

Potential advantages of producing post-smolt in intensive systems

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Strandbúnaður 2018, Grand Hótel Reykjavík, 19.-20. mars.

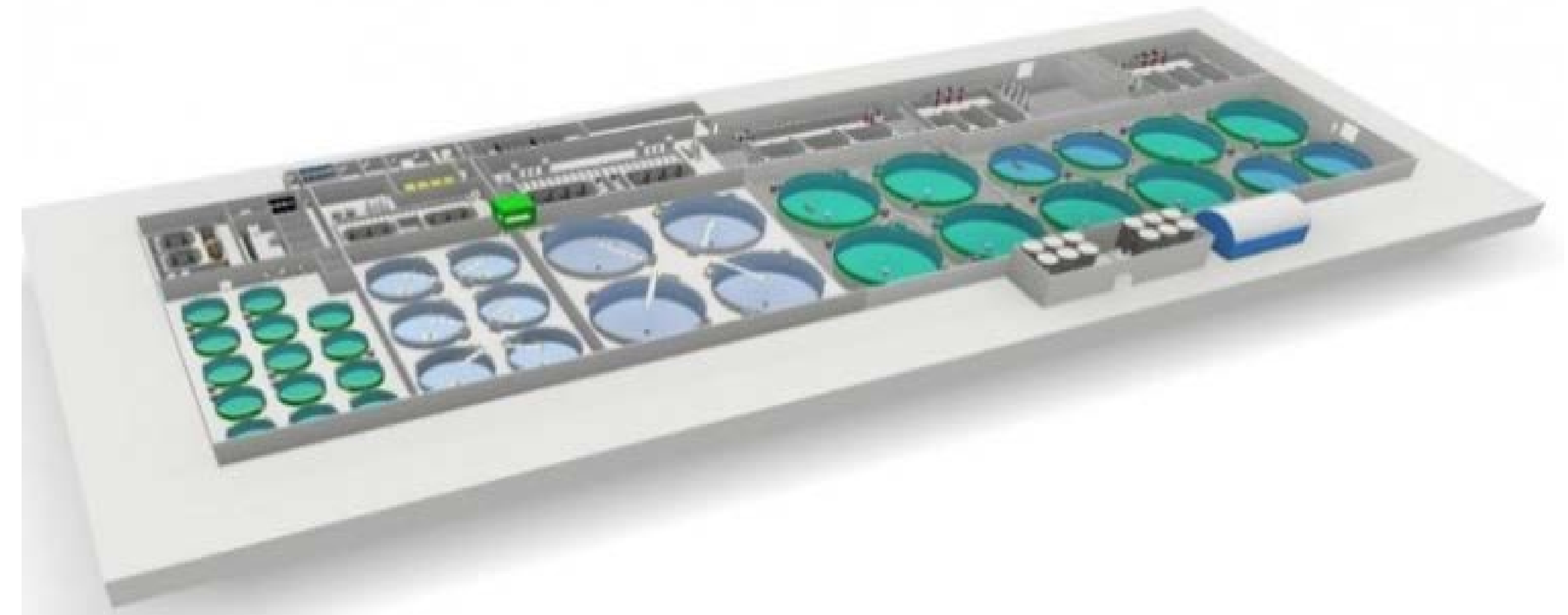
Alternative production systems

- **Traditional production regime:**
Onshore smolt production (c. 100 g size) and subsequent grow-out in open cages (harvest size)
- **Alternative I:**
Combined **onshore smolt & post-smolt production*** (500-1,000 g size) and subsequent grow-out in open cages (harvest size)
- **Alternative II:**
Onshore smolt production - **post-smolt production in closed cages**** (500-1,000 g size) and subsequent grow-out in open cages (harvest size)
- **Alternative III:**
Onshore smolt (c. 100g) and subsequent **entire post-smolt production in closed cages** till harvest size

* RAS: recirculating aquaculture systems

** S-CCS: semi-closed cage systems

Grieg Seafood's RAS facility, Adamselv, Finnmark



**A large smolt & post-smolt farm in Northern Norway with 15,000 m³ tank volume
(courtesy: Frode Mathisen, Director freshwater production, Grieg Seafood)**

AkvaFuture's closed floating cage facility (S-CCS) IRIS

Sæterosen, Brønnøysund

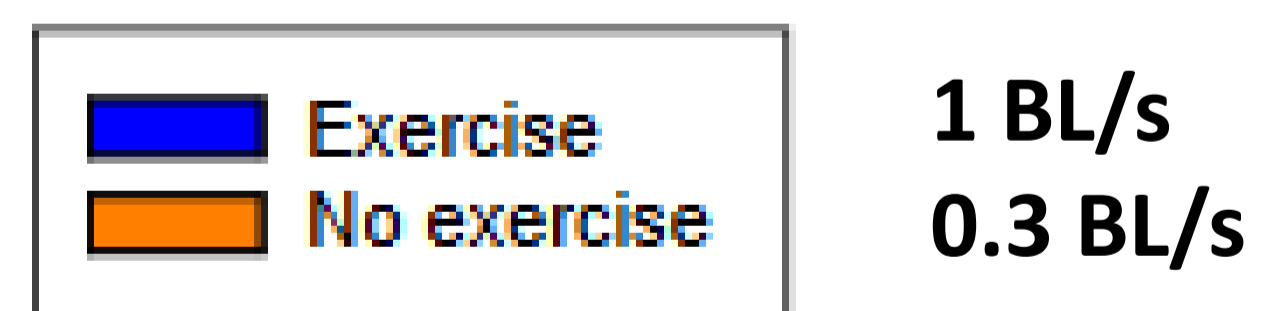
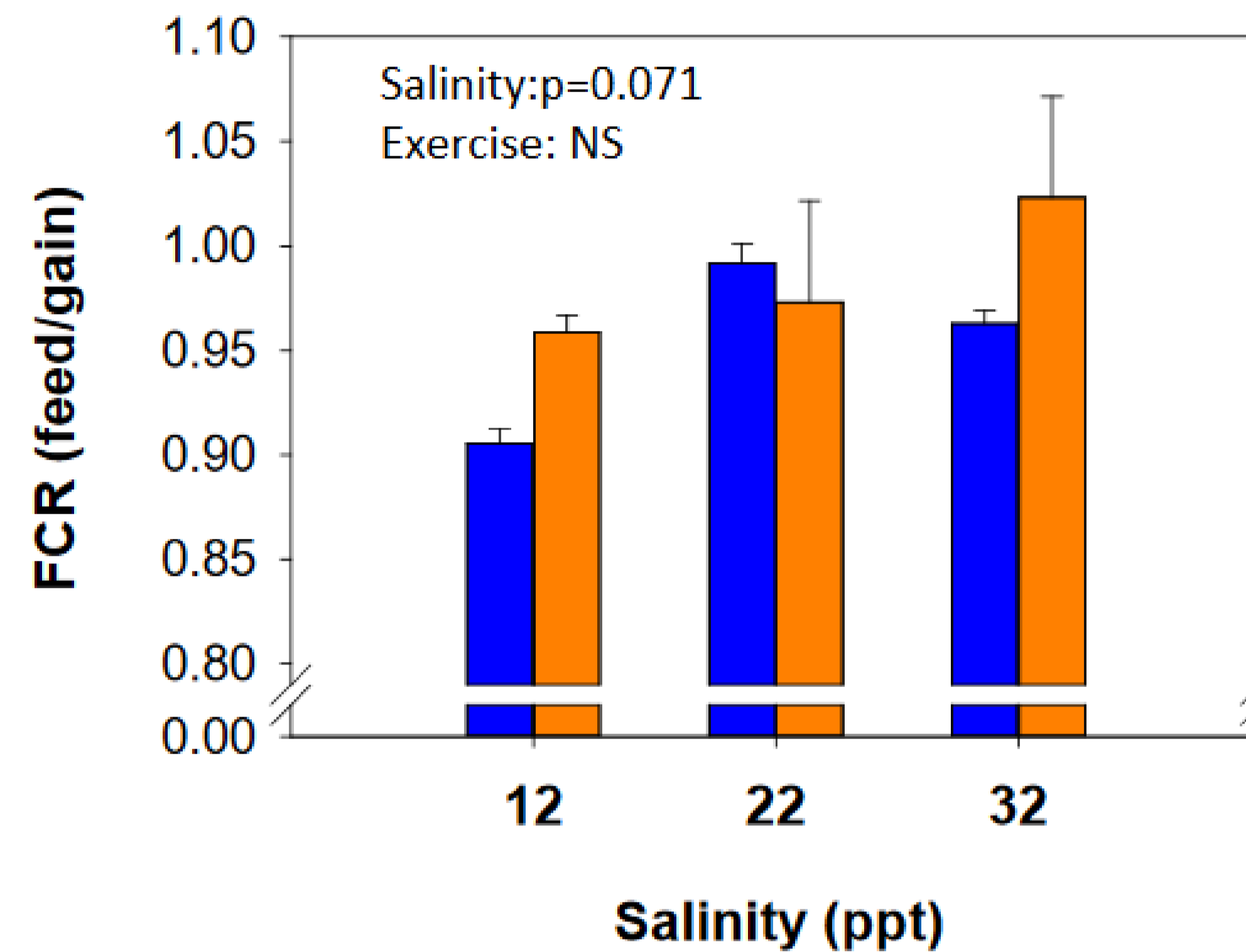
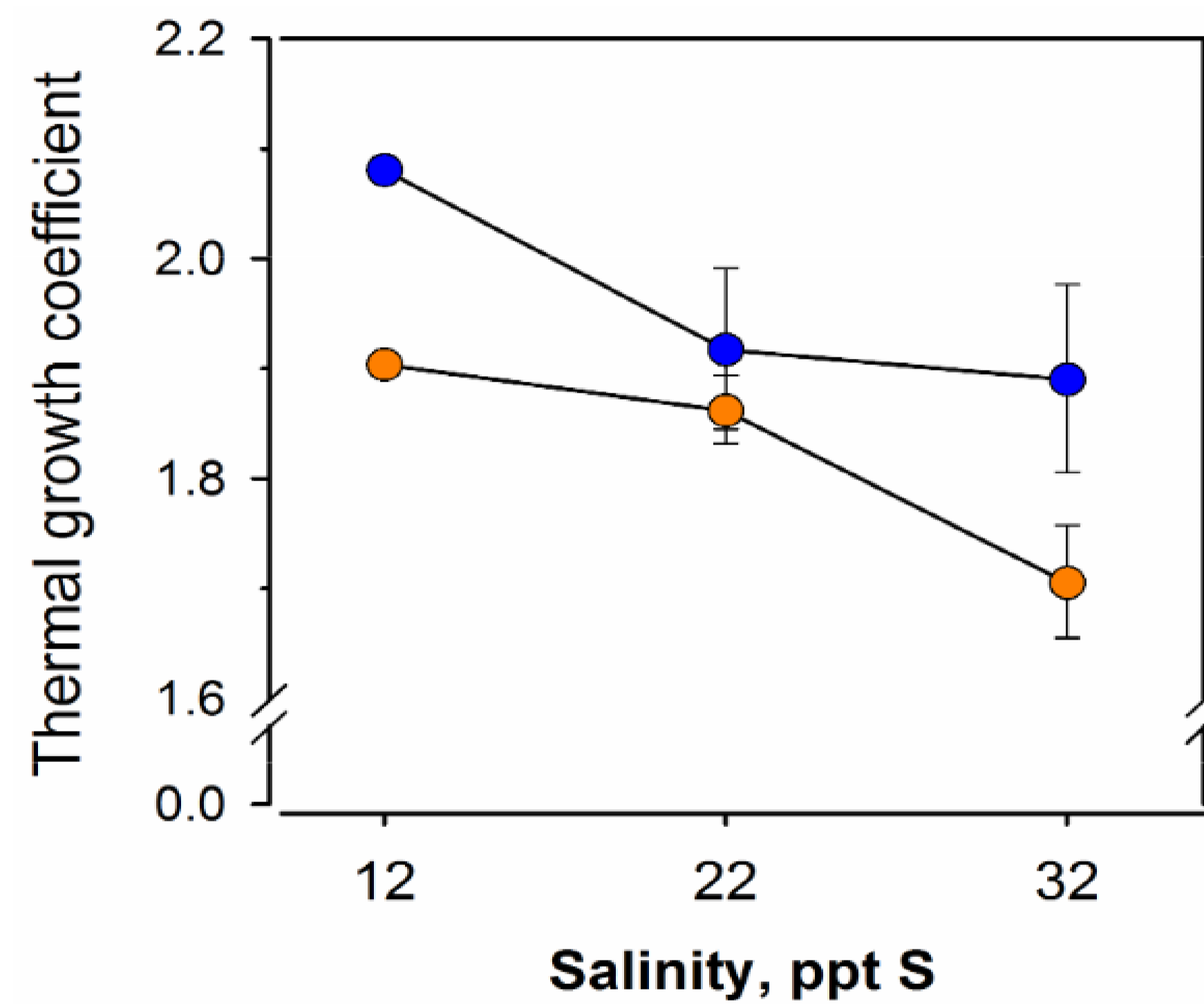


R&D farm emphasizing optimized 'super-smolt' & harvest size production
(courtesy: Anders Næss, CEO AkvaDesign as)

Optimizing post-smolt production

Salinity and exercise

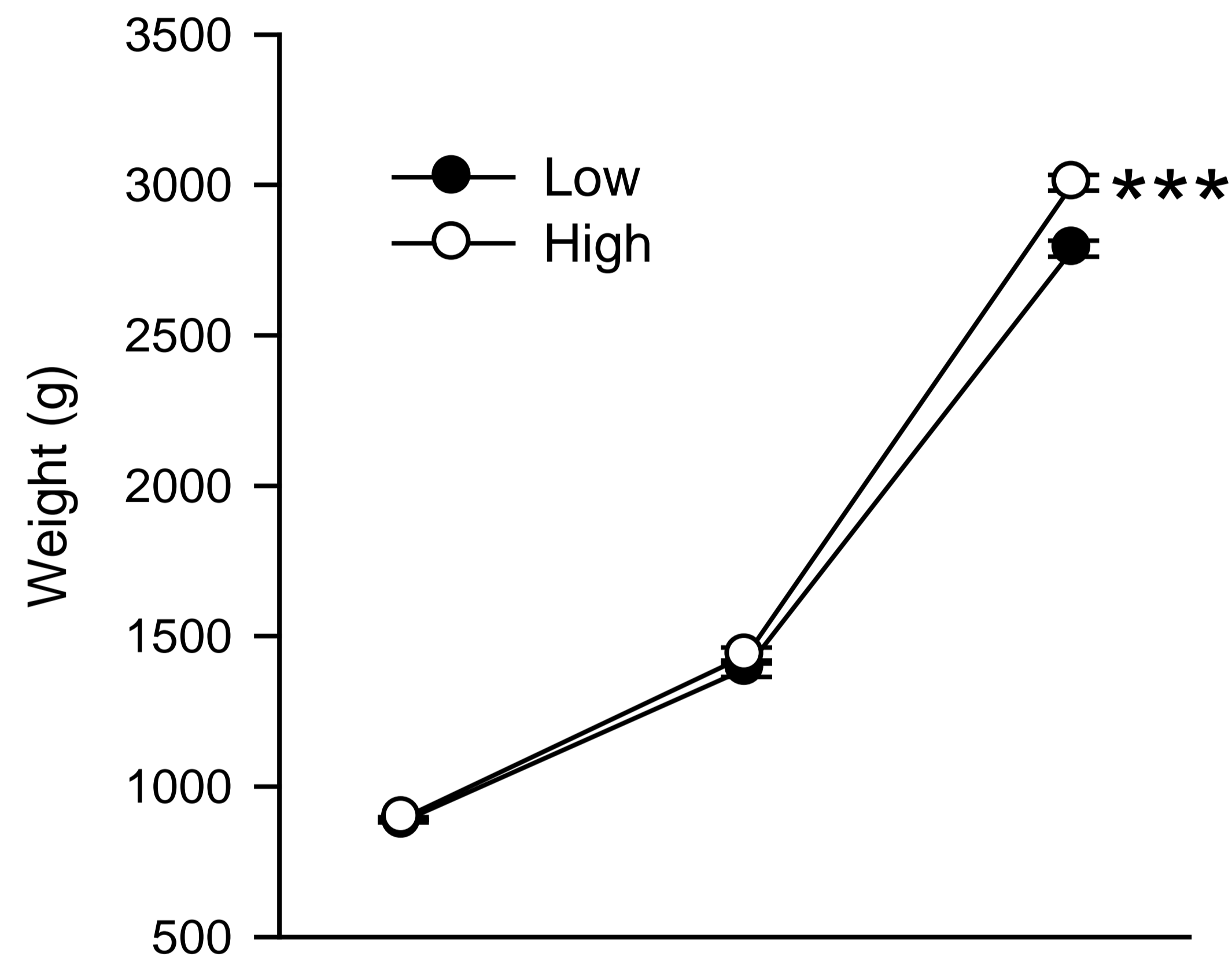
Fish size: 60 – 800 g ('super-smolt')



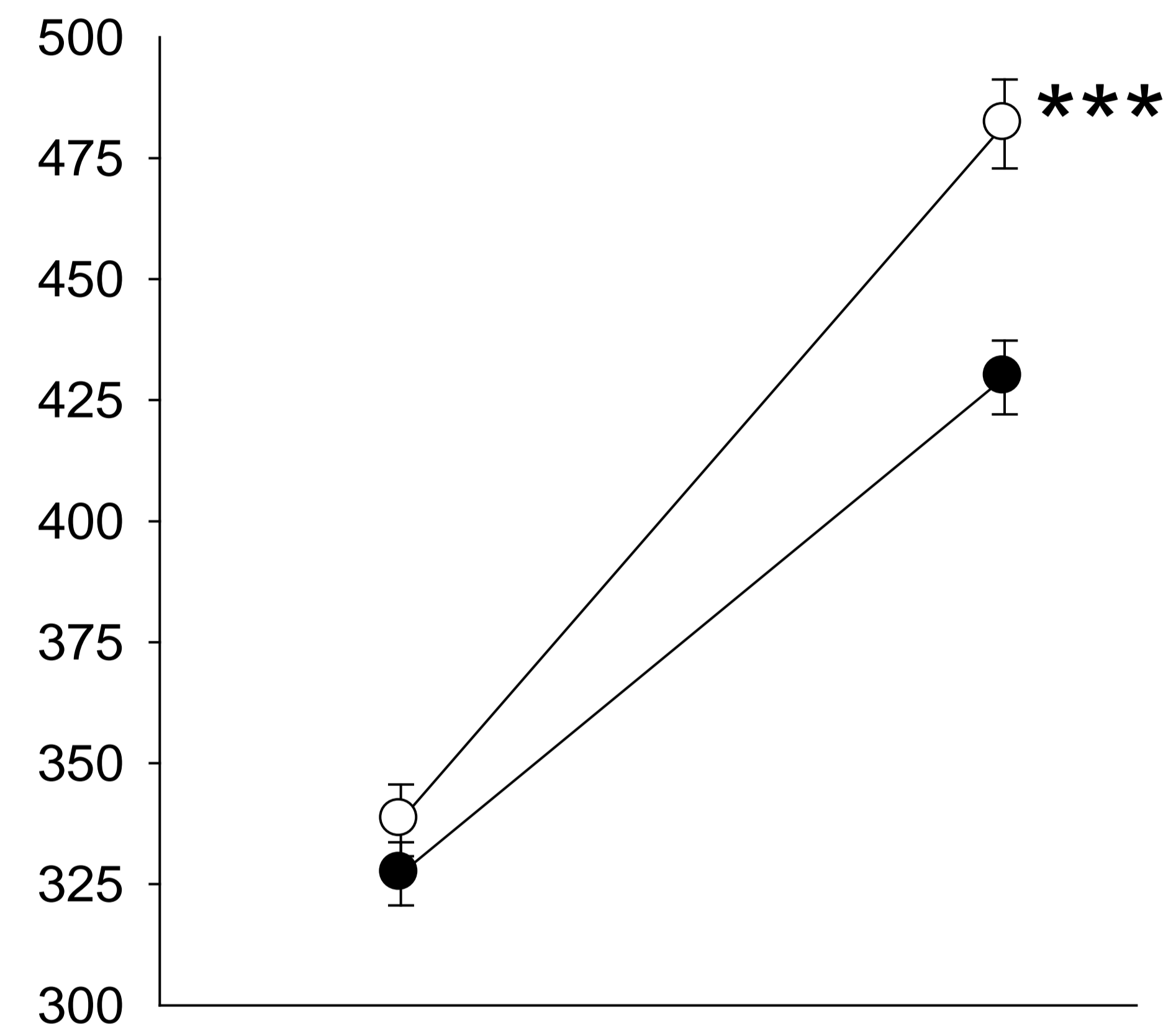
Ytrestøyl et al. 2013. Effects of salinity and exercise on performance and physiology of Atl. salmon postsmolts reared in RAS. Abstracts, Aquaculture Europe 2013, AES, Trondheim, p. 465

Optimizing post-smolt production

Exercise enhances growth in closed cages



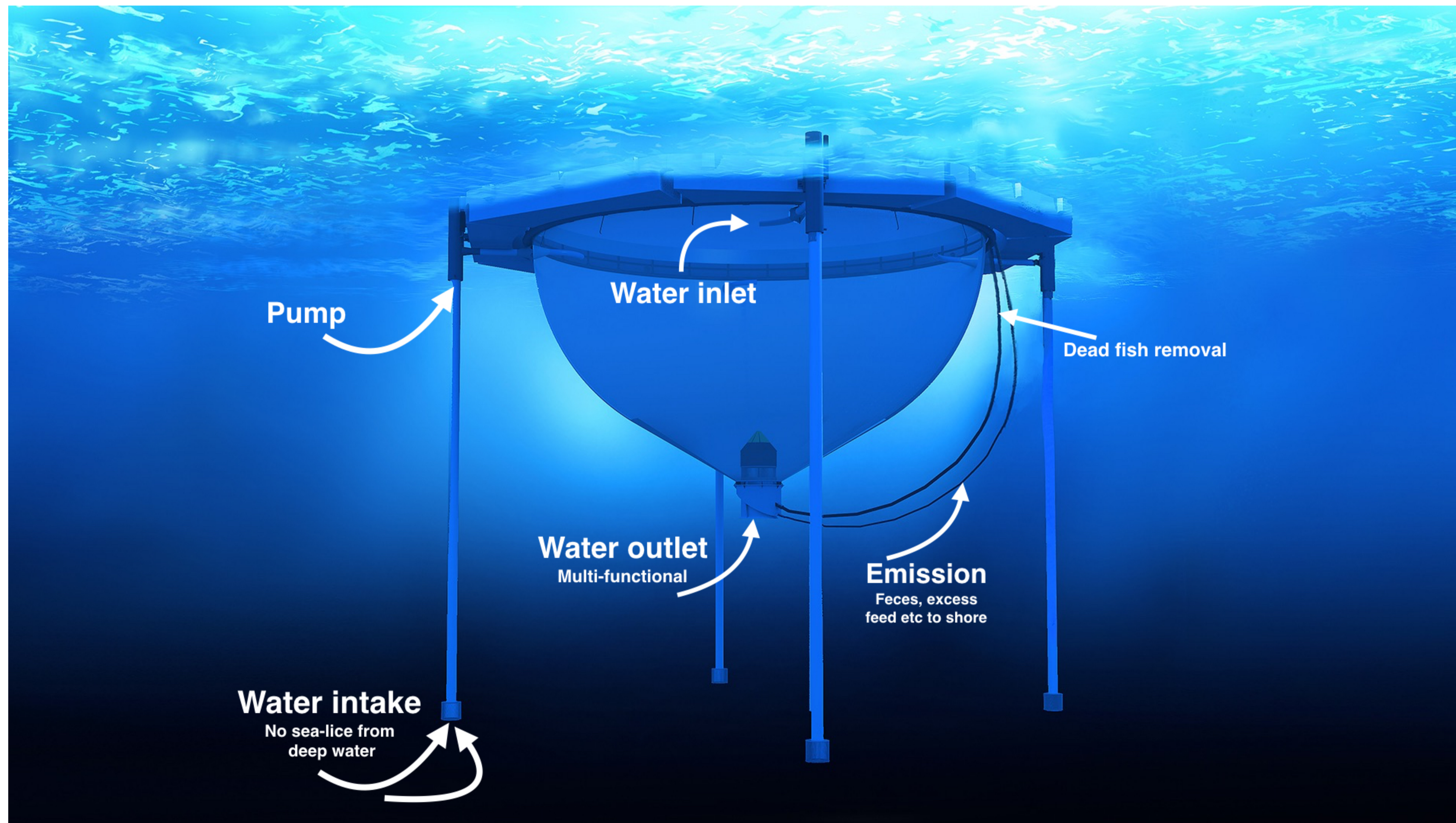
Trial 1: 168 days, 884-3,007g
0.1 vs 0.4 BL/S



Trial 2: 46 days, 327-482 g
0.2 vs 0.6 BL/s

Nilsen et al. 2018. The importance of exercise: Improved growth of Atlantic salmon with increased water velocity in closed cages, prepared for submission March 2018

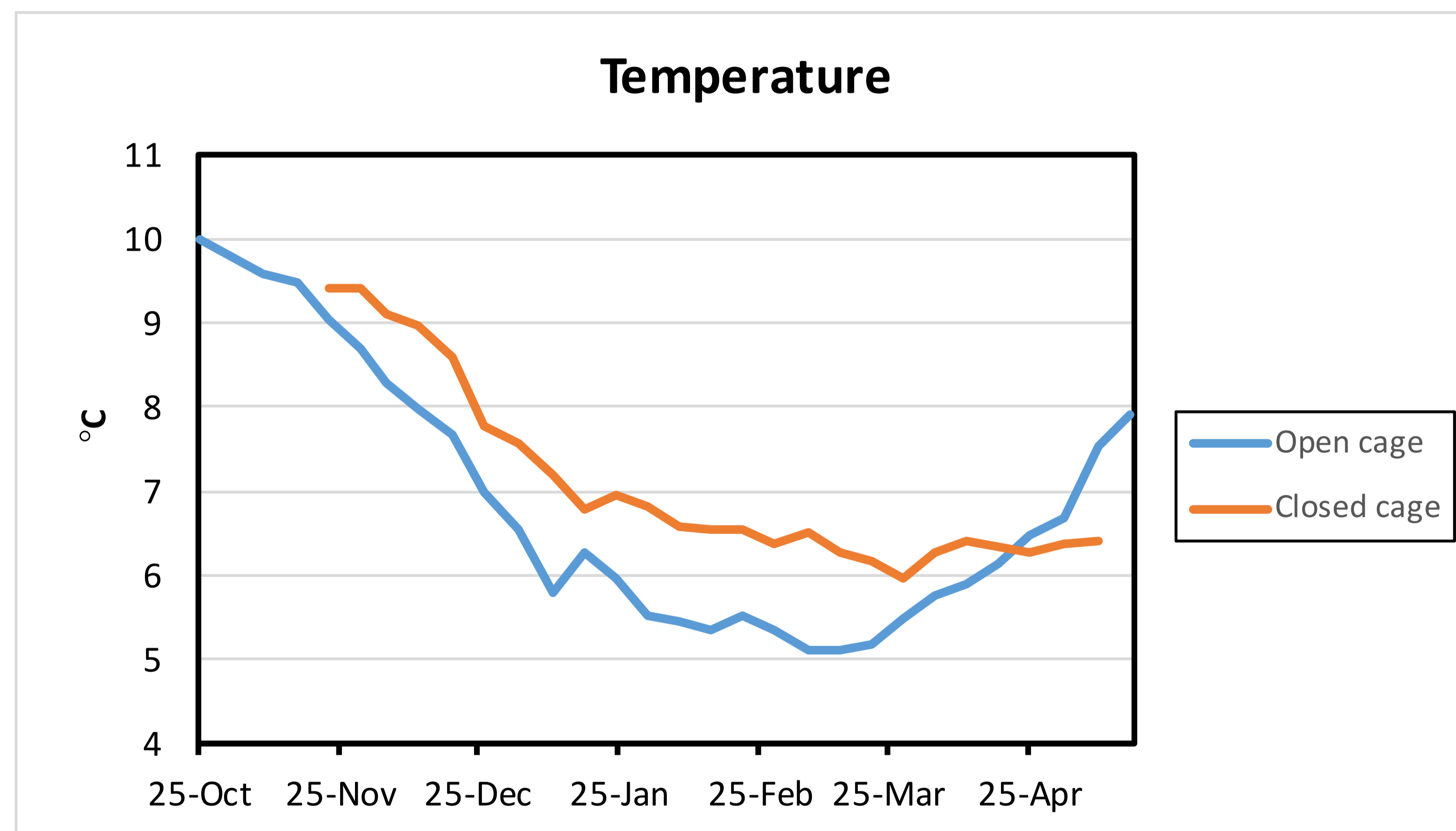
Design of a closed, floating cage Sæterosen, Brønnøysund



(courtesy: Anders Næss, CEO AkvaDesign as)

Winter temperature in Closed vs. Open cages IRIS

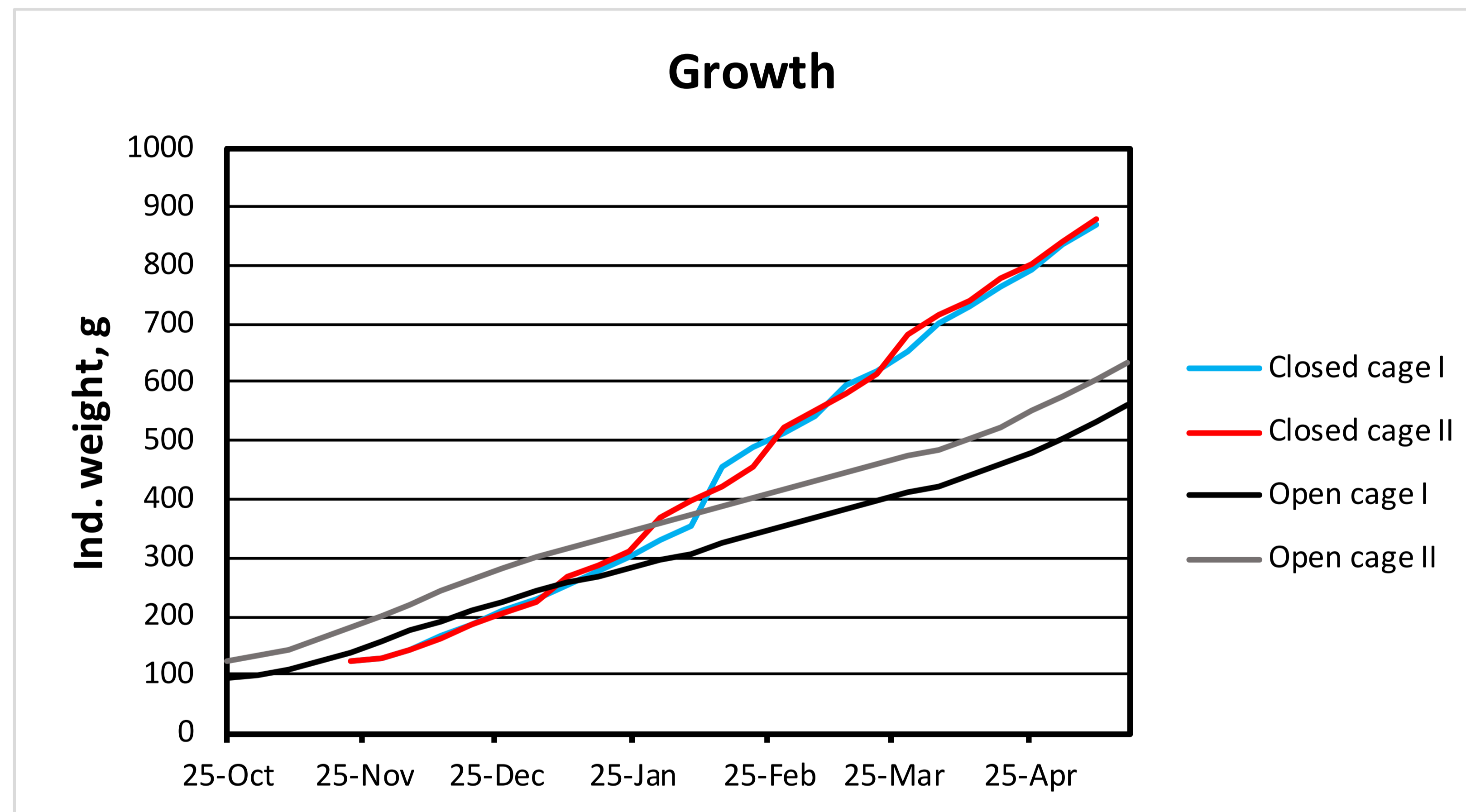
Sites Møllebogen & Heggevika, Nordland



Daily monitoring October 2014 – May 2015
(Open cage: 3 m depth, closed cage: pumped water from 25 m depth)

Growth rate in Closed vs. Open cages

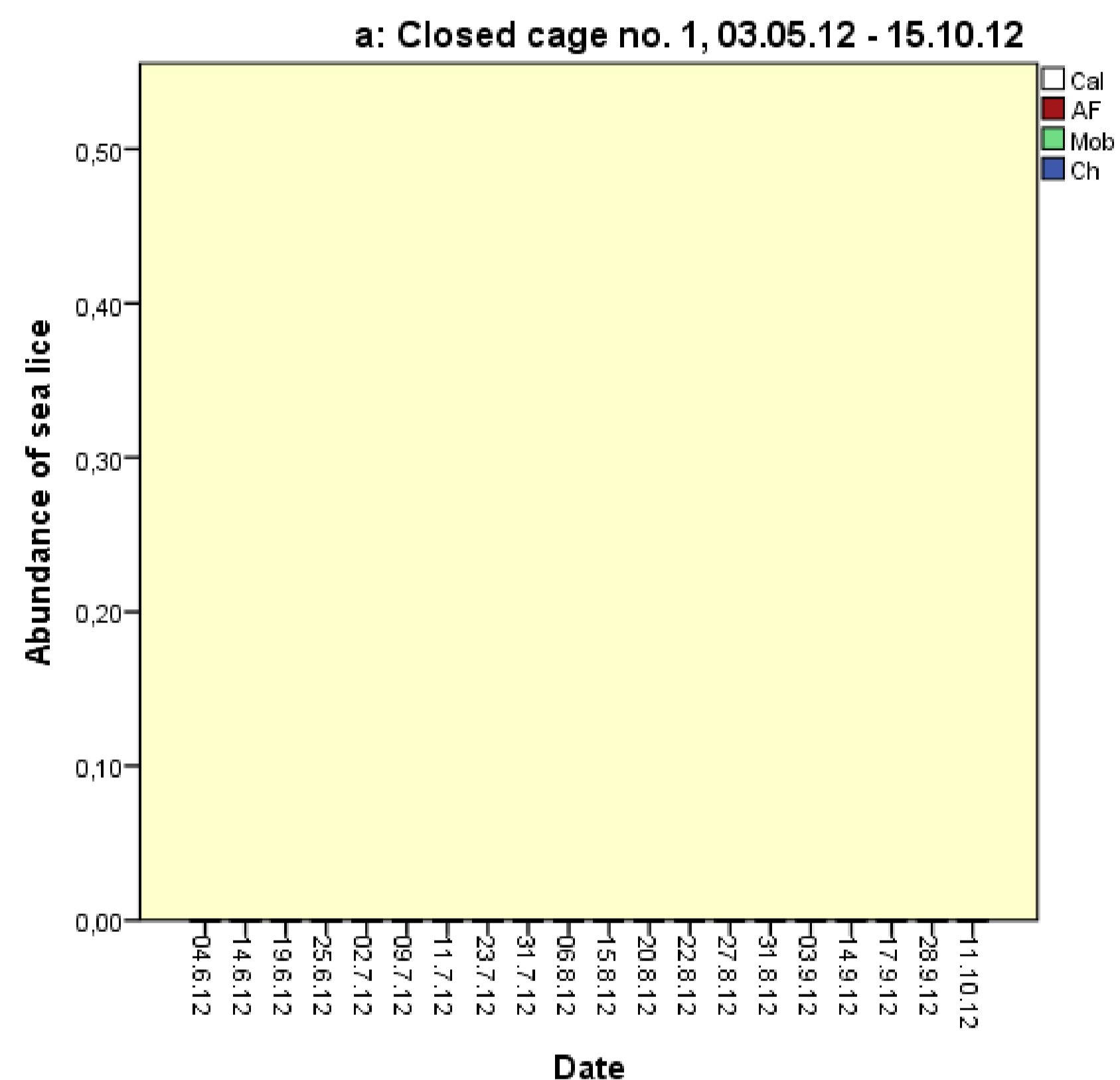
Sites Møllebogen & Heggevika, Nordland



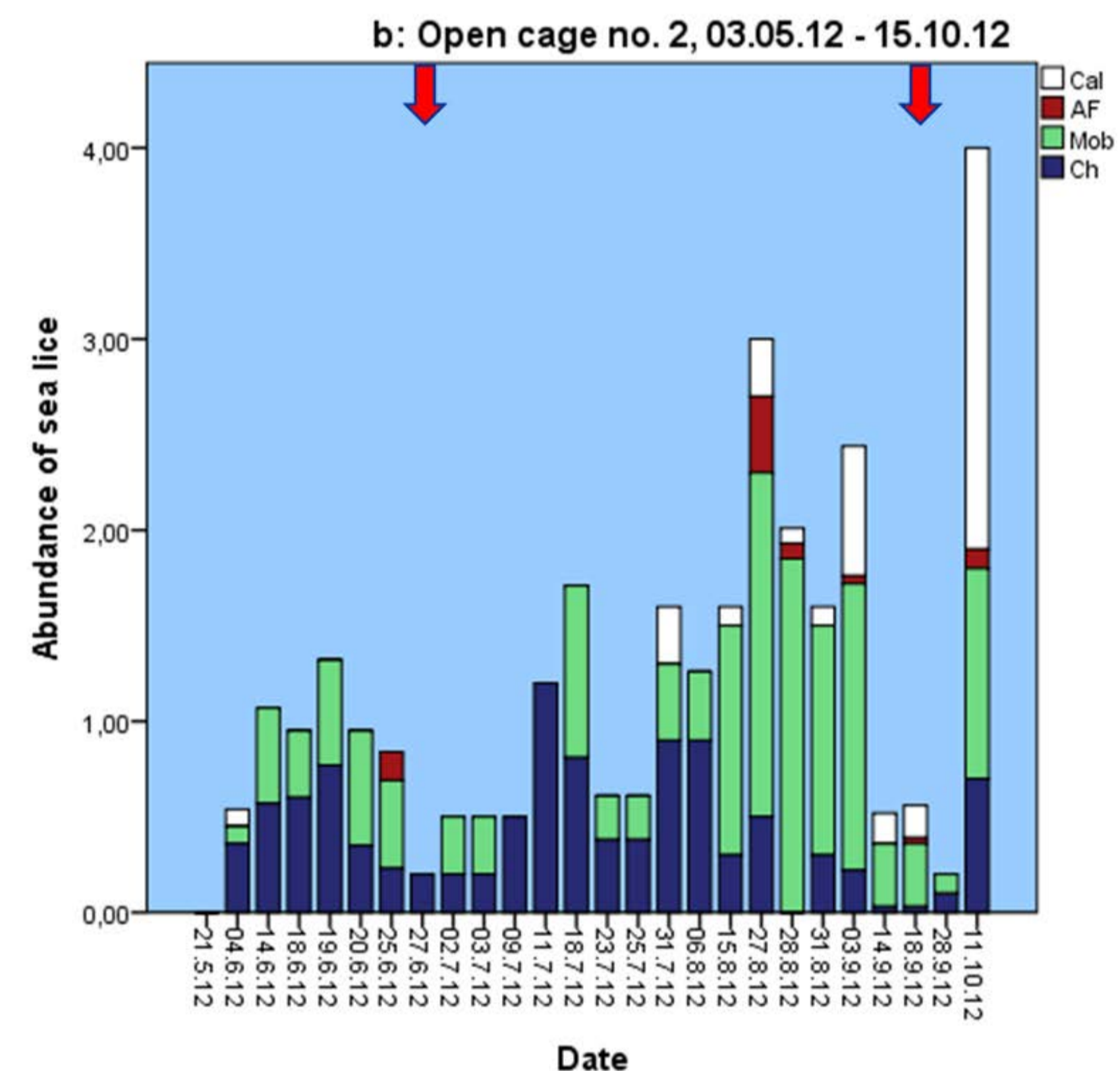
Stocking of «0-year smolt» Oct. – Nov. 2014 (in prep.)
TGC: 3.8 & 2.6 in closed & open cages, respectively

Production in closed, floating cages eliminates the sea lice problem

Abundance of lice in two salmon cages, **closed** (left) and **open** (right), May- Oct 2012



80,000 smolt;
No treatment

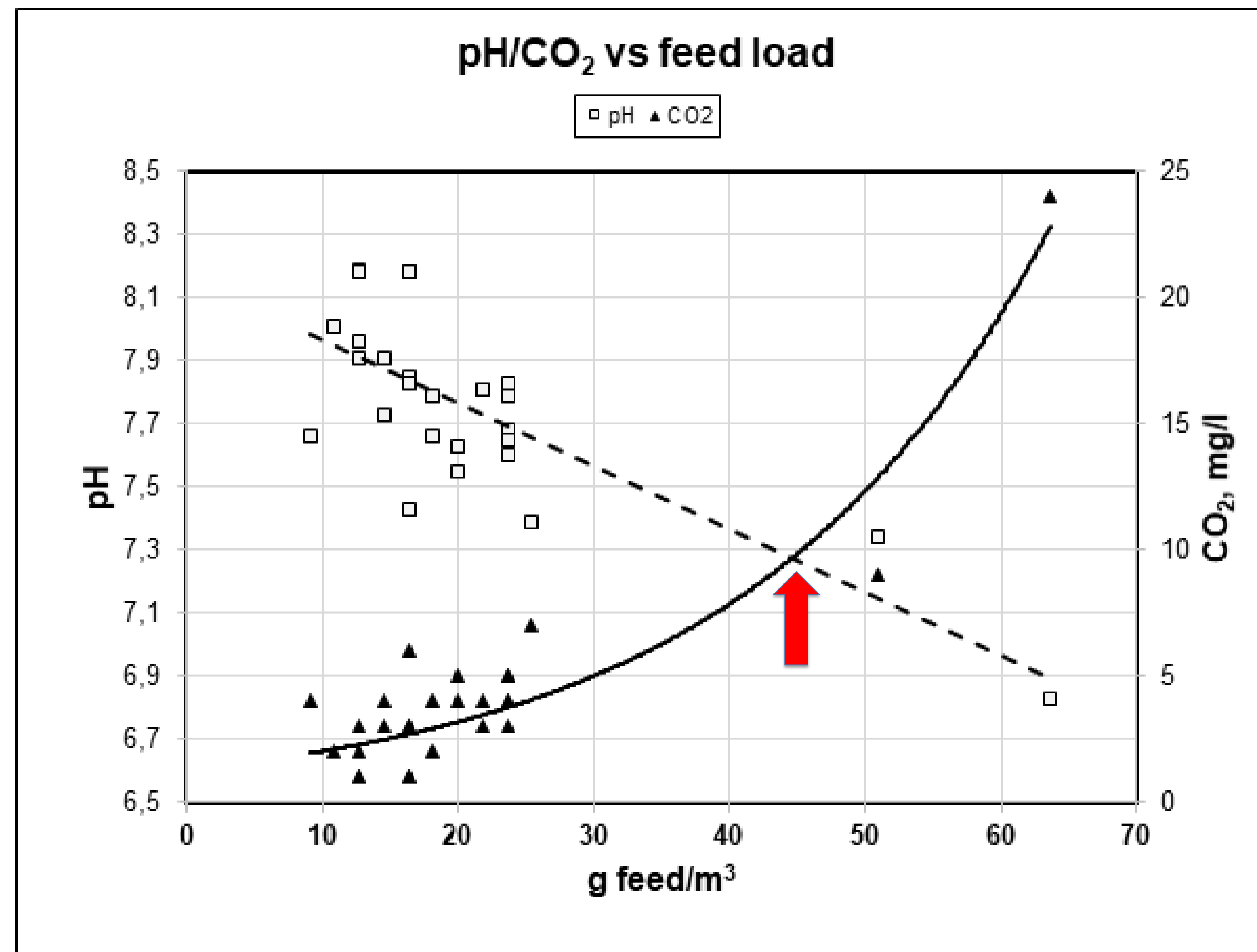


20,000 smolt;
two treatments

Nilsen, A., Vale Nielsen, K., Biering, E. & A. Bergheim. 2017. Effective protection against sea lice during the production of Atlantic salmon in floating enclosures. *Aquaculture*, 466: 41-50

Production capacity of closed cages in sea IRIS

(Oxygen enriched water without CO₂ removal)



Nilsen, A., Vale Nielsen, K, A. Næss & A. Bergheim. 2017. The impact of production intensity on water quality in oxygen enriched, floating enclosures for post-smolt salmon culture. *Aquaculture Engineering*, 78: 221-227

Grow-out in closed cages

Suggested standards:

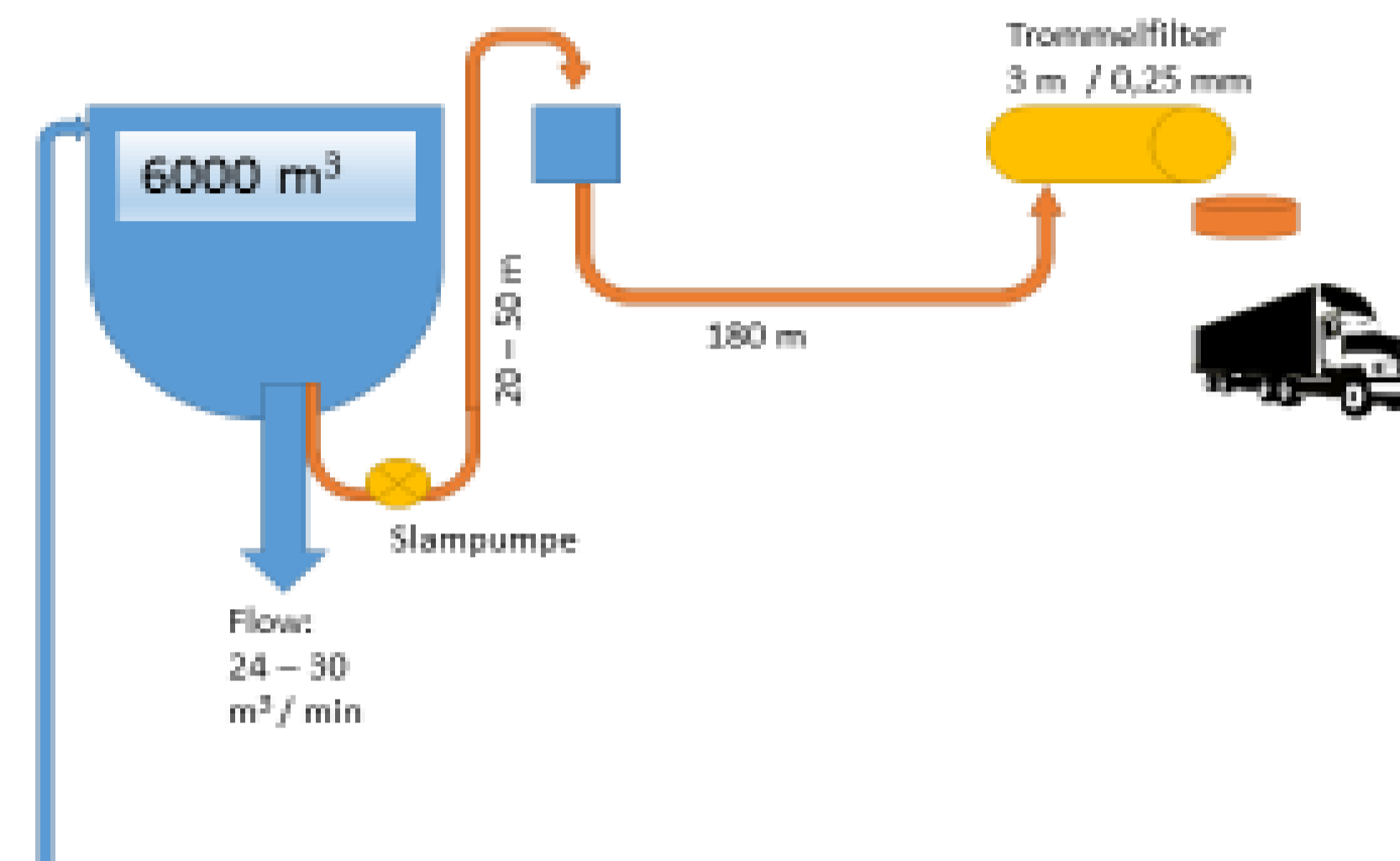
- No sea lice
- TGC \geq 2.7-3.0 in all groups
- FCR \leq 1.05
- Mortality \leq 5.0 %
- DO conc. 85-95 %
- CO₂ \leq 10 mg/L (pH \geq 7.15)
- NH₃ \leq 0.012 mg/L
- SWC \geq 0.2 L/kg/min
- Feed Load \leq 25-30 g/m³
- Fish density \leq 50 kg/m³
- Water velocity 0.4 – 1.0 BL/s

V=6000m ³ N= 200 000	Cage 8
Weight 16.10.16	60
Weight 19.02.18	4,350
Mortality, %	4.8
TGC	2.94
FCR	1.05
°C	8.8

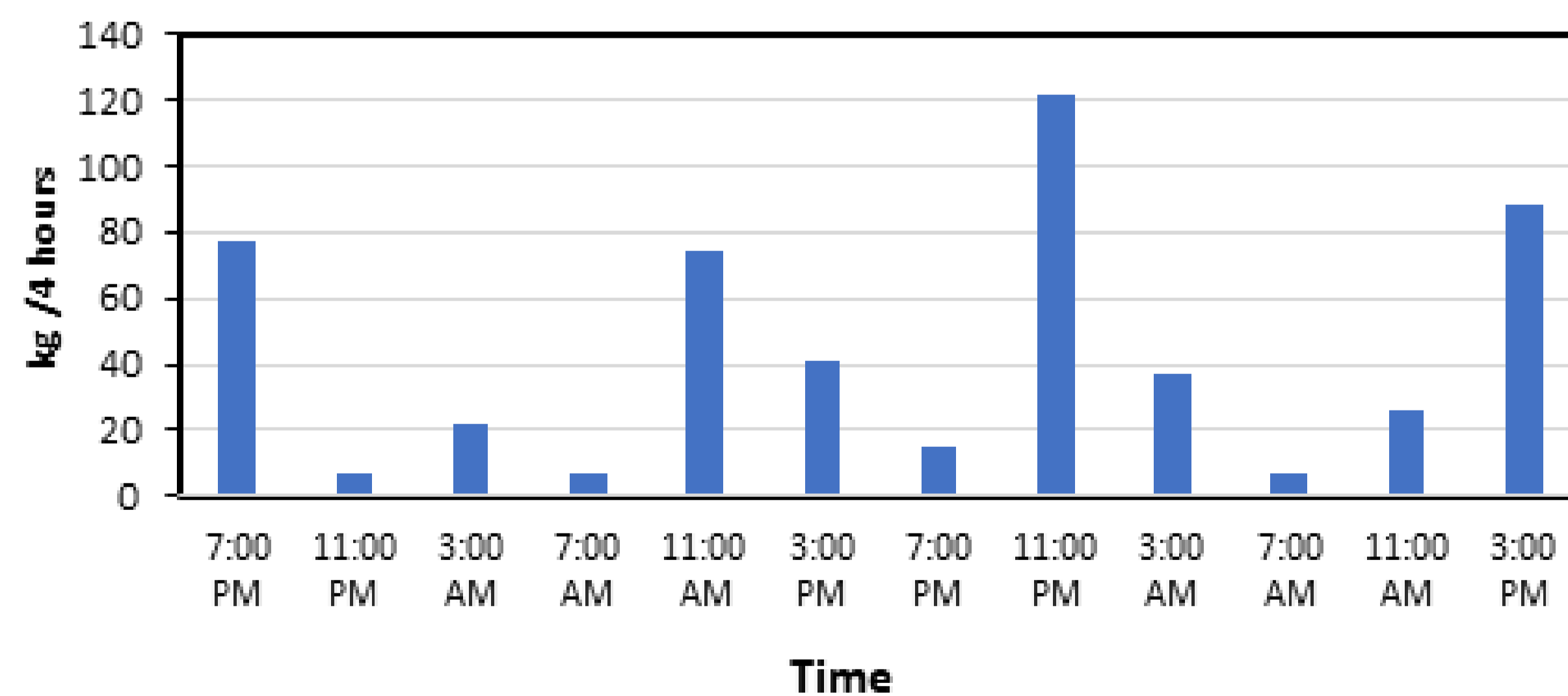
Preliminary data, AkvaFuture AS

Sludge system and efficiency

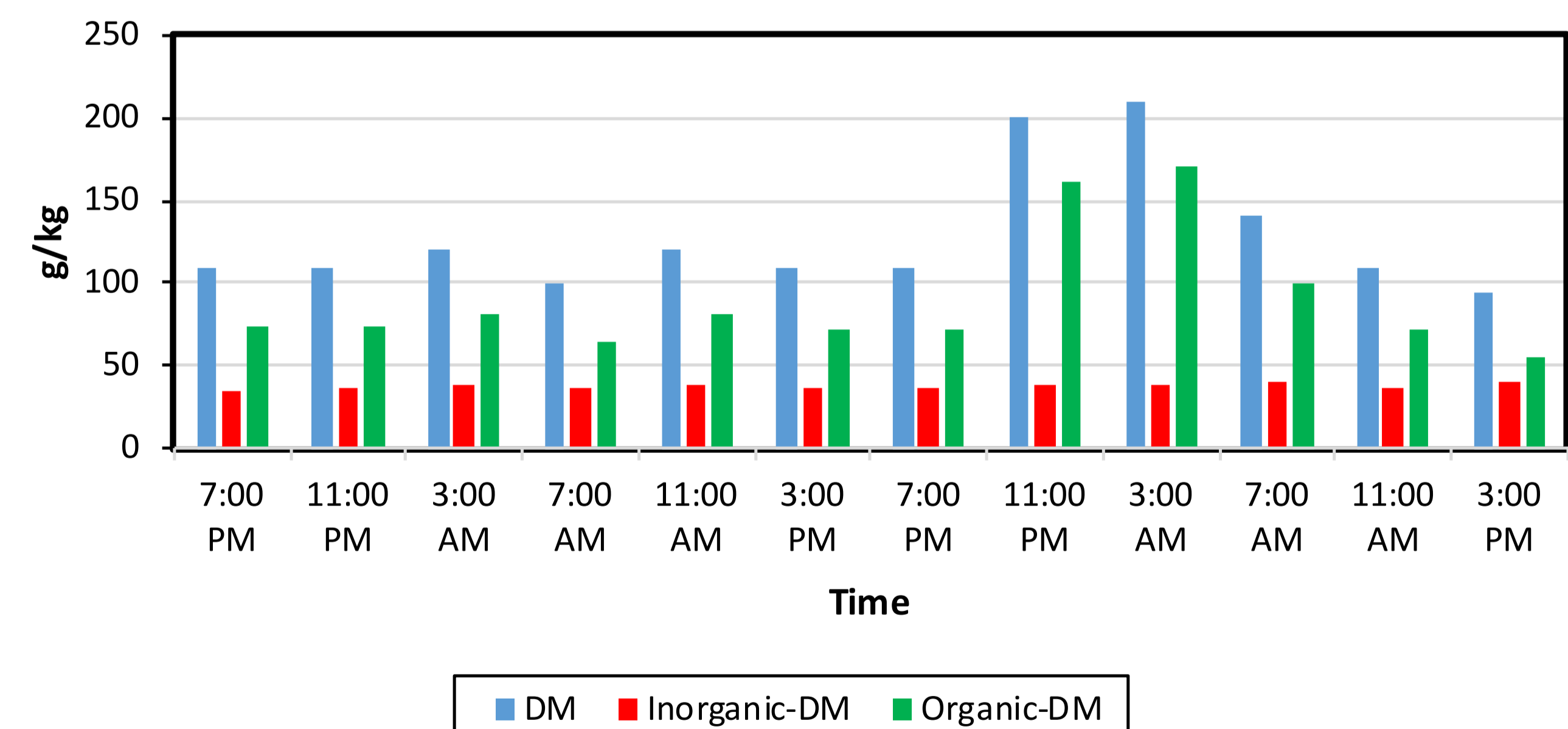
Sæterosen, Brønnøysund



Sludge quantity



Dry matter & composition



...and finally

Takk fyrir
Vielen Dank