

Species Profile for Aquaculture Rainbow Trout

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INTRODUCTION

Rainbow trout (*Oncorhynchus mykiss*) are native to the eastern Pacific Ocean ranging from northwest Mexico to Alaska and fresh-water bodies west of the Rocky Mountains.^[1] They are the most widely introduced salmonid species, having been transplanted to all continents (except Antarctica), including 99 countries worldwide.^{[1], [2]}

Rainbow trout (Figure 1) aquaculture started in California in 1870 at public hatcheries where trout were propagated and cultured as part of fish stocking efforts aimed at enhancing sportfishing.^[2] Fish stocking by U.S. agencies dating back to 1876 first introduced rainbow trout to the Great Lakes and over the course of more than a century, naturalized populations have established in all the Great Lakes.^{[3], [4], [5]}



Figure 1. Mature rainbow trout. Source: Ontario Aquaculture Research Centre.

Rainbow trout were first cultured in Ontario in 1887 at a private hatchery near Newcastle, and provincial government stocking programs later commenced in 1912 for the purpose of lake and river stock enhancement.^[5] Rainbow trout aquaculture in Ontario remained a government activity until 1962 when the Ministry of Natural Resources amended the *Game and Fish Act* to allow the private sector to culture and sell rainbow trout as a food fish for human consumption.^[6]

ONTARIO RAINBOW TROUT AQUACULTURE

Rainbow trout is Canada's most valuable freshwater aquaculture species, and Ontario is the country's largest producer.^[7] Ontario has a long history of rainbow trout aquaculture, and the species continues to be the primary aquaculture species in the province by value and production volume.

Rainbow trout aquaculture in Ontario is concentrated in open-water net pen production systems situated in Lake Huron and Georgian Bay, primarily surrounding Manitoulin Island.^[8] Net pen production systems are moored in protected waters where rainbow trout are cultured from the juvenile stage (fingerling) to market-size fish ready for harvest.^[6] In Ontario, rainbow trout fingerling begin their life cycle as eggs at land-based hatcheries where they are cultured in small tanks and raceways until reaching a suitable size for live-haul road transportation and transfer into open-water net pens.

Rainbow trout are typically cultured in open-water net pens for just over one year before reaching market size and harvested at approximately two years of age.^[9] While the majority of rainbow trout aquaculture in Ontario occurs in open-water net pens, there are other methods being used in the province to culture the species. Land-based flow-through aquaculture facilities utilize natural ground and surface water sources to culture rainbow trout broodstock, fingerling and market sized fish in circular tanks and raceways. Some land-based aquaculture facilities have adopted recirculating aquaculture systems (RAS) to optimize rearing conditions and improve growth. Rainbow trout in Ontario are additionally cultured in decommissioned aggregate pits using closed containment floating raceways, in private ponds, and in aquaponics.

FARMING CONDITIONS FOR RAINBOW TROUT

Rainbow trout are an adaptable cold-water species well suited to the freshwater conditions found in Ontario. The species can survive in a wide range of water temperatures (0°C–24°C) however will perform optimally in aquaculture at water temperatures between 13°C–18°C.^{[10], [11], [12], [13]}

Rainbow trout grow best in slightly alkaline waters between pH 7.0–8.0 and require well oxygenated water where oxygen saturation levels are maintained between 80%–100% to optimize fish health and productivity.^{[12], [14]} As a carnivorous species, rainbow trout require a diet with large amounts of high-quality protein and energy for optimal growth.^[15]

Commercially formulated aquaculture feed is available in Ontario and has proven to be a successful diet for the species. Under farmed conditions, female rainbow trout typically reach sexual maturation at 3 years of age and can spawn in successive years while males may mature at the age of two. Ontario aquaculture is home to fall- and spring-spawning rainbow trout broodstock populations which supply the sector with eggs to become the next generation of market sized fish.

SPECIES OUTLOOK

Ontario has an established rainbow trout aquaculture industry with a long history of sustainable production. With an abundance of clean, cold freshwater resources and an established industry infrastructure the province is positioned for aquaculture expansion across a diversity of production systems including land-based and open-water net pen systems. Ontario will continue to be a leader in freshwater aquaculture production sustainably producing world-class rainbow trout.

REFERENCES

1. Scott, W.B., and Crossman, E.J. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. 184:97-206.
2. Stanković, D., Crivelli, A.J., and Snoj, A. 2015. Rainbow Trout in Europe: Introduction, Naturalization, and Impacts. *Reviews in Fisheries Science & Aquaculture*. 23(1):39-71. <https://doi.org/10.1080/23308249.2015.1024825>.
3. Crawford, S.S. 2001. Salmonine introductions to the Laurentian Great Lakes: an historical review and evaluation of ecological effects. *Nation Research Council of Canada*. 132.

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4. Kerr, S.J. 2006. A historical review of fish culture, stocking, and fish transfers in Ontario, 1865-2004. Fish and Wildlife Branch: Ontario Ministry of Natural Resources.
 5. MacCrimmon, H.R., and Gots, B.L. 1972. Rainbow trout in the Great Lakes. Ont. Ministry Nat. Resour. 45:66.
 6. Moccia, R.D., Naylor, S., and Reid, G. 1997. An Overview of Aquaculture in Ontario. University of Guelph. 96-003.
 7. Government of Canada, F. and O.C. 2022. Government of Canada: Aquaculture Production Statistics 2020. Fisheries and Oceans Canada. Retrieved May 9, 2022. <https://www.dfo-mpo.gc.ca/stats/aqua/aqua20-eng.htm>.
 8. Moccia, R.D., and Burke, M. November 2022. 'AQUASTATS' Ontario Aquaculture Production in 2021. University of Guelph Aquaculture Centre.
 9. Johnston, T.A., and Wilson, C.C. 2015. Comparative ecologies of domestic and naturalised rainbow trout in northern Lake Huron. Ecology of Freshwater Fish. 24:338-354.
 10. Bear, E.A., McMahon, T.E., and Zale, A.V. 2006. Comparative Thermal Requirements of Westslope Cutthroat Trout and Rainbow Trout: Implications for Species Interactions and Development of Thermal Protection Standards. Transactions of the American Fisheries Society. 136(4):1113-1121. <https://doi.org/10.1577/T06-072.1>.
 11. Cocherell, D.E., Fangué, N.A., Klimley, P.A., and Cech Jr., J.J. 2014. Temperature preferences of hardhead *Mylopharodon conocephalus* and rainbow trout *Oncorhynchus mykiss* in an annular chamber. Environmental Biology of Fishes. 97:865-873. <https://doi.org/10.1007/s10641-013-0185-8>.
 12. Swales, S. 2006. A Review of Factors Affecting the Distribution and Abundance of Rainbow Trout (*Oncorhynchus mykiss* Walbaum) in Lake and Reservoir Systems. Lake and Reservoir Management. 22(2):167-178.
 13. Woynarovich, A., Hoitsy, G., and Moth-Poulsen, T. 2011. Small-scale rainbow trout farming. FAO fisheries and Aquaculture. 561:81.
 14. National Farm Animal Care Council (NFACC). 2020. Code of Practice for the Care and Handling of Farmed Salmonids.
 15. Janampa-Sarmiento, P.C., Takata, R., Freitas, M.T., Freire, L.S., Pereira, M.M.B., Lugert, V., Heluy, G.M., Pereira, M.M. 2020. Modeling the weight gain of freshwater-reared rainbow trout (*Oncorhynchus mykiss*) during the grow-out phase. Aquaculture. 49:e20190028. <https://doi.org/10.37496/rbz4920190028>.

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