State of resources reporting

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Lake trout in the Muskoka Lakes



Lake trout is the most popular fish species among anglers in the Muskoka Lakes.

In Ontario lake trout (*Salvelinus namaycush*) are typically found in lakes on the Canadian Shield and in the Great Lakes. More than 25 per cent of the world's lake trout lakes are found in Ontario, with over 2,283 inland lakes designated for lake trout management in the province.

Lake trout are a key sport fish in three large lakes in the Muskoka area. Lakes Muskoka, Rosseau, and Joseph, are collectively known as the Muskoka Lakes (Figure 1). Together these lakes support what is thought to be one of the highest concentrations of lake trout in southern Ontario, outside of Algonquin Park. The Muskoka Lakes are popular fishing destinations for local residents, as well as anglers from larger urban centres located south of the Muskoka area.

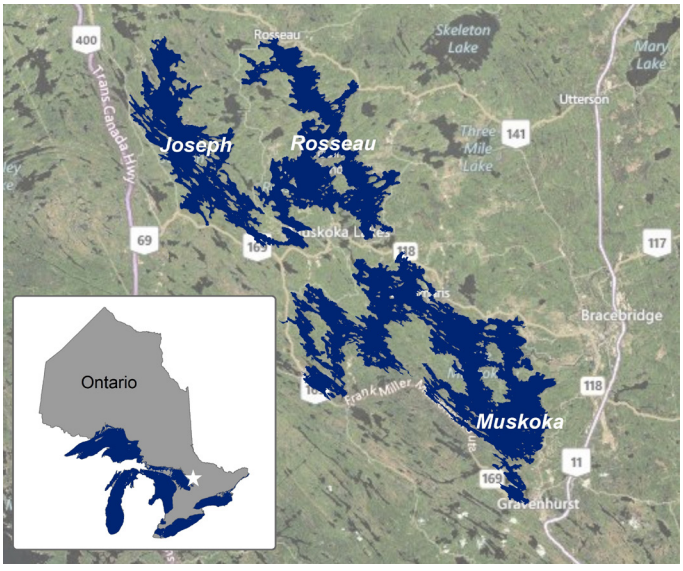


Figure 1: Lakes Muskoka, Rosseau and Joseph are collectively known as the Muskoka Lakes.

Lake trout biology

Lake trout are members of the genus *Salvelinus* (charr), which also includes brook trout and Arctic charr. Lake trout require clear, deep (greater than 10 metres), well-oxygenated, coldwater lakes. Lake trout are top predators and their survival and success depends on high quality habitat. For this reason the presence and abundance of lake trout in a lake is a useful indicator of the overall health of coldwater lake ecosystems.

The average lifespan of a lake trout is around 20 years, but it has been documented in Ontario that some can live for more than 50 years. A typical lake trout caught by an angler in Ontario weighs between 0.5 to 1.5 kilograms (kg), but occasionally some can attain weights of over 10 kg. The largest reported lake trout angled from Ontario waters weighed nearly 29 kg, and was caught in Lake Superior in 1952.

Lake trout have a varied diet depending on the lake they occupy, their age, their body size,

and the availability of prey. Young lake trout feed on zooplankton (small invertebrate animals suspended in the water), but feed on larger invertebrates, minnows and other small fish as they age. Adult lake trout feed on invertebrates and fish, like cisco, rainbow smelt, sculpins and yellow perch, and will actually scavenge and consume dead fish found on the lake bottom.

Lake trout reach sexual maturity around six to eight years of age and spawn in the fall when the water temperature drops below 10°C. Successful spawning requires clean, windswept, rocky shoals, or shorelines, where lake trout can spread their eggs. Often individuals will return to the same area each fall to spawn. Eggs incubate over the winter in spaces between rocks and hatch in the spring. This method of spawning is unusual for species belonging to the genus *Salvelinus*, because most members dig a nest in the gravel (known as a redd) in which to lay their eggs.

The Muskoka Lakes

The Muskoka Lakes are located approximately 200 kilometres (km) north of Toronto and are popular summer and winter recreational destinations for tourists. Consequently, the shorelines of these lakes are heavily developed with recreational homes. Although most of the land around the lakes is privately owned, there are several all-season public access points on each lake. Based on the physical and chemical characteristic of the Muskoka Lakes, the quality of habitat is optimal for the survival and growth of lake trout (Table 1).

What is the state of lake trout in the Muskoka Lakes?

The Muskoka Lakes have been monitored by the Aquatic Science Unit of the Ontario Ministry of Natural Resources (MNR) since the late 1980s. These long-term monitoring programs provide valuable insight to the ongoing health of fish populations, and collect data that is necessary to understand how factors, such as fishing pressure and climate change affect fish populations. The lessons learned from these three intensively studied lakes can then be applied to management plans for the surrounding, less studied lakes. The most recent estimates of lake trout abundance were collected in 2009 and 2010 and were based on the number of fish caught-per-net in standard netting surveys conducted by the MNR in July and August (Table 2). Generally speaking, the more fish caught in a net means the more fish there are per unit area in the lake.

Table 1: Physical and chemical characteristics of the Muskoka Lakes.

	Lake		
	Joseph	Rosseau	Muskoka
total surface area (ha†)	5,555	6,449	12,038
water clarity (m**)	6.5	5.6	4.2
total phosphorus (µg/L*)	4.9	5.7	4.2
average depth (m)	25	23	15
maximum depth (m)	93	90	67
dissolved oxygen (mg/L‡)	10.9	9.8	8.8
length of shoreline (km)	193	212	450
approximate number of shoreline properties	1,526	1,882	4,791

† ha hectares
** m: metres
* µg/L: micrograms per litre
‡ mg/L: milligrams per litre
Note: Dissolved oxygen is measured near the bottom of the lake where young lake trout are typically found. Lake trout reqire an average dissolved oxygen level greater than 7 mg/L to thrive.

Table 2: Biological characteristics of lake trout sampled from the Muskoka Lakes in 2009 to 2010.

	Lake		
	Joseph	Rosseau	Muskoka
estimated average abundance (# of fish >33 cm total length)	28,000	41,000	35,000
average total length (cm*)	48	45	51
age at maturity (years; males/females)†	9 / 13	11 / 13	6 / 7
total length at maturity (cm; males/females)†	51 / 58	51 / 55	51 / 56
annual mortality (per cent)	32	28	34

* cm: centimetres
† Estimation is based on the size at which 50 per cent of the sample is sexually mature.

Currently, the abundance of lake trout in each lake is considered to be reasonably healthy based on the biotic (living) and abiotic (non-living) factors affecting each of the three lakes. Trends in the relative abundance (catch-per-net) of lake trout in Lake Muskoka and Lake Rosseau appear stable, while there has been a modest downward, and more variable, trend in the relative abundance of lake trout in Lake Joseph (Figure 2). Despite this decrease, the catch-per-net of lake trout in Lake Joseph currently remains above that observed in most other southern Ontario lakes.

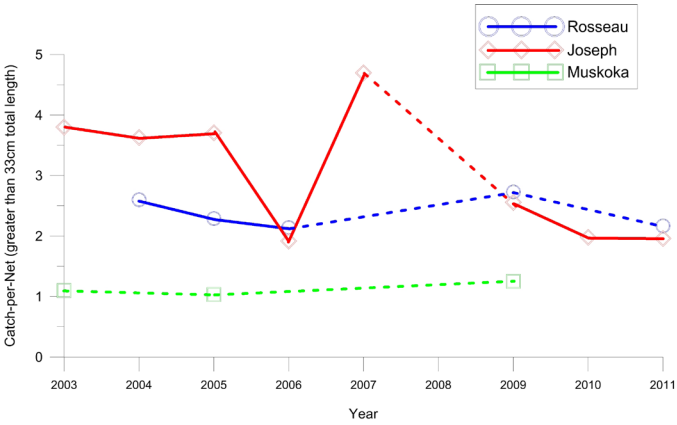


Figure 2: The average number of lake trout caught-per-net for each of the Muskoka Lakes. Symbols on the lines indicate those years in which surveys were completed, and dashed segments are for periods where years were not sampled and trend is assumed. Catch-per-net is used by researchers to estimate the abundance of lake trout in a lake. In these particular populations catch-per-net is estimated for lake trout greater than 33 cm in total length, which is approximately the minimum length caught and kept by anglers. Monitoring trends in catch rate is another tool that MNR uses to evaluate whether current management actions are effective.

What factors may be affecting lake trout in the Muskoka Lakes?

Habitat Loss

Shoreline development can degrade, or destroy spawning habitat, which make it difficult for lake trout to successfully reproduce. Nutrient concentrations in a lake can increase due to activities associated with residential development, such as the application of lawn and garden fertilizers, or leakage from septic beds. Excess nutrients, such as phosphorous, promote rapid growth of algae and aquatic plants. When plants and algae die they consume oxygen dissolved in the water, which lowers the concentration of oxygen in the lake. Currently the concentration of dissolved oxygen in each of the Muskoka Lakes is near optimal for lake trout, despite the large amount of shoreline development. This is likely because these lakes contain large volumes of water, which helps dilute any nutrient runoff and mitigate environmental effects.



Figure 3: Lake Rosseau shoreline. Photo by: MNR staff

Angling Pressure

Lake trout are targeted by recreational anglers because they are challenging to catch and delicious to eat. However, lake trout are vulnerable to overfishing because they are slow growing and mature at a later age than other angler caught species. Recreational angling for lake trout occurs on the three Muskoka Lakes in varying amounts, with Lake Joseph experiencing the highest amount of angling pressure. Results obtained from monitoring angling effort and success, combined with the results from standardized netting surveys indicate that the current amount of angling pressure for lake trout in the Muskoka Lakes is relatively stable and sustainable.

Pollution

Industrial pollution, specifically sulphur dioxide and nitrogen oxides contribute to acid rain when they combine with water molecules in the atmosphere. Acid rain can harm lake trout by lowering the pH of the lake (i.e., making water more acidic). Since the early 1970s, strict emissions controls have been in place to reduce the amount of sulphur dioxide and nitrogen oxides released into the atmosphere. This has helped reduce the impact of acid rain on aquatic ecosystems. Acidification is less of a

concern for large, deep lakes like the Muskoka Lakes than it is for many smaller, shallower lake trout lakes.

Mercury can also negatively affect aquatic organisms and the health of aquatic ecosystems. When mercury is converted to methylmercury by mirco-organisms in the environment it becomes a toxic contaminant. When an organism consumes methylmercury it cannot be quickly eliminated, so concentrations build up in the body. This type of contaminate build-up is known as bioaccumulation. Biomagnification then occurs throughout the food web as larger organisms consume smaller organisms that are contaminated with methylmercury. As a result large, predatory fish species found at the top of the foodweb, such as lake trout, are likely to contain higher concentrations of methylmercury than smaller fish species.

The Ontario Ministry of the Environment monitors mercury levels and other contaminants in sport fish species. These results are reported in the Guide to Eating Ontario Sport Fish. Generally, in the Muskoka Lakes lake trout less than 75 cm are safe to eat.

Climate Change

Climate change is the result of increased greenhouse gases (e.g., carbon dioxide and methane) trapped in the atmosphere. More greenhouse gases in the atmosphere increase the amount of heat absorbed by the Earth's surface and causes global temperatures to gradually rise. Increased global temperatures will affect the warming rates of lakes in the summer and cooling rates in fall. These changes will likely have an impact on the breeding success of lake trout and reduce the amount of coldwater habitat available in the summer, while potentially improving habitat for warm water fish species that compete with and prey on lake trout (e.g., smallmouth bass). It is thought that habitat change related to climate change will affect all of Ontario's lake trout populations to some extent. However, lake trout populations in the southern extent of the their range, like those found in the Muskoka Lakes, will be the most heavily impacted.

Exotic Species

Any species, whether it is a plant, animal, or micro-ogranism, that is accidentally or intentionally brought to a new environment outside of its normal range is considered an exotic species. An exotic species whose introduction causes harm to the environment, economy or society is known as an invasive species. Most of the damage caused by invasive species is the result of either competition with, or predation on native species. Invasive species typically have no natural predators when first colonizing a new environment, allowing them to quickly dominate, and potentially eliminate other native species.

The spiny waterflea (*Bythotrephes longimanus*; Figure 4) is an invasive zooplankton species from Eurasia that likely entered the Great Lakes when ballast water from transoceanic ships was discharged into Lake Ontario. Over the last 30 years this small predatory invertebrate has spread from the Great Lakes to many inland lakes, including the three Muskoka Lakes. The spiny waterflea competes for the same food source as other native zooplankton and larval fish. Smaller fish have difficulty trying to use the spiny water flea as a source of food because its long spiny tail functions to prevent capture and ingestion by predators. It is unknown at this time how the spiny waterflea will impact lake trout populations in these lakes.



Figure 4: Spiny waterflea. Photo by: Patrick Turko

Currently, invasive species are not having a noticeable impact on the health of lake trout in the Muskoka lakes. However, to ensure the conservation of these populations and the health of aquatic ecosystems it is essential to reduce the risk of introducing new invasive species. By being informed and taking the proper precautions it is possible to prevent the arrival of invasive species and slow the spread of those already established in Ontario.

How are lake trout managed in the Muskoka Lakes?

Angling Regulations

Angling regulations are developed to ensure fishery resources are used sustainably. The Ontario Recreational Fishing Regulations are often based on information from monitoring programs, such as that conducted by the Aquatic Science Unit on the Muskoka Lakes. The most up-to-date fishing regulations are available on the MNR Fish Ontario website.

To improve the efficiency and effectiveness of fisheries management in Ontario, the province is divided into 20 different Fisheries Management Zones (FMZ) based on climatic, geographic, biological, and social criteria. The Muskoka Lakes are located in FMZ 15. The fishing season for lake trout in the Muskoka Lakes is open from January 1 to October 1, except in Lake Joseph where the opening of the season is delayed until February 15. This delay was implemented in Lake Joseph in 1989 to provide additional protection to lake trout. Currently, there are no restrictions on the size of lake trout that can be harvested from the Muskoka Lakes. The catch and possession limits for lake trout are two fish with a sport fishing licence and one fish with a conservation fishing licence.

Lake Trout Stocking

Currently, each of the Muskoka Lakes contains wild, self sustaining lake trout populations. However, historically each lake had been stocked with varying numbers and life stages of lake trout to support recreational fishing.

Lake Rosseau was stocked from the early 1940s up to 1990, at which time stocking was discontinued as it appeared to be having an adverse affect on wild lake trout abundance. Lake Joseph was regularly stocked up until the 1970s.

Stocking in Lake Muskoka began in the 1920s and continues to the present day. Since the late 1990s, stocking has only occurred in areas of the lake where wild lake trout abundance was low to minimize the impact on the native population. To further reduce the impact of stocking, in 2006 the number of fish stocked annually was dramatically reduced along with the number of stocking locations throughout the lake. An effectiveness monitoring program is currently in place to evaluate the success of these management actions.

Habitat Protection

In the Muskoka Lakes, shallow, near-shore spawning habitat has been identified and recorded. This information, along with fish habitat guidelines, are provided to municipalities to help them ensure fish habitat is not affected when reviewing plans for development (e.g., creating new lakeshore lots). The federal Department of Fisheries and Oceans also uses this information when reviewing development proposals that may directly affect fish habitat, like dredging or filling.

To protect deep water habitat the MNR has implemented a policy that recommends municipalities limit shoreline development if water quality falls below a prescribed criterion. Often deep water habitat can be impacted by shoreline development if the activity causes an excess of nutrients to enter the lake. Currently the deep water quality of the Muskoka Lakes is well above the criterion, so application of this policy has not been required in these lakes.

In addition, the Muskoka River Water Management Plan was created to regulate how dams in the Muskoka Lakes are operated. This plan provides specific guidance to ensure lake trout eggs that are deposited in shallow water are not affected by changing water levels because exposure of eggs to air or surface ice would kill them.

What is the outlook for lake trout in the Muskoka Lakes?

The Muskoka Lakes have provided a lake trout fishery for over 100 years and continue to be a popular recreation and angling destination for many Ontarians. All three lakes possess good quality lake trout habitat and support large recreational fisheries. Results of recent monitoring programs suggest that the abundance of lake trout is healthy and has been relatively stable throughout 2003 to 2009.

There is some uncertainty regarding the abundance of lake trout in Lake Joseph as the most recent abundance estimate is below the long-term average. Continued monitoring of lake trout in Lake Joseph will determine if this a short-term downward

trend or the part of a longer trend which will require additional protective measures.

The abundance of lake trout in Lake Muskoka experienced declines in the more distant past; however, habitat improvement, fishing regulations, and a modified stocking strategy are improving the outlook for this population.

What can you do to help?

- Respect current fishing regulations for lake trout www.ontario.ca/fishing
- Help prevent the spread of aquatic invasive species www.invadingspecies.com
- Protect fish habitat

Information Sources

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Related Information

State of Resources Reporting:

- Lake Trout in the Upper Great Lakes
- Lake Trout in Lake Simcoe

CONTACT INFORMATION

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