Interreg Latvia – Lithuania

Co-funded by the European Union

**Interreg Latvia-Lithuania project**
**Latvian and Lithuanian conjunction - Improvement of Baltic salmon and pikeperch rearing methods for more sustainable, resilient, and healthy fish populations.**

# Program

## Online meeting about the efficiency of probiotic use, D.1.2.3

**August 28, 2025, 10:00 am | On-line**

10:00–10:05 | Opening
Chair: Santa Purviņa – agenda and goals.

10:05–10:25 | Trial Results

Latvia (Olga Revina): Efficiency of Probiotic Use in Flow-Through Systems
Lithuania (Santa Purviņa): Assessment of Probiotic Efficiency on Health and Growth Performance of Baltic Salmon Parr and Presmolts in RAS

10:25–10:45 | Discussion
Cross-site differences in probiotic efficiency.
Standardization needs.

10:45–11:00 | Next Steps & Wrap-up

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# MINUTES

## Online meeting about the efficiency of probiotic use, D.1.2.3

**August 28, 2025, 10:00 am | On-line**

Participants: Olga Revina, Brigita Bariseviciene, Janina Pavlaviciute, Justas Poviliunas, Svetlana Dickanciene, Alina Širvinska, Jurate Andriukaitienė, Žanna Bertaite, Kristofers Millers, Santa Purviņa

**Olga Revina** (LP) gave a detailed overview of the probiotic trials conducted in **Pelči (Latvia)** with fry, parr and presmolts. She explained the methodology applied during the rearing process, including the feed composition enriched with probiotics and the monitoring approach used throughout the trial period, and after experiments. Olga presented the main outcomes, emphasizing improvements in fish growth performance, and general health status compared to the control group. She also highlighted observations related to reduced necrosis incidence in probiotic-fed fish. The presentation included visual data such as growth curves and comparative tables, illustrating the positive impact of probiotics in practical rearing conditions.

**Santa Purviņa** highlighted results collected by **BIOR experts in Lithuania**, where probiotic trials were carried out with **Baltic salmon**. The measurement data were presented obtained from these experiments, including survival, weight gain, and health indicators. Santa underlined the temperature effect.

The project findings contribute to valuable comparative insights, allowing a discussion on how probiotic efficiency might differ between rearing sites.

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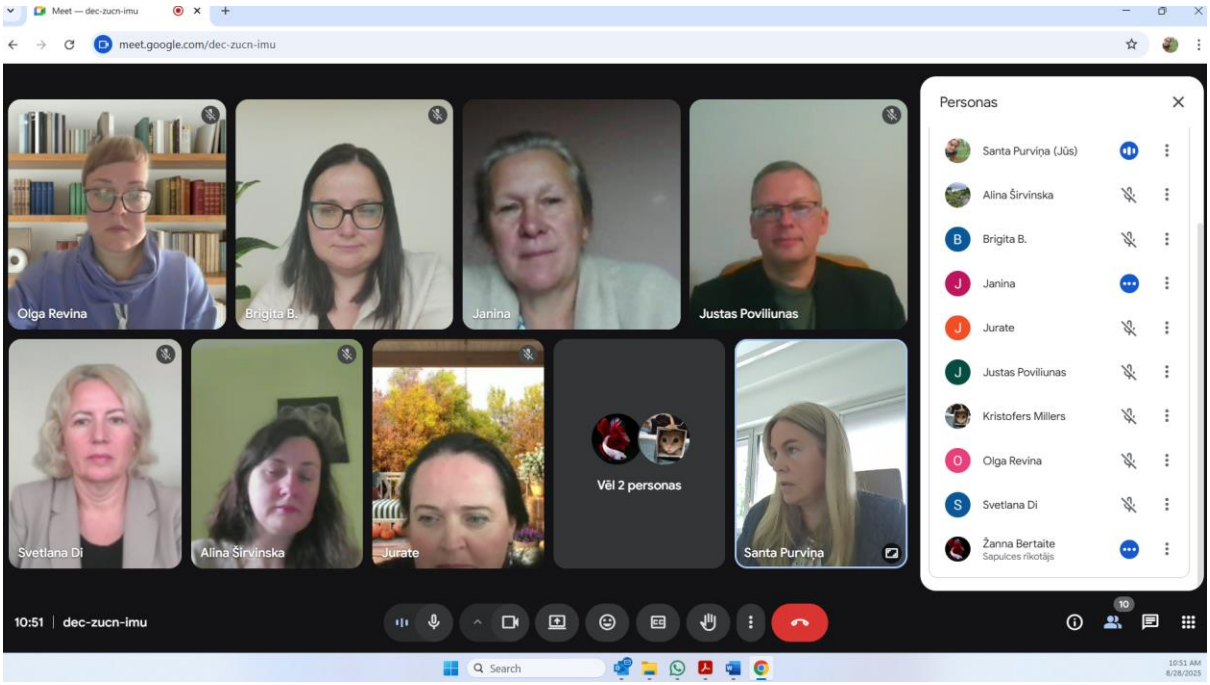
**Discussion and Next Steps**

- Participants agreed that probiotic application demonstrates clear potential in enhancing fish health and growth, though further standardization of methods is needed.
- Future work will focus on:
    - PP3 reporting and deliverables
    - finishing probiotic trials with both salmon and pikeperch,
    - comparing data across Latvian and Lithuanian sites, and
    - preparing final deliverables and recommendations for aquaculture sector on the combined results.



Interreg

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Latvia – Lithuania

*Latvian and Lithuanian conjunction - Improvement of Baltic salmon and pikeperch rearing methods for more sustainable, resilient, and healthy fish populations*

**Efficiency of Probiotic Use in Different Rearing Systems (Recirculation and Flow-Through)**

# D. 1.2.4. «Improvement of fish welfare in aquaculture enterprises»

Olga Revina
Lead scientist 1

***August 28, 2025***

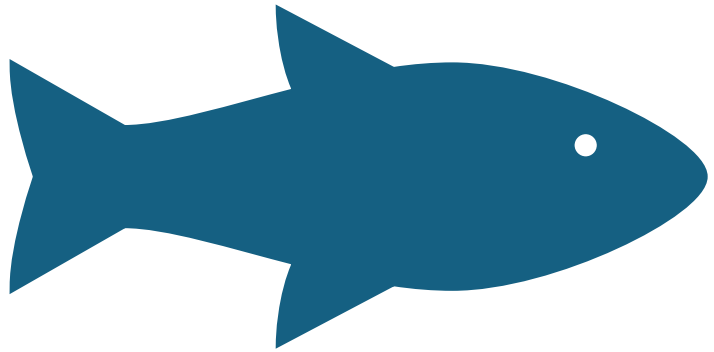
BIOR
INSTITUTE OF FOOD SAFETY, ANIMAL HEALTH AND ENVIRONMENT

# Main Aim of the Project

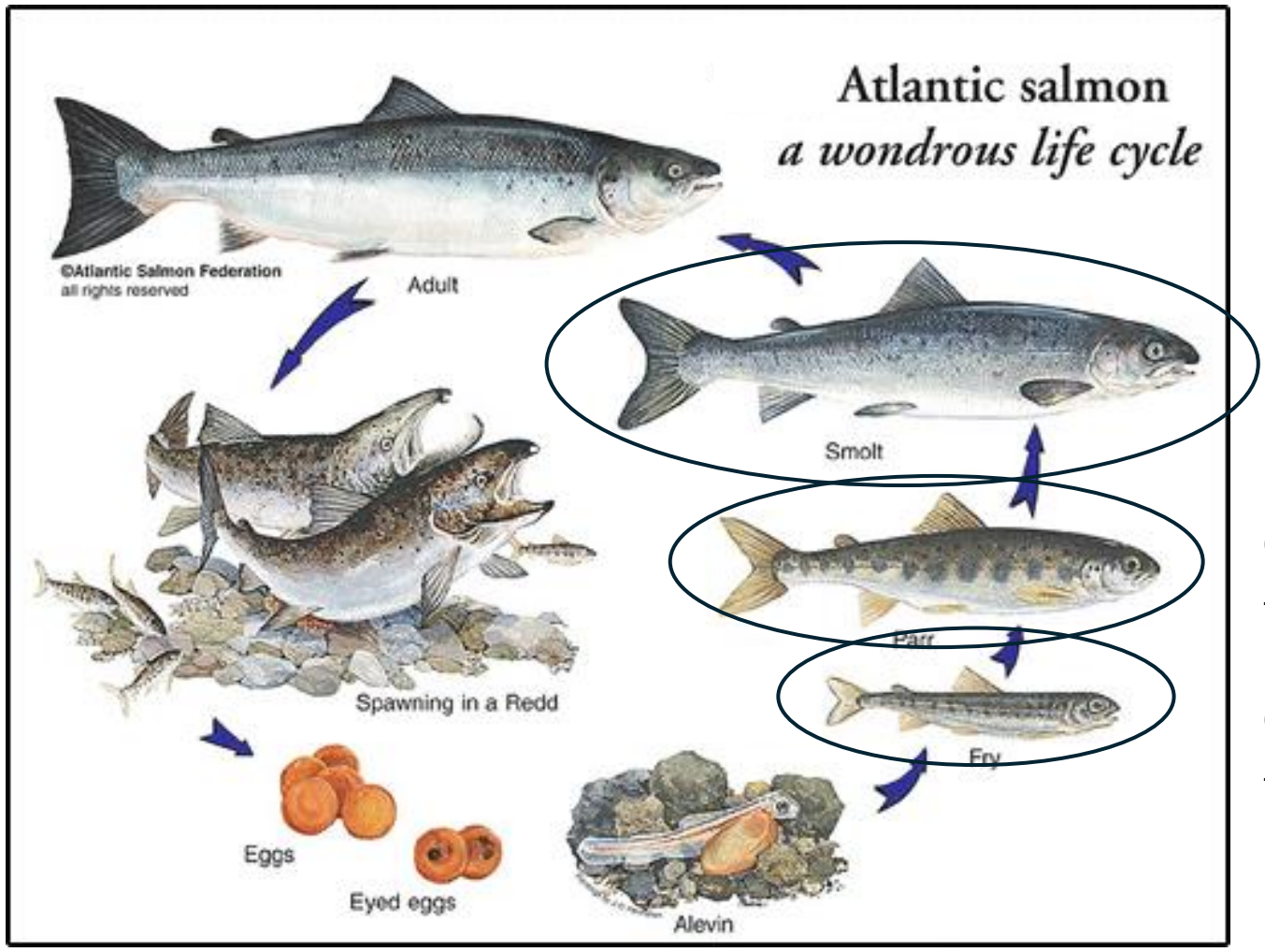
Improve salmon and pikeperch rearing methods, enhance resistance to diseases, and strengthen biosecurity → more sustainable, resilient, and healthy fish populations in the Baltic region.

**Shared goals of LV and LT partners:**

- Long-term sustainability of salmon populations.
- Close cooperation and knowledge exchange.
- Aim: Produce healthier smolts → stronger natural populations.



# Materials and methods
# **Experiment design FTS (LV)**




01.09.2024 (14-days trial)

03.08.2025 (14-day trial + follow-up observation)

01.05.2025 (31-day trial + follow-up observation)

# Materials and methods
## **Experiment design FTS (LV)**

- **Control group (Control**) - fish fed with with basic commercial feed *Aller aqua*.
- **Probiotic feeding group (ProbFeed) -** fish fed with basic feed, supplemented with 1 – 5 ml $kg^{-1}$ of *Smart Fishery probiotics* (Baltic Probiotics Ltd., Latvia).
- **Probiotic bathing group (ProbBath) -** fish fed with basic feed and additionally subjected to *probiotic bathing* (15 ml $m^{-3}$) for 15 minutes.

# Materials and methods
# **Growth measurements**

- **Sampling**
- At **start and end** of the trial:
    - 50 fish sampled **per tank**.
    - Measurements: **body weight** (g) and **total length** (cm).
- **Growth Parameters Calculated**
- **Weight Gain (WG):**

*Final weight – Initial weight*

- **Fulton's Condition Factor (K):**

$(W / L^3) \times 100$

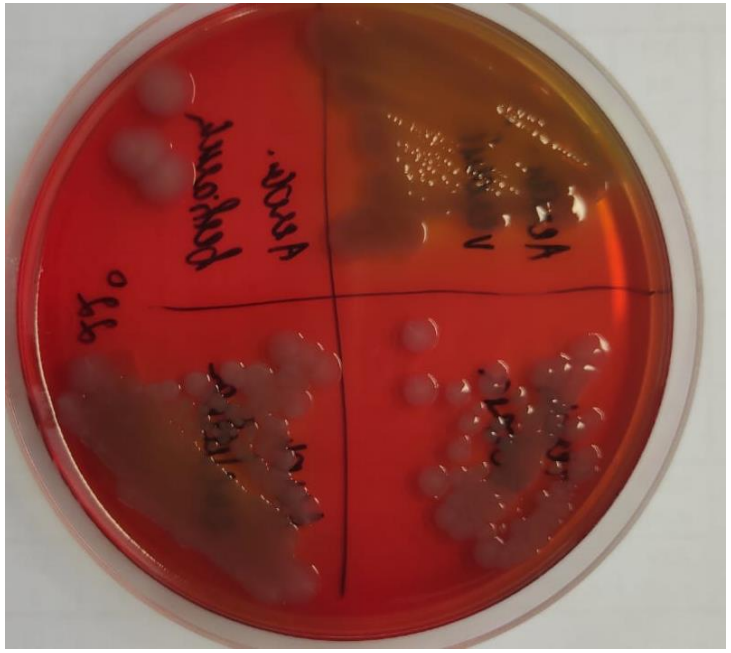
    - W = body weight (g)
    - L = body length (cm)

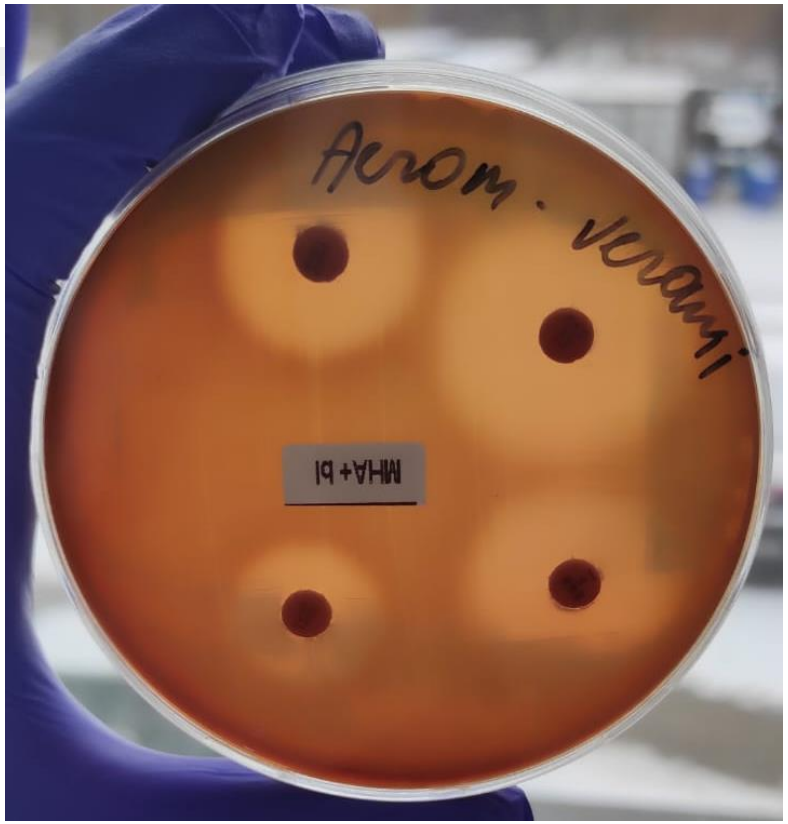
# Materials and methods
# **Bacterial Isolation and Antimicrobial Testing**

Samples: skin & gill mucus

Transported in **Amies medium** to the BIOR laboratory (Riga, Latvia).
•Pure strains identified by:
•Colony morphology, growth temp., biochemical tests.
•**MALDI-TOF MS** for precise species identification.
•Methods followed **CLSI & standardized microbiological protocols**.
•Antimicrobial susceptibility testing (AMR).

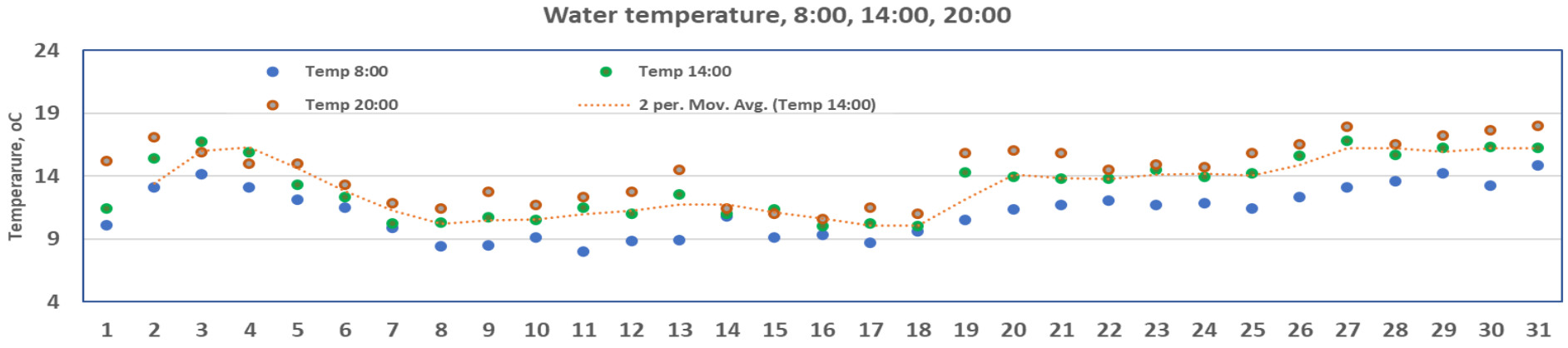
# Materials and methods
# **Bacterial Isolation and Antimicrobial Testing**

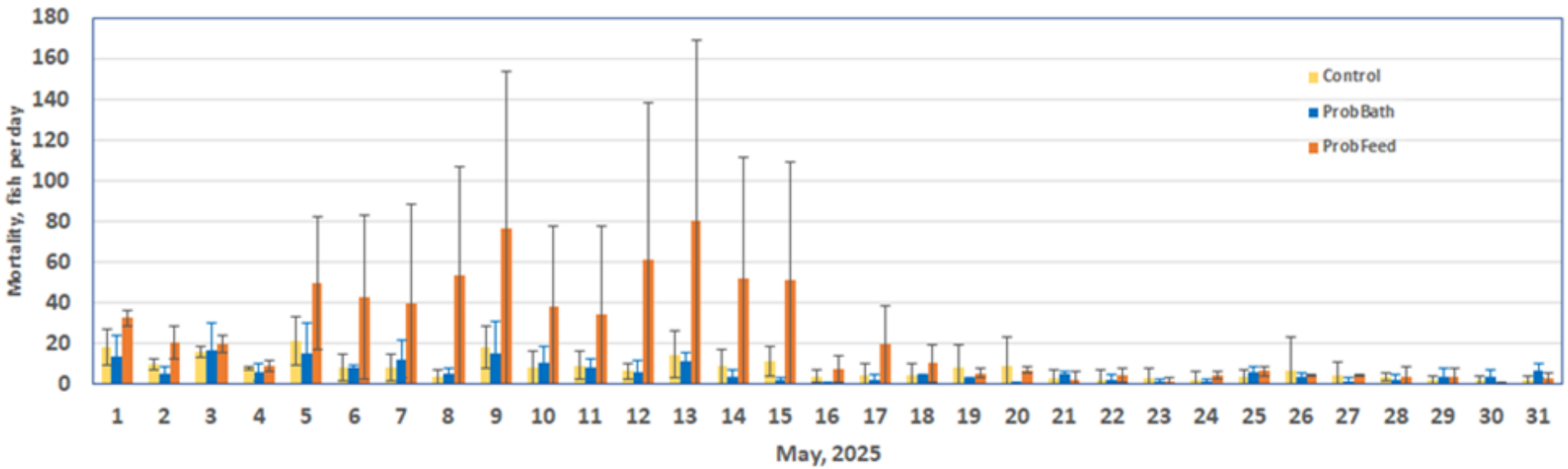




# Results

## Salmon Fry (FTS, May 2025)




Mortality:

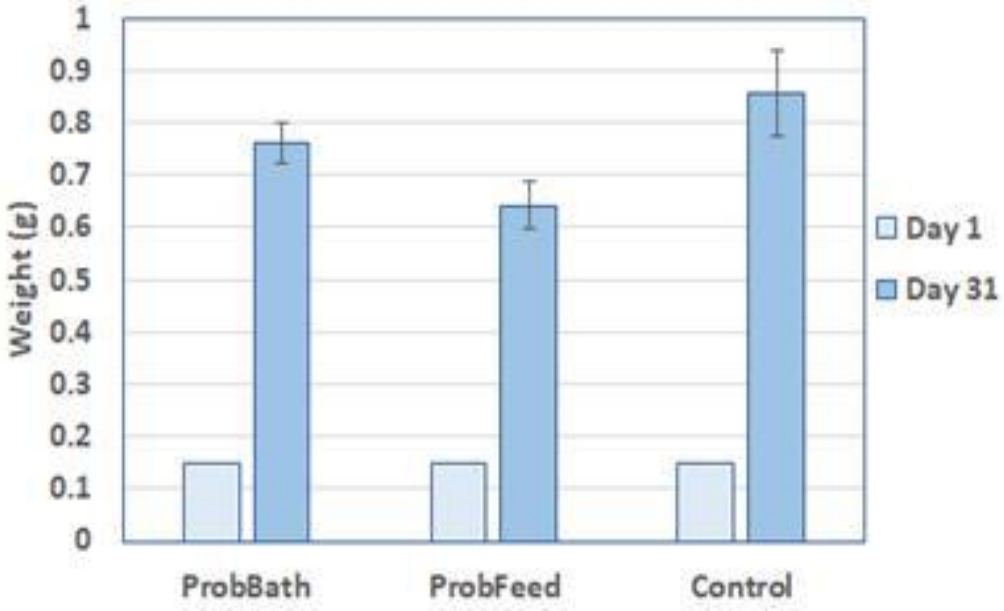
**Control** – moderate, steady losses.

**ProbBath** – lower mortality, especially after mid-May.

**ProbFeed** – highest losses at start, later stabilized.

# Results

## Salmon Fry (FTS, May 2025)




**Growth:**

Best – Control

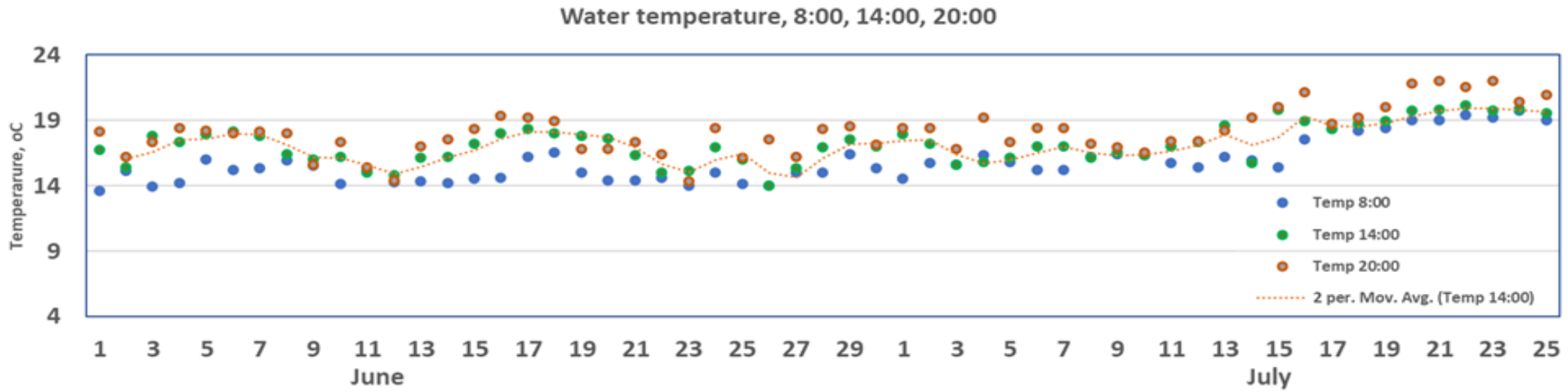
Medium – ProbBath

Lowest – ProbFeed

After the experiment concluded, monitoring of salmon fry continued for all experimental groups.

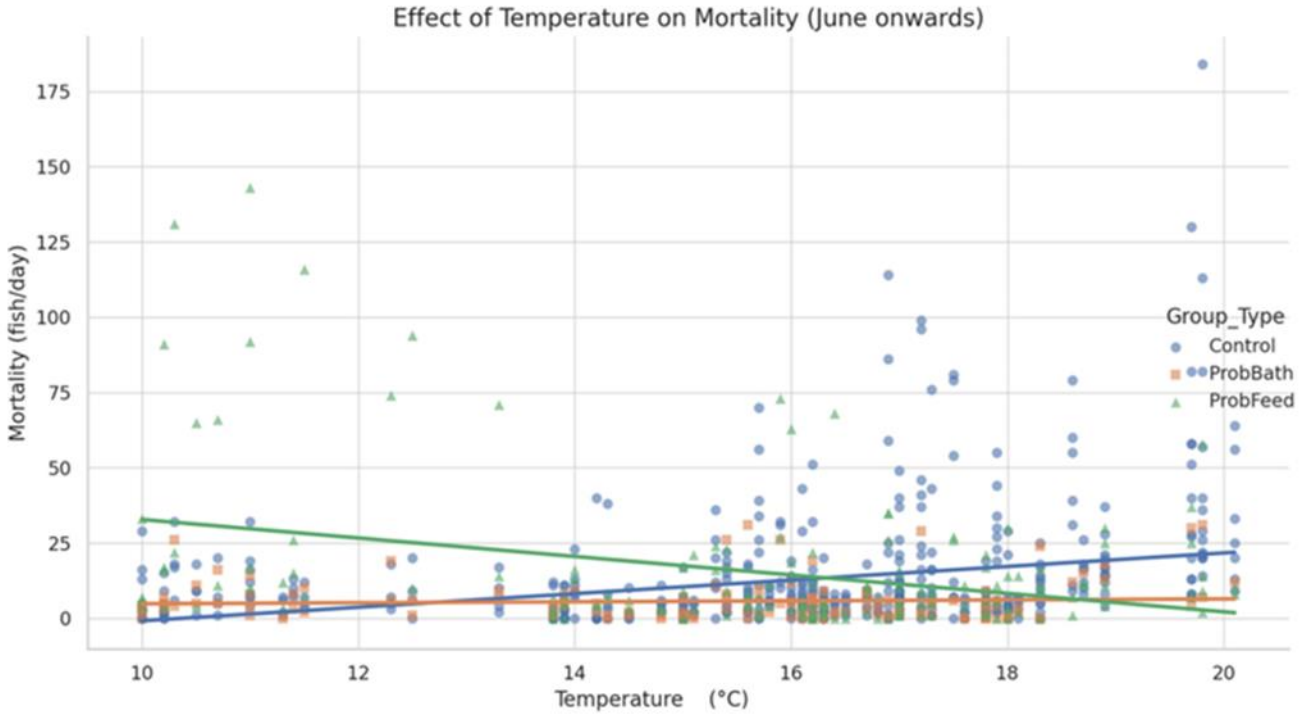
# Results

## Salmon Fry (FTS, June-July 2025)



# Results

## Salmon Fry (FTS, June-July 2025)




ProbFeed & ProbBath – Lowest mortality in ProbFeed group
→ possible protective effect at high temperature.

**Fry under Stress (June–July 2025)**

June: all groups stable – low mortality, normal feeding, similar growth.

July (heat stress): Temperature up to 22 °C, low oxygen in the mornings (3,4 mg/l).

**Control:** stress symptoms, mortality increased at high temperature.
**ProbFeed**: mortality decreased at high temperature.
**ProbBath:** stable tolerance.

Conclusion: Probiotics improved resilience to heat and low oxygen.

# **Results**
# Parr Trial (FTS, Aug 2025)

- **Growth Performance:**

**ProbBath** → significantly higher length & weight than Control ($p < 0.01$).

**ProbFeed** → no growth improvement compared to Control.

- **Condition Factor (K):**

**ProbBath** → significantly higher than Control & ProbFeed.

**ProbFeed** ≈ Control (no effect).

- **Gill Cover Necrosis:**

Reduced in both probiotic groups vs Control.

Control: 59% affected

ProbBath: 38%

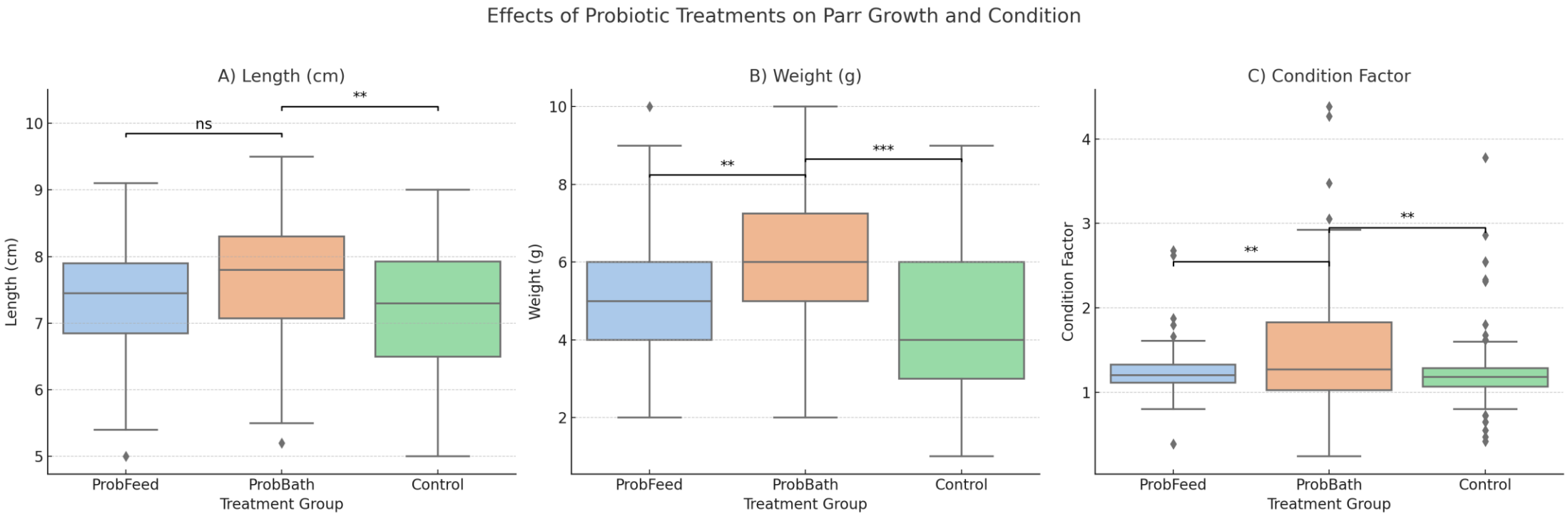
ProbFeed: 34%

- **Conclusion:**

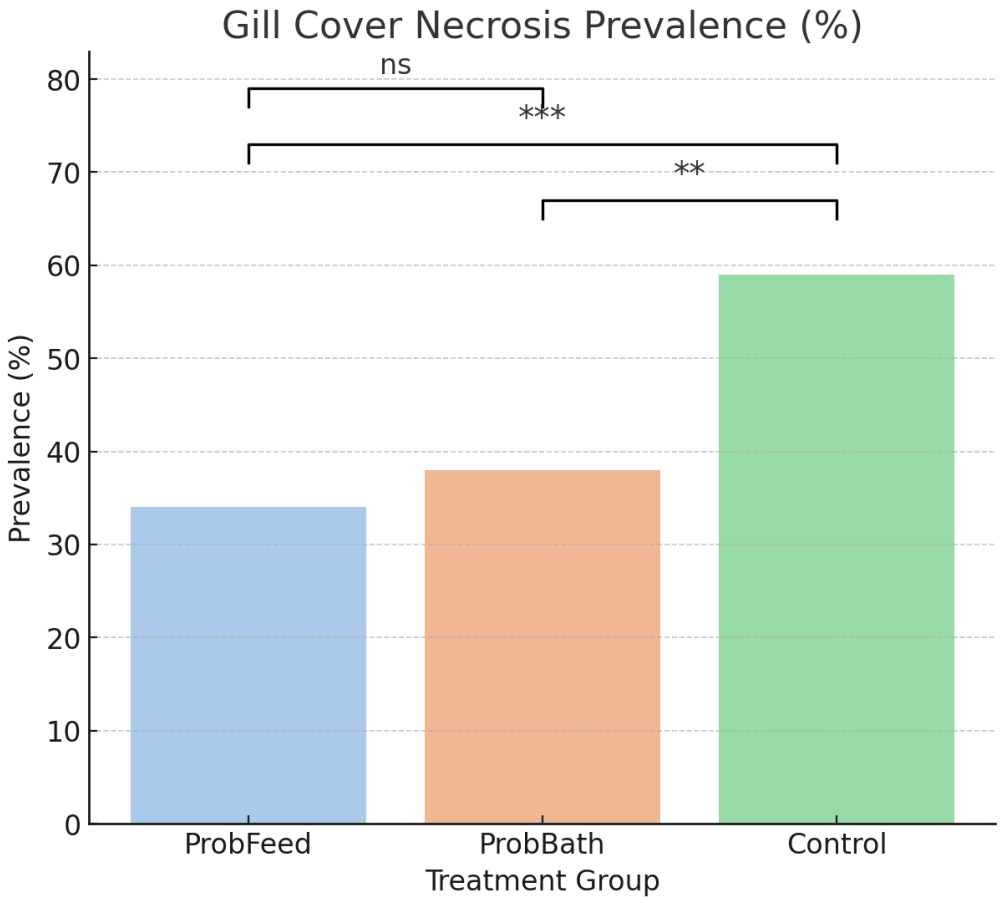
**Bath probiotics most effective** → better growth & condition.

Both probiotic methods **reduced gill pathology**.

# **Results**
# Parr Trial (FTS, Aug 2025)



# **Results**
# Parr Trial (FTS, Aug 2025)



# Results

## Parr Trial (FTS, Aug 2025)

**Summary**

- **ProbBath:** clear improvement in growth and body condition vs Control.
- **ProbFeed:** no measurable growth benefits compared to Control.
- **Gill Cover Necrosis:** reduced in both probiotic groups (similar protection levels).

**Conclusion**

- Bath application gave the **strongest growth benefits**.
- Both methods supported **better gill health** vs Control.

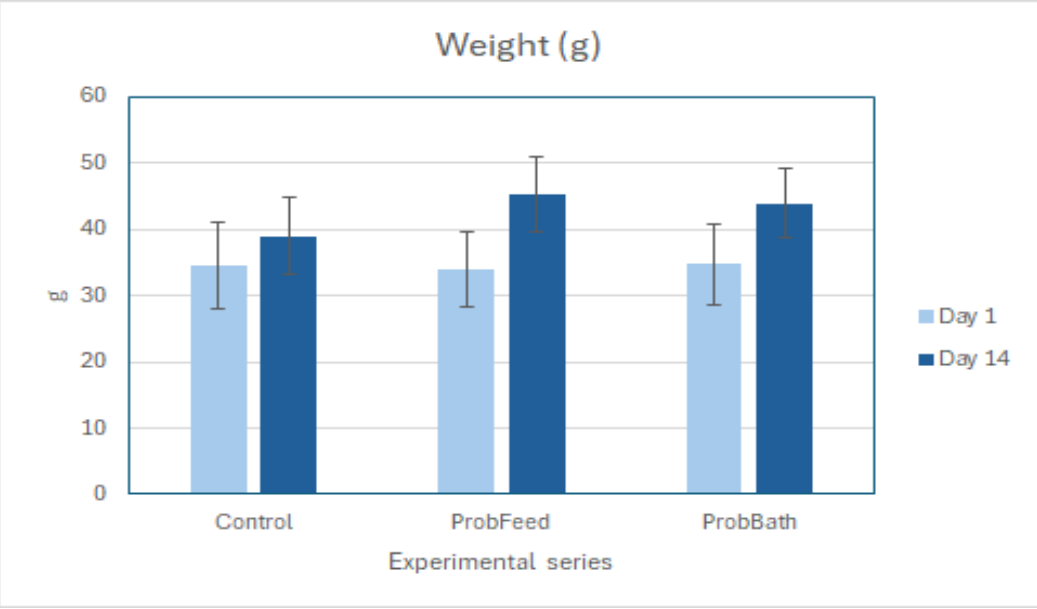
- Microbiological analyses will be continued.

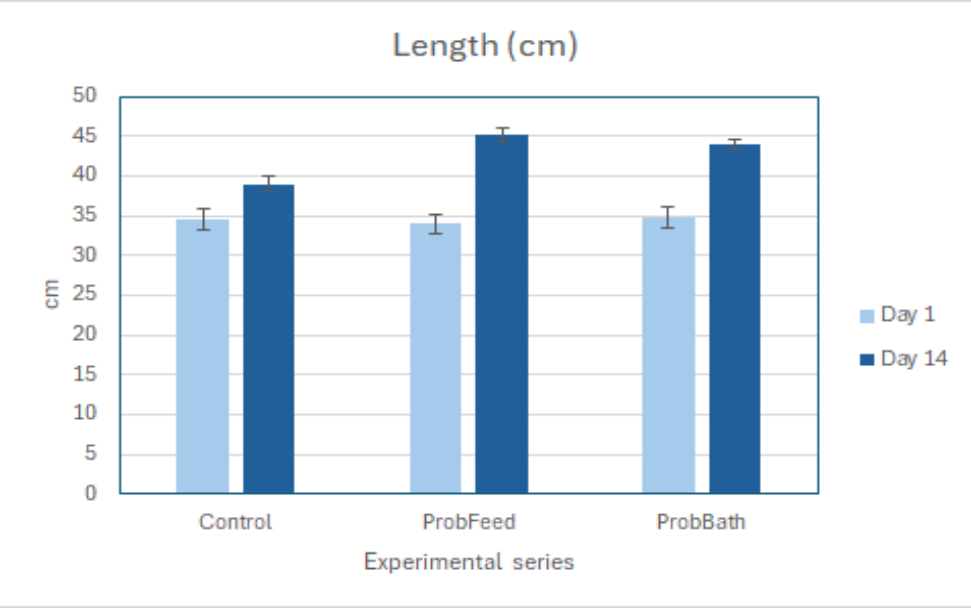
# Results

## Presmolts Trial (FTS, Sept 2024)

**Growth results (14 days):**

- **Control:** +4.5 g weight, +0.55 cm length
- **ProbFeed:** +11.3 g, +0.9 cm → ~2× Control
- **ProbBath:** +9.3 g, +1.0 cm → ~2× Control



# **Results**
## Presmolts Trial (FTS, Sept 2024)

- Both probiotic treatments **significantly improved growth**.
- Feed supplementation (ProbFeed) gave the **highest weight gain**.

# Results

## Presmolts Trial (FTS, Sept 2024)

| | Experiment group | Pathogen isolate | Antibiotics tested for AMR | | | | MAR |
|---|---|---|---|---|---|---|---|
| | | | **Doxycycline** | **Enrofloxacin** | **Florfenicol** | **Oxytetra-cycline** | |
| Day 1 | **Control** | *A.salmonicida* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| | | *A.veronii* | Susceptible | Susceptible | *Resistant* | Susceptible | 0,25 |
| | | *Pseudomonas spp.* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| | **ProbFeed** | *A.salmonicida* | Susceptible | Susceptible | *Resistant* | *Resistant* | 0,5 |
| | | *A.veronii* | Susceptible | Susceptible | *Resistant* | *Resistant* | 0,5 |
| | | *Pseudomonas spp.* | Susceptible | Susceptible | *Resistant* | *Resistant* | 0,5 |
| | **ProbBath** | *A.salmonicida* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| | | *A.bestiarium* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| | | *A.veronii* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| Day 14 | **Control** | *A.bestiarium* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| | **ProbFeed** | *A.bestiarium* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |
| | **ProbBath** | *A.salmonicida* | Susceptible | Susceptible | Susceptible | Susceptible | 0 |

# Conclusions

- **General findings**

Probiotic efficacy depends on **life stage, application method & temperature**.

- **Fry (FTS):**

**Baths** reduced mortality without affecting growth.

**Feed** increased early mortality but improved survival under high summer temperatures.

- **Thermal Resilience:**

Probiotics enhanced tolerance to heat (≥18 °C) and low oxygen.

- **Presmolts (FTS):**

Both methods improved growth (~2× vs Control).

Highest gains with **feed supplementation**.

Better **condition factor (K)** in probiotic groups.

# Conclusions

- **Pathogen Management:**

Early trials: Aeromonas & Pseudomonas detected, AMR only in ProbFeed.
After 14 days: pathogen diversity & AMR reduced; **no resistance in ProbBath group**.

- **Parr (FTS):**

**Bath probiotics** significantly improved growth & condition.
Both methods reduced gill cover necrosis.

- **Overall Conclusion:**

**Baths** → best for fry & parr.
**Feed** → best for presmolts.
Stage-specific probiotic use can improve health, resilience & seawater readiness.

# Thank You!!!

Interreg

Co-funded by the European Union

Latvia – Lithuania

Latvian and Lithuanian conjunction - Improvement of Baltic salmon and pikeperch rearing methods for more sustainable, resilient, and healthy fish populations(SPPwelfare, LL-00133)

# Assessment of Probiotic Efficiency on Health and Growth Performance of Baltic Salmon Parr and Presmolts (RAS)

BIOR

# Assessment of Probiotic Efficiency on Health and Growth Performance of Baltic Salmon Parr and Presmolts (RAS)

# Experiment Design

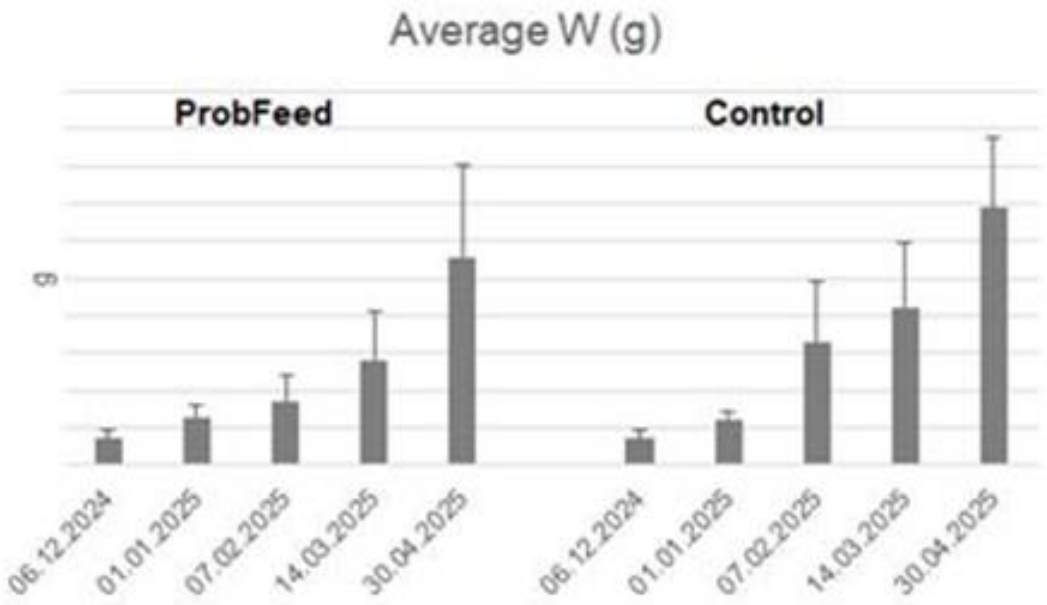
- 7000 Baltic salmon parr (avg. 3.6 g)
- Groups: Control (3040) vs. ProbFeed (3060)
- Tanks: 15 $m^3$ & 7 $m^3$
- Conditions: 11°C, pH 7.8, DO 92%

# Probiotic Treatment

- Smart Fishery probiotics (Baltic Probiotics Ltd.)
- Dilution: 1:50 with water
- Dosage: 1.5 ml per 1 kg feed

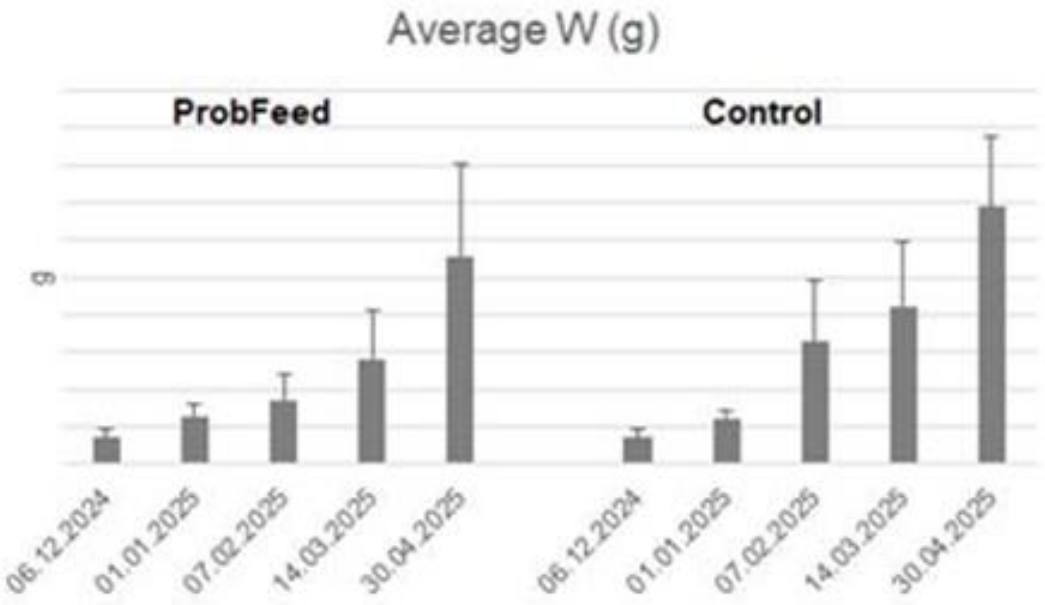
# Growth Performance – Length

- Initial length ~7.0 cm (both groups)
- Final: Control 14.33 ± 1.24 cm vs. ProbFeed 13.03 ± 2.07 cm
- Result: Control significantly larger ($p = 5.3 \times 10^{-5}$)



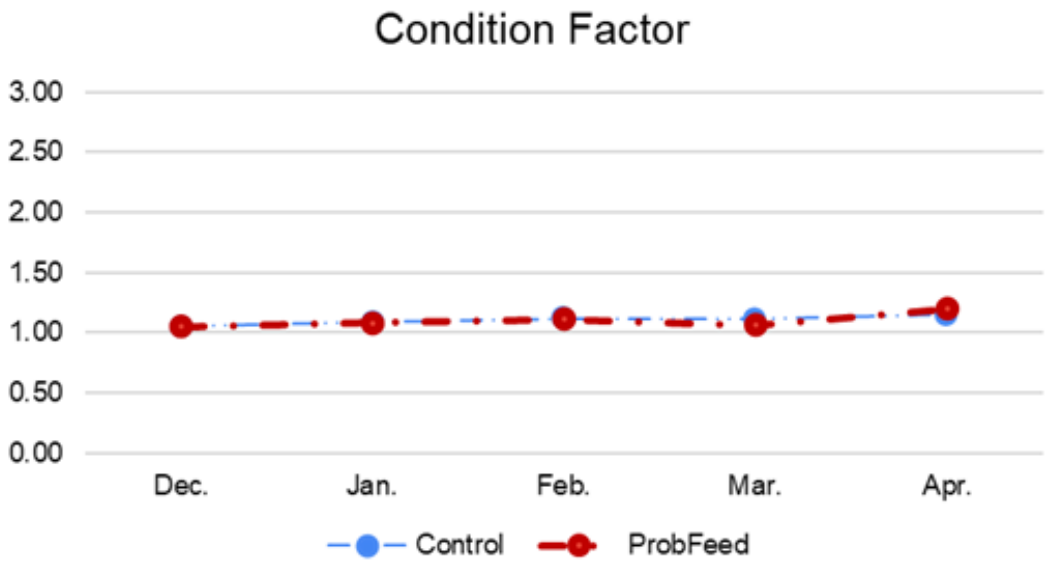
# Growth Performance – Weight

- Initial weight ~3.6 g (both groups)
- Final: Control 34.42 ± 9.35 g vs. ProbFeed 27.98 ± 12.39 g
- Max individual weight 56.1 g (ProbFeed)
- Result: slower weight gain in ProbFeed (p = 0.022)



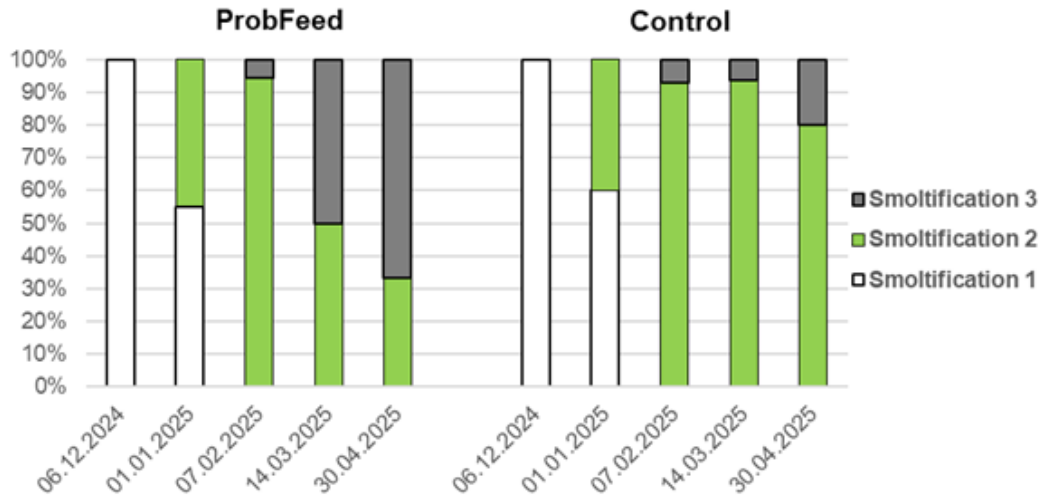
# Condition Factor (K)

- No significant difference between groups (p = 0.468)
- Seasonal variation observed
- Conclusion: probiotics did not affect body condition



# Smoltification Dynamics

- Dec: all parr (stage 1)
- Feb: 94% ProbFeed stage 2; 6% stage 3
- Mar: 50% ProbFeed stage 3 vs. 6% Control
- Apr: ProbFeed 66% stage 3 vs. Control 20% stage 3
- Result: faster smoltification trend in ProbFeed (p = 0.119, not significant)



# Biological Implications

- Probiotics may accelerate smoltification via gut–brain–endocrine axis
- Earlier smoltification = improved migration timing & seawater adaptation
- Positive biological trend despite lack of statistical significance

# Conclusions

- Probiotics did not improve growth at 11oC
- Condition factor was unaffected
- **Indications of faster smoltification in probiotic-fed group**
- Further trials with larger sample sizes would be necessary