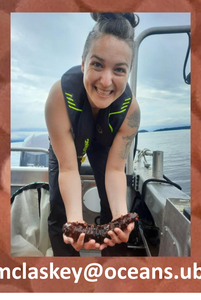
Thiamine deficiency in British Columbia Chinook salmon



a.mclaskey@oceans.ubc.ca

Anna K. McLaskey[1], Jacob E. Lerner[1,2] and Brian P.V. Hunt[1,2]

[1]University of British Columbia, Institute for the Oceans and Fisheries, Vancouver, BC, Canada
[2]University of British Columbia, Department of Earth, Ocean and Atmospheric Sciences, Vancouver, BC, Canada

BC Salmon Restoration and Innovation Fund
Fonds de restauration et d'innovation pour le saumon de la C-B

What is thiamine?

Thiamine is vitamin B1. Everyone needs vitamins, even salmon! Thiamine is a cofactor for enzymes required for basic cellular metabolism.

Where do salmon get thiamine?

From their food, just like you! Thiamine is produced by phytoplankton and bacteria, then transferred up the food chain. Egg thiamine comes from maternal prey.

Thiamine Deficiency Complex (TDC) is an emerging threat in the Pacific

Observed in the Great Lakes and Baltic Sea since the 1970's, discovered in the Pacific in last decade

TDC in California is tied to anchovy-dominated diet shift

(Photos: John Field / NOAA SW Fisheries Science Center)

Some forage fish contain **thiaminase** – an enzyme that degrades thiamine

What if salmon don't have enough?

Without enough egg thiamine, newly hatched salmon fry cannot survive. Low thiamine also affects migration, immune response, and feeding across their life cycle.

Hypothesized drivers of TDC

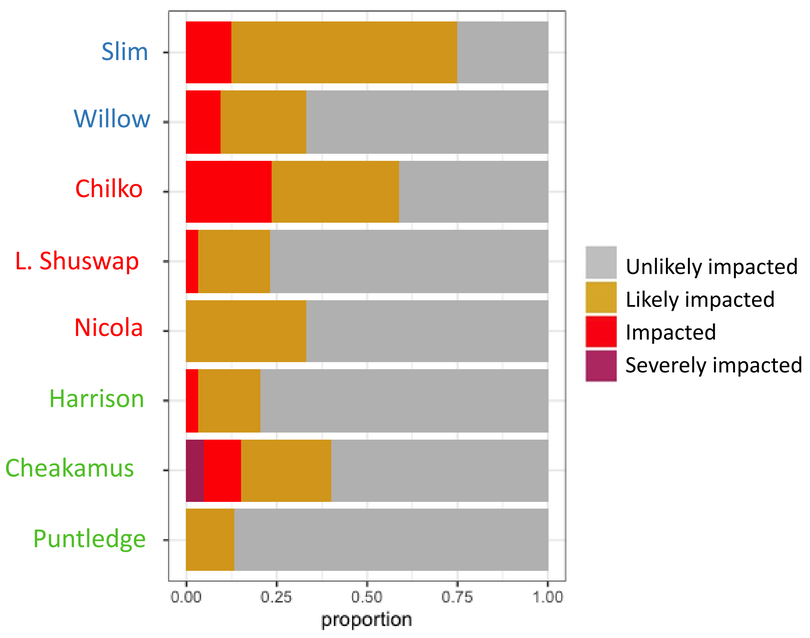
1. Consumption of **low thiamine prey**
2. Consumption of **high thiaminase prey**
3. Consumption of **lipid-rich prey** – lipid metabolism requires more thiamine

Do BC salmon have low thiamine?

- In 2023, some Chinook had egg thiamine levels below what is required for fry to survive (based on experiments done in California)
- BC egg thiamine levels are not as low as observed in California, but TDC is a real risk to BC Chinook populations
- Thiamine is lower in upriver populations, more variable in lower

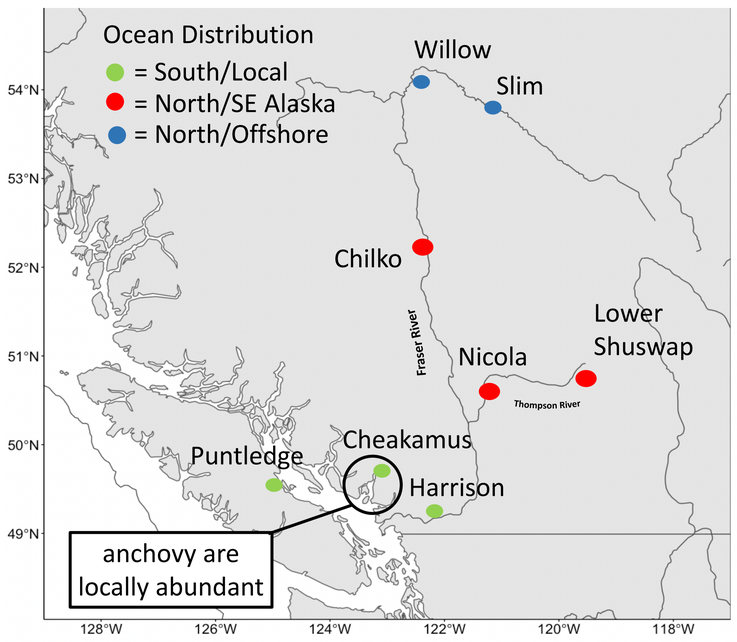
Stay tuned for 2024 results!

2023 Egg thiamine status by population

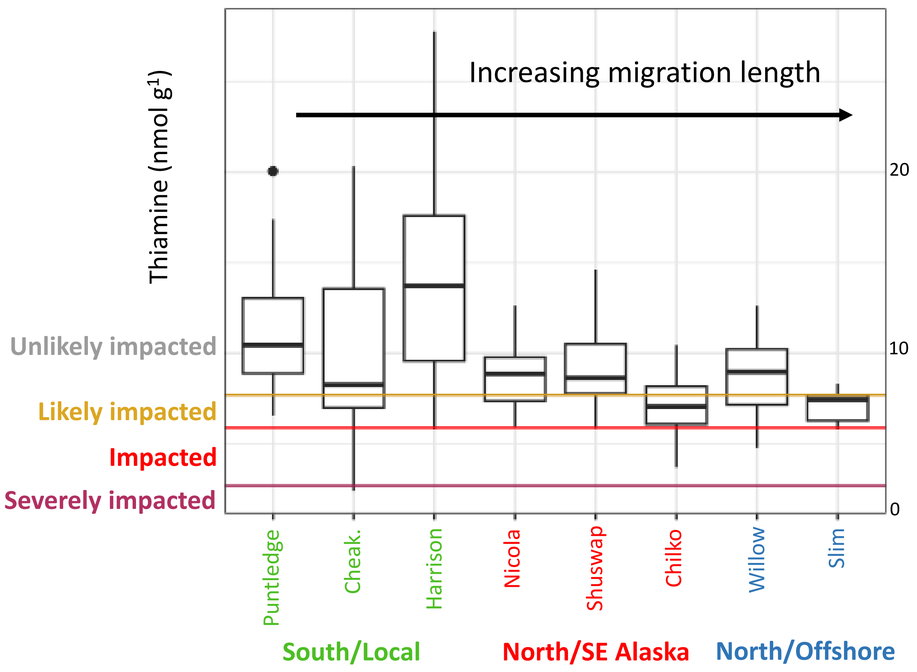


Egg thiamine levels based on fry-survival experiments in California

Populations have different marine distributions and freshwater migration distance



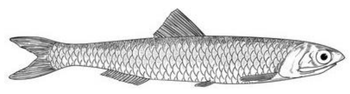
Egg thiamine declines with migration distance



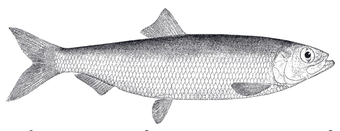
Next Steps: Investigate causes of low thiamine in BC Chinook

- Are anchovy in the Strait of Georgia a risk for local populations? (lowest concentration in Cheakamus population)
- Which prey are associated with low thiamine? (using SI and fatty acids)
- Evaluate influence of migration distance and run timing
- Assess individual factors – female size, age, lipid content, egg size

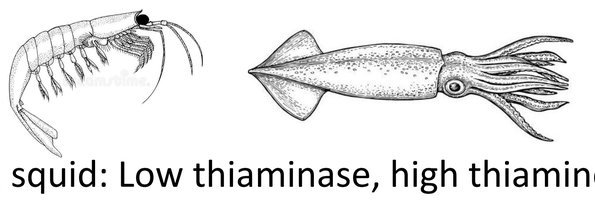
Measure thiamine nutrition of prey



Anchovy: High thiaminase, low thiamine

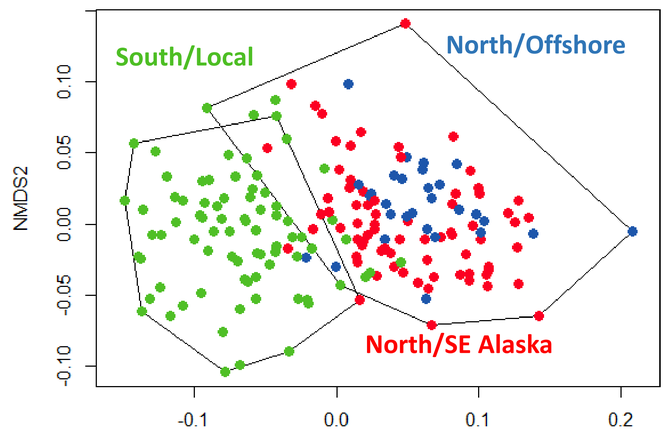


Herring: Moderate thiaminase, low thiamine



Krill, squid: Low thiaminase, high thiamine

Use stable isotopes and fatty acids to identify prey consumed



Egg fatty acids suggest different prey for South and North migrating populations