

## LAKE SAMMAMISH KOKANEE: A native fish population on the brink?

By Jim Bower



*Kokanee salmon are a life history variant of the more familiar sockeye salmon that spend their entire life in freshwater lake systems. Kokanee “return” from Lake Sammamish (rather than the ocean) to spawn in small streams within the basin.*

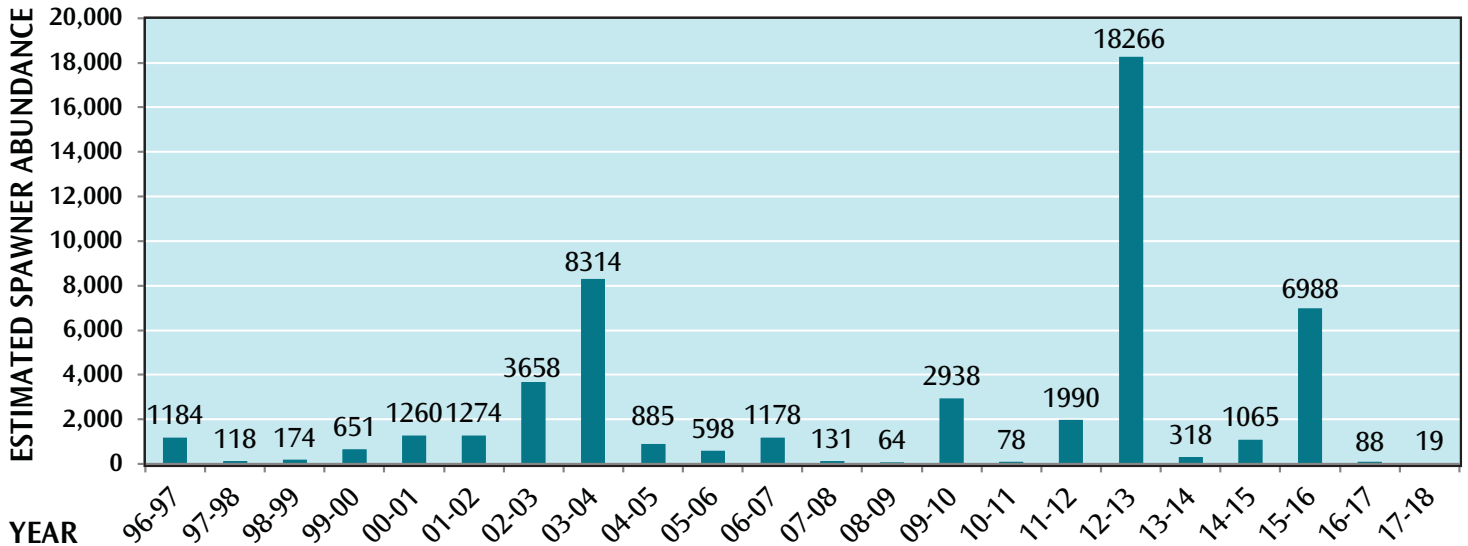
King County’s Lake Sammamish supports one of four native kokanee populations in Washington. The oral history and available archives indicate kokanee were the only Pacific salmon common to the basin since the last glaciation. This local population is culturally significant to native peoples and is an important gauge of our collective ability to manage numerous beneficial aquatic resources and delicate ecological balances in the face of development. Unfortunately, ongoing annual monitoring suggests we should be concerned about the long-term survival of this population.

### What’s going on?

Although there have been two large returns of adult spawners over the past six years, only 88 adult fish returned in the winter of 2016-2017, and just 19 returned in 2017-2018. This is not the first time periods of low returning kokanee have been observed in Lake Sammamish with a subsequent population rebound, including 1997-1998 and again in 2007-2008. Kokanee populations are known to be cyclical. Could the recent returns just be part of an otherwise normal population cycle? See the overall trend in diagram below.

Diagram 1

### LAKE SAMMAMISH KOKANEE—TOTAL ESTIMATED SPAWNER ABUNDANCE



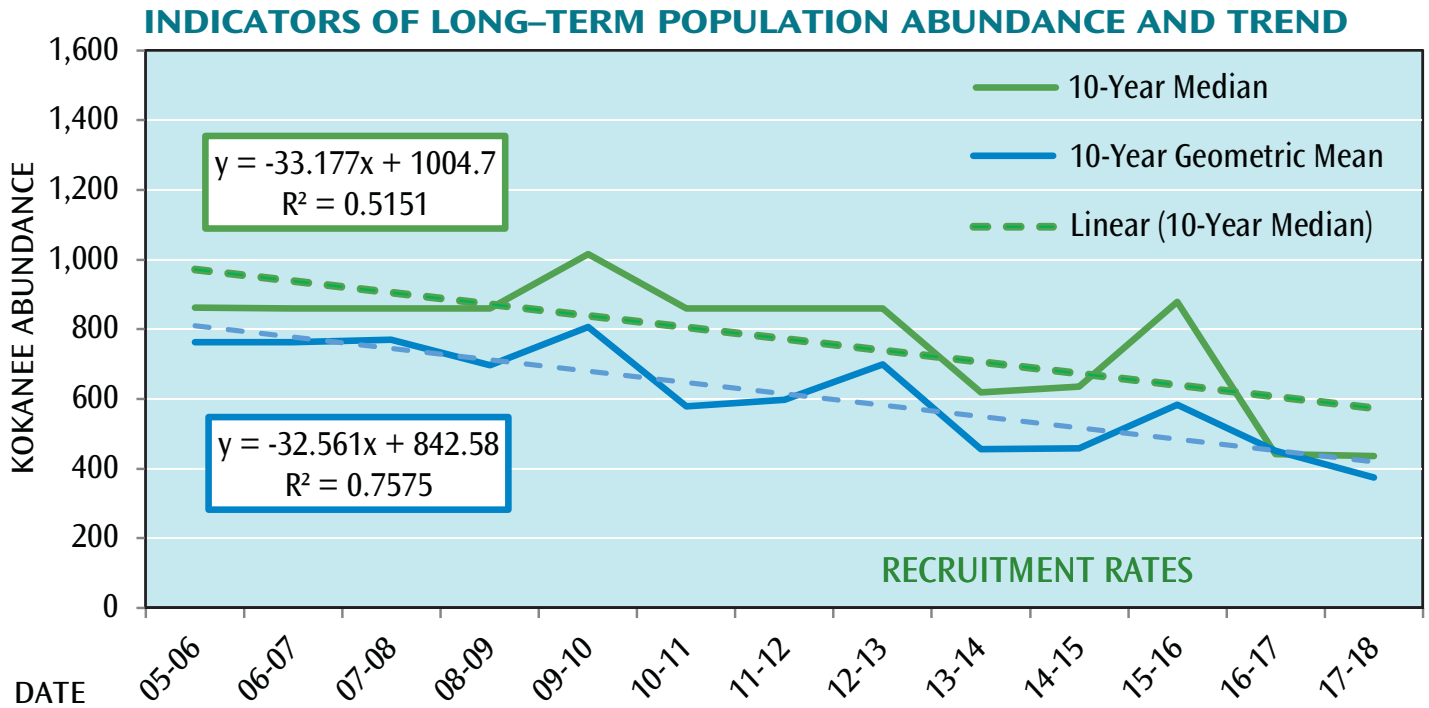
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## What does this trend mean?

When attempting to evaluate a long-term kokanee population trend, it is important to reduce the weight of outlier years (for example, the huge return during the winter of 2012-2013 and the dismal count in 2017-2018) and factor-in the variability among multiple generations of fish. For a population with predominant 2- to 4-year-old adult spawners, this can be achieved by considering either the 10-year median abundance or 10-year geometric mean abundance (see Diagram 2). Both measures suggest decreasing long-term adult spawner abundance and the potential loss of the population in only 10 to 20 years.

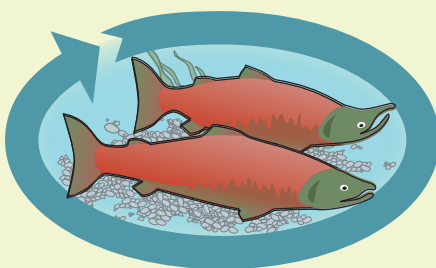
Moreover, because the decrease has been steady (rather than sudden), this result also suggests that chronic, ongoing environmental stressors are likely affecting the population.

Diagram 2



Are the recent poor returns during the winters of 2016-2017 and 2017-2018 different from other low return cycles?

## RECRUITMENT RATE



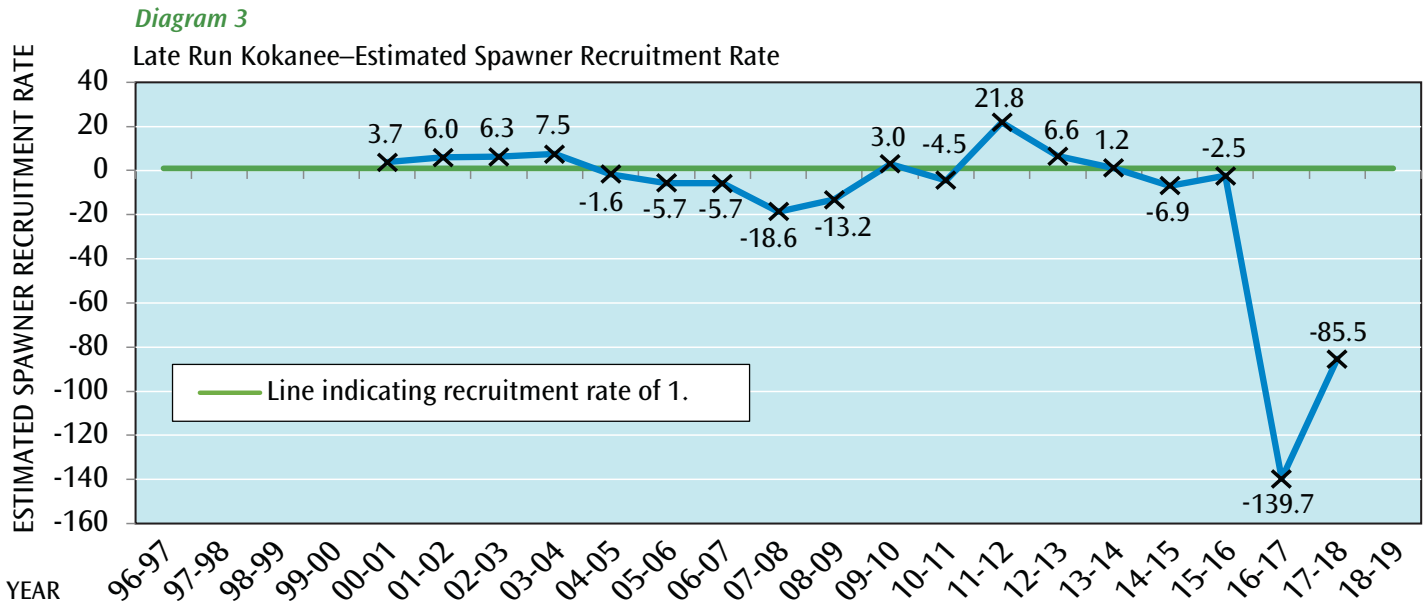
A simple fisheries stock assessment tool is adult-to-adult “recruitment”, which measures annual return rates after accounting for the varying age classes in different return years.

- A recruitment rate of “1” indicates a population is replacing itself;
- Greater than “1” indicates the population size is increasing; and
- Less than “1” indicates the population size is decreasing.

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Diagram 3 shows a recruitment rate between 2000 and 2015 that appears to cycle between +21.8 and -18.6. However, monitoring during the 2016-2017 and 2017-2018 returns reveal that not only were spawner abundances low, but the mortality rates of these cohorts were an order of magnitude below those observed between 2000 and 2015.

This monitoring data suggests that acute environmental stressors adversely affected the cohorts comprising these two return years. Furthermore, the population is likely at risk of an abundance and genetic “bottleneck” if similar recruitment rates are realized in returns during the upcoming winter of 2018-2019.



## What is causing the decline in kokanee populations?

It is common knowledge that salmon life stages during the first year are the most sensitive to mortality. However, in-stream fry production in Lake Sammamish tributaries average approximately 8 percent, which is not out of the ordinary for wild salmonids. Additionally, supplemental hatchery production has also significantly boosted overall fry abundance in the lake from 2010 to 2016.

The King County Lakes Monitoring program has detected unusually frequent and strong high temperature and low dissolved oxygen levels in Lake Sammamish during peak stratification in 2014, 2015, and 2016 that may be contributing to the problem. These events can temporarily – but significantly – reduce available lake habitat for kokanee and lead to reduced foraging opportunities, physiological stress, and increased predation. Elevated physiological stress is a major catalyst for viral, bacterial, and parasite disease vectors.

In addition, there may be complex primary and secondary productivity changes in the lake that have not been observed. There may also be bioenergetic effects from introducing millions of chinook, coho, and kokanee fry into the lake each spring that are not understood, such as potentially increased predation or competition for resources.

## What is being done?

Native Lake Sammamish kokanee are culturally significant and important to the biodiversity of our region. Their distinct genetic signature makes them impossible to replace. As a result, for several years King County has worked with the surrounding municipalities, resource agencies, nonprofit organizations, and other partners as part of the Lake Sammamish Kokanee Work Group (KWG), a collaborative effort to conserve this kokanee population. KWG partners are striving to develop and implement well-informed decisions for habitat management, adaptive monitoring, and kokanee preservation. Given the recent poor returns, the KWG has recommended several emergency measures, including reducing the proportion of returning adult spawners used for hatchery supplementation, deploying temporary weirs and remote egg incubators, and varying the release dates of hatchery fry to the lake.

*(continued on page 4)*

For more information about Lake Sammamish kokanee, or to sign up for email updates about kokanee monitoring and returns, go to [King County's Lake Sammamish kokanee web page](#).

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