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CtrlAQUA

Growth performance and welfare of post-smolt reared in semi-closed systems in sea – a comparative study

HYPOTHESIS:

The salmon industry faces challenges related to sea lice infestations, escapees, diseases and environmental impact. Semi closed containment systems (S-CCS) have been proposed to abate these challenges. In the S-CCS, cultured fish are separated from the natural environment by a physical barrier. The use of these systems reduces the time fish spend living in open sea cages.

This study investigated and documented welfare and growth performance of Atlantic salmon through an acute challenge test and a big-scale benchmark study.

1. The acute challenge test was conducted using post-smolts raised in large scale semi-closed system (S-CCS: Preline and Neptune), with reference groups raised in open sea cages.
2. Benchmark study, selected production data from six generations of salmon was used to compare growth and performance of fish raised in S-CCS (Preline) and in open sea cages (reference)

DURATION: May 2015 - February 2019

FISH SIZE TESTED: The Benchmark study was carried out in two phases.
- Phase one used post-smolts from 100 g to 800 g in seawater, and fish in S-CCS were compared with a reference group from an open sea cage.
- Phase 2, grow-out phase used salmon from 800 g to 5000 g in open sea cages

SALINITY TESTED: Seawater (SW)

HIGHLIGHTS:

(please see figure 1 for illustrations)

1. Acute Challenge test: Fish raised in the S-CCS showed lower concentration of plasma cortisol, magnesium and lactic acid at baseline levels, giving a stronger response to the acute stress challenge than fish from the reference group. **The results suggest lower basal stress in the S-CCS group compared with the reference group in open sea cages, as well as a more balanced response to stress in the S-CCS fish.**

2. The findings from the benchmark analyses showed a significantly lower infestation of sea lice in Preline fish during the post-smolt phase. Furthermore, in the grow-out phase the Preline group showed higher weight gain

and final weight compared to the reference group in open pen. Finally, salmon raised in Preline showed significantly higher survival compared to the reference group, indicating increased resilience in fish raised in S-CCS when transferred to open net pens in sea.

The results indicate reduced stress, lower sea lice infestations and greater weight

Assessment of Biomass and economical performance: S-CCS vs Open Cage

Estimations	Season	Fish stock N	Mortality %	Initial weight	Estimated Final weight per fish (kg)	Estimated Biomass in the system (kg)
Preline	Spring	200,000	14.4	0.115	4.654	790,784
Open net	Spring	200,000	8.64	0.115	3.797	695,787
Preline	Fall	200,000	7.05	0.115	4.872	905,704
Open net	Fall	200,000	25.12	0.115	4.030	603,532

Spring stockings: Approx 100,000 kg (~12 % higher than reference) estimated biomass gain with the Preline strategy.

Fall stockings: Approx 300,000 kg (~40 % higher than reference) estimated biomass gain with the Preline strategy.

*(*Assumtions: 200,000 Fish & initial weight)*

The factsheet is ready for commercial implementation

gain, S-CCS appears to have advantages compared to traditional long exposure to the natural environment in open sea cages in Norway. However, to determine the real potential of S-CCS strategy, further research is needed.

READ MORE:

Ovrebo et al. 2022. https://doi.org/10.1111/are.15919.

Balseiro, P., Moe, Ø., Gamlem, I., Shimizu, M., Sveier, H., Nilsen, T. O., Kaneko, N., Ebbesson, L., Pedrosa, C., Tronci, V., Nylund, A. and S. O. Handeland. Comparison between Atlantic salmon (Salmo salar) post-smolt reared in open pen and in the Preline semi-closed containment aquaculture system. 2018. Journal of Fish Biology, Vol 93-3, 567-579.