

# Immune response of thiamine deficient Chinook salmon (*Oncorhynchus tshawytscha*) to columnaris disease

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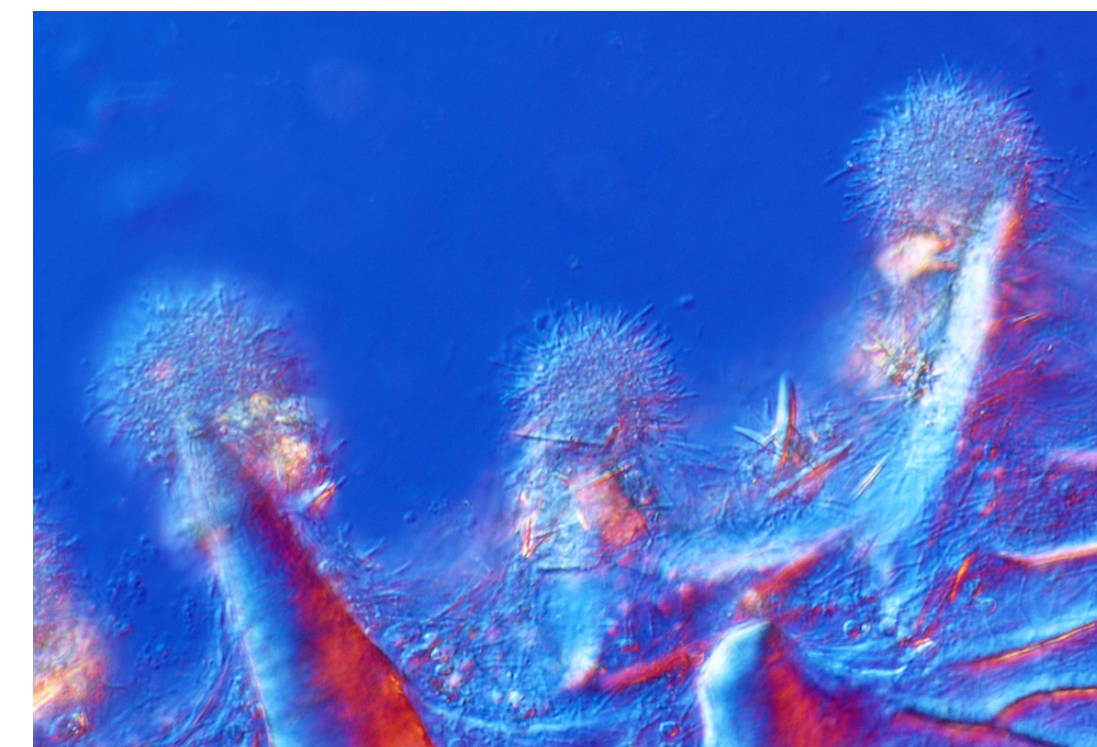
## Introduction

High morbidity and mortality of Chinook salmon (*Oncorhynchus tshawytscha*) fry has been reported in California's Central Valley associated with thiamine deficiency (TD). (1)

Thiamine is an essential B vitamin that is required by all living cells for energy metabolism and neurological function. (2)

- A deficiency in thiamine can lead to poor reproductive success, neurologic dysfunction and death. (2, 3)

*Flavobacterium columnare* is a gram-negative rod shaped bacteria that causes columnaris disease in freshwater fish



*Flavobacterium columnare* is a ubiquitous bacteria in freshwater that can be seen in aggregates called "haystacks" on wet mounts of gills and skin (6).

- Can result in substantial losses in wild and cultured fish. (4)
- Clinical signs and gross changes include gill necrosis, fin rot, and skin lesions.

The incidence of columnaris disease has increased in the past decade, particularly in the Pacific Northwest. (5)



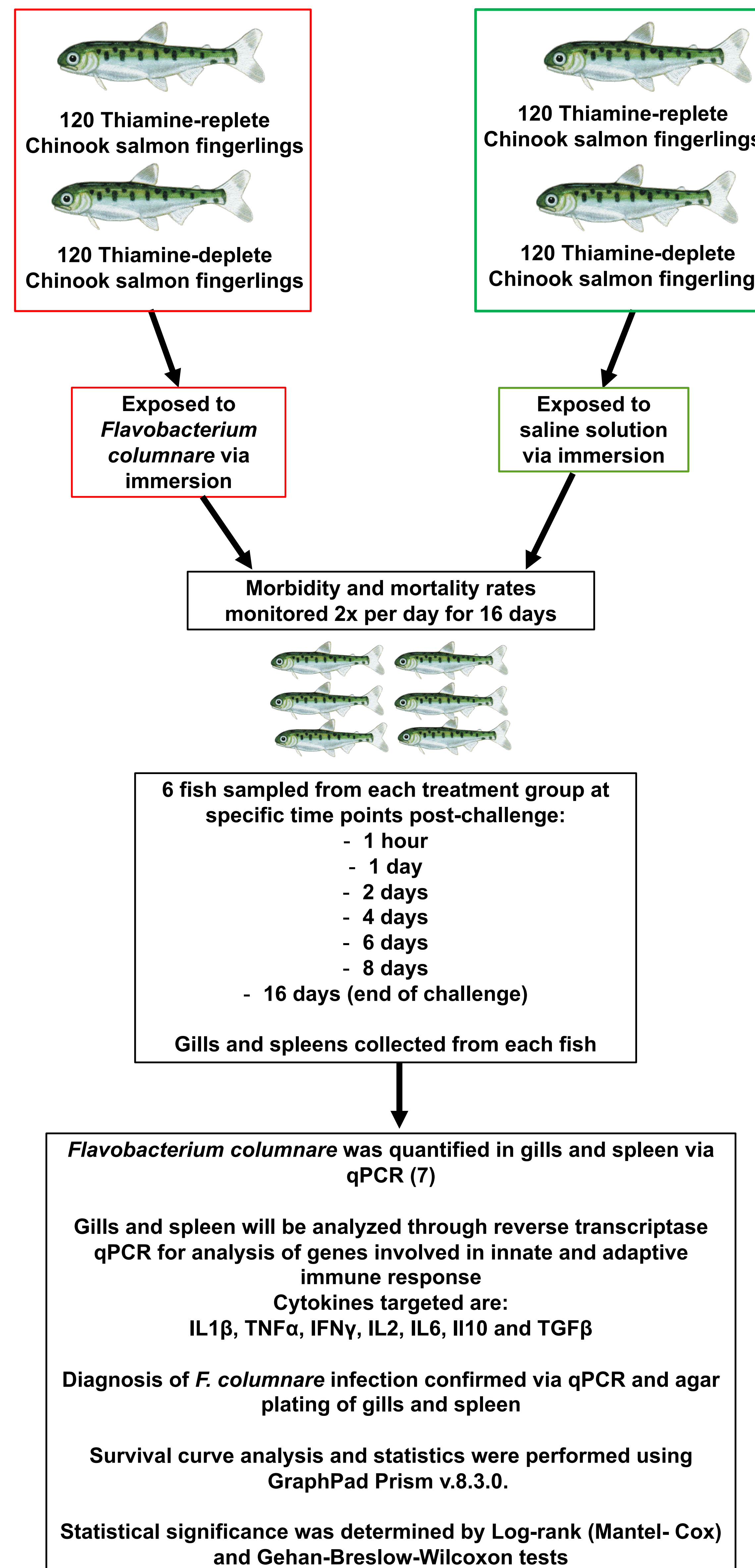
Gross changes of columnaris disease in salmonids present as gill necrosis, ulcerative skin lesions, and fin rot.

## Abstract

The main objective of this study is to investigate the pathogenesis of thiamine deficiency, particularly focusing our attention on the immune response and susceptibility of thiamine-deplete and -replete Chinook salmon fry to columnaris diseases.

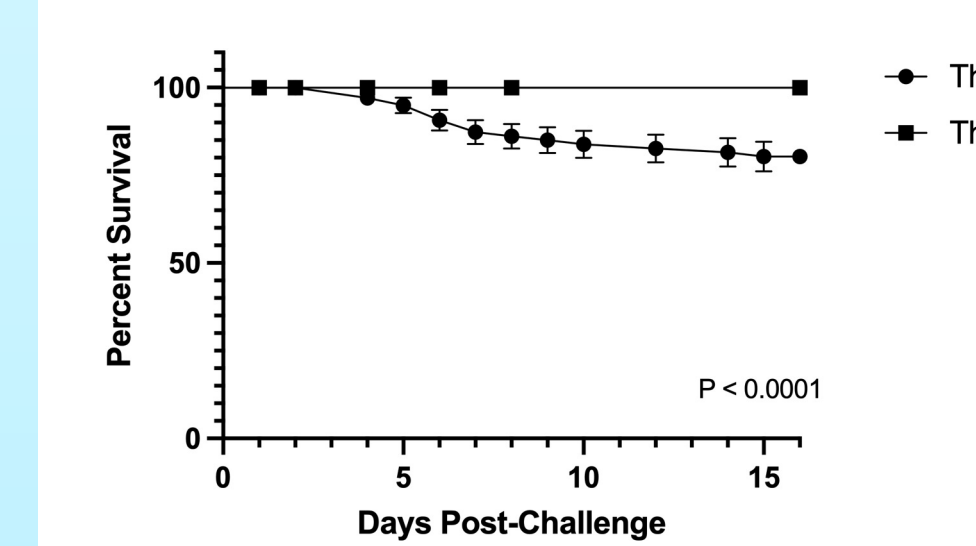
We hypothesize that thiamine deficient Chinook salmon are immunodeficient and will be significantly more susceptible to columnaris disease when compared to fish with normal thiamine values.

## Methods



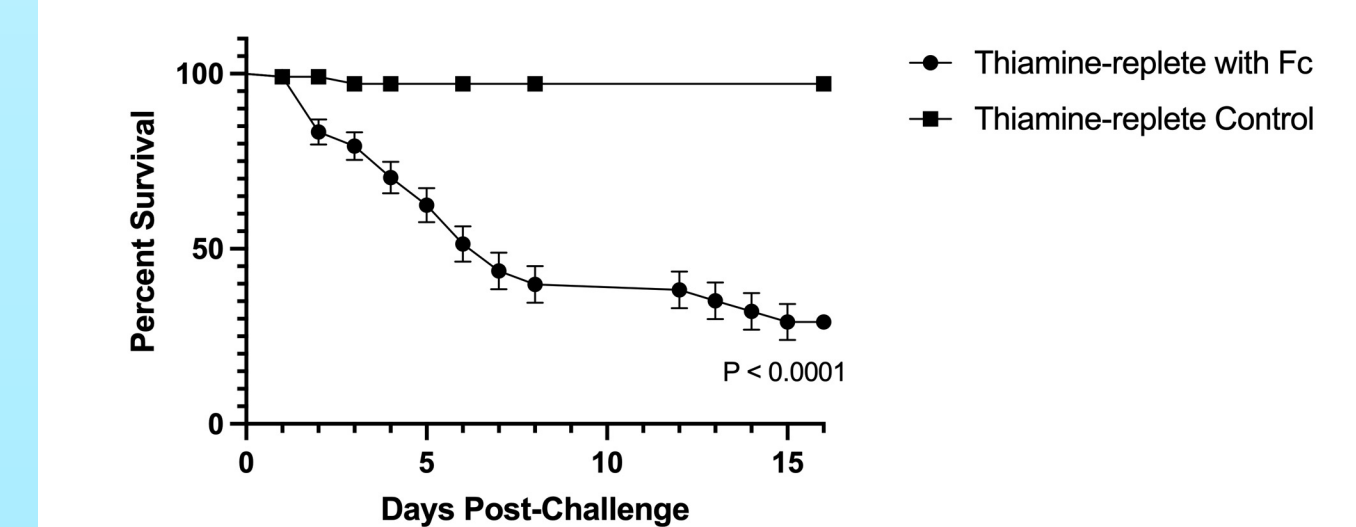
## Results

Survival of Exposed vs unexposed Thiamine-deplete



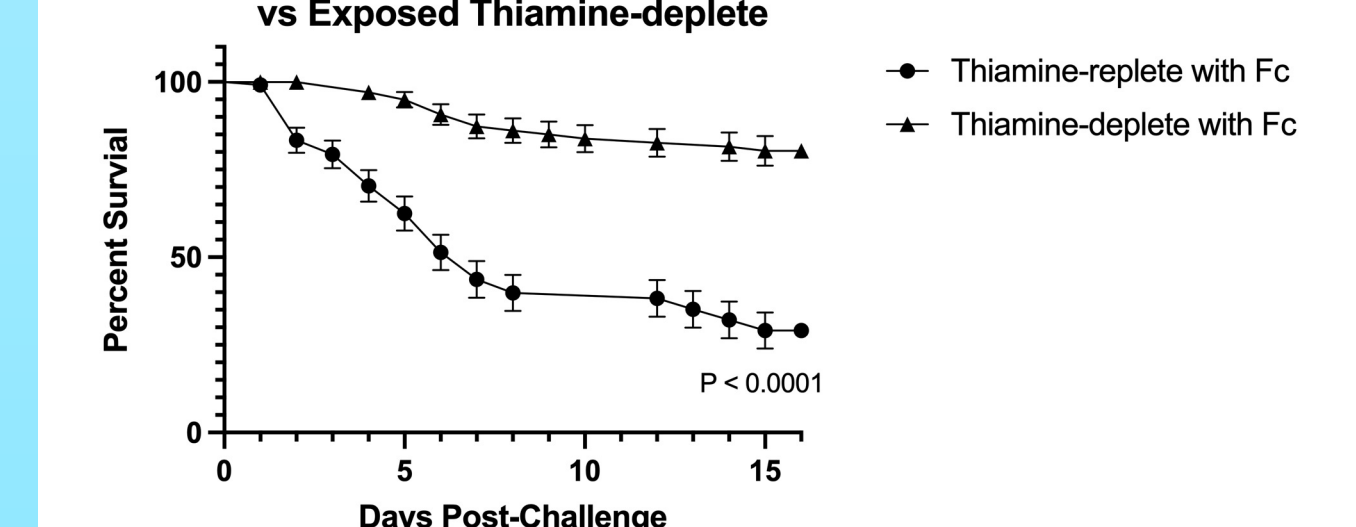
**Figure 1:** Thiamine-deplete Chinook salmon presented with less severe clinical signs and mortality due to columnaris disease throughout the challenge period of 16 days.

Survival of Exposed vs unexposed Thiamine-replete



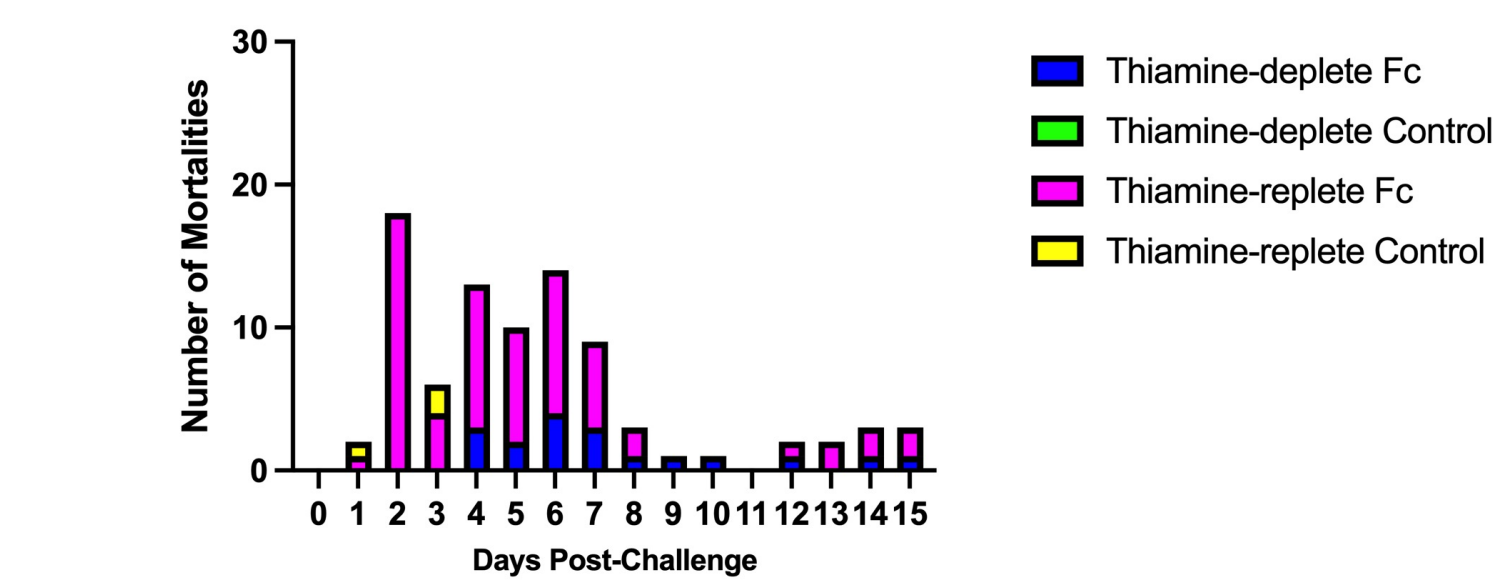
**Figure 2:** Thiamine-replete Chinook salmon challenged by *Flavobacterium columnare* presented with more severe clinical signs of columnaris disease and had over a 50% mortality rate by day 6 post-challenge.

Survival of Exposed Thiamine-replete vs Exposed Thiamine-deplete



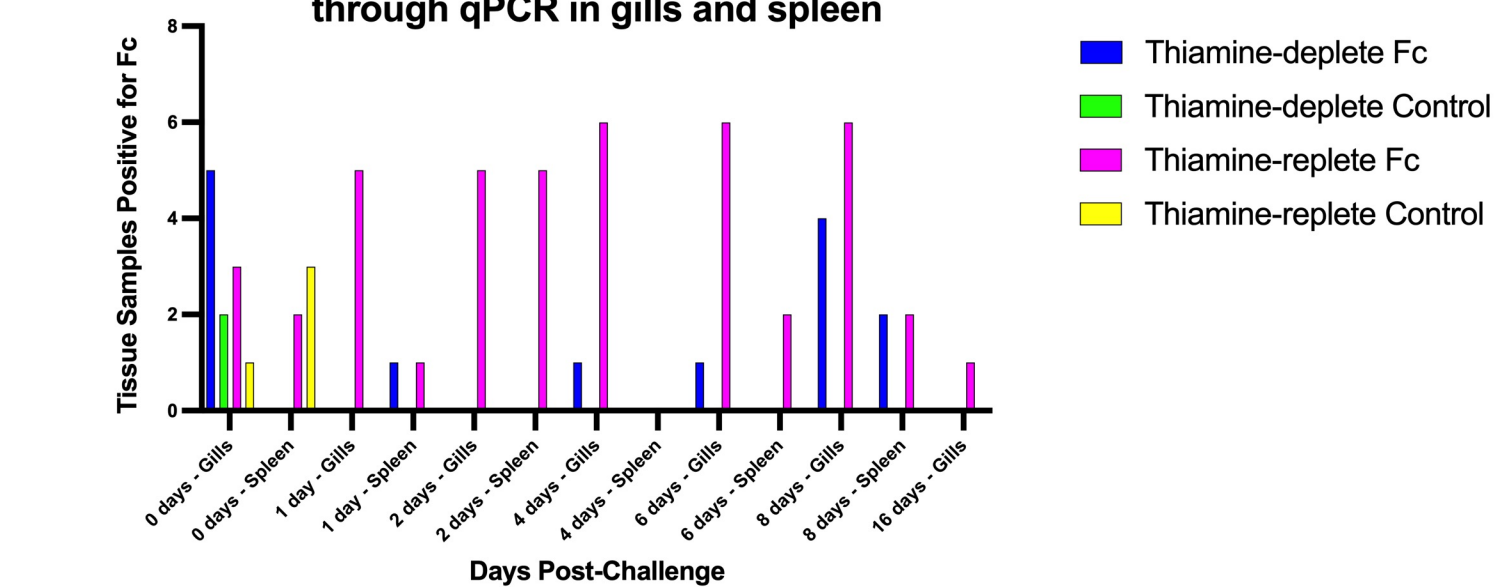
**Figure 3:** Thiamine-deplete Chinook salmon challenged with *Flavobacterium columnare* presented with a 80.3% survival rate while thiamine-replete Chinook salmon also exposed to *F. columnare* presented with a 29.03% survival rate at end of challenge.

Amount of Mortalities throughout the Challenge Period



**Figure 4:** Acute mortalities occurred in fish exposed to *Flavobacterium columnare*. The highest amount of mortalities occurred on Day 2 for the exposed thiamine-replete salmon. The exposed thiamine deficient salmon presented with the greatest amount of mortalities on Day 6 and continued to have a steady rate of one mortality per day throughout the challenge (16 days).

Comparison of the detection of *Flavobacterium columnare* through qPCR in gills and spleen



**Figure 5:** *Flavobacterium columnare* was diagnosed through qPCR of gills and spleen, with the highest frequency of detection in the gills of the thiamine-replete Chinook salmon.

## Conclusion

Thiamine deplete Chinook salmon fingerlings challenged with *F. columnare* presented significantly greater survival ( $p < 0.0001$ ) than the thiamine-replete Chinook salmon fingerlings.

Thiamine deficiency potentially led to a lack of an acute inflammatory response to the bacterium, resulting in higher survival rate in thiamine-deplete fish.

## References

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