

PROJECT: MICROPARASITES
SYSTEM: Semi-closed system in sea
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CtrlAQUA

Microparasites in semi-closed system in sea

A major step towards successful production of Atlantic salmon in closed and semi-closed containment system (CCS, S-CCS) is knowledge about how these systems affect the diversity, prevalence and load of microparasites (viruses, bacteria, protozoan parasites, and fungi) in comparison with existing knowledge from open production systems. Will change in the culture system (e.g. S-CCS with water intake at large depths) lead to introduction of new microparasites not found in open production systems?

HYPOTHESIS:

Use of S-CCS will not affect the diversity, prevalence and load of parasites compared to open production systems at the sea.

DURATION: 2015 - 2024

FISH SIZE TESTED: The salmon included in this study were tested as smolt (<100 gram), collected from smolt production sites before sea launching, and as post-smolt kept in S-CCS and open control cages up to a weight of 500 - 1000 gram.

SALINITY TESTED: Salt water

HIGHLIGHTS:

1. S-CCS reduce the impact of salmon lice (*Lepeophtheirus salmonis*) when the water intake is below 20 meters, compared to open cages in the same production areas. Still, lice do get into the S-CCS cages and further reduction of lice could possibly be obtained by lowering the water intake to deeper waters than 20 meters or by treatment of the intake water.
2. A range of microparasites (mostly viruses) can be introduced from smolt production sites into the S-CCS. This can be avoided with a stronger focus on production of smolt that are negative for viruses like HPR0, ISAV and PRV1.
3. S-CCS does not protect against infection with microparasites (viruses, bacterial, and protozoans like AGD). However, the result of these infections are in most cases not more severe than infections with microparasites in open cages. Exceptions have been experienced with *Paramoeba perurans* that resulted in mortality in a S-CCS in February, i.e. a time of the year where it is unusual with outbreaks of AGD in open cages. Another example is that Salmon gill poxvirus (SGPV) seem to be more easily transmitted between salmon in S-CCS compared to production in open cages. However, this virus did not result in any serious gill disease in the S-CCS cages.
4. There are indications that infections with *Eubothrium* sp. could be avoided by using S-CCS.



RECOMMENDATION:

1. Reduction of lice could possibly be obtained by lowering the water in-take to below 20 meters or by treatment of the intake water.
2. Introduction of microparasites into the S-CCS can be reduced by only stocking the cages with virus-free smolt. This will require a better control of the broodfish and the smolt production.
3. The existing S-CCS that have been

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followed in this project are early prototypes that need to be located in fjords and close to land. The future S-CCS will probably have to be more robust technologies compared to those tested in this project. It should be possible to treat the intake water and the waste-water from production in S-CCS.

READ MORE:

Are Nylund, Christian R. Karlsen, Chris Good, Svein M. Jørgensen, Heidrun Plarre, Trond E. Isaksen, Sigurd O. Handeland, Knut Wollseth, Karl F. Ottem (2015). Review of microparasites that could represent a future problem for production of salmonids in closed or semi-closed containment systems. Review was financed by the SFI CtrlAQUA, Department of Preventive Fish Health, 178 pages.

Thomas Borka Kloster-Jensen (2018). Development of a genotyping tool for Salmonid Gill Poxvirus (SGPV) in farmed- and wild salmon (*Salmo salar*) in Norwegian waters. Master thesis, University of Bergen.

Mjølnørød EB, Srivastava A, Moore LJ, Plarre H, Nylund A (2022). Identification of housekeeping genes of *Candidatus Branchiomonas isticola* associated with epitheliocystis in Atlantic salmon (*Salmo salar* L.). Archives of Microbiology 204:365. <https://doi.org/10.1007/s00203-022-02966-y>.
Siri Marie Lillebostad (2022). Phylogenetic and histological analysis of *Candidatus Branchiomonas isticola* associated with

epitheliocystis in farmed and wild salmonids in Norway. Master Thesis, University of Bergen.

Ylva Mathilde Osdal (2021). Pathogen screening in Semi Closed Containment Systems and open net pens with emphasis on the presence of *Tenacibaculum* spp. And development of Real Time RT-PCR assays for *Tenacibaculum* spp. Master thesis, University of Bergen. <https://hdl.handle.net/11250/2761262>