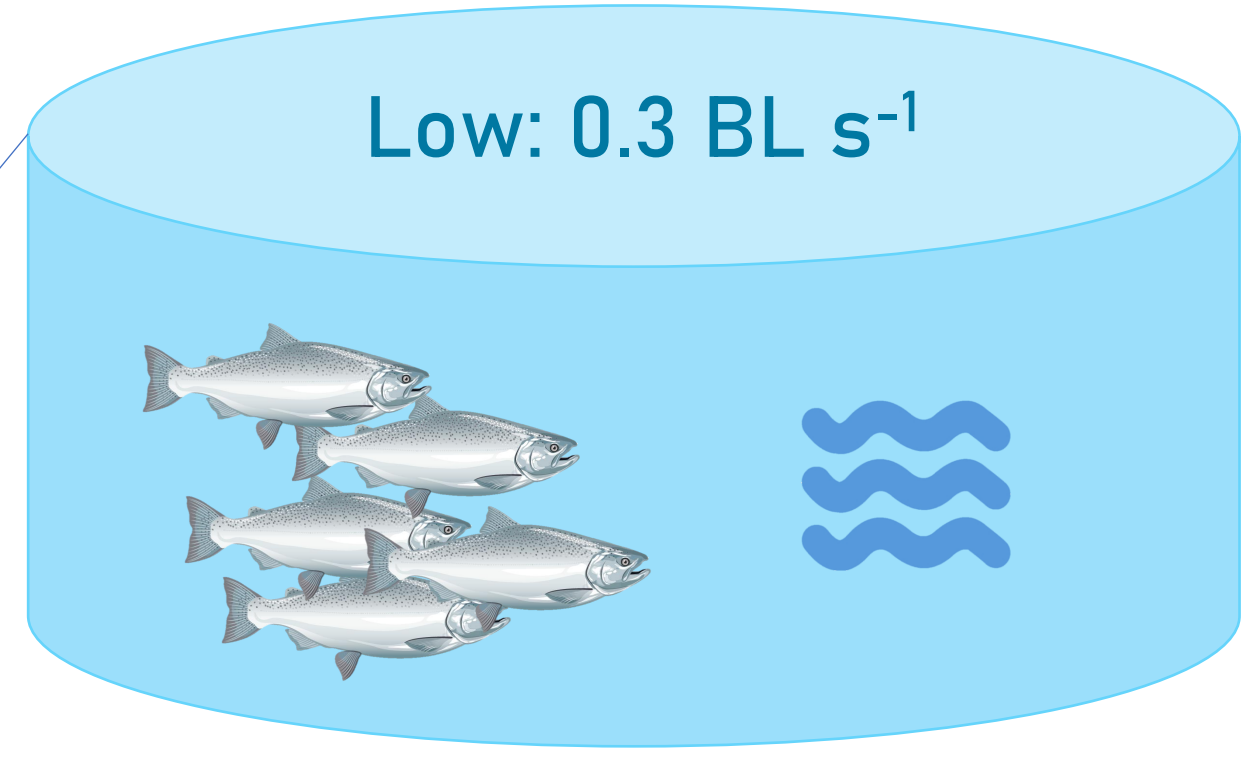


## Why & How

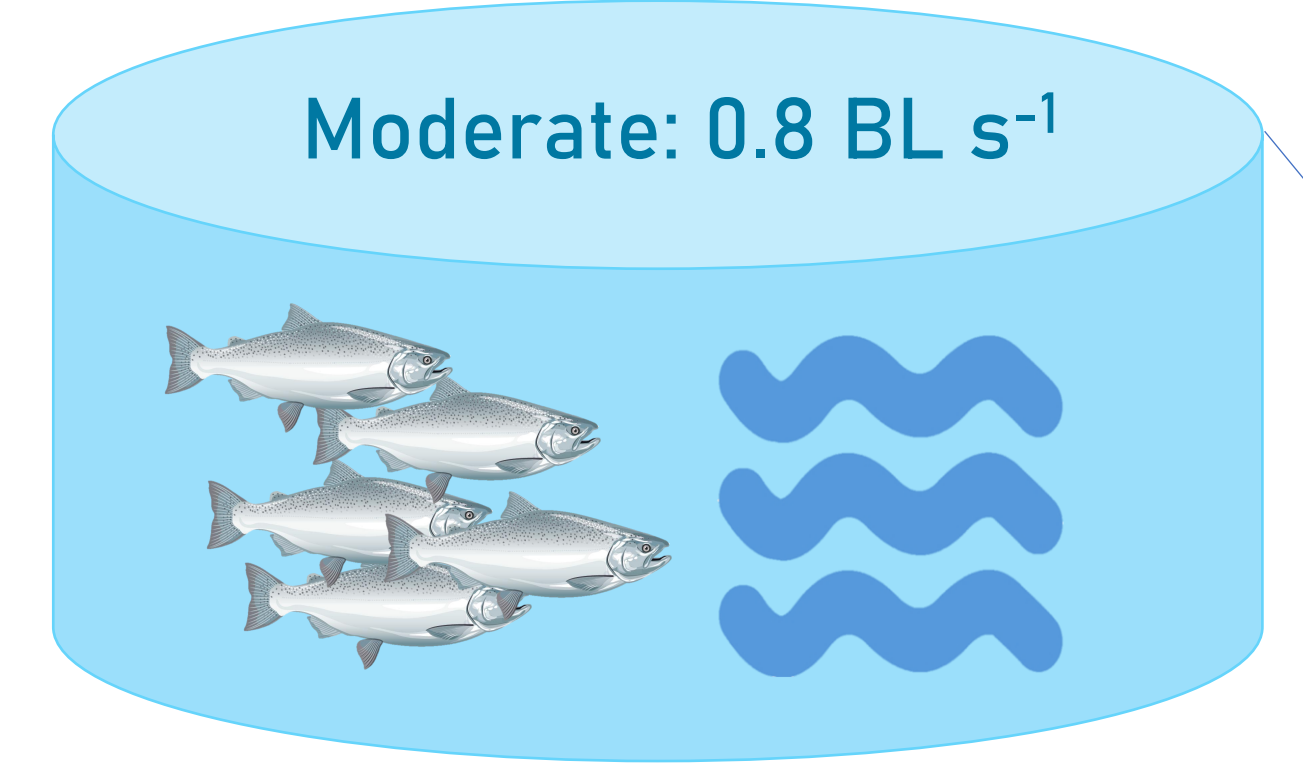
The relationship between sustained swimming and production performance for Chinook salmon is poorly understood.

Chinook salmon exhibit poorer feed and growth performance than Atlantic salmon and rainbow trout.

New Zealand salmon aquaculture industry is aiming to expand production into open ocean, high energy environments, where sustained swimming will become a large aspect of Chinook salmon farming.



Fish were held under flow regimes for ten months with multiple sampling timepoints throughout.



### Production performance

- Individual and tank feed intake
- Growth: Mass, fork length, girth, and condition factor
- Feed conversion ratio

### Chemical composition

- Chemical composition and retention (Miller et al 2019)
- Bone mineral content (Thieren et al 2012)
- Spine health: Spinal deformity severity and prevalence

### Aerobic capacity and swimming performance

- Maximum metabolic rate
- Aerobic scope
- Critical swimming speed
- Tail beat frequency
- Recovery time
- Recovery oxygen consumption
- Genetic parameters: Genetic x environment interaction, Genetic correlations, Heritability

### Morphology

- White muscle
- Gill
- Skin
- Body shape

## Impacts

### 1. Optimising nursery environments

The NZ salmon industry is modernising their nursery phase by transitioning to RAS and circular tank setups. Our research aims to assist with optimising tank conditions (e.g., flow regimes) to enhance production performance.



NZKS raceway nursery. Photo: S. Walker



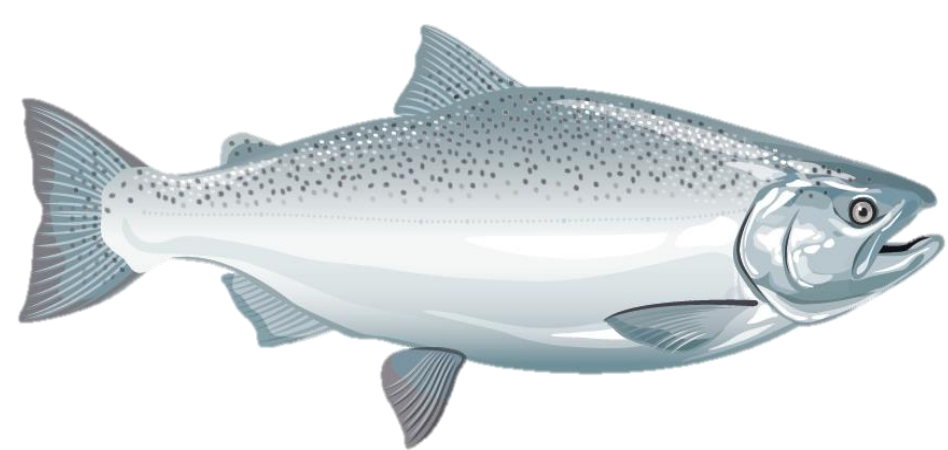
NZKS nursery tanks. Photo: S. Walker



Huon nursery. Photo: P. Tigges

### 2. Building robust and resilient salmon

Robust and resilient salmon may be defined as salmon that exhibit proficient growth rates and efficient feed efficiency without compromising any organs, as well as presenting good swimming abilities, aerobic endurance, and recovery efficiency, as well as exhibiting high stress and disease resilience.



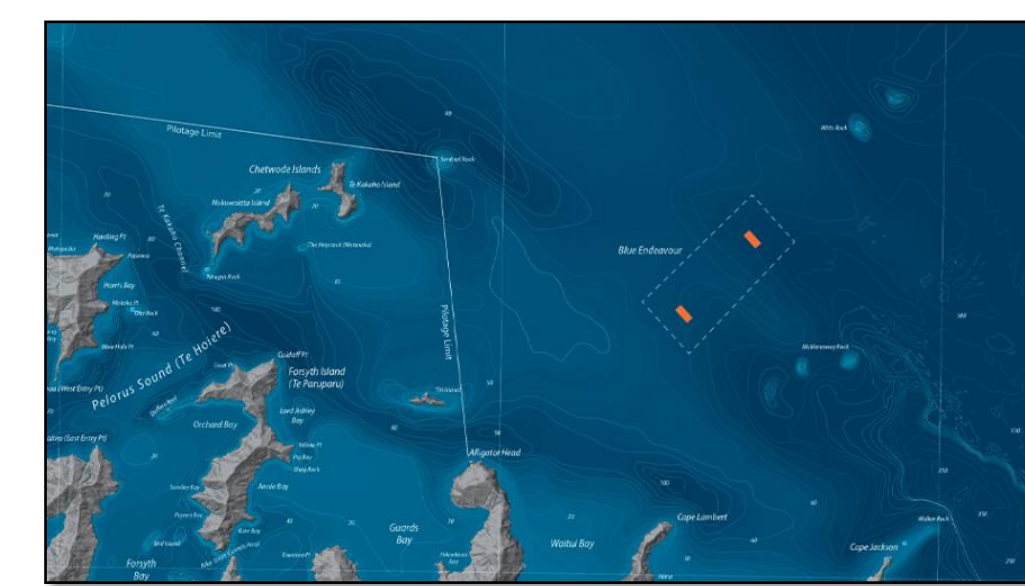
Sustained swimming offers a way to build robust and resilient salmon and our research is working to find suitable exercise regimes that can offer these traits to the New Zealand salmon aquaculture industry.

### 3. Improve animal husbandry and selective breeding program



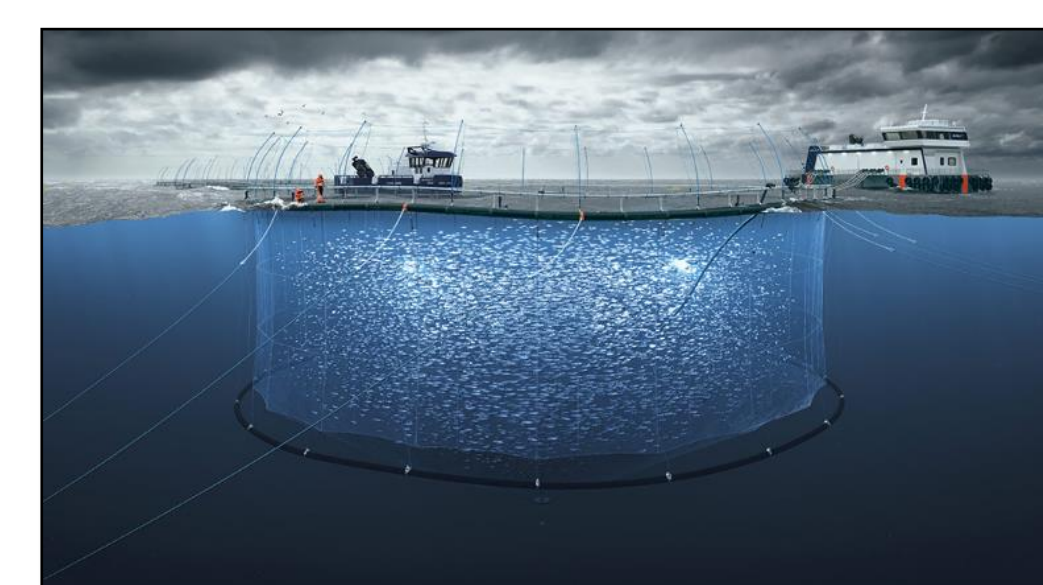
Identifying relationships between production performance and genetic parameters under flow regimes will improve general animal husbandry and selective breeding objectives.

### 4. Improve open-ocean site selection and infrastructure development



Blue Endeavour, NZKS

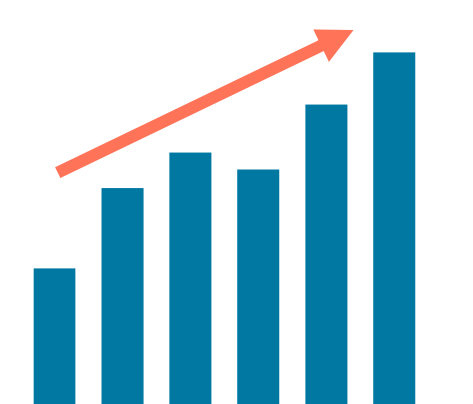
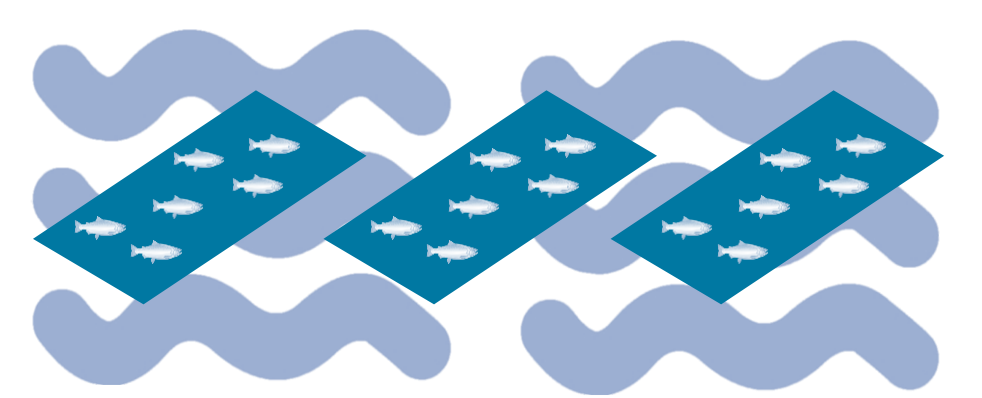
Understanding the range-, limits-, and optimal swimming speed for farmed Chinook salmon can improve guidelines for developing and planning offshore farms.



Blue Endeavour, NZKS

### 5. Supporting industry to develop offshore and expand industry

Our research provides support for the NZ salmon industry to integrate offshore farming, expand production, and meet 2030 \$3 bill. target.



Support is provided by developing baseline understanding of swimming energetics and using exercise regimes as a tool to prepare Chinook salmon for offshore high energy environments.