Exercising Chinook Salmon for Offshore Farming

Long-Term Influence of Sustained Swimming on Chinook Salmon, *Oncorhynchus tshawytscha* form and function

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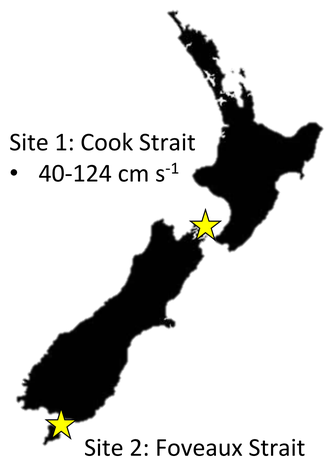
1. INTRODUCTION

The New Zealand Chinook Salmon Aquaculture Industry is aiming to expand into offshore high energy environments. Offshore environments are dominated by large water movements and strong currents that are not experienced in nearshore sites.

Even though profound swimming abilities are innate traits of salmonids, through domestication and selective breeding programs wild swimming phenotypes could have been lost. On top of this, up to 40% of harvested Chinook salmon in some farms in the Marlborough Sounds present spinal deformities that are likely to incur exacerbated energetic costs for swimming.

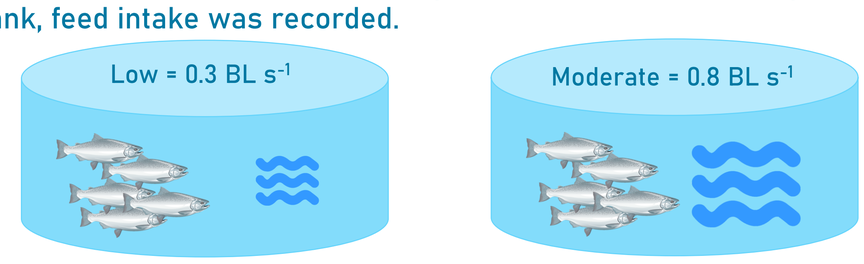
This raises concerns surrounding how sustained swimming will impact production-related traits and welfare in Chinook salmon farmed offshore.

Our objectives were to:
1. Assess the impact of sustained swimming on growth and feeding phenotypes;
2. Understand whether exercise can improve swimming performance and metabolic rates;
3. Highlight additional costs poor spinal health may impose on swimming performance and their energetic requirements.



2. METHODS AND MATERIALS

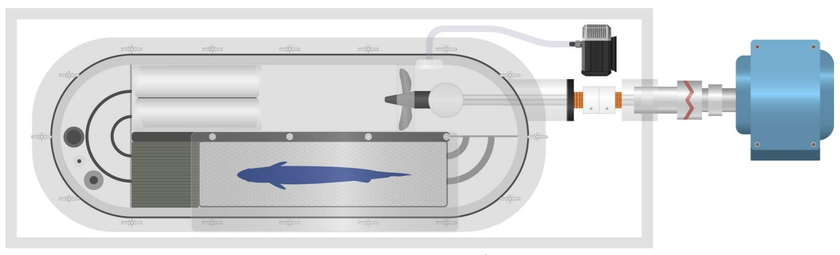
1. Chinook salmon were raised under low (0.3 BL s^{-1}) or moderate (0.8 BL s^{-1}) water currents for 10 months. They were fed to satiation daily and for each tank, feed intake was recorded.



2. Throughout the experiment, multiple sampling assessments were performed recording data on:
   - Length, weight and girth;
   - Condition factor;
   - Spinal health.

3. Specific tissues were sampled for histological and analytical assessments, as well as whole body for proximate composition.

4. Swimming respirometry was used to measure swimming performance and oxygen consumption rates.

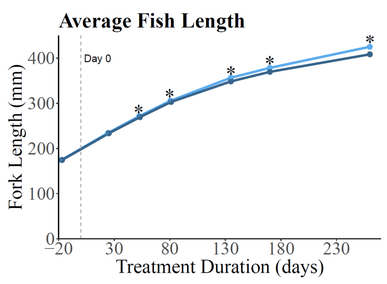


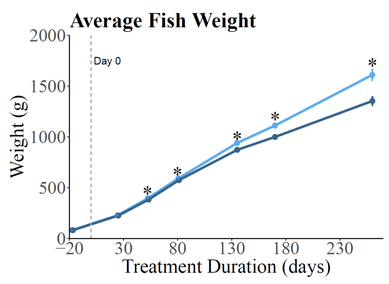
Loligo Systems 2022

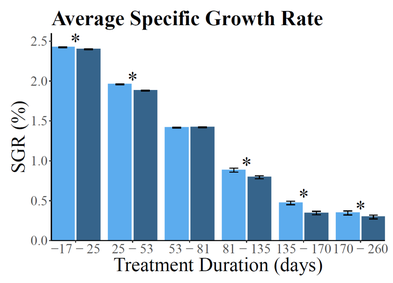
3. RESULTS AND DISCUSSION

Low Current | Moderate Current | Spinal deformity-Low Current | Spinal deformity-Moderate Current

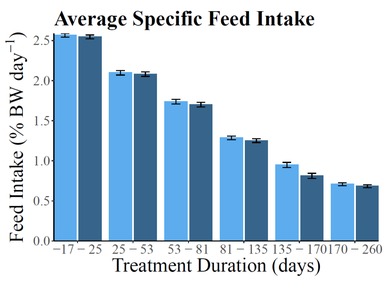
- Fish raised under low currents were longer, weighed more, and grew faster.

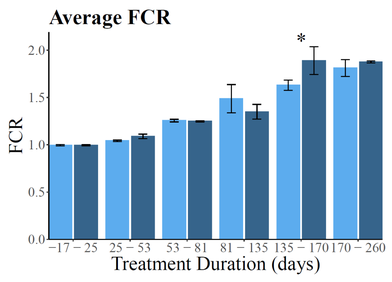


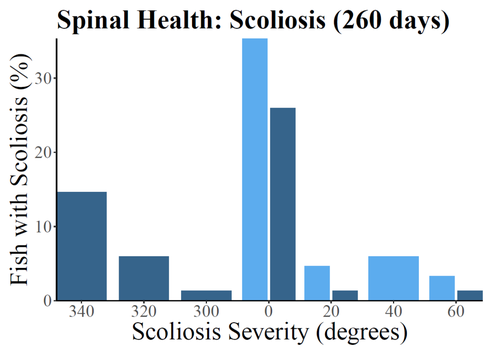




- Feed intake and feed efficiency was similar across treatments.

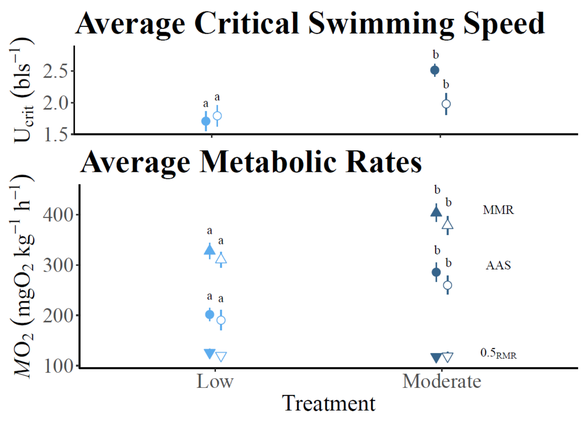


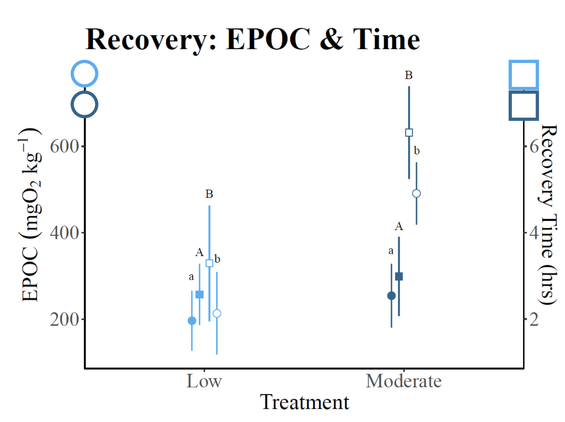




- Fish raised under moderate currents predominately exhibited 'right' scoliosis.
- Fish raised under low currents exhibited 'left' scoliosis, only.
- Fish with scoliosis were more common and severe in the moderate current group.

- Fish raised under moderate currents had a higher critical swimming speed, higher maximum metabolic rate, and larger aerobic scope.
- Spinal deformed fish, irrespective of current treatment, required more oxygen (EPOC) and time (hr) to recovery after reaching critical swimming speed.





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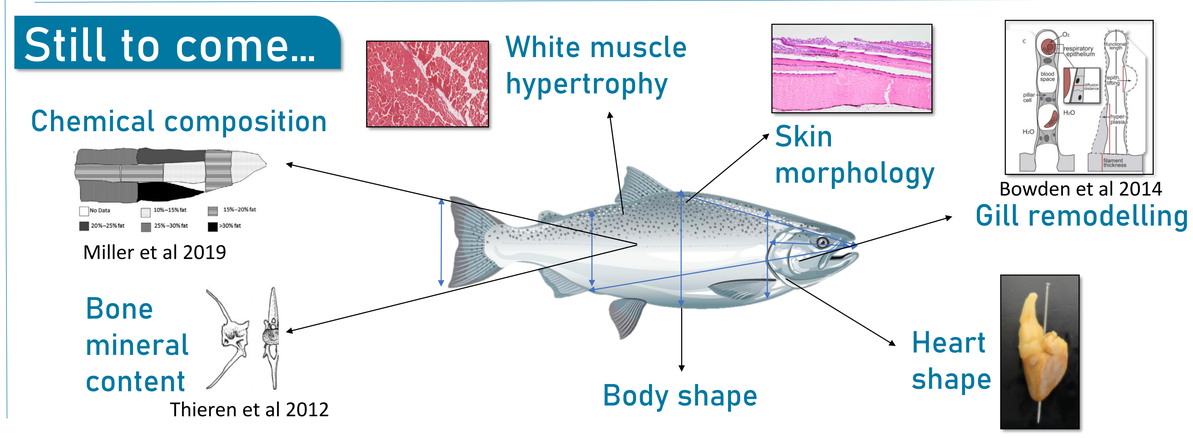

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