

Lusekonferansen 2023: God lusekontroll og god fiskevelferd
9. februar i Trondheim

Optimalisering av avlusningsstrategier: maksimal avlusningseffektivitet og god fiskevelferd



Cameron Thompson
forsker

Optidelouse Project
(901687)



IMR report (HI.no)

Delousing Efficacy and Physiological Impacts on Atlantic Salmon of Freshwater and Hyposaline Bath Treatments

Cameron Thompson, Angelico Madaro, Frode Oppedal, Lars Helge Stien, and Samantha Bui

Peer-Reviewed Research Article (submitted)

Comparison of non-medicinal delousing strategies for parasite removal efficacy and welfare impact on Atlantic salmon hosts

Cameron Thompson, Angelico Madaro, Lars Helge Stien, Jonatan Nilsson, Frode Oppedal, Øyvind Øverli, and Samantha Bui



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**Delousing Efficacy and Physiological Impacts on Atlantic Salmon
of Freshwater Pilot Study**

Cameron Thompson, Angelico Madaro, Frode Oppedal, Lars Helge Stien, and Samantha Bui

Peer-Reviewed Research Article (submitted)

**Comparison of non-medicinal delousing strategies for parasite
removal Treatment Combination Experiments**

Cameron Thompson, Angelico Madaro, Lars Helge Stien, Jonathan Nilsson, Frode Oppedal, Øyvind Øverli, and Samantha Bui



Treatment Combination Experiments

Round 1
September 2021
8 °C
~ 1-2 kg

150 fish
x 3

Common garden
→
n = 450

15 Treatments
Mechanical
28°C
34°C
Freshwater
Combinations
Controls

→
Sample
Pre-treatment
24 hours post
3 weeks

Round 2
March 2022
8 °C
~ 1-2 kg
~ 4-5 kg

70 fish
x 2

Common garden
→
n = 142

7 Treatments
Combinations
+ sedation

→
Sample
Pre-treatment
24 hours post

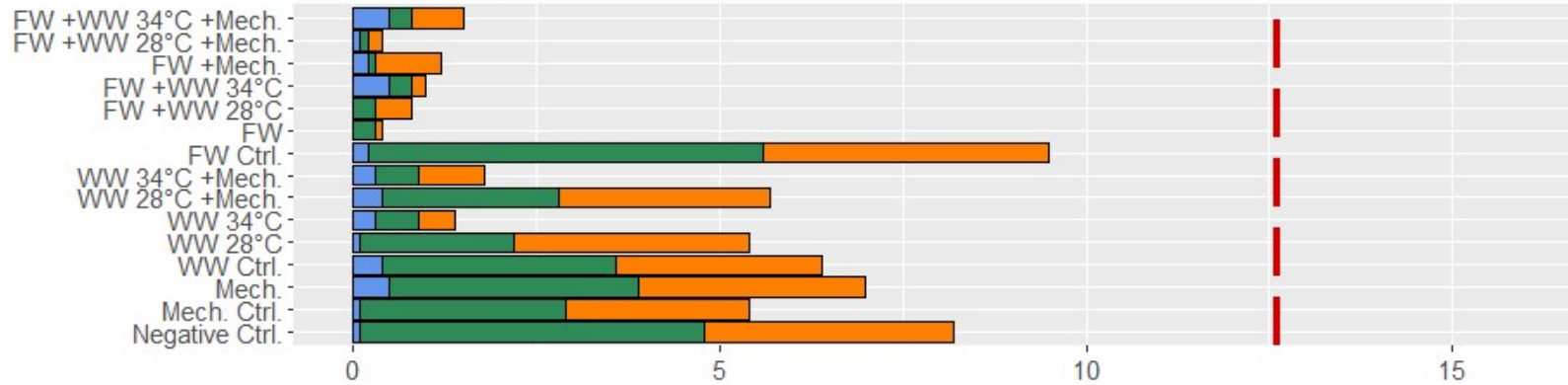
Measure: Delousing Efficacy + Welfare Outcomes



Delousing Efficacy

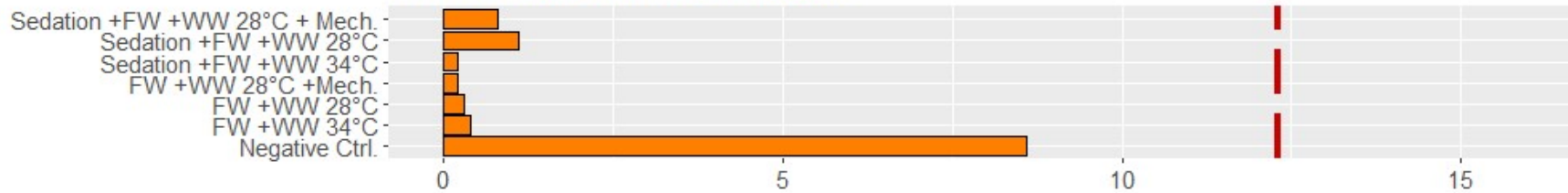
Pre- Treatment Counts

Round One, Tank C, 24-hours

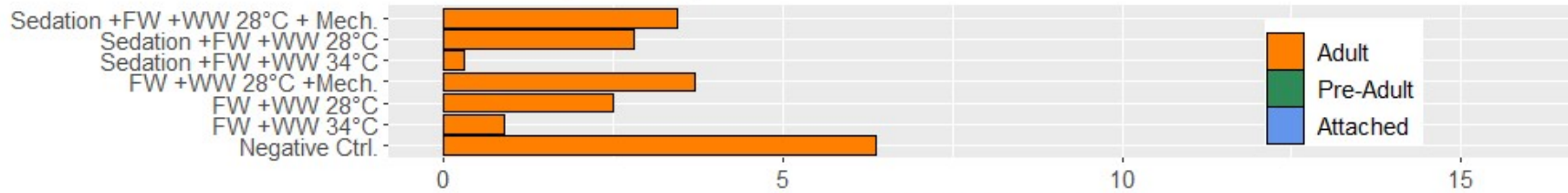


WW – Warm Water
FW – Fresh Water
Mech. – Mechanical
Ctrl. - Control

Round Two, Tank A, 24-hours



Round Two, Tank B, 24-hours

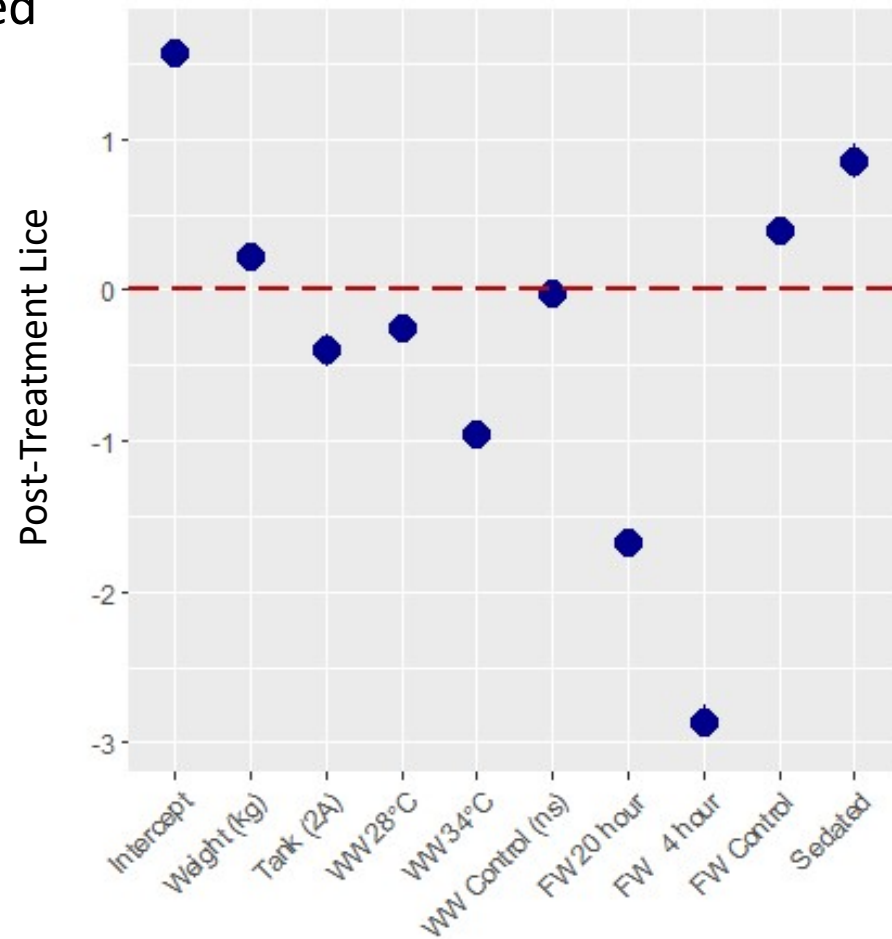


Salmon Lice per Host

Modeled Delousing Efficacy (GLMM)

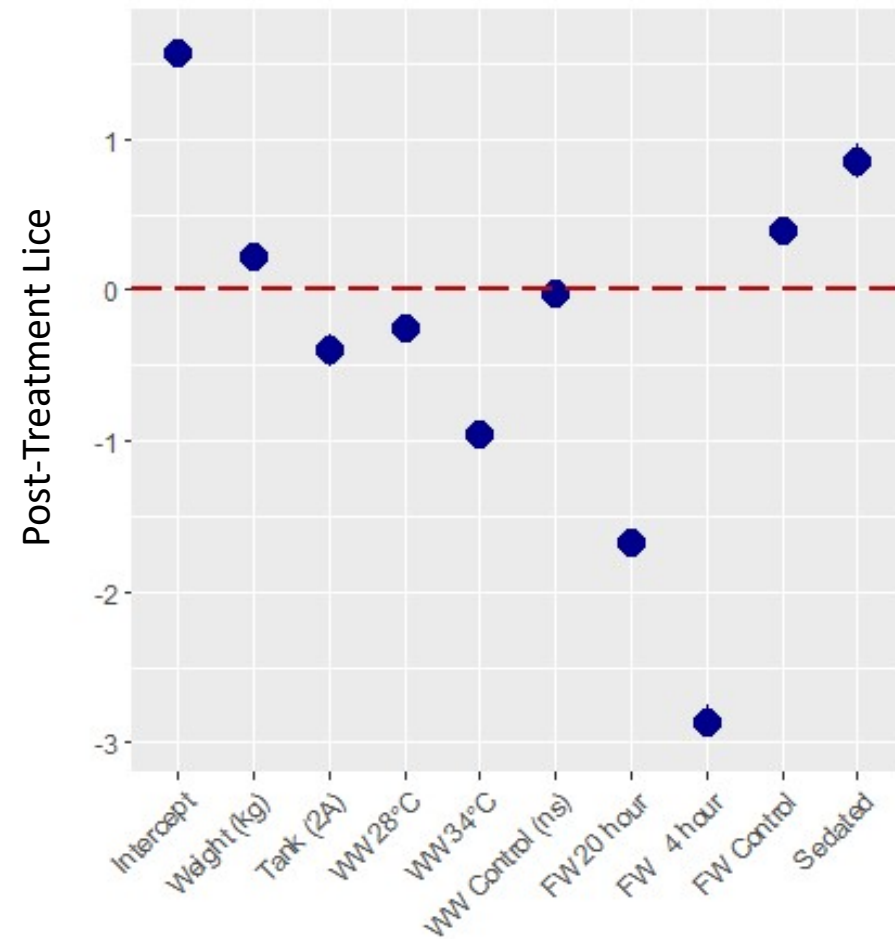
- Predicted lice load based on treatments applied
- Negative control is reference level
- Mechanical treatment was not selected

| | Estimate | S.E. | P-value |
|-------------|----------|------|---------|
| Intercept | 1.57 | 0.05 | < 0.001 |
| Weight (kg) | 0.22 | 0.03 | < 0.001 |
| Tank (2A) | -0.40 | 0.11 | < 0.001 |
| WW 28°C | -0.25 | 0.04 | < 0.001 |
| WW 34°C | -0.96 | 0.04 | < 0.001 |
| WW Control | -0.03 | 0.05 | 0.529 |
| FW 20 hour | -1.68 | 0.04 | < 0.001 |
| FW 4 hour | -2.86 | 0.11 | < 0.001 |
| FW Control | 0.39 | 0.05 | < 0.001 |
| Sedated | 0.85 | 0.12 | < 0.001 |

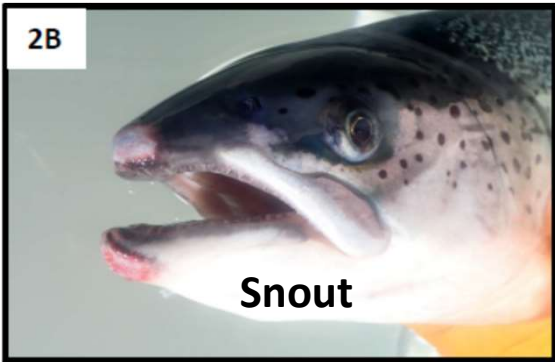


Modeled Delousing Efficacy (GLMM)

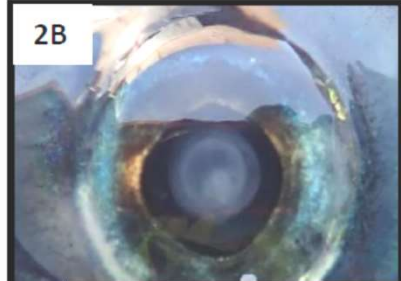
- Freshwater is highly effective
 - Least used commercial treatment
- Warm water baths
 - Effective at 34 °C less so at 28 °C
 - (Nilsson et al. 2023)
 - Most used commercial treatment
- Mechanical ≈ incidental (handling)



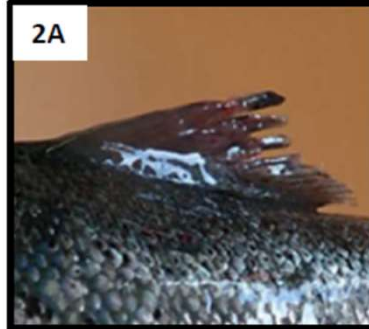
Welfare Assessment FISHWELL



Eye opaqueness



Fin damage



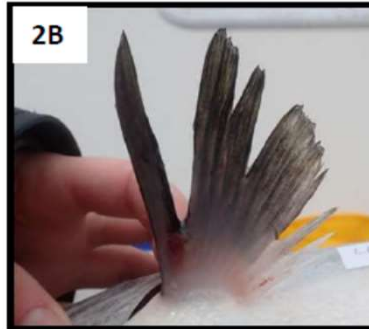
| Category | Eye | Fins | Skin | Snout |
|------------------|--------------|---------------|---------------|--------------|
| Sub - Categories | Eye Injury | Caudal Fin | Skin Wounds | Snout Injury |
| | Eye Bleeding | Dorsal Fin | Skin Bleeding | |
| | Eye Opaqness | Pectoral Fins | Scale Loss | |
| | | Pelvic Fins | | |
| | | Anal Fin | | |

11 qualitative indicators
0-3 scale



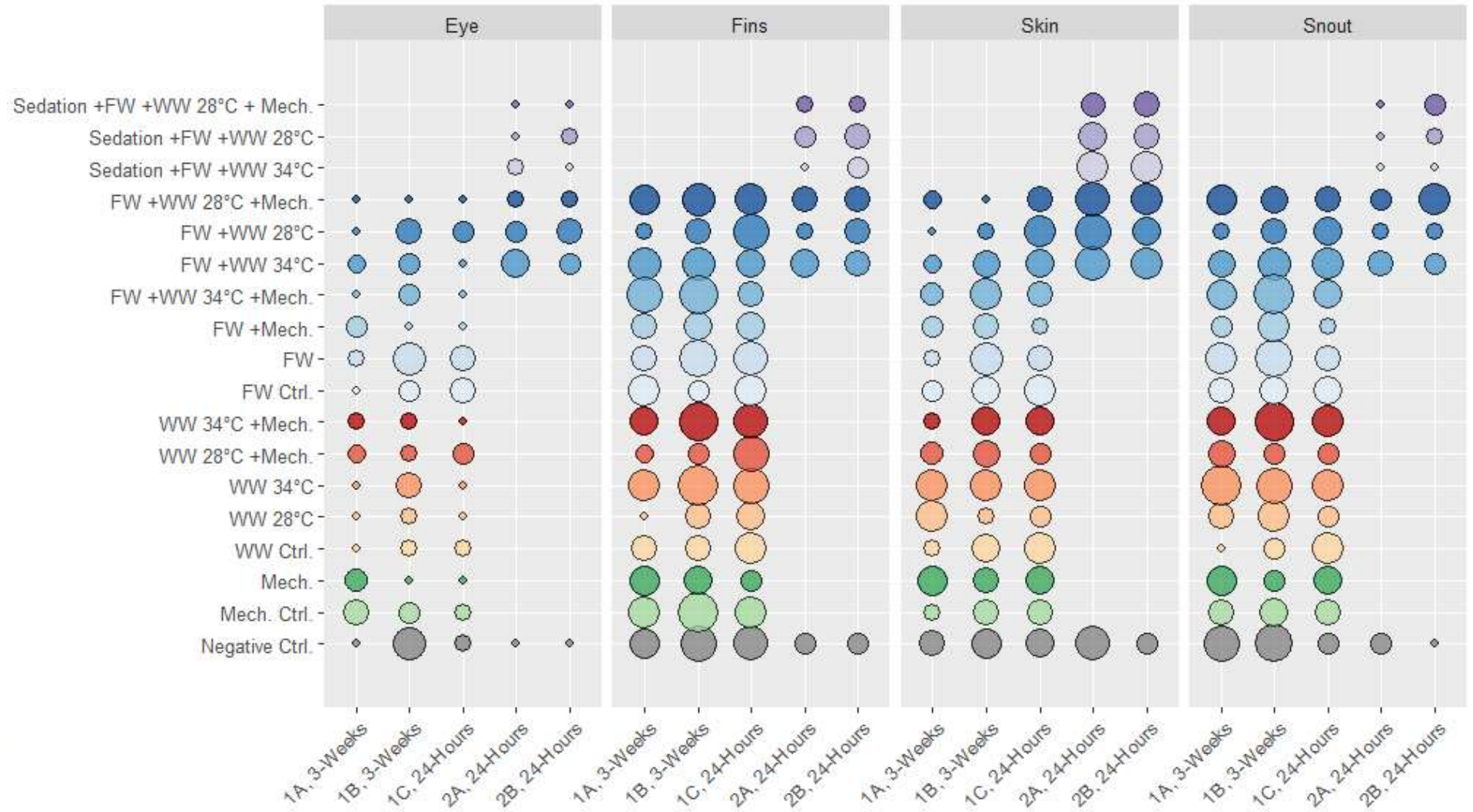
Binary: moderate/severe (yes or no)
4 categories

Indicator in category 2 – 3
-> moderate/severe



Welfare Outcomes

Severe Outcome Prevalence (%) \diamond 0 \circ 10 \bigcirc 50 \bigcirc 75



Modeled Welfare Outcome (GLMM)

- Overall reduced welfare after treatments/handling
- Poor model fits
- Minor differences between treatment levels

24 – Hour Post

- Sedated
 - **Reduced** Snout Injuries
 - **Reduced** Eye Injuries

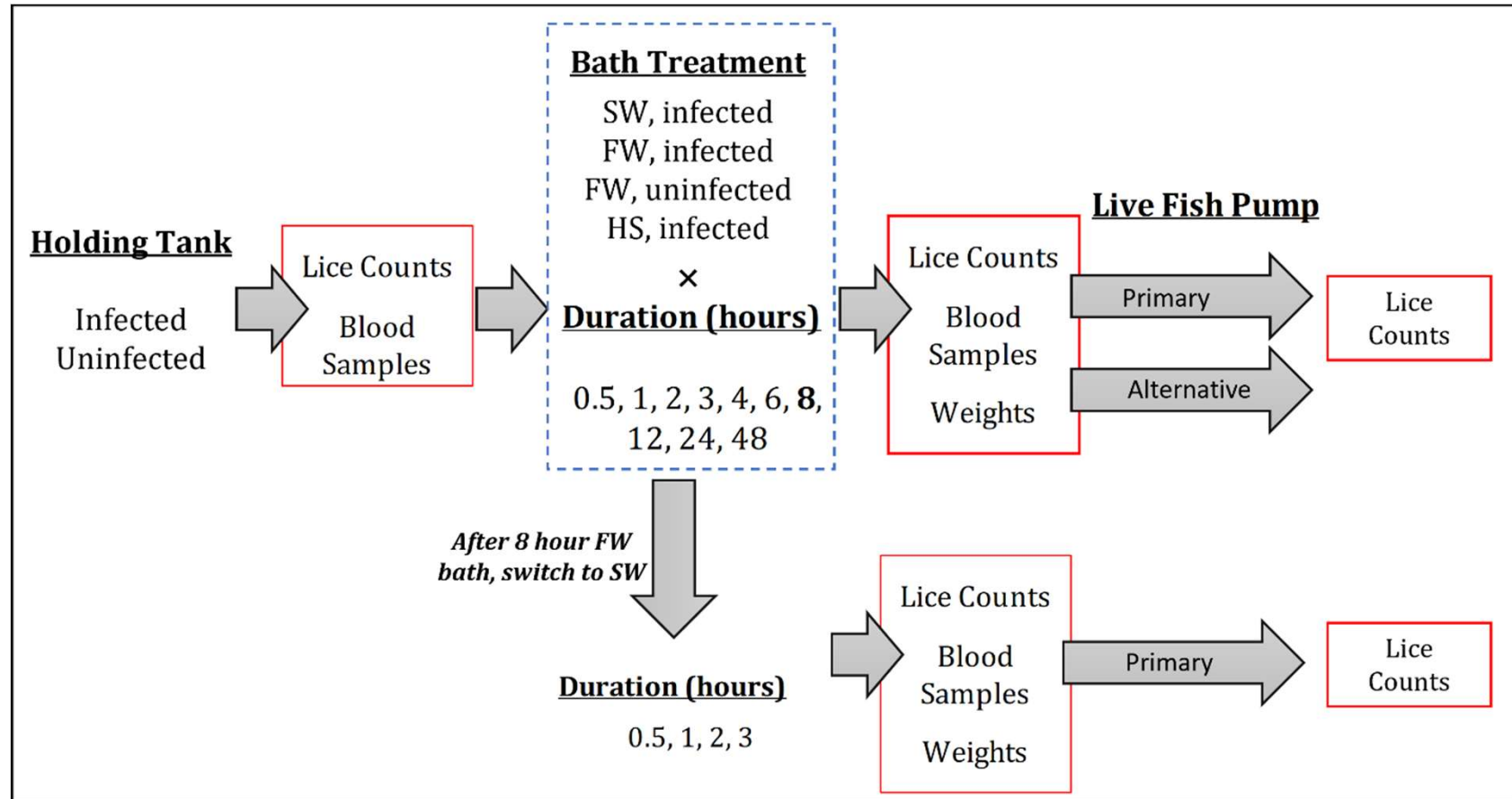
3 – Week Post

- Mechanical
 - **Reduced** Eye Injuries
- Warm Water (34° C)
 - **Increased** Snout Injuries
 - **Increased** Fin Injuries
 - **Decreased** Growth Rate (SGR)
 - **Decreased** Condition Factor (K)



Freshwater Pilot Study




545 Atlantic Salmon
 Mean weight = 350 g
 Salmon lice were all adults

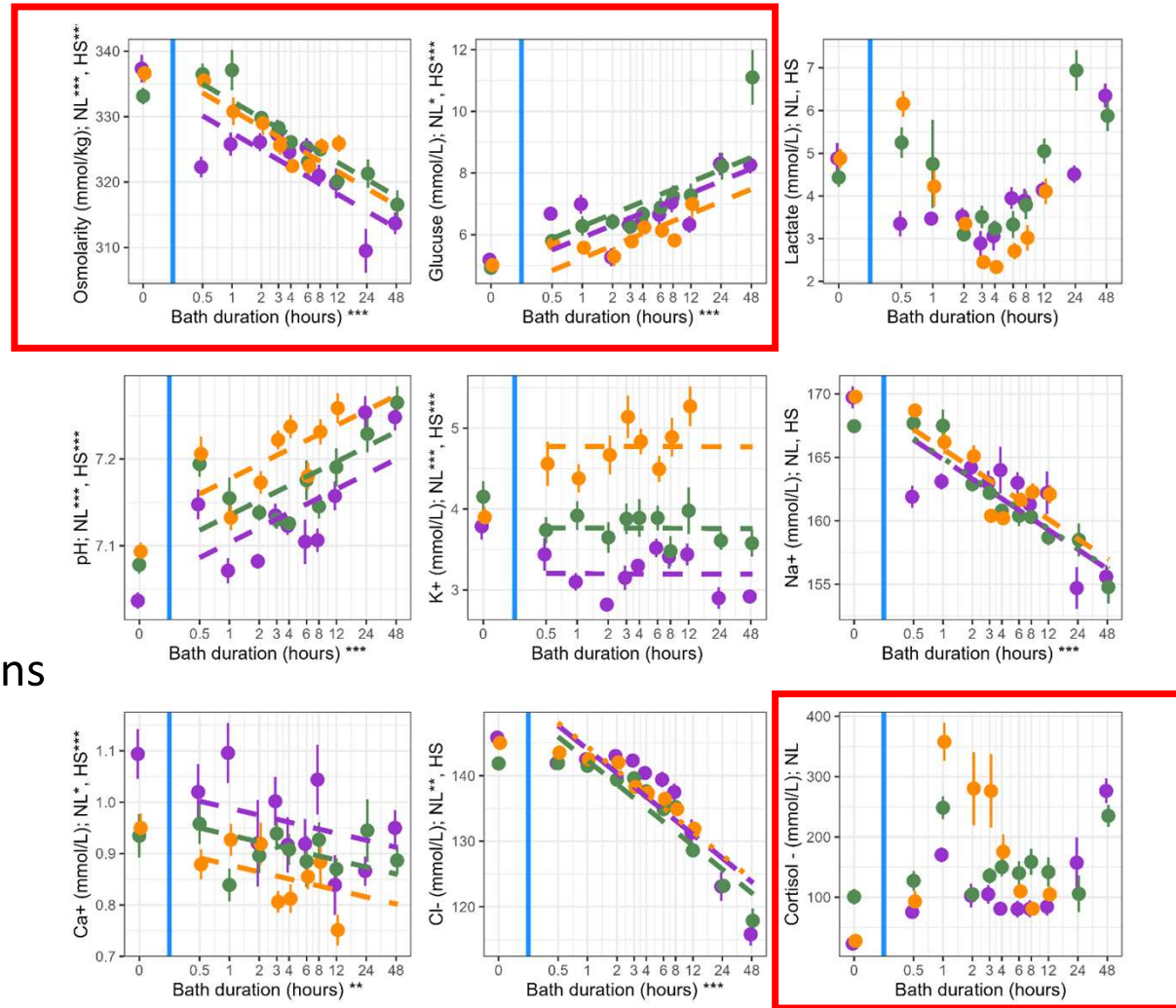


FW – Freshwater, SW – Seawater, HS – Hyposaline



Freshwater Pilot Study




-  Freshwater - no Lice
-  Freshwater- with Lice
-  Hyposaline - with Lice

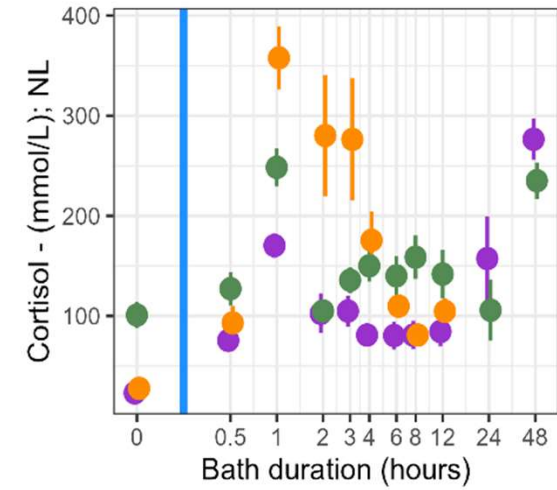
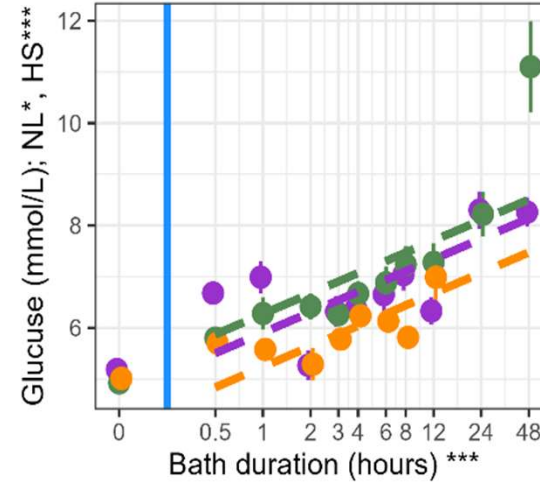
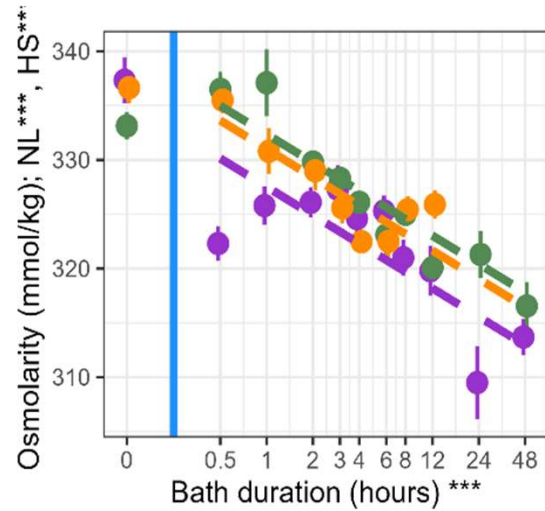


Osmolarity – concentration of blood plasma ions
Glucose & Cortisol - stress response

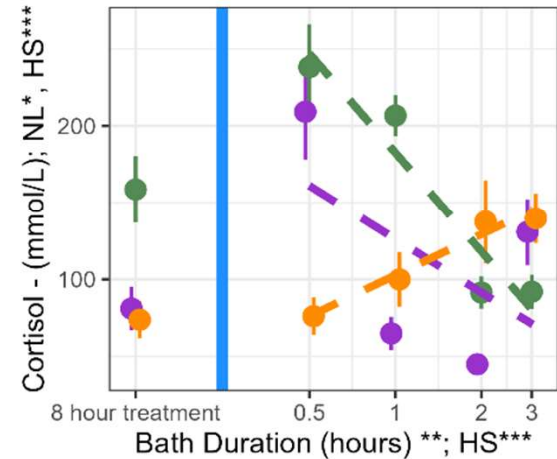
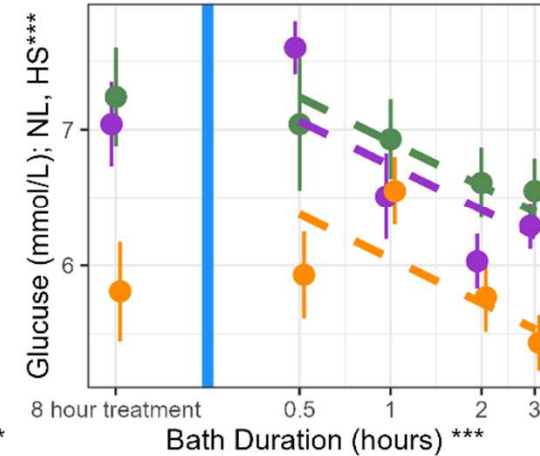
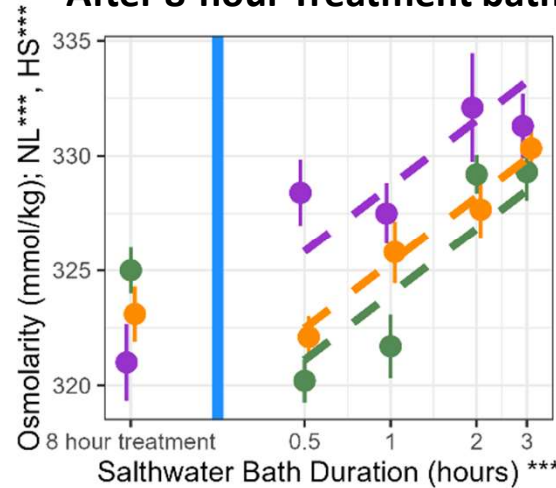


Freshwater Pilot Study

-  Freshwater - no Lice
-  Freshwater- with Lice
-  Hyposaline - with Lice

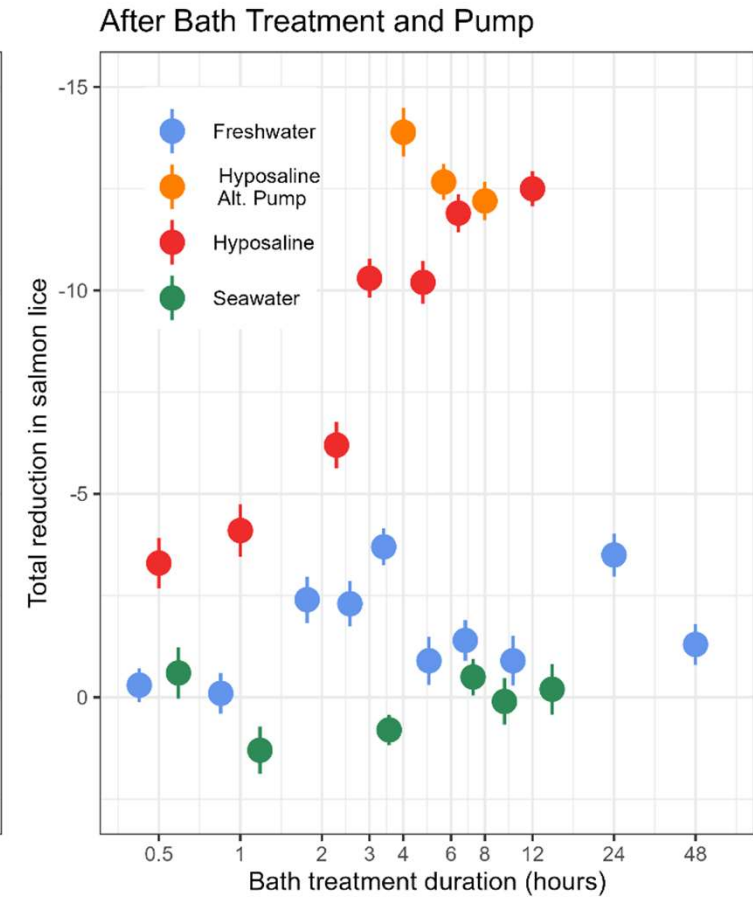
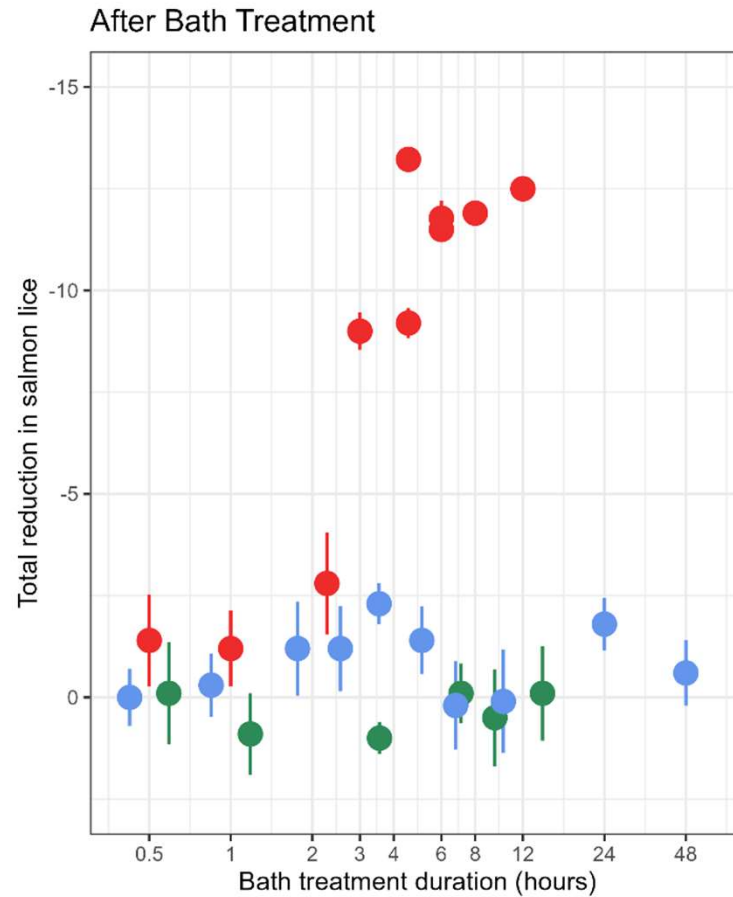


After 8-hour Treatment bath



Delousing Efficacy

- No difference due to freshwater?
- Hyposaline effective after 3 hours
- Greater delousing after pump

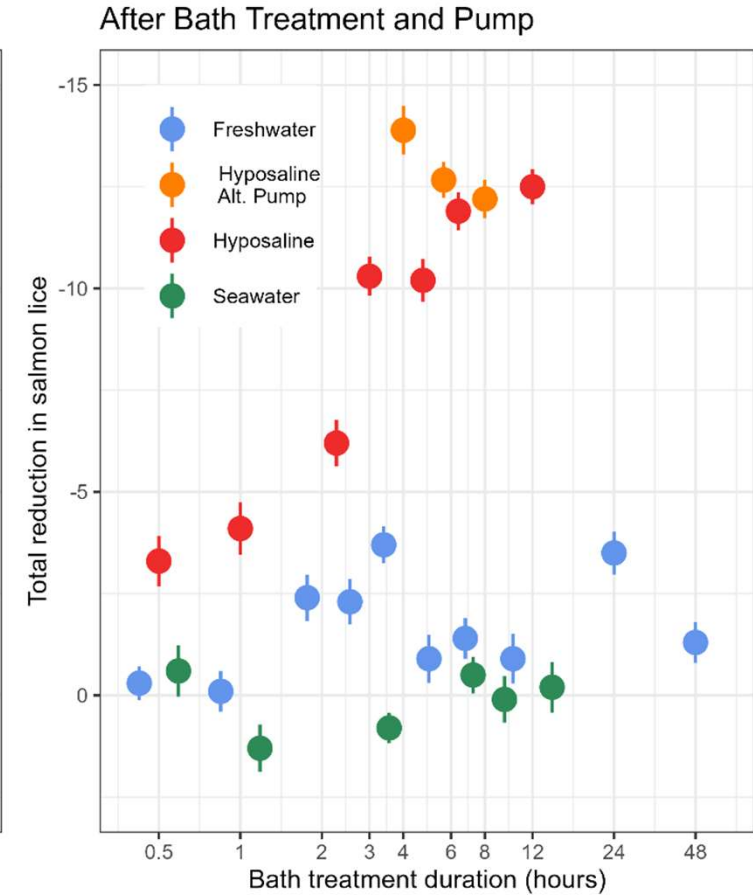
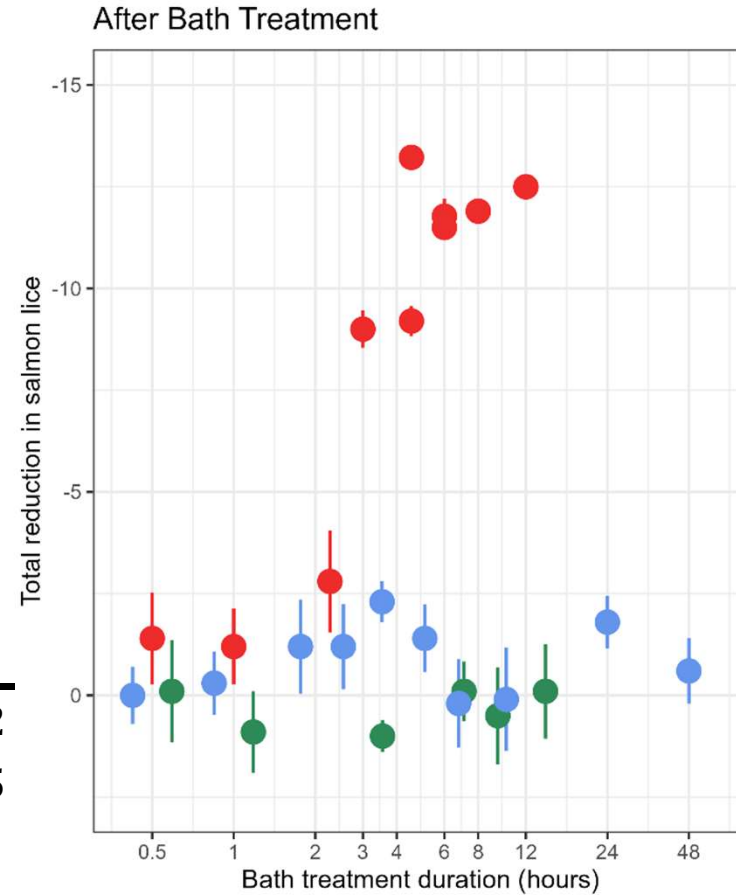


Delousing Efficacy

No Freshwater effect?

- No replicate tanks
- & separate rounds
- Different fish and lice
- Different tolerances
- Different water chemistry

| | <u>Mg [mg/L]</u> | <u>Ca [mg/L]</u> |
|------------|------------------|------------------|
| Hyposaline | 1.2 | 0.72 |
| Freshwater | 19 | 6.05 |



Optimising delousing strategies: Conclusion

- Fish Welfare
 - All Handling/Treatment has injury risk and leads to worse outcomes
 - No evidence that combination treatments are worse than single treatments
- Delousing Efficacy
 - Incidental handling delousing has strong effect
 - Freshwater/hyposaline treatment can be highly effective
 - Consider resistance



