

# Exploration of Potential Early Life Mortality in Canadian-Origin Chinook Salmon Eggs due to Thiamine Deficiency

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## KINGS OF THE SEA

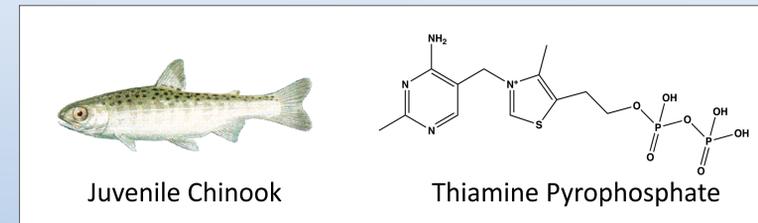


*Oncorhynchus tshawytscha*

The noble Chinook salmon (*Oncorhynchus tshawytscha*) celebrated round the world for its rich red flesh and succulent flavor. The largest of all Pacific salmon, adult Chinook salmon are frequently 36 inches in length and often exceed 30 pounds. Fisheries of this sought after fish are estimated to have a market value of \$25 million annually.

**The Canadian origin Chinook salmon returns are far below historic averages and the causes of the decline remain largely unknown.**

## IS THIAMINE DEFICIENCY A FACTOR IN THE DECLINE?



Juvenile Chinook

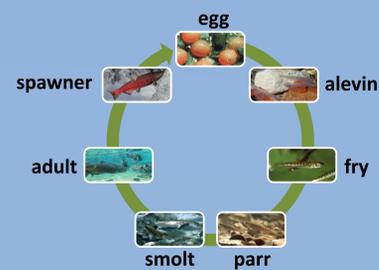
Thiamine Pyrophosphate

### Low Thiamine Levels in Eggs Characteristic of Early Life Mortality

- Early Life Mortality (EMS) is embryonic mortality effecting salmonids
- EMS results in loss of equilibrium, lethargy, hemorrhage, and death between hatch and first feeding
- EMS has been well documented in Brook Trout and Atlantic Salmon

## LIVE FAST, DIE YOUNG, AND LEAVE A BEAUTIFUL CORPSE – James Dean

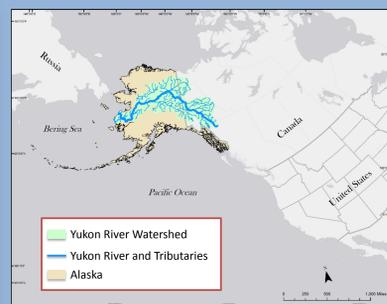
- Female Chinook salmon will lay an average of 5,000 eggs per female
- Chinook salmon are semelparous – only capable of spawning once before dying
- Parr spend first winter in natal streams



- Under natural conditions only ~30% of eggs will result in the emergence of fry
- Adult Chinook salmon will spend four to six years in the open ocean feeding on herring, sand lance, euphausiids, and other small fish before returning to their natal streams to spawn
- Less than 1% of salmon survive to spawn

## YUKON RIVER

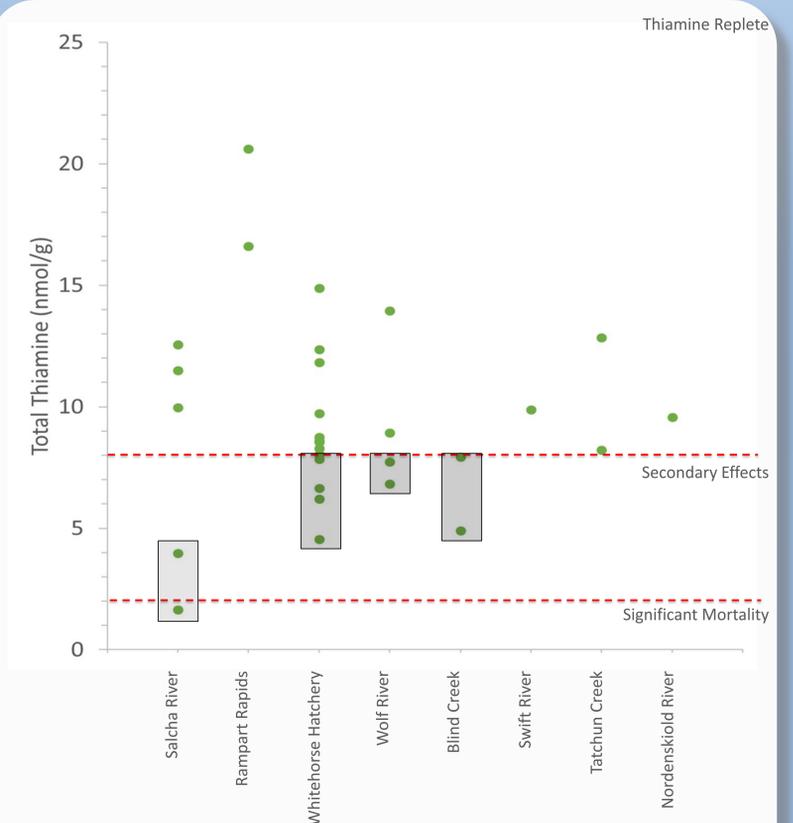
- The Yukon River stretches over 3,000 km before emptying into the Bering Sea
- The Yukon River Drainage system encompasses an area over 800,000 sq. km.
- An important source for commercial and subsistence fishing



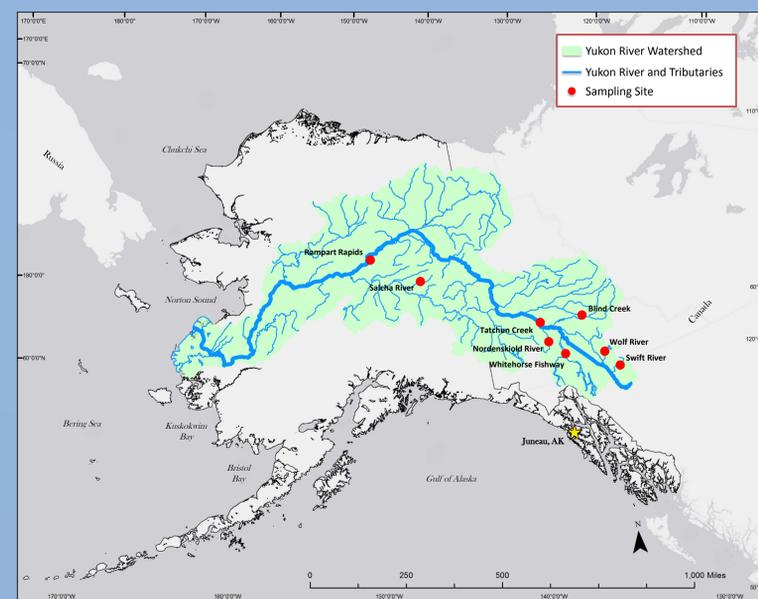
## CONCLUSIONS

- **1/3 of all the eggs sampled during 2013 were found to be thiamine deficient**
- There is a large degree of variability in total thiamine concentration between individuals, which may be a result of differing diets
- Because of the results of the 2013 sampling, the number of sampling sites was increased in 2014 and 2015
- Analysis of 2014 and 2015 samples is underway

## THIAMINE DEFICIENCY IN YUKON RIVER CHINOOK SALMON



## METHODS



- In 2013 spawning Chinook salmon eggs were collected from several Canadian rivers
- Chinook salmon eggs were collected during carcass surveys and from sport fishing
- Total egg thiamine was determined by fluorescence spectroscopy coupled to high performance liquid chromatography analysis

Fry hatched from eggs with total thiamine concentrations less than 8 nmol per gram suffer from adverse growth, poor vision, predator avoidance, prey capture, and immune function. Fry hatched from eggs with total thiamine less than 2 nmol per gram are unlikely to survive.