Great Lakes – Upper Mississippi

Species Summaries

LISTING STATUS: red (ESA listed as Threatened or Endangered), yellow (not ESA listed but federal sensitive species or state species of concern (majority of states), green (not listed in majority of states)

CURRENT RANGE: red (10 percent or less), yellow (11-25 percent), green (>25 percent)

HISTORICAL RANGE: red (<1,000 miles), yellow (1,000-10,000 miles), green (>10,000 miles)

TROUT UNLIMITED

Brook Trout (Great Lakes/Upper Mississippi)

Category	Status	Explanation
Listing status		Species of Special Concern (IA)
Current range		~50 percent of historical habitat currently occupied; but widely stocked outside of historical habitat
Historical range		Widely distributed historically in the region, over 77 million acres
Climate change		Stream warming and higher frequency of larger floods
Energy development		Mining of frack sands for hydraulic fracturing is a threat in some areas
Non-native species		Introduced rainbow and brown trout pose competition and predation risks; Great Lakes salmon and steelhead pose competitive risk to coaster brook trout
Water demand		Localized water demand can influence flows
Data issues		No consistent rangewide database, but state databases exist

Lake Trout

Category	Status	Explanation
Listing status		Species of Concern (IN, OH)
Current range		Populations in the Great Lakes are reduced, but the species has been widely stocked for sportfishing
Historical range		Great Lakes Basin, and somewhat uncertain distribution in the northeast due to early, undocumented stockings. Native to a few glacial refugia lakes in Montana
Climate change		Warmer lake temperature may render some lakes unsuitable
Energy development		No known threats
Non-native species		Pacific salmon and steelhead, sea lamprey, and invasive mussels
Water demand		No known issues
Data issues		Most populations have good monitoring data

Salvelinus fontinalis

Brook Trout *(Salvelinus fontinalis)*

The brook trout (*Salvelinus fontinalis*) is native to the Great Lakes and Upper Mississippi River basins, where its historical distribution includes Lake Superior and northern Lake Michigan and Lake Huron and tributaries, as well as the Upper Mississippi River Basin south to the Driftless Area of Wisconsin, Minnesota, Iowa and Illinois. The exact native range of brook trout in the Great Lakes is uncertain. For example, some notable trout experts suggest brook trout were native to the northern-most portion of Michigan's Lower Peninsula. However, others have suggested that brook trout did not invade the Lower Peninsula until Arctic grayling began to decline there around the mid-1800s. Regardless, some experts even think that brook trout did not naturally occur as far south as the Manistee and Muskegon rivers (now two of Michigan's most famous trout streams), or even the Au Sable River on the banks of which Trout Unlimited was founded. Why brook trout never inhabited these southern tributaries of Lake Michigan and Lake Huron is not clear, however. The most notable brook trout in the Great Lakes is the coaster. Coaster brook trout can exhibit an adfluvial life history whereby individuals reside in the Great Lakes but then migrate into tributaries to spawn in the fall. Around Isle Royale in Lake Superior, coaster brook trout are completely lacustrine where they reside in near-shore areas and spawn along gravel shorelines.

Great Lakes brook trout were impacted by historical logging practices, mining and impassible road crossings and dams. In the Driftless Area, high rates of soil erosion from certain agricultural practices degraded brook trout habitat. Across both regions, brook trout now occur in approximately 50 percent of their historical habitat. However, they have been widely cultured and stocked and therefore now occur in many streams not previously occupied, such as those in Michigan's Lower Peninsula. While some range reduction has occurred, the coaster life history has taken the biggest hit due to overharvest, habitat impacts and impassible barriers on tributary streams, and interactions with non-native salmon, steelhead and other sport fisheries in the Great Lakes. Coaster brook now occupy only about 13 percent of historical watersheds. Much effort has been put towards coaster brook trout recovery, including documenting and prioritizing fish passage projects, stream rehabilitation and reintroduction efforts with the goal of having populations in as many historical habitats as possible (1). In the Driftless Area, wide implementation of conservation farming practices and large-scale, multi-partner restoration programs – such as TUDARE – have led to restoration of many Driftless Area streams to the benefit of trout.

Salvelinus namaycush

Lake Trout *(Salvelinus namaycush)*

The lake trout is native to the Great Lakes basin, occupies cold, deep lakes and historically occupied all five of the Great Lakes. Because lake trout can attain large sizes (lake trout close to 50 inches long and over 100 pounds have been recorded), they are an important sport fish that have been cultured and stocked in many places. While lake trout can attain large sizes, they are often slow-growing because their cold, deep lake habitat is not very productive. This results in populations with an age distribution shifted towards older individuals when compared to most fish populations. Because early lake trout stockings were not well documented, the exact historical distribution of lake trout is not known.

Commercial fishing, pollution and nutrient enrichment, and introduced species have impacted lake trout populations in the Great Lakes. Commercial fishing exploited over 20 million pounds of lake trout as early as the early 1900s, especially in the upper lakes: Huron, Michigan and Superior. Since lake trout are often in unproductive lakes and have an older age distribution they are very susceptible to overfishing. Because many U.S. cities are located on the shores of the Great Lakes (Chicago, Cleveland, Detroit), many pollutants have been discharged into the Great Lakes (2). This has resulted in nutrient enrichment that has been detrimental to lake trout. For example, Lake Erie is

Lake trout

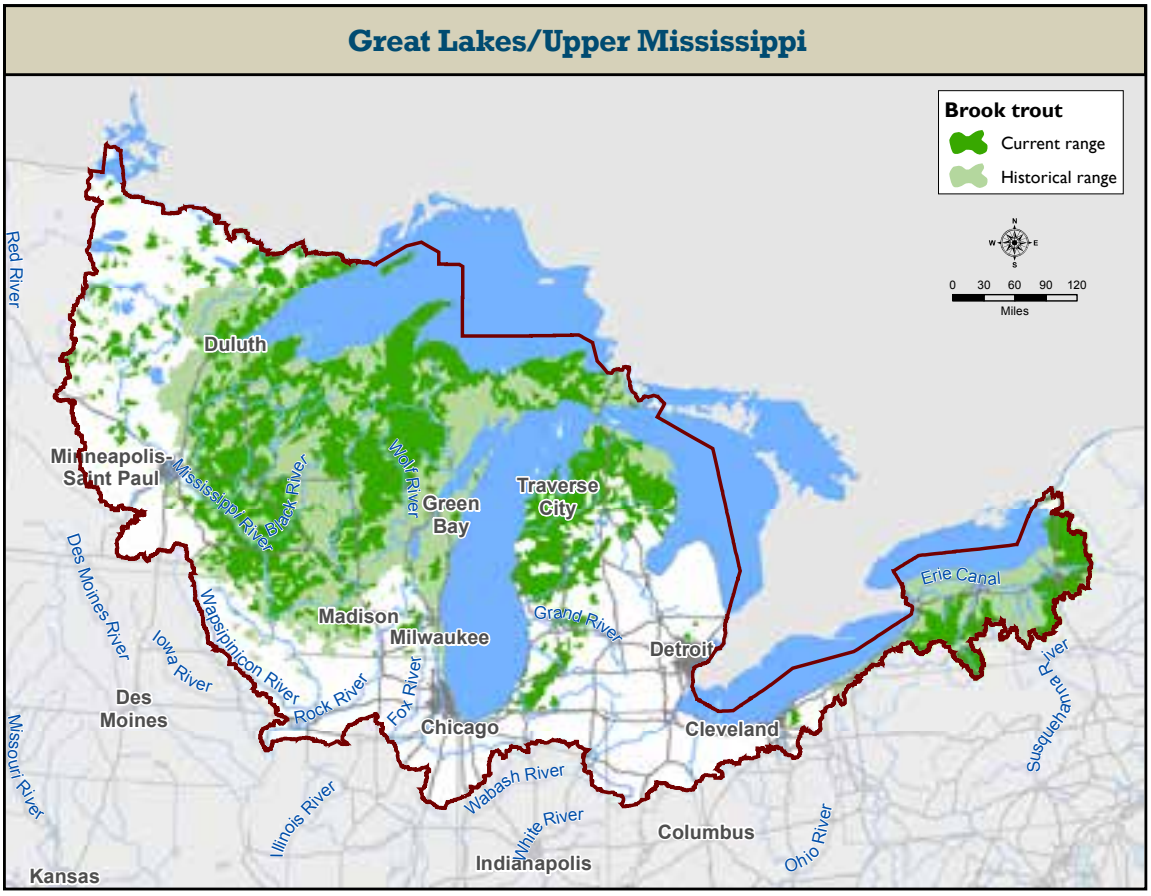
the shallowest of the Great Lakes and nutrient enrichment has resulted in excess algae blooms. When these algae blooms die off they sink to the bottom and are decomposed by bacteria. These bacteria consume oxygen and often deplete oxygen (hypoxia) in the deeper parts of lakes where lake trout reside. Because lake trout require well-oxygenated water, much of their habitat is no longer suitable. One of the largest impacts on lake trout has been the introduction of non-native species, particularly the sea lamprey. While the sea lamprey was native to Lake Ontario, it was restricted to below Niagara Falls, at least until construction of the Welland Canal. Sea lampreys attach themselves to lake trout and ingest bodily fluids. Lake trout were extirpated from Lake Ontario, Lake Erie and Lake Michigan and only remnant populations were left in Lake Huron; Lake Superior was the only lake to maintain offshore populations buffered from the sea lamprey. Pacific salmon and steelhead were introduced to take the place of lake trout at the top of the food chain in the Great Lakes and their naturalization there has inhibited lake trout conservation and recovery efforts.

Regional Trends

In the Great Lakes region, as in most places, a warming climate poses threats to trout that live in cold water. In fact, Wisconsin scientists predict that brook trout habitat will decrease by nearly 50 percent even under limited climate warming (3). Climate warming will trigger changes to precipitation regimes and in the upper Midwest climate warming is predicted to increase the intensity and severity of rainfall events, which will in turn lead to increased flooding – something that has been observed already in the last decade. Historic floods have ravaged trout streams over the last five years and streamflow trends have reflected an increase in peak flows and flooding in southern Wisconsin (4). Warming stream temperatures also have indirect effects on trout, such as increased prevalence of diseases and parasites. In fact, gill lice, a louse that attaches to the gills of brook trout and impedes their respiratory ability, have been observed to increase in some streams and scientists think that warmer temperatures may be part of the reason (5).

People don't often think of the upper Midwest when they think of energy development. However, energy development elsewhere causes impacts in the Midwest. Hydraulic fracturing used to extract oil and gas from some geologic formations with low permeability uses water to fracture the formation and 'frack sand' to keep the fractures open and permeable. Frack sands are high quality silica sand with durable, round grains and one oil or gas well can require several tons of this material. The increasing use of hydraulic fracturing has led to a high demand for frack sand -- most of which comes from the Midwest. Wisconsin, for example, which has numerous trout streams across the state, is a leading producer of frack sands. Like other types of mining, frack sand mining can contribute fine sediments to streams, use water, and expel used water with poor quality into streams and rivers.

While historical agriculture and silviculture may be mostly to blame for reductions in the historical abundance and distribution of brook trout in the upper Midwest, there is no doubt that the introduction of non-native salmonids has led to negative interactions with the region's native brook trout (6). Brown trout and rainbow trout have been widely stocked in streams and rivers to diversify sportfishing opportunities. However, the increased value placed on native trout species, whether due to petitions to list them under the Endangered Species Act or simply the recognition that they were here prior to European settlement, has led to more interest in preserving them



Historical and current distributions of native brook trout in the Great Lakes/Upper Mississippi Region.

in, or restoring them to, the coldwater habitats they once inhabited. For example, brown trout were widely stocked because they are known to be more tolerant of degraded stream conditions. However, stream restoration efforts have increased the habitat amenable to the fickle brook trout, and the removal of brown trout for the benefit of brook trout has been evaluated in some Driftless Area streams. Likewise, salmon and steelhead have been introduced into the Great Lakes and interactions with these Pacific Northwest fishes have been cited as one reason for the decline of the famed coaster brook trout. Since most introduced trout and salmon have been in the Midwest for decades, resource managers today also must balance the preferences of anglers wishing to pursue these highly prized sport fish versus those of anglers wishing to pursue what they consider to be part of their natural heritage – a native brook trout.

While commercial fishing and pollution have played a role in reducing the abundance of lake trout populations in the Great Lakes region, non-natives have played a significant role as well. The opening of the Welland Canal allowed sea lamprey to colonize Lakes Erie, Huron, Michigan and Superior, where they attach themselves to lake trout. Round gobies and smelts are also considered harmful to lake trout because they prey on eggs and fry. Because of suppressed abundance or extirpation of lake trout in the Great Lakes, Pacific salmon and steelhead were stocked to fill the void left by lake trout as a top predator. Originally stocked to control unchecked populations of alewives, which also invaded through the Welland Canal, Pacific salmon and steelhead have now naturalized and provide popular sport fisheries, the presence of which inhibits lake trout restoration in some of the Great Lakes. While fish non-native to the Great Lakes have been naturalized for some time now, new invaders such as zebra and quagga mussels have only recently invaded and their expansion will continue to alter Great Lakes ecosystems. Some recent evidence suggests that invasive mussels are altering Great Lakes ecosystems in a way that is detrimental to non-native Pacific salmon and alewives but beneficial to lake trout and other natives like yellow perch and walleye.

Consider...

People don't often think of the upper Midwest when they think of energy development. However, energy development elsewhere causes impacts in the Midwest. Hydraulic fracturing used to extract oil and gas from some geologic formations with low permeability uses water to fracture the formation and 'frack sand' to keep the fractures open and permeable. Frack sands are high quality silica sand with durable, round grains and one oil or gas well can require several tons of this material. The increasing use of hydraulic fracturing has led to a high demand for frack sand—most of which comes from the Midwest. Wisconsin, for example, which has numerous trout streams across the state, is a leading producer of frack sands. Like other types of mining, frack sand mining can contribute fine sediments to streams, use water and expel used water with poor quality into streams and rivers.

WWW.RECOVGLOBAL.COM

Wisconsin holds 75% of the frac sand market in the US. It is a relatively new industry with little oversight in Wisconsin.

SUCCESS STORY:

Stream Restoration in the Driftless Area

The Driftless Area – that area in Wisconsin, Minnesota, Iowa and Illinois missed by the most recent glaciation – is a bluff land region with numerous springs and over 4,000 miles of coldwater streams. Early land clearing and farming practices led to much erosion of upland soils that triggered a movement towards conservation farming in the 1930s. While stream conditions have improved substantially since then, many Driftless streams still have excess fine sediments that smother spawning habitat as well as the habitat for stream invertebrates that trout feed upon. Floodplains of Driftless Area streams also have accumulated as much as ten feet or more of new sediment derived from farm fields and gullies. Fire suppression and encroachment of shallow-rooted trees, when coupled with higher floodplains, has led to increased streambank erosion – a leading contributor of sediment to streams. Implementation of conservation farming practices has reduced soil erosion and benefited the 600 spring creeks in the Driftless Area; the region now hosts a fishing industry that contributes over $1 billion to the regional economy. In addition, local, state, federal agencies and conservation groups like Trout Unlimited – collectively known as the Driftless Area Restoration Effort (DARE) – have been working to restore Driftless streams by controlling streambank erosion, reconnecting streams with their floodplains and enhancing fish habitat. In the last 25 years, over 450 miles of stream have been restored in the Driftless Area and many projects completed on private land now have angler access easements. Thus, Driftless Area restoration is a boon for trout, as well as for anglers.

An angler coaxing trout in a restored reach of a Driftless stream. Photo: J. Hastings

Contour farming practices in the uplands of the Driftless Area.

SUCCESS STORY:

Protecting and Restoring Coldwater Fisheries in a Changing Climate

BY NICHOL DEMOL AND JEREMY GEIST, TROUT UNLIMITED

With more than twenty percent of the world's freshwater flowing through its rivers, streams and lakes, the Great Lakes basin provides an unparalleled coldwater resource. Because it is a veritable ark of coldwater fishes, perhaps nowhere else are the impacts of climate change more threatening to such a vast array of aquatic species. Climate warming is predicted to increase the intensity and severity of rainfall events, which could affect the ability of coldwater fishes in these rivers to thrive or even survive, thus impacting the livelihood of communities built around these water resources.

Volunteers planting native plants along the Rogue River to help slow down and infiltrate stormwater runoff before it enters the river. Photo by Nichol DeMol.

In the more urbanized Lower Peninsula of Michigan, Trout Unlimited is working with local governments in the Rogue River watershed to adopt policies that will protect coldwater resources from increased surface runoff. A Rogue River Stormwater Guidebook has been developed to educate and empower planning commissions on making wise land use decisions that protect natural resources. In addition, Trout Unlimited is working with homeowners, businesses and municipalities in the watershed to implement low impact development practices that manage stormwater close to its source and infiltrate runoff to protect water quality.

In northern Michigan, Trout Unlimited has started a new initiative that is addressing aquatic organism passage issues such as poorly designed road-stream crossings and dams. There are over 2,500 dams in Michigan and an unknown number of road culverts that act as barriers to fish migration, fragment coldwater habitat and disrupt stream processes. Trout Unlimited is currently identifying, prioritizing and implementing road-stream crossing improvements and habitat restoration in northwest Michigan that will improve watershed resiliency in the face of predicted climate change and sustain coldwater fisheries for the enjoyment of future generations of anglers.

Perched culvert in Northern MI.