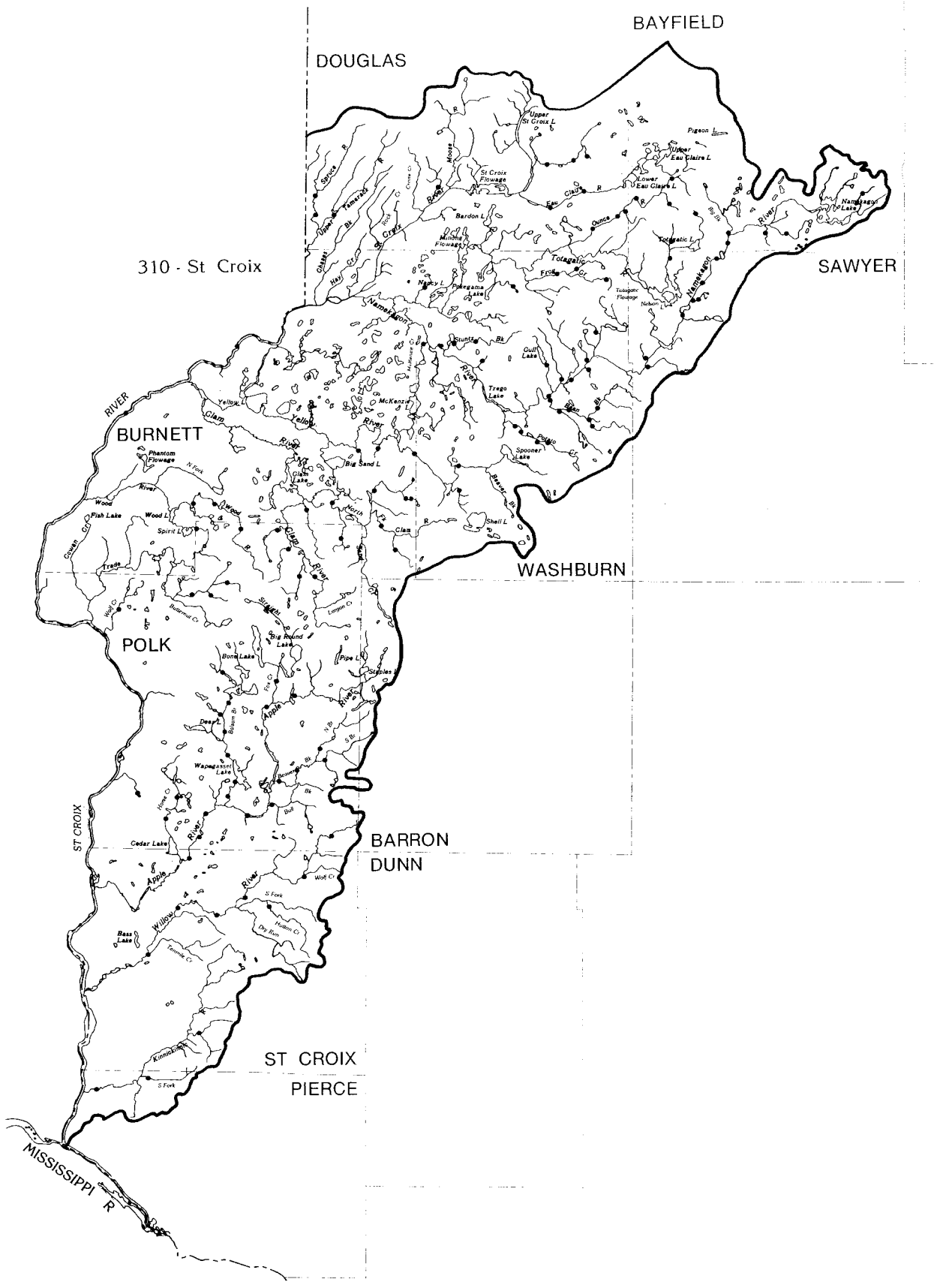
MAP 33

● Fathead minnow 153(20)



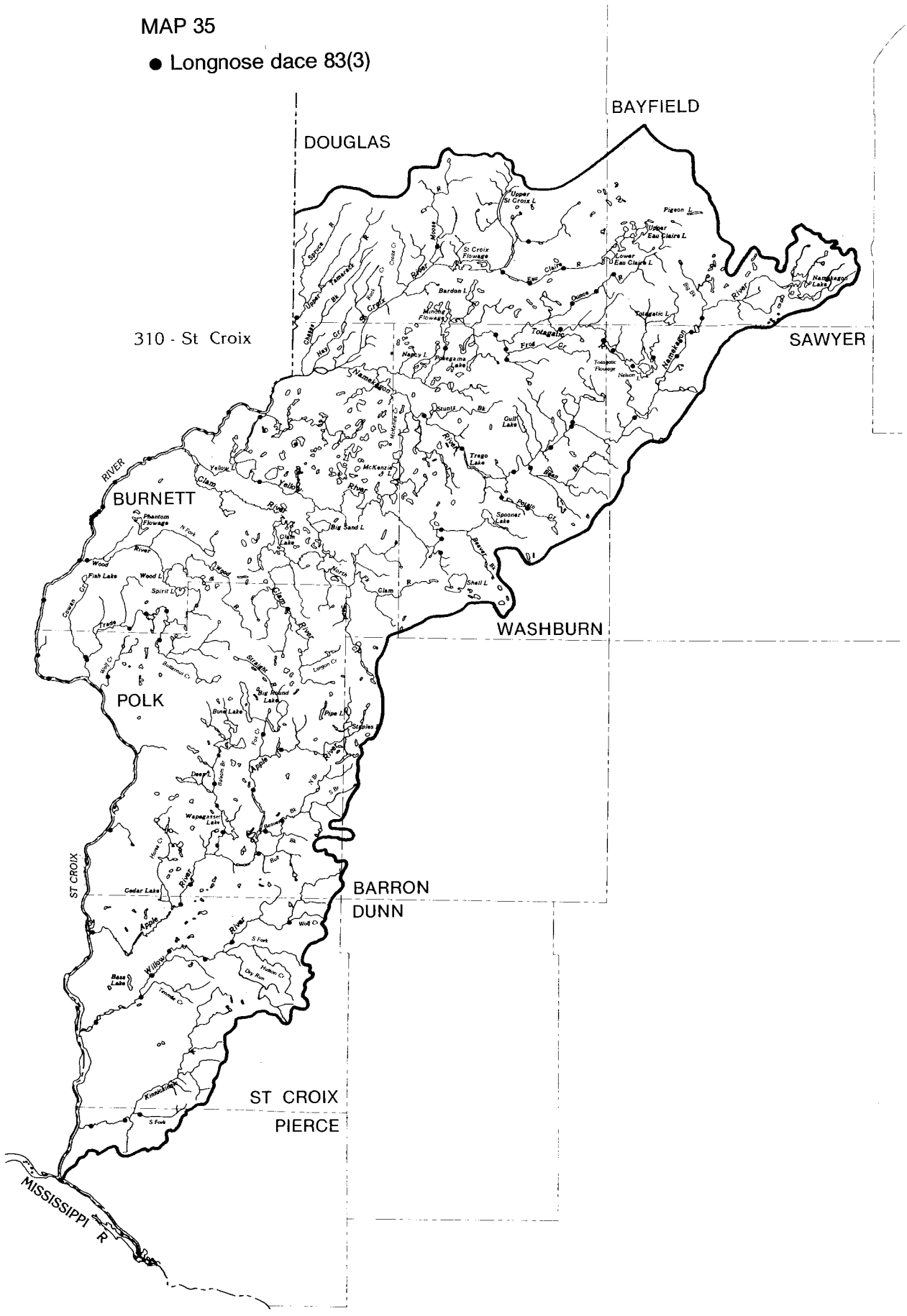
MAP 34

● Blacknose dace 118(3)



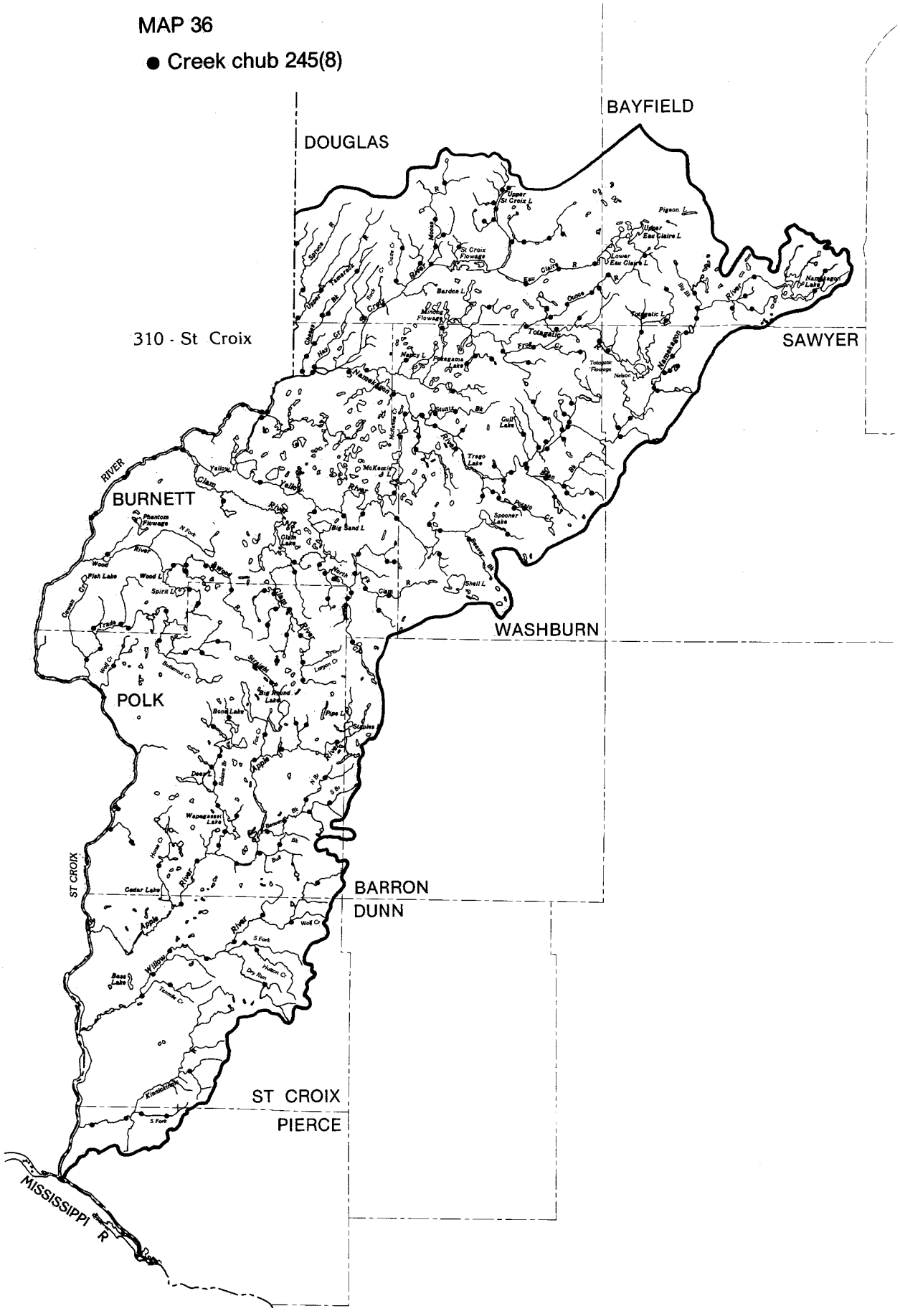
MAP 35

● Longnose dace 83(3)



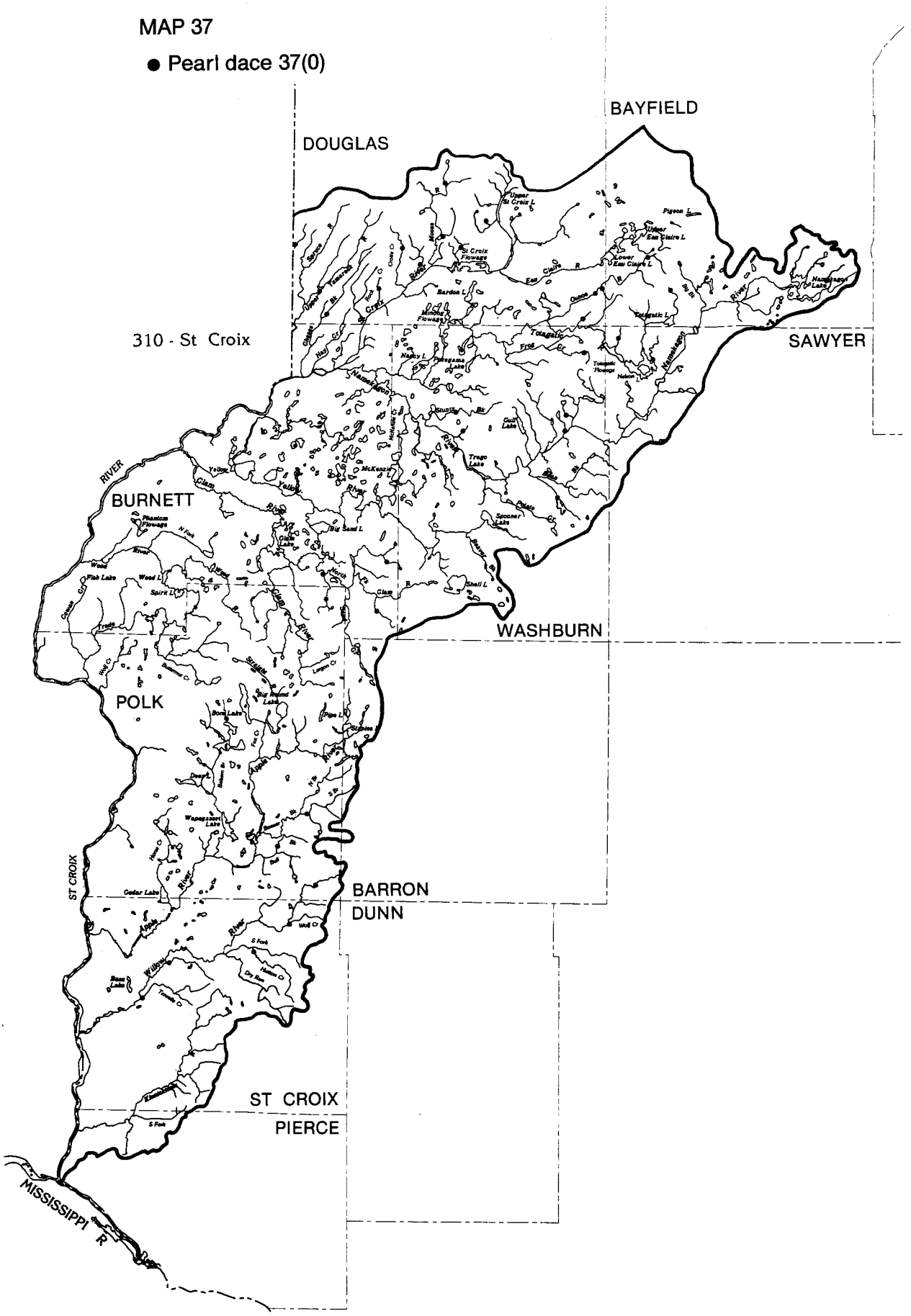
MAP 36

● Creek chub 245(8)



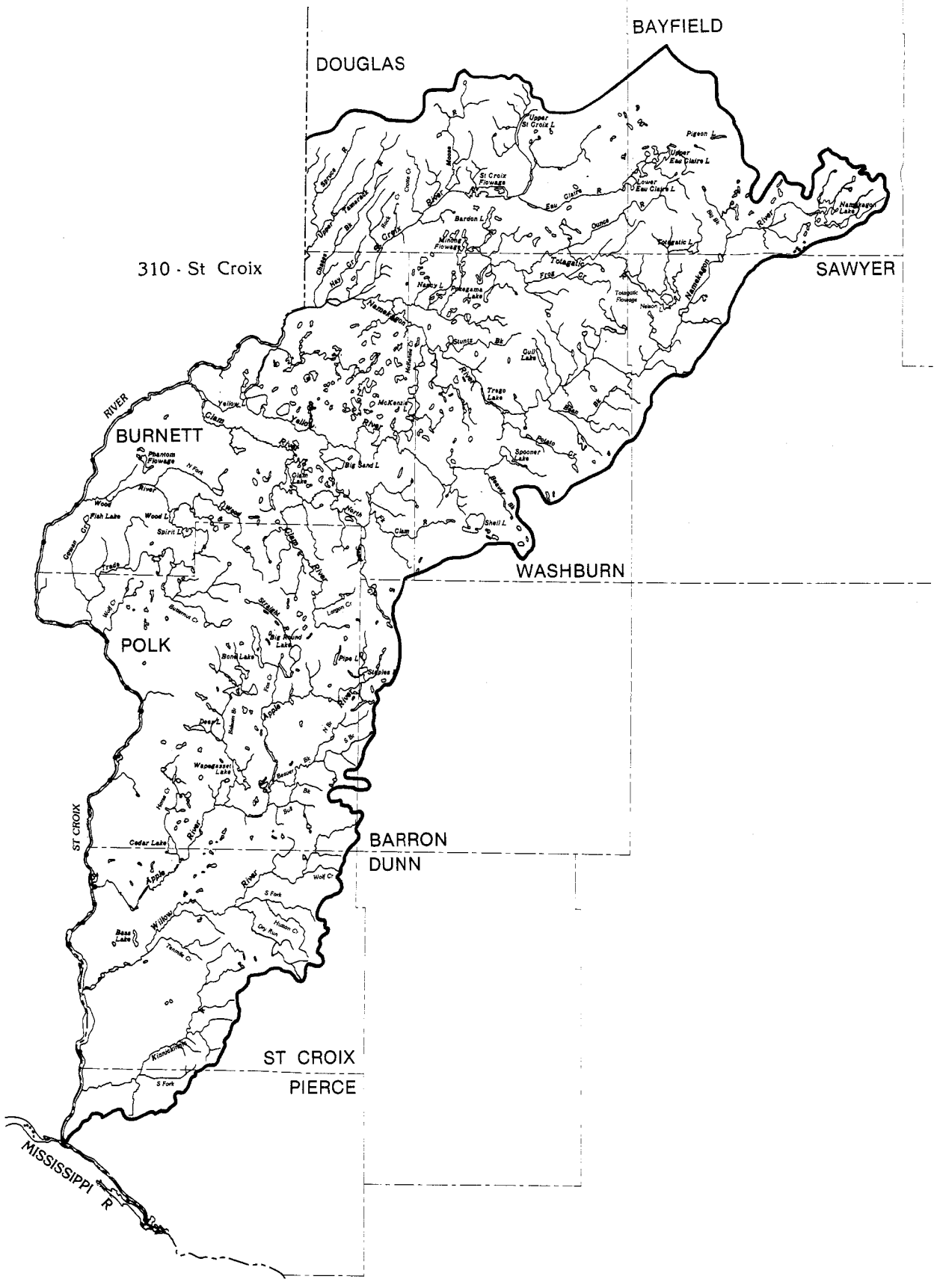
MAP 37

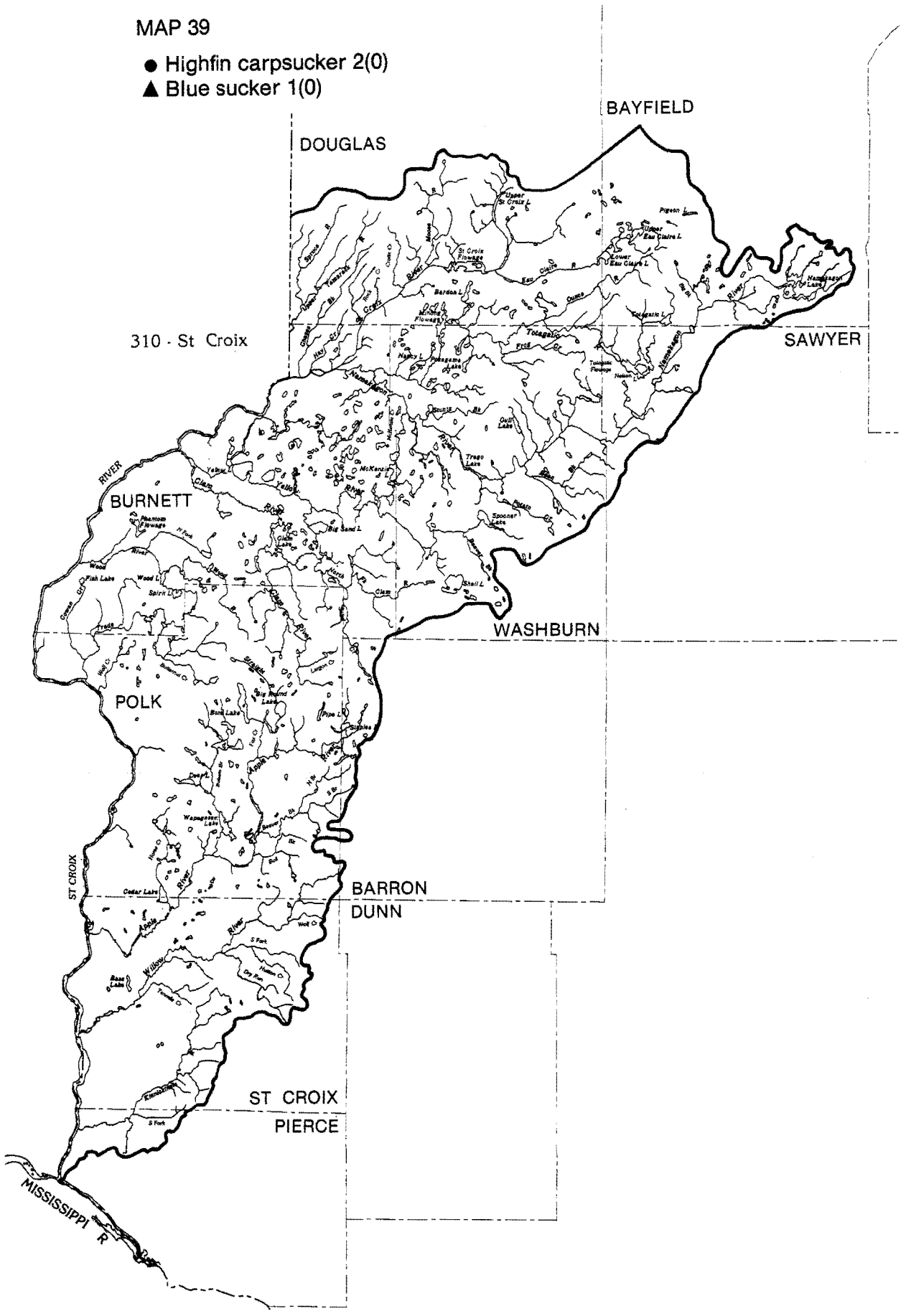
● Pearl dace 37(0)



MAP 38

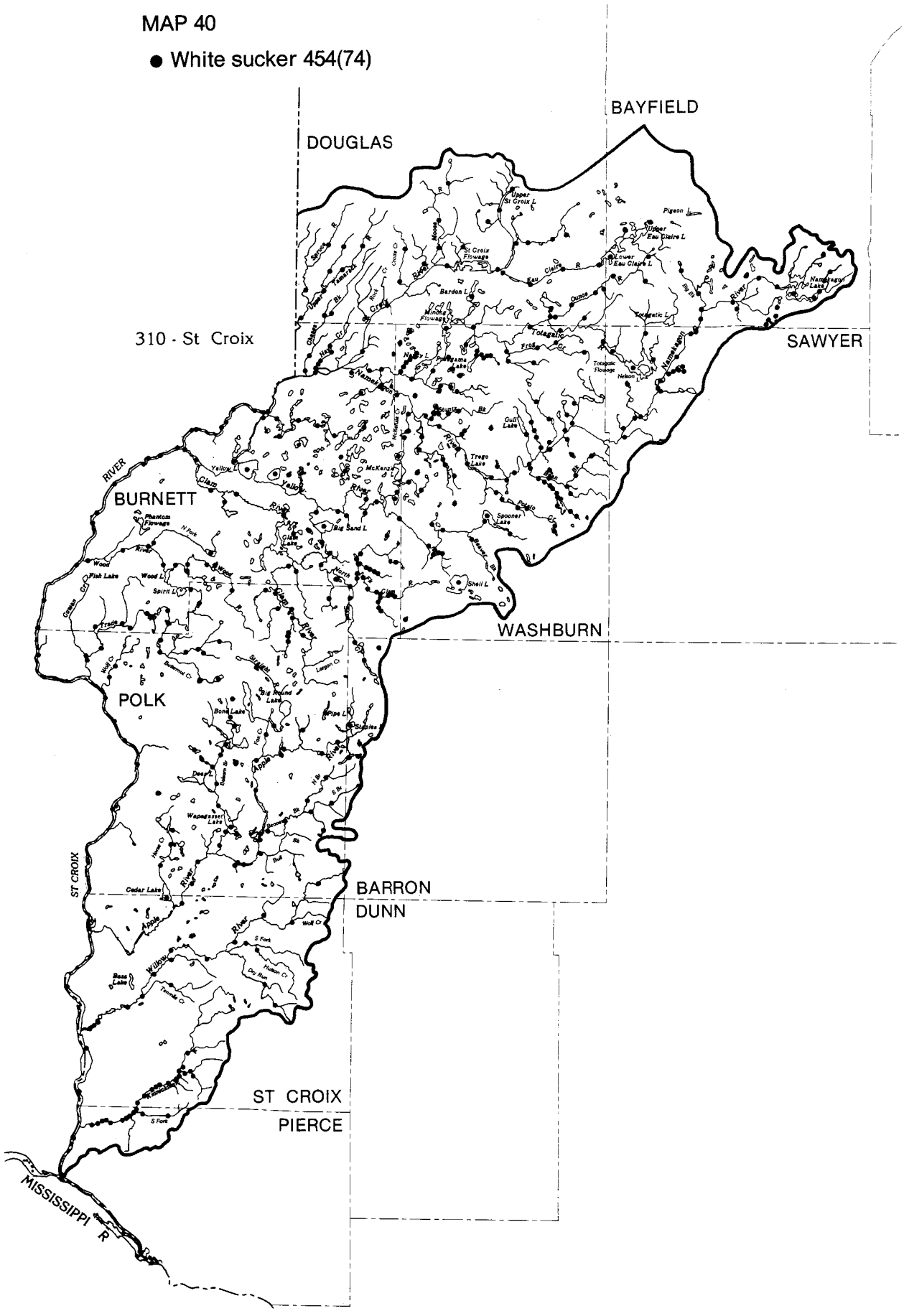
● Quillback 18(0)

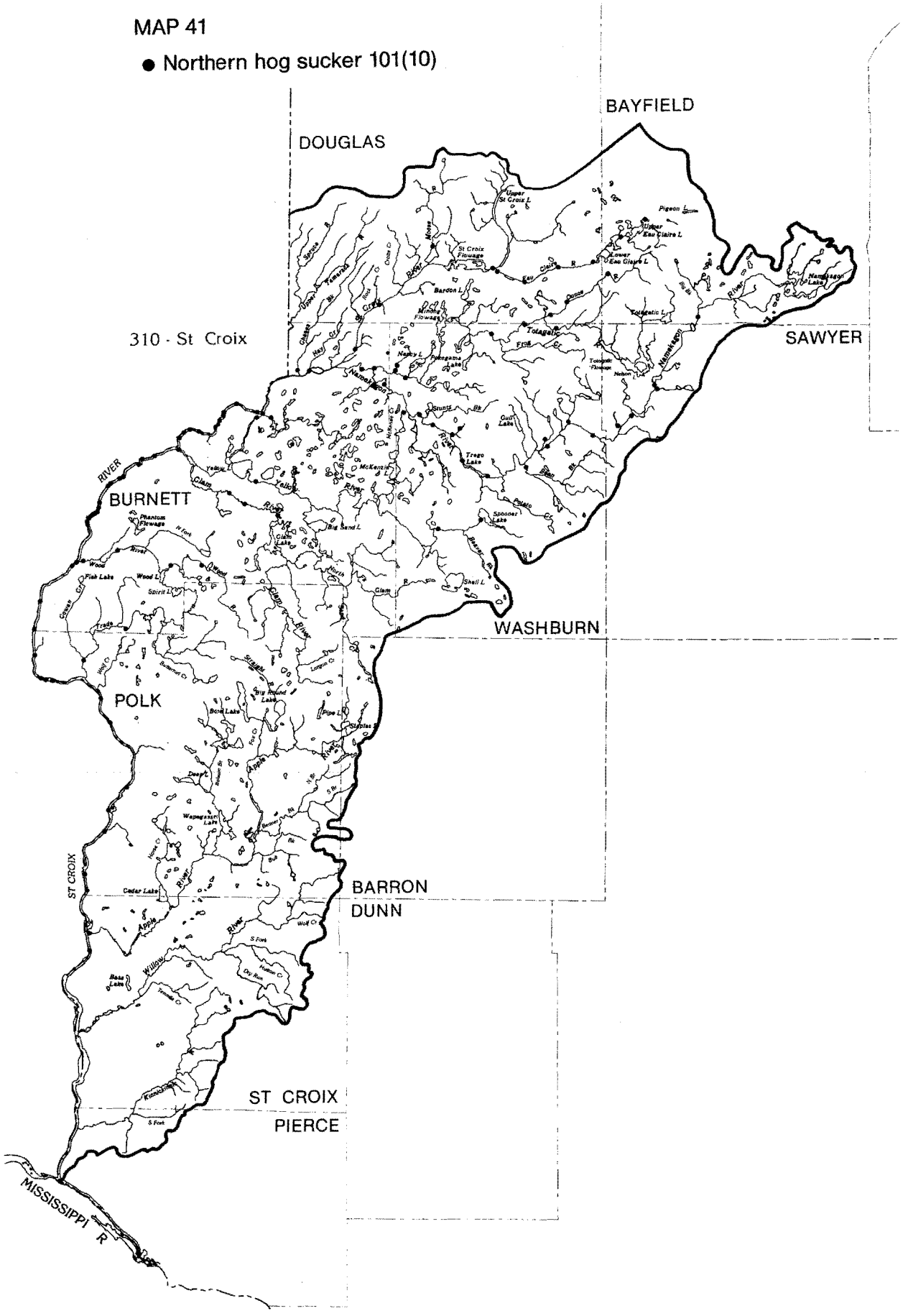



MAP 39
● Highfin carpsucker 2(0)
▲ Blue sucker 1(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R.

MAP 40

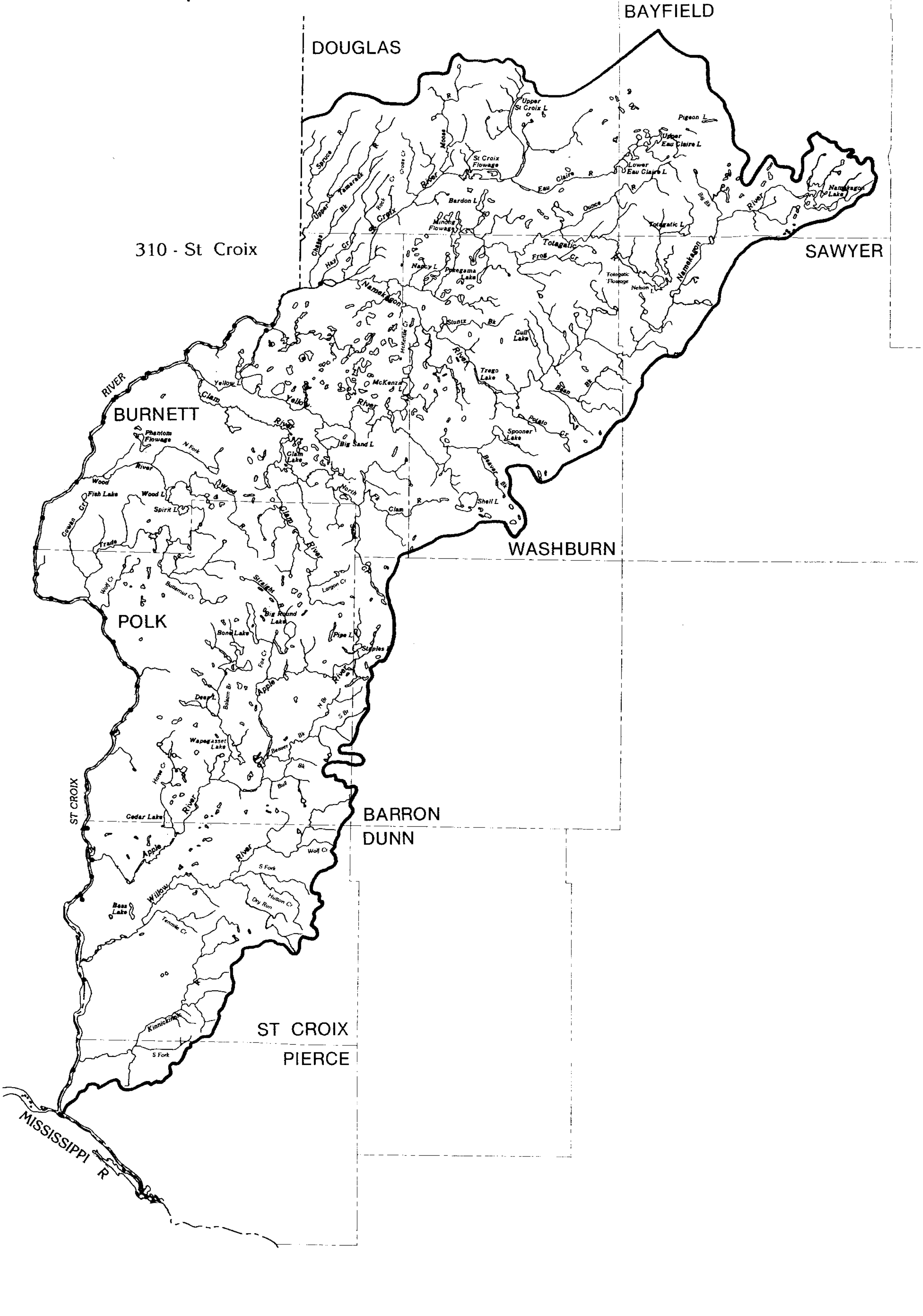
- White sucker 454(74)




MAP 41
● Northern hog sucker 101(10)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

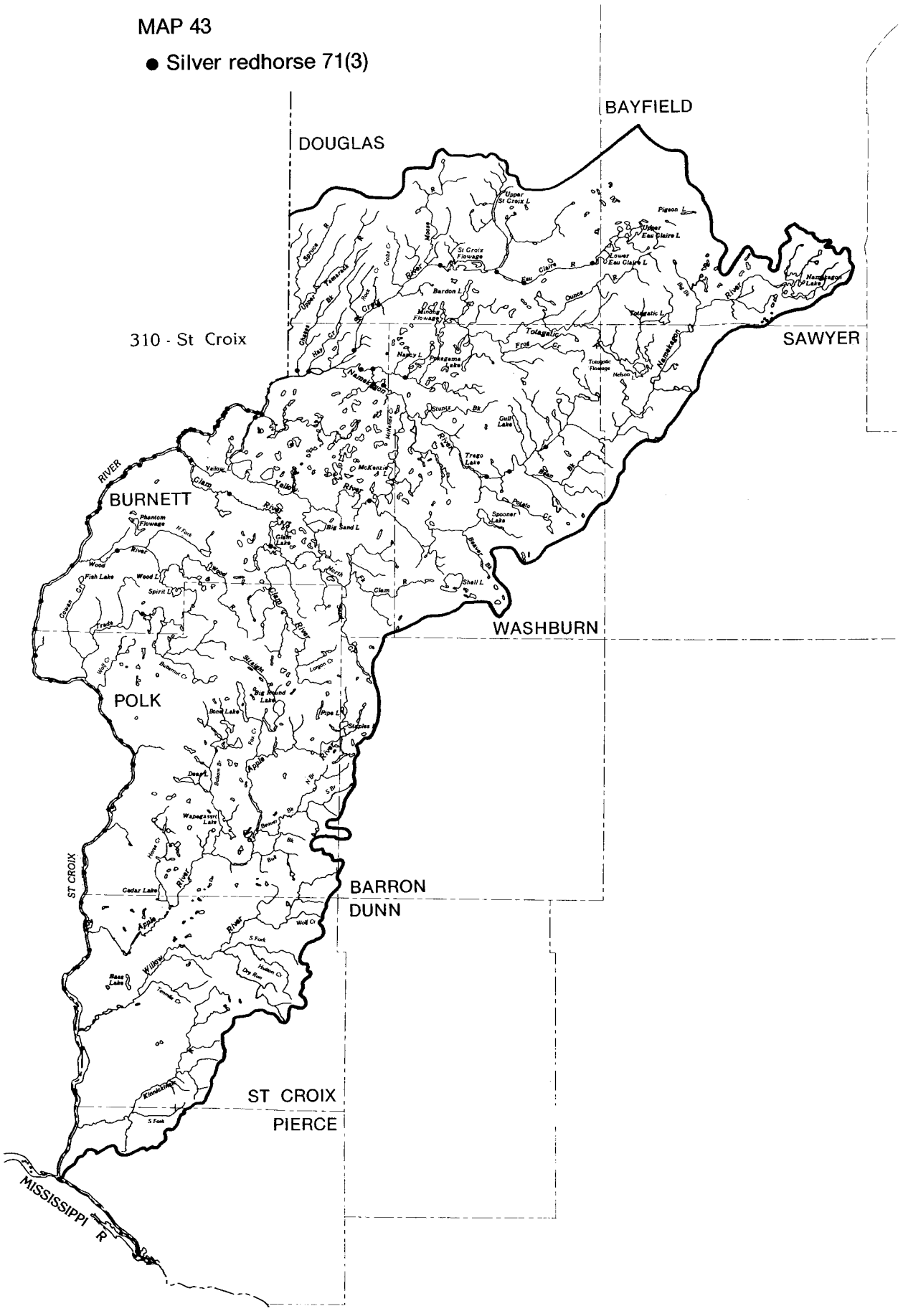
MAP 42

● River redhorse 33(2)
▲ Spotted sucker 2(0)



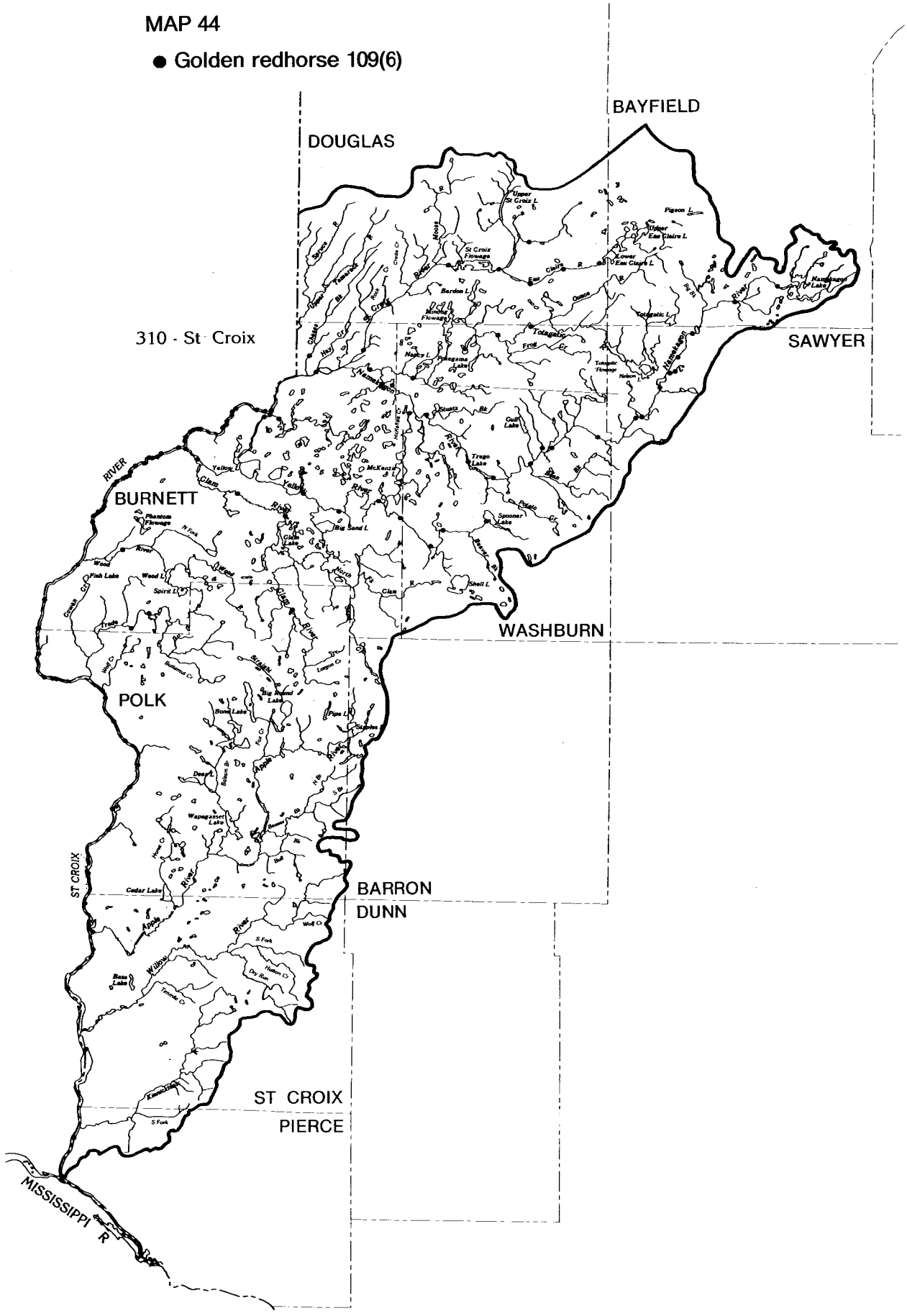
MAP 43

● Silver redhorse 71(3)



MAP 44

● Golden redhorse 109(6)

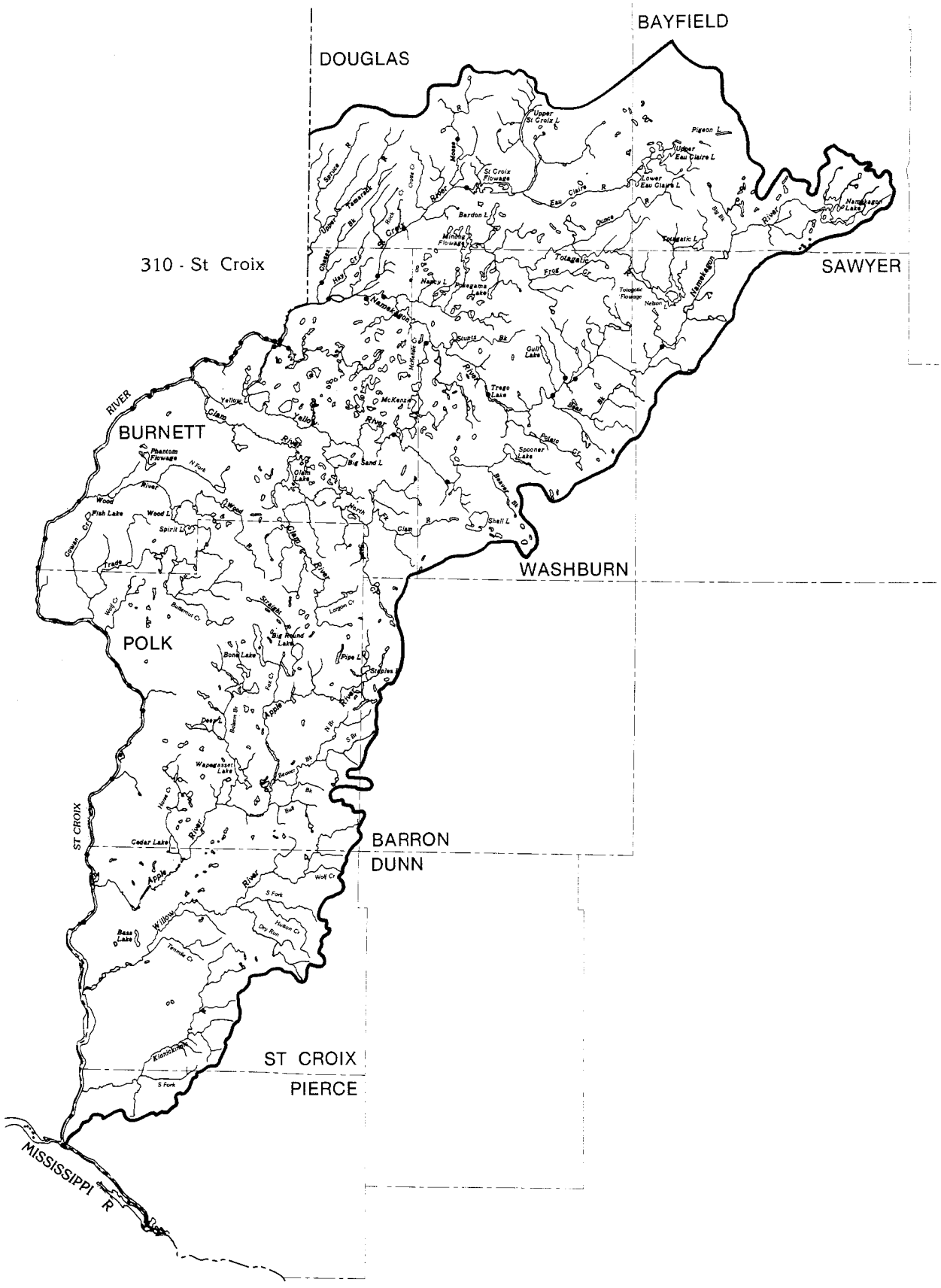


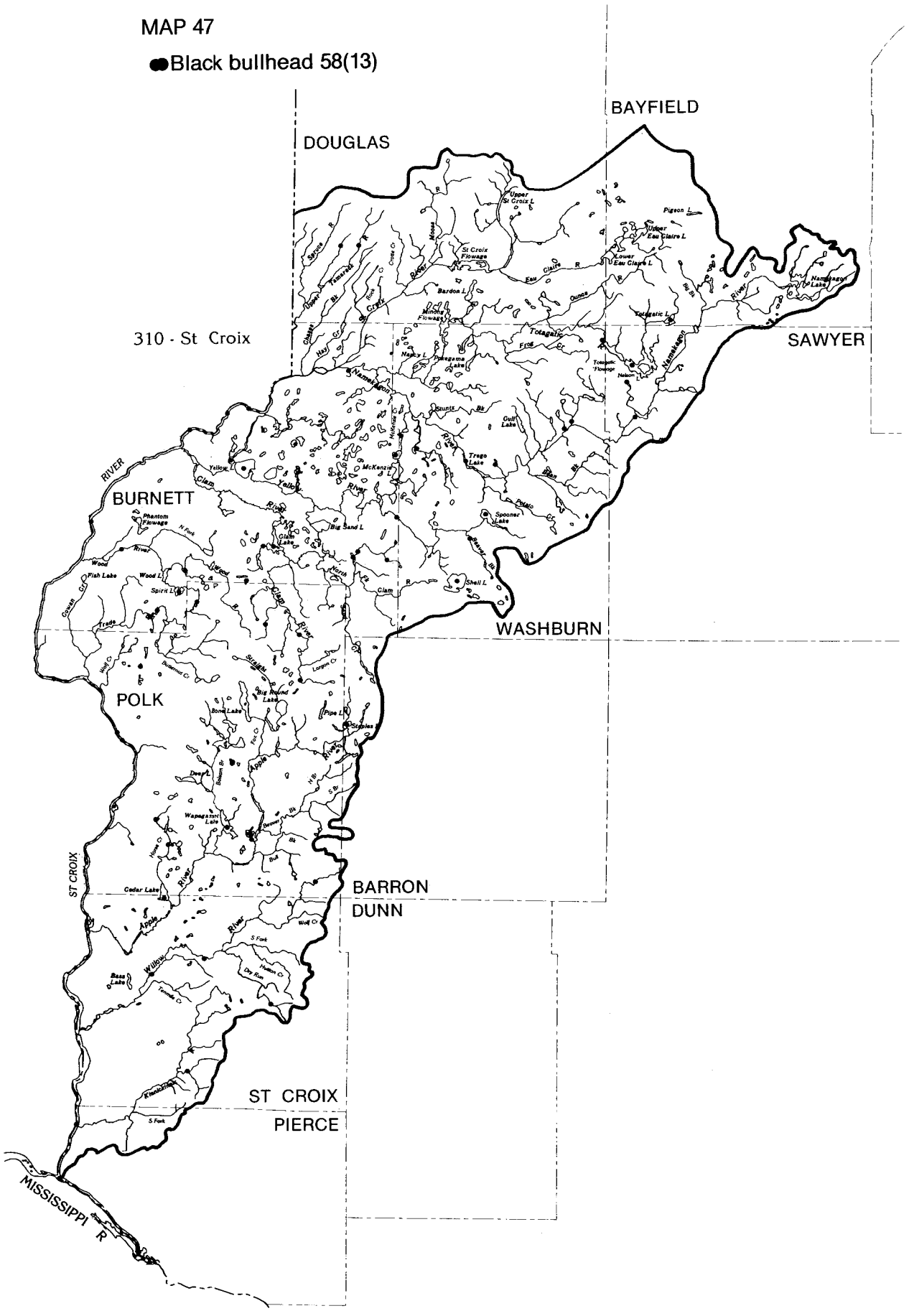
MAP 45

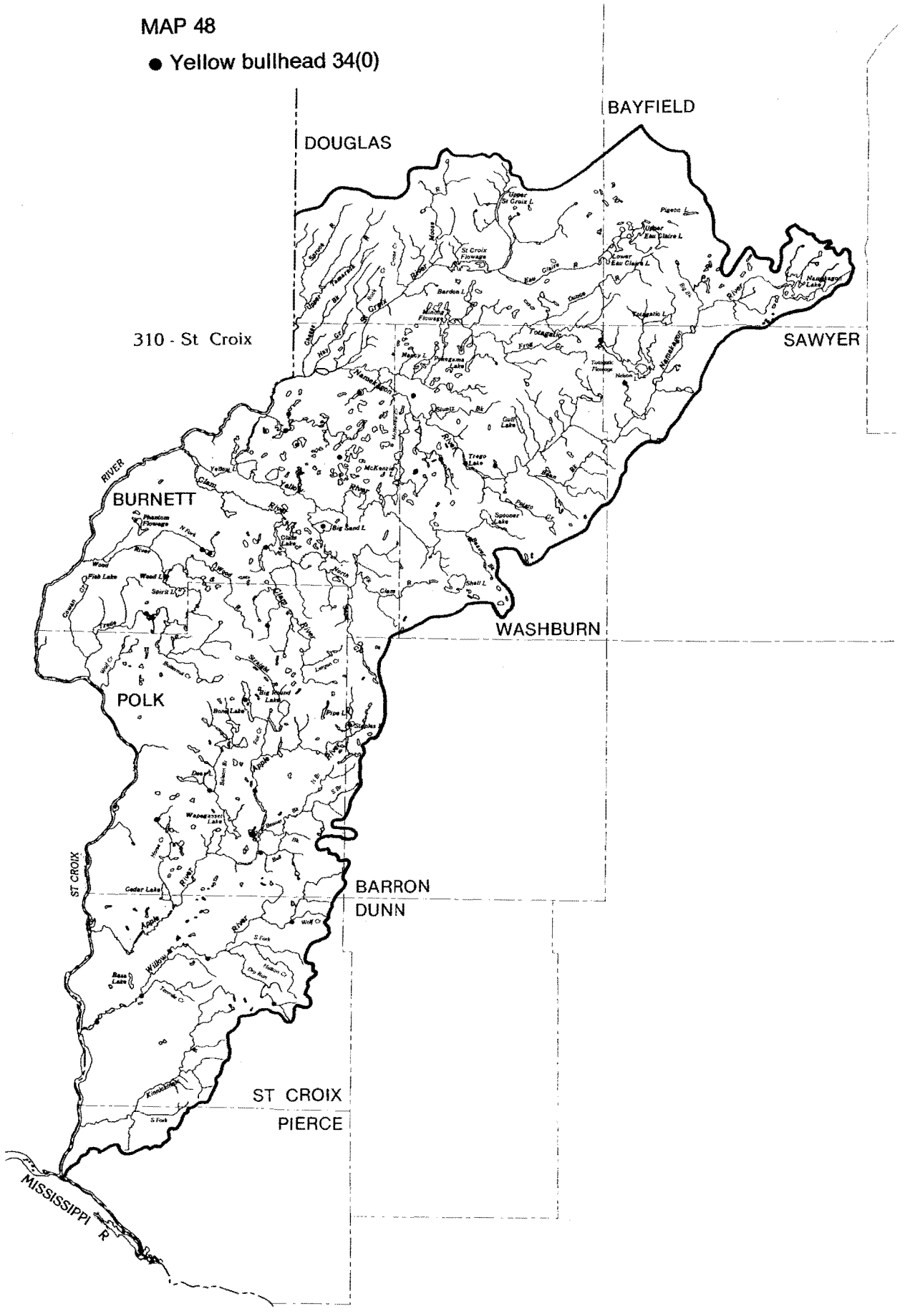
● Shorthead redhorse 96(9)

MAP 46

● Greater redhorse 41(0)

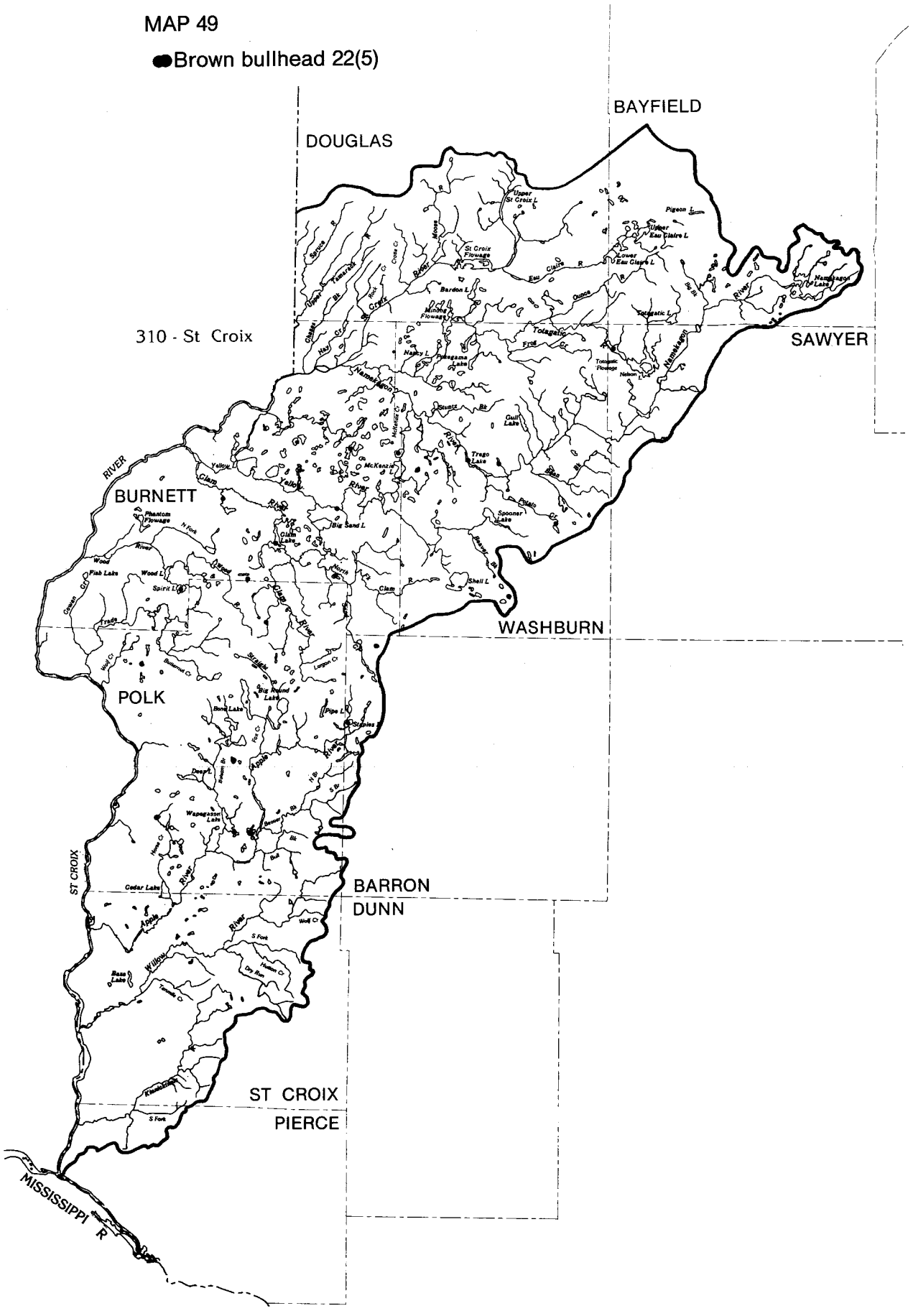



MAP 47
Black bullhead 58(13)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER


MAP 48
● Yellow bullhead 34(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

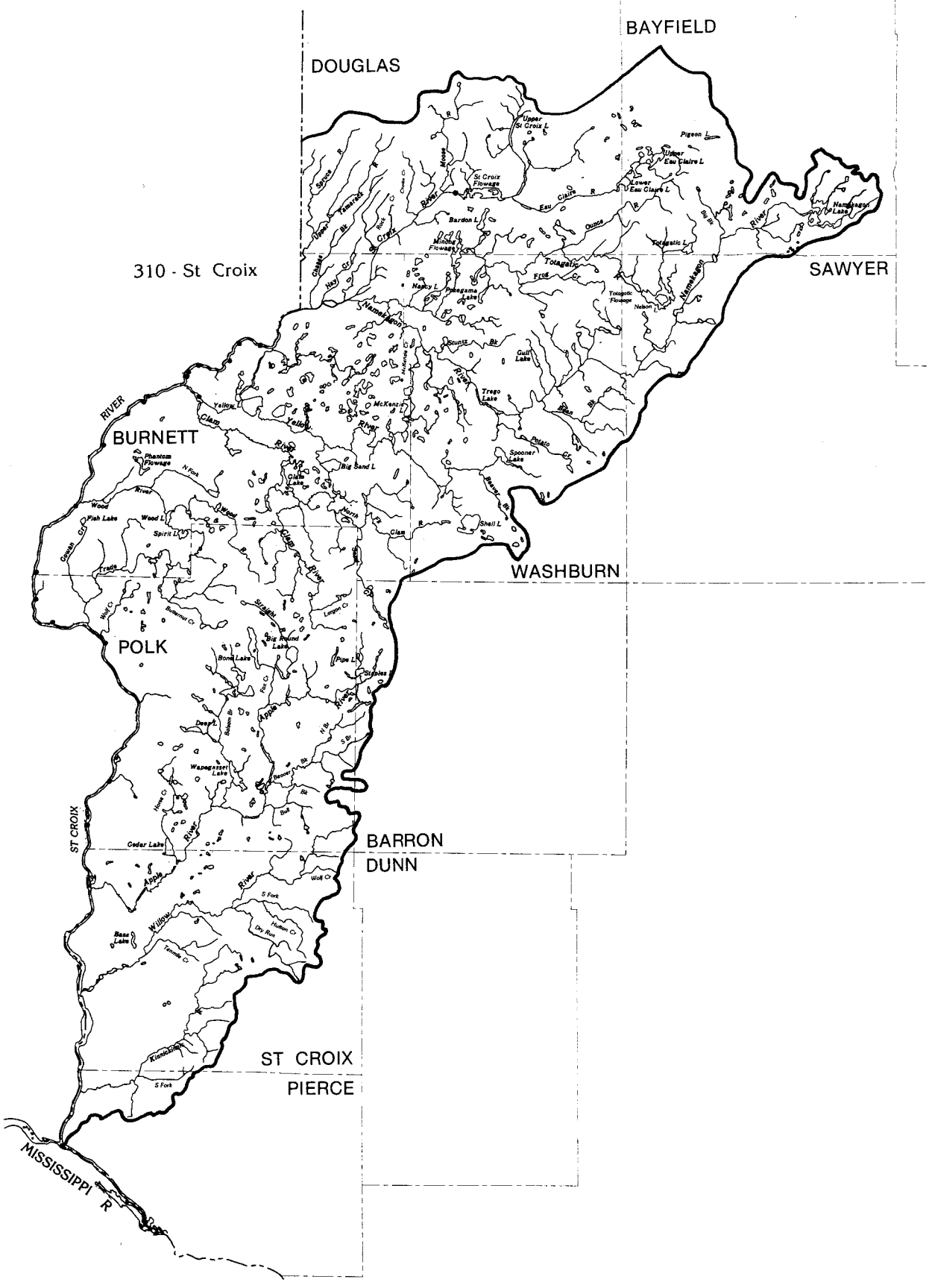
MAP 49

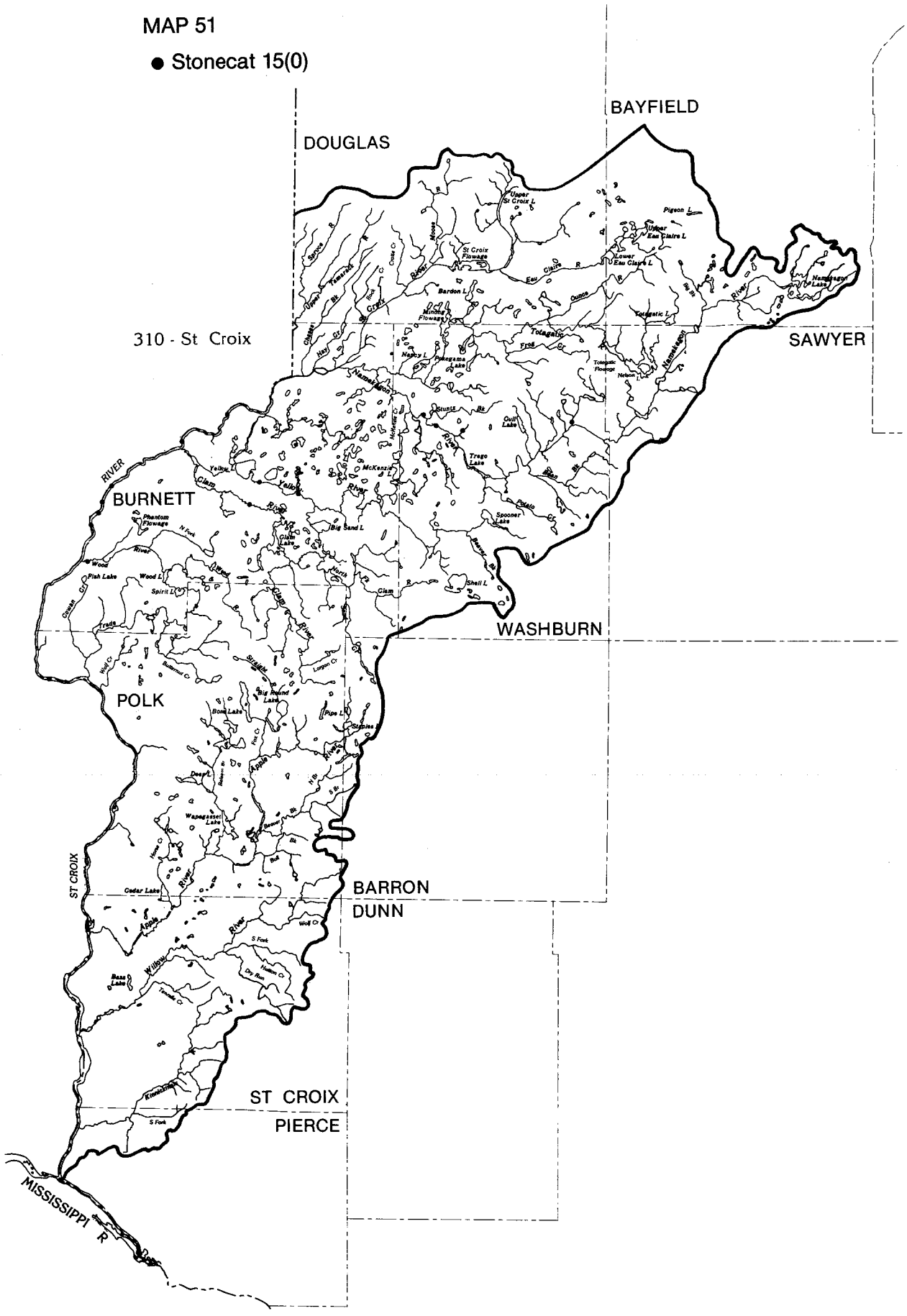
●●Brown bullhead 22(5)



MAP 50

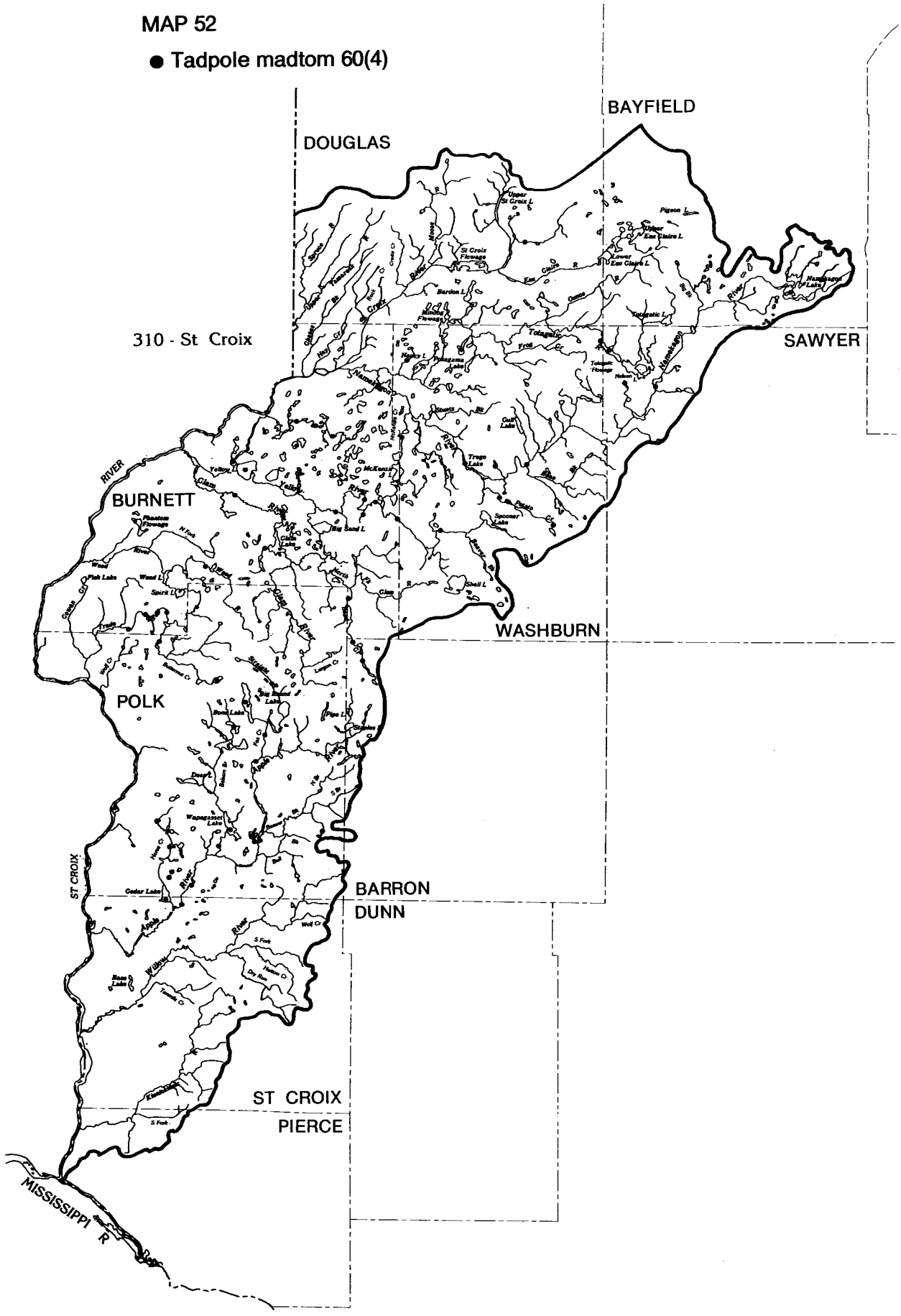
● Channel catfish 19(0)




MAP 51
● Stonecat 15(0)
310 - St Croix
DOUGLAS
BAYFIELD
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER

MAP 52

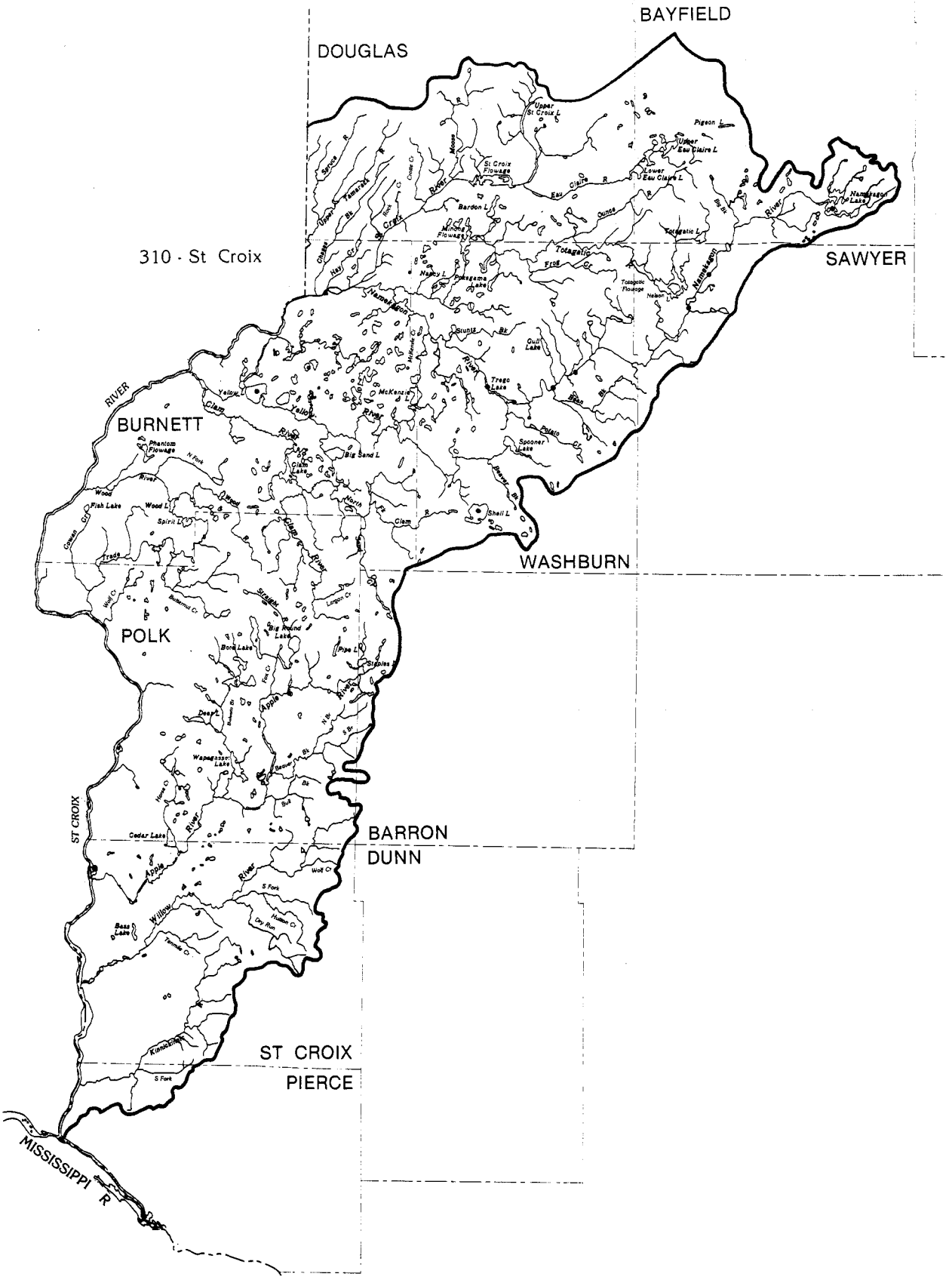
● Tadpole madtom 60(4)



MAP 53

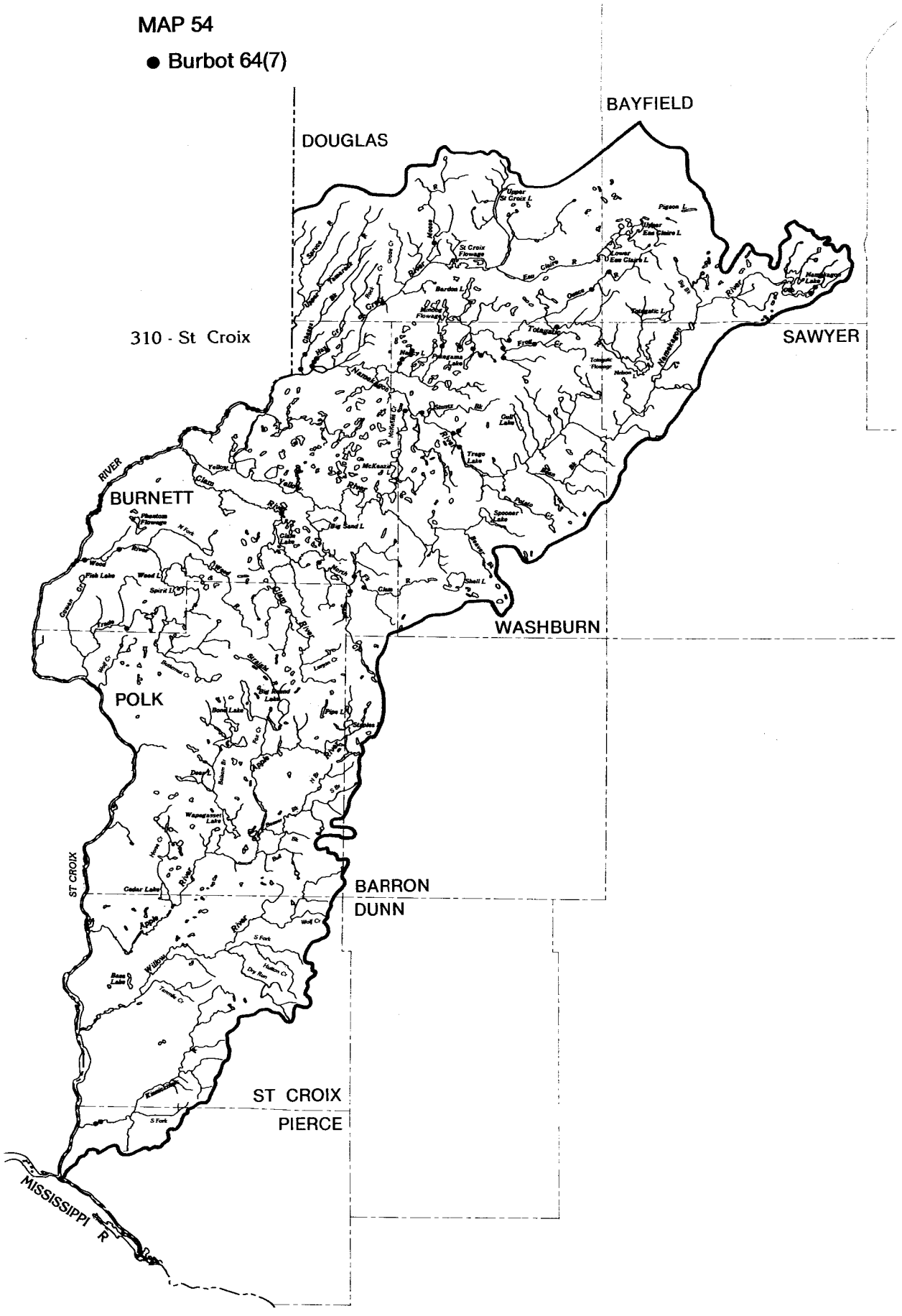
● Trout-perch 11(0)

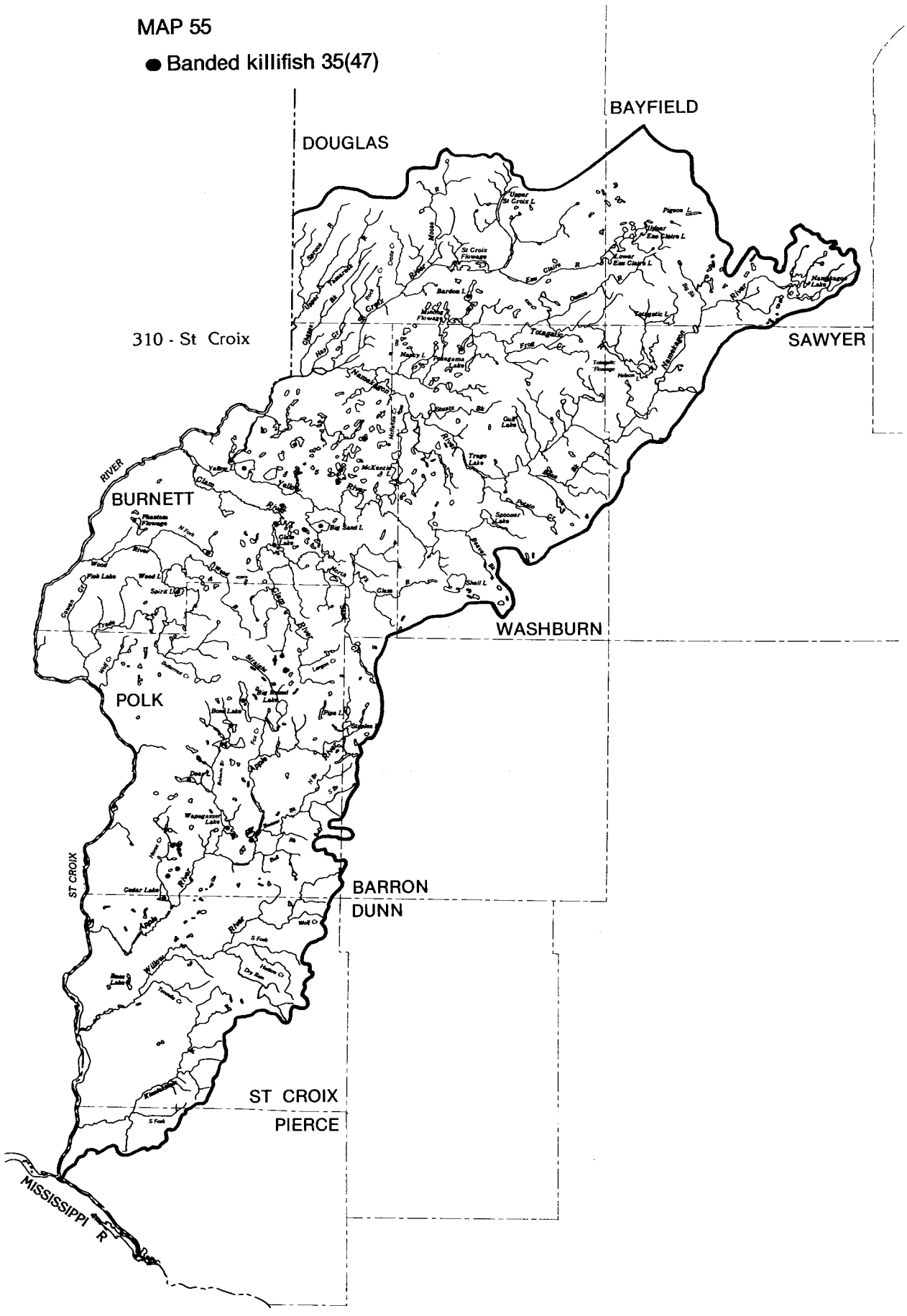
▲ Flathead catfish 1(0)



MAP 54

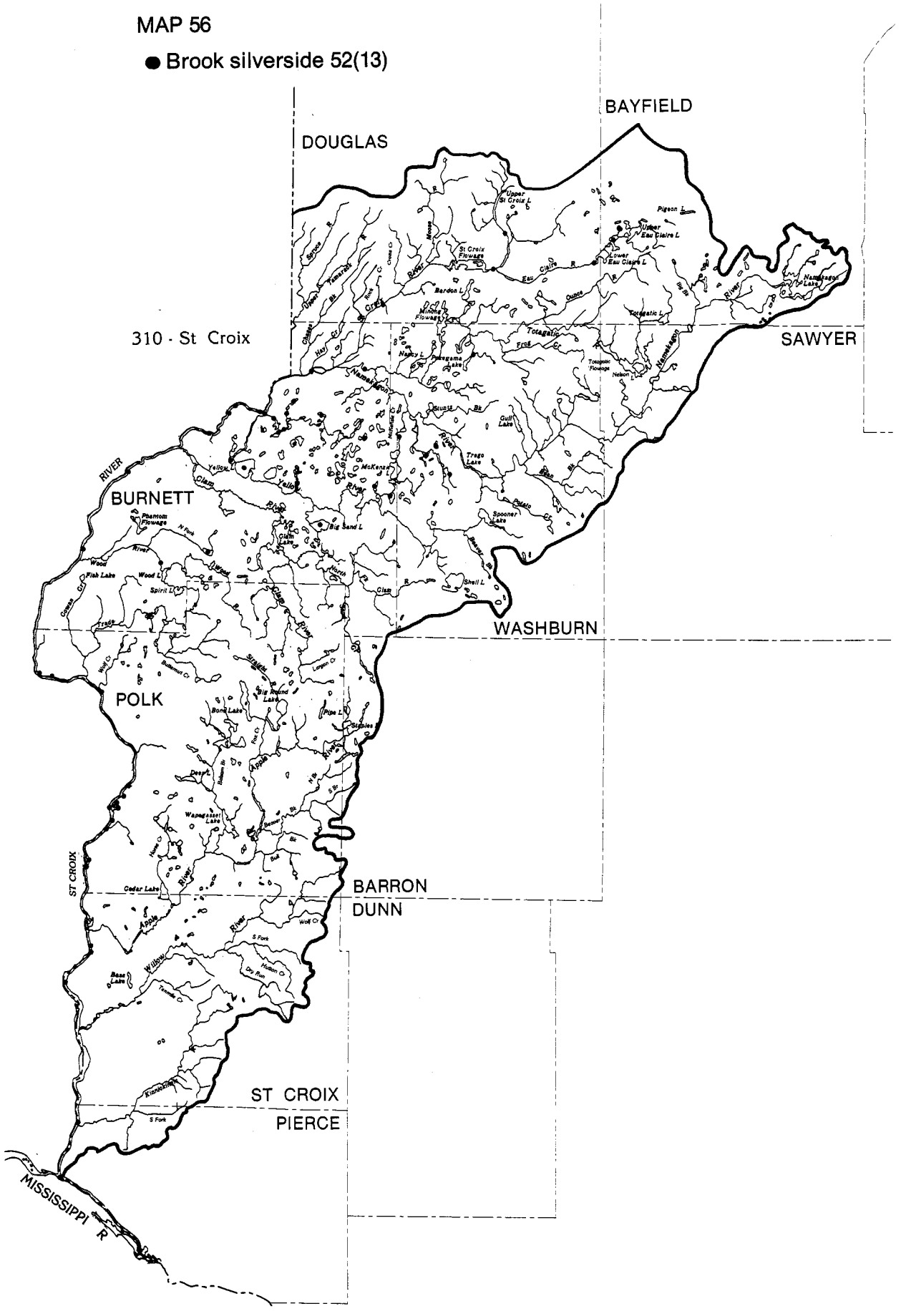
● Burbot 64(7)




MAP 55
● Banded killifish 35(47)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

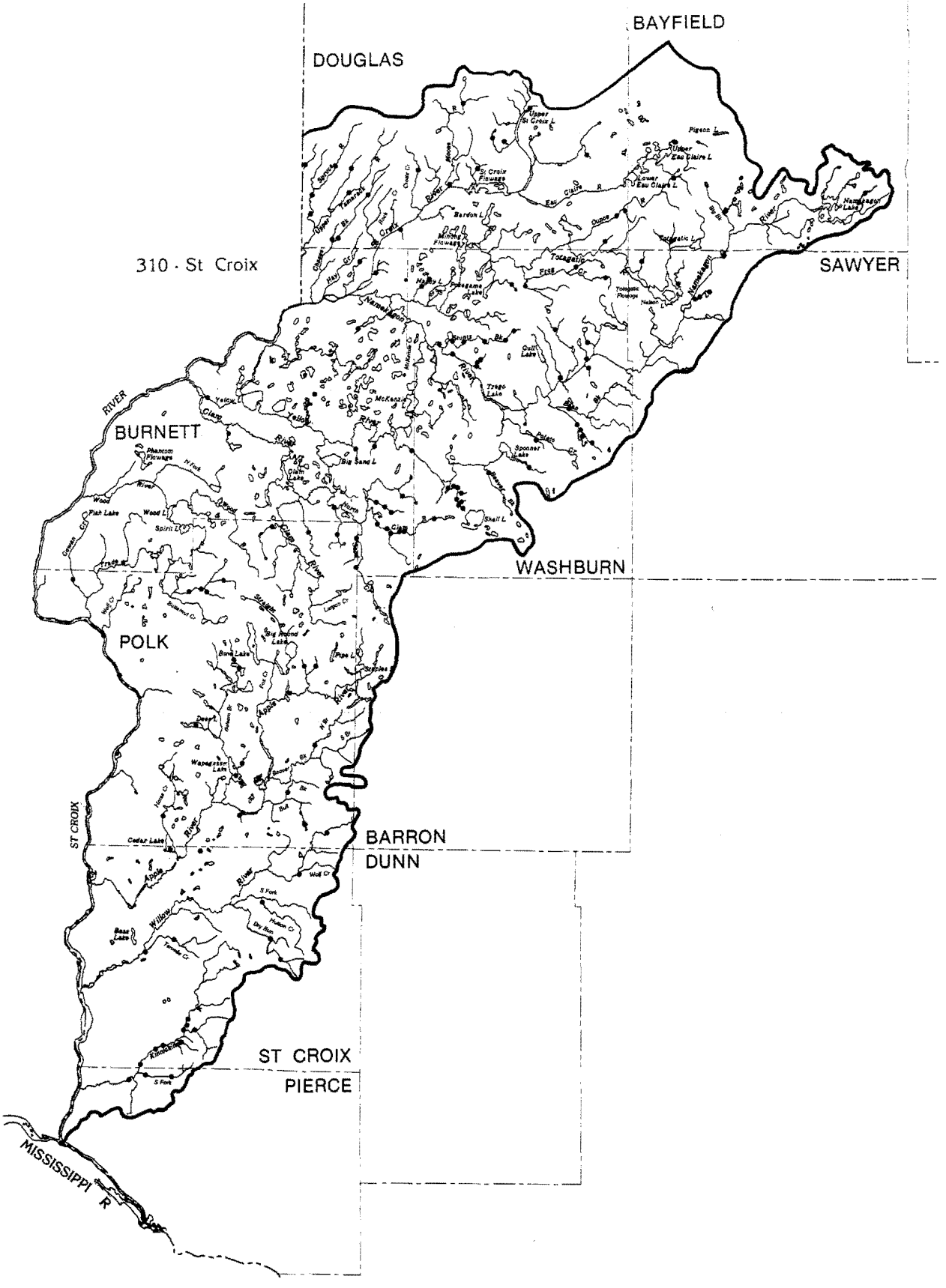
MAP 56

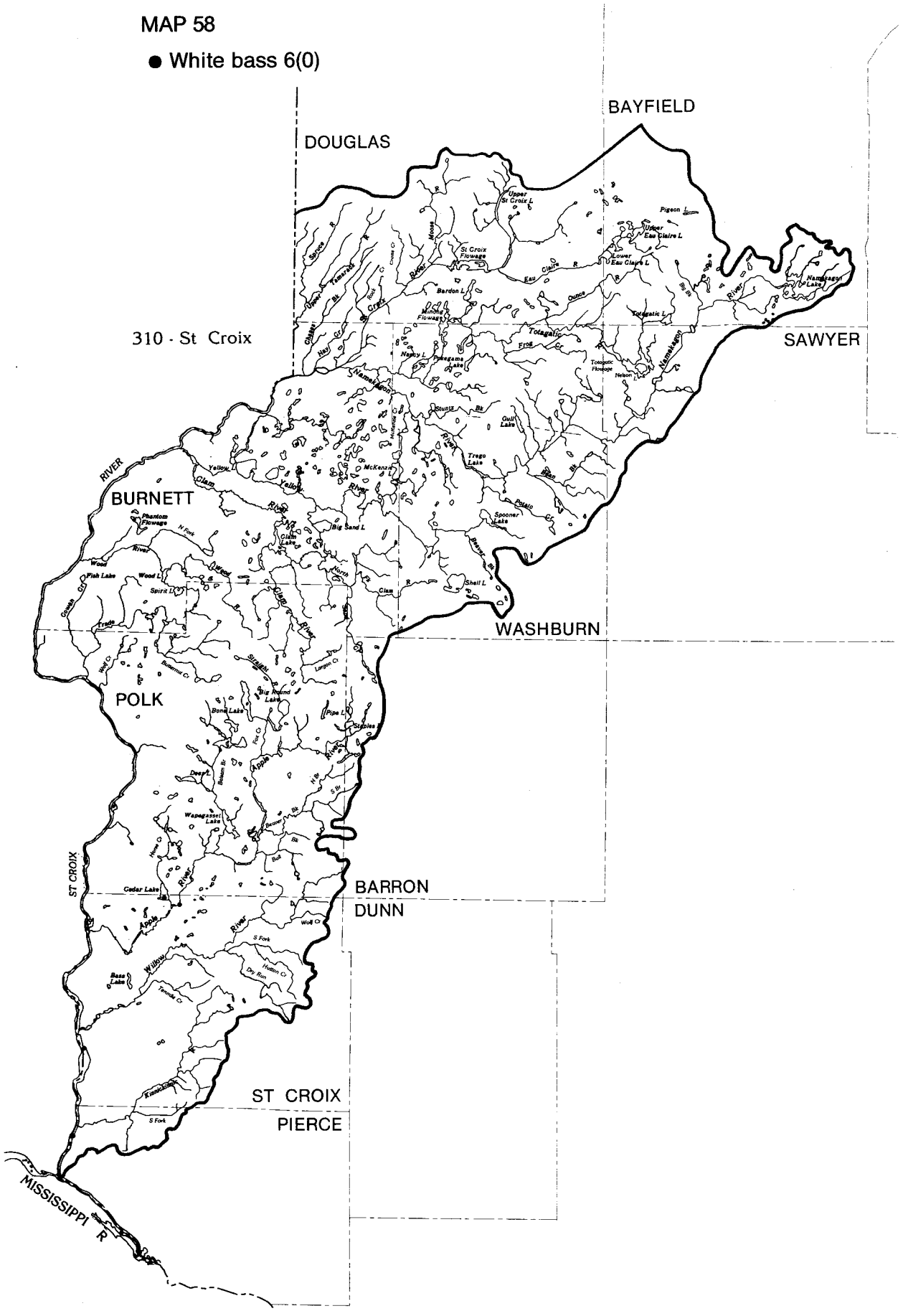
● Brook silverside 52(13)

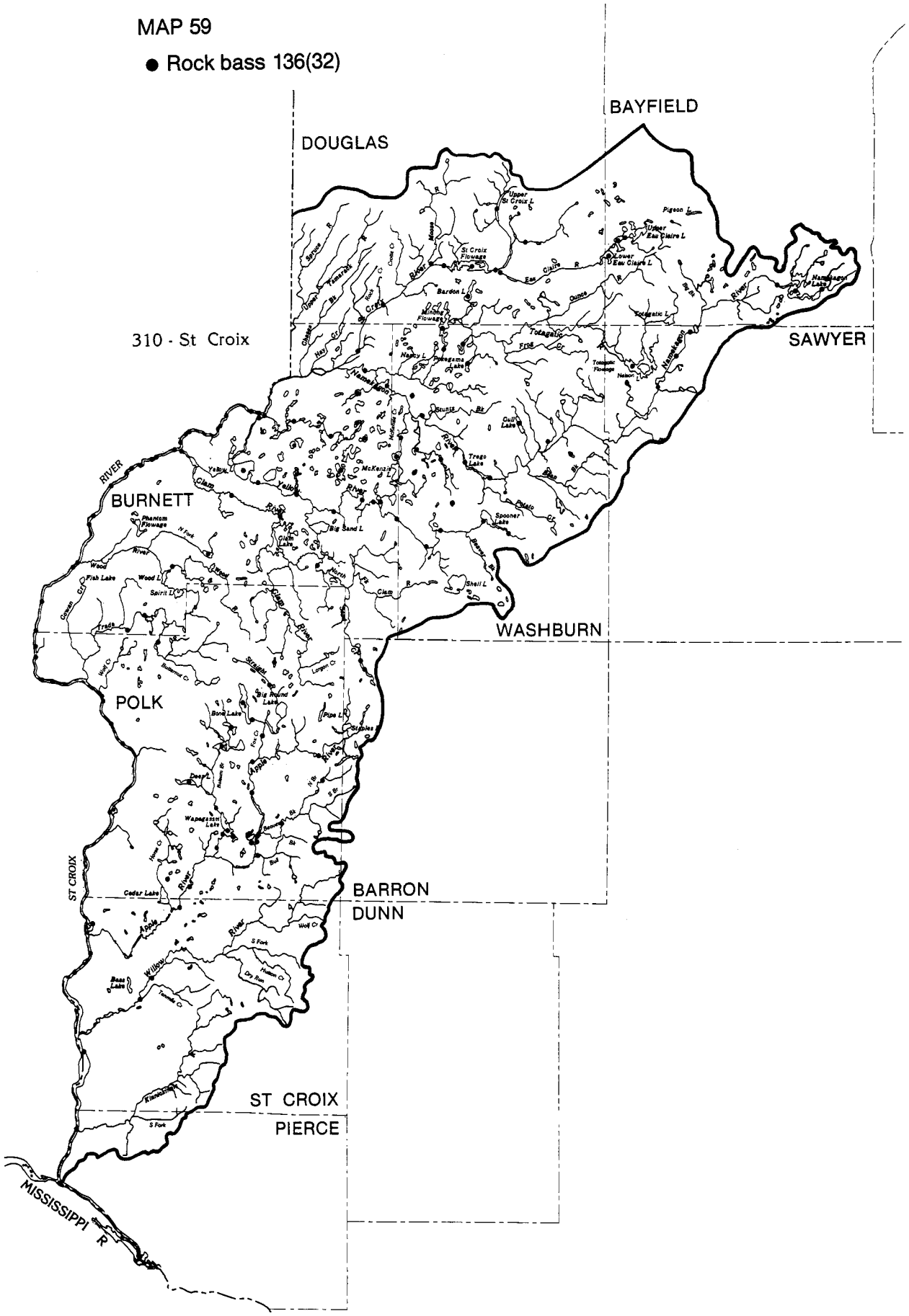


MAP 57

● Brook stickleback 139(4)

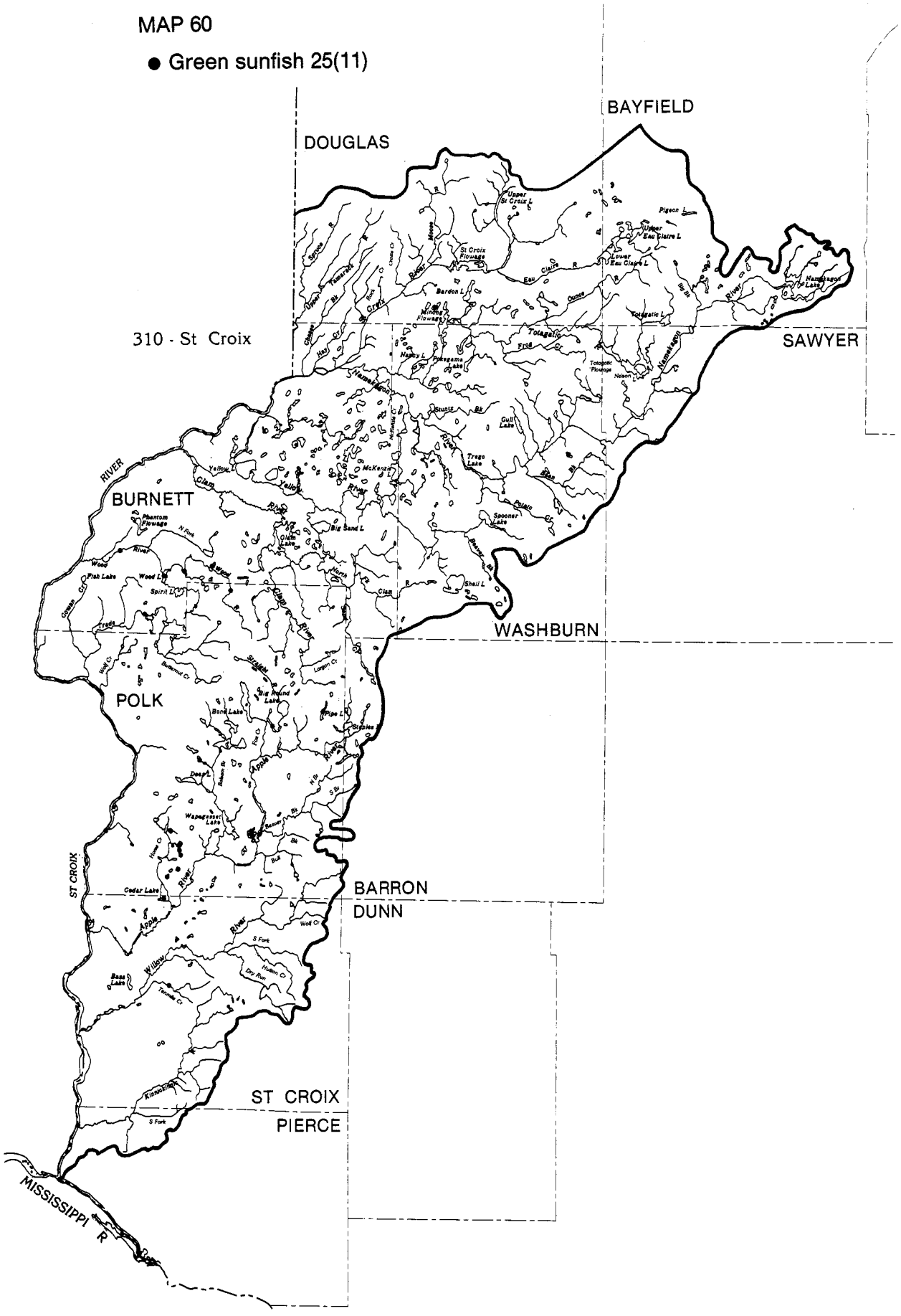



MAP 58
● White bass 6(0)
310 - St Croix
DOUGLAS
BAYFIELD
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
RIVER
ST CROIX
MISSISSIPPI R


MAP 59
● Rock bass 136(32)
310 - St Croix
BAYFIELD
DOUGLAS
SAWYER
WASHBURN
BURNETT
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER

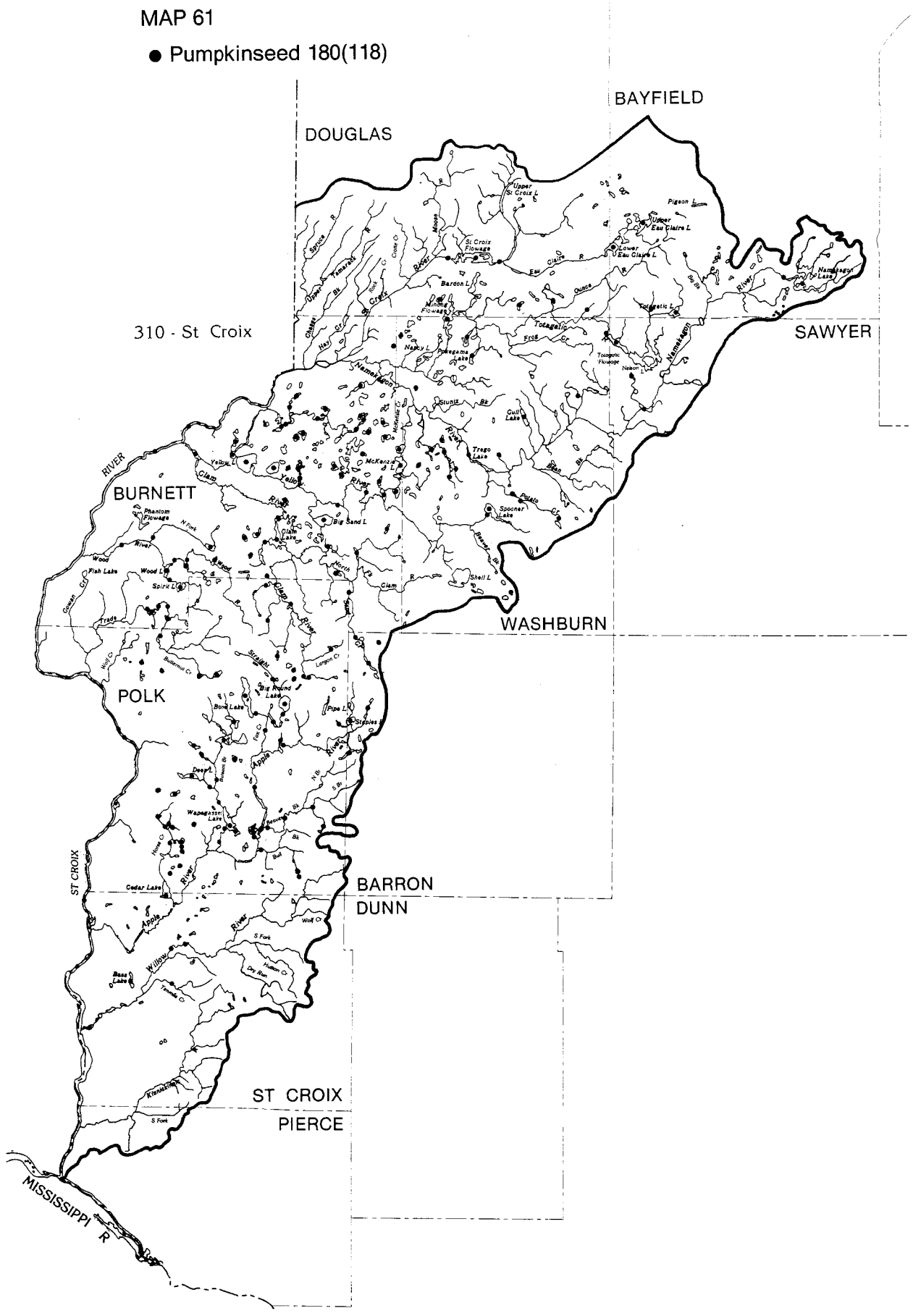
MAP 60

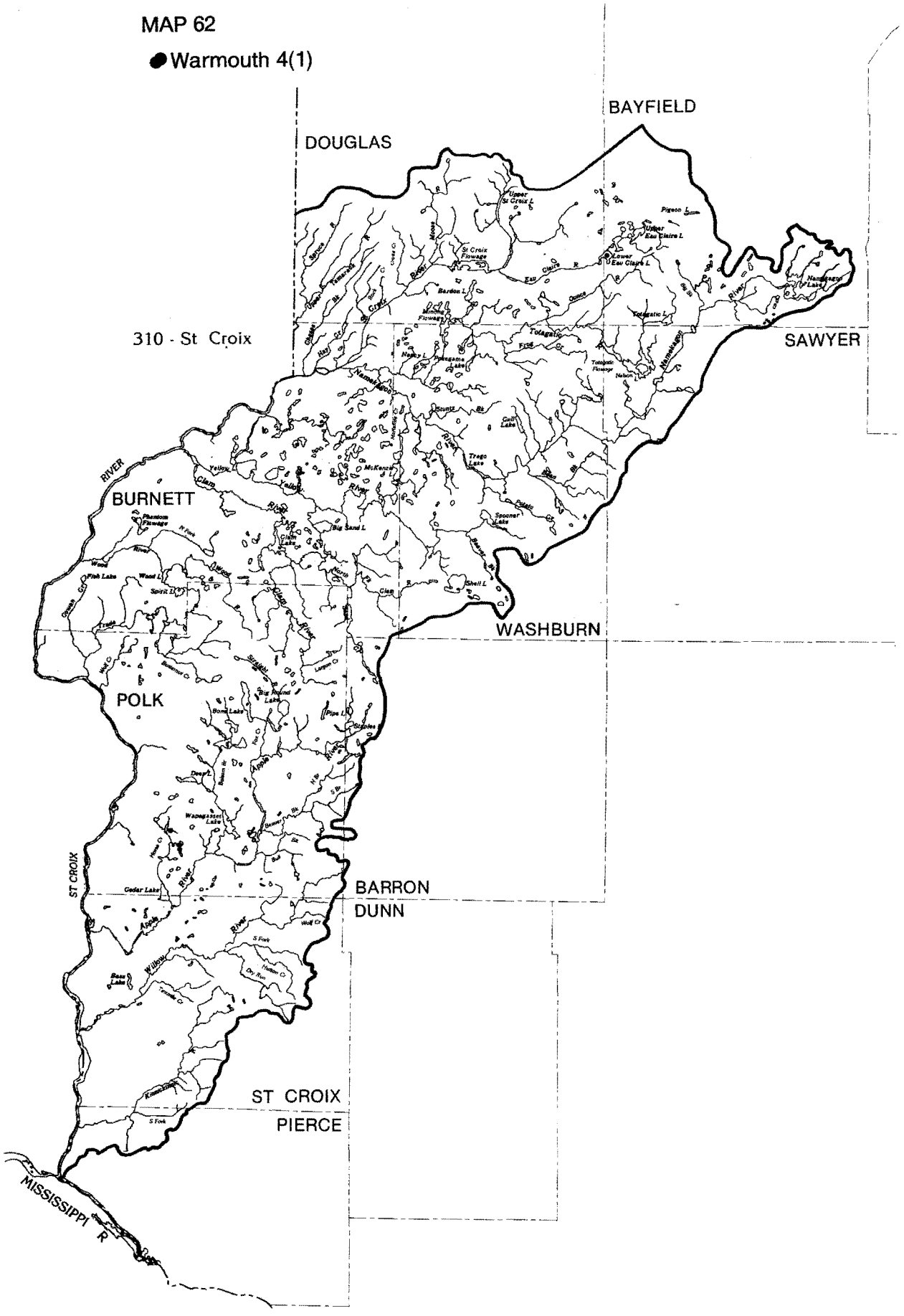
● Green sunfish 25(11)

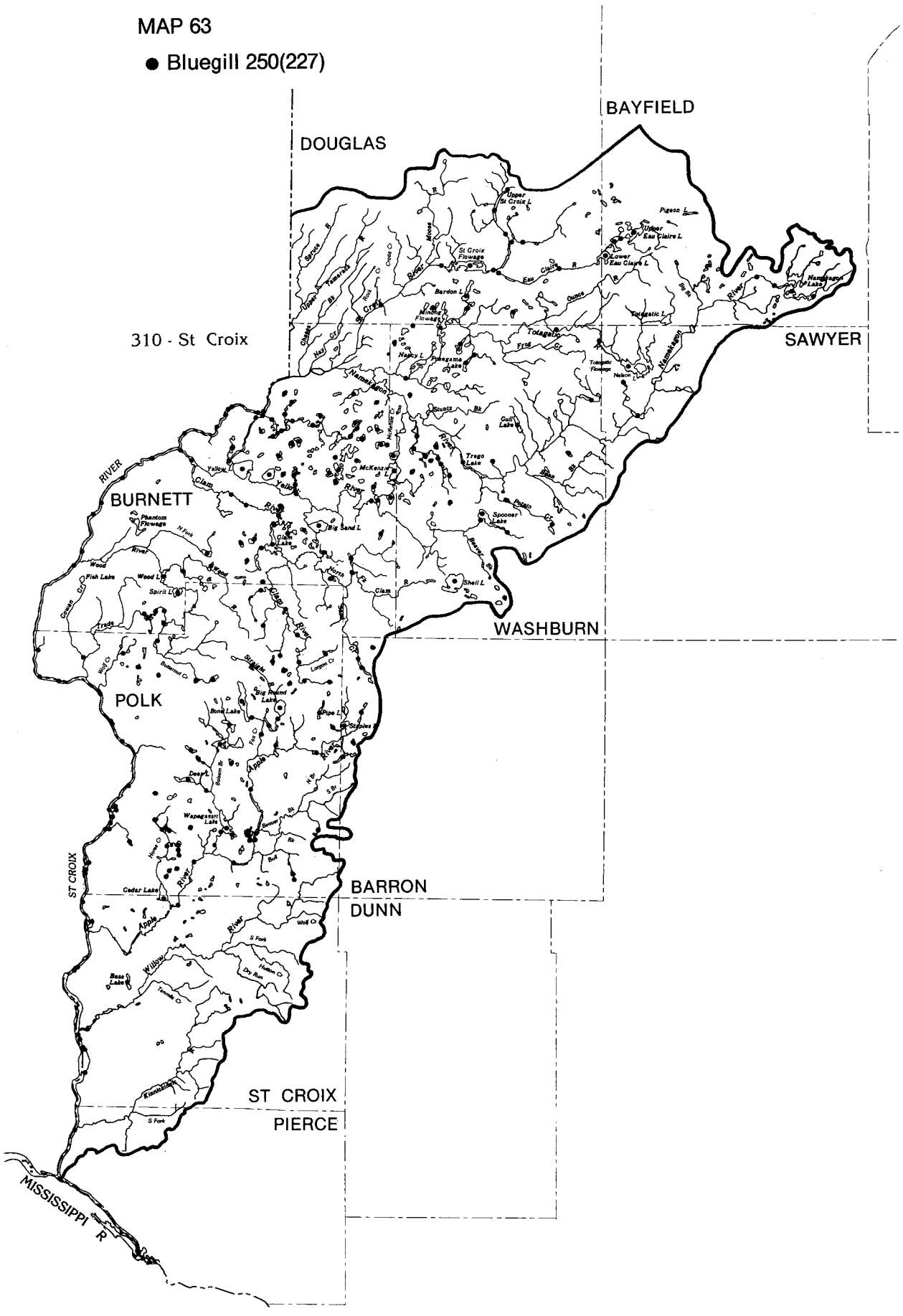


MAP 61

● Pumpkinseed 180(118)

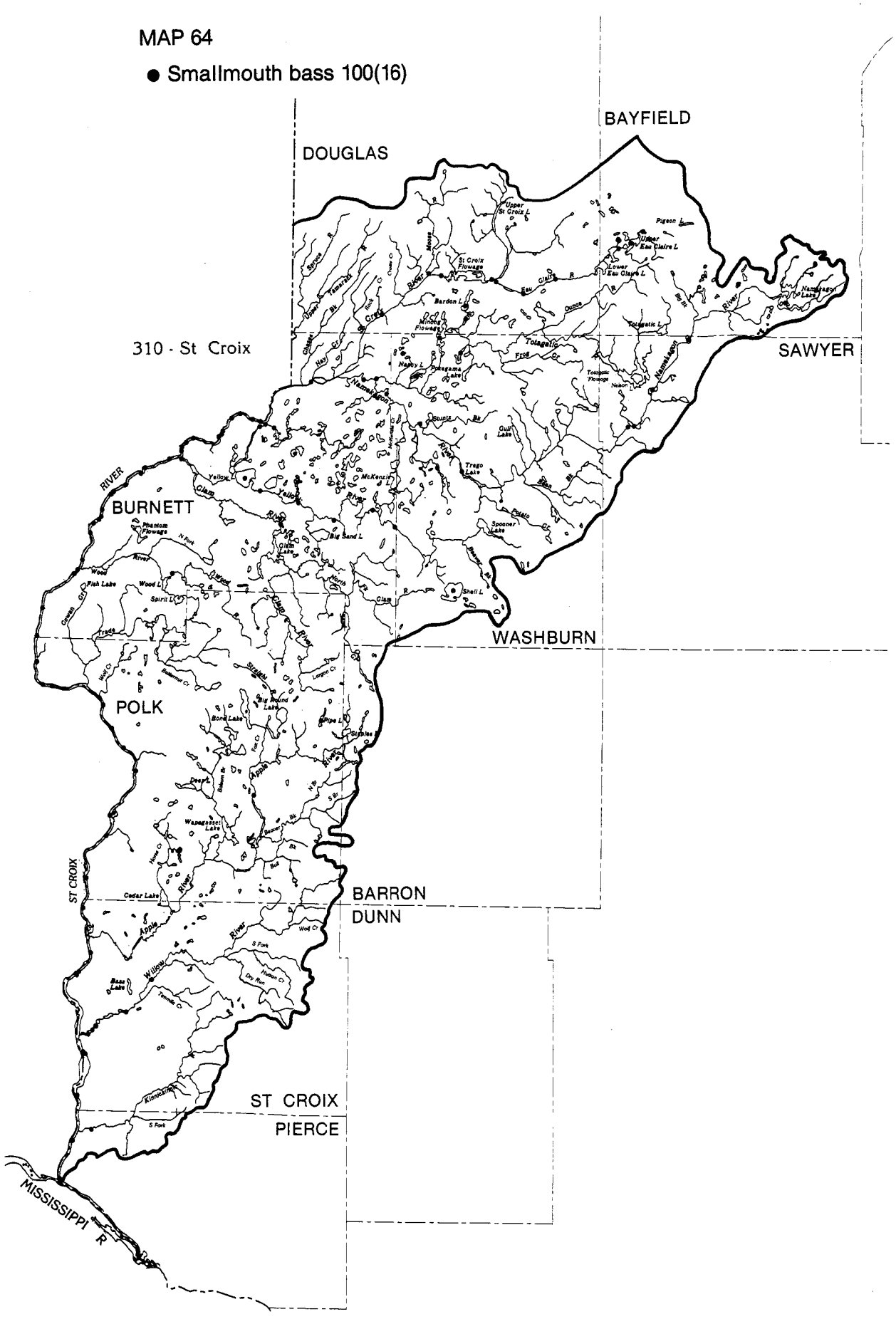


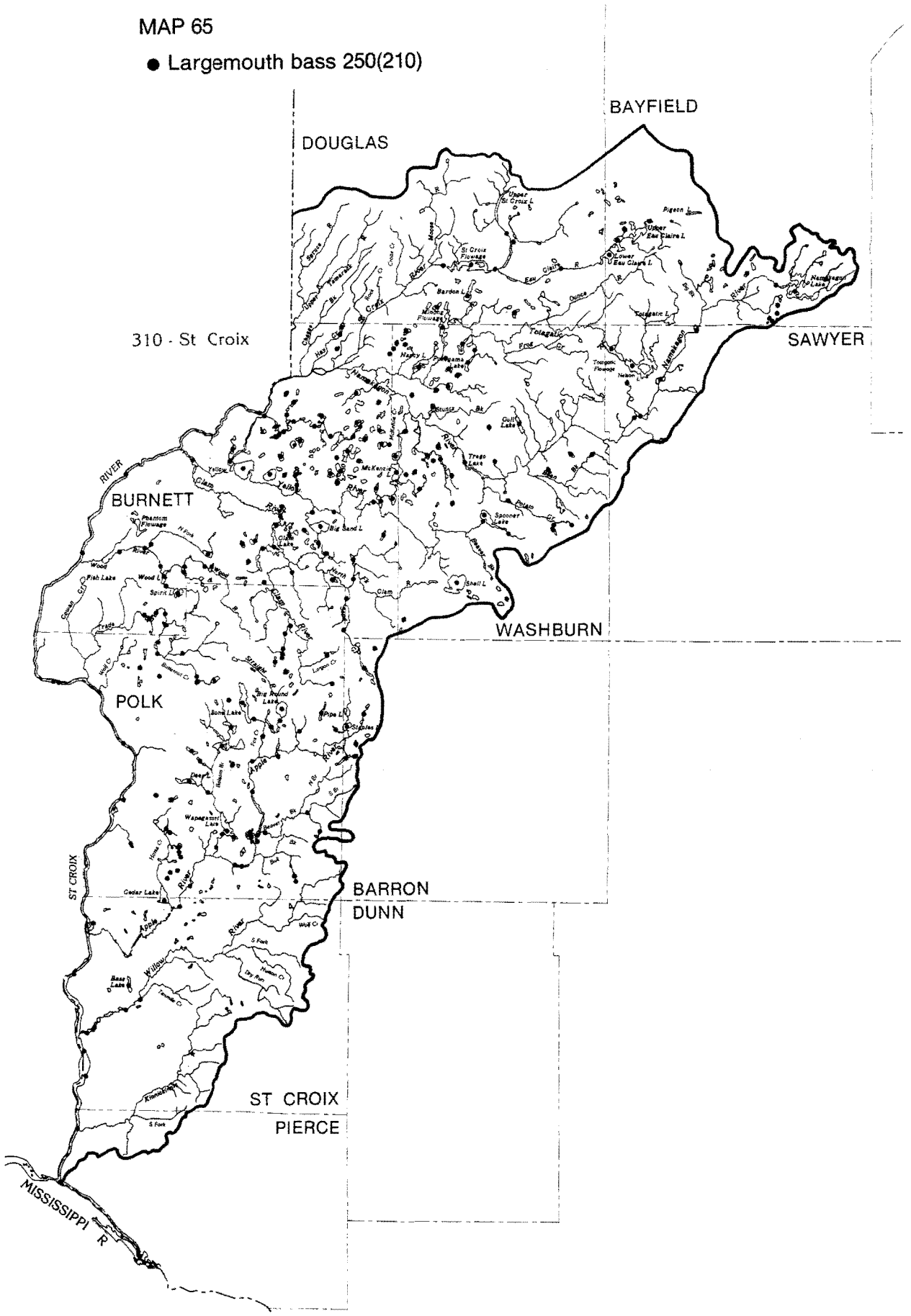

MAP 62
Warmouth 4(1)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

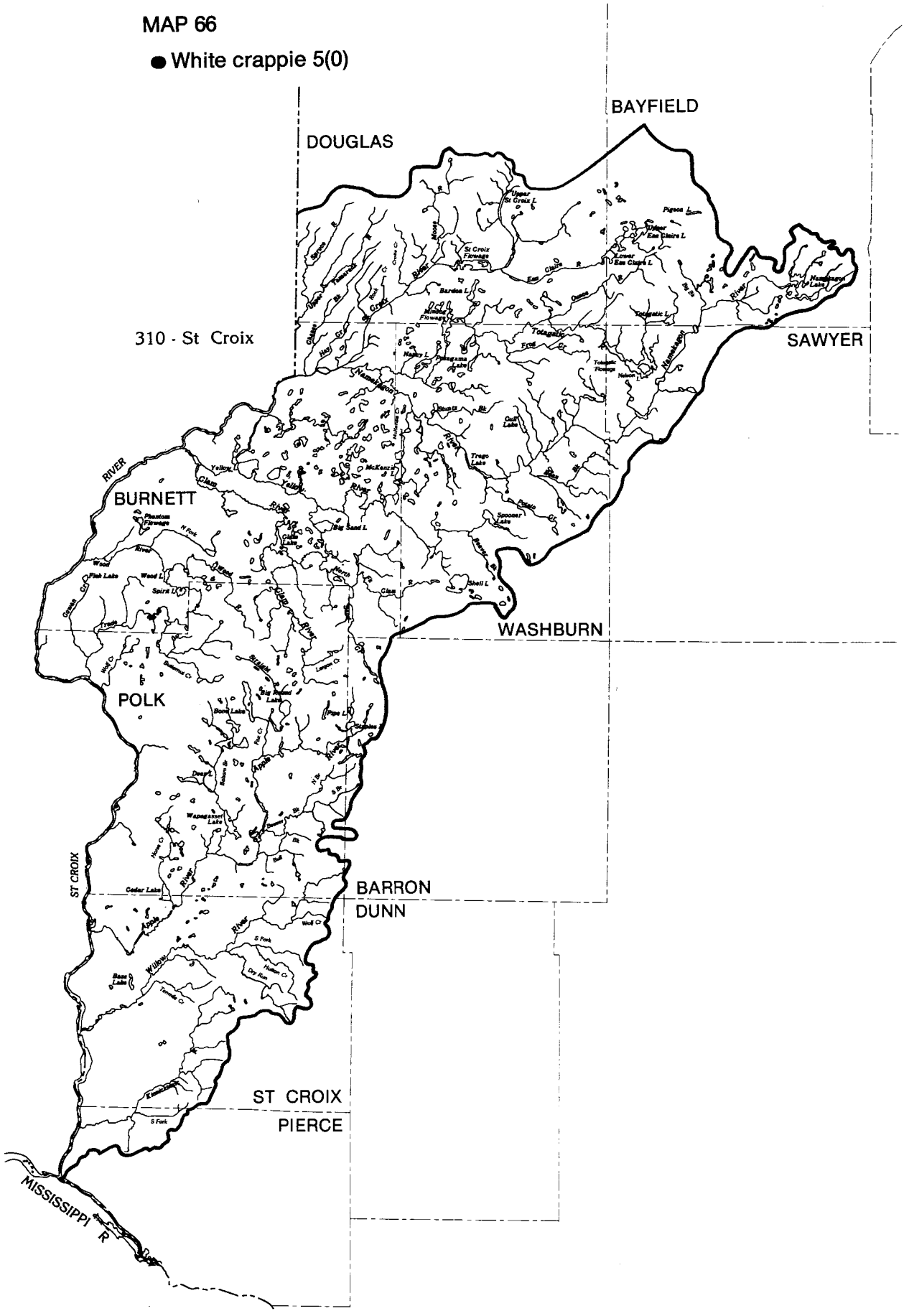

MAP 63
● Bluegill 250(227)
310 - St Croix
DOUGLAS
BAYFIELD
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER

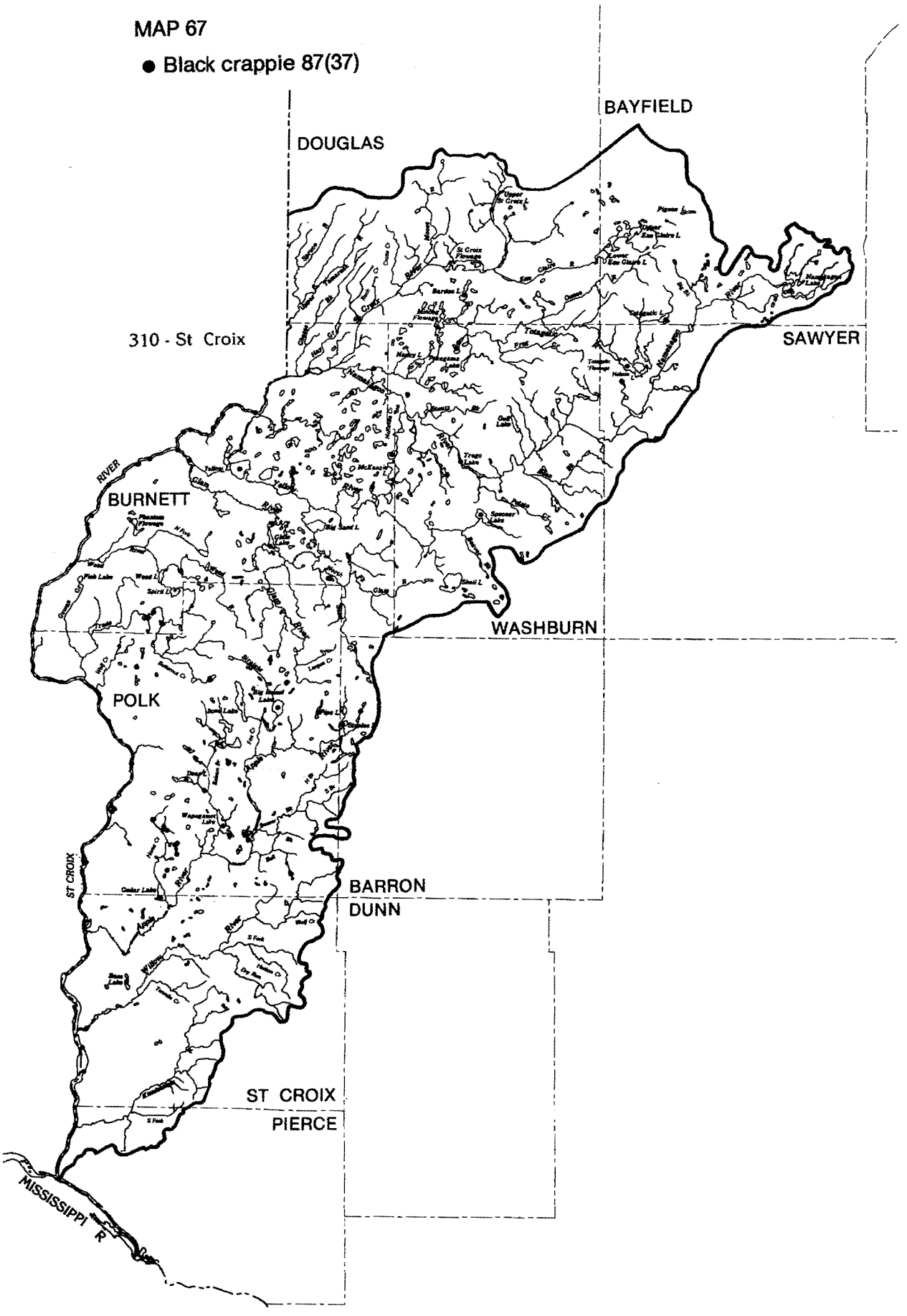
MAP 64

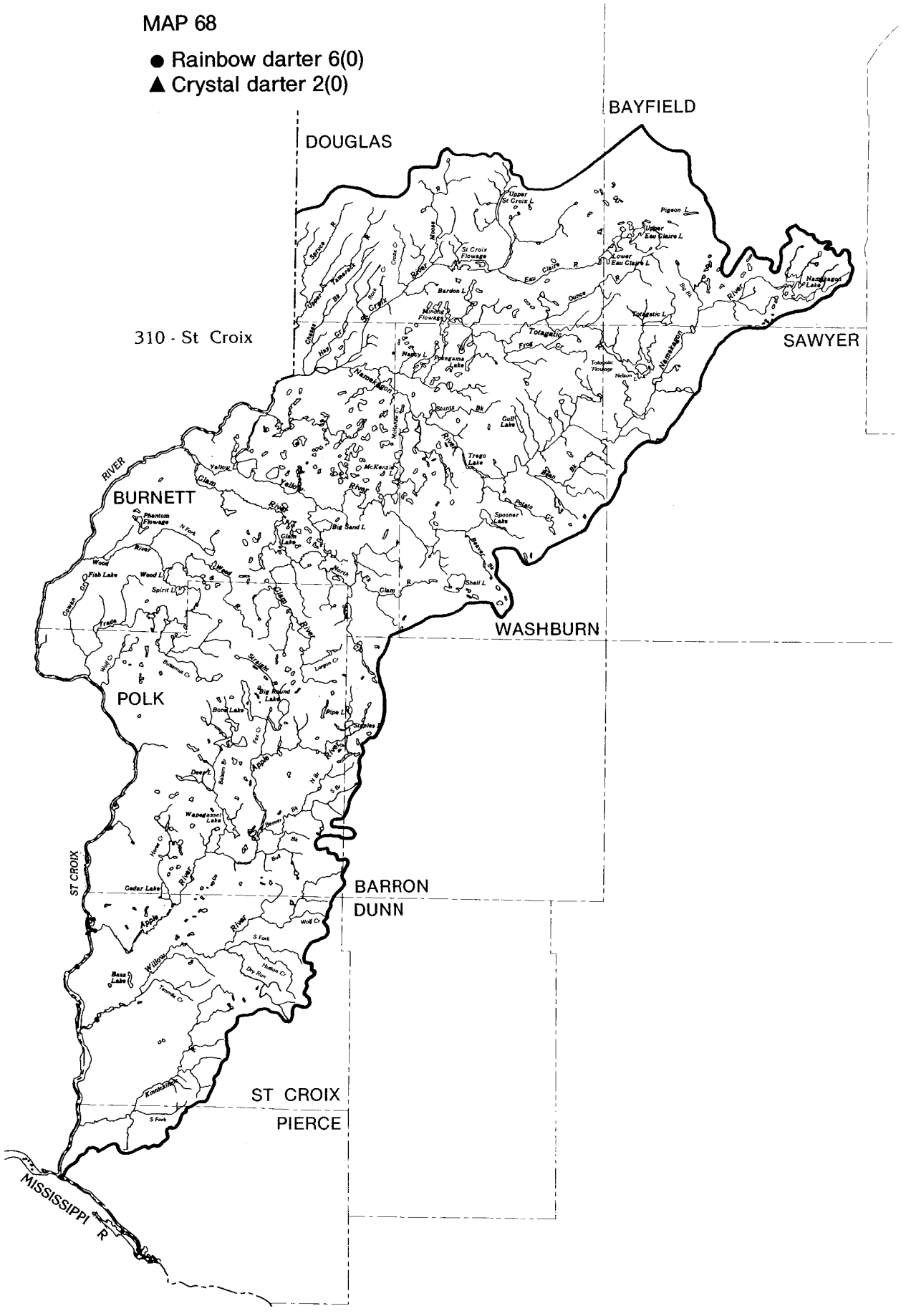
● Smallmouth bass 100(16)




MAP 65
● Largemouth bass 250(210)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

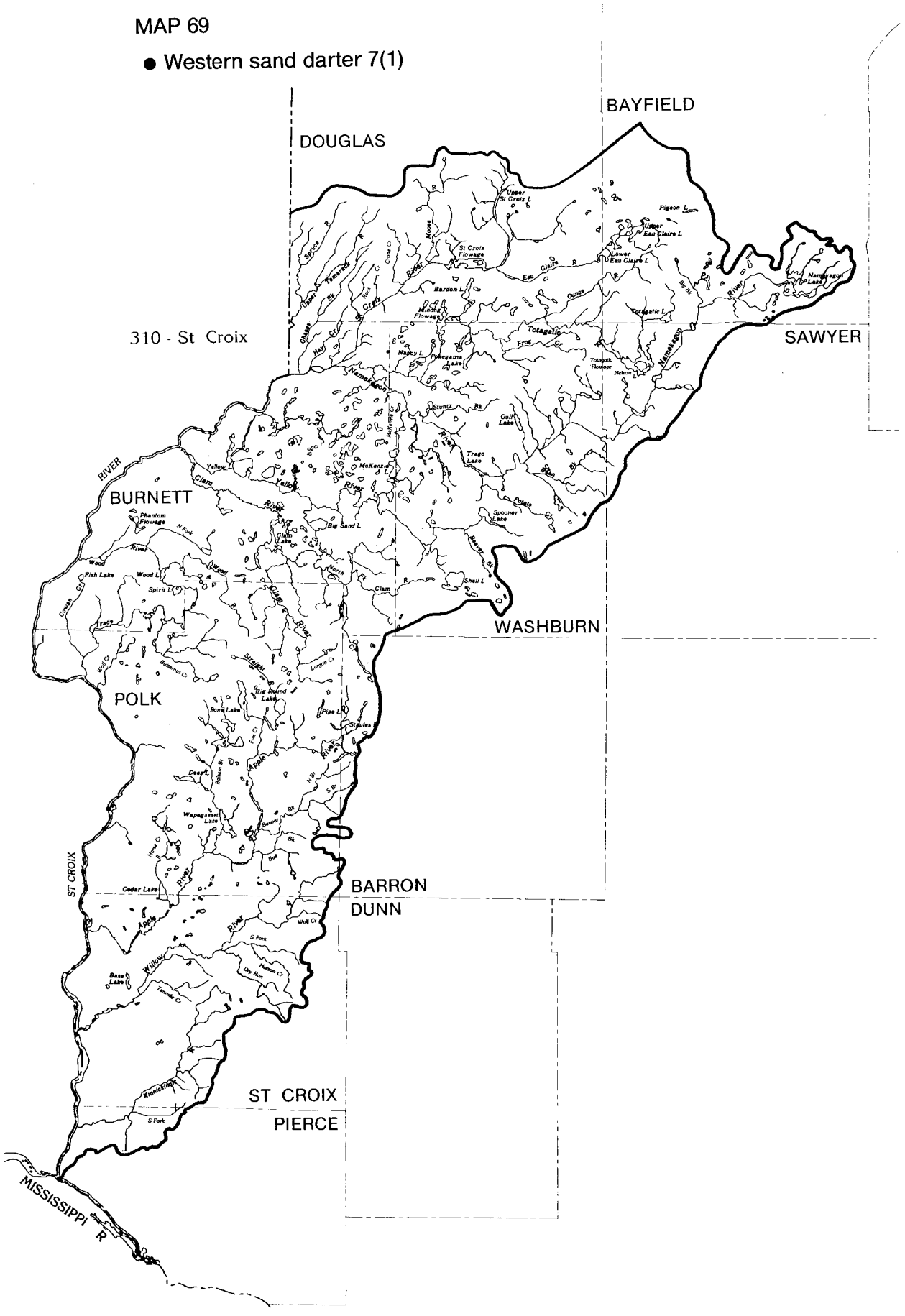

MAP 66
● White crappie 5(0)
310 - St Croix
BAYFIELD
DOUGLAS
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
ST CROIX
MISSISSIPPI R


MAP 67
● Black crappie 87(37)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R


MAP 68
● Rainbow darter 6(0)
▲ Crystal darter 2(0)
310 - St Croix
BAYFIELD
DOUGLAS
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER

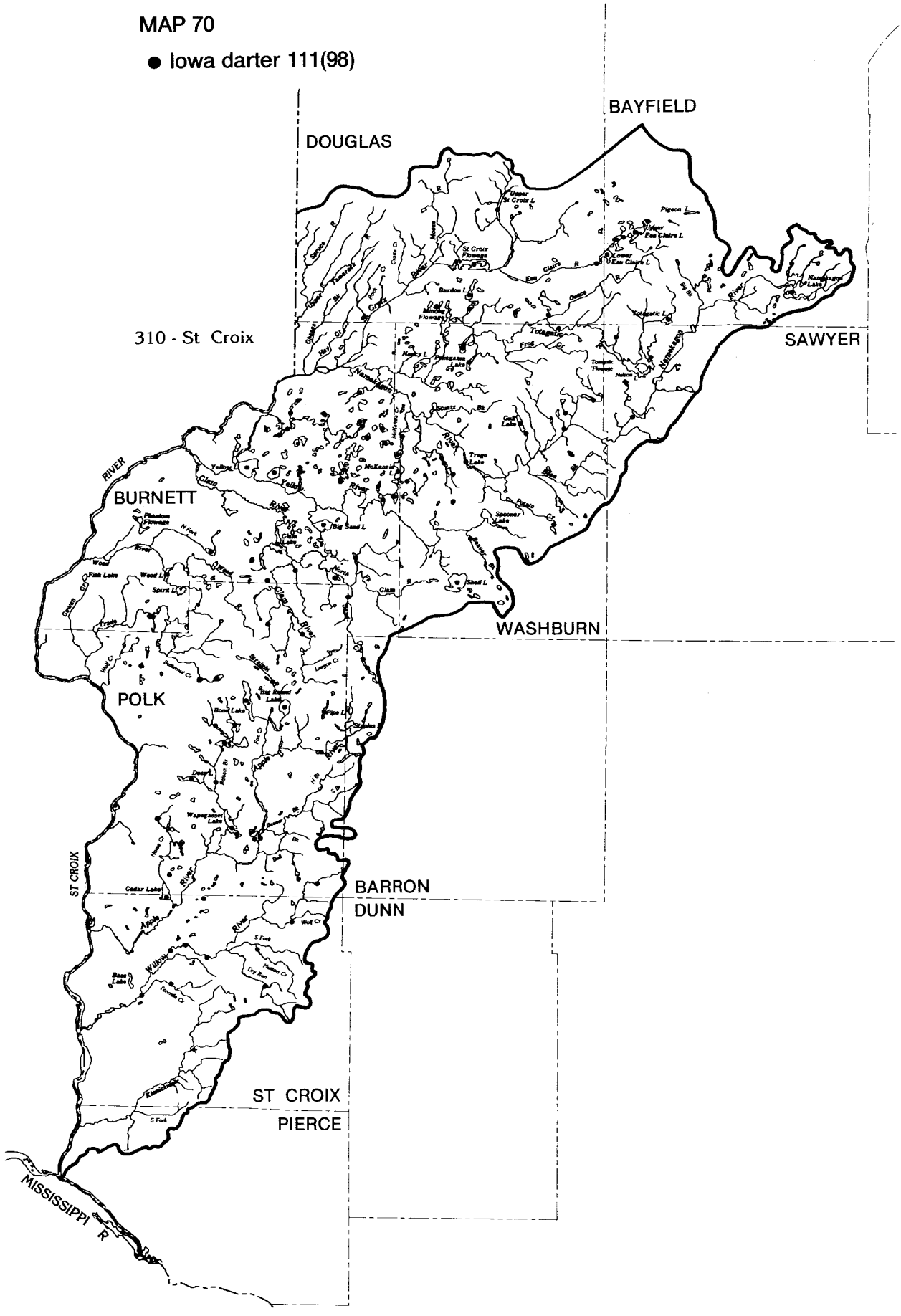
MAP 69

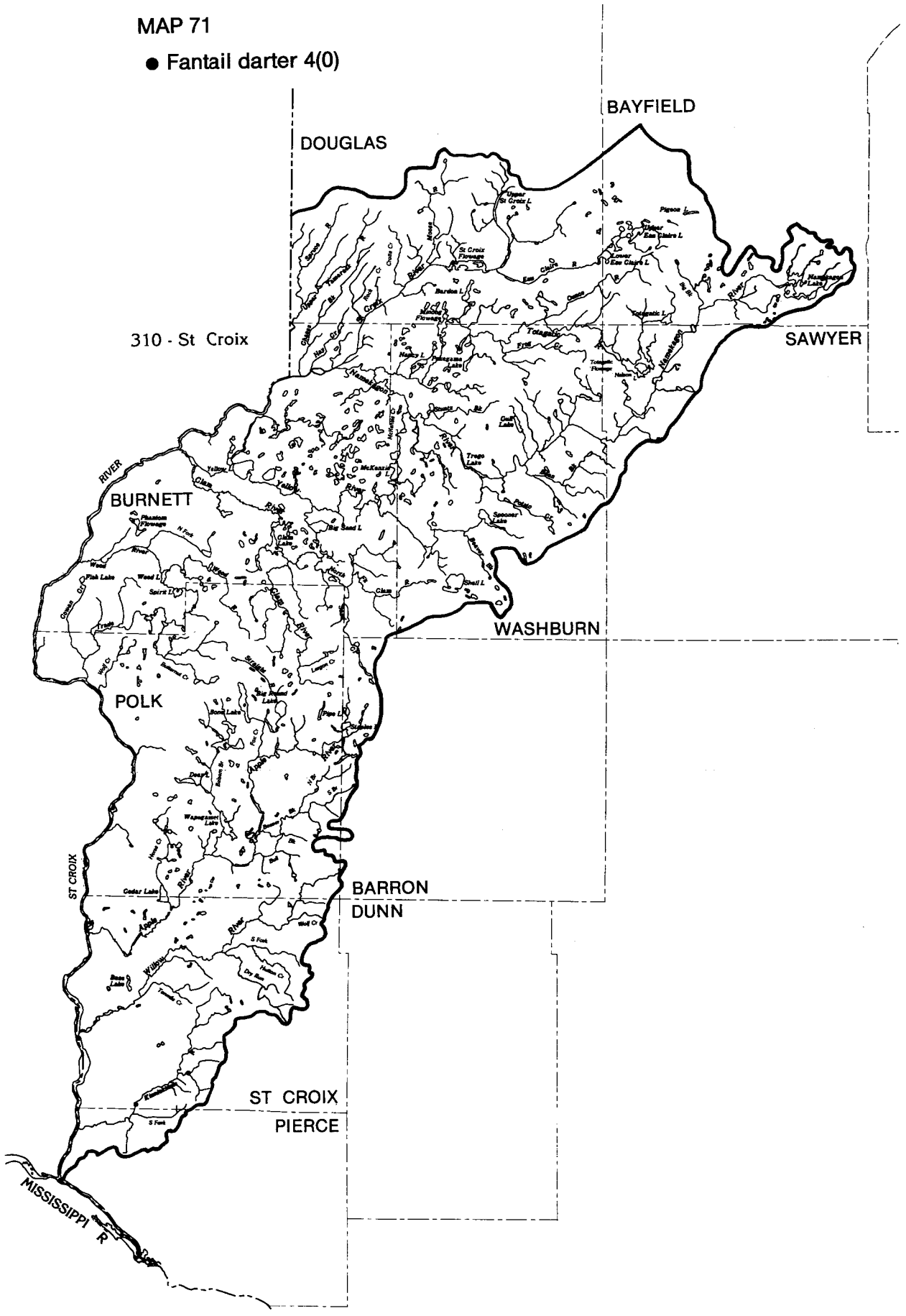
● Western sand darter 7(1)



MAP 70

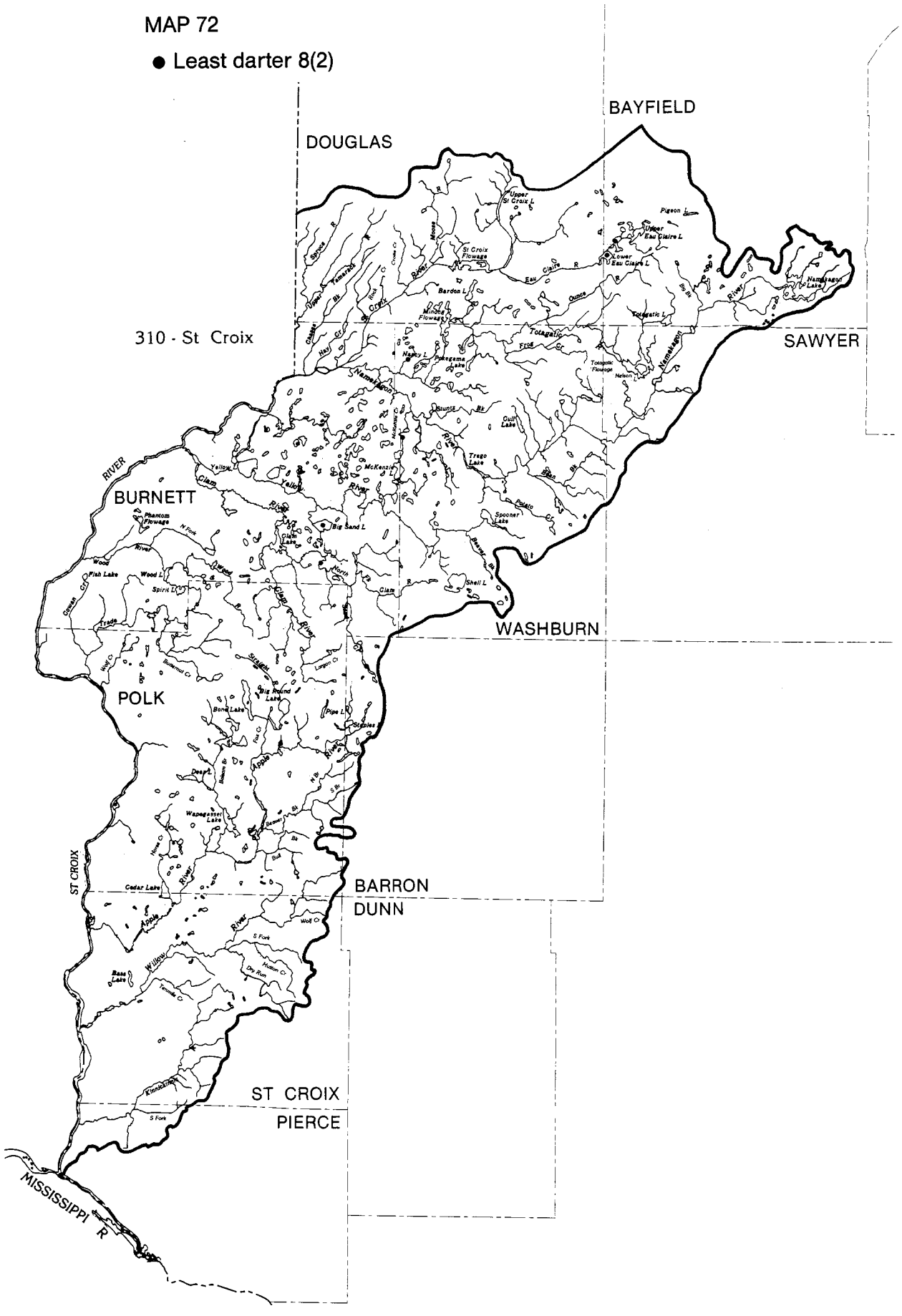
● Iowa darter 111(98)

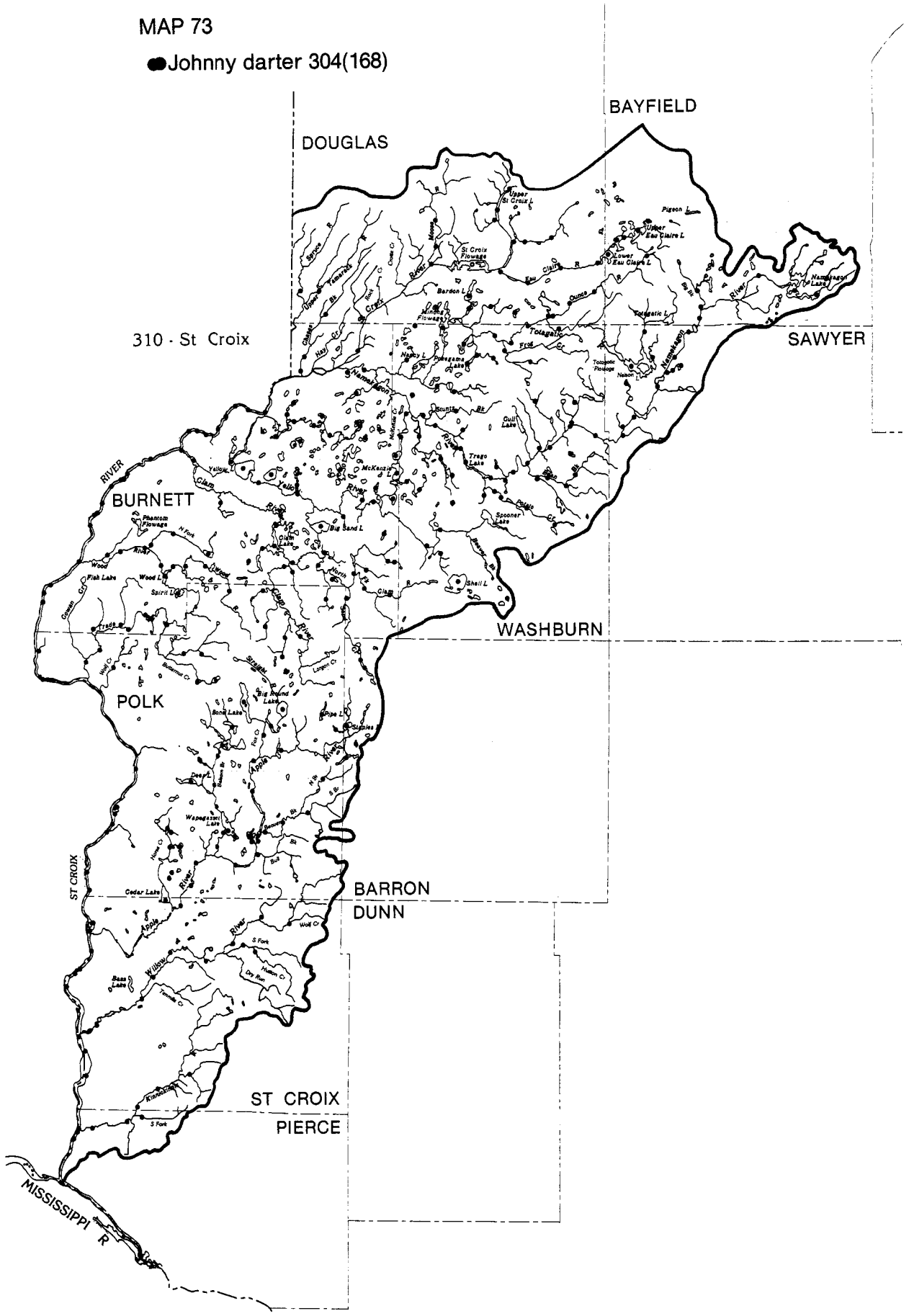



MAP 71
● Fantail darter 4(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

MAP 72

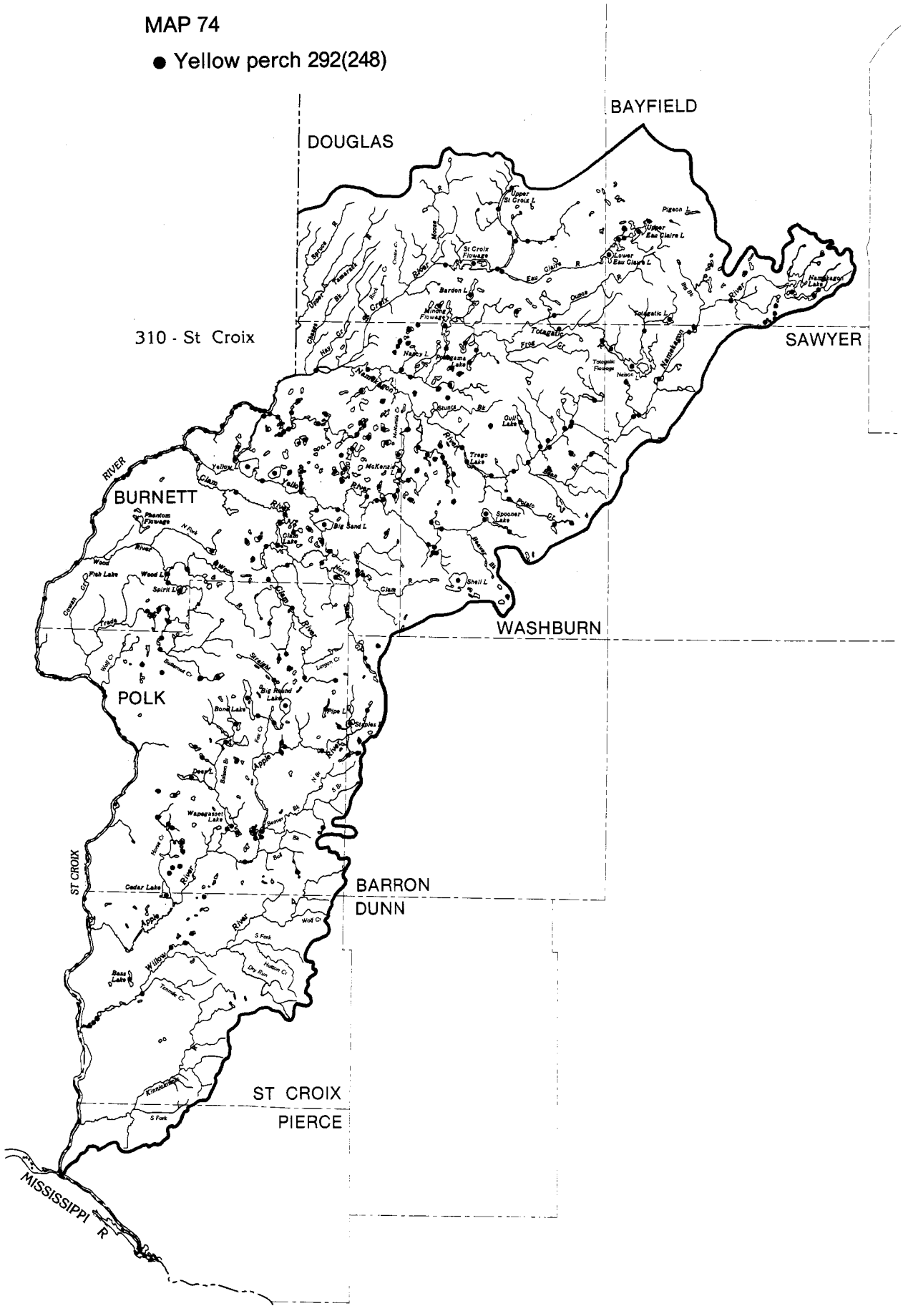
● Least darter 8(2)

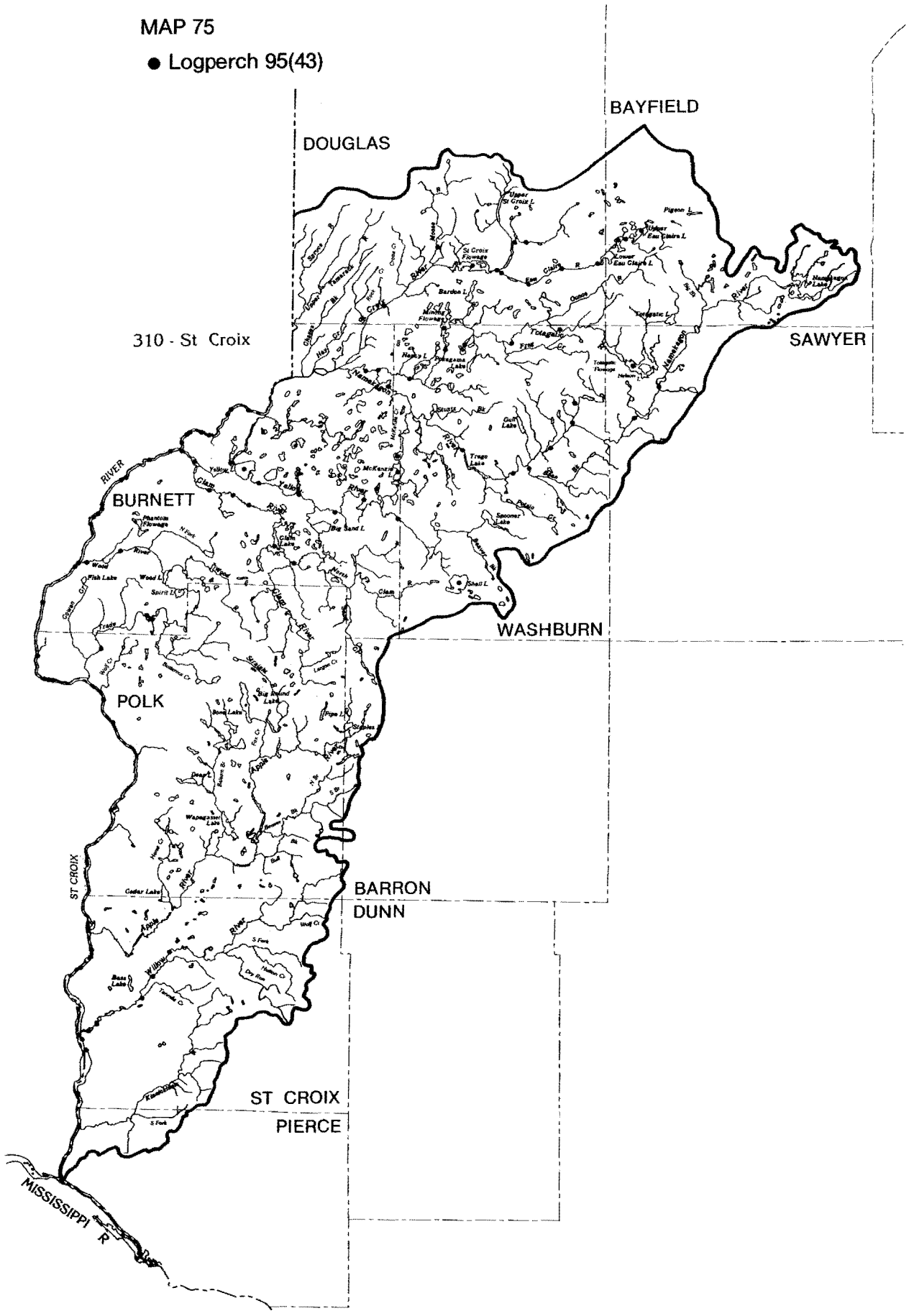



MAP 73
Johnny darter 304(168)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

MAP 74

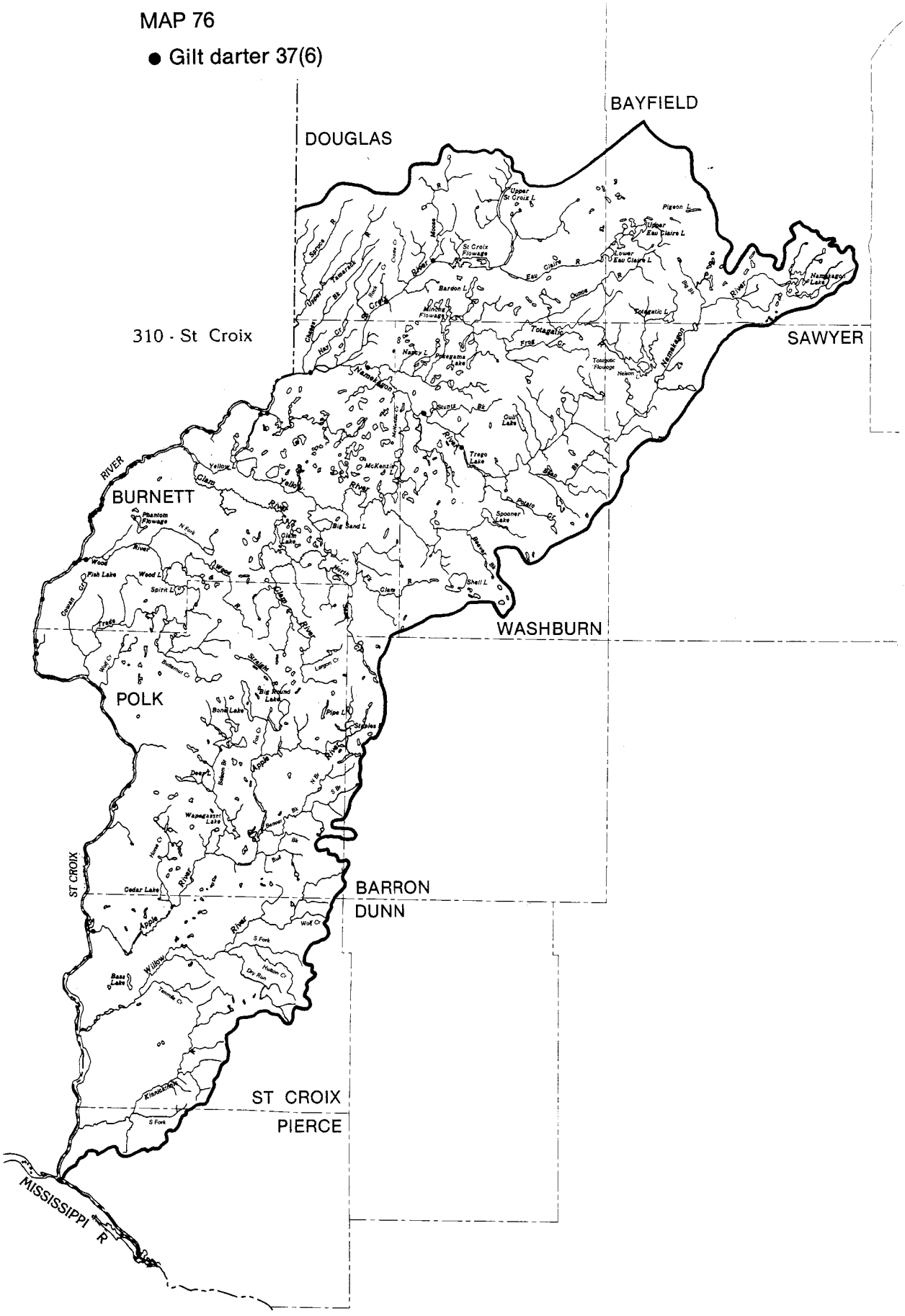
● Yellow perch 292(248)




MAP 75
● Logperch 95(43)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

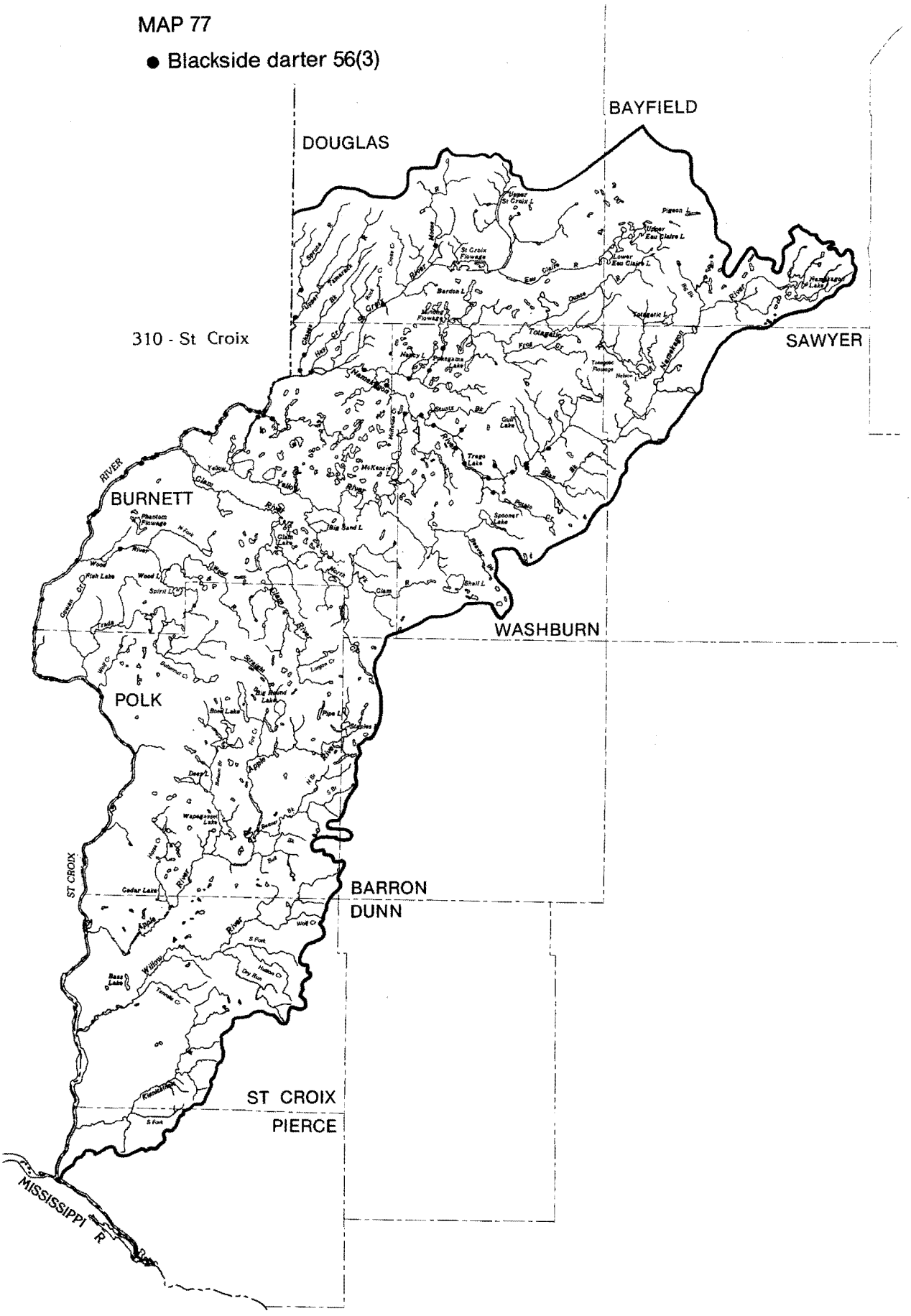
MAP 76

● Gilt darter 37(6)



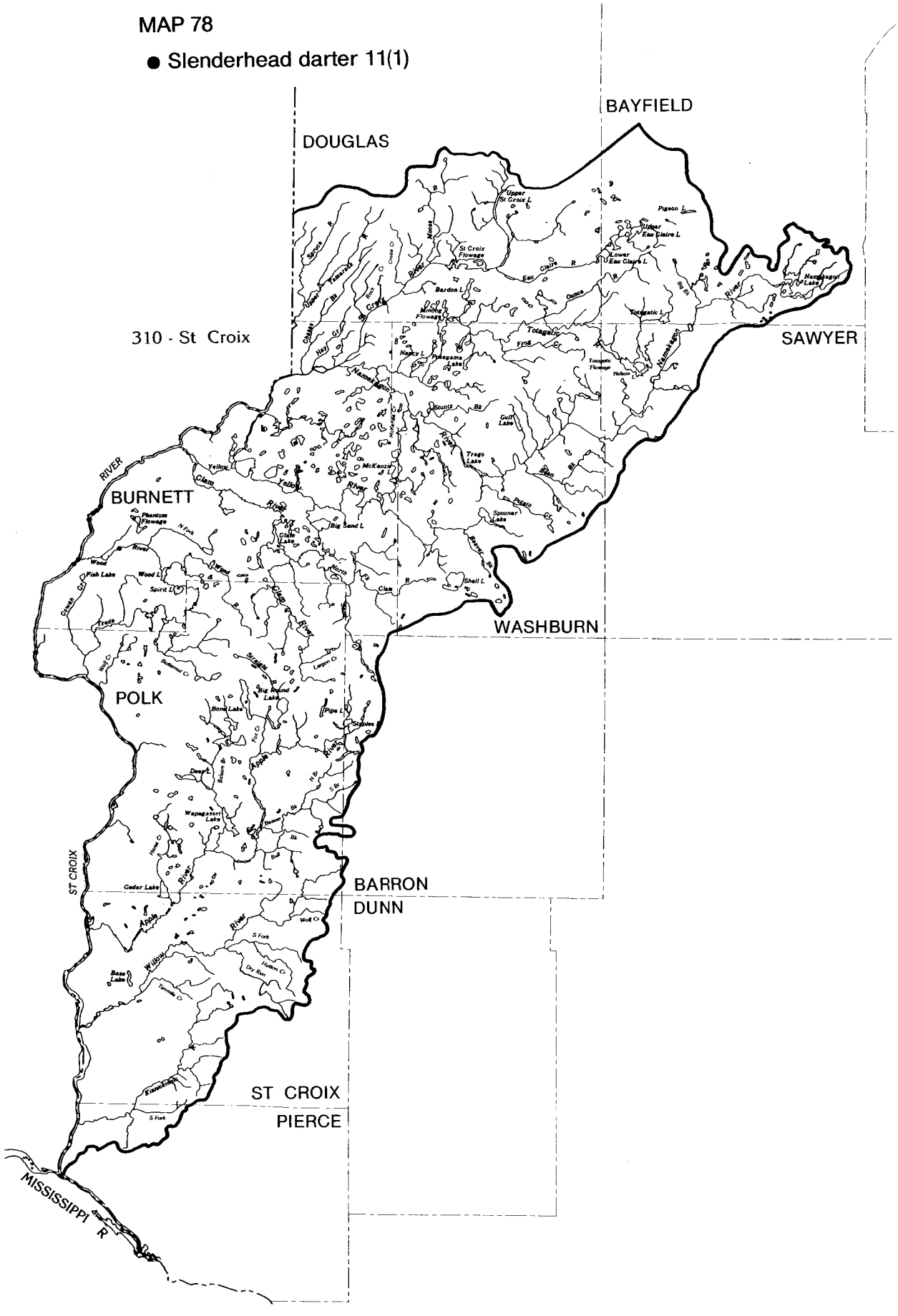
MAP 77

● Blackside darter 56(3)

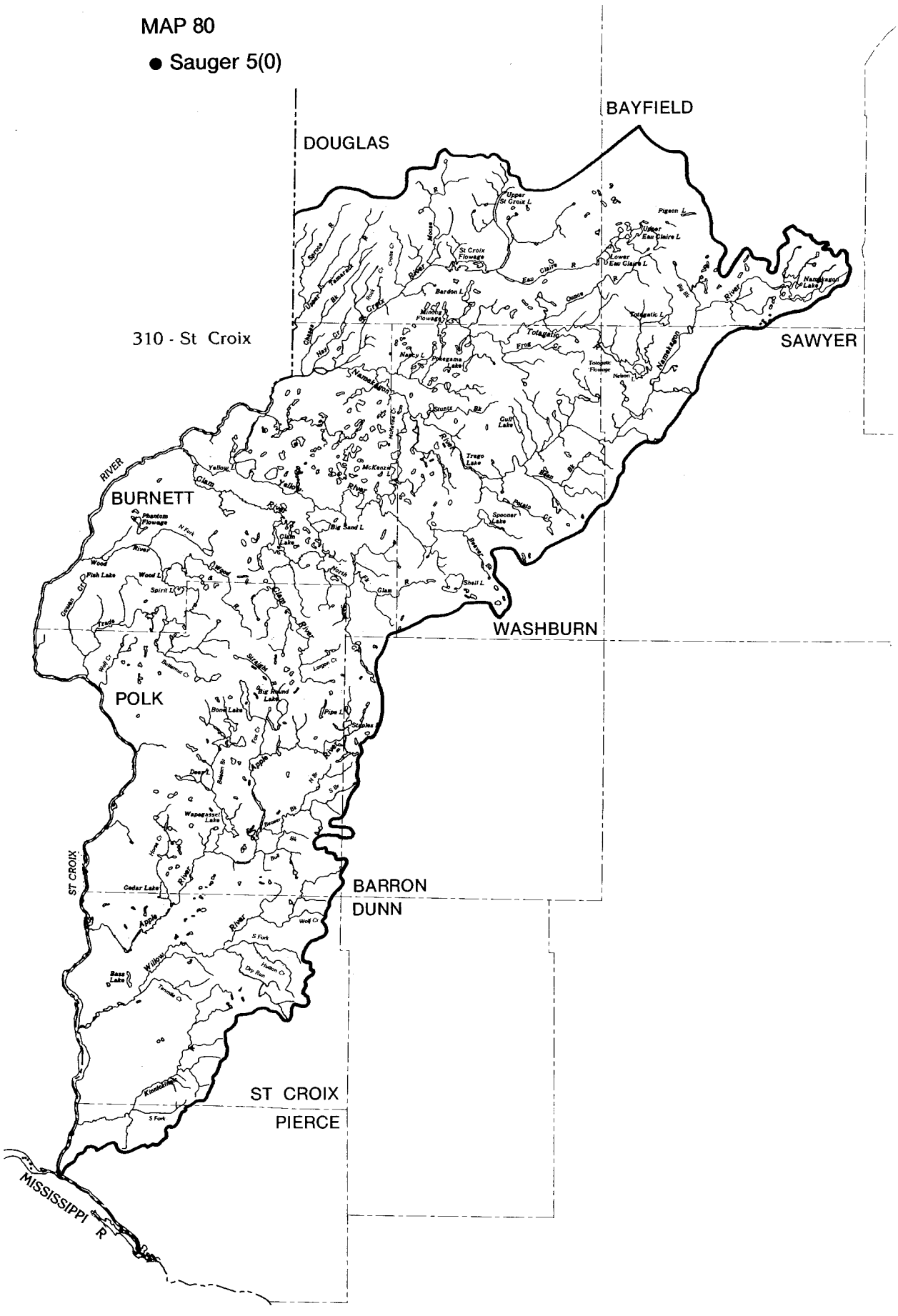


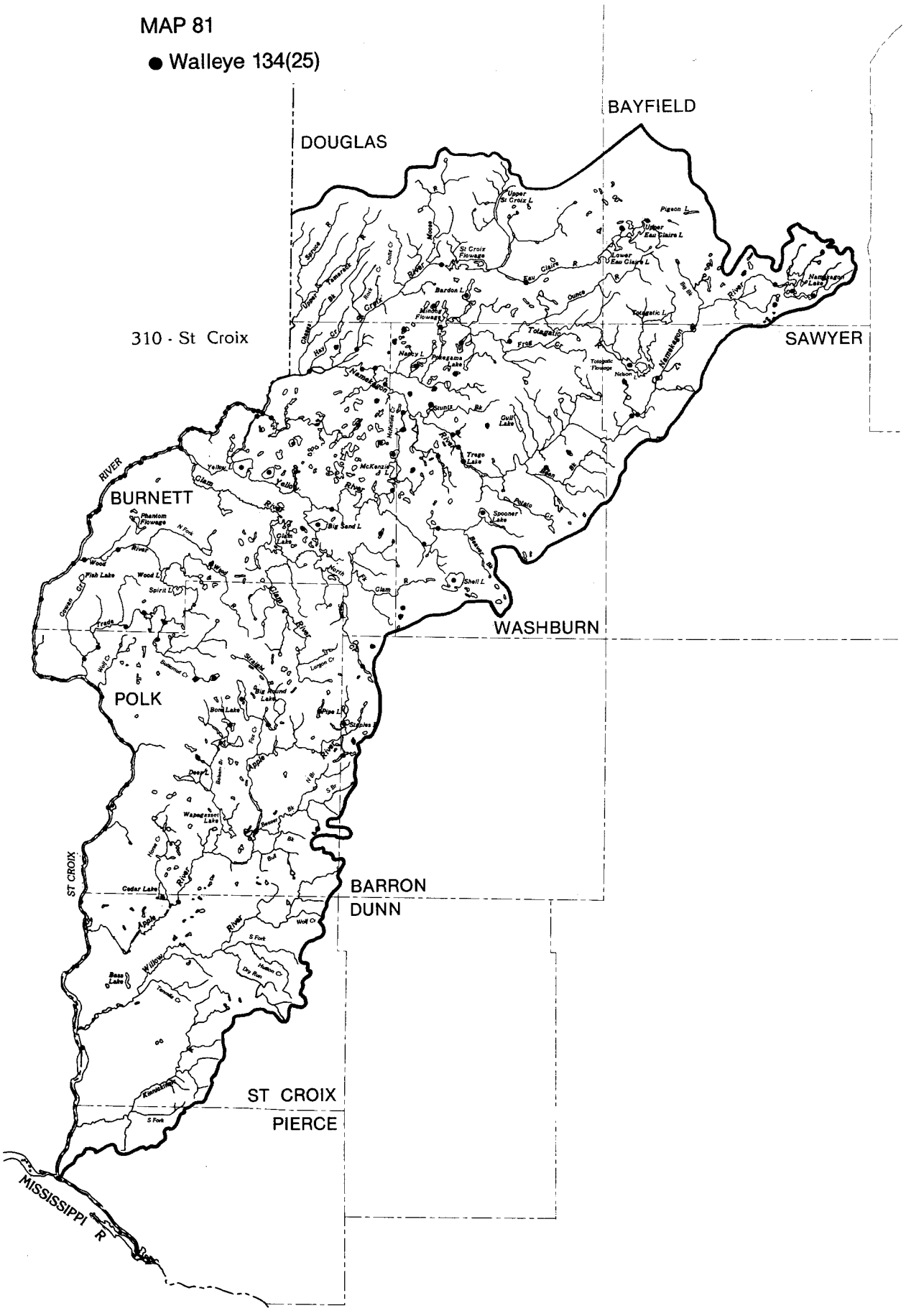
MAP 78

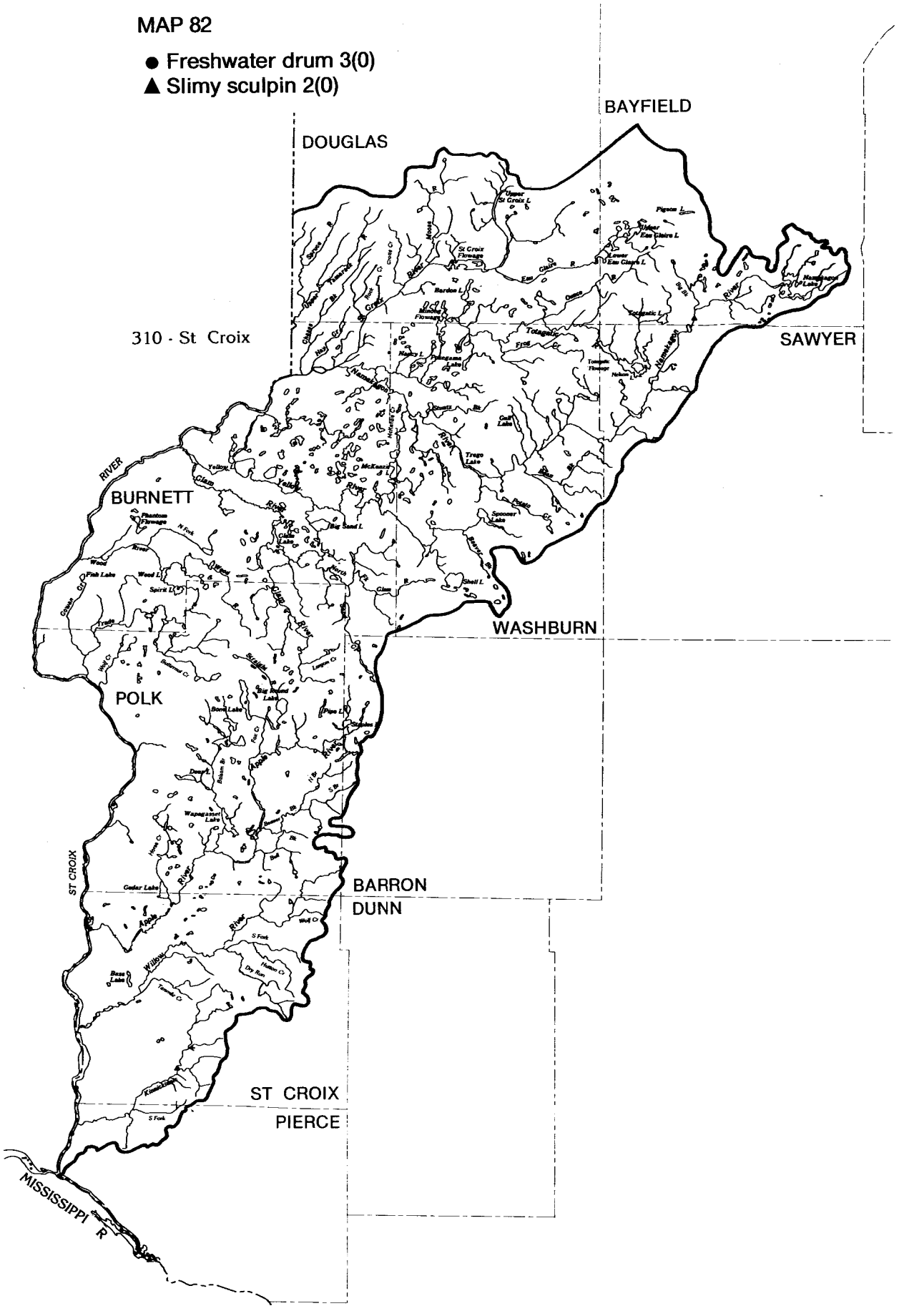
● Slenderhead darter 11(1)

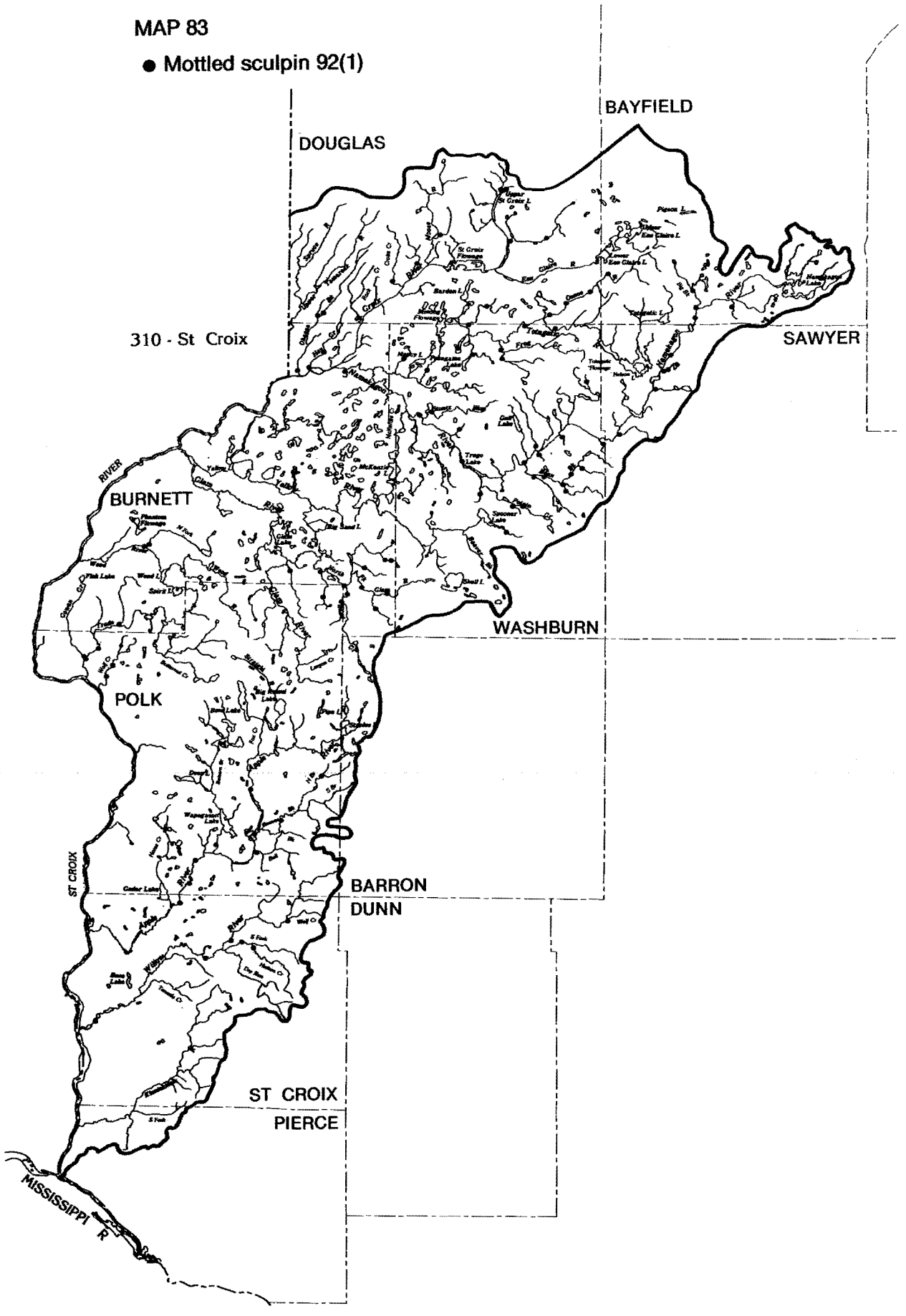



MAP 79
● River darter 11(1)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R.


MAP 80
● Sauger 5(0)
310 - St Croix
BAYFIELD
DOUGLAS
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER


MAP 81
● Walleye 134(25)
310 - St Croix
BAYFIELD
DOUGLAS
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER


MAP 82
● Freshwater drum 3(0)
▲ Slimy sculpin 2(0)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R
ST CROIX RIVER


MAP 83
● Mottled sculpin 92(1)
BAYFIELD
DOUGLAS
310 - St Croix
SAWYER
BURNETT
WASHBURN
POLK
BARRON
DUNN
ST CROIX
PIERCE
MISSISSIPPI R

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 St. Croix River basin represents the efforts and cooperation of a number of people.

One requiring special thanks is David Siegler for his work throughout the study, particularly coding the raw data for entry into the computer, drafting the base map and 83 species maps, and proofing the tables and figures in this report. Another is Dale Becker for his work as principal fish taxonomist and as a member of the sampling crew until July 1978. Another member of the crew was Keith Otis, who was our principal taxonomist from July 1978 until he left in September 1980. Thanks are given to Tom Beard and Don Stafford for their help in making collections from 514 stations.

Three other individuals—Fred Hagstrom, Ken Kahler, and Jim Kreitlow—are recognized for their work in the field as crew leaders and in the laboratory.

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I am particularly indebted to Dr. George Becker who shared not only his skills in fish taxonomy with members of this study, but also data from fish collections that he and his students had made.

Credit is given to District Fish Management personnel who assisted by sending us fish from their stream and lake surveys and copies of their reports.

This manuscript was critically reviewed by Anne Forbes.

Photographs were taken by the author except where listed.

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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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