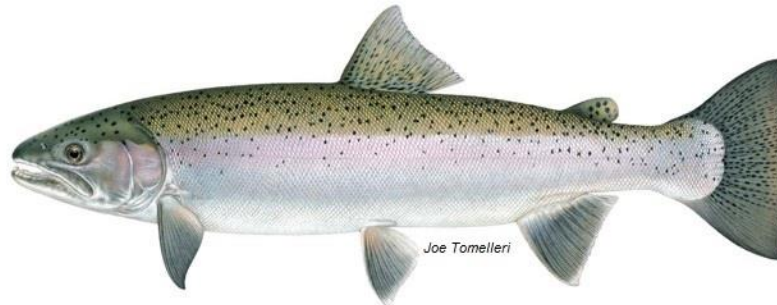


Rainbow Trout Genetics and Future Management



The Minnesota Department of Natural Resources (MN DNR) has sustained fishable populations of two strains of Rainbow Trout in North Shore tributaries to Lake Superior. The Kamloops is a domesticated hatchery strain introduced in the 1970s. The steelhead is a naturalized (wild) strain that was introduced in the late 1800s that have adapted to survive the sometimes hostile conditions of North Shore tributaries. Since 1997, steelhead regulations have been catch-and-release only due to population declines and Kamloops have been stocked to provide a harvest fishery while steelhead populations are rehabilitated. Studies conducted on the North Shore indicate that continued maintenance of both strains would be detrimental to steelhead populations. In 2016, MN DNR started the Steelhead Genetics Project to evaluate hybridization between Kamloops and steelhead populations in Minnesota waters of Lake Superior. In 2016 and 2017, the MN DNR collected genetic samples from juvenile steelhead in North Shore streams, adult steelhead that returned to traps, and anglers collaborated with MN DNR to collect genetic samples from adult steelhead caught in streams and Lake Superior.

What do previous genetic studies done on North Shore rainbow trout tell us?

- Survival of eggs from Kamloops and Kamloops x steelhead crosses was much lower than steelhead crosses. Steelhead production is reduced when Kamloops spawn with steelhead (Negus 1999).
- Offspring from Kamloops x steelhead crosses can be produced and survive winter in North Shore streams, but do not survive as well as offspring from steelhead x steelhead crosses (Close 1999).
- Survival of Kamloops x steelhead crosses from fry to age-1 was 42-70% lower compared to wild steelhead crosses. When steelhead spawn with Kamloops it reduces the number of young fish produced and thus the contribution the steelhead parent could have made if it had spawned with another steelhead, this is called “gamete wastage” (Miller, et al. 2004).
- A model indicated that continued annual Kamloops stocking could result in large and consistent hybridization of Kamloops and steelhead, reduce the long-term reproductive potential of steelhead, and increase extinction risk of steelhead in Lake Superior (Page et al. 2011).

What have we learned from the Steelhead Genetics Project?

- Samples collected in 2016 and 2017 confirmed that genetic introgression (Kamloops genes mixing into steelhead populations) is occurring in the French River Feral Steelhead Broodstock, the Knife River Captive Steelhead Broodstock, juvenile steelhead sampled along the North Shore

and in Wisconsin's Brule River, as well as adults caught by anglers along the North Shore and in Michigan waters of Lake Superior.

- Samples collected in 2016 and 2017 also confirmed juvenile and adult Kamloops exist in the wild and, without genetic testing, are visually indistinguishable from wild steelhead. Pure wild-produced Kamloops, with all fins intact, were confirmed in the French River Feral Broodstock. This has forced MN DNR into genetic testing every fish it uses during steelhead spawning operations.
- Other findings:
 - Introgression was detected in both juvenile and adult samples from the Brule River, Wisconsin.
 - The levels of hybridization among North Shore streams was highest in the lower shore, intermediate in middle shore, and lowest in the upper shore; higher levels of introgression generally corresponded to rivers stocked with Kamloops in the last few decades.
 - In 2016, naturally-produced (unclipped) Kamloops juveniles or adults were found in nine streams spread throughout the North Shore and adult fish caught by boat anglers fishing Minnesota waters of Lake Superior. In 2017, naturally-produced adult Kamloops were caught by anglers in 5 streams: Stewart, Split Rock, Devil Track, Baptism and Cascade.
 - In 2016, juvenile fish showed some sign of Kamloops genetic introgression in 22 of the 24 streams sampled.
 - In 2016 and 2017, relatively high introgression was found in French River feral (wild) steelhead broodstock and lower introgression was found in Knife River captive steelhead broodstock.

Implications for Rainbow Trout management?

- Confirmation of Kamloops genetic introgression into wild steelhead populations was one of the criteria in MN DNR's *Fisheries Management Plan for the Minnesota Waters of Lake Superior* that would justify a re-evaluation and potential phase-out the Kamloops program. This means there are two competing goals in the management plan, 1) rehabilitate steelhead populations to allow a limited angler harvest, and 2) stock Kamloops for harvest opportunities until steelhead are rehabilitated. The MN DNR met with the Lake Superior Advisory Group on October 23, 2017 to present this information and is in the process of soliciting feedback.
- Hybridization is not isolated to Minnesota waters. Kamloops have been positively identified passing through Wisconsin's Brule River fish trap and genetic introgression was found in juvenile and adult samples from Wisconsin's Brule River. Minnesota is obligated, through the Great Lakes Fishery Commission's Joint Strategic Plan, to ensure its management strategies do not negatively impact other jurisdictions on Lake Superior.
- Continuation of Kamloops stocking would further increase hybridization and jeopardize gains made in steelhead rehabilitation over the past 20+ years.

Works Cited and other Pertinent Publications:

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