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

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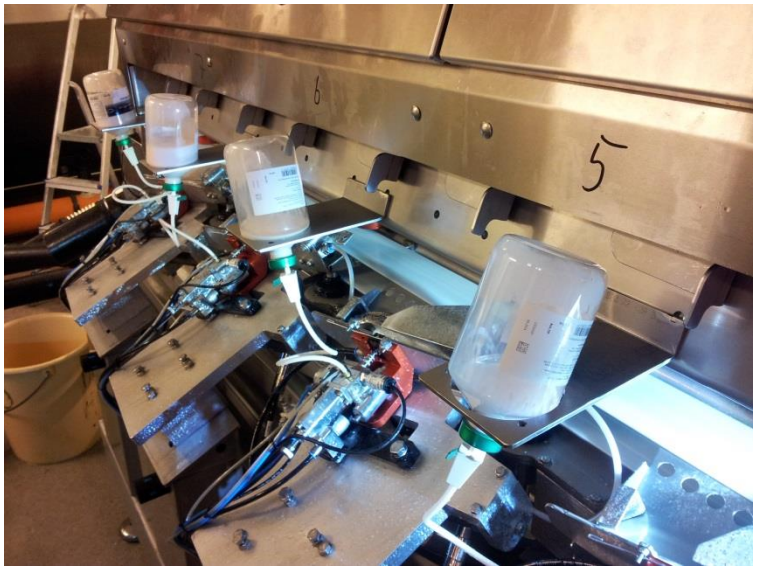
Background

- 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



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Background

- Experiment 1: Presented EAS Trondheim 2013
  - same treatment (but without Aqui-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 Aqui-S), but transfer the fish to a real sea cage environment to investigate the long term effects of handling closed to commercial situation

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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

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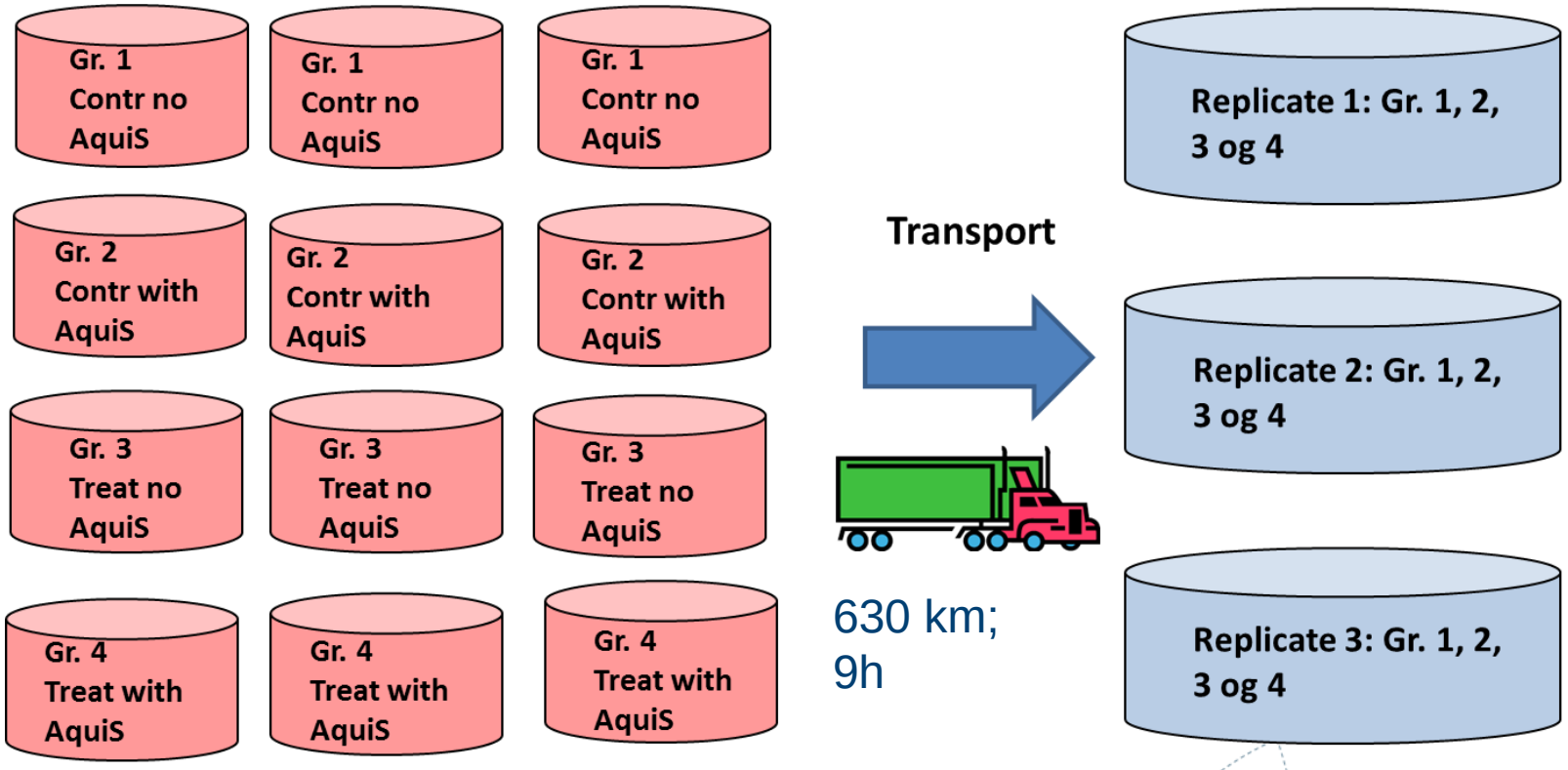
Experimental design



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

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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

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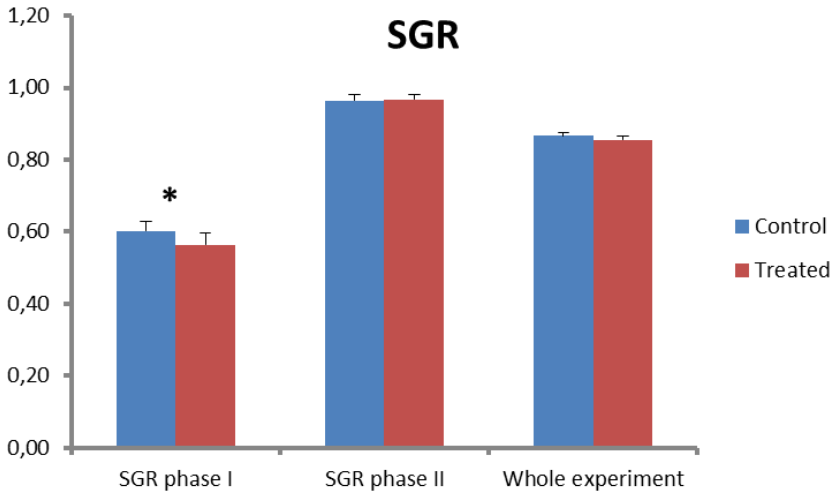
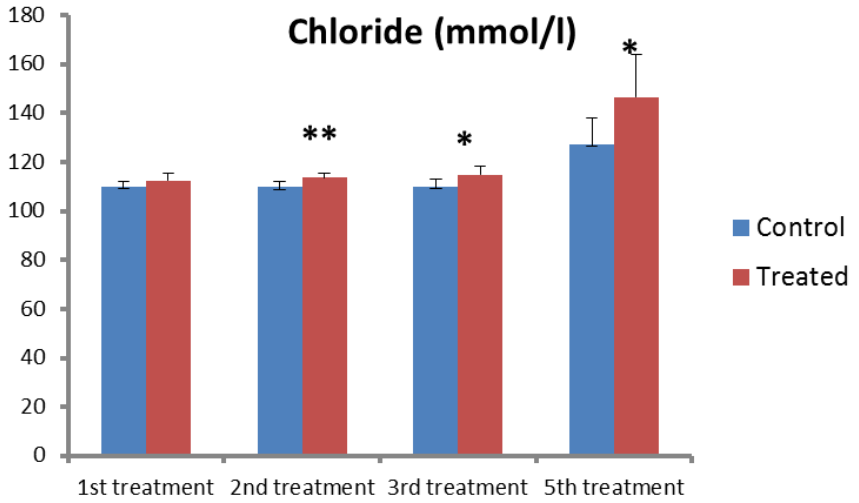
Results phase I (fresh water)





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

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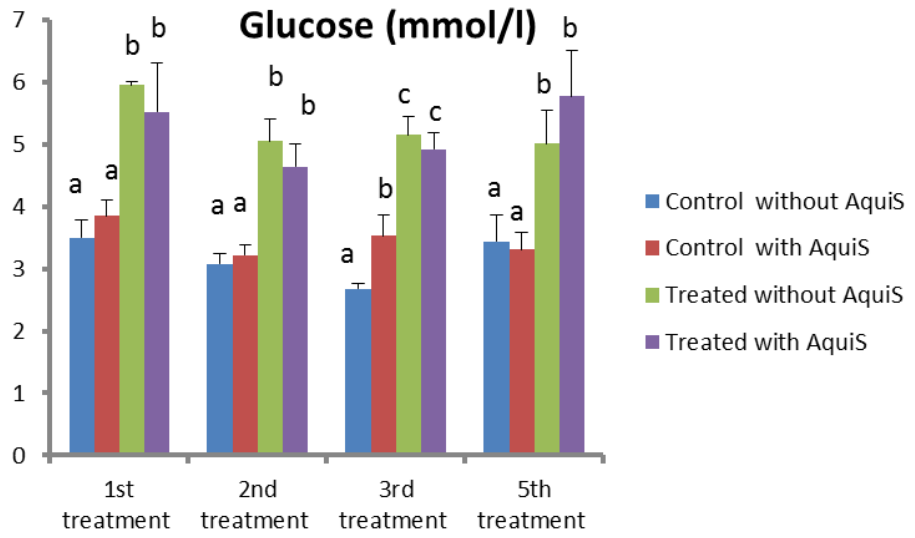
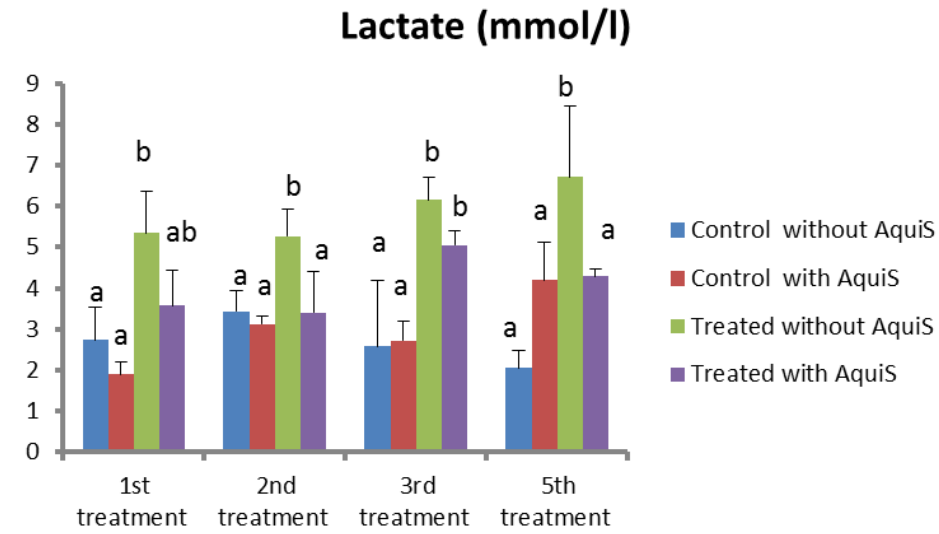
Results phase I (fresh water)





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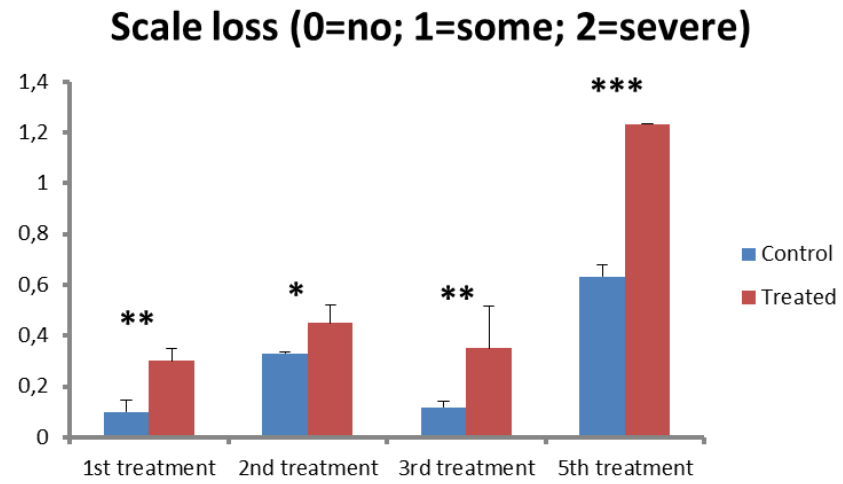
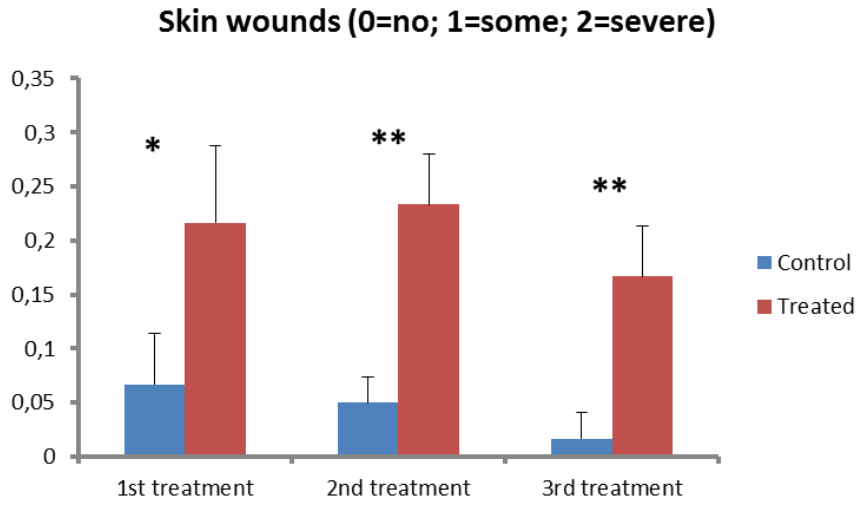
Results phase I (fresh water)





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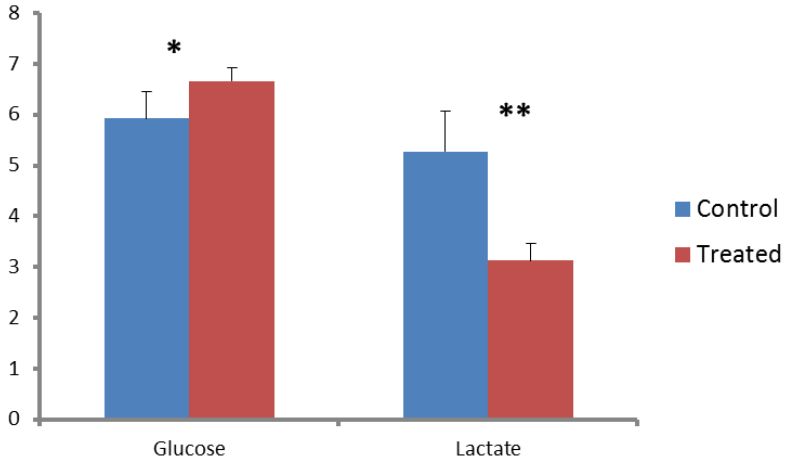
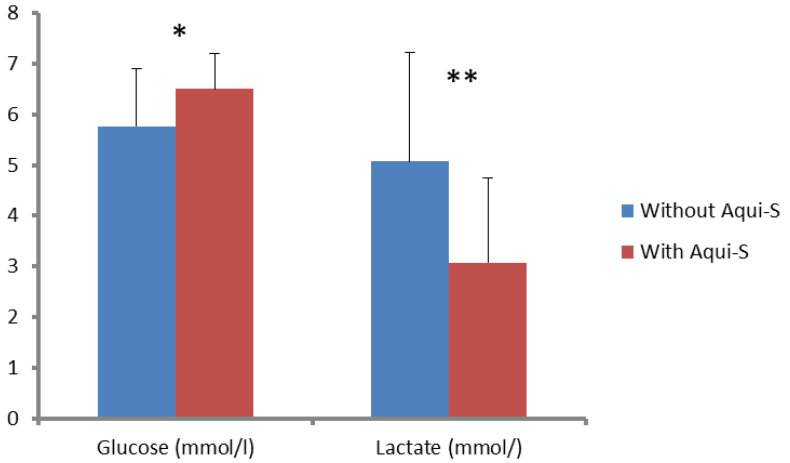
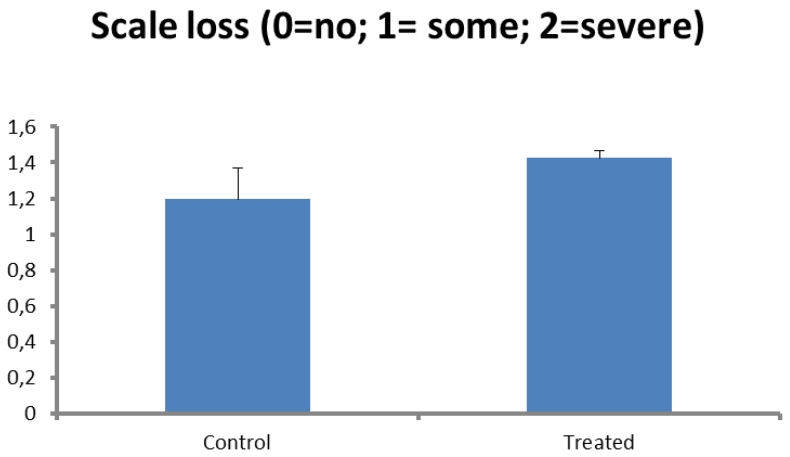
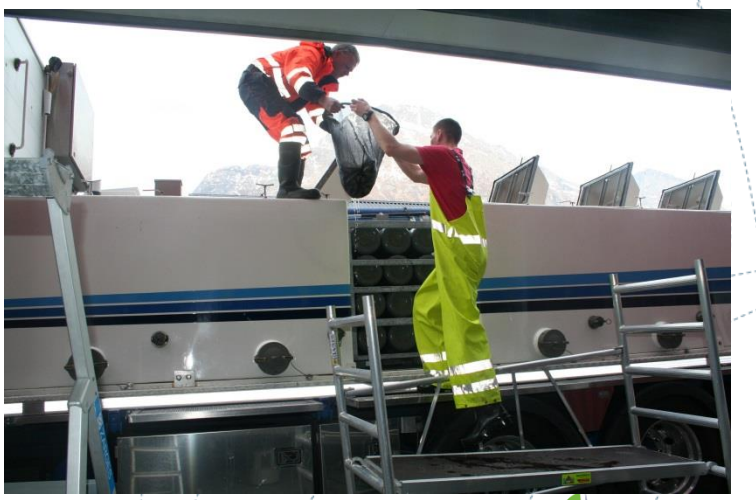
Results – coping with transport

Glucose, lactate and scale loss after transport









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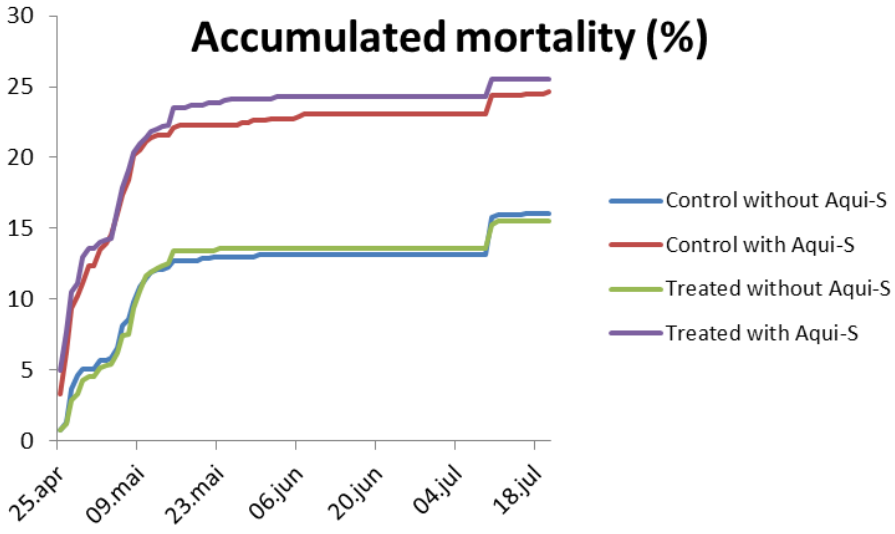
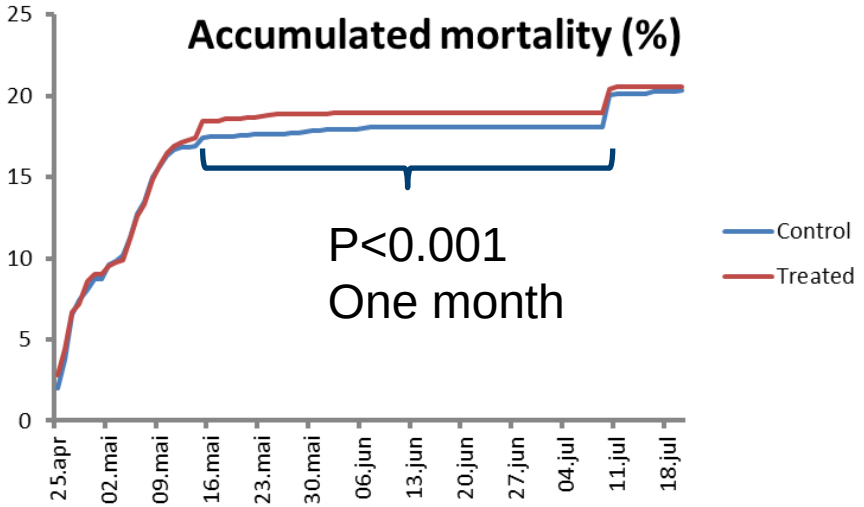
Results phase II (sea water) - mortality





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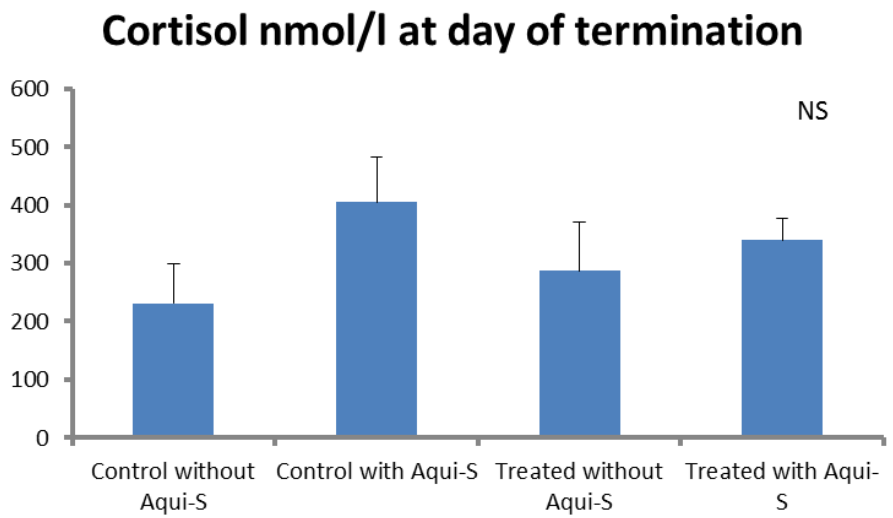
Results phase II (sea water) – Cortisol after ended experiment



Anesthetics: Metomidat

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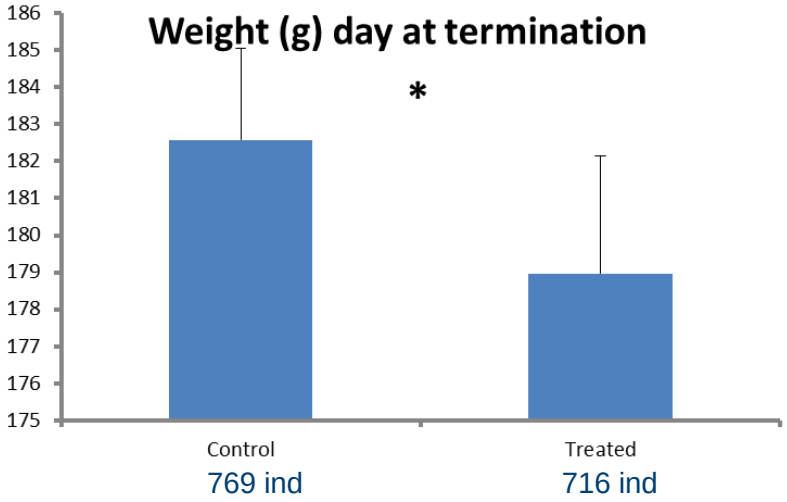
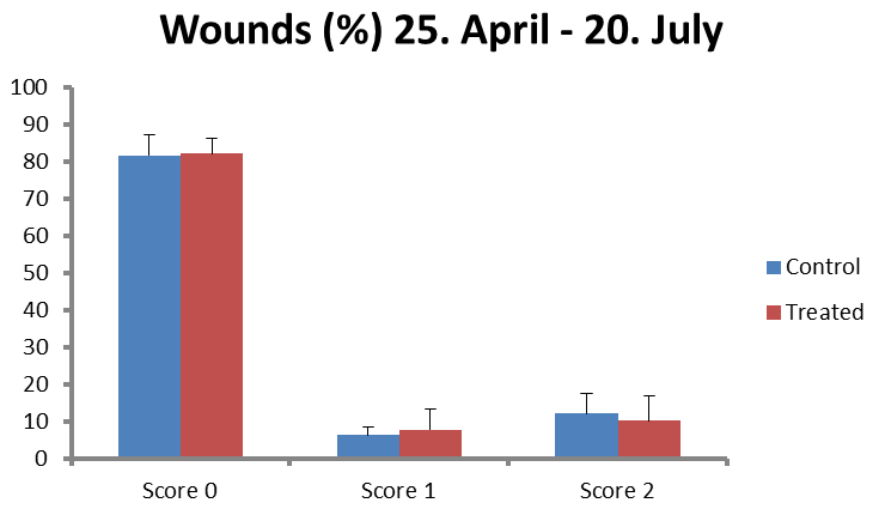
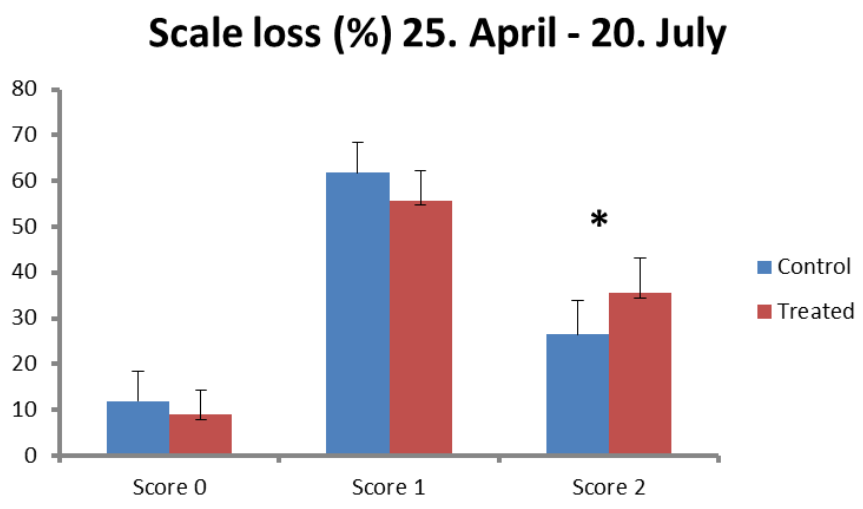
Results phase II (sea water) – Weight and welfare







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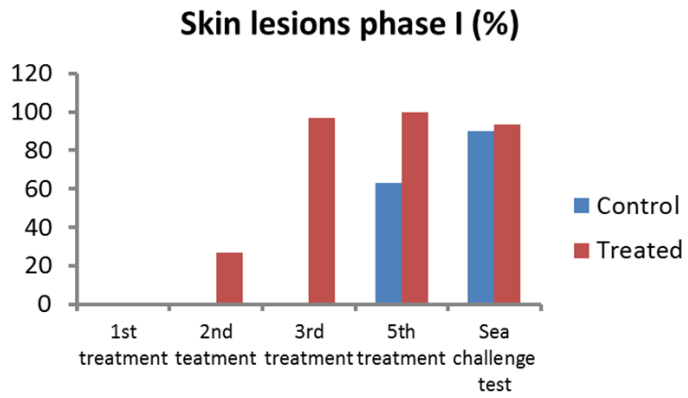
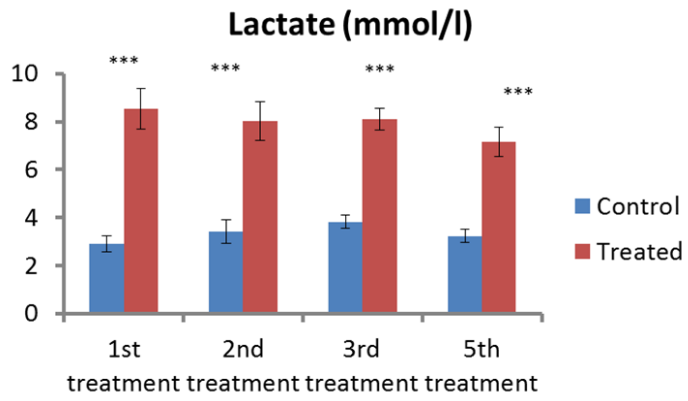
Discussion

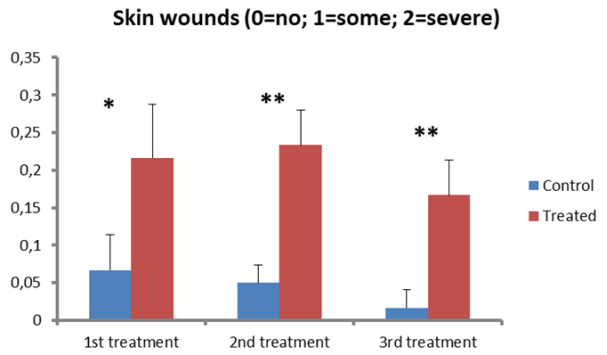
- Both experiment 1 and 2 show clear short term physiological stress and morphological effects (scale loss and wounds) of crowding and pumping

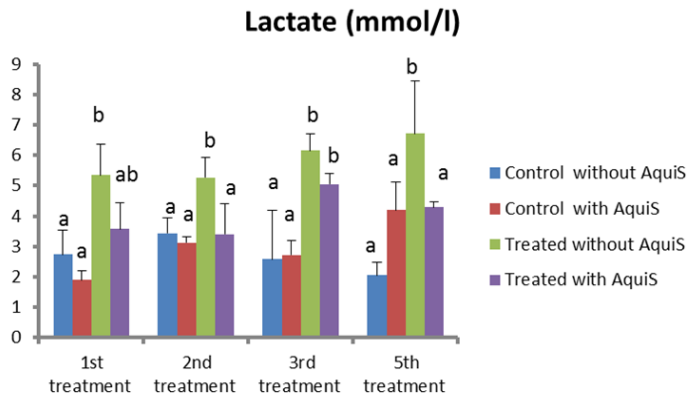
Experiment 1





Experiment 2

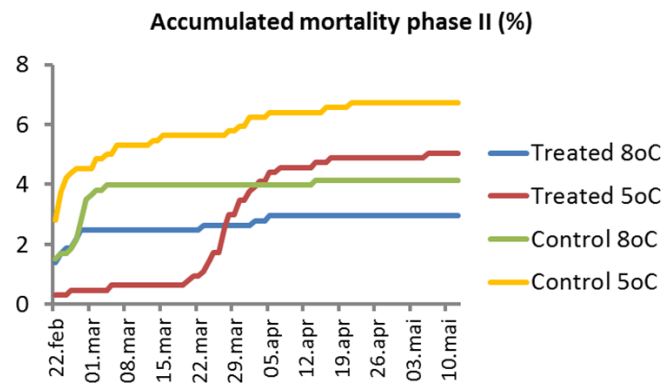




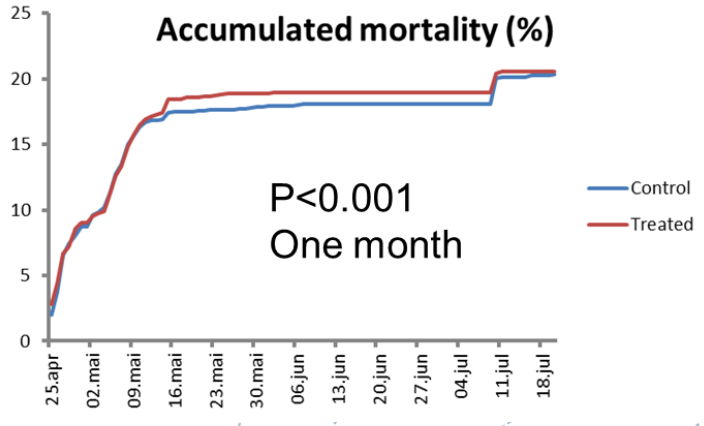
Discussion

- 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



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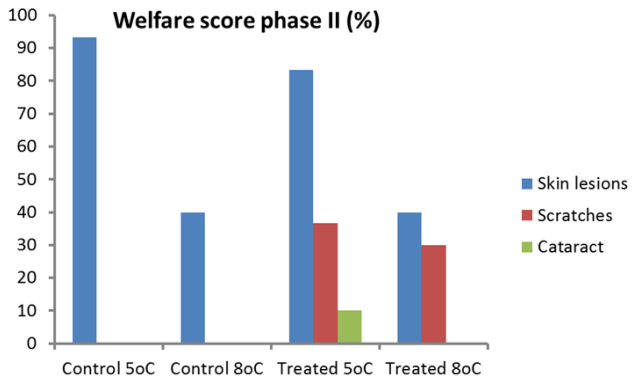
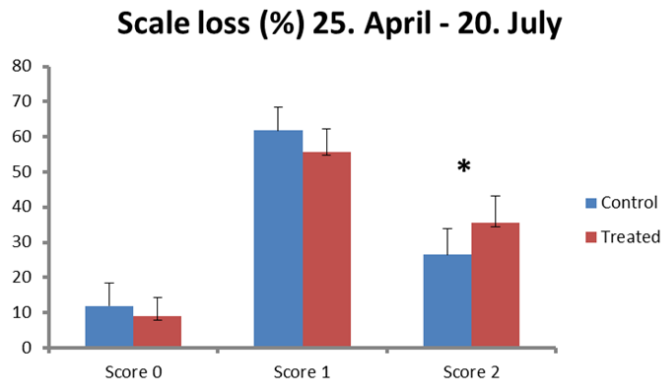
Discussion

- The weight difference from freshwater phase in Experiment 1 disappeared after sea transfer, while in Experiement 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



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Discussion

- Aqui-S caused less stress among the fish during crowding and pumping in the freshwater phase
- During transport Aqui-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
- Aqui-S had no effect on scale loss and wounds
- Aqui-S had no long term effects on the treated fish

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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

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