

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

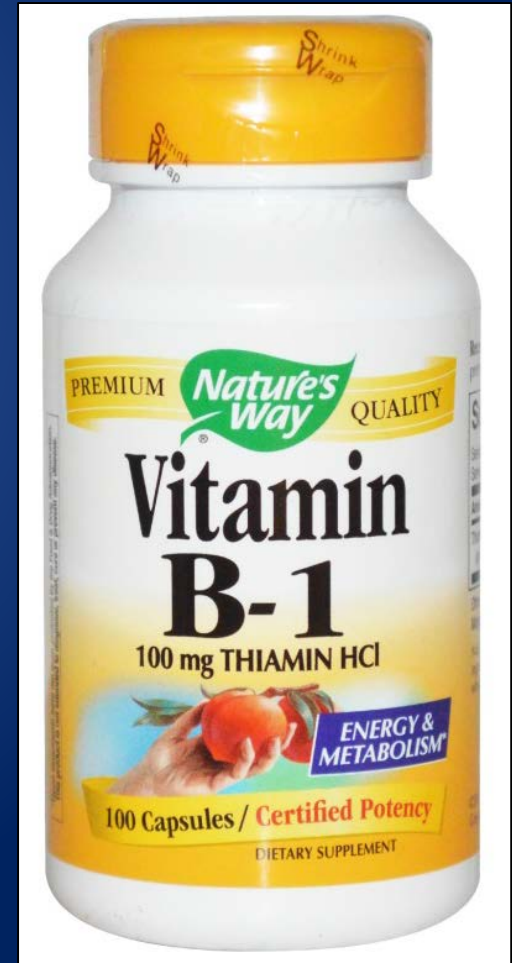
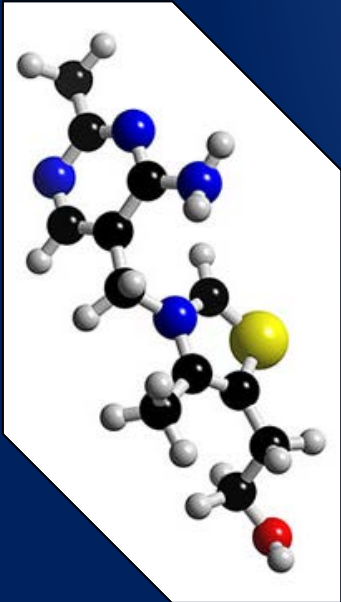


Sean Larson
Yukon River Panel
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What is Thiamine Deficiency?

- Thiamine (vitamin B1) is a vitamin that all animals need to function
- Needed for the production of ATP (energy!)
- Only obtained from diet
- Thiamine deficiency occurs two ways:
 - 1) Fish consume prey **low in thiamine**
 - 2) Fish consume prey **high in thiaminase**
- Thiaminase = enzyme that breaks down thiamine



Documented Population Declines



Great Lakes Region

- Non-native alewife became dominant prey for Lake trout, Chinook, and coho salmon
- Chinook and coho salmon eggs that were low in thiamine were associated with fry mortality
- Symptoms include: loss of appetite, stunted growth, muscle atrophy, convulsions, and loss of equilibrium
- Major die off of Lake trout



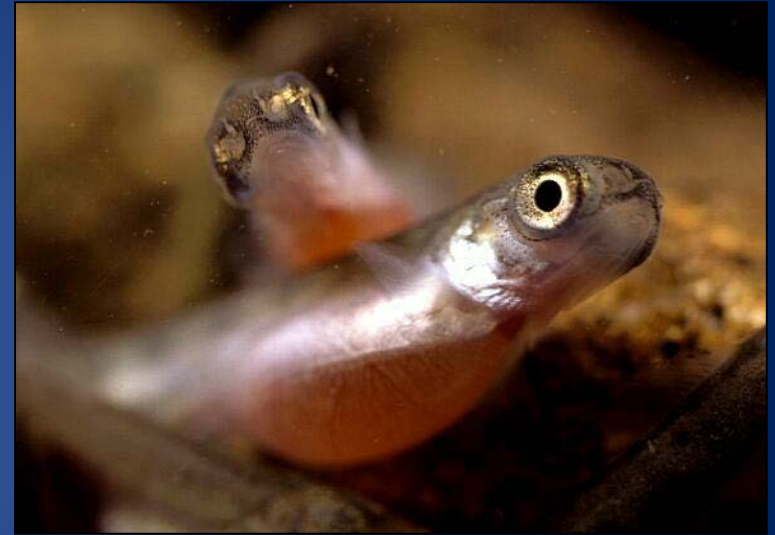
Critical Thresholds for Egg Thiamine

Secondary Effects

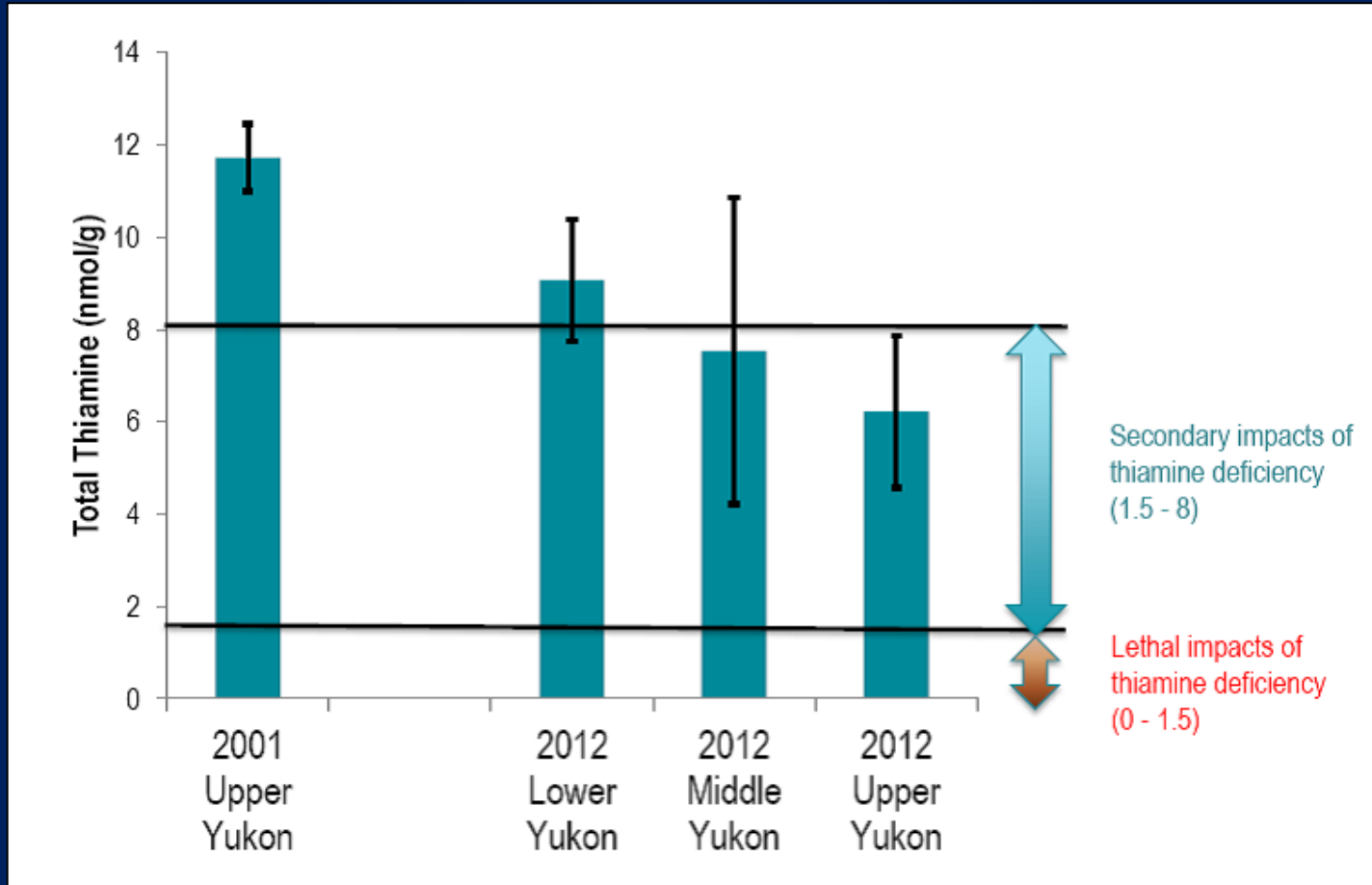
- Egg Thiamine levels fall below **8 nmol/g**
- Adverse effects on growth, vision, predator avoidance, prey capture and immune function

Early Mortality Syndrome

- Egg thiamine levels fall below **1.5 nmol/g**
- Significant fry mortality



Previous Yukon River Research



An exploratory assessment of thiamine status in Yukon River Chinook salmon; Honeyfield et al.

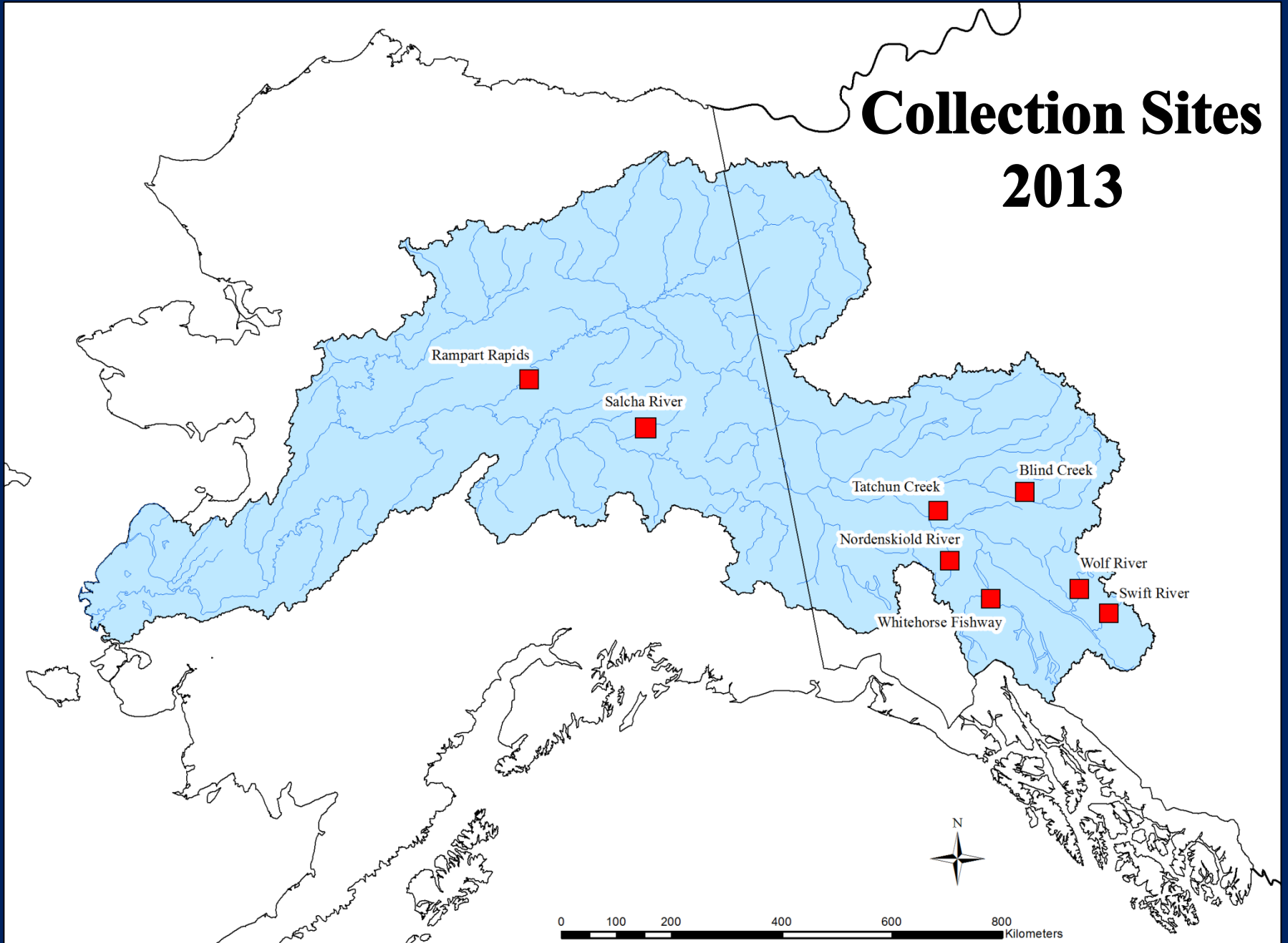
- Egg thiamine values were low enough to lead to secondary effects
- Suggests that thiamine deficiency may be involved
- Further research is warranted

Methods

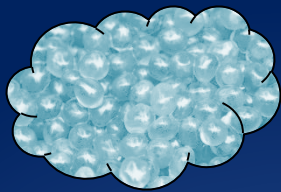
- Collect Chinook salmon eggs from various locations in the Yukon River Drainage
- Assess thiamine concentrations in the eggs and compare them to critical thresholds
- Determine if more research is warranted



Collection Sites 2013

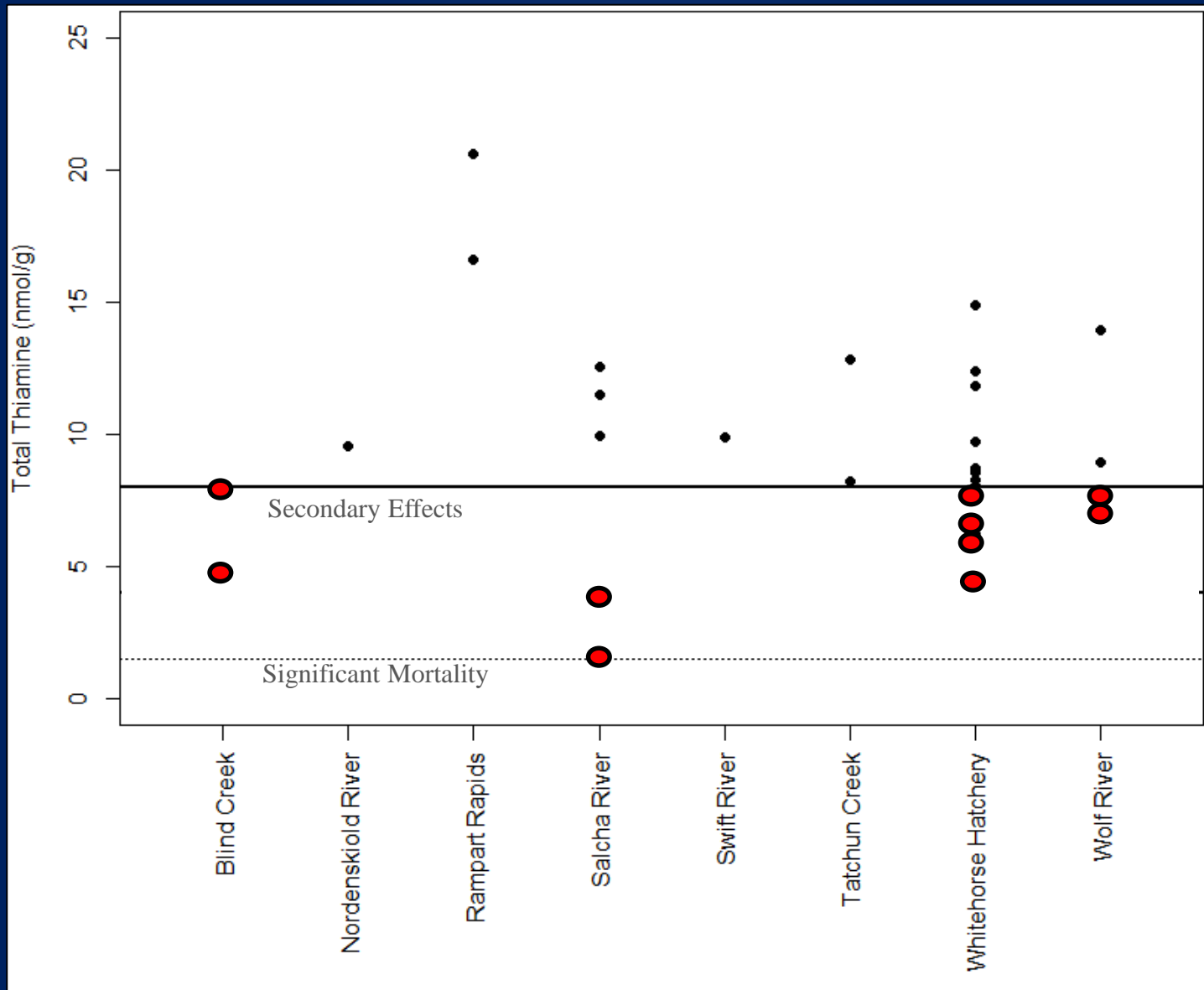






High-Performance Liquid Chromatography

Results



Sampling Location	N	Total Thiamine		% of egg lots < 8 nmol/g
		Mean	SD	
Blind Creek	2	6.42	2.14	100.0
Nordenskiold River	1	9.56	-	0.0
Rampart Rapids	2	18.61	2.82	0.0
Salcha River	5	7.93	4.83	40.0
Swift River	1	9.89	-	0.0
Tatchun Creek	2	10.54	3.27	0.0
Whitehorse Hatchery	13	8.94	2.75	30.8
Wolf River	4	9.36	3.18	50.0

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Upper Yukon River	12	10.67	4.52	33.3

Conclusions

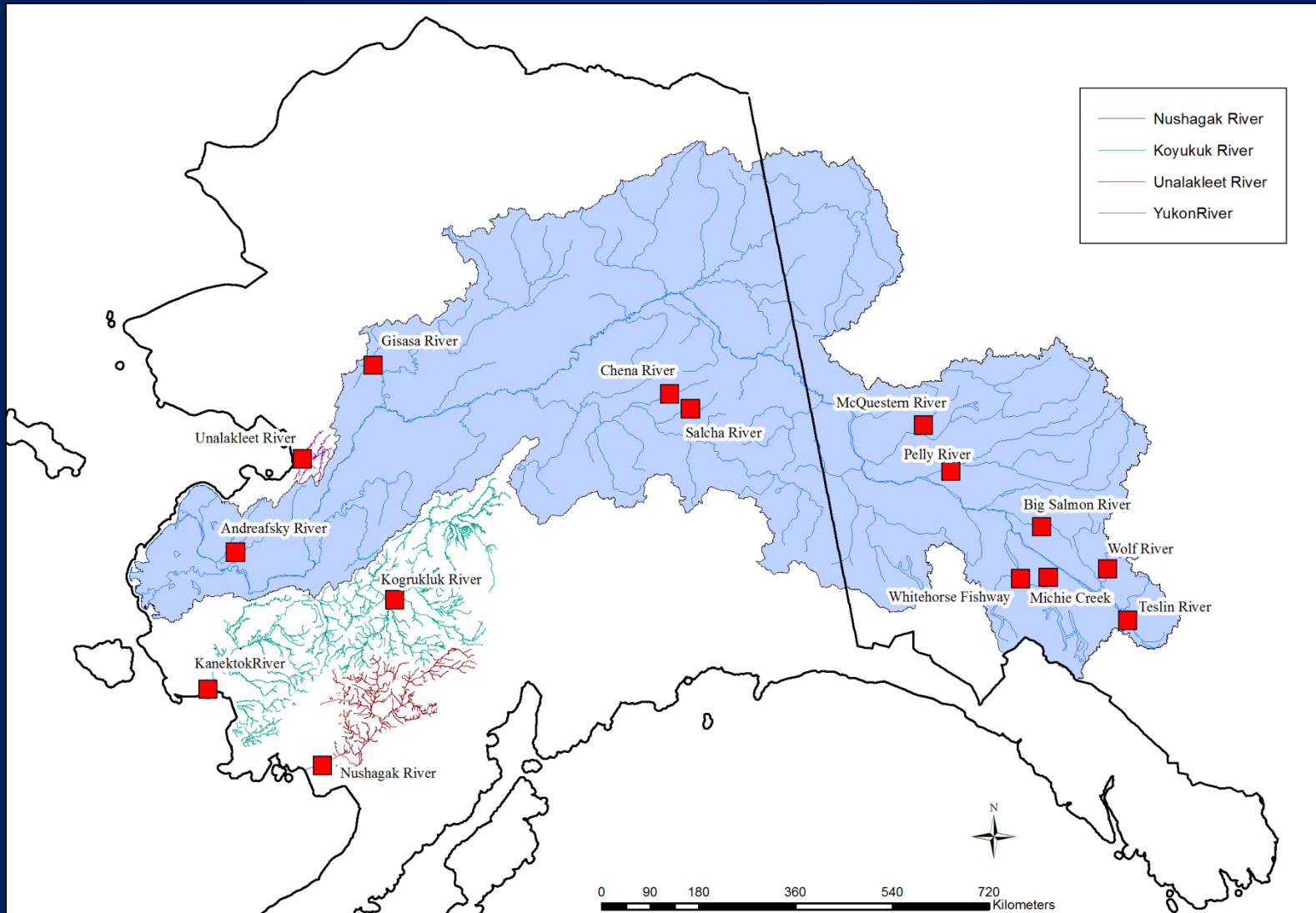
- Fry hatched from eggs with thiamine less than 8 nmol/g may have lowered survival rates
- Fry hatched from eggs with thiamine less than 1.5 nmol/g are unlikely to survive
- Some indication that thiamine deficiency could be present
 - Roughly 1/3 of all the eggs sampled were below 8 nmol/g
- *Sample sizes are small!*
- Large degree of variability in thiamine concentration between individuals, which may be a result of differing diets

Questions Remain...

- What are thresholds specific to Yukon Chinook salmon?
- 2012: 77% of eggs were thiamine deficient
2013: 33% of eggs were thiamine deficient
 - Interannual variability in the incidence of thiamine deficiency within the Yukon River?
 - Are marine diets changing?
- Do diets really differ between thiamine deficient and thiamine replete fish?
 - Stable isotope analysis



Next Step - NPRB



Acknowledgements

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Questions?

