# Assessing Factors to Evaluate Welfare in Atlantic Salmon (*Salmo salar*) Infested With Sea Lice (*Lepeophteirus salmonis*)

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## Introduction

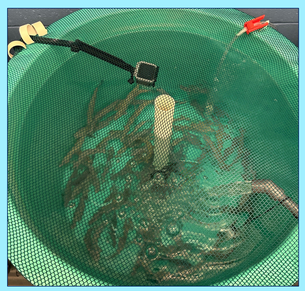
Considerations in welfare of farmed fish have been gaining importance in recent years (Lugert et al.,2020). The issue is to define parameters that could be used in a production setting to assess whether fish are exhibiting undue stress. Sea lice are parasitic crustaceans that pose a significant threat to the health and well-being of salmonids (Zhang et al., 2023).
The purpose of this study was to assess a number of different physiological and behavioural traits to assess which may be most effective in determining the welfare state of individual/populations of Atlantic salmon. In this study, we exposed salmon to sea lice copedids and assessed their behaviour over the course of early infestation from chalimus to pre-adult stages using video surveillance.

## Methods

- Cameras were placed above and inside the tank
- Salmon were Infected with seal lice as per (Carvalho et al., 2024)
- Tanks were monitored as infestation progressed.
- Infected fish were kept in SW tanks (33-34ppt, 12°C)
- Control groups were kept in FW (12°C)
- Fecal samples taken from effluent for cortisol analysis
- Assessments included direct observations and video of salmon behaviour pre-feeding, during feeding and post-feeding

| Parameters | Categories |
|---|---|
| Swimming behaviour | Swimming/Schooling (Yes/No)<br>Activity (Normal, Mild, Erratic) |
| Position in tank | Horizontal position<br>Vertical position |
| Feeding behaviour | Feed response |
| Respiratory rate | Gill beats/min |

- Statistics included ANOVA
- Programs used: Microsoft Excel




## Results and Discussion

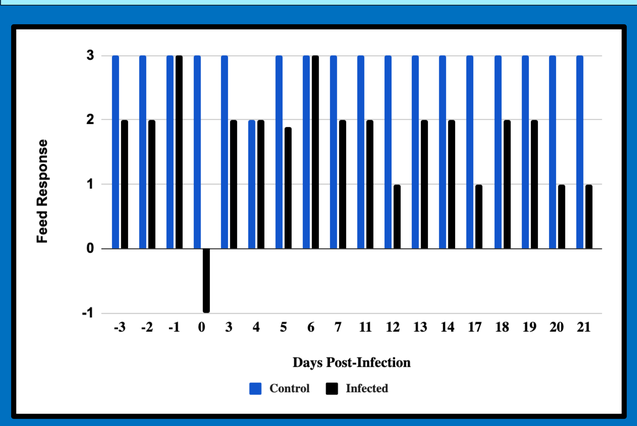



**Figure 1: Mean Feeding Response of Atlantic Salmon Infected With Sea Lice**

**Feed Response Score:**
-1: Not Fed
0: 0% Feed Consumed
1: >50% Feed Consumed
2: >75% Feed Consumed
3: >95% feed Consumed

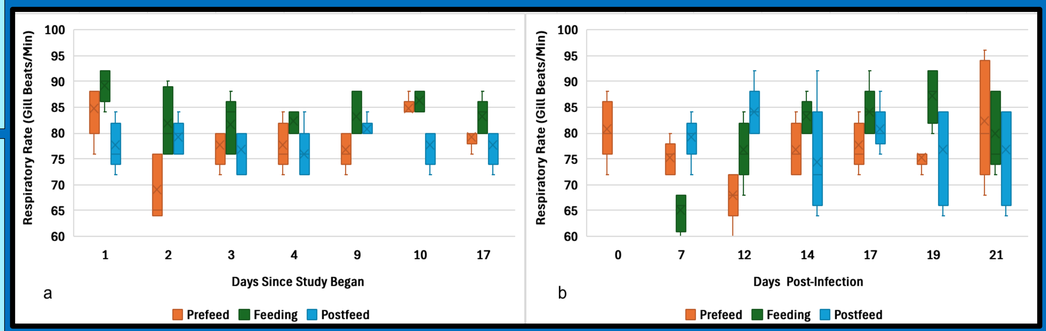



**Figure 2: a) Respiratory Rate (Gill Beats/Min) of Non-Exposed Group (N=5) b) Respiratory Rate (Gill Beats/Min) of Exposed Group (N=5)**

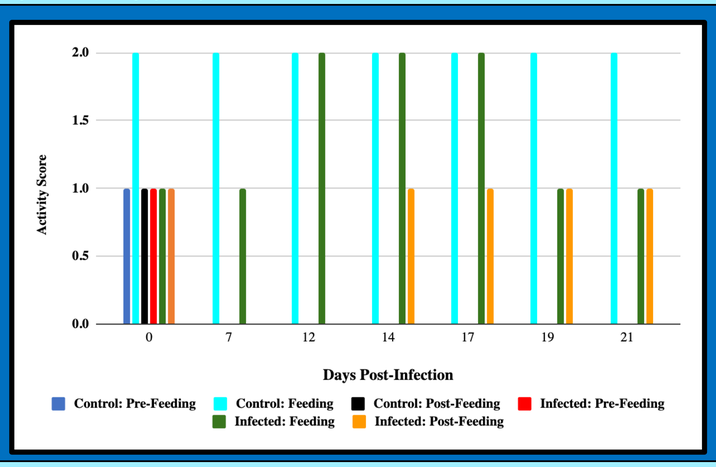



**Figure 3: a) Activity score of the control group b) Activity score of the exposed group**
**0 = Normal/Relaxed; 1 = Mild increase in activity/Few fish dashing; 2 = Majority of fish in frenzy**

- Exposed group had a variable feed response that was lower than the control.
- However, 2-3 days before exposure, the fish already had lower feed response than the control (Figure 1). The cause of this is unknow. Looking at pre-infestation feed responses for a longer period would help rule out if this was just a fluke or a trend.
- No difference in pre-feeding respiratory rates were found.
- Pre-Feeding respiratory rate variability most likely due to activity during that period. Ensuring no other activities are performed during observation would help reduce this effect in future studies.

- There were no significant differences between the feeding and post-feeding respiratory rates in exposed group vs. control group.
- However, there was more variability in feeding and post feeding respiratory rates amongst individuals in the exposed group (Figure 2).
- This indicates that some fish may be more affected by sea lice than others.
- The control group consistently exhibited frenzy/erratic behaviour in response to feeding and very little disorganized swimming behaviour pre- and post-feeding.
- The exposed group showed increased post-feeding activity 14 days post-infection and decreased activity was observed on day 0, 7, 19 and 21 post-infection
- Flashing was observed in the exposed group but not the control group.

## Conclusion

Reduced feed consumption and abnormal erratic activity (i.e. outside the expected feeding frenzy) and large respiration variability within a population appeared to be the best indicators to assess welfare in this study. The next steps is to use these indicators of welfare to assess the effects of habitat enrichment on populations to enhance welfare.

## References

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