Chinook Salmon Collapse: Causes and Approaches to Restoration

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Executive Summary/Abstract

Yukon River salmon, in particular Chinook reliably sustained people throughout the watershed of the Yukon River for countless generations.

In recent years, the population of Chinook has collapsed to a shadow of its former glory.

This paper points to overharvest as the most obvious cause of the collapse and advocates a purposeful and targeted harvest reduction as an approach to restoring Yukon River Chinook.

Introduction

The Yukon River has supported salmon, and people, since at least the last glaciation. No doubt, there have been good years and bad years among those thousands of years. However, it appears that the Chinook have undergone a recent population shift, even more significantly as the human population shifted. We seem to be living in a time of less abundance and smaller, weaker fish.

Almost certainly, the causes for these regime shifts are because of actions taken by a recently arrived wave of humans, primarily from Europe, who transformed Yukon River fishing.

This transformation has gravely affected Yukon River Chinook to the point that there are now far fewer fish available than 20 years ago, and the few that are available are much lower quality than their ancestors.

Quite simply, recent waves of humans to the Yukon River watershed have overexploited a resource that fed not only the people of the Yukon, but sustained a web of life ranging from insects and plants through towering spruce to magnificent Grizzly bears.

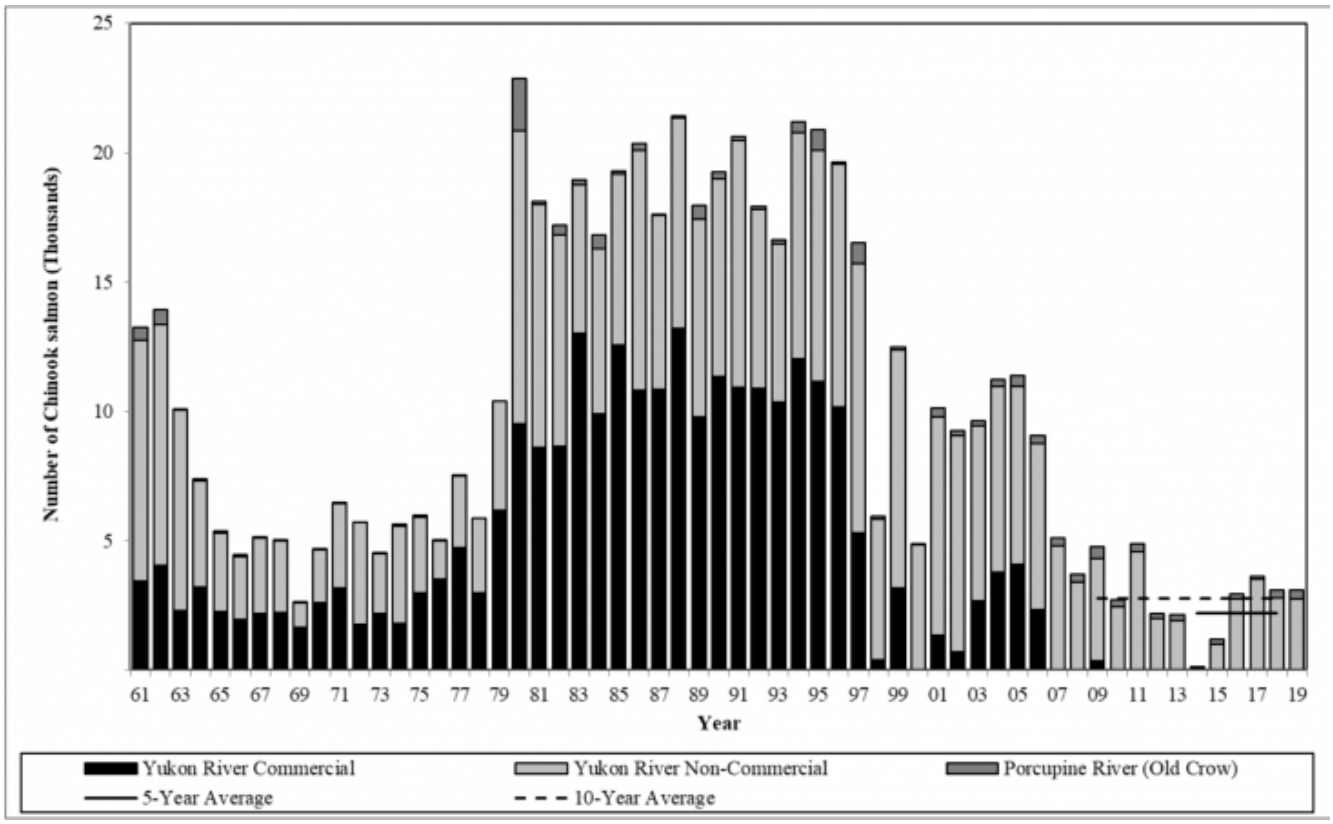
It is not impossible for this damage to be repaired, but it will be difficult, and it will take time and many people will need to change the way they live and harvest.

Discussion

Overfishing

The following two charts are taken from the Yukon River Panel's (YRP) Joint Technical Committee's (JTC) 2019 review of the Yukon River salmon season[1]. The Yukon River Panel is a bi-national body charged with making recommendations about all matters related to salmon management on the Yukon River. It takes its mandate from the Yukon River Salmon Agreement, an annex to the Pacific Salmon Treaty. One of the roles of the YRP is to restore salmon populations[2]. The first of these charts shows how the Canadian fisheries exploded- trebled- in 1979 until 1998, which roughly translates to three, seven year generations of Chinook.

This period coincided with a commercial fish plant in Dawson City.



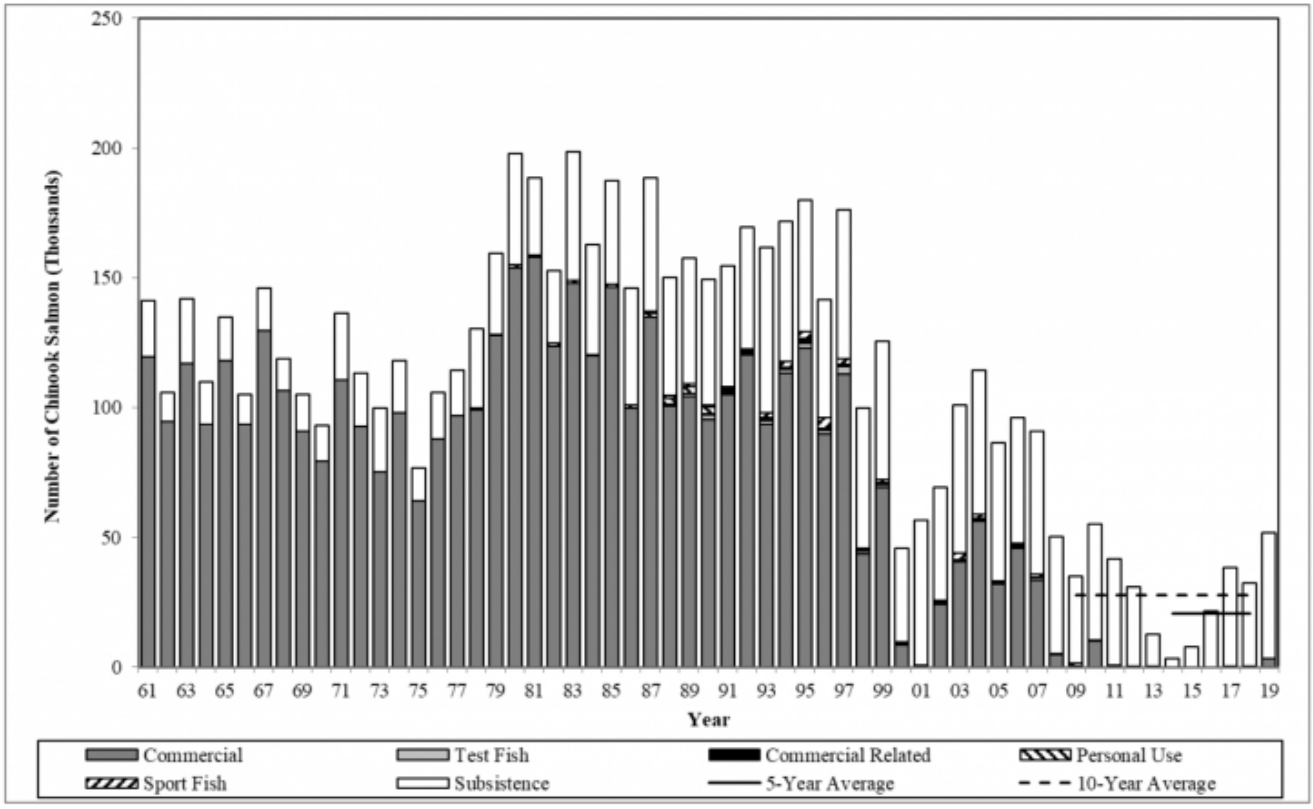


Figure 4.–U.S. (Alaska) harvest of Chinook salmon, Yukon River, 1961-2019.

Note: The 2016–2019 harvest estimates are preliminary. Commercial harvests through 2007 were Chinook salmon-directed commercial fishing. Commercial harvests 2008 to present include Chinook salmon incidentally harvested and sold from the chum salmon fisheries. 'Commercial related' refers to the estimated harvest of female Chinook salmon to produce roe sold between 1990 and 2002.

The second chart shows how the US harvest went from ~100K to ~150K in that same timeframe. Again, an increase in the commercial fishery was a major cause of the increase. However, the situation in Alaska does not translate exactly to Canada; Canada does not have a subsistence fishery, which allows all Alaskans to harvest Chinook to meet their personal needs and to trade and sell them freely, so long as they are not sold to fish processing plants. Alaska does not have an Indigenous food fishery, listed as "non-commercial in the top chart.

It is a bit difficult to know exactly how many Chinook are taken in the Alaskan subsistence fishery, because catch reports are not mandatory, but it appears that since the fishery collapsed, it has averaged about 30-50K. Prior to the period that I call overfishing, about 100K Chinook had been taken every year for decades. I'm not a fisheries scientist, and I'm definitely not a politician, but it seems to me that a period of overfishing from about 1979 through to about 2000 has resulted in a permanent reduction in the amount of fish available to catch.

Selective fishing as a cause and as a solution

Chinook salmon, and especially, Yukon River Chinook, are famous for their size. Chinook salmon can live up to eight or nine years and range up to 100 lbs.

Harvesters agree that one of the earliest indicators that all was not well with Chinook was that the very largest fish became more and more rare. First the super giants, the 80lb plus fish vanished, then as the years passed, the size of the largest fish steadily shrank until now few fish reach even 30lbs. This is

important because, an object's volume increases 3 times as fast as its diameter, which means that a fish that is twice as big will hold eight times as many eggs. So, not only so we have fewer fish, but the fish we do have are less fertile. This means that to rebuild the Chinook salmon run, we shall need to have more fish spawning than we did before we collapsed the Chinook runs.

Environmental changes

We are exceptionally fortunate that the Yukon River watershed has escaped major industrialization; we have only one major dam, in Whitehorse, and few spawning or rearing streams have been damaged or polluted. However, the Yukon and Alaska are particularly affected by the climate crisis; the far NW of North America is warming faster than any other part of N. America.

Salmon are cold blooded- they cannot regulate their temperature. If they get overheated, they have to lay low, ideally in a cool spring, until their temperature falls again. If the water in the Yukon rises much above about 18 degrees, salmon have to stop migrating.

The following chart[3] shows the temperature of the Yukon near its mouth in 2019. Not only was it much warmer than normal most of the season, it rose to 21 degrees. Much too warm for Yukon River salmon. This almost certainly affects salmon spawning success.

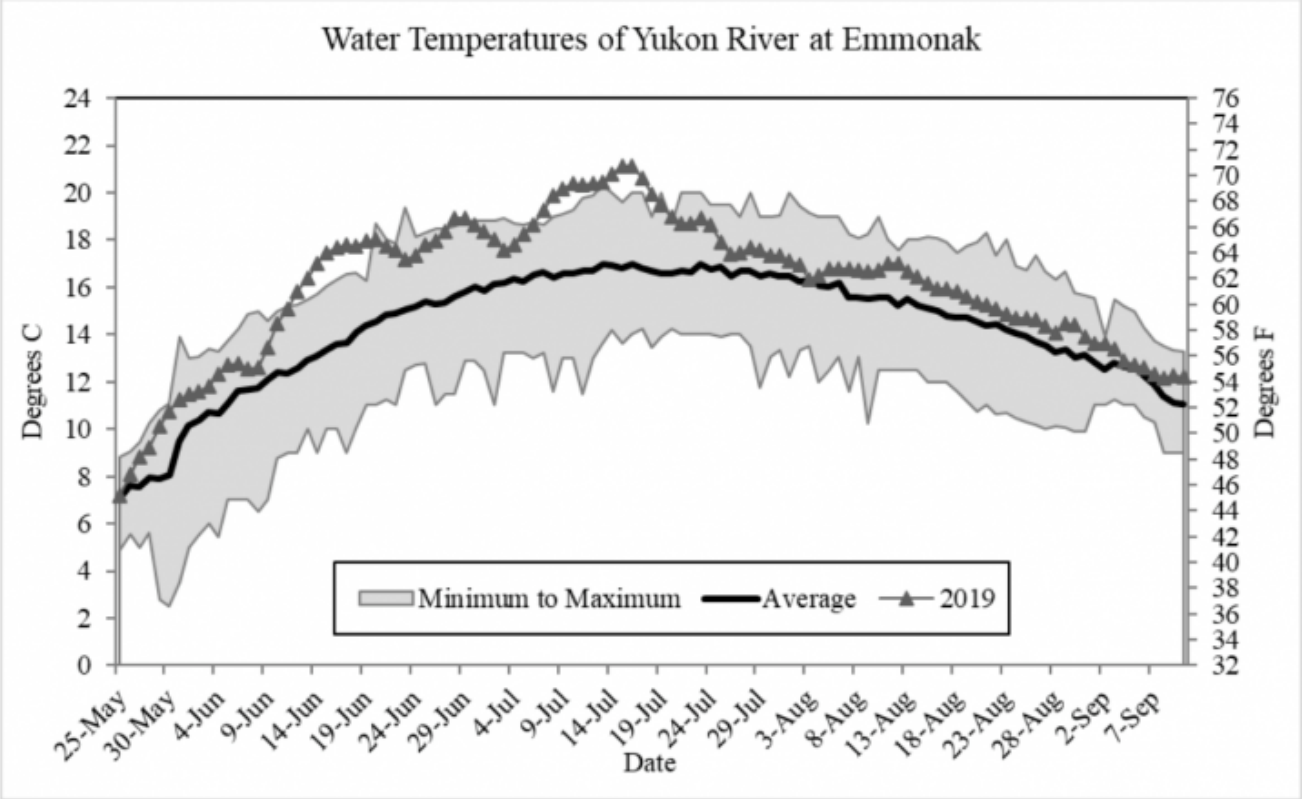


Figure 18.–Lower Yukon daily water temperatures, comparing 2019 to historical minimum, maximum, and average temperatures.

Conclusions

We are hurting ourselves as well as the environment; it would be foolish in the extreme not to address over fishing, salmon size and environmental change and not make every effort to restore the Chinook runs to pre-collapse conditions. If we actually manage to restore salmon to their pre-collapse abundance and size, and build in a buffer for warm water years, we could harvest, reliably, two to three times as many Chinook as we do now, in perpetuity.

We need to fish smarter (allow the bigger fish to pass) and better (allow more fish to pass) and we need to address the climate crisis.

We can, in theory, do this, but will we?

Is it even in our nature, in our culture, to sacrifice something today for more in the future?

Stick around, because we are going to find out.

References

[1] **https://www.yukonriverpanel.com/publications/yukon-river-joint-technical-committee-reports/#**

[2] **https://www.yukonriverpanel.com/publications/yukon-river-salmon-agreement/**

[3] **https://www.yukonriverpanel.com/publications/yukon-river-joint-technical-committee-reports/#**