2014 LAKE OPEONGO CREEL UPDATE – HARKNESS LABORATORY

Welcome back anglers!

Every year since 1936 Harkness Laboratory of Fisheries Research staff have cleaned fish and interviewed anglers regarding their fishing efforts on Lake Opeongo. This survey is currently in its 78th year and is one of the longest running biological surveys in the world. Thank you, anglers for helping in this ongoing study!

The creel survey has greatly increased our knowledge regarding lake trout growth, reproduction and harvest. It has also helped to improve our understanding of fisheries management in North America.

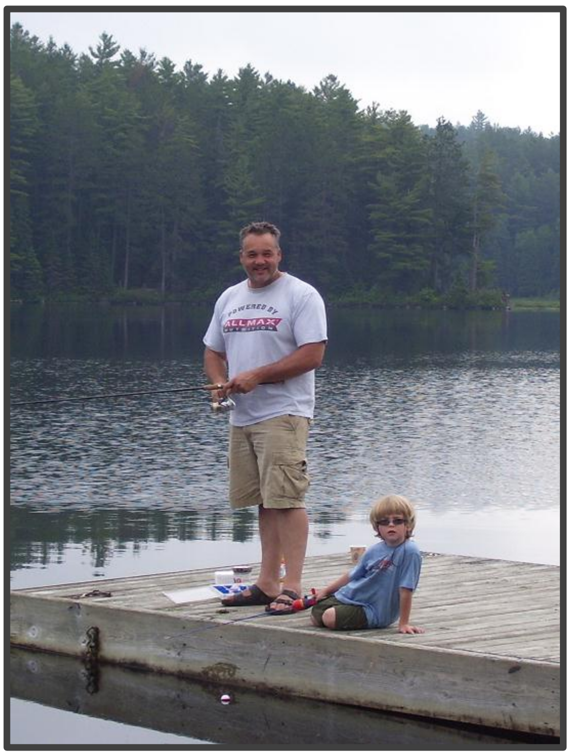


Photo: Fishing off the dock at Opeongo, 2013.

Anglers are the cornerstone of these studies, and the purpose of this report is to provide information to those who took the time to participate in the angler survey. This past year we interviewed over a 1,000 fishing parties meeting close to 3,000 anglers. Almost 5,000 anglers fished Lake Opeongo in 2013 with ~600 lake trout sampled by laboratory staff at the Creel Hut.

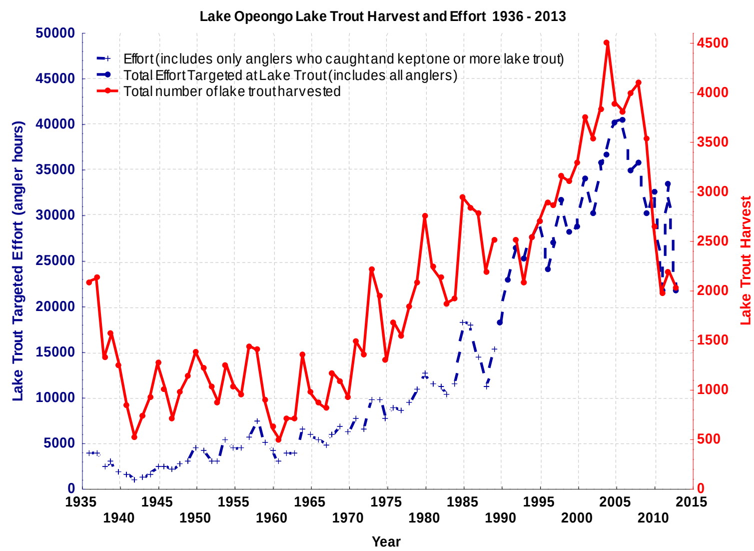
Why so many questions?

One use of creel census data is to estimate how many hours it takes an angler to catch a fish. This is called "CPUE" or catch per unit effort.

Although trends in catch per unit effort can be used to indicate the health of fish populations in a lake, it is not entirely correct to do so. We know from many examples that anglers are very effective predators, and even in the face of declining fish populations, skilled anglers can catch fish.

From our data we have noticed that while CPUE is declining among "inexperienced" anglers, it has remained relatively constant among "experienced" anglers.

Overall, there was a decrease in angling effort from 2013, and slight decrease in harvest, back to 2011 levels. Catch per unit effort for day trip anglers targeting lake trout increased from 0.195 per hour to 0.232, or a lake trout every 4.3 hours. The average lake trout was 443 mm fork length, with the largest fish measuring in at 625 mm. The average weight was 2.3 lbs, and the heaviest fish seen at the Hut weighed 7.25 lbs.



Trends in lake trout angler harvest and effort, 1936 to 2013.

How Many Lake Trout Are Being Harvested?

Annual lake trout harvest and fishing effort steadily increased from the 1960s until several years ago. Recent years have seen a decline in effort and harvest. Based on experiences with other lake trout lakes in Ontario, Opeongo was being exploited at or near its maximum sustainable level from 1996-2010. This year's estimated lake trout harvest was **2,012 fish** and angling effort was **21,703** rod hours. While this fishery continues to adapt to changes in cisco abundance and lake trout life history, it is likely the status of the population would deteriorate if the fishing effort and harvest had continued to increase at the rate seen in the 1990's and early 2000's. How can we be a "sensible predator" and ensure that the lake trout stocks are not over-exploited?

Here's something to think about…

MNR Science

Are Current Trout Harvest Levels Sustainable?

During the fishing season, many people enjoy catching lake trout for the family dinner or the excitement of releasing them back into the lake. Some anglers return to Opeongo on many occasions with friends and family over the fishing season, some angler's day trip and some like to camp overnight. Everyone realizes that there is a limit to harvest - a "maximum sustainable yield" (MSY) that can be removed each year while ensuring a healthy population for future generations. The MSY for lake trout lakes can be estimated from simple measurements such as the total dissolved solids in a lake (a measure of lake productivity) and lake size. MSY is expressed in kilograms per hectare (kg/ha).

For Lake Opeongo lake trout, the estimated MSY is 0.72 kg/ha. With a surface area of just over 5,000 hectares and an average size of lake trout harvested of about 1.25 kg. This translates to a sustainable harvest level of approximately 3,000 lake trout per year.

*(5,154 ha * 0.72 kg/ha ÷ 1.25 kg/lake trout = 2,969 lake trout)*

From 1997-2012 harvest levels exceeded the predicted maximum sustainable yield for lake trout in Opeongo.

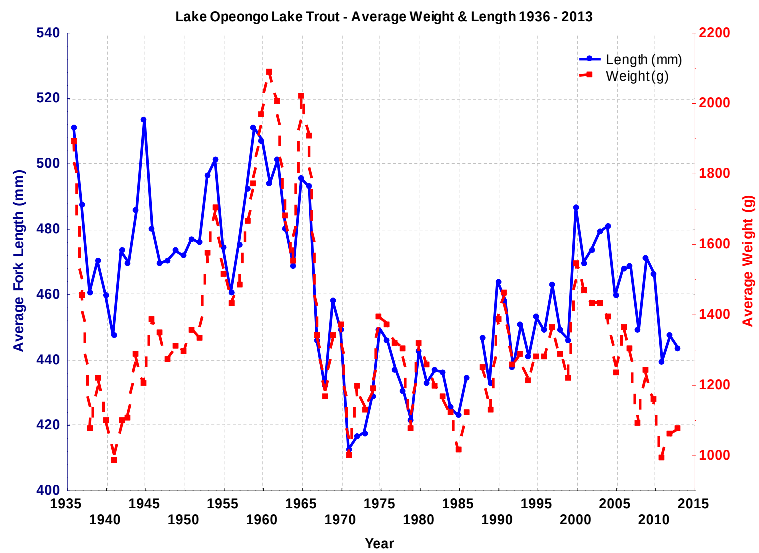
Some key points to consider when looking at angler harvest over the years…

- Anglers are getting better at fishing
- New technology makes fishing easier and more reliable
- More anglers are releasing larger, spawning sized fish
- The cost of fishing has doubled in the last decade
- Fisheries outside Algonquin have been degrading
- The average angler is growing older and has more leisure time and is less likely to angle in the Algonquin interior
- There is more information on health benefits of eating fish
- Instant, accurate, and extended weather forecasts influence the planning of a fishing trip

Please, Release Me, Let Me Go….

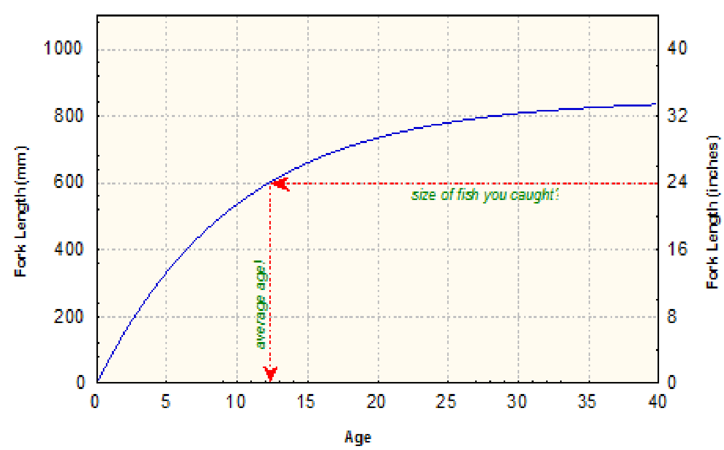
The ability of a species to survive catastrophe is related to its genetic diversity and the number of genetically unique individuals present in a population…in other words, a genetically diverse population has better chances at adapting to changing environmental conditions. Protecting genetic diversity can be achieved by maintaining fish populations at a "healthy" state. A "healthy" population includes many large, older fish that have a chance to spawn and pass on their genes to future generations before they are harvested. This has important consequences for the population: large females spawn more eggs, producing young that have a higher chance of surviving the difficult first year of life.

Catch and release, especially of large lake trout, will ensure a healthy and diverse population.



What has happened to the average size of lake trout since the early 1970's? They are spawning younger and at smaller sizes.

How old is your lake trout?



The approximate age of your lake can be determined by measuring its fork length and using the graph shown above.

Blackfin Cisco in Algonquin Park

Allan Bell, M.Sc. Candidate, Trent University

Photo: Blackfin Cisco from Radiant Lake, Harkness Lab

The 2010 Creel bulletin featured information on the discovery of the Blackfin cisco (*Coregonus nigripinnis*) in the netting survey of Radiant Lake. Additional netting surveys have revealed that healthy populations of Blackfin Cisco reside in Hogan, Cedar and Mink lakes as well. These additional discoveries are very encouraging since Blackfin Cisco are listed as extinct by the IUCN red list of Threatened Species.

Blackfin Cisco were once very common and one of the seven Cisco species that comprised the deepwater Cisco community of the Great Lakes. In the early 20th century, the combined effects of overfishing and introduced species such as rainbow smelt (*Osmerus mordax*) severely damaged the deepwater cisco community leaving some species threatened, others extirpated and in the case of Blackfin Cisco the designation of extinct.

So how is it that a fish from the Great Lakes has been found in Algonquin Park? The answer lies in the outflow of melt water during the retreat of the ice sheets of the last ice age. When the ice sheets were melting, the outflow of the post-glacial great lakes system was located in northern Algonquin Park as opposed to the St. Lawrence system today. This outflow facilitated the movement of many Great Lakes species (including Blackfin Cisco, Mysis plankton, Channel Catfish and Walleye) into lakes in northern Algonquin long after many other lakes higher in elevation had been isolated. Blackfin Cisco have remained isolated in these lakes and their continued presence is due to the protection from invasive species and habitat destruction that Algonquin Park provides.

Since Blackfin Cisco disappeared at a time when freshwater fisheries science was just budding in Ontario, comparatively little is known about this species as opposed to other species of fish. The discovery of these populations has allowed us to study certain aspects of these fish that highlight their distinctness from other species of fish in Algonquin and Ontario.

Photo: Lake whitefish (left) and Blackfin cisco (right) gill arches showing gill rakers

The first topic of my study is gill raker count. A gill raker is a calcified protrusion on the leading edge of a gill arch which is part of the gill apparatus of the fish. Since gill rakers are involved in how a fish feeds, their counts reflect differences in feeding strategy between different species of fish. For example a whitefish feeds primarily by foraging on the bottom of the lake on the substrate, whereas a Blackfin Cisco feeds on Mysis plankton in the water column.

Corresponding to the difference in feeding strategy, the gill raker counts of whitefish fall in the 20-30 range whereas Blackfin Cisco counts are in the 50-65 range. The high number of gill rakers in Blackfin Cisco show that they are very efficient at sieving the water for plankton; a trait that shows they are specialized on this food source. Other populations of Cisco surveyed in Algonquin have gill raker counts in the 40-50 range, which shows how high gill raker count is a trait unique to the Blackfin Cisco in Algonquin.

This coming field season may include trips to northern Algonquin to survey other lakes within the glacial outflow area for additional Blackfin Cisco populations, as well as continuing to study aspects of these rare and fascinating fish such as habitat preference and morphology.

Otolith (ear stone) section from Hogan Lake - July 14, 2009 Preliminary Interpretation - Blackfin Cisco – 20 years old.

Reproduction Markings on Lake Trout Otoliths

Danielle Eisner M.Sc, University of Toronto

How can we tell when a fish spawned?

Usually it is easy to determine if a fish is going to spawn by examining the fish's weight and condition nearing the spawning season. Telemetry tags which provide a fish's location can also be used to identify if the fish has gone to the spawning area. Of course, we can also directly observe the fish spawning if conditions permit. These methods are all useful if one has the ability to continually monitor the population. Scientists sometimes cannot continually monitor wild populations. How can scientists overcome this roadblock? Otoliths!

Otolith markings

Checks are a general term for discontinuous otolith markings. Continuous otolith markings are annuli or age rings. Checks and annuli are created during times of stress, when the fish's growth slows. Fish can be stressed by being exposed to suboptimal temperatures, low food resources, or chemicals. The size of the check reflects the degree and duration of the stressful situation.

'Spawning' checks on otoliths

Reproduction is considered a stressful time for fish because the fish have to choose whether to invest in growth and survival or reproduction. It is possible to use certain checks (called 'spawning' checks) to determine if a fish has spawned. 'Spawning' checks have a different appearance to annuli as they are thinner and usually lighter in colour. They have been observed on a variety of otoliths but have yet to be validated as indicators of spawning, until now.

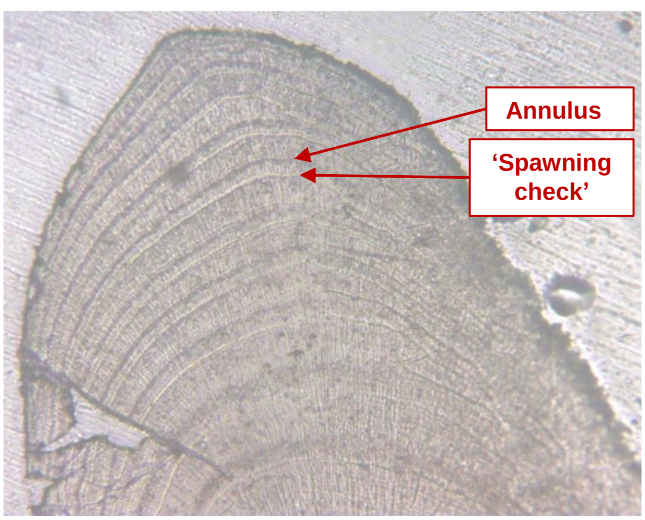
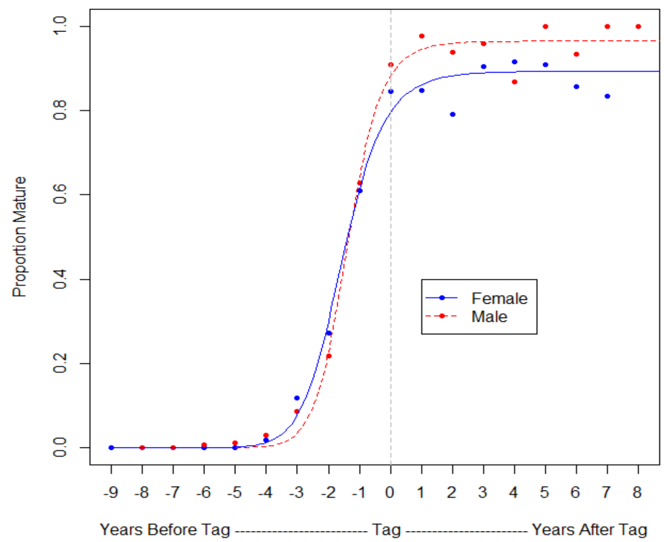


Photo: Visual differentiation between annulus (age ring) and 'spawning' check.

The analysis

My work utilised tagged lake trout, those caught on the spawning shoal during the spawning season, and therefore it is reasonable to assume that these fish were all mature at tagging. These fish were also recently mature, ≤9 for females and ≤8 for males. I determined what proportion of fish had a spawning check the year they were tagged, each year before tagging and 8 years after tagging.



Graph showing: proportion of mature fish for years before and after their tag year. The vertical dashed line denotes the tag year. Since the female curve begins one year to the left of the male curve it is seen that males on average mature a year before females. The majority of males mature by age 7 and the majority of females by age 8. There is a significant difference between the curves to the right of the tag year, which indicates that females are more likely to skip spawning than males.

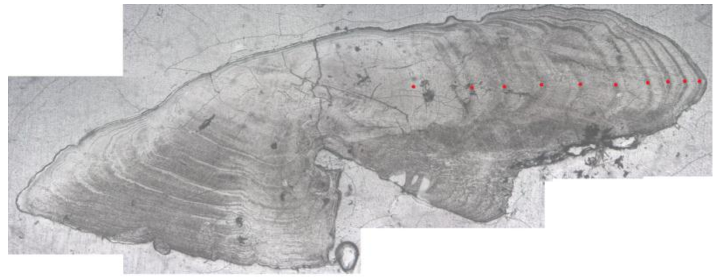
Could these marks be caused by tagging?

Although some tags have been shown to lower the health of fish by impacting growth; the anchor tags (t-tags) and PIT tags on these fish do not cause stress checks. These lake trout were tagged with t-tags and sometimes PIT tags. T-tags are small plastic tags that stick out of the fish with an identification number and only affect the growth of fish when the tags are really large compared to the fish size, or inserted in the jaw. PIT tags are internal, and can be read with a scanner and they only affect fish growth when the fish is small (none of these tagged fish are small). I compared the growth of tagged fish to the growth of mature fish that were never tagged and found that the curves were not significantly different. This means these tags do not affect the growth of fish. Additionally, 'spawning' checks were noted on years prior to tagging.

Otoliths to Determine Age and Growth

When a fish is caught on Lake Opeongo, Harkness Laboratory of Fisheries Research collects otoliths from the fish. These are later sectioned (cut), put on a microscope slide, magnified, and aged. We age fish to determine; the age of the fish, the age of maturity, the age structure of a lake and to estimate the previous size of a fish.

Lake trout Otolith being removed in the Creel Hut at Lake Opeongo.



Lake trout otolith cross section. The annuli are the dark thick bands on the right side and the thin light bands on the left. We age the dorsal (right) side of lake trout otoliths. The red dots mark each of the annuli. Age: 10, Length: 601 mm, Weight: 2.440 kg

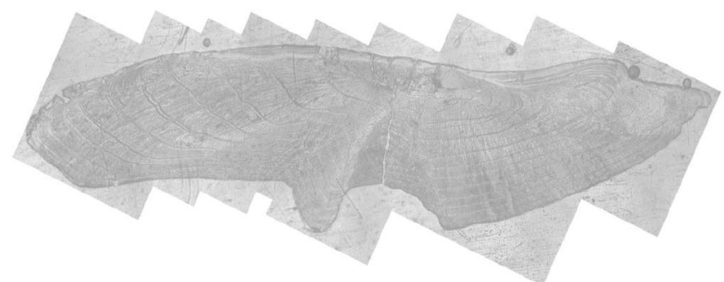
What are otoliths?

Otoliths are fish ear bones; their main functions are hearing, balance, and orientation. For scientists, otoliths function as black boxes that record life history information. The deposition of calcium carbonate onto the otolith makes this possible, but unlike scales and other bones the calcium carbonate remains there for the duration of the fish's life. This is the main reason we use otoliths to age long-lived fish (i.e. lake trout).

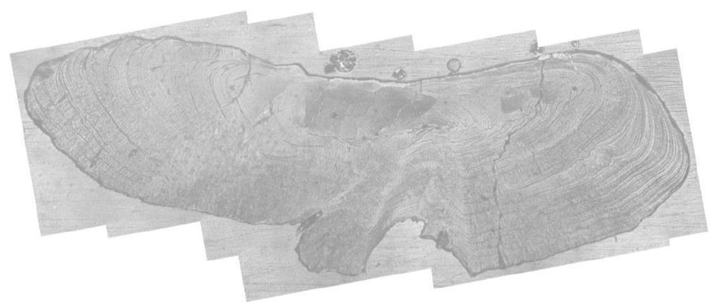
How do you age fish?

Just like you would trees! You count the rings (called annuli). Annuli in temperate fish (fish that experience winter) are formed during the winter due to temperature stress and thus can be used for ageing. To age fish you start from the outside and count in, this is because outside annuli are easier to see. Most of the annuli are easy to see, the first one (closest to the centre) is the hardest. We use a method called "feathering" to see the first annulus. Whereby you look on the top of the image and see where there are bumps and follow the bumps inward to find the annulus. The otolith of the lake trout at the top left tells us this fish was 10 years old at the time of capture.

Various fish otolith examples:



Smallmouth Bass (Opeongo) Age: 10
Length: 466 mm
Weight: 1.245 kg



Lake Whitefish (Opeongo) Age: 9
Length: 309 mm
Weight: 0.300 kg

Burbot (Opeongo) Age: 4
Length: 367 mm
Weight: 0.310 kg

Did we get 'Eve'?

The photo accompanying this summary is a female rock bass caught on July 8, 2013 from Lake Opeongo. It's the first rock bass reported from Algonquin Park's largest lake and was 8 years old on capture. Lake surveys have never revealed young rock bass in Opeongo so this one is likely an introduction from an angler.

Photo Credit: Dustin Boczek, Harkness Lab

Rock bass are not native to Algonquin Park. They are efficient inshore predators. They therefore put native brook trout and many small native fish species at risk in lakes and rivers. This a worrying sign that invasive fish are spreading in parts of Algonquin Park and posing a threat to one of Canada's most important aquatic conservation areas – aided by individuals not aware of the risk to native species. In this particular case, the female was carrying eggs and had not spawned.

Did we get 'Eve' and stop an invasion or are we too late? Only time, and park visitors interested in preserving native brook trout populations, can tell.

What Is Your Fair Share Of The Resource?

Here's an interesting idea to consider, "what is your fair share of this resource?" The "fair share" of each angler is calculated by dividing the sustainable number of lake trout which can be harvested each year among the number of anglers fishing the lake.

While we cannot estimate the number of individual anglers who visit Opeongo each year (many anglers make more than one trip), we do know that over the last five years there have been on average 2,100 lake trout trips made each year. If we divide the recommended harvest of lake trout by total number of trips we find that a **'fair share"** of lake trout is about 1.4 fish per trip. On average, there are 2.5 anglers per trip, with a limit of 2 lake trout per angler. This means the legal limit for each trip would be 5 lake trout - quite a lot more than the "fair share" of 1.4 lake trout. Food for thought: think about an alternative species to fish for on Opeongo or consider visiting some of the other quality lakes around the Hwy 60 corridor to spread out effort. ***The choice is ours!***

Counting Fish in a Natural System: Long-Term Study of Unexploited Brook Trout

Erin Brown, M.Sc. Candidate, Trent University

Paddling through the backcountry of Algonquin Park, you might be lucky enough to stumble upon one of Algonquin's hidden treasures, a natural brook trout lake. Brook trout are well adapted to the coldwater lakes in the park, left behind from the last glaciation event. Their native range beyond Algonquin Park is largely intact, but is increasingly being impacted, with documented regional population losses. Although Algonquin brook trout lakes appear pristine; invasive species, climate change, and increased angling pressure represent a significant threat for these populations. Thus it is important to take steps to conserve and manage this native, culturally significant Algonquin species.

Fig1: Snapshots of Mykiss Lake, brook trout capture-recapture study.

To ensure populations are not overharvested regulations have been put in place, with some lakes being designated as sanctuary lakes. These sanctuary lakes are a priceless asset to Algonquin Park and the scientists that study brook trout. Brook trout within these untouched sanctuary lakes provide scientists with a proxy to examine how populations behave in natural systems and give them the opportunity to explore the dynamic ecological processes that underlie population variation. In the field of population dynamics, we are interested in studying this variation - changes in the population size and structure over short and long-term. Studying populations over a short time span has proven to be useful and is most common as it allows scientists to examine ecological processes at fine scales. On the other hand, studying populations over a longer time span allows scientist to explore the 'big picture'.

The goal of this study was to investigate the long-term population dynamics of a sanctuary brook trout population located in Mykiss Lake (23.5 hectares). We were interested in exploring how the abundance and survival of adult brook trout changes over time as well as between seasons, and if these population parameters were influenced by biological attributes, such as sex, weight & length. We were also interested in exploring the population growth rate over time to determine how much of that growth could be attributed to survival and recruitment. To address these questions the Mykiss Lake brook trout population was subject to a long-term (1990-2004) capture-recapture study, led by the crews at Harkness Lab. During this period fish were caught twice a year; once during the fall and again in the spring using different types of gear for each season. Fish were marked with two different identification tags, external T-tags and internal PIT-Tags, before being released. If the individual was already marked (i.e. from the previous season) it was classified as a recapture and released back into the population. Biological information, such as length, weight, and breeding status was recorded for each individual and monitored over the observed life of the fish. In total, there were 28 sampling occasions with 5,633 handling occasions, performed on 2,534 unique fish. With this information, encounter records were created for each individual fish and estimates of population size and survival were explored.

We were floored to find that on average, there are estimated to be 525 brook trout in Mykiss Lake at any given time – that's approximately 22 fish per hectare! Furthermore, the estimated adult population size fluctuated during the study (Figure 2) with large 'spikes' or increases in the population. These increases may be explained by immigration events from a neighbouring lake or rare climatic events. Survival of adult brook trout also fluctuated over time, but on average remained quite high with no significant effect of sex on survival. Interestingly, when exploring the effects of weight on survival a difference in survival was observed between the winter and summer months. Specifically, larger individuals experienced higher survival rates during the winter months and decreased survival rates in the summer months.

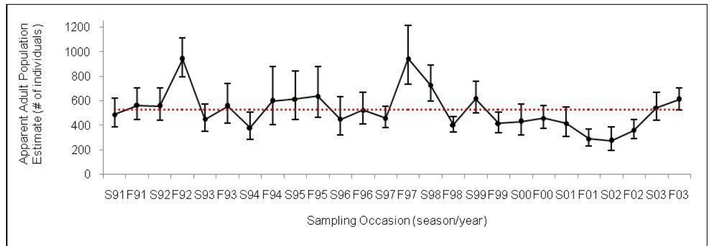


Fig2: Time varying (black) and average (red) population estimates for Mykiss Lake brook trout between 1991-2003 (S = spring, F = fall).

Within the field of freshwater fisheries science growth, recruitment, and survival are important parameters that influence populations. Having strong, reliable estimates of these parameters from natural, unexploited populations is an invaluable tool that has the potential be used to assess the health of similar populations that are under human pressures. Although challenging to conduct, retrospective long-term studies such as this, and others like it taking place in Algonquin Park and Harkness Lab, will aid in the development of effective brook trout stewardship programs aimed at preserving this beautiful species for future generations.

Brook Trout Monitoring In Algonquin Park

Among the many features that define Algonquin Park one of the most important is the concentration of brook trout lakes within the park boundaries. Free from introduced species, brook trout can thrive in cold water lakes covering the park including some of the largest brook trout lakes in Ontario. The sustainability of brook trout in these lakes is not assured despite the refuge provided by Algonquin Park. Brook trout are poor competitors and can be easy prey for invasive predators such as bass and pike. Over harvesting can lead to population declines.

For several years crews at the Harkness Laboratory of Fisheries Research on Lake Opeongo & Algonquin FAU have been conducting lake surveys of brook trout populations in Algonquin Park. The purpose of the program is to update information on brook trout lakes, including population status, age and growth data, and habitat distribution. To do so required some new approaches to the science of monitoring. First, minimizing brook trout mortality caused by netting was a key demand by Algonquin Park staff. Second, adopting a new approach that addressed the need for estimating brook trout occurrence in lakes in a timely fashion was also a key management issue.

To accomplish all this, the crews are using what is called a multi-pass survey technique that operates in the following way. Using a depth contour map, a lake is subdivided into depth zones and the number of sample sites chosen is based on the area of each zone – a fair and randomized approach to fisheries monitoring. At each site a monitoring gill net is set for one hour only and the catch is recorded and fish are released. The nets are comprised of different mesh sizes to catch fish of different size. Each site is visited at least 3 times over several days (therefore the "multi-pass" label). Afterwards, the detection of brook trout at each site and in each net set is estimated from the data and this in turn can be used for mapping the occurrence of brook trout in lakes based on depth of each site. Basically, the chance of finding a brook trout at any given site in each lake is used to assess that status of each population – a basic change from traditional fisheries assessment methods.

The early results are proving very interesting and we have reasons to cheer about brook trout status in Algonquin Park. Smaller lakes (less than 100 hectares in area) are proving to be quite different from each other. There is no common pattern of brook trout occurrence in all small lakes with most lakes showing good numbers. Large lakes on the other hand do appear similar in terms of brook trout occurrence and distribution – basically, they are repetitive in how brook trout are distributed in the lake. One feature of a lake, the boundary between warm and cold water, is proving to be a defining feature of brook trout habitat use in all lakes. The work for 2014 continues in several lakes throughout the park.

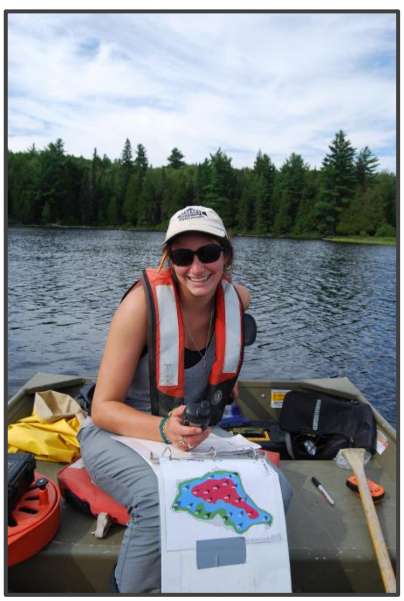


Photo: Field crew member conducting a netting survey

Welcome Lake Record Breaker!

Photo:The crew on Welcome Lake this winter installing receivers

Welcome Lake is going to be a record breaker for brook trout – not the size of brook trout but the new research going on underneath the lake surface. In winter 2014 (Can you say "Polar Vortex"!), an acoustic array was set up in Welcome Lake to record the positions of brook trout moving in the lake. A set of mid-size and large brook trout were surgically implanted with acoustic transmitters (pingers) that broadcast the location of each fish and this data is recorded by the acoustic array. This will be largest study of its kind and certainly the largest done for brook trout. It's record breaker in terms of scope and new science.

The purpose is to determine the effectiveness of new monitoring methods for assessing the status of brook trout in Algonquin Park lakes. How close are fish to the monitoring gear? What are we missing when we survey a lake? How does brook trout habitat shift during the open water season, and in turn, should we adjust our sampling depths? All these questions are being addressed this year on Welcome Lake. And all are questions about the movement of brook trout that we need to address to advance effective monitoring for this unique species in Algonquin Park.

This Summer in Algonquin Park

Meet the Researcher Day: *August 2nd, 2014 from 9:00am - 3:00pm*

Join us at the East Beach Pavilion. This is a great chance to meet and chat with researchers who use Algonquin Park as their laboratory. Meet those who study reptiles and amphibians, birds, small mammals, fish, wolves, and even humans (through archaeology). Suitable for all ages, enjoy the fundraising barbeque for Algonquin research projects and free draws with great prizes!

Rock Bass Family Fishing Day: *July 5th, 2014 from 9:00am - 3:00pm*

Bring your children and fishing rods for a fun-filled day at Whitefish Lake. Learn fishing, cleaning, and cooking techniques for this easy-to-catch Algonquin delicacy. All participants in watercraft must wear a personal flotation device (PFD). The day includes fishing, lunch, prize draws, and a Park Helper Children's Program clean-up. Fishing gear (rod and tackle) and PFDs can be obtained on loan at the event. Lunch is provided free of charge.

Help Stop Invading Species!

The introduction or further expansion of non-native or exotic species into Algonquin Park could endanger our continued enjoyment of the special brook trout and lake trout fisheries to which the Park is home.

Ensuring these introductions do not happen is the responsibility of all of us. As anglers, there are precautions we can take which will help to prevent these types of introductions. Signs posted at the Opeongo boat launch also provide information on proper cleaning of boats and fishing gear.

Boaters and Anglers – you can help!

- Inspect your boat, motor, trailer, and boating equipment such as anchors and fishing gear, centerboards, rollers and axles and remove any visible plants or creatures before leaving the waterbody.
- Drain water from your motor, live well, bilge and transom wells while on land, immediately before leaving the waterbody.
- Wash or dry your boat, tackle, downriggers, trailer, and other boating equipment to kill harmful species that were not visible at the boat launch. Some aquatic species can survive more than 2 weeks out of water.
- Rinse with hot water, spray with high pressure water or dry your boat and equipment in the sun for 5 days before transporting them to another body of water to prevent the spread of invasive species.

For further information on what you can do to help prevent the spread of invasive species have a look at: http://www.invadingspecies.com/stop-the-spread/boaters-anglers/ or call 1-800-563-7711.

Need More Information on Algonquin Park?
Visit the Friends of Algonquin website at:
www.algonquinpark.on.ca

Special Thanks!

The staff and researchers at the Harkness Laboratory of Fisheries Research would like to take this opportunity to thank all those anglers who participate in our research activities. Without the continuing support of the angling community many of the programs and projects that we undertake at the "Fish Lab" would not be possible.

Any questions about fisheries research in Algonquin?

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