

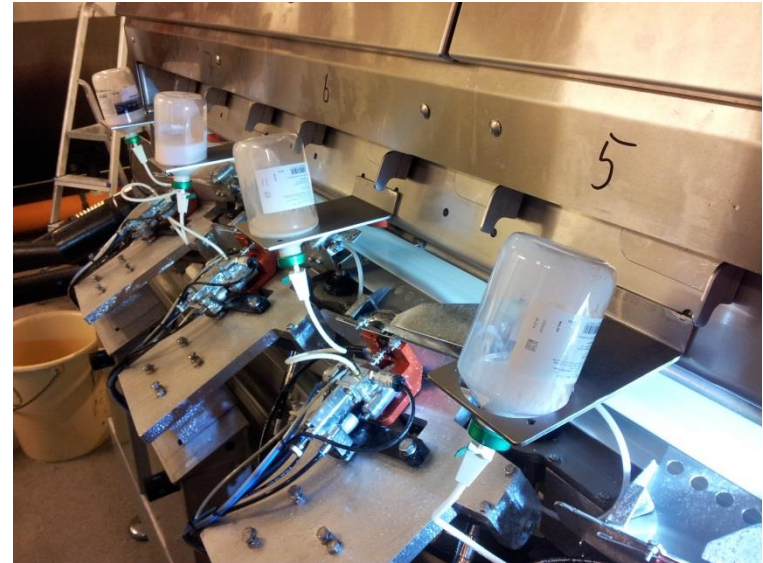
Performance in sea of Atlantic salmon exposed to crowding and pumping during pre-smolt phase

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Background

- During smolt production farmed Atlantic salmon are repeatedly handled during crowding, pumping, sorting, vaccination and transport
- Rough handling is thought to be one reason for the high mortalities that are recorded by some farmers
- Less robust fish and skin problems are other challenges
- The sedative Aqui-S may reduce the negative effects of handling



Background

- Experiment 1: Presented EAS Trondheim 2013
 - same treatment (but without Aqu-i-S)/experimental design during freshwater phase, but «sea transfer» to controllable tank environment at two different temperatures
 - Results: Repeated handling : increased mortality 30 days after sea transfer
 - Development of wounds
- Experiment 2: In this experiment we wanted to repeat the treatment (but with Aqu-i-S), but transfer the fish to a real sea cage environment to investigate the long term effects of handling closed to commercial situation



Objectives

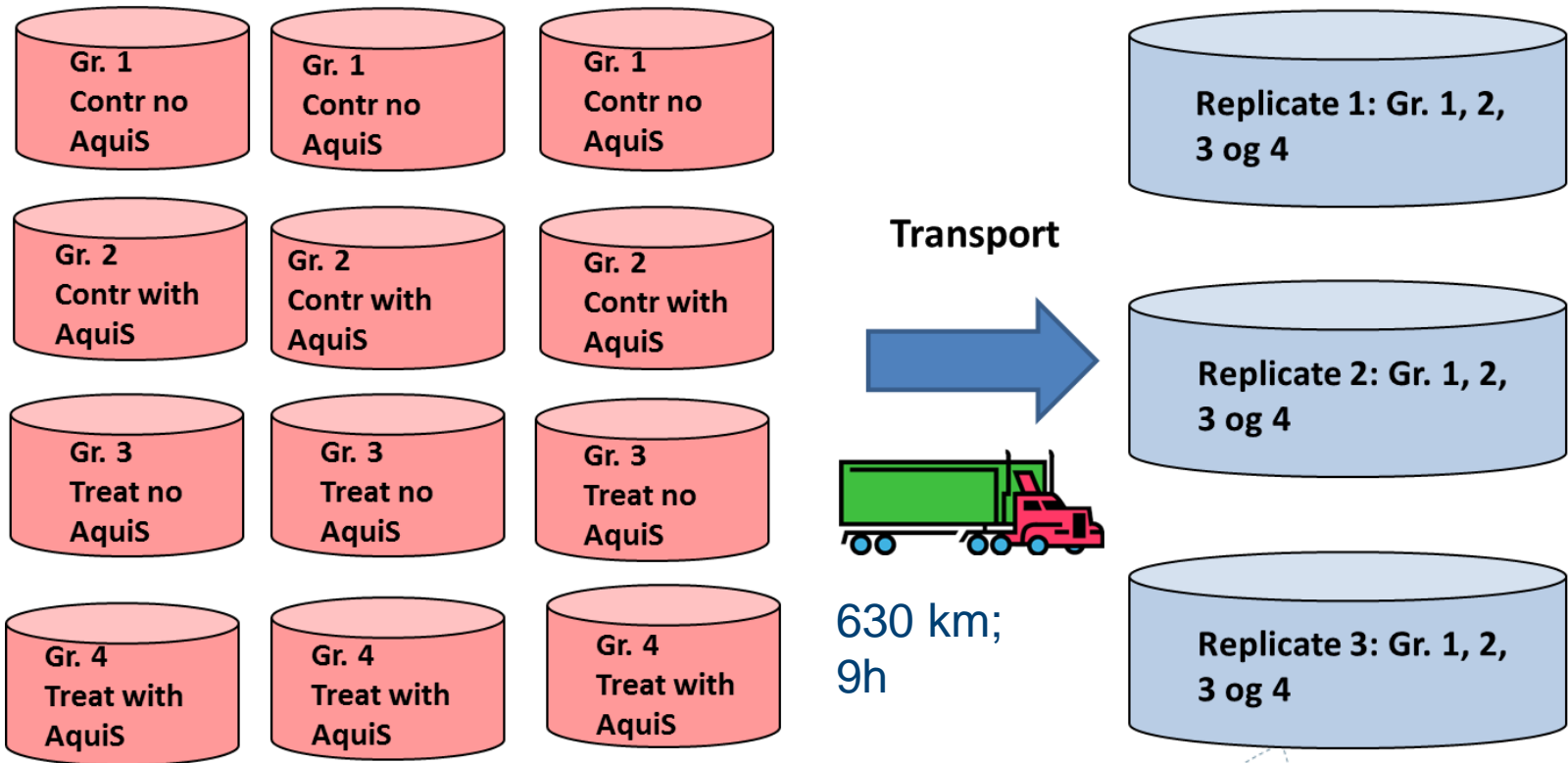
Main objective:

Investigate performance after sea water transfer in repeatedly handled smolt

Secondary objectives:

- Measure growth and mortality after crowding and pumping
- Evaluate physiological stress and skin status caused by single events of and repeated crowding and pumping
- Investigate short- and long term effects of handling with and without the use of the sedative Aqui-S

Experimental design



Phase 1: Five weekly treatments in freshwater FT (March/April 2014)

Gr 1: Control; no crowding/ pumping no Aquis

Gr 2: Control; no crowding/ pumping with Aquis

Gr 3: Crowded/pumped 5 times; once a week. Each tank crowded for 3 hours; and fish pumped to a neighbor tank and back. No Aquis

Gr 4: Crowded/pumped 5 times; once a week. Each tank crowded for 3 hours; and fish pumped to a neighbor tank and back. With Aquis

Phase 2: Three months in seawater cages

PIT-tagged fish from phase 1 merged and divided between three parallel cages

Methods

Aqui-S:

- Applied after protocol from supplier (5 ml Aqui-S per cubic)

Sampling phase I:

- Individual + bulk weight and length
- Blood (lactate, glucose and chloride)
- Skin welfare score
- Skin samples (histology) – results not available

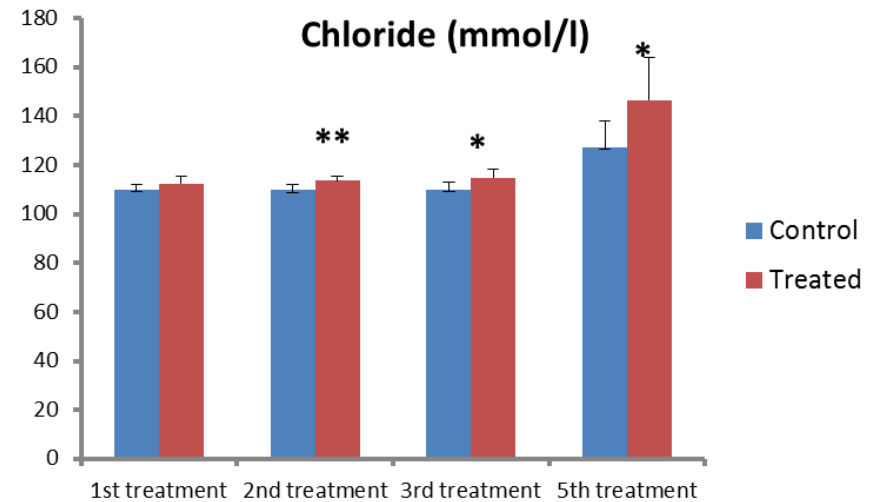
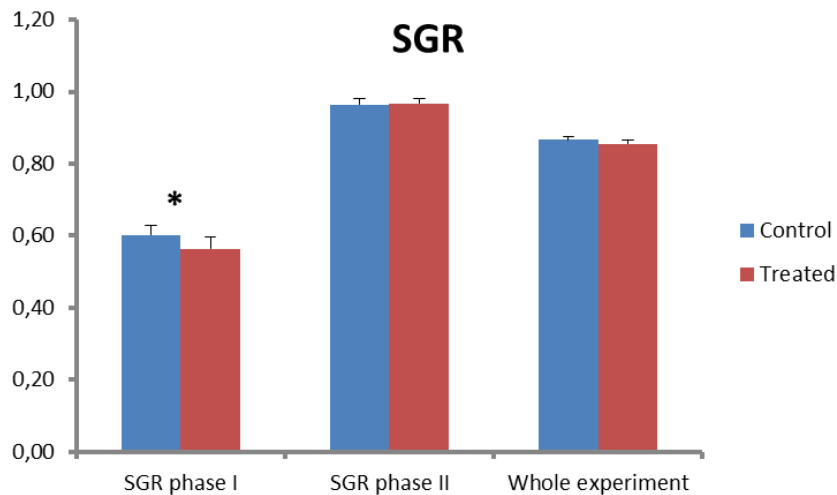
Sampling phase II:

- Individual + bulk weight and length
- Blood (cortisol)
- Skin welfare score
- Skin sampled (histology) – results not available



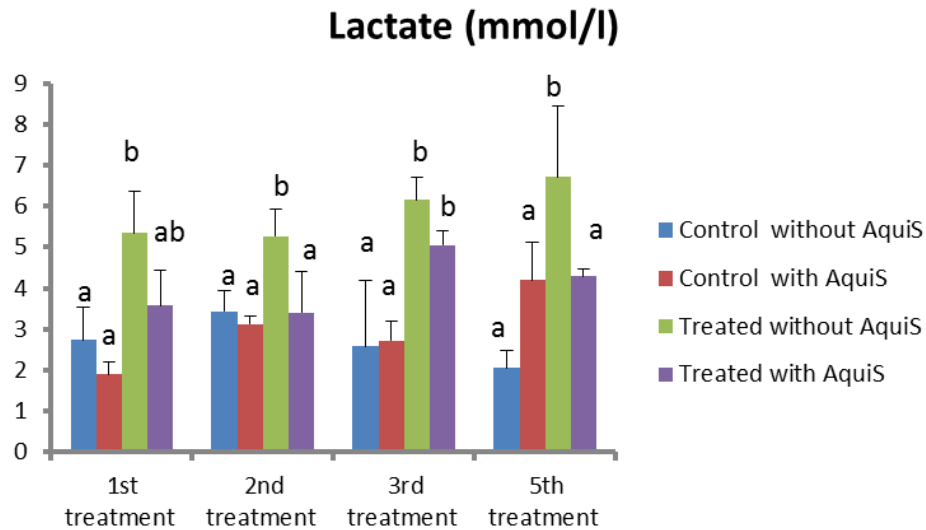
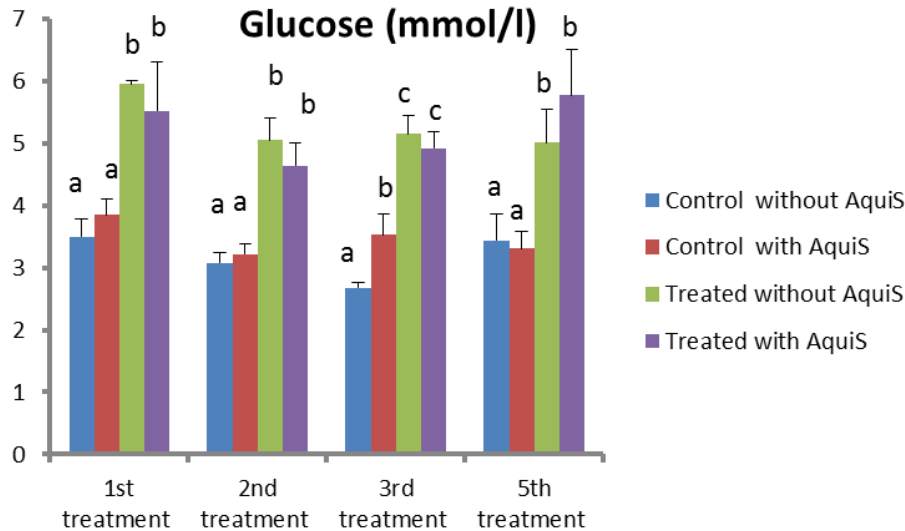


Results phase I (fresh water)



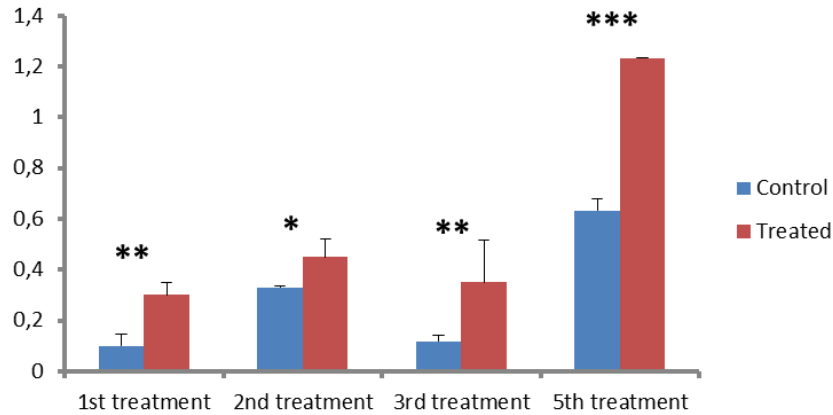
$$SGR = ((\ln W_2 - \ln W_1) * 100) / \text{days}$$

Results phase I (fresh water)

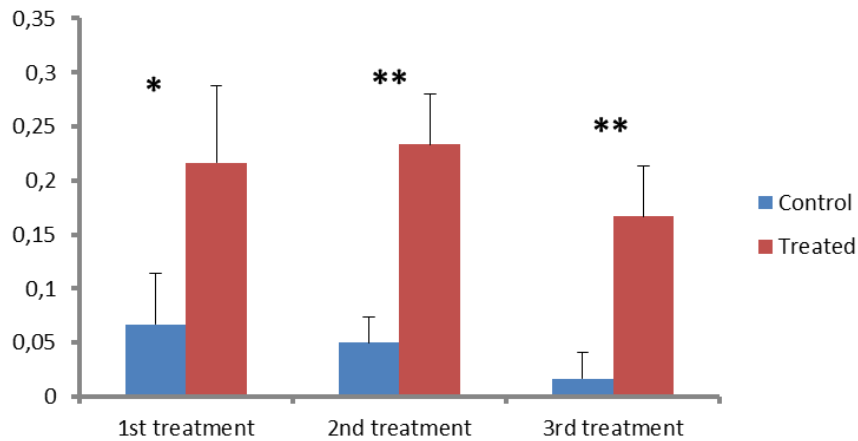


Results phase I (fresh water)

Scale loss (0=no; 1=some; 2=severe)

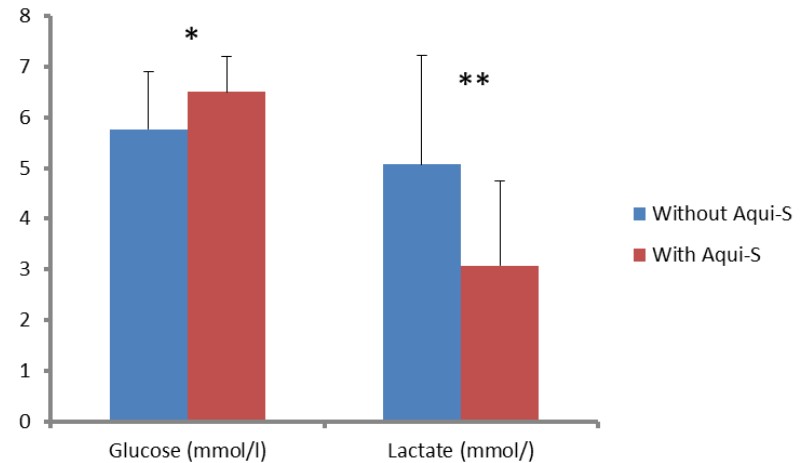
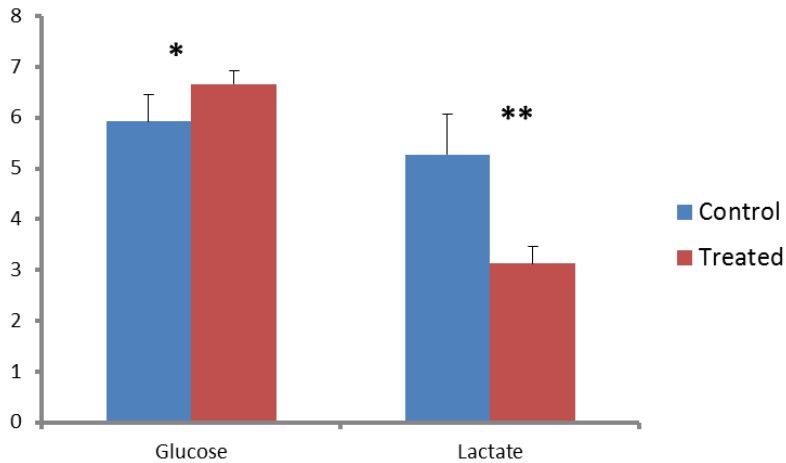


Skin wounds (0=no; 1=some; 2=severe)

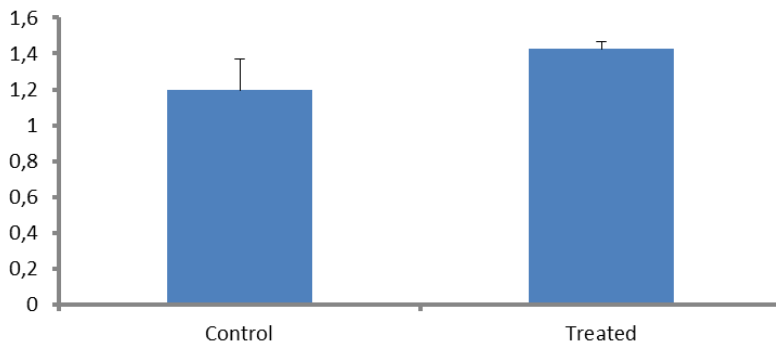


Results – coping with transport

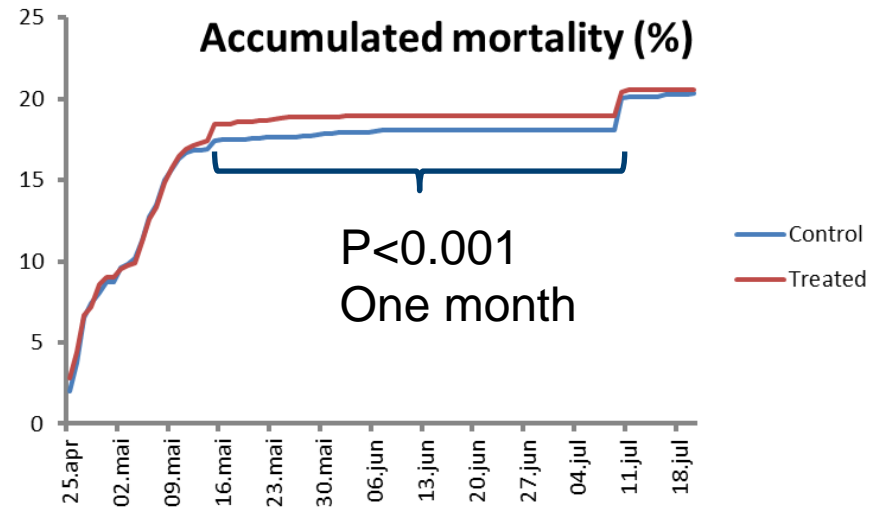
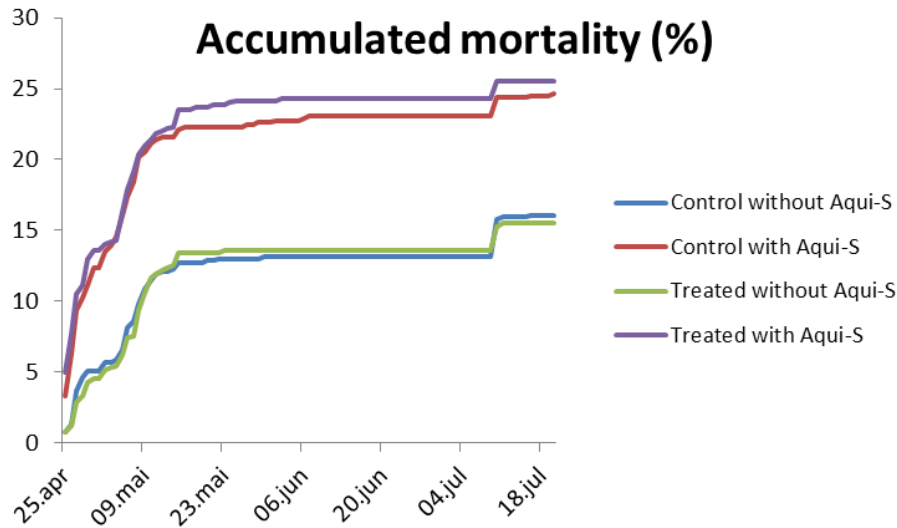
Glucose, lactate and scale loss after transport



Scale loss (0=no; 1= some; 2=severe)

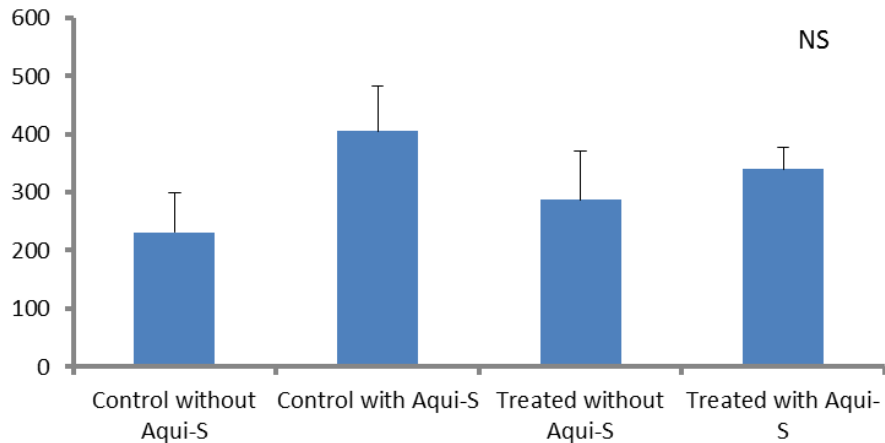


Results phase II (sea water) - mortality



Results phase II (sea water) – Cortisol after ended experiment

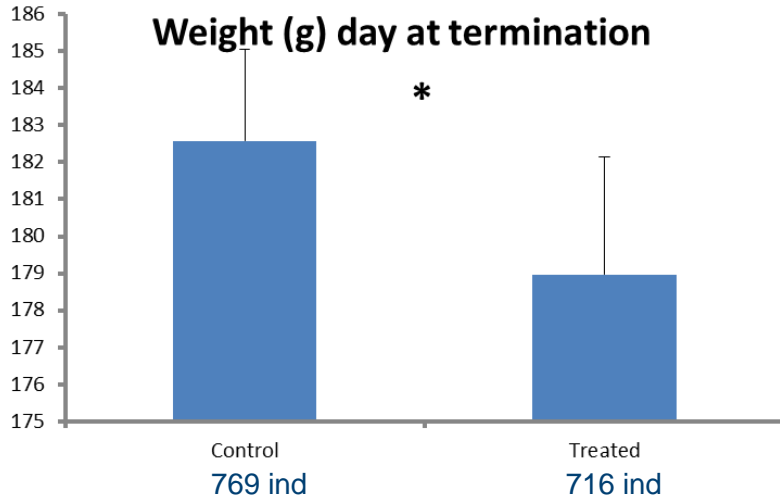
Cortisol nmol/l at day of termination



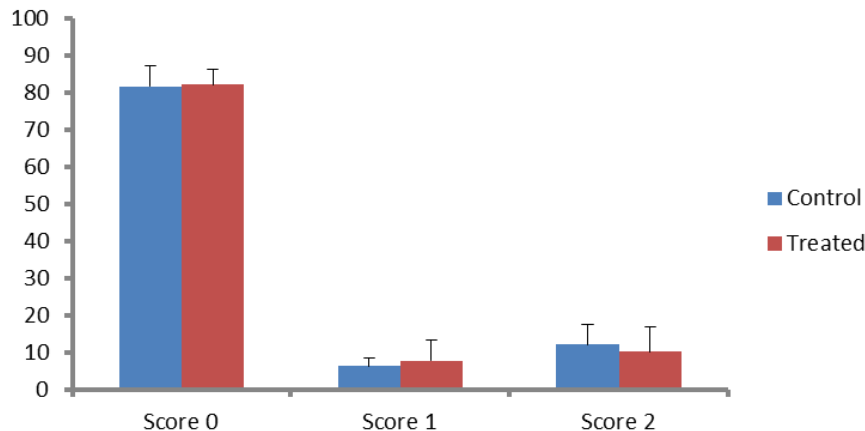
Anesthetics: Metomidat



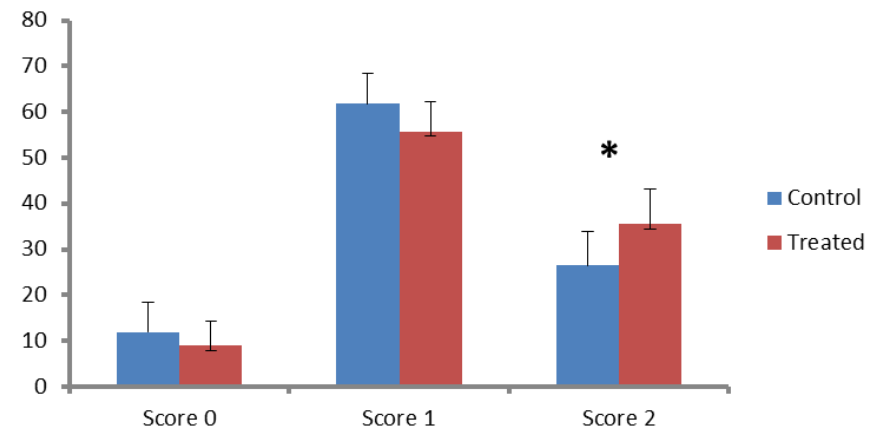
Results phase II (sea water) – Weight and welfare



Wounds (%) 25. April - 20. July



Scale loss (%) 25. April - 20. July

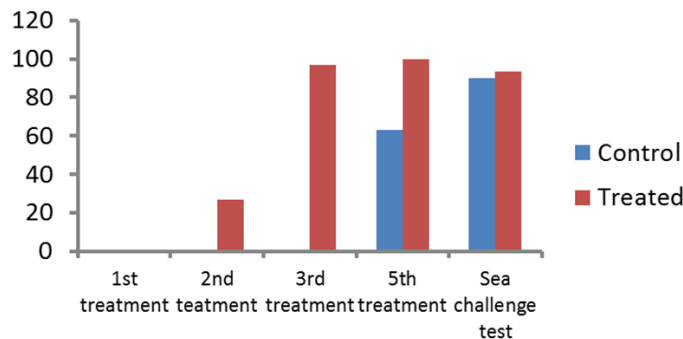


Discussion

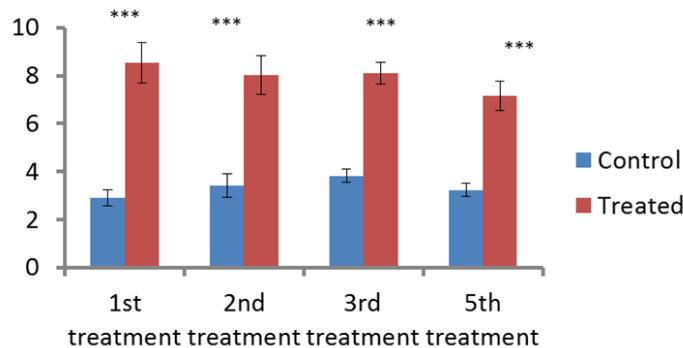
- Both experiment 1 and 2 show clear short term physiological stress and morphological effects (scale loss and wounds) of crowding and pumping

Experiment 1

Skin lesions phase I (%)

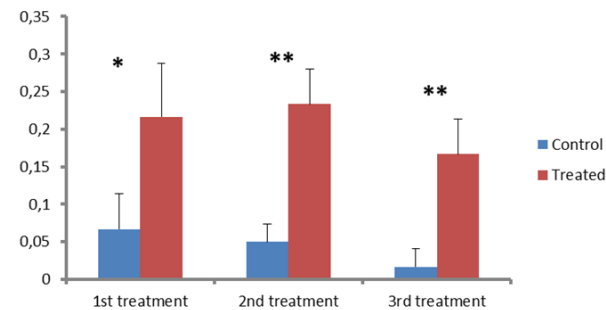


Lactate (mmol/l)

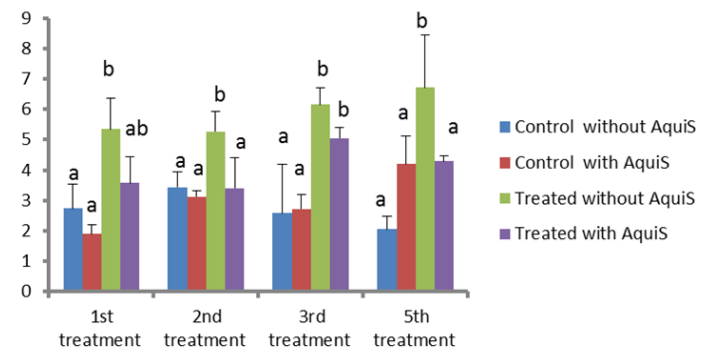


Experiment 2

Skin wounds (0=no; 1=some; 2=severe)



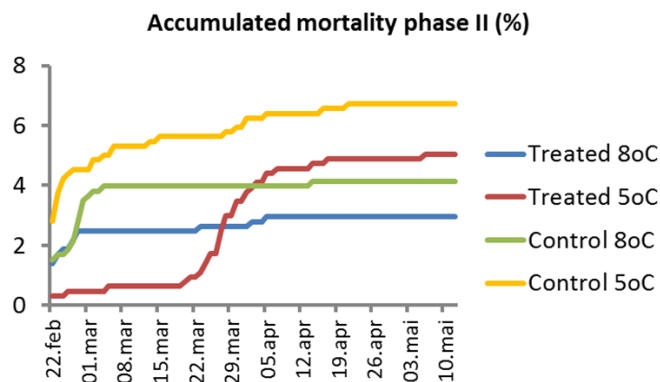
Lactate (mmol/l)



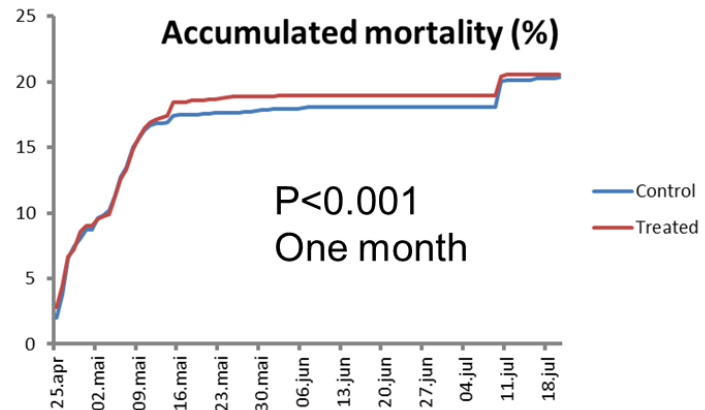
Discussion

- In the first experiments from 2013 the wounds among crowded/pumped fish developed in sea water and caused mortality 30 days after transfer.
- In the second experiment the mortality after 15th of May was higher for treated fish

Experiment 1



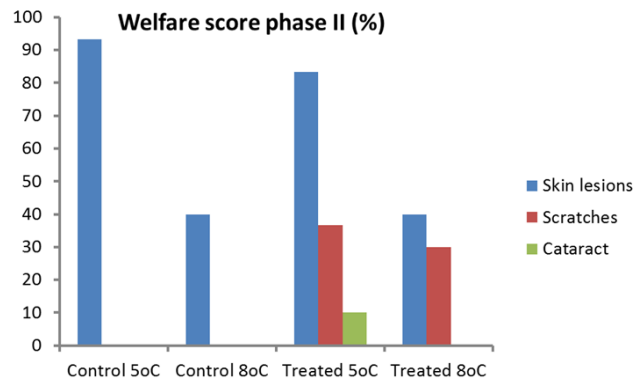
Experiment 2



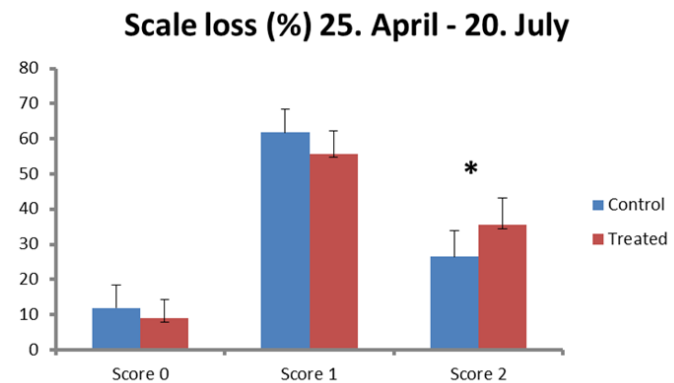
Discussion

- The weight difference from freshwater phase in Experiment 1 disappeared after sea transfer, while in Experiment 2 the treated fish were smaller at the day of termination
- In both Exp 1 and 2 the effects on skin continues through the whole sea water phase

Experiment 1



Experiment 2



Discussion

- Aqwi-S caused less stress among the fish during crowding and pumping in the freshwater phase
- During transport Aqwi-S caused lower levels of lactate but higher levels of glucose. Higher mortality was recorded few days after transport. Reason for this mortality is unclear
- Aqwi-S had no effect on scale loss and wounds
- Aqwi-S had no long term effects on the treated fish

Concluding remarks

- Crowding and pumping of Atlantic salmon smolt results in both short term and long term effects
 - Increased mortality
 - Reduced growth
 - Impaired skin health



Acknowledgements

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