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The Distribution of Minnesota Fishes and Late Pleistocene Glaciation

JAMES C. UNDERHILL

Introduction

The fishes of Minnesota have been the focus of research for almost a century beginning with the pioneer ichthyologists Ulysses O. Cox (1, 2), Alfred Woolman (3) and with more recent contributions by Thaddeus Surber (4), Samuel Eddy (5) and many others (6, 7, 8, 9). At present the ichthyofauna totals 153 species belonging to 19 families, including 13 species which have been introduced (Table 1). The origin of and the migration routes followed by various species have been of interest for over a half century (10). Minnesota was covered by glacial ice up until at least late Wisconsinan time (11). Species that migrated into the state from the periglacial region could have been derived from three refugia; unglaciated Alaska, the Atlantic refugium, and/or the lower Mississippi River refugium. The routes followed in their dispersal were dependent on drainage connections that existed during late Pleistocene and early Holocene time.

Late Pleistocene and Holocene History

Minnesota is unusual in that its waters drain by three widely divergent courses; 57 percent via the Mississippi River to the Gulf of Mexico, 35 percent via the Red River, Rainy River and Lake of the Woods to Hudson Bay, and 8 percent to the Lake Superior basin to the Gulf of St. Lawrence.

The Mississippi drainage can be subdivided into five subbasins: (1) the upper Mississippi basin, from the headwaters at Lake Itasca to St. Anthony Falls at Minneapolis; (2) the lower Mississippi basin, southward to the Iowa boundary, including the Cedar River of southeastern Minnesota and the Des Moines River of southwestern Minnesota; (3) the St. Croix basin, from the headwaters of the Snake and Kettle River in Minnesota and the St.Croix River in northwestern Wisconsin, to the Mississippi River near Hastings, Minnesota; (4) the Minnesota basin, from the source of the Little Minnesota River, northeastern South Dakota and Big Stone Lake to the mouth of the Minnesota River at Fort Snelling, and (5) the Missouri basin, 1348 km² in Minnesota, comprising a few small streams in southwestern Minnesota which drain through Iowa and South Dakota to the Missouri River.

The upper Mississippi River rises in Lake Itasca in southern Clearwater County. It flows northeasterly and then in an almost complete circle to the mouth of the Crow Wing River; at this point it is only 121 km from its source, but the distance by river is almost 563 km. From the mouth of the Crow Wing River, the Mississippi flows southeastward to Minneapolis; St. Anthony Falls at Minneapolis is here considered the lower boundary of the upper Mississippi River basin.

The lower Mississippi River flows southward below St. Anthony Falls and is joined by the Minnesota River at Fort Snelling and the St. Croix River near Hastings, Minnesota. The Cedar River, an important tributary to the Mississippi River in Iowa, drains 3120 km² in Freeborn, Mower, and parts of Faribault, Fillmore, Dodge, and Steele counties in southeastern Minnesota. The Des Moines River, another important tributary to the Mississippi River in Iowa, drains 3940 km² in seven counties in southwestern Minnesota.

The Hudson Bay drainage comprises the Rainy River system, which connects Rainy Lake and Lake of the Woods, and the succession of lakes about Rainy River, the Boundary Waters, which drain northward in Manitoba through English-Winnipeg river system to the south end of Lake Winnipeg. The area drained in Minnesota is about 29,267 km².

The Red River, while draining into Lake Winnipeg and Hudson Bay, is considered a separate basin. It has its headwaters in Jim Creek, a tributary to Lake Traverse in Roberts County, northeastern South Dakota, and flows northward for a distance of 314 km to the International Boundary. From the boundary, it flows northward approximately 240 km to Lake Winnipeg, Manitoba, Canada. The entire basin lies within the Glacial Lake Agassiz basin. It drains a total of 88,100 km² in Minnesota.

The St. Louis River is the largest tributary to Lake Superior draining 4,400 km² in Carleton, Lake, St. Louis, Aitken, and Itasca Counties. The Pigeon River, which forms a portion of the International Boundary, drains a total area of 1620 km² and is the second largest stream in the basin.

Glaciation has had a profound effect on Minnesota and its ichthyofauna; events in the late Pleistocene and Holocene have determined in large part the distribution of fishes within the drainage systems of the state. All of Minnesota was glaciated at some time and as recently as 14,000 years ago the Des Moines Lobe of Wisconsinan ice occupied all but the southwestern and southeastern corners of the state (11). Therefore all of the drainage systems, except the Mississippi River below St. Paul and melt water streams of the southwest, were covered by ice. Ice also filled the Lake Superior basin and the high ground to the north. The eastern margin of the Des Moines Lobe was controlled by a moraine of earlier date, but in the region of Minneapolis the ice overrode the retaining St. Croix moraine to form the Grantsburg Sublobe (12). The Grantsburg Sublobe, at its maximum, extended northeastward to Grantsburg, Wisconsin, across the bed of the present St. Croix River. This sublobe completely blocked the upper Mississippi channel and diverted its flow to the northeast around the tip of the ice. Water impounded by the ice formed a large shallow lake known as Lake Grantsburg.

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At this time waters from the ice free upper Mississippi basin were drained via the St. Croix River. As the sublode wasted back, the Mississippi River, flowing along the northern ice margin, gradually reached its present channel at Fort Snelling, Minnesota. At approximately the same time that the Des Moines Lobe formed, there was an expansion of ice into the valley of the St. Louis River, which is known as the St. Louis Sublobe. The Superior Lobe flowed eastward from the Lake Superior basin to the northeastern margin of the St. Louis Sublobe. Melt waters from the Superior Lobe joined those of the upper Mississippi basin, flowing through the St. Croix outlet. It was then possible (12000-14000 BP) for fishes from the Mississippi River refugium to migrate into the upper Mississippi as well as the Lake Superior region.

Sometime between 11000 and 12000 years ago, a proglacial lake, Lake Milnor, marked the beginning of one of the more significant events in the geological history of western Minnesota — the formation of Glacial Lake Agassiz (15, 16). Lake Agassiz, named after Louis Agassiz, the father of glacial geology and zoology in the United States, occupied a drainage of over 2,000,000 km² throughout its 4000 year history. Its expanse from the Rocky Mountains in Alberta to Lake Superior in Ontario is an area three times that of the modern Laurentide Great Lakes (14). It inundated at least 1,000,000 km² in Manitoba, Saskatchewan, Ontario, Minnesota, and North and South Dakota. Retreat of the Des Moines Lobe was followed by its readvance into Iowa, and the advance of the James River Lobe in South Dakota, about 12000-12600 BP (13). Retreat of the latter lobes into the Red River Basin formed Lake Agassiz I. Stratigraphic studies along the southern margin of the lake indicate that there was periodic wasting of the ice margin followed by surges of the Red River and James River lobes. Perhaps as many as six surges may have occurred, which filled the Agassiz basin. Continued wastage of the ice lobes transformed Lake Milnor into Lake Agassiz. Waters impounded between the ice margin to the north and the height of land to the south drained southward through the River Warren, producing the modern Minnesota River valley. This southern outlet to the Mississippi River was operative when the eastern Lake Agassiz outlets were blocked by ice in the Lake Superior-Nipigon basins. This was the first time since late Wisconsinan glaciation that fishes were able to migrate directly to the Red River Basin.

At about 11500 BP the ice had wasted back to the International Boundary into central Manitoba and Lake Agassiz extended 700 km from the north to the River Warren outlet (14). When the ice margin wasted away north of Thunder Bay, Ontario, about 11000 BP, Lake Agassiz flowed eastward through the Nipigon basin into Lake Superior, and the southern River Warren outlet was abandoned. Lake Superior drained via Sault St. Marie to Lake Huron (17, 18). Fishes from the eastern Great Lakes refugium could have then gained access to Lakes Superior and Agassiz. By 10500 BP all of the Lake Agassiz floor in Minnesota was much as it is today.

The eastern ice readvanced through the region about 9900 BP, across the Lake Superior basin to Marquette, Michigan (Marquette Lobe), closing the Nipigon outlets. Lake Agassiz rose and again drained southward through the Minnesota Valley to the Mississippi River (14, 24). This Lake Agassiz II stood at the Campbell Beach level and covered about 350,000 km². The River Warren was again a route for migration from the Mississippi refugium.

About 9500 BP the Marquette Lobe retreated and uncovered the eastern outlets at Nipigon and the waters in Lake Agassiz dropped rapidly; they dropped at least 200 meters in the period 9500-8500 BP (19). The ice margin wasted back beyond the Hudson Bay-Lake Superior divide about 8500 BP, and Lake Agassiz then drained eastward via proglacial Lake Objibway to the Ottawa River and the St. Lawrence River at Montreal (20, 21). The final drainage of Agassiz was into the Tyrell Sea Near James Bay about 7500 BP (22).

Along with the major Agassiz connections there are other events that are of great significance in an attempt to explain the dispersal of fishes into glaciated western and north central Minnesota.

In the northern part of the Agassiz basin, Glacial Lake Koochiching existed as an eastern arm of Lake Agassiz (17, 22). The lake was apparently ice walled and drained eastward through the Embarass Gap, then down the Pike River into Lake Aitkin-Upham. From there the flow was through the Cloquet River, then around the Superior Lobe to the Moose, Kettle, and the St. Croix rivers. Continued melting of the ice wall uncovered a lower outlet, the Prairie River channel, near Grand Rapids, which carried melt water from Lake Koochiching into Lake Aitkin-Upham. For a short period, water in the southern Lake Agassiz basin (Lake Climax) drained northward at Trail, Minnesota, through the McIntosh channel into Lake Koochiching. Any fishes in the upper Mississippi and St. Croix drainages could have migrated into Lake Koochiching at this time. Continued wastage of the ice front at the west end of Lake Koochiching opened a lower outlet, the reversed McIntosh channel, and drainage was southward; the Prairie River outlet was abandoned. During this period, 9000-10000 BP, Lakes Aitkin and Upham became separated and were drained by the Mississippi and St. Louis rivers respectively (23).

Events associated with the eastern outlets of Lake Agassiz I and II through the Lake Nipigon basin to Lake Superior have been summarized by Teller (14) and Teller and Thorleifson (19). The eastern outlets were finally abandoned about 8500 BP and drainage systems as we know them today in the Lake Agassiz basin in Minnesota came into existence.

Clayton (17) and Farrand and Drexler (24) provide a detailed late Wisconsin glacial history of events in the Lake Superior basin. Up until about 11500 BP, the Lake Superior basin was filled with Laurentide ice. When the ice sheet wasted back into the basin, two proglacial lakes were formed on the ice margin. Lake Duluth was at the western margin of the basin with Lake Ontonagon at the southern margin, and these drained southward into the St. Croix River to the lower Mississippi River. At this time the route from the lower Mississippi to the Lake Superior basin was open for migration. These outlets were abandoned when the Superior Lobe retreated northeastward out of the basin and lower outlets were uncovered — perhaps in the Huron Mountain region of Michigan. The Marquette readvance of the Superior Lobe about 10000 BP may well have filled the entire Lake Superior basin (17). Western outlets again were operative and melt waters drained to the St. Croix River via the Portage and Brule River spillway. Once the Marquette Lobe had retreated beyond the tip of the Keewenaw Peninsula, waters drained eastward to the lower Great Lakes (ca 9500 BP).

Changes that may have occurred in the drainage systems in Minnesota in the Holocene are largely conjectural but similarities in faunal and floral assemblages may provide clues to such changes. An example is the channel catfish, *Ictalurus punctatus,* which is present in the St. Louis River above Scanlon, Minnesota (7), and is absent throughout the remainder of the Lake Superior basin. It is common in the St. Croix River. There is evidence that early in post Pleistocene

time the Cloquet River (upper St. Louis River) was tributary to the upper Mississippi River and that the early St. Louis River through headwater erosion and migration, captured the Cloquet River (25).

Distribution of Fish Species

Unfortunately there is little in the way of fish fossil material in Minnesota of Holocene origin, except for that in kitchen middens of relatively recent origin, that would enable us to date more precisely the time of migration of various fish species.

Dispersal of fishes from the periglacial regions of either the Lower Mississippi River basin and/or the Eastern Laurentide Great Lakes was possible from about 14000 BP to 8500 BP until the closure of the eastern outlet of Agassiz II. Throughout the Holocene, the present land barriers between the drainage basins are presumed to have existed. For example, St. Anthony Falls has been a barrier to fish migrants since the late Pleistocene (26). The assumption is that the 65 native species found in the Upper Mississippi River drainage (Table 1) migrated during the period that the glacial St. Croix River, the upper Mississippi River, and the Lake Superior drainage were connected during the late Pleistocene. Only five of these species, *Coregonus artedi, C.clupeaformis, Salvelinus namaycush, Lepomis megalotis* and *Pungitius pungitius* are absent from either the lower Mississippi and/or the St. Croix River drainage. Of these *C. artedi, C.clupeaformis, S. namaycush,* and *L. megalotis* are present in the Lower Mississippi River drainage in Wisconsin where suitable habitats are present (27). *Pungitius pungitius* is known only from the Lake Superior, Rainy River-Lake of the Woods and Upper Mississippi River drainages. The remaining 60 species are shared with the St. Croix River and Lower Mississippi River drainages. The similarity indices (28) are St. Croix-Upper Mississippi River, 0.561; Lower-Upper Mississippi River, 0.500. The 60 species may have been derived from both the Mississippi and Great Lakes refugia.

Of the 88 species native to the St. Croix River, there are only three, *Ichthyomyzon gagei, Hiodon alosoides,* and *Percina evides* that are not present in the lower Mississippi River drainage. The goldeye, *H. alosoides,* does occur in the Minnesota River and may well be present but rare in the Mississippi River drainage south of the mouth of the St. Croix River (27). *Ichthyomyzon gagei* and *Percina evides* represent disjunct populations, present far south in the lower Mississippi River basin (29, 30). The latter species may have had a much wider post Pleistocene or early Holocene range immediately following deglaciation with subsequent reduction and disappearance of intervening populations in the Holocene, perhaps during the dry hypsithermal period up to 5500 BP.

The Minnesota River basin has 84 species of native fishes, all shared with the lower Mississippi River with the exception of the goldeye, *H. alosoides,* whose distribution was discussed previously.

The Missouri River drainage in Minnesota supports fewer species, 38, than any other drainage. The paucity of species is a reflection of the fact that only the headwaters of various tributaries occur within the state. Twenty-four species occur in the downstream reaches of the Big Sioux River in Iowa and South Dakota (30, 31) for a combined total of 62 species. The Missouri ichthyofauna includes three species *Notropis lutrensis, N. topeka* and *Fundulus sciadicus* unique to the drainage. Both *N. topeka* and *F. sciadicus* are prairie species. *Notropis lutrensis* is common in the lower Mississippi River basin in turbid streams from Iowa southward.

The Red River has the fourth largest number of native species, ten more than the Rainy River-Lake of the Woods drainage. The two drainages share fifty-six species (Table 1). The Red River shares seventy-three species with the Minnesota-St. Croix-Lower Mississippi basin; only *Coregonus artedi* and *C. clupeaformis,* both native to cold water lakes, are not found in the lower Mississippi River drainage in Minnesota. Such a close similarity in the ichthyofaunas serves to indicate the significance of the River Warren outlets of Lake Agassiz I and II to the dispersal of fishes from the Mississippi River refugium.

The Rainy River-Lake of the Woods drainage shares six species, *Salvelinus namaycush, Catostomus catostomus, Couesius plumbeus, Cottus bairdi, C. cognatus,* and *Pungitius pungitius,* with the Lake Superior ichthyofauna that are not present in the Red River drainage. Two of these, *Couesius plumbeus* and *Catostomus catostomus,* are the only two species that used only the eastern outlets of Lake Agassiz I or II in their dispersal into the Hudson Bay drainage. Both species have a wide range throughout western and northwestern Canada and into Alaska (33, 34). Both species may have survived in the Alaskan refugium as well as the eastern Great Lakes region. *Salvelinus namaycush, Cottus bairdi, C. cognatus,* and *P. pungitius* may also have used the eastern outlets to Lake Agassiz in their dispersal; however, as noted earlier they are present in the upper Mississippi drainage basin in Minnesota and the lower Mississippi River drainage in Wisconsin (27). Other species common to both the Lake Superior and Rainy River drainages may also have used the eastern outlet but these species were so widely distributed throughout the periglacial regions in late Pleistocene time that they used the western outlets as well. The two species of *Cottus* are common to the Lower Mississippi River drainage but absent from the Red River fauna; they also apparently used the eastern outlets of Lake Agassiz but failed to colonize the Minnesota and Red River drainages. Nineteen species found in the Red River and absent from the Rainy River-Lake of the Woods basin used the southern outlets in their dispersal; *Ichthyomyzon castaneus, Lepisosteuso sseus, Amia calva, Hypentelium nigricans, Ictiobus cyprinellus, Moxostoma valenciennesi, Campostoma anomalum, C. oligolepis, Hybopsis storeriana, Notropis anogenus, N. rubellus, N. texanus, Ictalurus punctatus, Noturus flavus, Morone chrysops, Pomoxis annularis, Etheostoma caeruleum, E. microperca* and *Aplodinotus grunniens.*

Seventeen species of fish, *Alosa chrysochloris, Moxostoma-duquesnei, Clinostomus elongatus, Dionda nubila, Hybognathus nuchalis, Hybopsis x-punctata, Notropis amnis, N. umbratilis, Opsopoeodus emilae, Phenocobius mirabilis, Pimephales vigilax, Noturus exilis, Aphredoderus sayanus, Morone mississippiensis, Ammocrypta asprella, Etheostoma asprigene* and *E. chlorosomum,* are restricted to the lower Mississippi River drainage south of the mouth of the St. Croix River. These are species which were either late migrants that are still expanding their ranges or species that are restricted in distribution by habitat or reproductive requirements. Environmental modifications in the aquatic environment that occurred in the past 200 years may have prevented the natural expansion of a species' range if it is assumed that it was indeed a late arrival during the Holocene. Except in the Great Lakes, there is no clear evidence of extirpation of fish species in Minnesota waters (10). Until we know considerably more

about the biology of the individual species and species interactions it would be conjectural to discuss habitat or reproductive factors as limiting the distribution of a species or a group of species.

The Lake Superior drainage has 68 native fishes and the largest number, eleven, of introduced species. Seven species are found only in Lake Superior, *Coregonus hoyi, C. kiyi, C. zenithicus, Prosopium coulteri, P. cylindraceum, Cottus ricei,* and *Myoxocephalus thompsoni.* The pygmy whitefish, *P. coulteri,* is endemic to Lake Superior, but the other six species are or were found in the other Great Lakes (10).

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Table 1. Fishes of Minnesota. (X = native, I = introduced, L = St. Croix below Taylors Falls, WI = present in Wisconsin, SD = Present in Iowa and/or South Dakota).

Species	Drainage								Species	Drainage							
	Lower Mississippi River	Minnesota River	St. Croix River	Upper Mississippi River	Missouri River	Red River	Rainy River and Lake of the Woods	Lake Superior		Lower Mississippi River	Minnesota River	St. Croix River	Upper Mississippi River	Missouri River	Red River	Rainy River and Lake of the Woods	Lake Superior
Ichthyomyzon castaneus	X	-	X	-	-	X	-	-	*Moxostoma erythrurum*	X	X	X	X	X	X	X	-
Icthyomyzon fossor	WI	-	-	-	-	-	-	X	*Moxostoma macrolepidotum*	X	X	X	X	X	X	X	X
Ichthyomyzon gagei	-	-	X	-	-	-	-	-	*Moxostoma valenciennesi*	X	X	X	X	-	X	-	-
Ichthyomyzon unicuspis	X	-	L	-	-	X	X	X	*Campostoma anomalum*	X	X	X	X	X	X	-	-
Lampetra appendix	X	X	X	-	-	-	-	X	*Campostoma oligolepis*	X	X	WI	-	-	X	-	-
Petromyzon marinus	-	-	-	-	-	-	-	I	*Carassius auratus*	I	I	-	-	-	-	-	-
Polyodon spathula	X	X	-	-	SD	-	-	-	*Clinostomus elongatus*	X	-	-	-	-	-	-	-
Acipenser fulvescens	X	-	X	-	-	X	X	X	*Cteropharyngodon idella*	I	-	-	-	-	-	-	-
Scaphirhynchus platorynchus	X	X	-	-	-	-	-	-	*Couesius plumbeus*	-	-	-	-	-	-	X	X
Lepisosteus osseus	X	X	-	-	SD	X	-	X	*Cyprinus carpio*	I	I	I	I	I	I	-	I
Lepisosteus platostomus	X	X	X	X	-	-	-	-	*Dionda nubila*	X	-	-	-	-	-	-	-
Amia calva	X	X	X	X	-	X	-	-	*Hybognathus hankinsoni*	X	X	X	X	X	X	X	X
Hiodon alosoides	-	X	L	-	SD	X	X	-	*Hybognathus nuchalis*	X	-	-	-	-	-	-	-
Hiodon tergisus	X	X	L	-	-	X	X	-	*Hybopsis aestivalis*	X	X	L	-	-	-	-	-
Alosa chrysochloris	X	-	-	-	-	-	-	-	*Hybopsis gracilis*	-	-	-	-	SD	I	-	-
Alosa pseudoharengus	-	-	-	-	-	-	-	X	*Hybopsis storeriana*	X	X	L	-	-	X	-	-
Dorsoma cepedianum	X	X	L	-	SD	-	-	X	*Hybopsis x-punctata*	X	-	-	-	-	-	-	-
Coregonus artedii	-	-	-	X	-	X	X	X	*Nocomis biguttatus*	X	X	X	X	X	X	X	X
Coregonus clupeaformis	-	-	-	X	-	X	X	X	*Notemigonus crysoleucas*	X	X	X	X	X	X	X	X
Coregonus hoyi	-	-	-	-	-	-	-	X	*Notropis amnis*	X	-	-	-	-	-	-	-
Coregonus kiyi	-	-	-	-	-	-	-	X	*Notropis anogenus*	X	X	WI	X	-	X	-	-
Coregonus zenithicus	-	-	-	-	-	-	-	X	*Notropis atherinoides*	X	X	X	X	SD	X	X	X
Oncorhynchus gorbuscha	-	-	-	-	-	-	-	I	*Notropis blennius*	X	X	L	X	-	X	X	-
Oncorhynchus kisutch	-	-	-	-	-	-	-	I	*Notropis cornutus*	X	X	X	X	X	X	X	X
Oncorhynchus mykiss	I	I	I	I	-	I	I	I	*Notropis dorsalis*	X	X	X	X	X	X	X	-
Oncorhynchus tshawytscha	-	-	-	-	-	-	-	I	*Notropis heterodon*	X	X	X	X	-	X	X	X
Prosopium coulteri	-	-	-	-	-	-	-	X	*Notropis heterolepis*	X	X	X	X	X	X	X	X
Prosopium cylindraceum	-	-	-	-	-	-	-	X	*Notropis hudsonius*	X	X	X	X	SD	X	X	X
Salmo salar	-	-	-	-	-	-	-	I	*Notropis lutrensis*	-	-	-	-	X	-	-	-
Salmo trutta	I	I	I	I	-	I	I	I	*Notropis rubellus*	X	X	-	-	-	X	-	-
Salvelinus fontinalis	X	-	X	I	-	I	I	X	*Notropis spilopterus*	X	X	X	X	X	X	X	-
Salvelinus namaycush	-	-	-	X	-	-	X	X	*Notropis stramineus*	X	X	X	X	X	X	X	-
Osmerus mordax	-	-	I	-	-	-	I	I	*Notropis texanus*	X	X	X	-	-	X	-	-
Carpiodes carpio	X	X	X	-	X	-	-	-	*Notropis topeka*	-	-	-	-	X	-	-	-
Carpiodes cyprinus	X	X	X	-	X	X	X	-	*Notropis umbratilis*	X	-	-	-	-	-	-	-
Carpiodes velifer	WI	-	-	-	-	-	-	-	*Notropis volucellus*	X	X	X	X	-	X	X	X
Catostomus catostomus	-	-	-	-	-	-	X	X	*Opsopoeodus emilae*	X	-	WI	-	-	-	-	-
Catostomus commersoni	X	X	X	X	X	X	X	X	*Phenacobius mirabilis*	X	-	-	-	-	-	-	-
Cycleptus elongatus	X	-	WI	-	SD	-	-	-	*Phoxinus eos*	X	X	X	X	SD	X	X	X
Hypentelium nigricans	X	X	X	-	-	X	-	-	*Phoxinus erythrogaster*	X	X	-	-	X	-	-	-
Ictiobus bubalus	X	X	L	-	SD	-	-	-	*Phoxinus neogaeus*	-	-	X	X	-	X	X	X
Ictiobus cyprinellus	X	X	L	X	SD	X	-	-	*Pimephales notatus*	X	X	X	X	X	X	X	X
Ictiobus niger	WI	-	-	-	-	-	-	-	*Pimephales promelas*	X	X	X	X	X	X	X	X
Minytrema melanops	X	-	L	-	-	-	-	-	*Pimephales vigilax*	X	-	-	-	-	-	-	-
Moxostoma anisurum	X	X	X	X	X	X	X	X	*Rhinichthys atratulus*	X	X	X	X	X	X	X	X
Moxostoma carinatum	X	X	L	-	-	-	-	-	*Rhinichthys cataractae*	X	X	X	X	X	X	X	X
Moxostoma duquesnei	X	-	-	-	-	-	-	-	*Semotilus atromaculatus*	X	X	X	X	X	X	X	X
									Semotilus margarita	X	X	X	X	-	X	X	X

Table 1. Fishes of Minnesota. (X = native, I = introduced, L = St. Croix below Taylors Falls, WI = present in Wisconsin, SD = Present in Iowa and/or South Dakota).

Species	Drainage								Species	Drainage							
	Lower Mississippi River	Minnesota River	St. Croix River	Upper Mississippi River	Missouri River	Red River	Rainy River and Lake of the Woods	Lake Superior		Lower Mississippi River	Minnesota River	St. Croix River	Upper Mississippi River	Missouri River	Red River	Rainy River and Lake of the Woods	Lake Superior
Ictalurus melas	X	X	X	X	X	X	X	X	*Pomoxis nigromaculatus*	X	X	X	X	SD	X	X	X
Ictalurus natalis	X	X	X	X	-	-	X	-	*Ammocrypta asprella*	X	-	WI	-	-	-	-	-
Ictalurus nebulosus	X	X	X	X	X	X	X	X	*Ammocrypta clara*	X	X	L	-	-	-	-	-
Ictalurus punctatus	X	X	X	-	X	X	-	X	*Gymnocephalus cernua*	-	-	-	-	-	-	-	I
Noturus exilis	X	-	-	-	-	-	-	-	*Etheostoma asprigene*	X	-	-	-	-	-	-	-
Noturus flavus	X	X	X	-	X	X	-	-	*Etheostoma caeruleum*	X	X	L	-	-	X	-	-
Noturus gyrinus	X	X	X	X	X	X	X	X	*Etheostoma chlorosomum*	X	-	-	-	-	-	-	-
Pylodictus olivaris	X	X	X	-	SD	-	-	-	*Etheostoma exile*	X	X	X	X	X	X	X	X
Umbra limi	X	X	X	X	SD	X	X	X	*Etheostoma flabellare*	X	X	L	-	-	-	-	-
Esox lucius	X	X	X	X	X	X	X	X	*Etheostoma microperca*	X	-	WI	X	-	X	-	-
Esox masquinongy	WI	-	WI	X	-	-	X	X	*Etheostoma nigrum*	X	X	X	X	X	X	X	X
Anquilla rostrata	X	X	X	X	SD	-	-	X	*Etheostoma zonale*	X	X	-	-	-	-	-	-
Fundulus diaphanus	X	X	WI	X	SD	X	-	-	*Perca flavescens*	X	X	X	X	X	X	X	X
Fundulus sciadicus	-	-	-	-	X	-	-	-	*Percina caprodes*	X	X	X	X	SD	X	X	X
Lota lota	X	X	X	X	-	X	X	X	*Percina evides*	-	-	X	-	-	-	-	-
Percopsis omiscomaycus	X	X	X	X	X	X	X	X	*Percina maculata*	X	X	X	-	SD	X	X	-
Aphredoderus sayanus	X	-	-	-	-	-	-	-	*Percina phoxocephala*	X	X	X	-	-	-	-	-
Labidesthes sicculus	X	-	X	X	-	-	-	-	*Percina shumardi*	X	-	L	-	-	X	X	-
Morone americana	-	-	-	-	-	-	-	I	*Stizostedion canadense*	X	X	L	-	SD	X	X	X
Morone chrysops	X	X	X	-	SD	X	-	X	*Stizostedion vitreum*	X	X	X	X	SD	X	X	X
Morone mississippiensis	X	-	-	-	-	-	-	-	*Aplodinotus grunniens*	X	X	X	-	SD	X	-	-
Ambloplites rupestris	X	X	X	X	-	X	X	X	*Cottus bairdi*	X	-	X	X	-	-	X	X
Lepomis cyanellus	X	X	X	X	X	X	X	X	*Cottus cognatus*	X	-	WI	X	-	-	X	X
Lepomis gibbosus	X	X	X	X	-	X	X	X	*Cottus ricei*	-	-	-	-	-	-	-	X
Lepomis gulosus	WI	-	WI	-	-	-	-	-	*Myoxocephalus thompsoni*	-	-	-	-	-	-	-	X
Lepomis humilis	X	X	L	-	X	-	-	-	*Culaea inconstans*	X	X	X	X	X	X	X	X
Lepomis macrochirus	X	X	X	X	X	X	X	X	*Pungitius pungitius*	-	-	-	X	-	-	X	X
Lepomis megalotis	WI	-	-	X	-	-	X	-	Total Species	117	88	92	69	39	80	68	79
Micropterus dolomieui	X	X	X	X	-	X	X	X	Introduced	5	4	4	4	1	5	4	11
Micropterus salmoides	X	X	X	X	SD	X	X	X	Native Species	112	84	88	65	38	75	64	68
Pomoxis annularis	X	X	X	X	SD	X	-	-									