Stress-resilience differences related to emergence time in farmed rainbow trout

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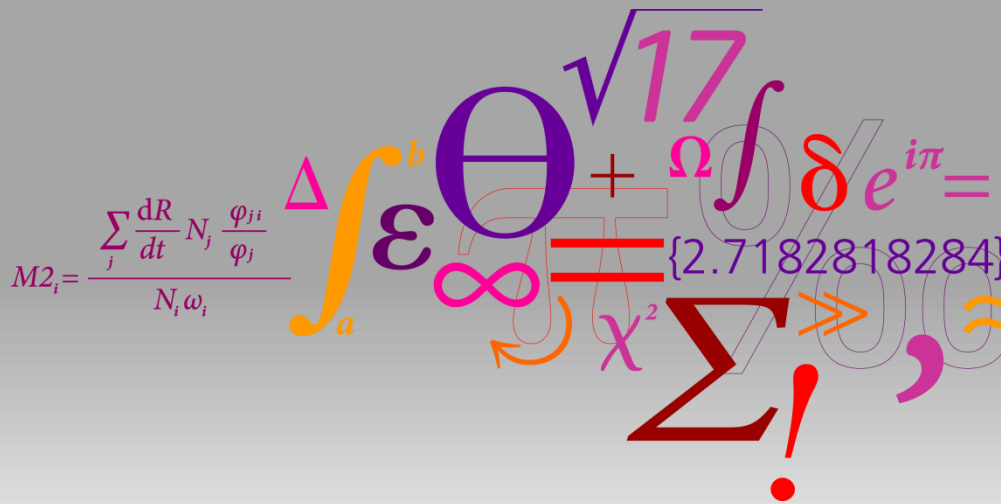


DTU Aqua
Institut for Akvatiske Ressourcer

Swim-up behavior and Emergence time

By E. Peter Steenstra

By E. Peter Steenstra

Individual variation in time from emergence in salmonid fishes.

Has emergence time any effect on fish robustness?? Any effect on stress resilience?

Previous data

Journal of Fish Biology (1992) **41** (Supplement B), 93–99

Early predictors of life-history events: the link between first feeding date, dominance and seaward migration in Atlantic salmon, *Salmo salar* L.

N. B. METCALFE AND J. E. THORPE*

Journal of Fish Biology (2013) **83**, 214–219

The relationship between emergence from spawning gravel and growth in farmed rainbow trout *Oncorhynchus mykiss*

M. Å. ANDERSSON*, D. C. LAURSEN*, P. I. M. SILVA*†‡ AND E. HÖGLUND*§

Physiology & Behavior

Coupling between stress coping style and time of emergence from spawning nests in salmonid fishes: Evidence from selected rainbow trout strains (*Oncorhynchus mykiss*)

Madelene Åberg Andersson [a,*], Uniza Wahid Khan [b], Øyvind Øverli [b], Hans Magnus Gjøen [b], Erik Höglund [a]

PLOS ONE

Effects of Emergence Time and Early Social Rearing Environment on Behaviour of Atlantic Salmon: Consequences for Juvenile Fitness and Smolt Migration

Martin H. Larsen[1]*, Jörgen I. Johnsson[2], Svante Winberg[3], Alexander D. M. Wilson[4], David Hammenstig[2], Per-Ove Thörnqvist[3], Jonathan D. Midwood[4], Kim Aarestrup[1], Erik Höglund[5,6]

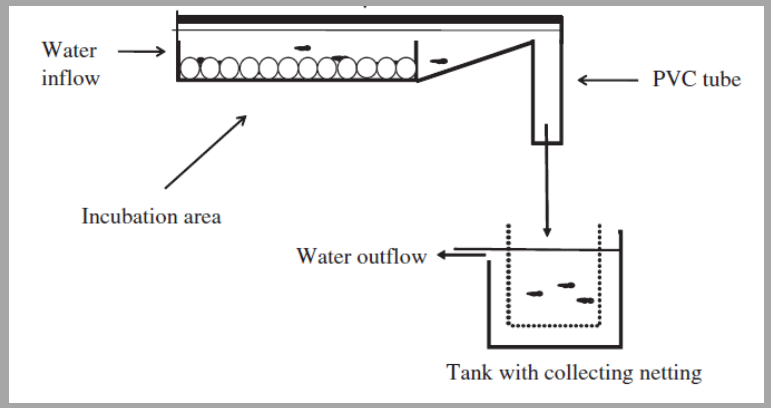
Wild fish with different emergence time seem to have different SCS and competitive ability. Fish emerging early have been shown to be more aggressive, prone to be dominant, proactive.

Farmed fish??

Hypothesis

Does farmed fish sorted by emergence time differ in how they respond and resist against punctual and repeated stressors?

Selecting fish by emergence time: Sorting device



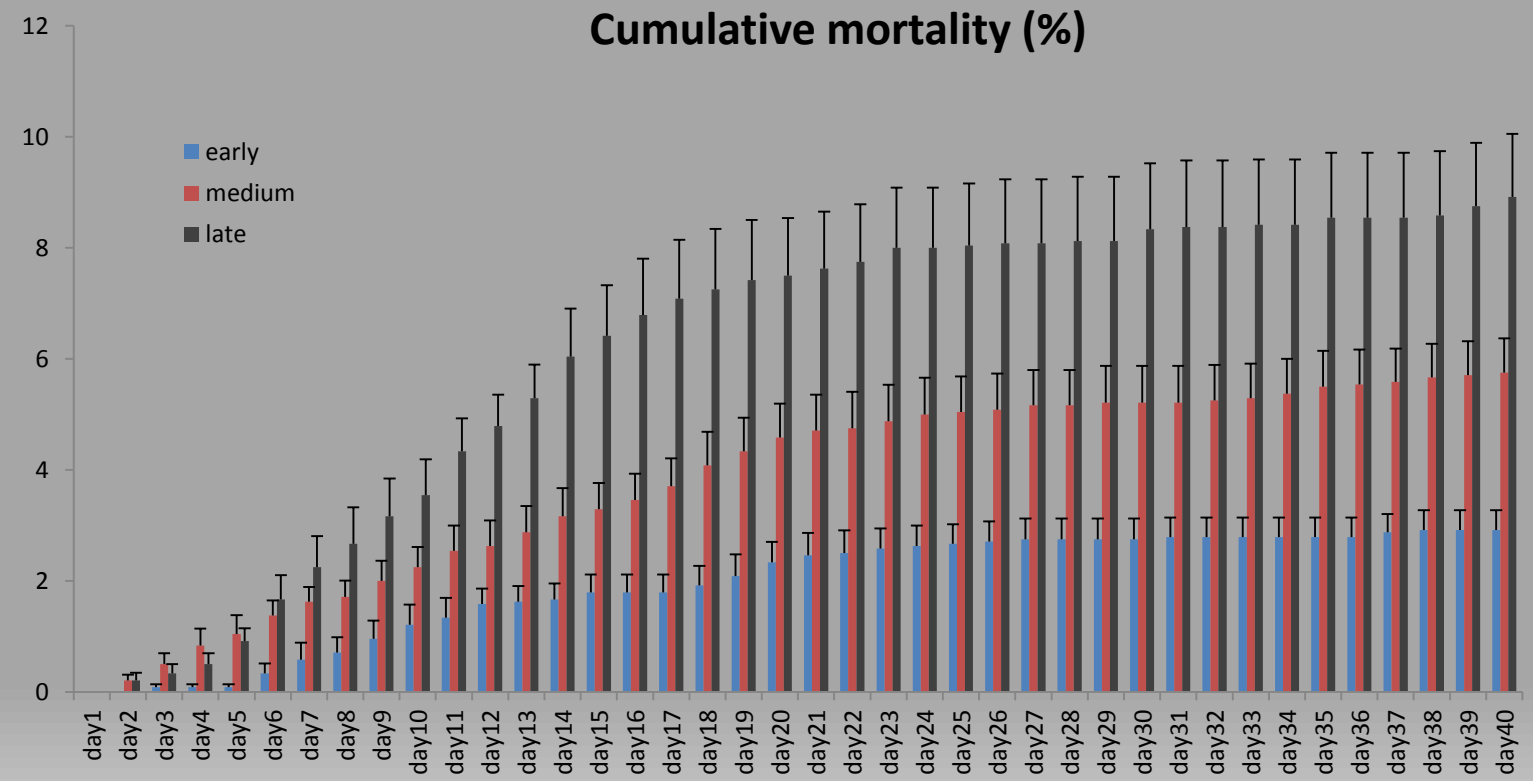
Vaz-Serrano et al., 2011

Three swim-up fractions:

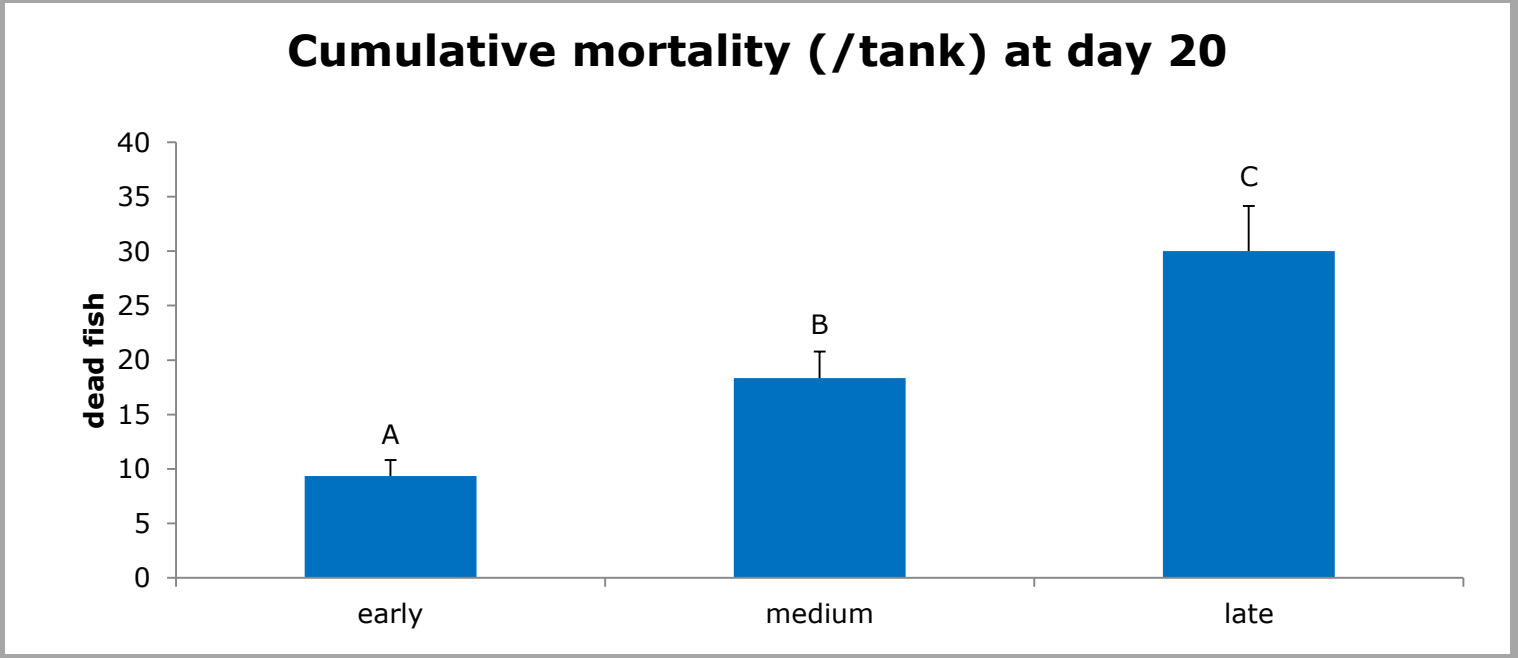
- **Early 20%**
- **Medium 20%**
- **Late 20%**

→ **Stress resilience**

Mortality after sorting

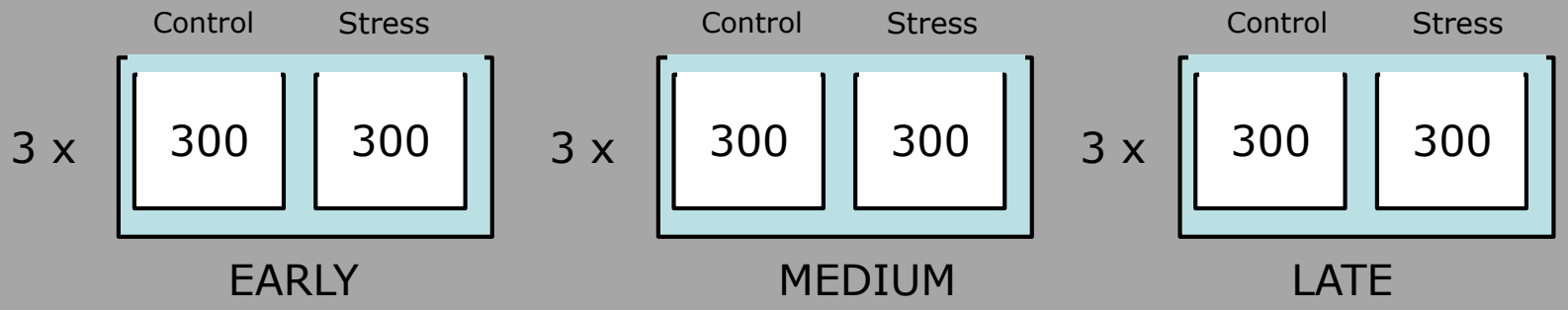


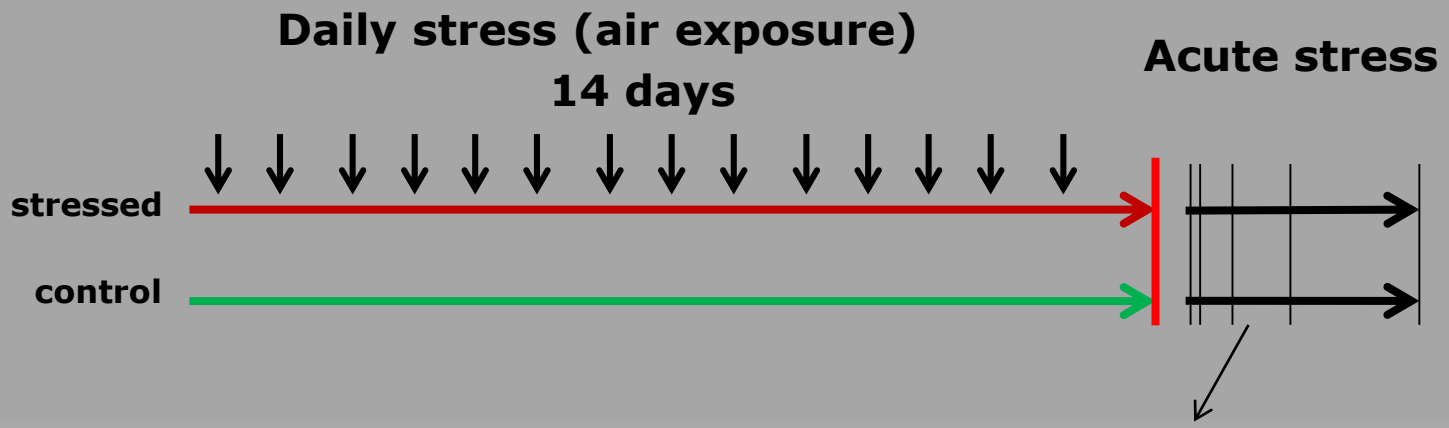
Mortality after sorting



Stress resilience test – Exp. Design

5 g fish





Sampling points: 0, 1, 2, 4, 8 h.

Brains and blood

Stress resilience test – samples

Stress markers analyzed:

- Fish length/weight – condition factor
- Plasma cortisol
- Plasma glucose and lactate
- Brain serotonergic activity

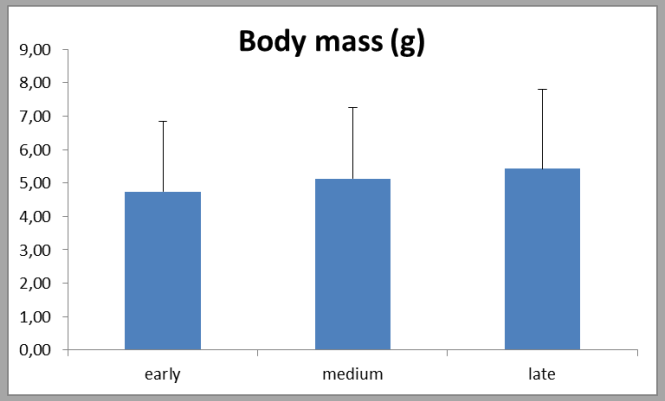
Data provided information about:

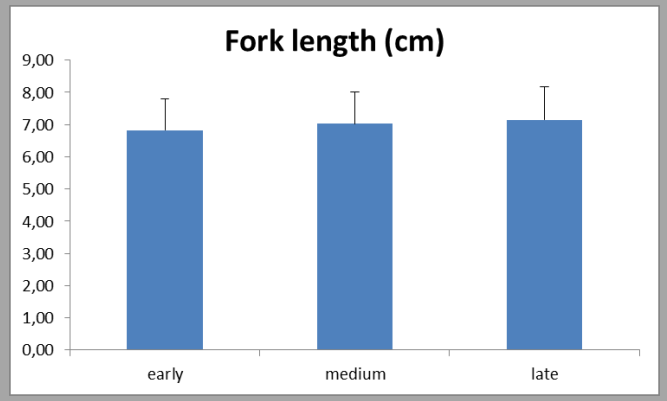
- Normal acute stress response in each fraction

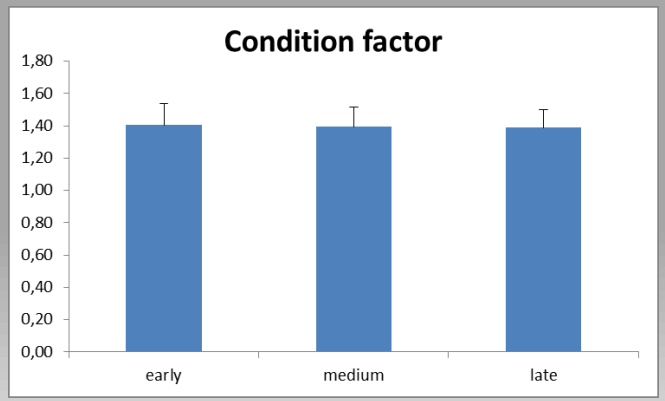
- Effects of repeated stress on the normal acute stress response - Resilience

Data – Fish size

Fish size and condition factor – Among Fractions **n= 150**

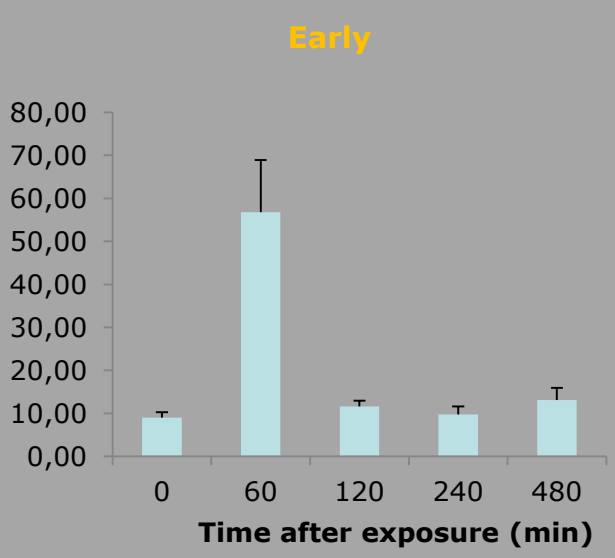


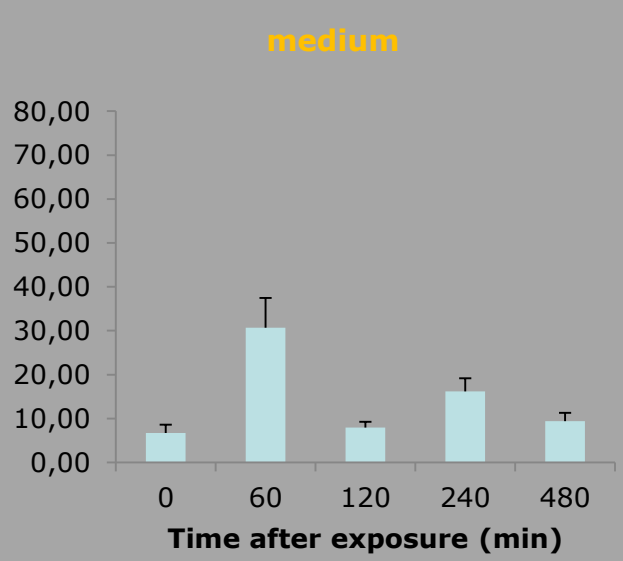


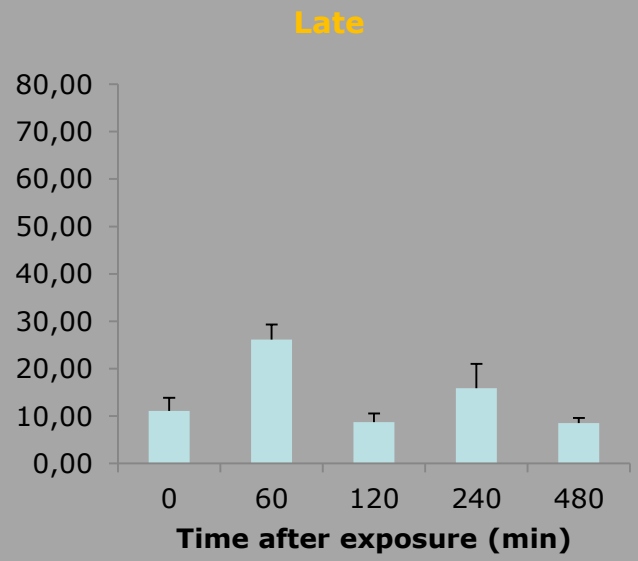


Stress resilience data - Cortisol

Response to acute stress in control fish

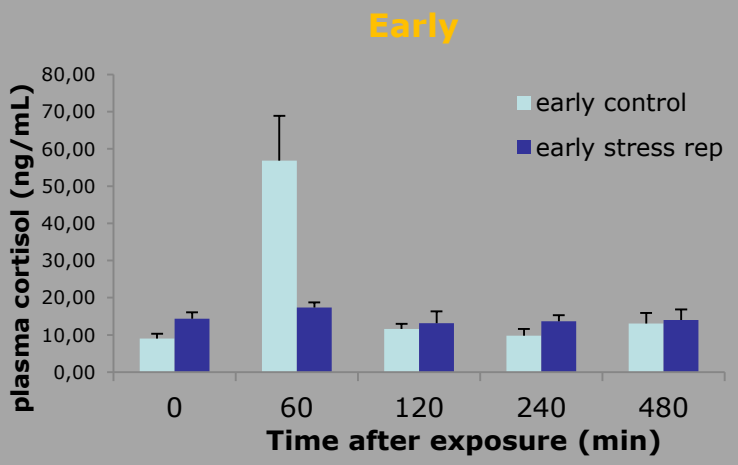


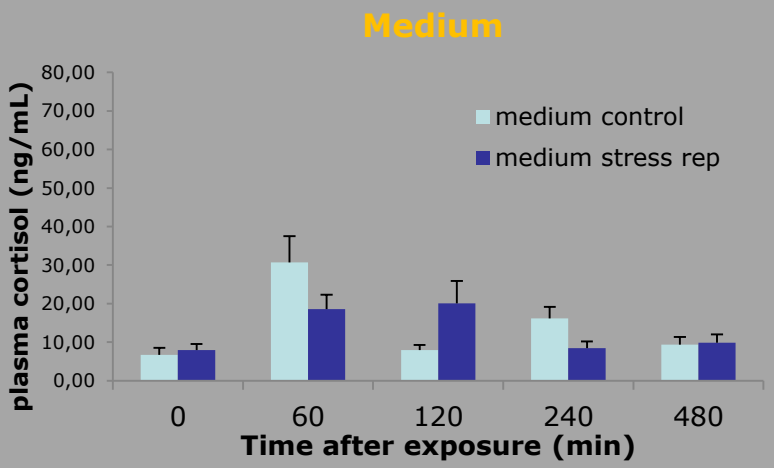


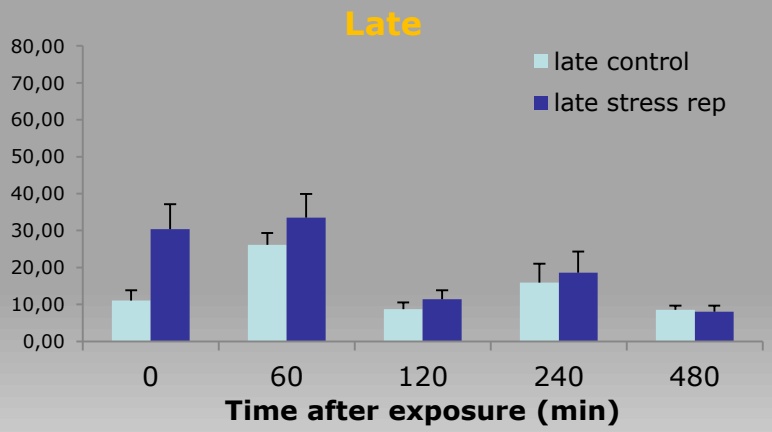


Stress resilience data - Cortisol

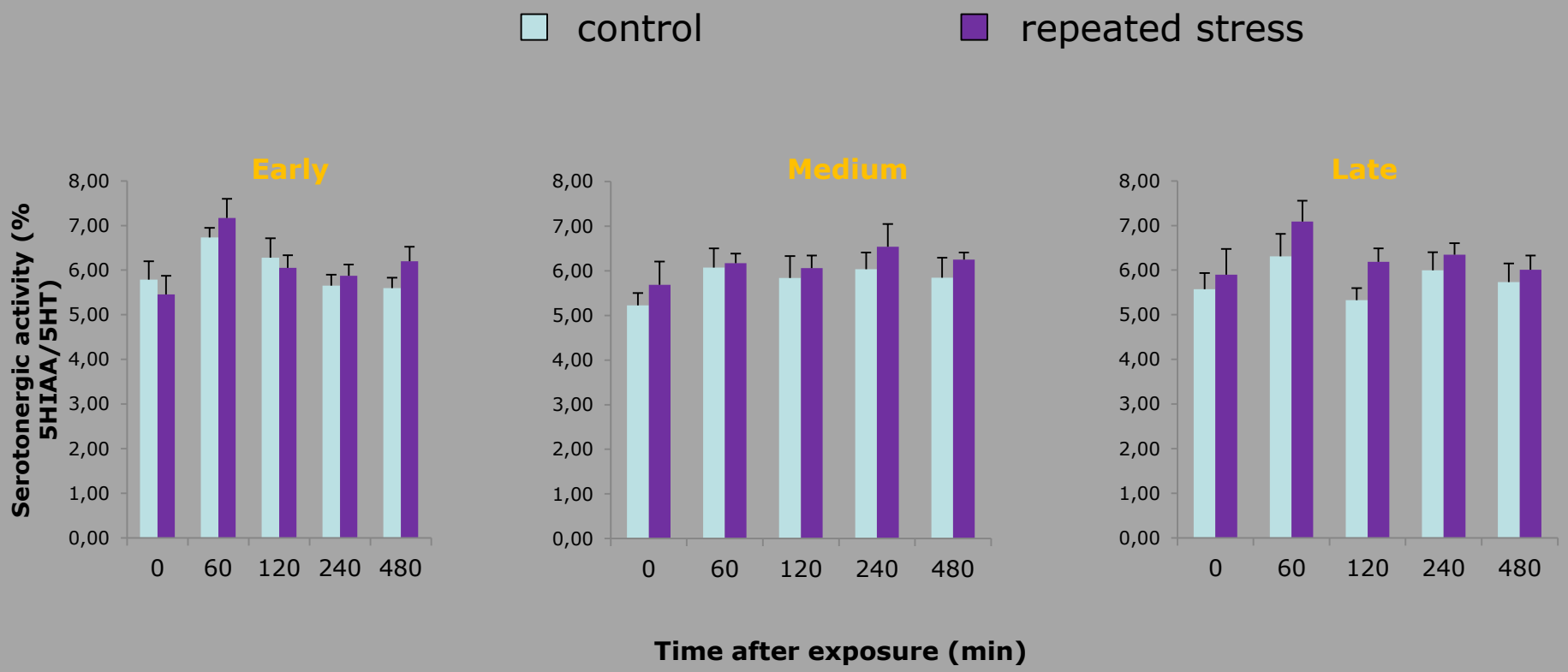
Response to acute stress in repeatedly stressed fish







Stress resilience data – Brain serotonergic activity



Restrictive feeding – competition tests

Has emergence time any effect on juvenile growth or on juvenile competitive ability for food?

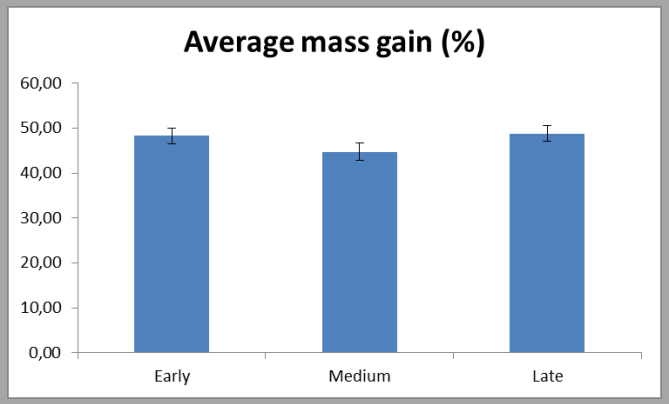
Fish (~60 g) from the three different fractions were PIT-tagged and held together in the same tanks.

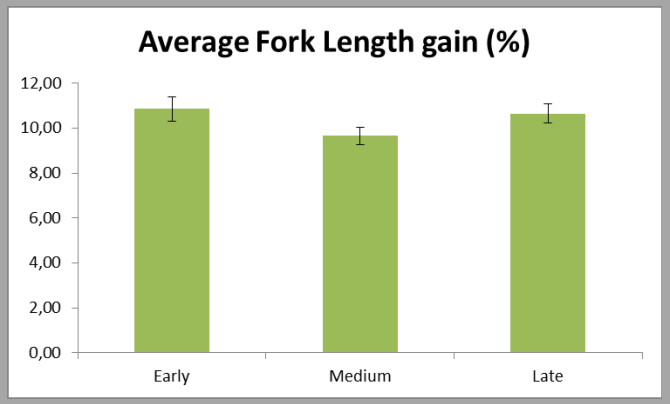
3 tanks containing 15 fish of every fraction (45 fish /tank) each.

Growth of the fish was then evaluated under different feeding regimes.

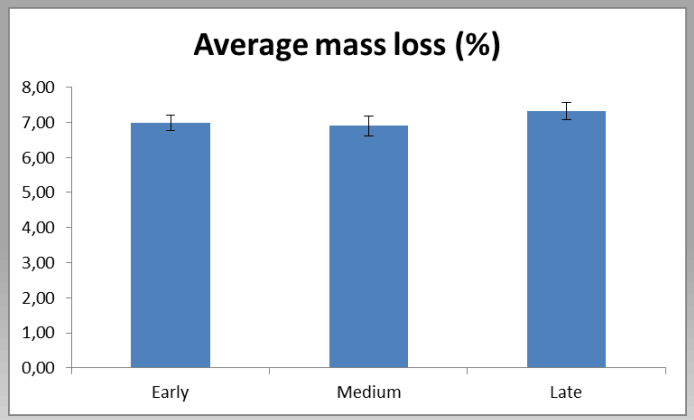
Restrictive feeding – competition exp.
Competition and growth

After 15 days under normal feeding (~2% body mass/day):





After 10 days of fasting:

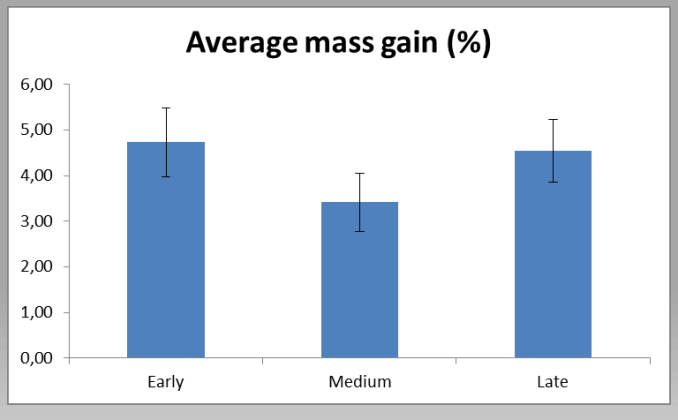


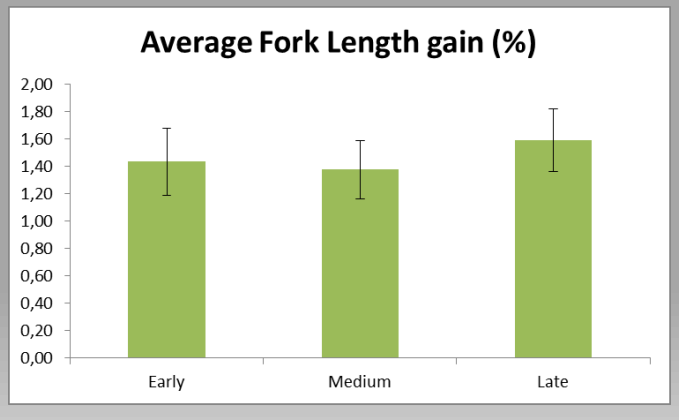
Restrictive feeding – competition exp.
Competition and growth

Next step:

Stocking density reduced: 15 fish per tank (5 fish of each fraction, size-paired)

After 7 days at low density with restrictive feeding (0.5% body mass/day):





Conclusions

Acute stress response and stress resilience are different in fish from different emerging fractions.

Early fraction apparently has a higher capacity to habituate to mild stressors, i.e. more resilient.

No relationship has been found between emergence time and fish growth or fish competitive ability.

Performance of farmed trout related to emergence time seem to be highly influenced by fish origin/genetic background

Acknowledgements

Jonas Müller – Christian Albrechts Universität zu Kiel

Present and former members of RobustFish project: Peter V Skov, Ivar Lund, Lars-Flemming Pedersen, Erik Höglund.

Our technicians: Ole Madvig Larsen, Rasmus Frydenlund Jensen

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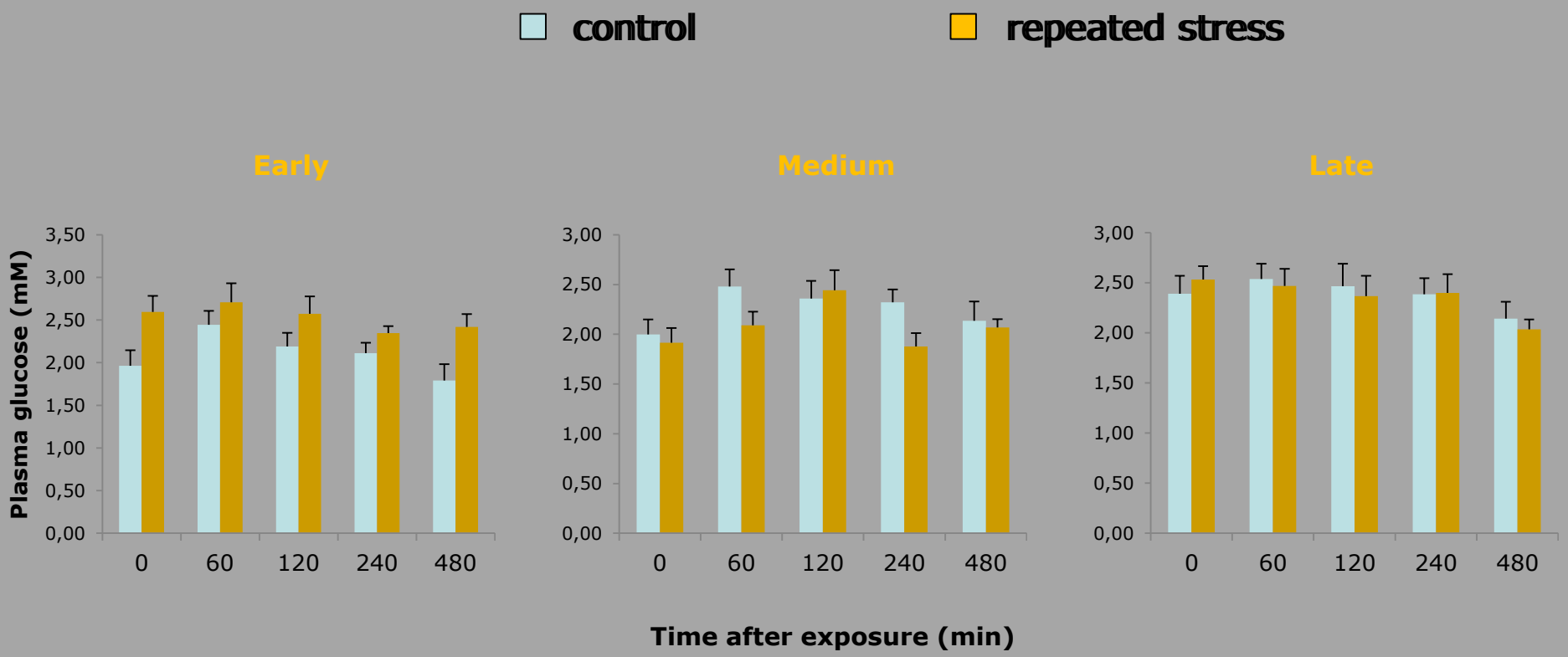
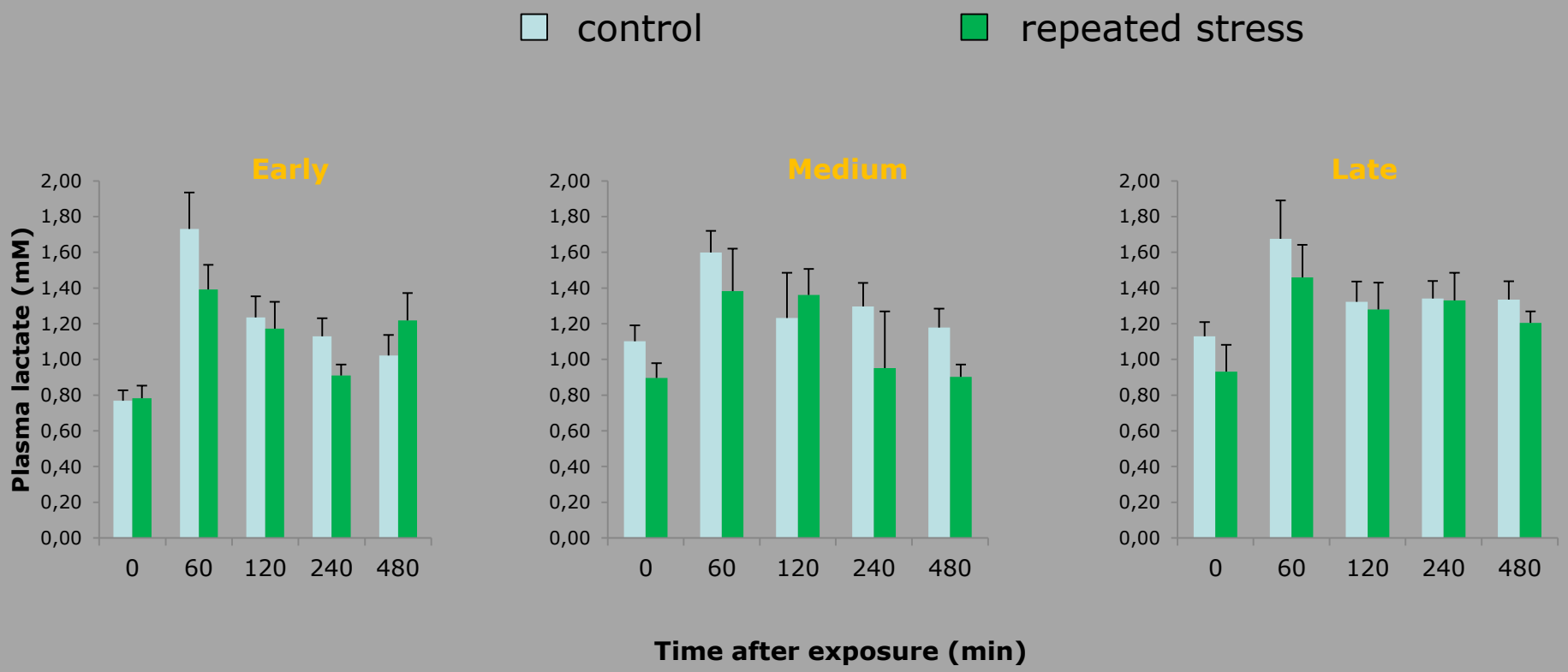
Stress resilience data - Glucose

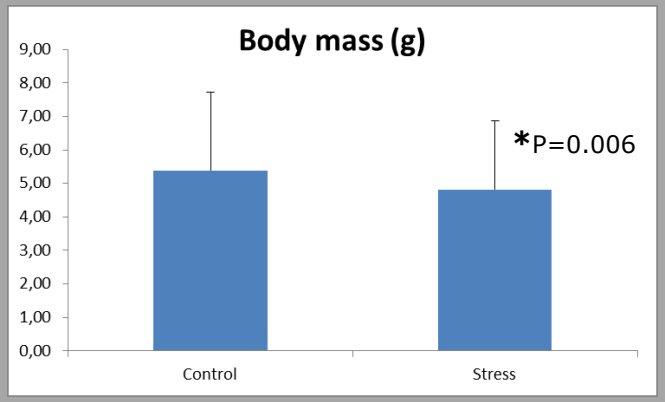


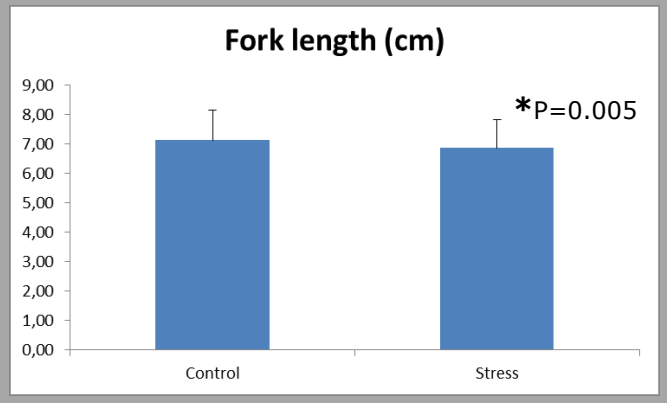
Stress resilience data - Lactate

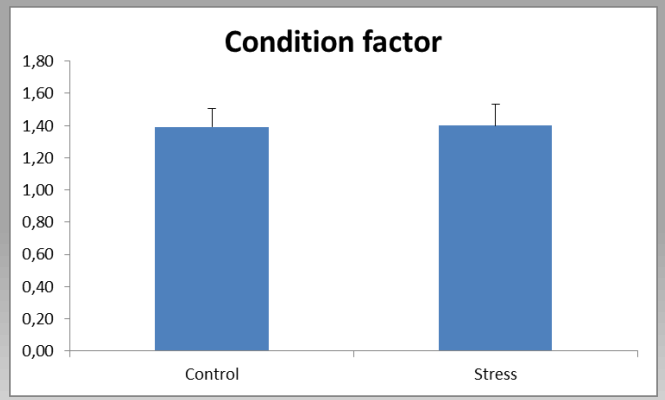


Data – Fish size

Fish size and condition factor – Control vs Repeated stress **n=225**

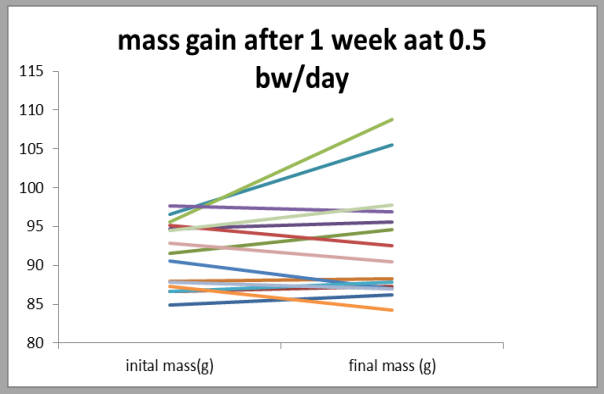


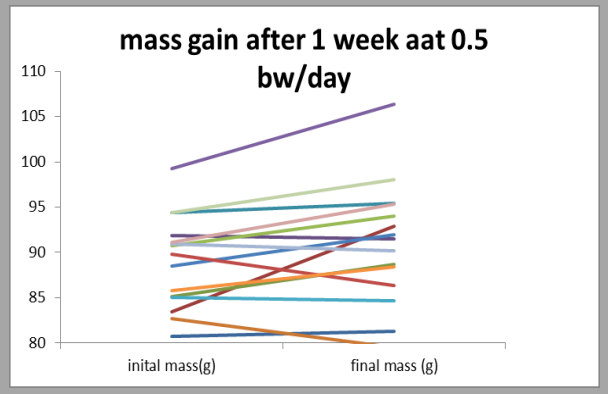


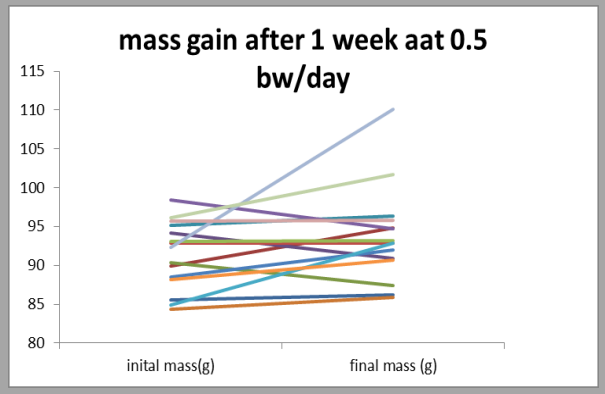


Restrictive feeding – competition exp.
Competition and growth

At low density and with restrictive feeding, fish **truly compete for food.**







Any relationship between dominance and emergence fraction?

Apparently not