



UiT Norges arktiske universitet

PROJECT PRESENTATION

'Dietary stimulated and aging smolt: Do we compromise the welfare of post-smolt in today`s salmon farming?'

Even H Jørgensen, professor emeritus UiT (project leader)

David Hazlerigg, professor UiT

Juan Fuentes, senior investigator, CCMAR, Faro, Portugal

Merco Campinho, senior investigator, CCMar , Faro, Portugal



FISKERI- OG HAVBRUKSNÆRINGENS
FORSKNINGSFOND

Sven Martin Jørgensen



Background

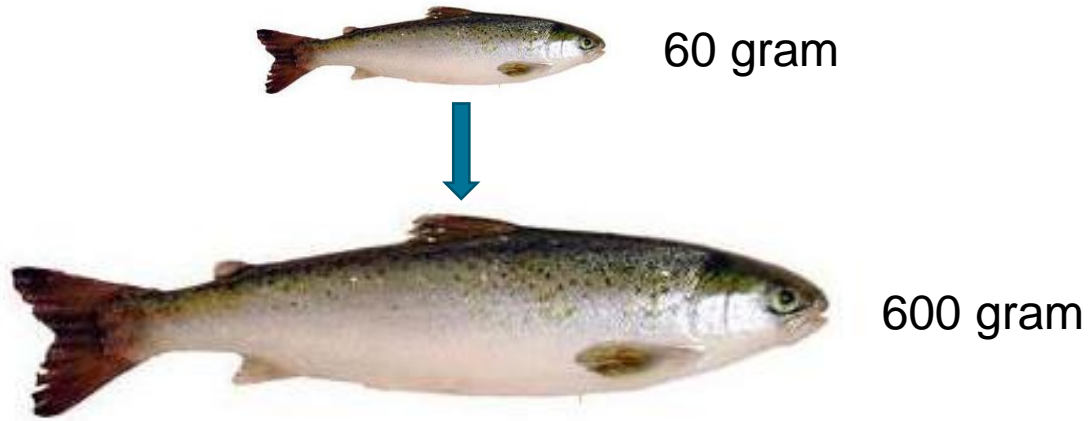
Salmon aquaculture in Norway: ~12-14% mortality after SW transfer [Hjeltnes et al., 2018]. **Smolt quality and susceptibility to pathogen infection** considered to be major contributing factors [Santurtun et al, 2018].

B. Hjeltnes, B.B. Jensen, G. Bornø, A. Haukaas, C.S. Walde, (2019). Fiskehelserapporten 2018, Veterinærinstituttet.

Santurtun, E., D. M. Broom, and C. J. C. Phillips (2018). A review of factors affecting the welfare of Atlantic salmon (*Salmo salar*). *Animal Welfare* 27.3: 193-204.



PRESENT CHALLENGES



RAS



«Pseudosmolting»

Fry from one and
the same RAS tank
= different develop-
ment trajectories?



Photo: Torstein Kriststensen

Smolt production strategies today:

1) Light stimuli (long day → short day → long day)

2) Stimulated by 'diet' (with or without daylength manipulation)

3) No treatment at all

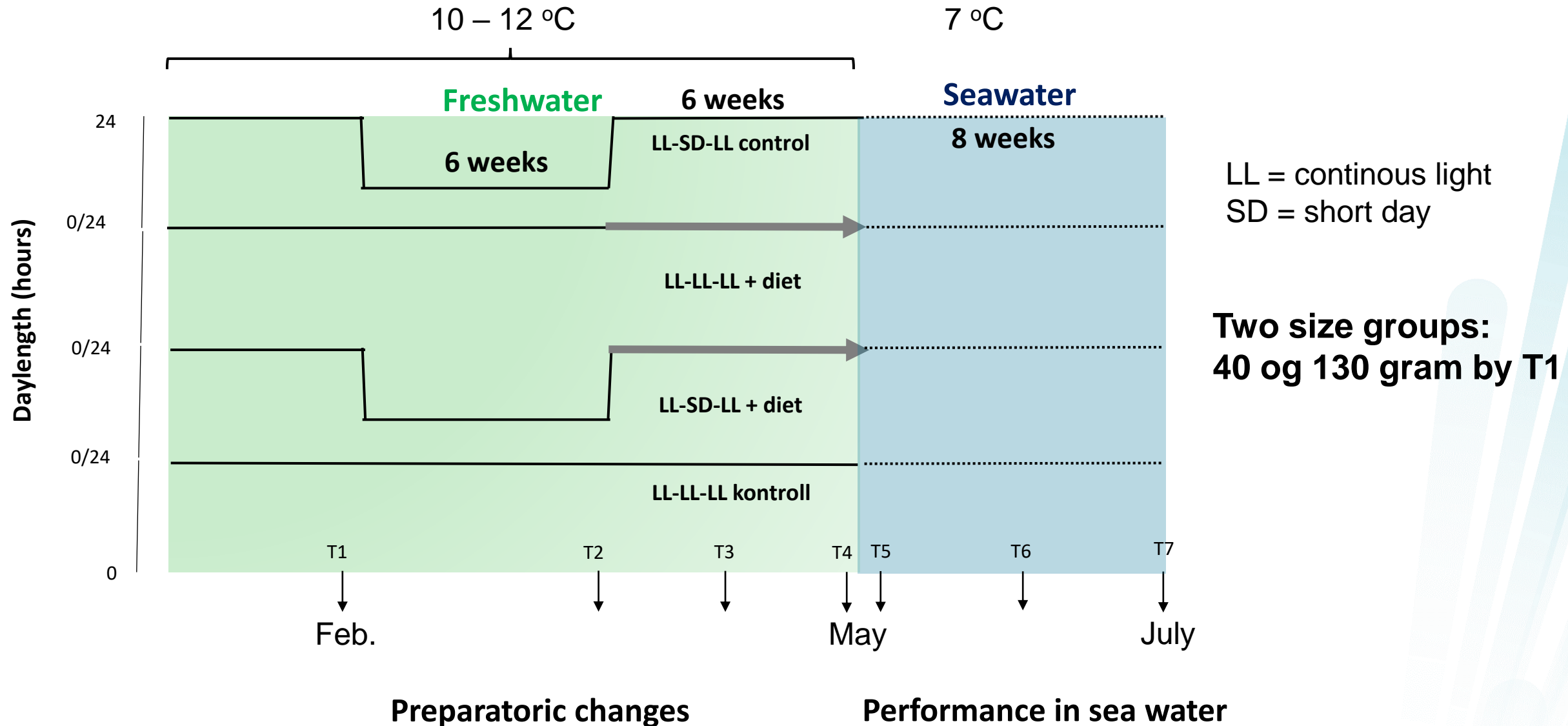
PRESENT PROJECT



'Supersmolt feed only'
- normal feed added a **salt mixture**
and **free tryptophan**

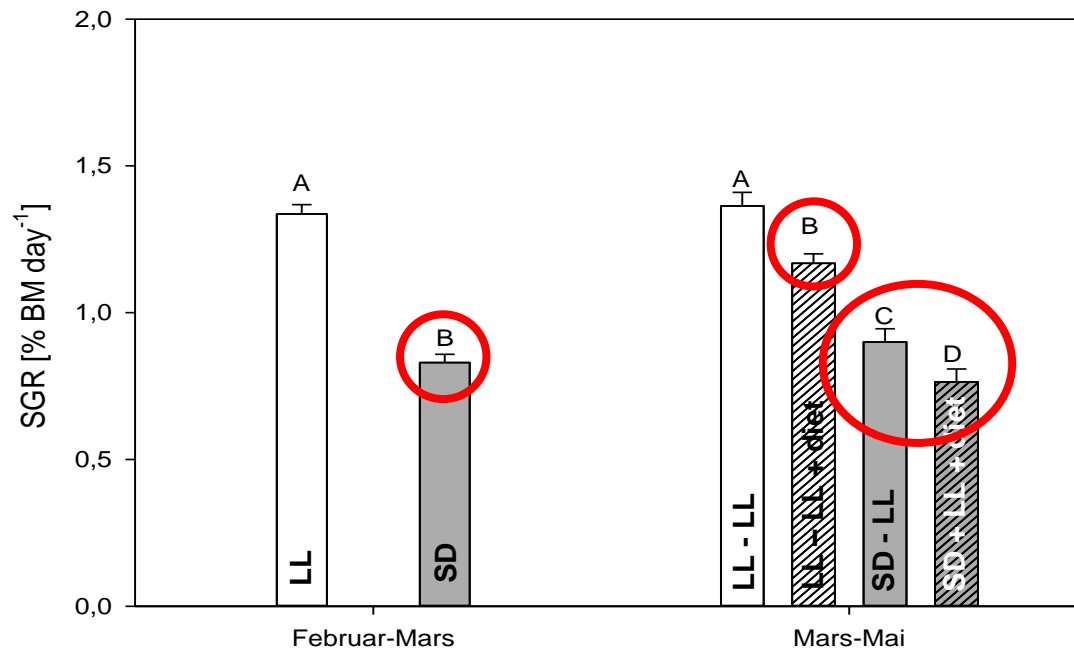


EXPERIMENT

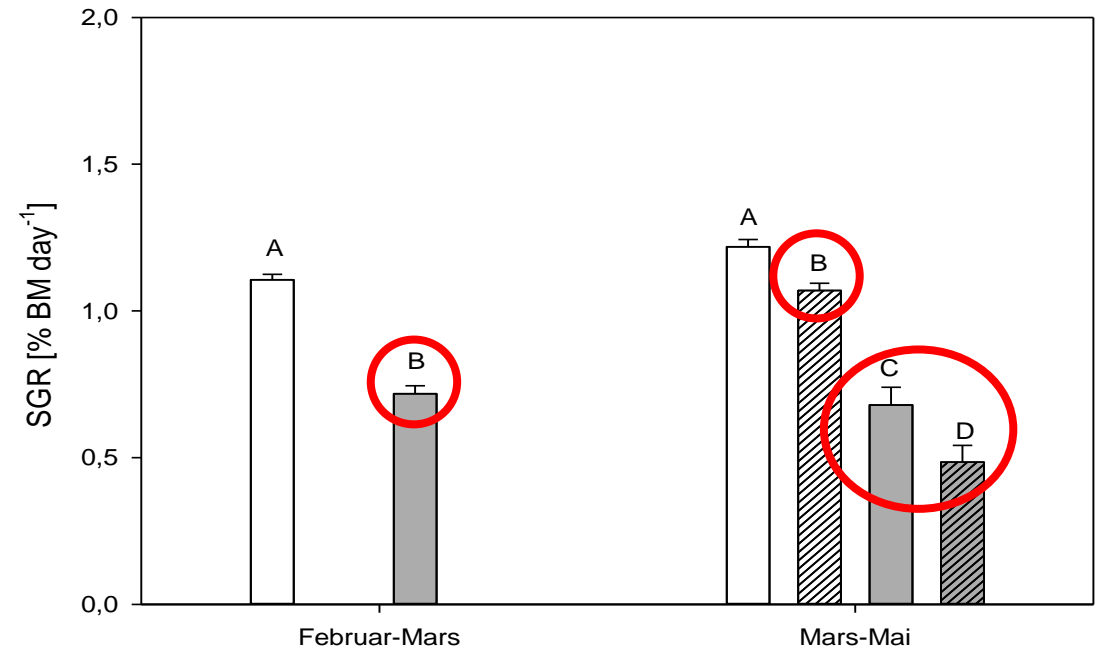


RESULTS FW; GROWTH

Small fish



Big fish

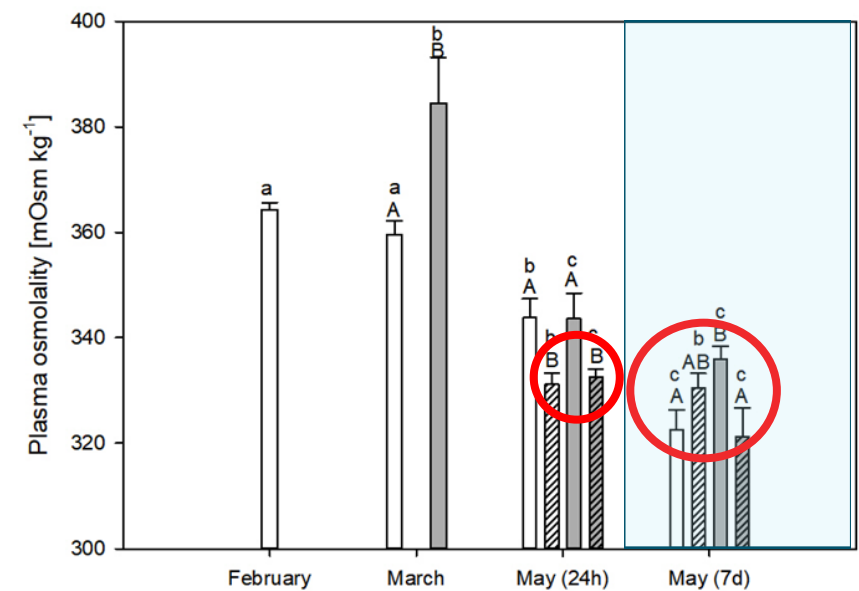
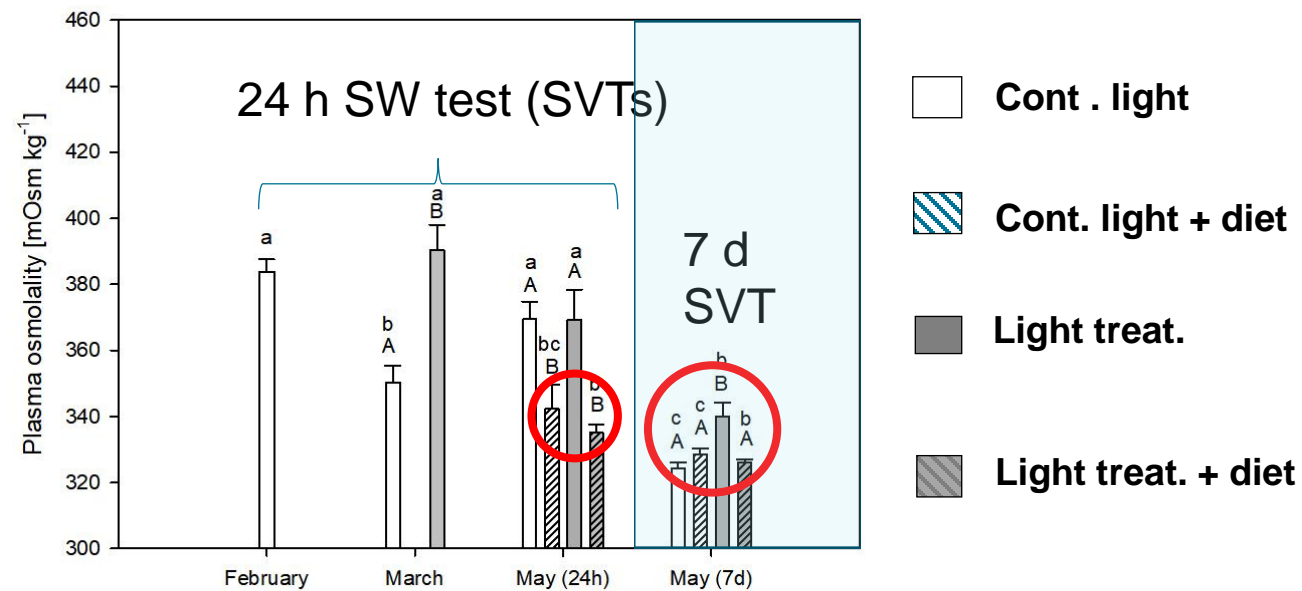


- Short day leads to reduced growth
- Salt-diet reduced growth slightly
- Also reduced growth after transfer from SD to LL !

RESULTS FW; seawater tolerance

Small fish (85 – 140 g)

Big fish (200 – 400 g)



- Diet (+/- light treatment) gives the best seawater tolerance at the end of the FW phase
- No big differences after 7 days in SW, osmolality in all treatment groups within what is expected in a SW ready smolt

RESULTS; Silvering and condition factor

T1



Weak parr marks

Continuous light

Continuous light + diet

Light treatment

Light treatment + diet

T3



Condition factor 1,25

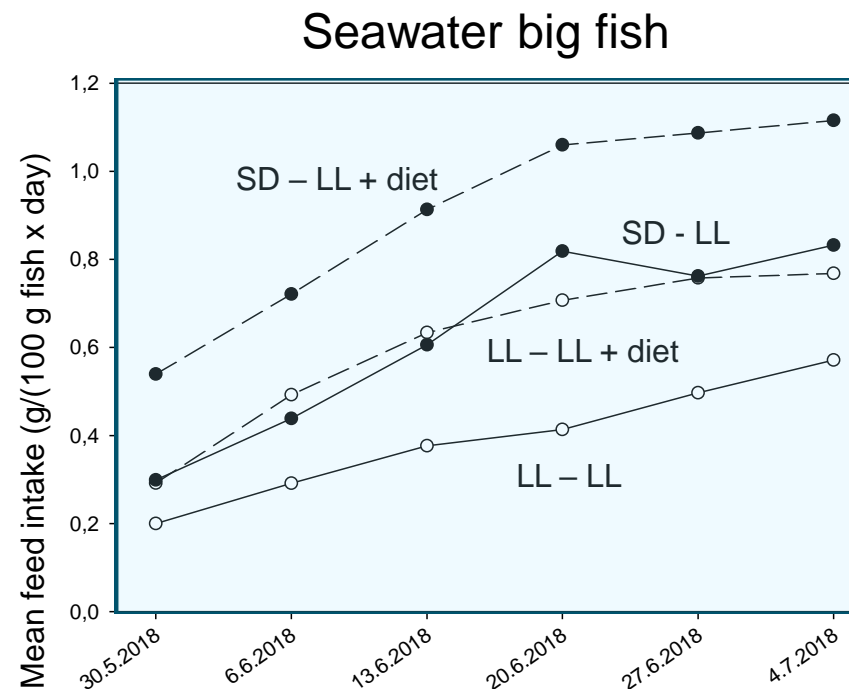
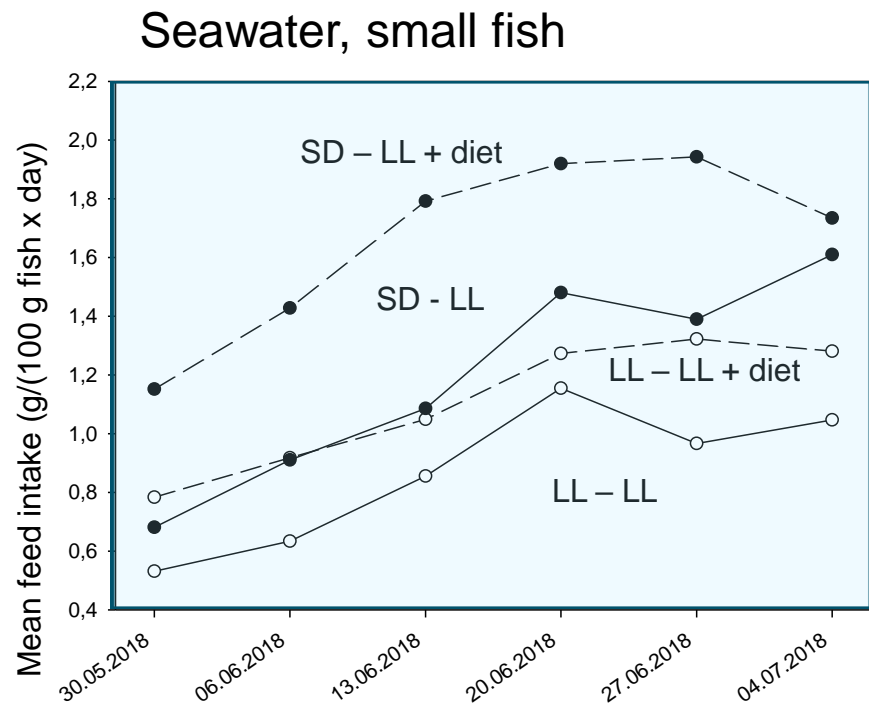


Condition factor 1,10

CONCLUSIONS

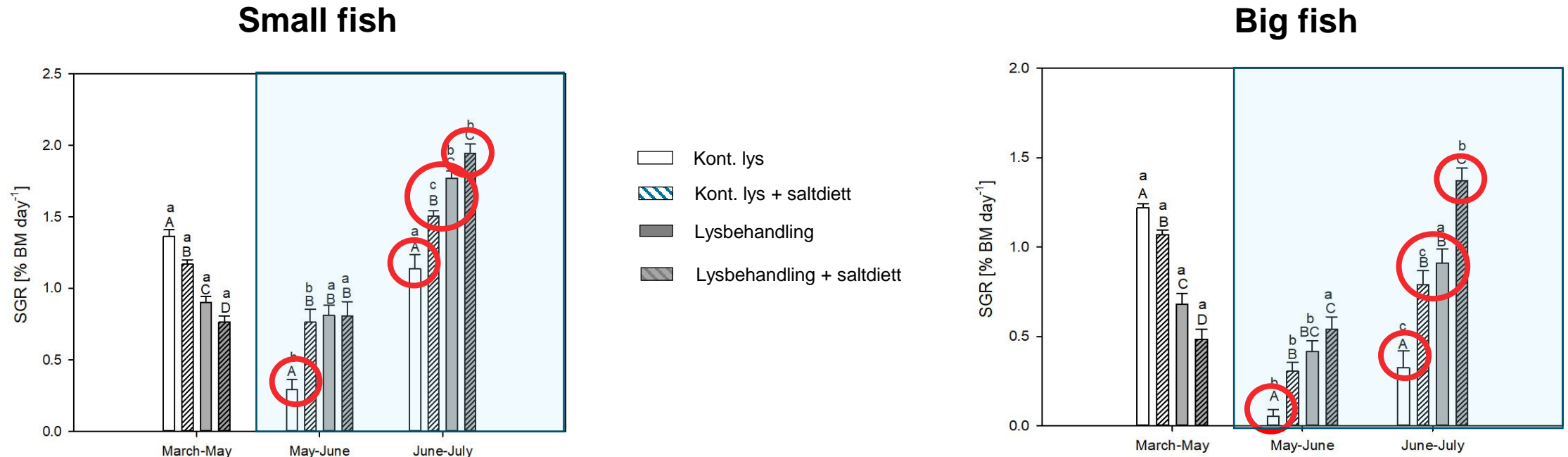
- Based on classical smolt indices (silvering and SW tolerance) fish in all treatments seems to be **ready for SW**.
- Only the fish in the groups that had been given the traditional light treatment had a reduction in condition factor, which in a 'real' smoltification is a result of **hormonal responses** to the exposure to short day followed by long day.
- Continuous light seems not to produce a 'real' smolt, neither when combine with diet.

RESULTS; feed intake in SW



- Despite seemingly similar SW readiness in FW, big differences between treatment groups in feed intake (appetite) after transfer to sea.

RESULTS; growth in sea water



- Fish on continuous light without diet had poor growth, despite good SW tolerance
- No difference in growth between light treated and continuous light + diet
- Combination light treatment + diet had the best growth

CONCLUSION

- Diet stimulation alone does not produce a 'real' smolt
- But it develop good SW tolerance and grow as good as the light treated fish
- Differences in growth after SW transfer seems to be due to differences in appetite and feed intake
- **Combination of diet and light treatment gave the best growth after SW transfer.**
- Surprising similar results for small and large smolt

So, do we compromise the welfare of postsmolts?

Light and dietary smolt stimulation works well, even in the production of big smolt.

To prepare the pre-smolt for seawater transfer should always be done. Strange that we still struggle with this after 60 years of study of the smoltifications process.

Still things we dont know and which needs more studies. Brings me to a new study currently ongoing in Tromsø.



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NEW PROJECT (Synchrosmolt)

'Smolt production protocols and breeding strategies for synchronized smoltification'

Simen Savdve, ass. professor, Norwegian University of Life Sciences (NMBU), Ås (project leader)

Turid Mørkøre, professor, NMBU

David Hazlerigg, professor UiT

Even H Jørgensen, professor emeritus UiT



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HYPOTHESIS

Non optimized genetics

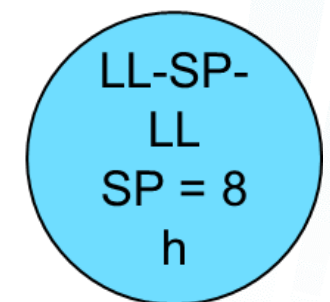
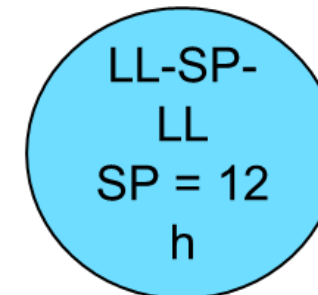
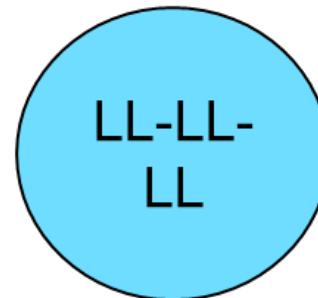
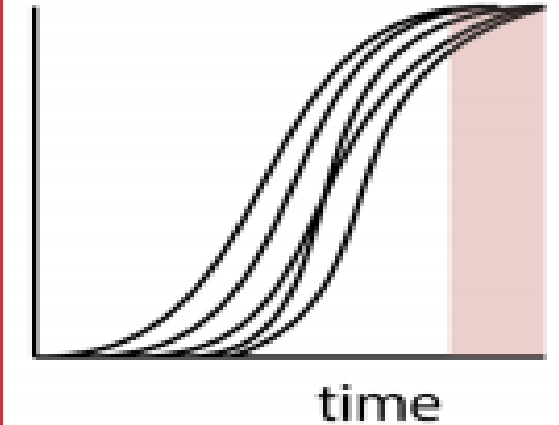
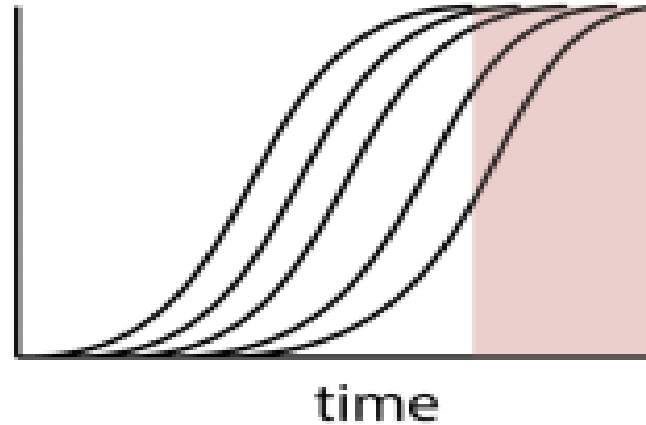
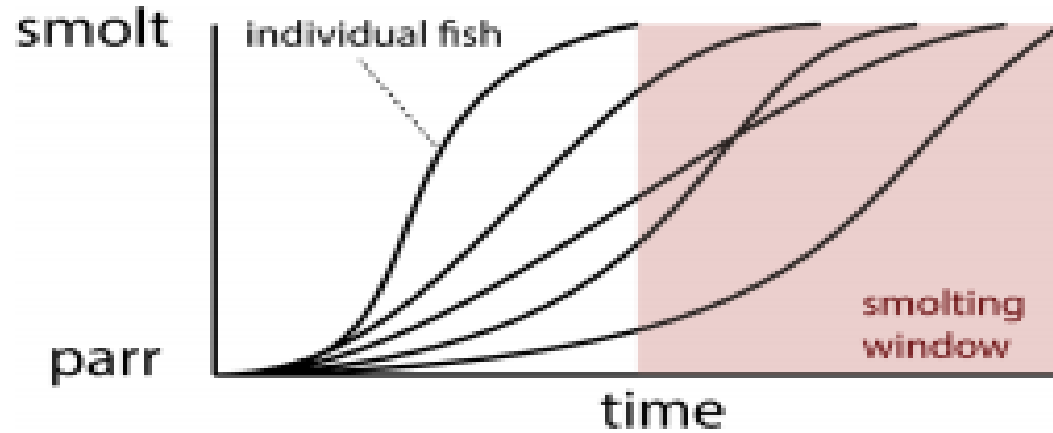
Non optimized light regimes

→ Optimized light regime

SynchroSmolt

→ Optimized genetics

→ Optimized light regime



Publications

More than one way to smoltify a salmon? Effects of diet and light treatment on smolt development and seawater growth performance in Atlantic salmon. Stribern, A., Lauritsen, D.E., Fuentes, J., Campinho, M.A., Gaetano, P., Duarte, V., Hazlerigg, D. and Jørgensen, E.H. Aquaculture, 532, 2021.

<https://doi.org/10.1016/j.aquaculture.2020.736044>

Modulation of intestinal growth and differentiation by photoperiod and dietary treatment during smoltification in Atlantic salmon (*Salmo salar*, L.). Duarte, V., Gaetano, P., Striberny, A., Jørgensen, E.H., Camphino, M. A. and Fuentes, J. Aquaculture, in press.

Photoperiod and dietary treatment in freshwater modulate the short-term intestinal response to seawater in Atlantic salmon (*Salmo salar*). Gaetano, P., Duarte, V., Striberny, A., Hazlerigg, D., Jørgensen, E.H., Camphino, M.A. and Fuentes, J. Aquaculture, in press.

THANK YOU!

