Kootenay Lake Sport Fishing Update

May 2015

This bulletin provides an update on the status of fish populations in Kootenay Lake and responds to concerns about:

- kokanee population status and recent disease findings,
- low catch rates of Gerrard rainbow trout in the sport fishery,
- poor condition of Gerrard rainbow and bull trout,
- nutrient restoration program,
- outlook for the future of Kootenay Lake.

Kokanee

Kokanee Population Status

The number of Main Lake kokanee that survive to spawn cycle up and down, and since the 1960s have ranged between 250,000 and 2 million. Although average kokanee numbers have improved notably since the start of the Kootenay Lake nutrient restoration program in 1992, they have been decreasing since 2012. Last fall, main lake kokanee spawner numbers, likely responding to increasing abundance of Gerrard rainbows (see below), were the lowest they have been in recent years at 150,000, and in-lake estimates of 1 and 2 year old kokanee were also low, suggesting that adult kokanee returns in the next few years may decline. We expect kokanee to recover in numbers, over time, and are reviewing actions to accelerate recovery. However, we are currently in the middle of a necessary adjustment in the main lake food web, of both kokanee numbers, and predator numbers and condition.

Last fall, main lake kokanee spawners were the largest size on record – also a direct response to the current food web status: less kokanee in that cohort (age) are competing for their zooplankton food and so growing larger. These kokanee have more eggs; more eggs means more fry; more fry mean more kokanee; and this compensating recruitment contributes to recovery. The Ministry recognizes the significance of the current reduction in kokanee numbers and is doing as much as possible to reduce the time it takes for kokanee to [return to the desired range in abundance].

What about the Fish Disease in Kokanee?

A fish disease, common in north western North America was detected in most spawning kokanee stocks in Kootenay Lake in 2013 for the first time and again in 2014. Infectious hematopoietic necrosis virus (IHN) occurs in rainbow trout as well as various salmon species including coho, chinook, and sockeye. While IHN is not as harmful to adult fish, it can often affect the survival of newly hatched fish or juveniles (fry). However, egg-to-fry survival rates have remained normal despite identification of IHN in adult spawners, and IHN was not detected in fry leaving Meadow Creek in 2014.

We don't know where the virus came from. It could have been introduced by a migrating animal (e.g. birds), could have been present from time to time in the past but undetected, or introduced by a person/boat. Disease (e.g. IHN virus) and parasites are rarely major factors in fish abundance, and in the long term, this is likely true for Kootenay Lake as well.

There is no practical way of controlling disease in wild fish populations but reductions are already occurring naturally over time. However, at our spawning channels where we have some control, we have modified operations to reduce the risk of disease spread. Evidence from other populations where IHN occurs suggests that infection rates vary up and down with time, often on a 10 year cycle.

Ministry biologists don't anticipate IHN virus will affect Kootenay Lake kokanee survival in the long term. Monitoring at Meadow Creek suggests that although adults have IHN, fry leaving the channel do not have the virus, and the number of fry surviving has been as high as years that IHN was not present.

Are Rainbow and Bull Trout Affected by IHN?

IHN virus is a fish disease that can affect many fish species, and this includes rainbow and bull trout. Fish health testing conducted in 2014 on Gerrard rainbow trout indicated they did not have the virus. Rainbow trout are less susceptible to the IHN strain detected in Kootenay Lake, and if infection occurs, the effects may not be significant.

Are IHN Infected Fish Safe to Eat?

IHN virus is not harmful to humans, and cannot be transferred to humans by either touching or eating infected fish. However, anglers are reminded that parasites such as the broad fish tapeworm are common in many fish species and people can be infected if they eat improperly prepared fish (details on page 81 of the 2015-17 Freshwater Fishing Regulations Synopsis).

Gerrard Rainbows and Bull Trout

Gerrard population status

Gerrard rainbow spawner numbers have varied since recovering from dangerously low late 1950 numbers (as low as 50). From 1960 to present there has been a Gerrard Guardian present during spawning, who conducts daily shore-based counts, from which we estimate total spawner numbers. From 1960 – 2008, spawner numbers recovered and varied from 300 – 800. Then, from 2009 to 2012, spawner numbers increased strongly and varied from 1100-1600, with total spawners in the last six years the highest in the past 50 years (see graph). Kootenay Lake has experienced an unprecedented abundance of rainbow in the last decade.

Gerrard and bull trout predation on kokanee

A key factor driving the growth and survival of Gerrard rainbow trout in Kootenay Lake is the abundance of kokanee, which form their diet. Access to kokanee is especially important when Gerrards return to the lake in a weakened condition after spawning.

Gerrard rainbows, in conjunction with Kootenay Lake's bull trout population, hunt and eat many kokanee. For example, a likely conservative estimate of Gerrard and bull trout abundance in Kootenay Lake of the size that would eat kokanee is roughly 20,000, and based on consumption rates required for growth, this population could consume up to 2 million kokanee each year. Gerrard rainbow also compete strongly with one another for the kokanee food source, perhaps strongly enough to affect their growth, condition, and survival. In the last two years, anglers have noticed that catch rates have declined and many rainbow trout and bull trout are lower weight for their length than they usually have been in the past. Given this recent trend and other available information, it is likely the temporary reduction in prey over the last two years is now showing up in the form of reduced condition and numbers of larger, trophy-sized trout. We are working to reduce the time it takes to recover an improved fishery and to better understand the mechanisms and factors behind this variability.

Although current catch rates for large rainbows are low and likely decreasing, catch rates for small Gerrards (< 2kg) are increasing and higher than ever recorded. Catch data suggest that small fish catch rates in the past have been a good indicator of larger fish catch rates in subsequent years, so it is likely these increasing catch rates indicate we have the building blocks for the next generation of Gerrards. However, given the current low kokanee abundance, these large numbers of small fish will start to eat kokanee, and could potentially lengthen the time it takes for kokanee to recover. Therefore, decreasing abundance of small Gerrards through harvest is a necessary step to allow kokanee to recover more quickly. Anglers annually catch between 8,000 and 15,000 small rainbow in the Gerrard fishery and harvest only 30%. Therefore, an increase in harvest rate by anglers could have a significant impact on young Gerrard numbers (a reduction of up to 10,000 young Gerrards in just one year), and therefore reduce the recovery time of kokanee. This is one way anglers can participate and have a direct influence on recovery time for Kootenay Lake.

Where are the very biggest Gerrards (>25 lbs)?

Angler survey information suggests catch rates for Gerrards (>7kg or 15 lbs) have been above the long term average since 2010, and the catch rate in 2011 was the highest ever recorded for large Gerrards. Similar catch rates have been observed two other times in the last 25 years, in 1999 and between 2004 and 2006. However, although we do not monitor it directly, reports from anglers and derby results suggest that there have been few of the very largest Gerrards caught in recent years (>11 kg or 25 lbs) despite high catch rates of larger fish, while previous periods of high catch of large fish included a small component of the very largest Gerrards (>11 kg or 25 lbs).

The reason for this is not yet clear, although we expect that Gerrard rainbow density (competition for food), kokanee population structure and abundance, angler harvest rate and size selectivity are all plausible contributing factors.

This issue will continue to be investigated to better understand kokanee/rainbow/angler dynamics and predict how these factors need to align to produce the desired outcome of high catch rates for large rainbow (>7 kg or 15lbs) in addition to the opportunity to catch the fish of a lifetime (>11 kg or 25lbs).

Nutrient Restoration Program

The nutrient restoration program on Kootenay Lake was implemented to restore decreasing productivity as a result of upstream dams, which trap nutrients that formerly reached Kootenay Lake. This program started on the North Arm of Kootenay Lake in 1992, to rebuild the food web that had been impacted by construction of BC Hydro's Duncan Dam. In 2004 nutrient restoration started in the South Arm of Kootenay Lake to compensate for similar impacts of the Libby Dam in the United States.

Phosphorus and/or nitrogen is added to the lake, both of which are naturally occurring and vital to biological processes. Nutrients are taken up by phytoplankton (plants suspended in water), which are then consumed by zooplankton, and zooplankton is the food source for kokanee.

Since nutrient additions began in 1992 in the North Arm and 2004 in the South Arm, average kokanee biomass in the entire lake is 2.5 times higher. Zooplankton has increased, and particularly in the South Arm, the zooplankton that kokanee prefer (*Daphnia*), has doubled following nutrient additions. These results show that the nutrient program is working to restore productivity and that kokanee are benefiting.

The program involves weekly additions of nutrients that mimic the hydrograph (a record showing the changes in flow over time) of the rivers prior to dam construction. This is a lake restoration project rather than an enhancement project – therefore the amount of nutrients added are roughly equal to (or less than) what would otherwise be flowing into the systems if the dams were not there. Optimization of the program, such as adjustment in amount and timing, are made based on results from a comprehensive monitoring program. Seasonal variability such as flow, temperature and light affect growing conditions, and nutrient additions are adjusted and balanced to ensure optimal growth of phytoplankton to move benefits up the food chain.

Nutrient additions at times are a contentious issue because when a water body is high in nutrients it can be a serious problem – it causes blooms of algae that do not benefit fish, decrease water transparency and deplete oxygen. On Kootenay Lake careful monitoring of water chemistry and physical parameters indicate that Kootenay Lake is naturally very low in nutrients. Oxygen levels are high and available to fish from top to bottom, which means the lake is not suffering low oxygen conditions. As well, nutrient levels in Kootenay Lake are well below levels observed in highly productive, high-nutrient systems.

The North and South Arm nutrient addition programs will continue as there are clear benefits for fish and fisheries on Kootenay Lake, and in particular to providing food for kokanee.

The Future

There will be a period of low abundance in kokanee populations. The fall 2014 hydro-acoustic survey estimate of kokanee abundance, for kokanee of all ages (excluding the spawners which had left the lake) was roughly 17 million, however most of these were fry, with 1 million kokanee to represent the next two spawning years. This suggests that adult kokanee returns in the next few years will be low; hence the need to decrease kokanee harvest. Higher fry numbers in this estimate suggest that we currently have the raw material to increase kokanee numbers quickly, however kokanee numbers will likely not increase significantly for at least a few years while these fry grow to adults. However, if we can reduce mortality from predation, kokanee numbers will likely rebound strongly. It is important to note that when numbers are down, kokanee compensate by growing larger in size and more fecund (more eggs). This was observed in 2014 with the largest fish ever recorded at Meadow Creek, which had more than twice the average number of eggs per female.

Although angler reports suggest declining catch rates for Gerrards, and last year's peak count of spawners was a decrease from the year previous, counts were still the sixth highest in more than 50 years of continuous record, suggesting there is still a reduction in Gerrard numbers to come. Low catch rates, poor condition and a decreasing trend in spawner counts also suggest that we will see a decrease in Gerrard spawners this spring, and potentially for several years to come. The outlook for improved numbers of large Gerrard rainbow trout is also good in the medium term, as recent record high escapement was built from returns of less than 200 spawners, and recent angler surveys suggest high catch rates of small Gerrards which will rebuild spawner numbers in the future. High numbers of young Gerrards are now starting to eat kokanee, and kokanee numbers are already depressed. We anticipate angler harvest of smaller fish may mitigate this impact if harvest rates increase. Anglers can have an immediate and meaningful contribution to recovery of predator/prey balance in Kootenay Lake by harvesting more small rainbow trout.

Management Actions

The Ministry is taking direct and immediate action to reduce the time it takes for kokanee numbers to increase, and for Gerrard rainbow abundance to stabilize.

This includes:

- starting April 1st, 2015, increased kokanee survival in the lake by decreasing harvest (daily quota=0)
- starting April 1st, 2015, Increased young Gerrard harvest to give kokanee an opportunity to recover (rainbow trout daily quota=4, one over 50cm)
- Assembled a team of experts to review all options to increase kokanee and Gerrard abundance.
- Longer term review and data analysis to better understand predator/prey dynamics in the lake, and inform future management actions and learn from current situation.

Time to Recovery

The recovery time for kokanee and Gerrards is difficult to predict because of uncertainty in how quickly the Gerrards and bull trout will respond to reduced kokanee numbers, and how willing anglers will be to reduce young Gerrard abundance. However, in spite of this uncertainty, we have attempted to lay out the best and worst case for recovery time:

- Best case – Less than one kokanee generation (2 to 3 years)
  - We currently have the building blocks for quick recovery - fry production has remained high, kokanee food is abundant and young Gerrard abundance could be reduced by anglers
  - Potential upturn in kokanee spawners by 2017 and concurrent moderate Gerrard catch rate increase to follow in 2017 and beyond
  - This requires a sustained increase in kokanee size and survival rates, as well as a strong reduction in predator abundance

- Worst Case – two kokanee generations or more (8+ years)
  - If predator numbers are slow to drop off and most young Gerrards remain unharvested, consequently exerting additional pressure on depressed kokanee stocks

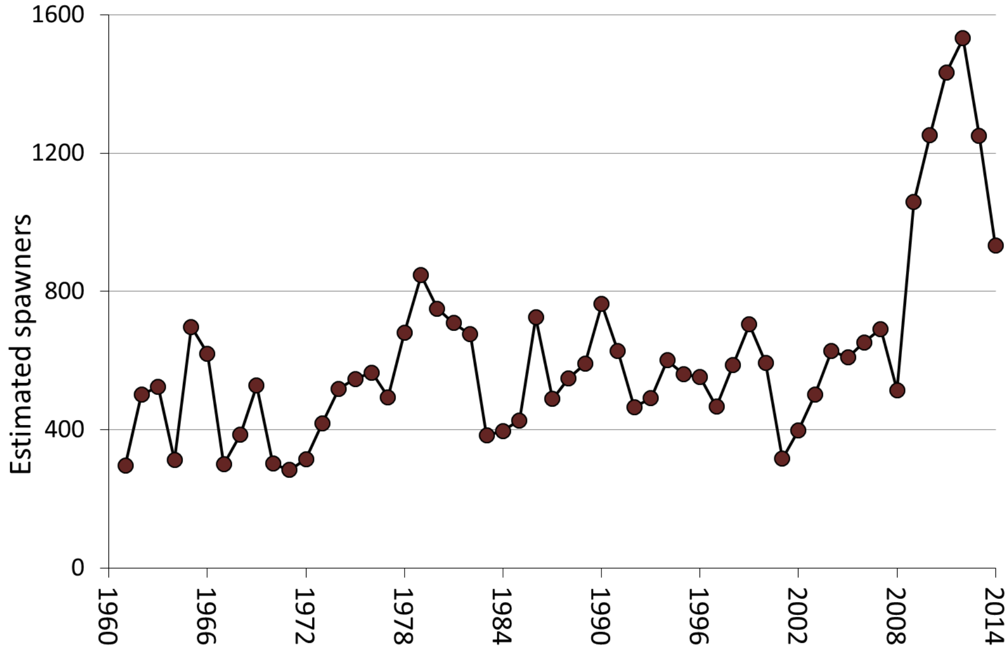

Figure 1. Estimates of Gerrard rainbow trout spawners, 1961-2014.

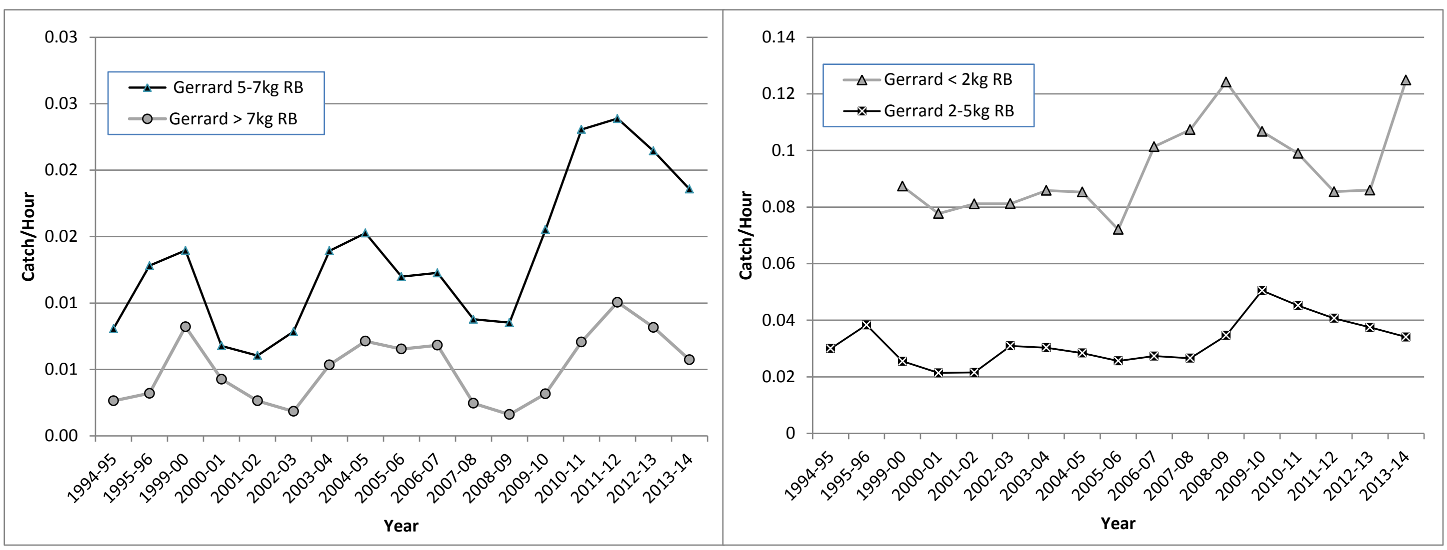

Figure 2. Estimates of Gerrard rainbow trout catch rates, 1994-2014.