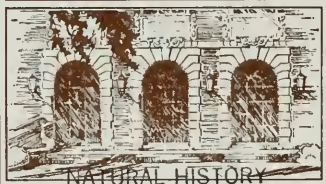


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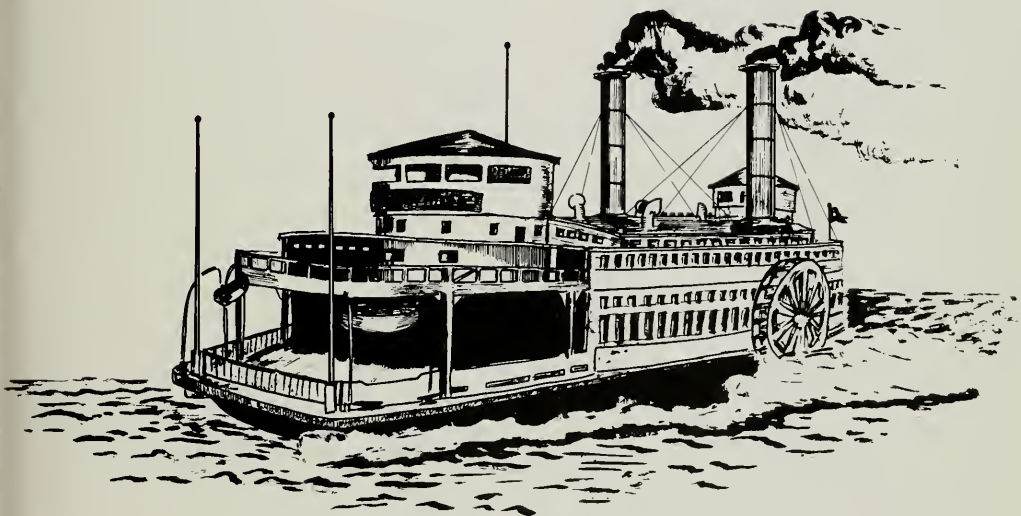


NATURAL HISTORY

SURVEY

A DISTRIBUTIONAL ATLAS OF UPPER MISSISSIPPI RIVER FISHES

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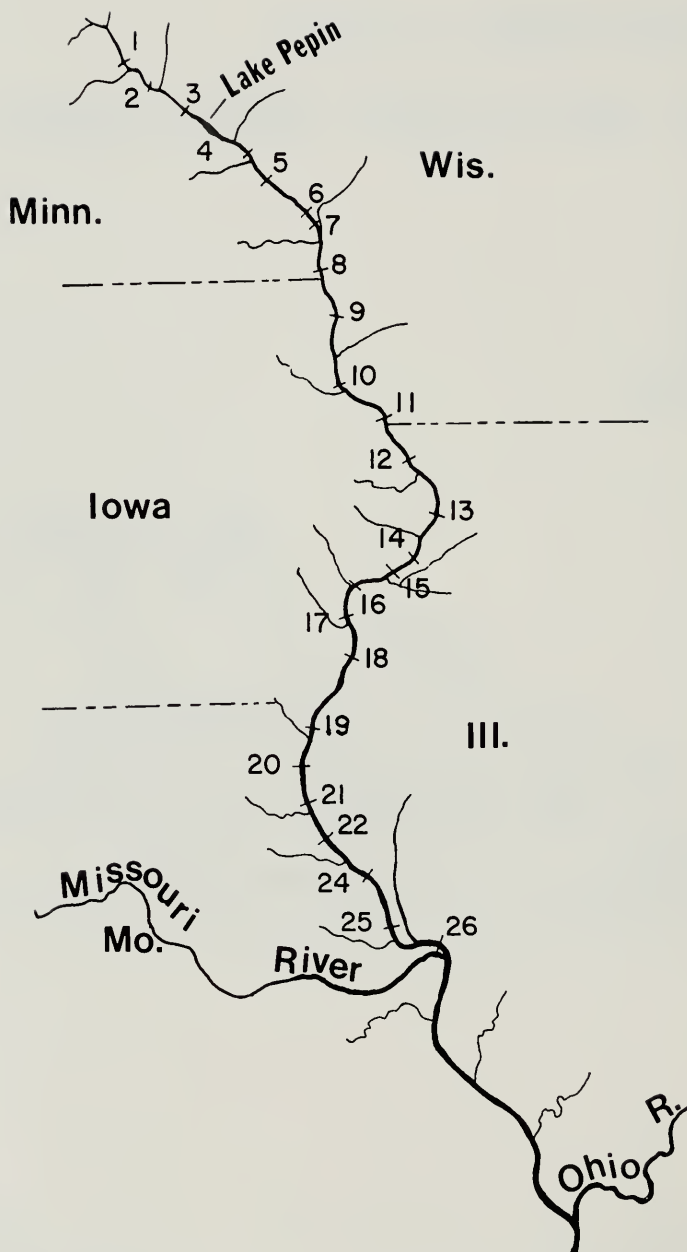


Fig. 1.—The upper Mississippi River and its major tributaries. The numbers refer to navigation pools and their downstream locks and dams. Note the absence of a pool 23 and of locks and dams below dam 26 in the unimpounded river, referred to as B-26.

A DISTRIBUTIONAL ATLAS OF UPPER MISSISSIPPI RIVER FISHES

Philip W. Smith, Alvin C. Lopinot, and William L. Pflieger

GROWING CONCERN OVER POLLUTION and habitat alteration in the Mississippi River prompts us to publish information we have assembled on the present distribution of fishes in that river. Since 1962 a concerted effort, under the aegis of the Upper Mississippi River Conservation Committee (hereafter UMRCC), has resulted in a vast quantity of distributional data, and its publication can provide a criterion that will aid in the detection and measurement of future changes in the environmental quality of the river.

The upper Mississippi River, as defined in this report, extends from river mile 0 at the mouth of the Ohio River near Cairo, Illinois, to river mile 854 at St. Anthony Falls near Minneapolis, Minnesota. River miles are indicated on the navigation charts (Middle and Upper Mississippi River, U.S. Army Engineer Division, North Central Corps, 1963), and they are prominently posted along the river banks so that the numbers are readily visible as a navigation aid to boat and barge pilots in the river channel.

Most of the upper Mississippi River consists of navigation pools separated by numbered locks and dams (Fig. 1). Each pool takes the same number as its downstream lock and dam. Pool 1, for example, lies between St. Anthony Falls and lock and dam 1; pool 2, between lock and dam 1 and lock and dam 2, etc. Since there is no lock and dam 23, there is no pool 23. The lowermost combined lock and dam is number 26; lock 27 and dam 27 are at different locations on the river. In the fisheries literature the pool between lock and dam 25 and lock and dam 26 is termed pool 26, and the river below dam 26 is called B-26. Below dam 27 the river is unimpounded.

In the Mississippi River, commercial and sport fishes have received considerable attention from researchers (UMRCC 1945-1968; Barnickol & Starrett 1951; Carlander 1954; Starrett & Barnickol 1955; and Nord 1967). Other fishes, which comprise well over half of the total number of species known to occur in the Mississippi, have received less attention, and detailed information on their distribution and abundance in the river is not generally available. Many of these fishes are small and difficult to identify, but they can serve as indicators of ecological conditions in the river when the assemblage of species and their numerical relationships are known.

HISTORICAL RESUMÉ

Prior to the establishment of the present UMRCC in 1943, knowledge of the fish fauna of the river was based largely on the work of Meek (1892), Forbes & Richardson (1908), Greene (1935), specimens deposited

in the Museum of Zoology at the University of Michigan, old reports of federal and state fish commissions and the U.S. Bureau of Fisheries, and scattered publications citing records from the Mississippi River. For an excellent summary of early investigations, see Carlander (1954).

With the establishment of the UMRCC, its Fish Technical Section inaugurated field operations early in 1944. These investigations continued through 1946 and involved personnel and financial support from the conservation departments of Missouri, Iowa, and Illinois and the Illinois Natural History Survey. The 2-year investigation of the river between Caruthersville, Missouri, and Dubuque, Iowa, culminated in the publication of *Commercial and Sport Fishes of the Mississippi River* (Barnickol & Starrett 1951).

Aware of the need for a list of all of the fishes in the upper Mississippi River, the UMRCC asked Dr. Reeve M. Bailey of the University of Michigan to compile an official guide for common and scientific names for all species. Bailey's mimeographed preliminary list, a remarkably accurate prediction of species that have since been found in the river, was based at least in part on specimens submitted to him for identification by Barnickol and Starrett and other UMRCC collectors. The list appeared in the proceedings of the eighth annual meeting (UMRCC 1952). A table showing the distribution of fish species for pools 3-11 also appeared in the proceedings of the eighth annual meeting and was revised the following year (UMRCC 1953) by Drs. John Greenbank and Raymond E. Johnson.

Subsequent issues of the mimeographed UMRCC proceedings added a few new distributional records, and Robert C. Nord canvassed old literature and the member agencies of UMRCC for all fish distributional records for the river. In 1962 we proposed to the Fish Technical Section of the UMRCC that a cooperative small-fishes survey of the river be undertaken in 1963 by personnel of the member agencies of the committee. It was our hope that a number of intensive minnow-seine collections would provide information on the small fishes and would supplement the information on commercial and sport fishes in Barnickol & Starrett's (1951) bulletin. In 1963 biologists from the Illinois and Iowa conservation departments made over 100 minnow-seine collections and a few otter-trawl collections, and biologists from the Missouri Conservation Department sampled intensively a dozen sites in their part of the river. The Wisconsin and Minnesota departments of conservation subsequently sent in a few additional collections, but the need for more sampling was obvious.

In 1964 and 1965 staff members of the Natural History Survey made a few more collections in the Illinois portion of the river. Dissatisfied with the species representation in many of the collections, we again approached the UMRCC Fish Technical Section and proposed that mouths of preselected tributaries be sampled the following summer by seining and electrofishing. Col-

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lections were made at the mouths of 63 tributaries by agencies from all five member states of the UMRCC during the summer of 1966, and the results were summarized in a mimeographed compendium of the upper Mississippi River fisheries (Nord 1967).

Since 1967 the Missouri Conservation Department has contributed the results of its investigations of the lower part of the river, and a few recent collections have been secured by Illinois Natural History Survey and Missouri Conservation Department personnel and by Larry Dunham, the biologist assigned to the river by the Illinois Department of Conservation. As a result of the UMRCC cooperative effort since 1962, collections are available for virtually the entire upper river (Fig. 2).



Fig. 2.—Locations of collecting stations sampled since 1962. At each site one to many minnow-seine collections were made, and at many of them electrofishing samples were also taken.

ACKNOWLEDGMENTS

We acknowledge the support of our respective agencies and the Upper Mississippi River Conservation Committee, especially the following present and former members of the Fish Technical Section: John G. Brasch, John L. Funk, William J. Harth, Raymond C. Hubley, Jr., Jerome H. Kuehn, Robert C. Nord, Roger Schoumacher, and William C. Starrett. We are grateful to the following persons for making collections: Marvin E. Braasch, Joe P. Bystry, Francis W. Collins, Robert DeCook, William Dornack, Larry Dunham, Bob Dunn, Alan Finke, Don Garver, Don Helms, Max Hensley, James L. La Buy, David J. McGinty, Thomas Molamphy, Thixton Miller, Jack Newton, Paul W. Parmalee, John W. Robinson, Kenneth Russell, John Skrypek, Jerry Stumpf, E. J. Trimberger, and Mark R. Weber.

We are grateful to W. C. Starrett and P. G. Barnickol for permission to use the unpublished records in their minnow-seine collections, to Kenneth D. Carlander for the loan of a critical specimen, to Robert E. Jenkins for counsel on records of redborses, to George C. Becker and James C. Underhill for advising us about certain Wisconsin and Minnesota fishes, and to O. M. Price for providing photographs of alligator gars. Robert C. Nord has freely provided help and encouragement, and Lawrence M. Page and Marvin E. Braasch helped to process collections and data, plot records, and provide aid in a variety of other ways. Richard M. Sheets, Illinois Natural History Survey Technical Illustrator, designed the cover, and Robert M. Zewadski, Associate Technical Editor of the Survey, edited the manuscript.

SOURCES OF DATA

A distribution map is provided for each species known from three or more sites in the upper Mississippi River. Records for specimens personally examined by one of us are plotted with a solid symbol. A few of them date back to 1944, but most are based on specimens taken since 1962. Specimens for most records are deposited in the collection of the Illinois Natural History Survey; for certain other records specimens are located in the University of Kansas Museum of Natural History and the University of Michigan Museum of Zoology. In a few cases records are based on large specimens that were identified and then returned to the river.

Supplemental records based on specimens not seen by one of us are plotted with hollow circles. Because the emphasis in this paper is on present distribution, the hollow symbols represent the most recent published records available from each locality. The source for each hollow circle on the maps can be determined by consulting the corresponding account in the list of species, where the sources are indicated. Published records that we regard as questionable and certain quite old records are discussed in the annotated list but are not plotted on the maps.

ANNOTATED LIST OF SPECIES

An asterisk preceding the name of a species denotes that we regard its presence in the river as accidental.

The scientific and common names used follow Bailey (1970). The families of fishes are arranged in phylogenetic sequence, following the classification proposed by Greenwood et al. (1966). Within each family, however, genera and species are listed in alphabetical order. For each species a statement about its present distribution is given, and supplemental records and their sources are listed.

Ichthyomyzon castaneus Girard.—The chestnut lamprey is occasionally taken from pool 20 downstream to the mouth of the Ohio River, but it is extremely sporadic, if still present at all, above pool 20. Supplemental records for pools 7–9 (UMRCC 1953) and 4, 5, 10, and 11 (Nord 1967), but based on specimens collected almost 20 years ago, are available. Starrett, Harth, & Smith (1960:342) noted that in Illinois the species no longer occurred as far north as its type-locality (Mississippi River, Galena, Illinois), but in Wisconsin recent records are available from the Fox and Yellow rivers (George C. Becker, personal communication, August 10, 1970).

Ichthyomyzon unicuspis Hubbs & Trautman.—The silver lamprey is occasionally taken from pool 10 downstream to the mouth of the Ohio River, but it is uncommon below the mouth of the Missouri River. Supplemental records are available for pools 5 and 7–9 (UMRCC 1953). Although our opinion is based on specimens collected nearly 20 years ago, we believe the species still occurs above pool 10.

Acipenser fulvescens Rafinesque.—The lake sturgeon is rare in the river. In 1966 an Illinois commercial fisherman secured two specimens near Quincy that had a combined weight of 56 pounds, and a Missouri fisherman caught a 32-pound specimen near Elsberry. Supplemental records are as follows: pools 4, 8–10 (UMRCC 1953), 3, 6, 17, 19, 20, and 22 (Nord 1967).

Scaphirhynchus albus (Forbes & Richardson).—The pallid sturgeon is extremely rare. It is represented by a small specimen given to Barnickol & Starrett (1951: 290) in 1944 by a fisherman, who caught the fish near the mouth of the Missouri River (the type-locality), and a small specimen secured at river mile 75 in the spring of 1970. A record for Keokuk (Coker 1930) is not accepted because it is quite old. There is no other evidence of the occurrence of the pallid sturgeon in the Mississippi above the mouth of the Missouri River.

Scaphirhynchus platyrhynchus (Rafinesque).—The shovelnose sturgeon is taken occasionally from Lake Pepin to the mouth of the Ohio River. Supplemental records are as follows: pools 4 (UMRCC 1965), 5–6 (UMRCC 1968), 7–9, 12, 14, 18–20, 25, 26 (UMRCC 1955), 10, 11, 13, and 15 (UMRCC 1960).

Polyodon spathula (Walbaum).—The paddlefish is taken occasionally from pool 9 downstream to the mouth of the Ohio but is rare in the upper pools. Supplemental records exist for pools 4, 5 (UMRCC 1953), 6, 8 (Nord 1967), 9 (UMRCC 1958), 10–15, 17–20, 22, 24 (UMRCC 1961), 25, 26 (UMRCC 1963), and B-26 (Barnickol & Starrett 1951).

Lepisosteus osseus (Linnaeus).—The longnose gar is generally distributed and seemingly more common above than below the mouth of the Missouri River. Supplemental records are as follows: pools 3–5 (UMRCC

1964), 8–10 (UMRCC 1953), 11, 13, 16, 17, 19, 24, and B-26 (Barnickol & Starrett 1951).

Lepisosteus platostomus Rafinesque.—The shortnose gar is widely distributed and especially abundant below the mouth of the Missouri River. Supplemental records are available for pools 2–5 (UMRCC 1964), 6, 8, 9 (UMRCC 1953), 7 (UMRCC 1958), 11, 12, 14, 15, 25 (Barnickol & Starrett 1951), 16, and 17 (Starrett & Barnickol unpublished).

Lepisosteus spatula Lacépède.—The alligator gar is rare. In addition to the published records of Barnickol & Starrett (1951), photographs of a 130-pound specimen from Cairo and a 110-pound specimen from Chester, both caught by Illinois commercial fishermen in 1965, are available through the kindness of Mr. O. M. Price of the Illinois Department of Conservation.

Amia calva Linnaeus.—The bowfin is widely distributed and seemingly more common in the impounded pools above the mouth of the Missouri River than below. Supplemental records are as follows: pools 3–6, 25, 26 (UMRCC 1963), 7, 8, 22 (UMRCC 1961), 9, 10, 20 (UMRCC 1960), 11, 13, 16, 17, 24 (UMRCC 1964), 12 (UMRCC 1966), 14, 15, 19, B-26 (Barnickol & Starrett 1951), and 21 (UMRCC 1965).

Anguilla rostrata (Lesueur).—The American eel is occasionally taken from Lake Pepin to the mouth of the Ohio River. Supplemental records are available for pools 5, 12, 13, 22 (UMRCC 1964), 7, 21, 24, 25 (UMRCC 1963), 8 (UMRCC 1953), 9 (UMRCC 1955), 10 (UMRCC 1957), 11 (UMRCC 1965), 14, 16, 17, B-26 (Barnickol & Starrett 1951), 15 (UMRCC 1966), 18 (UMRCC 1961), and 19 (UMRCC 1960).

Alosa alabamae Jordan & Evermann.—The Alabama shad is extremely rare and is represented by one small specimen taken in 1962 in a seine haul at river mile 152. An old record for Keokuk, reported as *A. ohioensis* by Coker (1930), has not been plotted.

Alosa chrysochloris (Rafinesque).—The skipjack herring is moderately common near the mouth of the Ohio River and occasional as far upstream as pool 15. Supplemental records are: pools 13 (UMRCC 1958), 16, 17 (Nord 1967), and 20, 21 (Barnickol & Starrett 1951). Other early published records are not plotted.

Dorosoma cepedianum (Lesueur).—The gizzard shad is abundant throughout the river. There is a supplemental record for pool 2 (UMRCC 1965).

Dorosoma petenense (Günther).—The threadfin shad is moderately common near the mouth of the Ohio River.

Hiodon alosoides (Rafinesque).—The goldeye is common from pool 20 downstream to the mouth of the Ohio and especially common below the mouth of the Missouri River. Supplemental records are as follows: pools 3, 4, 6, 11 (UMRCC 1953), 5, 8, 10, 12, 13, 18, 24, 25 (Nord 1967), 14, 17, and 19 (Barnickol & Starrett 1951).

Hiodon tergisus Lesueur.—The mooneye is widely distributed but is much more common above pool 20 in less turbid pools than it is below pool 20. Supplemental records exist for pools 3–5 (UMRCC 1964), 6–11 (UMRCC 1953), 14, 15 (Barnickol & Starrett 1951), 12, 13, 16–21, 22, 24, and 25 (Nord 1967).

**Salmo gairdneri* Richardson.—A specimen of the

rainbow trout, collected in 1969 from pool 14, is clearly a stray from a tributary. Supplemental records for pools 7, 9, and 10 (Nord 1967), undoubtedly also stragglers from tributaries, are available.

**Umbra limi* (Kirtland).—The mudminnow, recorded from pools 7–9 (UMRCC 1953), probably is accidental in the river proper.

**Esox americanus* Gmelin.—The grass pickerel, although represented by several collections, is rare, and the specimens may have been stragglers from overflow ponds. Supplemental records for pools 9, 10 (UMRCC 1953), 17 (Nord 1967), 18 (UMRCC 1948), 25 (UMRCC 1951), and 26 (Barnickol & Starrett 1951) are available.

Esox lucius Linnaeus.—The northern pike is moderately common upstream from pool 11 and occasional downstream as far as the mouth of the Ohio River. Supplemental records are: pools 2 (UMRCC 1965), 3–5 (UMRCC 1964), 13 (UMRCC 1967), 14, 15, 17 (Barnickol & Starrett 1951), 16 (UMRCC 1960), 18 (UMRCC 1954), and 19 (UMRCC 1956).

Camptostoma anomalum (Rafinesque).—The stone-roller is widely distributed but is distinctly uncommon. If there are permanent populations, they are localized in shallow runs and chutes, and it is possible that the occasional specimens are stragglers from small tributaries of the river. Supplemental records are available for pools 4, 7, 11 (UMRCC 1953), 10 (Becker 1966), and 17 (Nord 1967).

**Dionda nubilata* (Forbes).—In 1963 a specimen of the Ozark minnow was seined at river mile 68 and another at mile 121, both on the Illinois side. If these fish came from tributaries, they crossed the river, for the species is not otherwise known in southern Illinois although it is common in Missouri streams.

Cyprinus carpio Linnaeus.—The carp is an abundant and important fish throughout the river. Supplemental records are as follows: pools 5, 17 (UMRCC 1963), 11 (UMRCC 1964), and B-26 (Barnickol & Starrett 1951).

**Ctenopharyngodon idella* (Valenciennes).—A 34-inch, 21-pound male specimen of the grass carp was caught at Chester, Illinois, by commercial fisherman Paul DeSherlia in January 1971. This species, recently introduced in the southern states, has found its way into the Mississippi River and, according to fishermen, has since been caught at other sites.

Eriocymba buccata Cope.—A few specimens of the silverjaw minnow were taken in the minnow seine at two sites (river miles 41 and 105) in 1963.

Hybognathus argyritis Girard.—A few specimens of this minnow were collected at several sites between the mouths of the Missouri and Ohio rivers. This species, recently rediscovered by Pflieger (1971), is widespread in the Missouri River system.

Hybognathus hankinsoni Hubbs.—The brassy minnow has been recorded from pools 3, 4, 6, and 9 (UMRCC 1953). It is also reported from several sites upstream from pool 1 (Underhill 1957).

Hybognathus nuchalis Agassiz.—The silvery minnow is relatively common between Lake Pepin and pool 14 and below the mouth of the Missouri River, but it has

not been taken at all in the intermediate section. Supplemental records for pools 6–8, 10, and 11 (UMRCC 1953) are assignable on geographic grounds to this species, but published records of "*nuchalis*" below the mouth of the Missouri River cannot be so assigned.

Hybognathus placitus Girard.—The plains minnow is moderately common in the silt-laden part of the river below the mouth of the Missouri.

Hybopsis aestivalis (Girard).—The speckled chub is represented by several specimens in most of the minnow-seine collections made below Lake Pepin. Supplemental records are as follows: pools 6, 8–11 (UMRCC 1953), 7 (Nord 1967).

Hybopsis gelida (Girard).—The sturgeon chub is extremely rare and is confined to that part of the river below the mouth of the Missouri. A supplemental record from pool B-26 (Starrett & Barnickol unpublished) is available.

Hybopsis gracilis (Richardson).—The flathead chub is represented in virtually every minnow-seine collection made below the mouth of the Missouri River.

Hybopsis meeki Jordan & Evermann.—The sicklefin chub is uncommon but is represented by a few specimens in several collections taken below the mouth of the Missouri River.

Hybopsis storeriana (Kirtland).—The silver chub is common throughout the river. Supplemental records are available for pools 5–9 (UMRCC 1953).

Hybopsis x-punctata Hubbs & Crowe.—The gravel chub is rare but is represented in three recent minnow-seine collections made below the mouth of the Missouri River.

**Notomys biguttatus* (Kirtland).—The hornyhead chub is represented by one specimen in a 1963 collection from pool 4. It is widely distributed above pool 1 (Underhill 1957).

Notemigonus crysoleucas (Mitchill).—The golden shiner is widely distributed but not common. Supplemental records are as follows: pools 6–8, 11 (UMRCC 1953), 16, and 20 (Nord 1967).

Notropis amnis Hubbs & Greene.—The pallid shiner is rare at present. Supplemental records for pools 3, 4, 5, 9, 11 (UMRCC 1953), and 21 (Starrett & Barnickol unpublished) are available. In view of the present rarity of the species, older records are not plotted, since the species has been decimated in many areas.

**Notropis anogenus* Forbes.—The pugnose shiner is represented by a record for pool 4 (UMRCC 1953) and is probably accidental in the river.

Notropis atherinoides Rafinesque.—The emerald shiner is the most abundant fish in the river. A supplemental record for pool 5 (UMRCC 1953) is available.

Notropis blennioides (Girard).—The river shiner is the second most abundant fish in the river, but is somewhat less common below the mouth of the Missouri River than it is above that point. Supplemental records are available for pools 5 (UMRCC 1967) and 6 (UMRCC 1953).

**Notropis boops* Gilbert.—The bigeye shiner is represented in two recent minnow-seine collections (river miles 43 and 327), but it is probably accidental in the river.

Notropis buchanani Meek.—The ghost shiner is widely distributed and rather common below pool 14, but it has become quite rare and may be extirpated above pool 14. Supplemental records, all of which are almost 20 years old, for the upper pools (UMRCC 1953), pool 26, and B-26 (Starrett & Barnickol unpublished) are available.

**Notropis chryscephalus* (Rafinesque).—The striped shiner was present in one of our minnow-seine collections and in two of those made by Starrett & Barnickol (unpublished) below the mouth of the Missouri River; these fish probably came from nearby small tributaries.

Notropis cornutus (Mitchill).—The common shiner is recorded from pools 1 (Underhill 1957), 8, 9, 11 (UMRCC 1953), and 10 (Becker 1966). It is reportedly rare below pool 1 but widely distributed above that pool and in the headwaters of the river (Underhill 1957).

Notropis dorsalis (Agassiz).—The bigmouth shiner is widely distributed above the mouth of the Missouri but is usually represented by only a few specimens. Supplemental records for the northern pools (UMRCC 1953) and pool B-26 (Starrett & Barnickol unpublished) are available.

Notropis emiliae (Hay).—The pugnose minnow is generally distributed above pool 18 but is usually present only in small numbers. Supplemental records are as follows: pools 3–9, 11 (UMRCC 1953), 16, and 17 (Nord 1967).

Notropis hudsonius (Clinton).—The spottail shiner is widely distributed and rather common above the mouth of the Missouri River, and it is known from several sites above pool 1 (Underhill 1957). Below the mouth of the Missouri it is sporadic and less common. Supplemental records are available for pools 5 (UMRCC 1967), 6, and 7 (UMRCC 1953).

Notropis lutrensis (Baird & Girard).—The red shiner is moderately common from pool 18 to the mouth of the Ohio River.

**Notropis rubellus* (Agassiz).—The rosyface shiner is recorded from pools 6 and 11 (UMRCC 1953) but is probably accidental in the river.

Notropis shumardi (Girard).—The silverband shiner is relatively common near the mouth of the Ohio River, but this species becomes progressively less common upstream.

Notropis spilopterus (Cope).—The spotfin shiner is fairly common from pool 18 upstream into the headwaters (Underhill 1957). The one record for the lower river is probably based on a straggler from a tributary. Supplemental records are as follows: pools 4 and 6 (UMRCC 1953).

Notropis stramineus (Cope).—The sand shiner is widely distributed throughout most of the river, but it is usually present in small numbers. Supplemental records exist for pools 4 (UMRCC 1967) and 6–8 (UMRCC 1953).

Notropis texanus (Girard).—The weed shiner is recorded from pools 5–11 (UMRCC 1953) and 12 (Nord 1967), but it is not common in the river.

**Notropis venustus* (Girard).—The blacktail shiner

was taken in a recent minnow-seine collection at river mile 43, but the fish probably came from a tributary.

Notropis volucellus (Cope).—The mimic shiner is common near the mouth of the Ohio River and is present in smaller numbers upstream to the mouth of the Missouri River. It is also recorded from pools 3–11 (UMRCC 1953), but it is apparently rare and may be extirpated in the upper pools. It is not known from the intermediate section of the river.

Phenacobius mirabilis (Girard).—The suckermouth minnow is widely distributed but not common. Supplemental records are available for pools 5, 8–10 (UMRCC 1953), and B-26 (Starrett & Barnickol unpublished).

**Phoxinus erythrogaster* (Rafinesque).—The southern redbelly dace has been recorded from pool 11 (UMRCC 1953). Details are lacking, but the specimen or specimens almost certainly were accidental in the river and probably came from a nearby small tributary.

Pimephales notatus (Rafinesque).—The bluntnose minnow occurs throughout the river, but it is common only in the headwaters (Underhill 1957). Supplemental records are available for pools 2 (Underhill 1957), 3–6, 11 (UMRCC 1953), and 20 (Starrett & Barnickol unpublished).

Pimephales promelas Rafinesque.—The fathead minnow occurs throughout the river but is quite uncommon. Supplemental records are as follows: pools 1 (Underhill 1957), 3–6, 8, 9 (UMRCC 1953), 10 (Becker 1966).

Pimephales vigilax (Baird & Girard).—The bullhead minnow is generally distributed below Lake Pepin and is abundant above the mouth of the Missouri River. A supplemental record for pool 5 (UMRCC 1967) is available.

**Semotilus atromaculatus* (Mitchill).—The creek chub is accidental in the river, except in its headwaters (Underhill 1957). Supplemental records are as follows: pools 3, 8 (Underhill 1957), 4, and 9 (Nord 1967).

**Semotilus margarita* (Cope).—The pearl dace is known from pool 1 and the headwaters of the river (Underhill 1957).

Carpiodes carpio (Rafinesque).—The river carp-sucker occurs throughout the river and is particularly abundant below the mouth of the Missouri. Supplemental records for pools 2 (UMRCC 1965), 5 (UMRCC 1964), 6, and 7 (UMRCC 1953) are available.

Carpiodes cyprinus (Lesueur).—The quillback is widely distributed and common, but it is distinctly less common below the mouth of the Missouri River than above the mouth. A supplemental record for pool 6 (UMRCC 1953) is available.

Carpiodes velifer (Rafinesque).—The highfin carp-sucker is occasionally taken above pool 14. Supplemental records are as follows: pools 2 (UMRCC 1965), 3, 5, and 6 (UMRCC 1953).

Catostomus commersoni (Lacépède).—The white sucker is widely distributed above pool 12, but it is evidently present only as a straggler below pool 12. Supplemental records exist for pools 2 (UMRCC 1965), 4 (UMRCC 1967), 6–9 (UMRCC 1953), 13, 16 (Nord 1967), 15, and 19 (Barnickol & Starrett 1951).

Cycleptus elongatus (Lesueur).—The blue sucker is

widely distributed but not common. Supplemental records are as follows: pools 4, 6, 8-10 (UMRCC 1953), 5 (UMRCC 1964), 7, 11, 25 (Nord 1967), 15, 16, 21, and 24 (Barnickol & Starrett 1951).

Hypentelium nigricans (Lesueur).—The northern hog sucker is rare and probably present only as a straggler below pool 12. Supplemental records are in existence for pools 4, 6, 9 (UMRCC 1953), 10, 15, 16, and 19 (Nord 1967).

Ictiobus bubalus (Rafinesque).—The smallmouth buffalo is widely distributed and moderately common below pool 12 but rare above. Supplemental records are as follows: pools 2 (UMRCC 1965), 5, 10, 11 (UMRCC 1953), 17, 22, 25, and B-26 (Barnickol & Starrett 1951).

Ictiobus cyrinellus (Valenciennes).—The bigmouth buffalo is widely distributed and moderately common throughout the river. Supplemental records are available for pools 2 (UMRCC 1965), 3-5 (UMRCC 1964), 6-11 (UMRCC 1953), 12, 15, 22, 24, 25, and B-26 (Barnickol & Starrett 1951).

Ictiobus niger (Rafinesque).—The black buffalo is widely distributed and fairly common from pool 14 to the mouth of the Ohio River. Supplemental records are as follows: pools 4-6, 8-10 (UMRCC 1953), 7 (Nord 1967), 11-17, 21, 22, 24, 25, and B-26 (Barnickol & Starrett 1951).

Minytrema melanops (Rafinesque).—The spotted sucker is occasionally taken between Lake Pepin and pool 17. Supplemental records for pools 5 (UMRCC 1964), 9 (UMRCC 1953), 11, and 17 (Barnickol & Starrett 1951) are available; records of presumably greater age for pools 18 and 20 (Nord 1967) are not plotted.

Moxostoma anisurum (Rafinesque).—The silver redhorse is rather rare but is taken most frequently above pool 12. Supplemental records are available for pools 4 (UMRCC 1967), 6-10 (UMRCC 1953), 12, 20 (Nord 1967), and 16 (Barnickol & Starrett 1951).

Moxostoma erythrurum (Rafinesque).—The golden redhorse is rather rare and is taken most frequently above pool 14. Supplemental records are as follows: pools 5, 8 (UMRCC 1967), 6, 9, 11 (UMRCC 1953), 7 (Nord 1967), and 10 (Becker 1966).

Moxostoma macrolepidotum (Lesueur).—The most generally distributed *Moxostoma* in the river, the short-head redhorse is usually present in small numbers. Supplemental records exist for pools 2 (UMRCC 1965), 5 (UMRCC 1964), 13, 15, 17, 18, 20, 21, and 25 (Barnickol & Starrett 1951).

Moxostoma valenciennesi Jordan.—The greater redhorse is recorded from pools 5 (UMRCC 1964) and 8 (UMRCC 1953). The latter record has recently been confirmed by Dr. R. E. Jenkins of Roanoke College, who examined the specimen on which it was based.

**Ictalurus catus* (Linnaeus).—Adult white catfish, taken near New Boston and near Wolf Lake, Illinois, by commercial fishermen during the summer of 1970, are the first records for the Mississippi River. The specimens are regarded as escapees from stockings at sites near the Mississippi River.

Ictalurus furcatus (Lesueur).—The blue catfish is

taken occasionally below pool 26, but it has become rare above the mouth of the Missouri River. The northernmost recent record is for pool 13 (UMRCC 1958). Supplemental records are as follows: pools 13 (UMRCC 1958), 19 (Nord 1967), 20-22, 24, 25, B-26 (Barnickol & Starrett 1951), and 26 (Rock 1963).

Ictalurus melas (Rafinesque).—The black bullhead is widely distributed but not common. Supplemental records are available for pools 3-5 (UMRCC 1964), 6-10 (UMRCC 1953), 11, 14-18, 20, 21, 26, B-26 (Barnickol & Starrett 1951), 12, 24 (Nord 1967), 22, and 25 (UMRCC 1951).

Ictalurus natalis (Lesueur).—The yellow bullhead is widely distributed but not common. Supplemental records are as follows: pools 2 (UMRCC 1965), 5 (UMRCC 1964), 6-11 (UMRCC 1953), 13, 24 (Nord 1967), 17, 18, 21, 25, 26, B-26 (Barnickol & Starrett 1951), and 20 (UMRCC 1951).

Ictalurus nebulosus (Lesueur).—The brown bullhead is recorded from several sites above pool 10. Supplemental records for pools 2 (UMRCC 1965), 3, 5 (UMRCC 1964), 4 (UMRCC 1967), 6, 8, 9 (UMRCC 1953), and 26 (Barnickol & Starrett 1951) are available. Records of unknown age for pools 11 and 13 (Nord 1967) are questionable and not plotted. The published record for pool 26 is probably based on a straggler from the Illinois River, which has populations of the brown bullhead.

Ictalurus punctatus (Rafinesque).—The channel catfish is common throughout the river. Supplemental records are as follows: pools 2 (UMRCC 1965), 3-5 (UMRCC 1964), 9 (UMRCC 1960), 19, and 25 (Barnickol & Starrett 1951).

Noturus flavus Rafinesque.—The stonecat is widely but sporadically distributed. Supplemental records are available for pools 4, 6, 9-11 (UMRCC 1953), 13, and 16 (Nord 1967). Specimens from sites below the mouth of the Missouri River represent the small-eyed phenotype discussed by Taylor (1969:123).

Noturus gyrinus (Mitchill).—The tadpole madtom is widely distributed but usually not common. Supplemental records for pools 6-8 (UMRCC 1953), 21, and B-26 (Starrett & Barnickol unpublished) are available.

Noturus nocturnus Jordan & Gilbert.—The freckled madtom is represented in recent minnow-seine collections from pools 20 and 21, and it probably is restricted to localized rubble riffles.

Pylodictis olivaris (Rafinesque).—The flathead catfish is fairly common throughout the river. Supplemental records are as follows: pools 2 (UMRCC 1965), 3-5 (UMRCC 1964), 6 (UMRCC 1953), 7 (UMRCC 1958), 8-10 (UMRCC 1960), 11, 12, 15-22, 25, B-26 (Barnickol & Starrett 1951), and 13 (Rock 1963).

**Aphredoderus sayanus* (Gilliams).—The pirate perch is recorded from pools 5-9 (UMRCC 1953), but this species is probably rare in the river proper.

Percopsis omiscomaycus (Walbaum).—The trout-perch is generally distributed above pool 10 and rather common in Lake Pepin. Supplemental records exist for pools 5, 6, and 8-10 (UMRCC 1953). The southernmost record is for river mile 150 (Starrett & Barnickol unpublished).

Lota lota (Linnaeus).—The burbot is rare and not known to many commercial fishermen. A specimen, taken in a hoopnet near New Boston, Illinois, late in 1969 by commercial fishermen Wesley Long and son, has been presented to us by Mr. Herbe McAtee, vice-president of the Boston Bay Conservation Club in Viola, Illinois. Supplemental records are as follows: pools 3, 5, 9, 11, 25 (Nord 1967), 4 (UMRCC 1964), and 8 (UMRCC 1953).

**Fundulus notti* (Agassiz).—The starhead topminnow is represented by a 1967 collection of eight specimens in pool 26, but it probably does not regularly occur in the river.

Fundulus notatus (Rafinesque).—The blackstripe topminnow is occasionally taken below pool 20. A supplemental record for pool 25 (Starrett & Barnickol unpublished) is available.

**Fundulus olivaceus* (Storer).—The blackspotted topminnow is represented by a 1963 record for the mouth of the Ohio River.

Gambusia affinis (Baird & Girard).—The mosquitofish is taken occasionally below pool 24. A supplemental record for pool B-26 (Starrett & Barnickol unpublished) is available.

Labidesthes sicculus (Cope).—The brook silverside is widely distributed, but this species is much more common above pool 18 than it is below that pool. Supplemental records are available for pools 3-6 (UMRCC 1953).

Menidia audens Hay. —The Mississippi silverside is represented by a 1963 collection at the mouth of the Ohio River.

**Culaea inconstans* (Kirtland).—The brook stickleback is recorded from pools 4 and 7 (UMRCC 1953), but it is probably accidental in the river.

Morone chrysops (Rafinesque).—The white bass is common throughout the river. A supplemental record for pool 5 (UMRCC 1967) is available.

Morone mississippiensis Jordan & Eigenmann. —The yellow bass is widely but sporadically distributed, and it is sometimes locally common. Supplemental records are as follows: pools 6, 13, 20, 22 (Nord 1967), 7 (UMRCC 1960), 14-19 (Barnickol & Starrett 1951), 24 (UMRCC 1958), and 26 (Rock 1963).

Ambloplites rupestris (Rafinesque).—The rock bass is generally distributed above the mouth of the Missouri River; however, it is quite rare except above pool 8, where it is common. Supplemental records for pools 5 (UMRCC 1964), 8, 10, 11, 26 (UMRCC 1960), 12-14, 16, 17, 20, 21, and 25 (Nord 1967) are available.

**Centrarchus macropterus* (Lacépède).—The flier is represented by a specimen from Cairo, Illinois, (Barnickol & Starrett 1951) and is probably accidental in the river.

Lepomis cyanellus Rafinesque. —The green sunfish is widely distributed but not common. Supplemental records are as follows: pools 2 (UMRCC 1965), 5, 6, 8, 9, 11 (UMRCC 1953), 12, 14 (Nord 1967), 15, 18 (Barnickol & Starrett 1951), and 25 (UMRCC 1960).

Lepomis gibbosus (Linnaeus).—The pumpkinseed is common above pool 14. Supplemental records are avail-

able for pools 3-5 (UMRCC 1964), 6 (UMRCC 1953), 10, 11, 14, and 16-19 (Nord 1967).

Lepomis gulosus (Cuvier).—The warmouth is widely distributed below pool 5 but quite uncommon. Supplemental records are as follows: pools 6, 9, 10 (UMRCC 1953), 7, 12, 14, 21, 24, 25 (UMRCC 1958), 8 (UMRCC 1960), 11, 16-18, B-26 (Barnickol & Starrett 1951), and 22 (Nord 1967).

Lepomis humilis (Girard).—The orangespotted sunfish is widely distributed and rather common. Supplemental records for pools 3-8 (UMRCC 1953) and 18 (UMRCC 1948) are available.

Lepomis macrochirus Rafinesque. —The bluegill is abundant throughout the river. Supplemental records for pools 5 and 15 (UMRCC 1967) are available.

Lepomis megalotis (Rafinesque).—The longear sunfish is represented in recent minnow-seine collections made near the mouth of the Ohio River, but this species is uncommon in the upper Mississippi.

**Lepomis microlophus* (Günther).—The redear sunfish is represented in a recent seine collection from pool 26, but this fish is probably accidental in the river.

Micropterus dolomieu Lacépède. —The smallmouth bass is widely distributed, but it is rather rare below pool 17. The southernmost record is at river mile 120 (Starrett & Barnickol unpublished). Supplemental records are as follows: pools 5 (UMRCC 1967), 8 (UMRCC 1960), 15, 18, 25 (UMRCC 1958), 16, 20 (Nord 1967), 26 (UMRCC 1952), and B-26 (Barnickol & Starrett 1951).

**Micropterus punctulatus* (Rafinesque).—The spotted bass, taken only below the mouth of the Missouri River, is probably accidental in the Mississippi. A published record for pool 14 (Barnickol & Starrett 1951) is probably based on a misidentification and is not accepted.

Micropterus salmoides (Lacépède).—The largemouth bass is widely distributed and rather common throughout the river. Supplemental records for pools 2 (UMRCC 1965) and 5 (UMRCC 1967) are available.

Pomoxis annularis Rafinesque. —The white crappie is common throughout the river. Supplemental records are as follows: pools 2 (UMRCC 1965), 5 (UMRCC 1964), 16, 17, and B-26 (Barnickol & Starrett 1951).

Pomoxis nigromaculatus (Lesueur).—The black crappie is common throughout the river, especially in the northern pools. Supplemental records are available for pools 5 (UMRCC 1967), 6 (UMRCC 1953), 7 (UMRCC 1955), 24, 25, and B-26 (Barnickol & Starrett 1951).

Ammocrypta asprella (Jordan).—The crystal darter is represented by records for pools 6 (UMRCC 1953) and 8 (Nord 1967) and is extremely rare. A record for pool 11 (Greene 1935:174) is not plotted because of its age.

Ammocrypta clara Jordan & Meek. —The western sand darter occurs between Lake Pepin and the mouth of the Missouri River, and it is locally common. Supplemental records are as follows: pools 5 (UMRCC 1967), 6-8, 10, 11 (UMRCC 1953), and 16 (Nord 1967).

Etheostoma asprigene (Forbes).—The paucity of records of the mud darter is surprising in view of the abun-

dance of the species in some of the large tributaries of the Mississippi River. Supplemental records for pools 4-11 (UMRCC 1953) are available.

**Etheostoma caeruleum* Storer.—A recent record of the rainbow darter in pool 25 is probably based on a straggler from a small tributary.

Etheostoma chlorosomum (Hay).—The bluntnose darter appears to have a northern disjunct population in pools 8 and 9 (UMRCC 1953), but it seems to be accidental in pool B-26.

**Etheostoma exile* (Girard).—The Iowa darter is represented by published records for pools 5, 7, 8 (UMRCC 1953), and 9 (Nord 1967).

**Etheostoma flabellare* Rafinesque.—The fantail darter is probably accidental in the Mississippi River. Supplemental records for pools 4 and 10 (UMRCC 1953) are available.

Etheostoma nigrum Rafinesque.—The johnny darter is widely distributed but rather uncommon. Supplemental records are as follows: pools 5 (UMRCC 1967), 6, 9, and 11 (UMRCC 1953).

**Etheostoma spectabile* (Agassiz).—The orangethroat darter, recently taken in pool 25 and at river mile 43, is probably accidental in the river.

**Etheostoma zonale* (Cope).—The banded darter, recorded from pools 9-11 (Nord 1967), is probably accidental in the river.

Perca flavescens (Mitchill).—The yellow perch is generally distributed above pool 19 and locally common. Supplemental records are available for pools 5 (UMRCC 1964), 8-11 (UMRCC 1960), 15-17 (UMRCC 1958), and 22 (Nord 1967).

Percina caprodes (Rafinesque).—The logperch is widely distributed and rather common in the upper pools. Supplemental records for pools 5 (UMRCC 1967), 6, and 11 (UMRCC 1953) are available.

**Percina maculata* (Girard).—The blackside darter is probably accidental in the river. Supplemental records for pools 4, 5, 8, 9 (UMRCC 1953), and 10 (Becker 1966) are available.

Percina phoxocephala (Nelson).—The slenderhead darter is widely distributed but rare. Supplemental records for pools 4, 6, 7, 9, and 11 (UMRCC 1953) are available.

**Percina sciera* (Swain).—The dusky darter is represented by a 1963 collection from river mile 43, but this species is accidental in the river.

Percina shumardi (Girard).—The river darter is widely distributed, and it is common above the mouth of the Missouri River. Supplemental records for pools 5-10 (UMRCC 1953) are available.

Stizostedion canadense (Smith).—The sauger, widely distributed and common throughout most of the river, is especially common below the mouth of the Missouri River. Supplemental records are available for pools 5 (UMRCC 1967), 13 (Nord 1967), and 26 (Rock 1963).

Stizostedion vitreum (Mitchill).—The walleye is widely distributed, but it is distinctly less common below pool 20 than it is above that pool. Supplemental records are as follows: pools 5 (UMRCC 1967), 6 (UMRCC 1953), 17, 19 (UMRCC 1960), 11, 15, 16 (Barnickol & Starrett 1951), 24, 25 (Nord 1967), and 26 (Rock 1963).

Aplodinotus grunniens Rafinesque.—The freshwater drum is common throughout the river and is particularly abundant below the mouth of the Missouri River. A supplemental record for pool 5 (UMRCC 1963) is available.

**Cottus caroliniae* (Gill).—The banded sculpin, taken in 1963 at river mile 70, is accidental in the river.

PROBLEMATIC AND ERRONEOUSLY REPORTED SPECIES

The following species, included in Bailey's preliminary list (UMRCC 1952) because most of them are known to occur in the lower reaches of tributary streams, have not been taken in the Mississippi River: spotted gar, *Lepisosteus oculatus*; brown trout, *Salmo trutta*; muskellunge, *Esox masquinongy*; redbfin shiner, *Notropis umbratilis*; blacknose dace, *Rhinichthys atratulus*; longnose dace, *Rhinichthys cataractae*; river herring, *Moxostoma carinatum*; spotted sunfish, *Lepomis punctatus*; bantam sunfish, *Lepomis symmetricus*; and slough darter, *Etheostoma gracile*.

The report of the spotted gar in the "Mississippi River system of Illinois" (Hubbs & Lagler 1941:26) evidently referred merely to the drainage, and a specimen recorded from pool 19 (Anonymous 1962), made available to us through the courtesy of Dr. Kenneth D. Carlander of Iowa State University, is reidentified as an aberrant specimen of the shortnose gar.

The brown trout is, as Bailey suggested, likely to be found eventually as a straggler in the river.

The muskellunge, reported from pools 10, 17 (Nord 1967), and 9 (Greene 1935) but presumably based on old records, probably does not now occur in the river.

The redbfin shiner, blacknose dace, and longnose dace are abundant in a number of tributaries, and it is surprising that recent specimens of these species have not been represented among the many thousands of minnows we have examined from the Mississippi River.

The river herring occurs in Lake St. Croix (Phillips & Underhill 1967:177), and it will probably be found eventually in the Mississippi River.

The spotted and bantam sunfishes have become so rare in the northern parts of their ranges that they are no longer probable additions to the Mississippi River fauna.

The slough darter is common in many tributaries and adjacent swamps in southern Illinois but has not been taken in the river proper.

The cisco, *Coregonus artedii*, was reported from pool 8 (UMRCC 1953). Details are now lacking, but whatever the provenance of the specimen, if indeed it was correctly identified, the cisco does not occur naturally in the Mississippi River.

The cypress minnow, *Hybognathus hayi*, was reported from three sites below the mouth of the Missouri River (Smith 1965:7), but the specimens are here reidentified as juveniles of *H. nuchalis*.

THE CONTRIBUTIONS OF TRIBUTARIES

Of the 134 species recorded here, 30 probably represent stragglers that are accidental in the Mississippi River. *Salmo gairdneri* evidently came from trout-stream tributaries, and the following eight species probably came

from marginal sloughs and lakes: *Umbra limi*, *Esox americanus*, *Notropis anogenus*, *Aphredoderus sayanus*, *Fundulus notti*, *Centrarchus macropterus*, *Lepomis microlophus*, and *Etheostoma exile*. The origins of the specimens of *Ictalurus catus* and *Ctenopharyngodon idella* are unknown. A long list of stragglers from tributary streams includes: *Dionda nubilus*, *Nocomis biguttatus*, *Notropis boops*, *Notropis chryscephalus*, *Notropis rubellus*, *Notropis venustus*, *Phoxinus erythrogaster*, *Semotilus atromaculatus*, *Semotilus margarita*, *Fundulus olivaceus*, *Culaea inconstans*, *Micropterus punctulatus*, *Etheostoma caeruleum*, *Etheostoma flabellare*, *Etheostoma spectabile*, *Etheostoma zonale*, *Percina maculata*, *Percina sciera*, and *Cottus caroliniae*.

Six other species of small fishes, although never recorded from the Mississippi River, are common in some of the small tributaries and may eventually be found as stragglers in the river. They are the ribbon shiner, *Notropis fumcus*; telescope shiner, *Notropis telescopus*; bleeding shiner, *Notropis zonatus*; creek chubsucker, *Erimyzon oblongus*; slender madtom, *Noturus exilis*; and northern studdfish, *Fundulus catenatus*.

The most dramatic contribution of a tributary to the regular fauna is made by the Missouri River, having introduced into the Mississippi the silt-tolerant *Scaphirhynchus albus*, *Hybognathus argyritis*, *Hybognathus placitus*, *Hybopsis gelida*, *Hybopsis gracilis*, and *Hybopsis meeki*. The Ohio River has a diluting effect upon the Mississippi's silty water. Near the mouth of the Ohio there is a sharp increase in the abundance of *Aloa chrysochloris*, *Dorosoma petenense*, *Notropis shumardi*, *Notropis volucellus*, and *Menidia audens*. Medium-sized

river appear to contribute little or nothing to the river fauna and to have assemblages of typical Mississippi River fishes near their mouths.

PRESENT STATE OF THE MISSISSIPPI RIVER

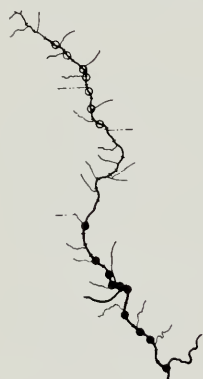
Despite the steady decline in the number of commercial fishermen and despite highly publicized references to the Mississippi River as a sewer, the evidence available indicates that the Mississippi has a rich fish fauna and that it supports good populations of most of its native species. With the exception of the muskellunge, no indigenous species of fishes are known to have been extirpated in historic times.

Several species appear to be less generally distributed and less common than formerly, but their decline cannot be attributed with certainty to increased pollution. Species such as the lake sturgeon were said to be decimated in the Mississippi River 60 or more years ago (Forbes & Richardson 1908:25). It is probable that drainage of marginal lakes and sloughs, erection of flood-control dams, destruction or modification of habitats through efforts to maintain a navigable channel, and excessive siltation have been the major causes of the observable changes in the numbers and distribution of fishes. However, such current threats as pesticide residues, mercury accumulations, industrial and domestic wastes, oil spills, accidental discharge of toxicants, thermal pollution, the proposed creation of a 12-foot navigation channel, and loss of marginal refuges make the need for constant surveillance of the Mississippi River ever more acute.

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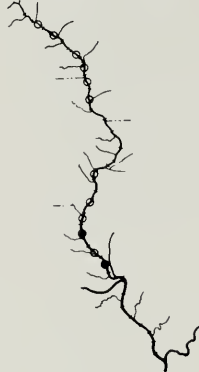
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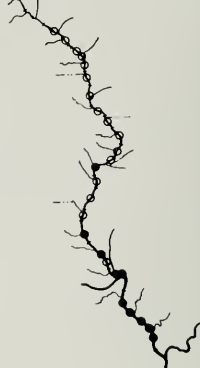
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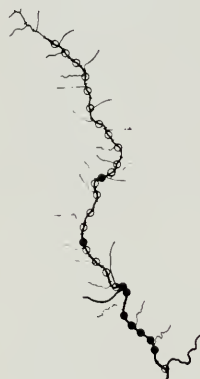
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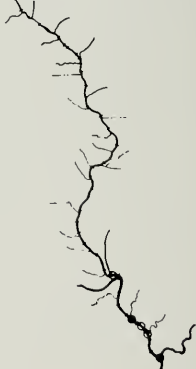
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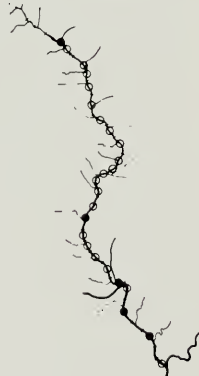
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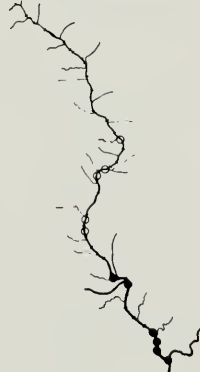
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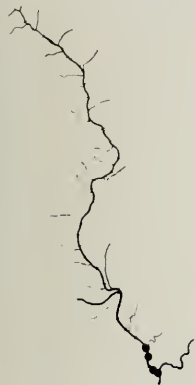
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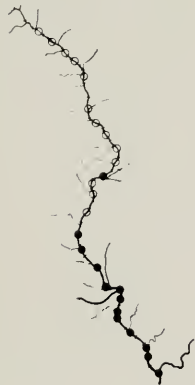
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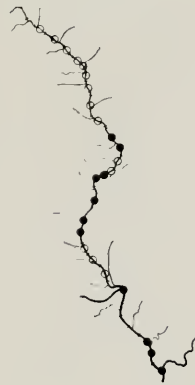
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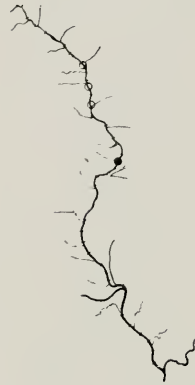
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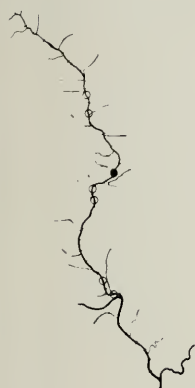
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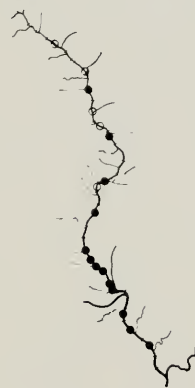
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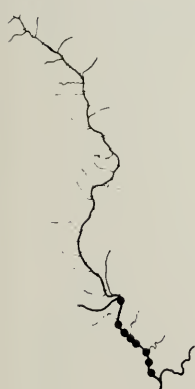
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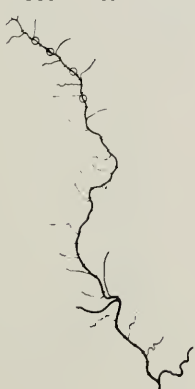
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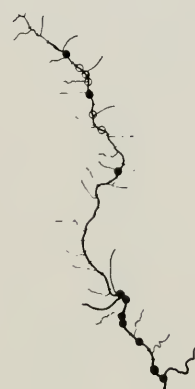
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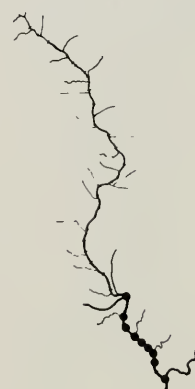
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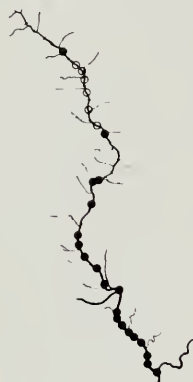
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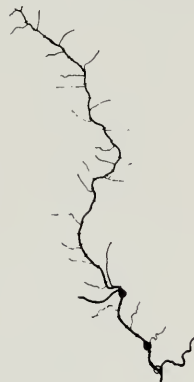
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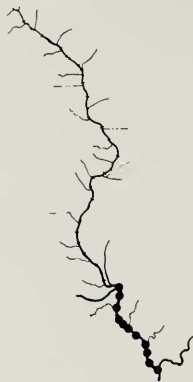
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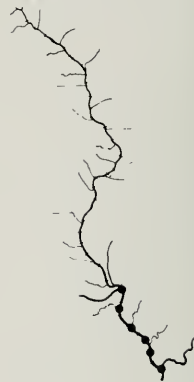
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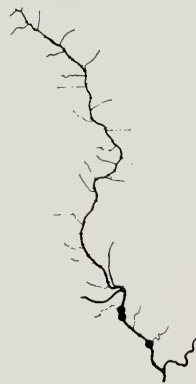
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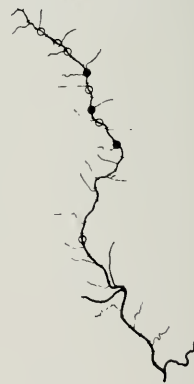
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NOTEMIGONUS CRYSOLEUCAS



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NOTROPIS ATERINOIDES



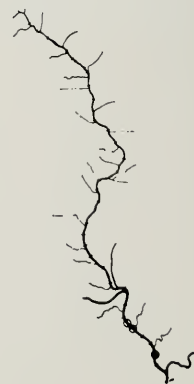
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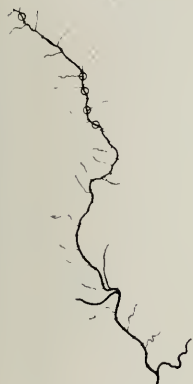
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NOTROPIS CHRYSOCEPHALUS



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NOTROPIS DORSALIS



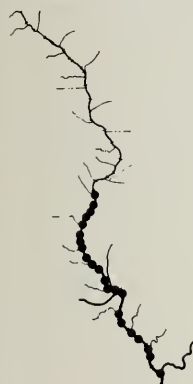
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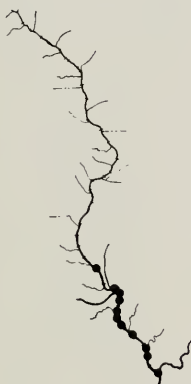
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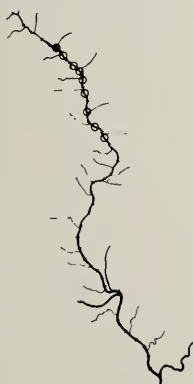
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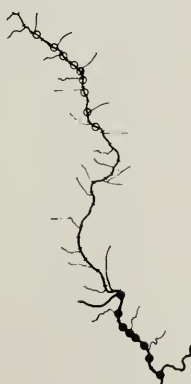
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NOTROPIS TEXANUS



NOTROPIS VOLUCELLUS



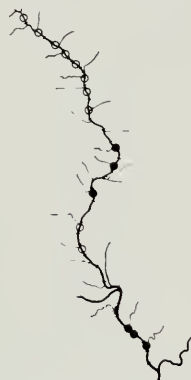
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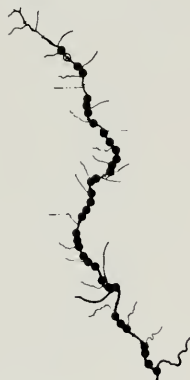
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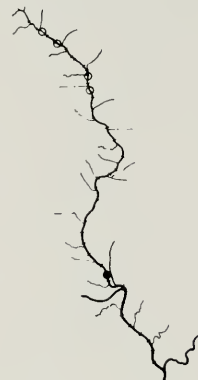
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PIMEPHALES VIGILAX



SEMOTILUS ATROMACULATUS



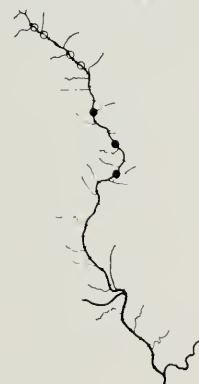
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CARPIODES CYPRINUS



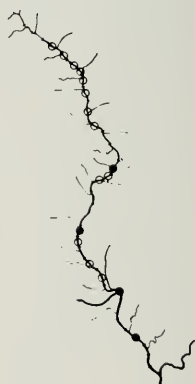
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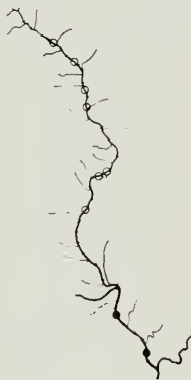
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CYCLEPTUS ELONGATUS



HYPENTELIUM NIGRICANS



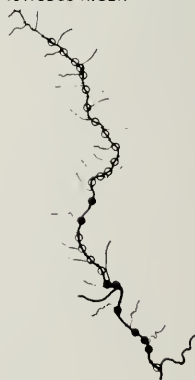
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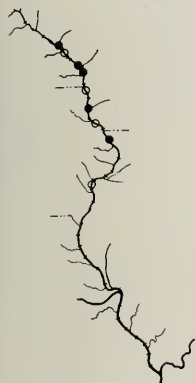
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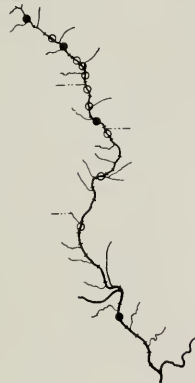
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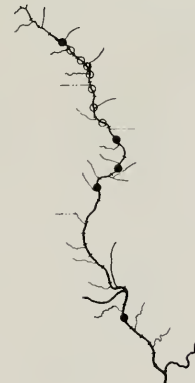
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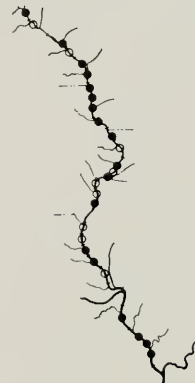
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MOXOSTOMA ERYTHRURUM



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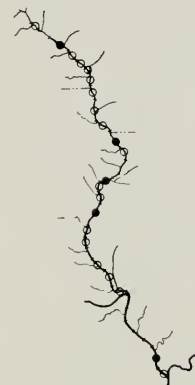
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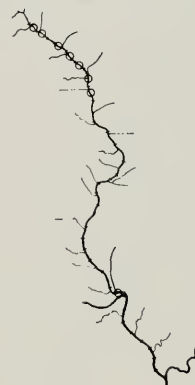
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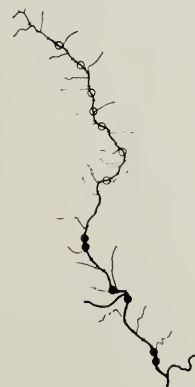
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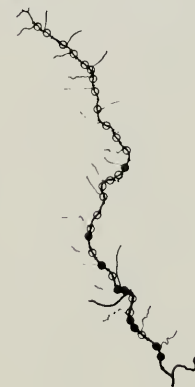
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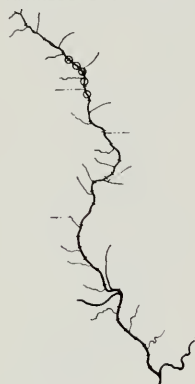
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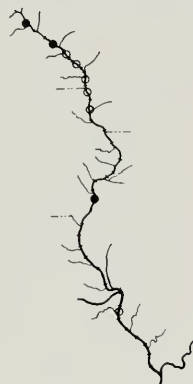
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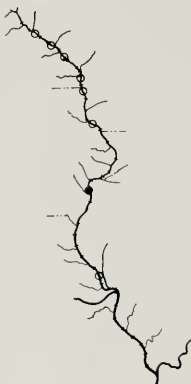
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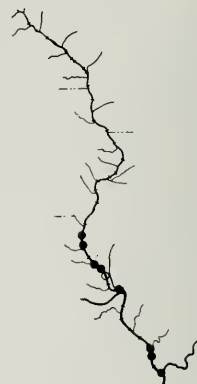
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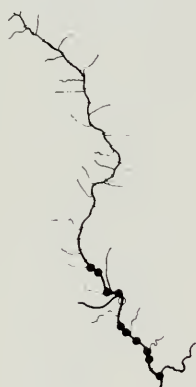
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FUNDULUS NOTATUS



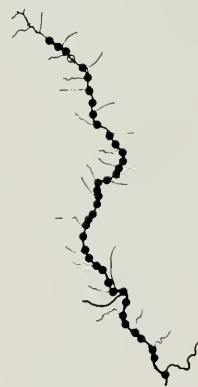
GAMBUSIA AFFINIS



LABIDESTHES SICULUS



MORONE CHRYSOPS



MORONE MISSISSIPPIENSIS



AMBLOPLITES RUPESTRIS



LEPOMIS GULOSUS



LEPOMIS CYANELLUS



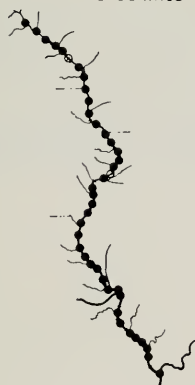
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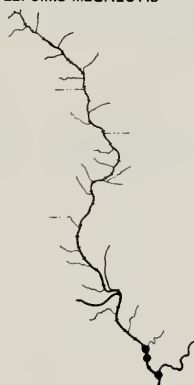
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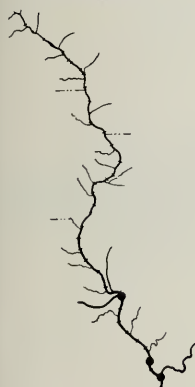
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MICROPTERUS DOLOMIEUI



MICROPTERUS PUNCTULATUS



MICROPTERUS SALMOIDES



POMOXIS ANNULARIS



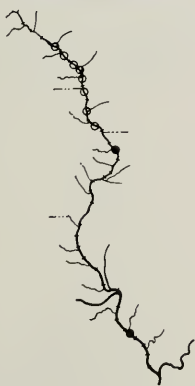
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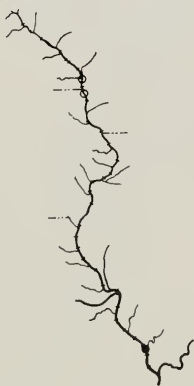
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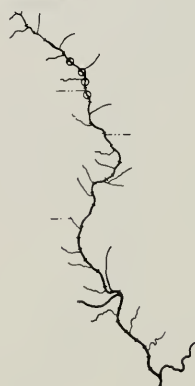
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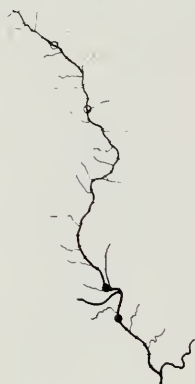
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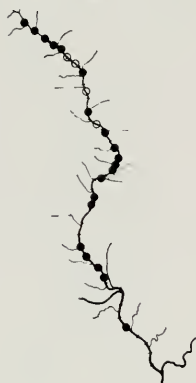
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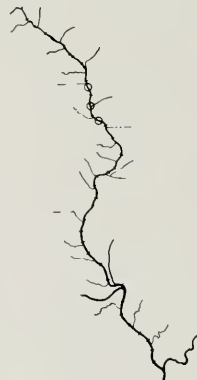
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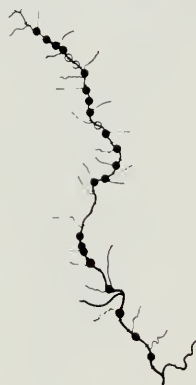
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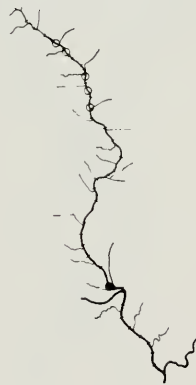
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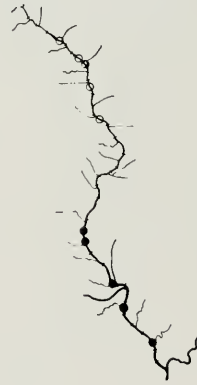
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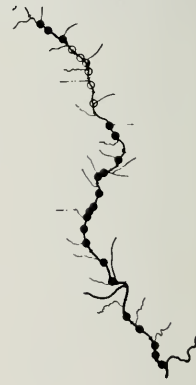
PERCINA MACULATA



PERCINA PHOXOCEPHALA



PERCINA SHUMARDI



STIZOSTEDION CANADENSE



STIZOSTEDION VITREUM



APLODINOTUS GRUNNIENS





