



Production and challenges of juvenile cod production - on overview

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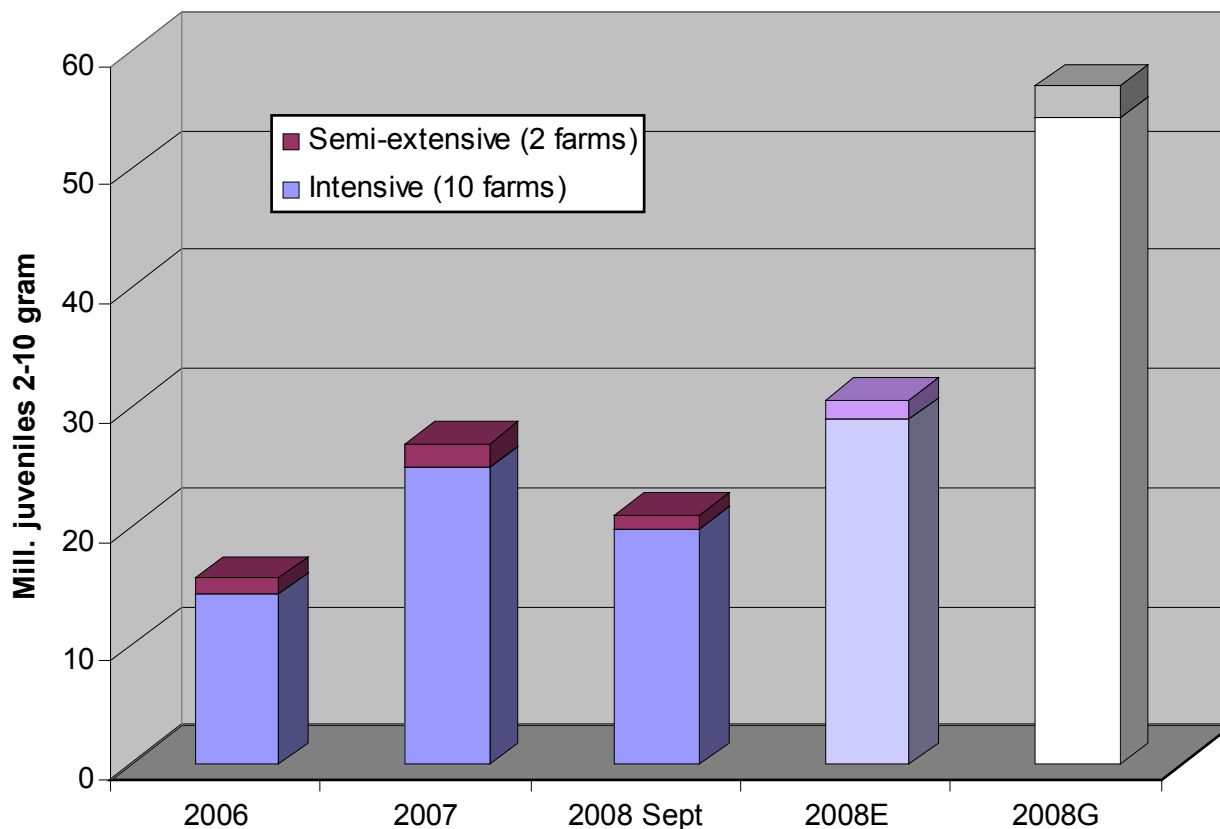


Norwegian cod fry industry 2008

- 10 farms in production intensive methods
- 2 farms under construction
- 3 farms with semi-extensive methods (1 of these without production in 2008)
- All 15 producers interviewed by Lars Olav Sparboe (APN) in September 2008
 - Production trends, goals
 - Main challenges



Norwegian production of cod juveniles 2006-2008

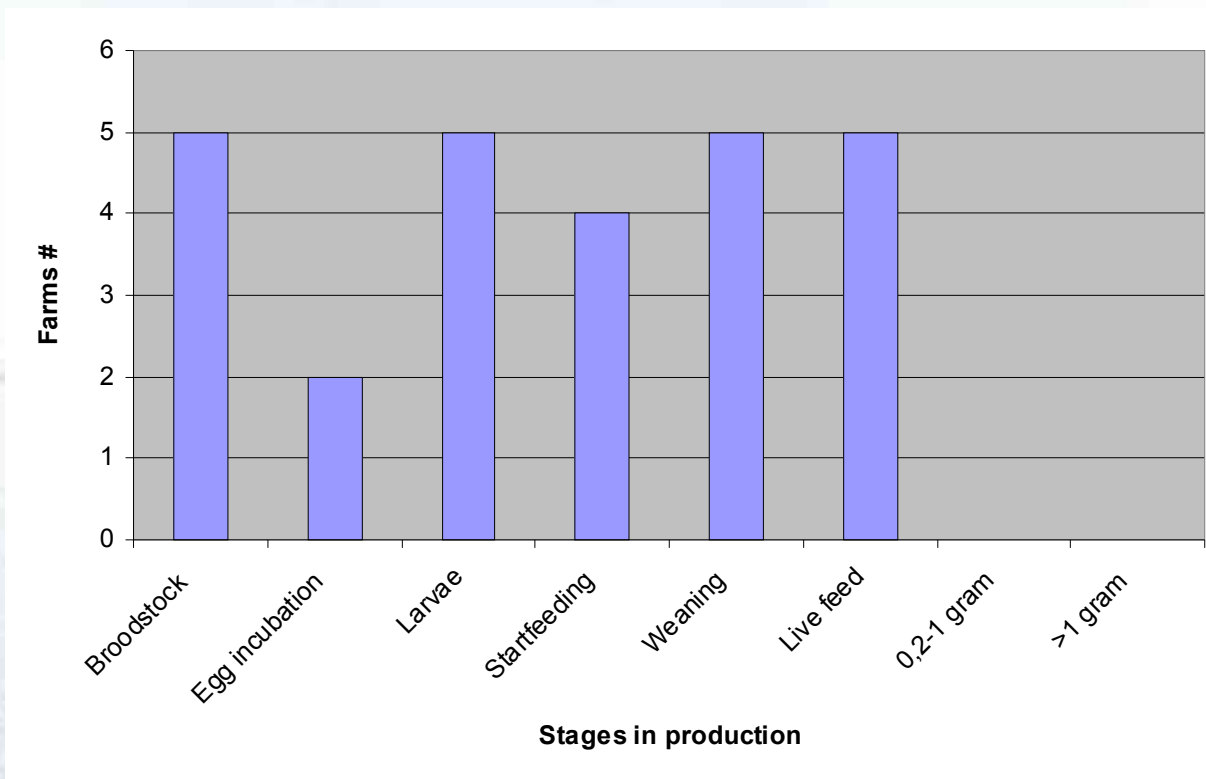


Source: Norwegian producers (12 farms)

2008G = The farms production goals for 2008 when asked in February 2008



□ Challenges in production - intensive farms



□ Challenges in production - semi-extensive farms

- Timing of spawning <-> natural plankton production



Main challenges

- **Quality**
 - Deformities
 - Growth
 - Optimization through all stages
- **Broodstock**
 - Strengthen breeding programmes
 - Increase capacity - demand is bigger than supply
 - 365 availability of eggs
 - Nutrition
 - Predictability
 - Egg quality, disease screening



**Larvae and juvenile
quality:**

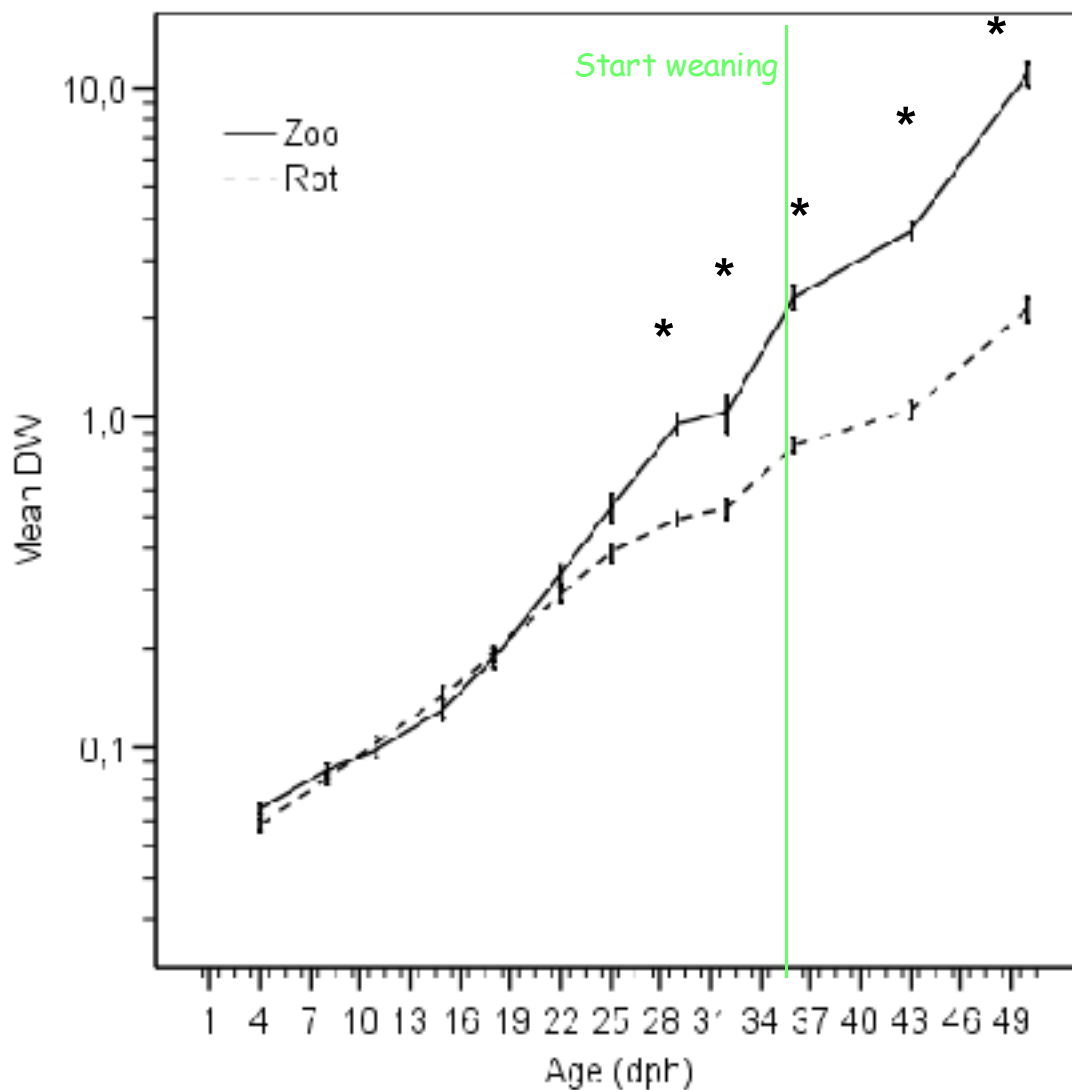
**Long term effect of
startfeeding methods**



Background and methods

- Growth rates and developmental success are highly variable and differ between producers and production systems
- Experimental trial with different startfeeding methods: zooplankton & dry feed vs. rotifers & dry feed
 - Laboratory trial with 5 temperature regimes and fish then moved to sea pens
 - Trial with different oxygen and ammonia levels
 - Trial with different salinities and temperatures

Larval phase

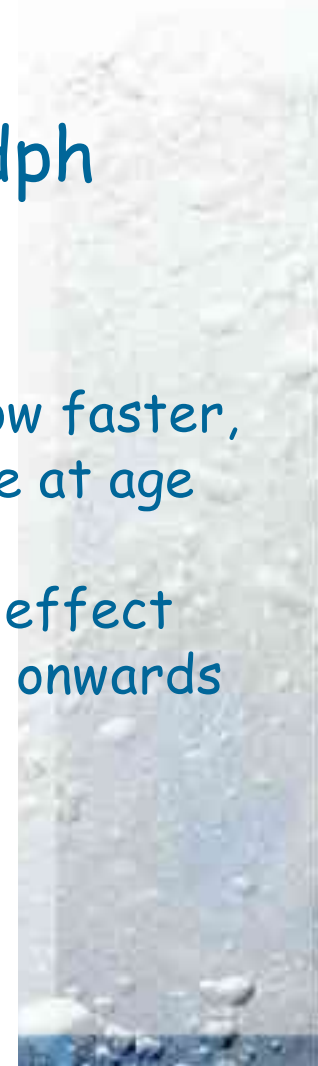


1 - 50 dph

Z-fish grow faster,
bigger size at age

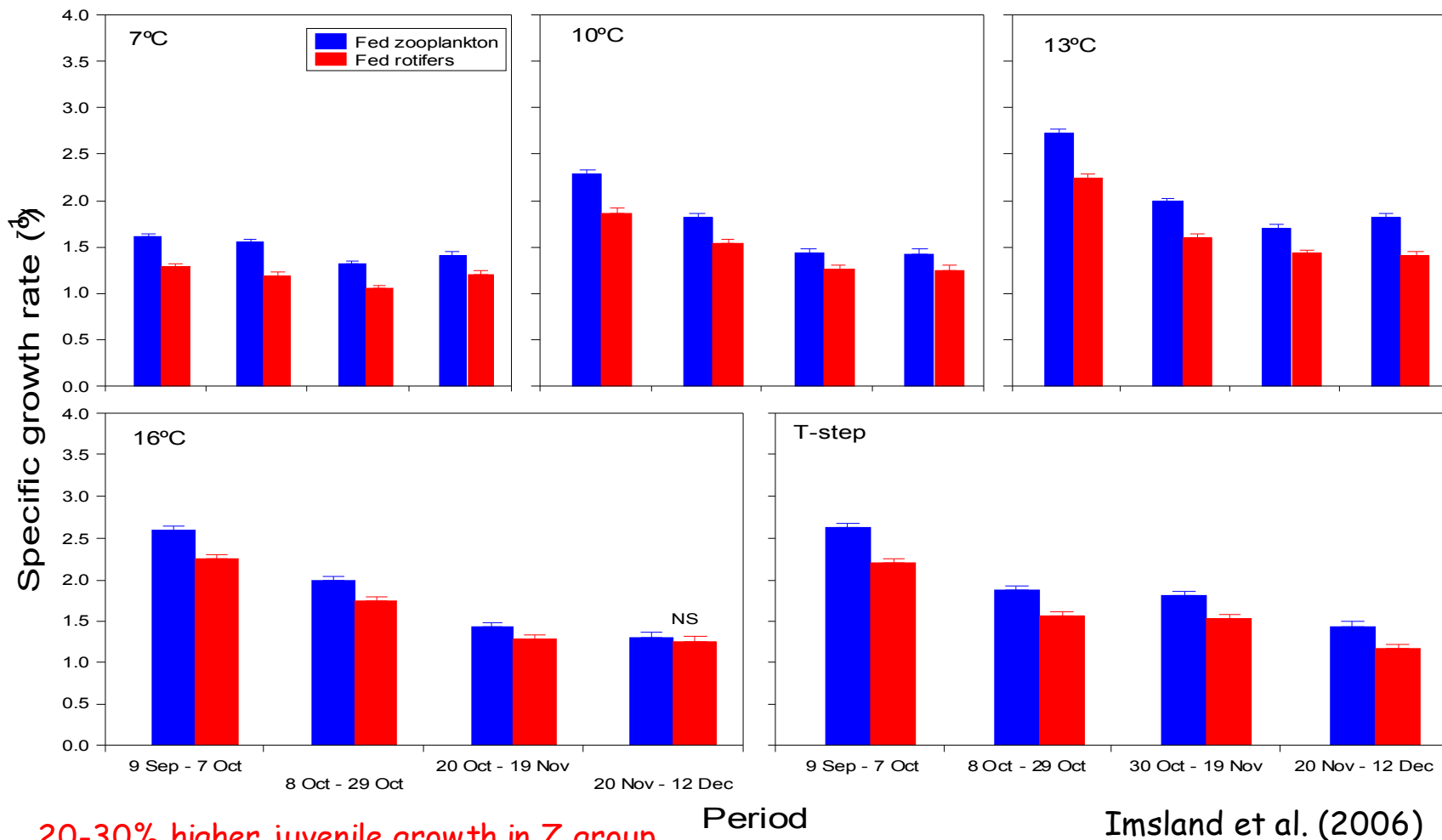
Prey type effect
from d 29 onwards

Koedijk et al.





Effect of start feeding on juvenile growth

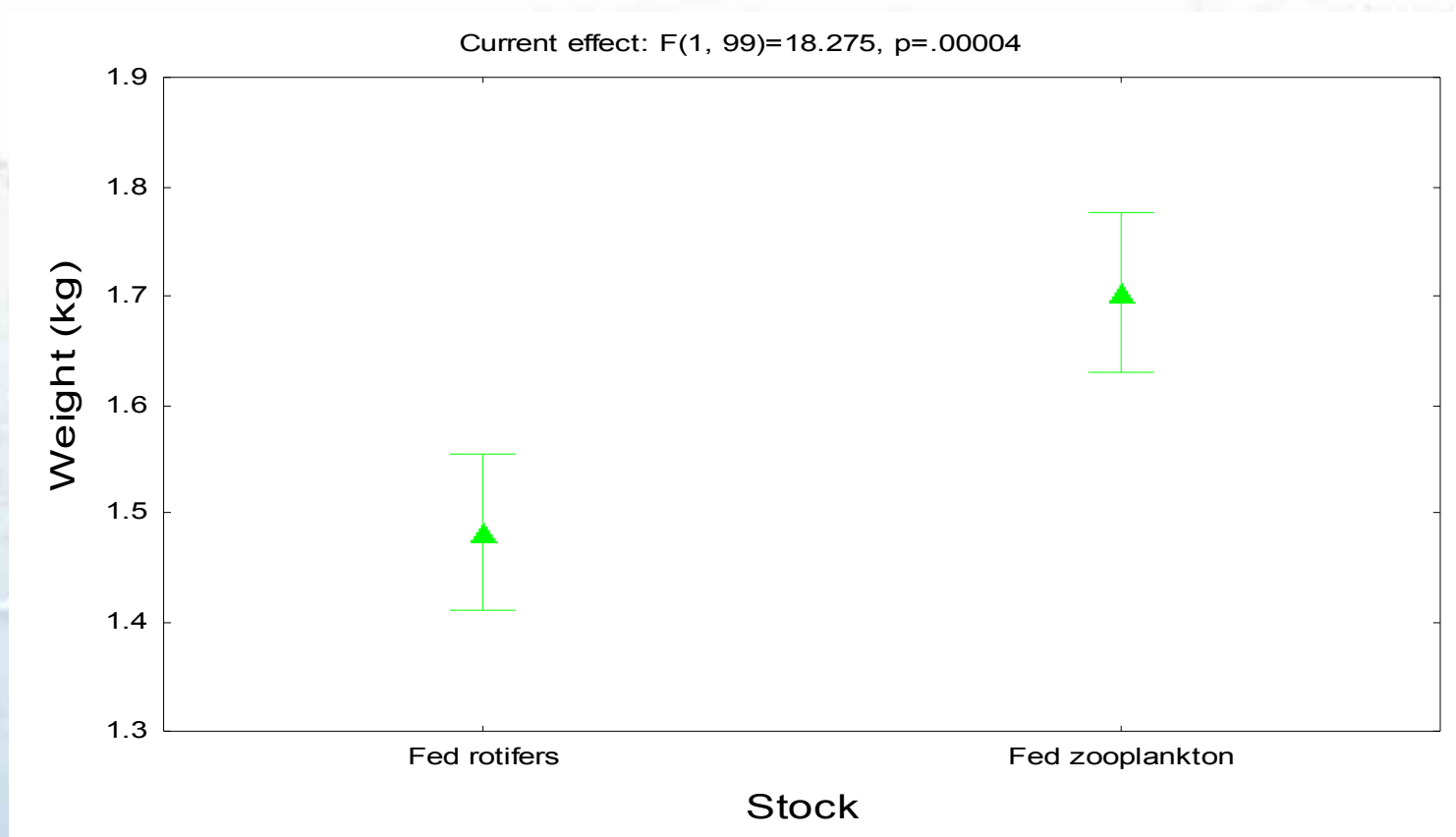


20-30% higher juvenile growth in Z group

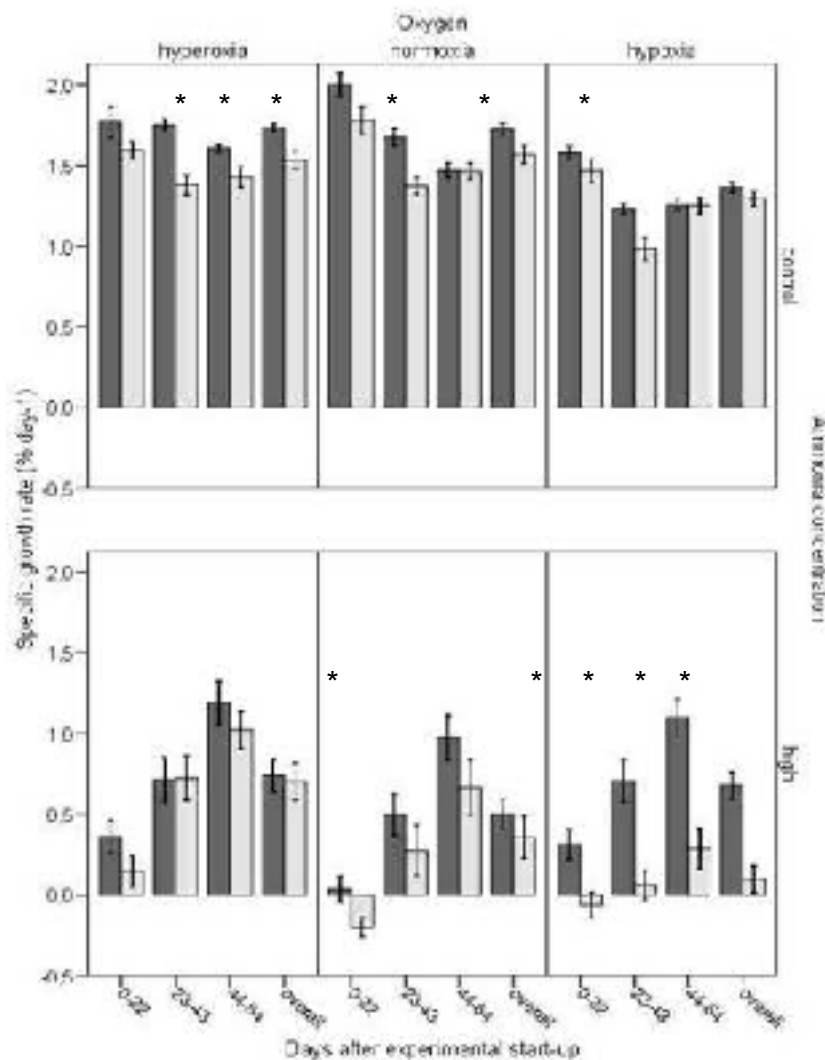
Period

Inslund et al. (2006)

Long term effect is approx. 15-20 %



Juvenile performance: oxvaen, ammonia

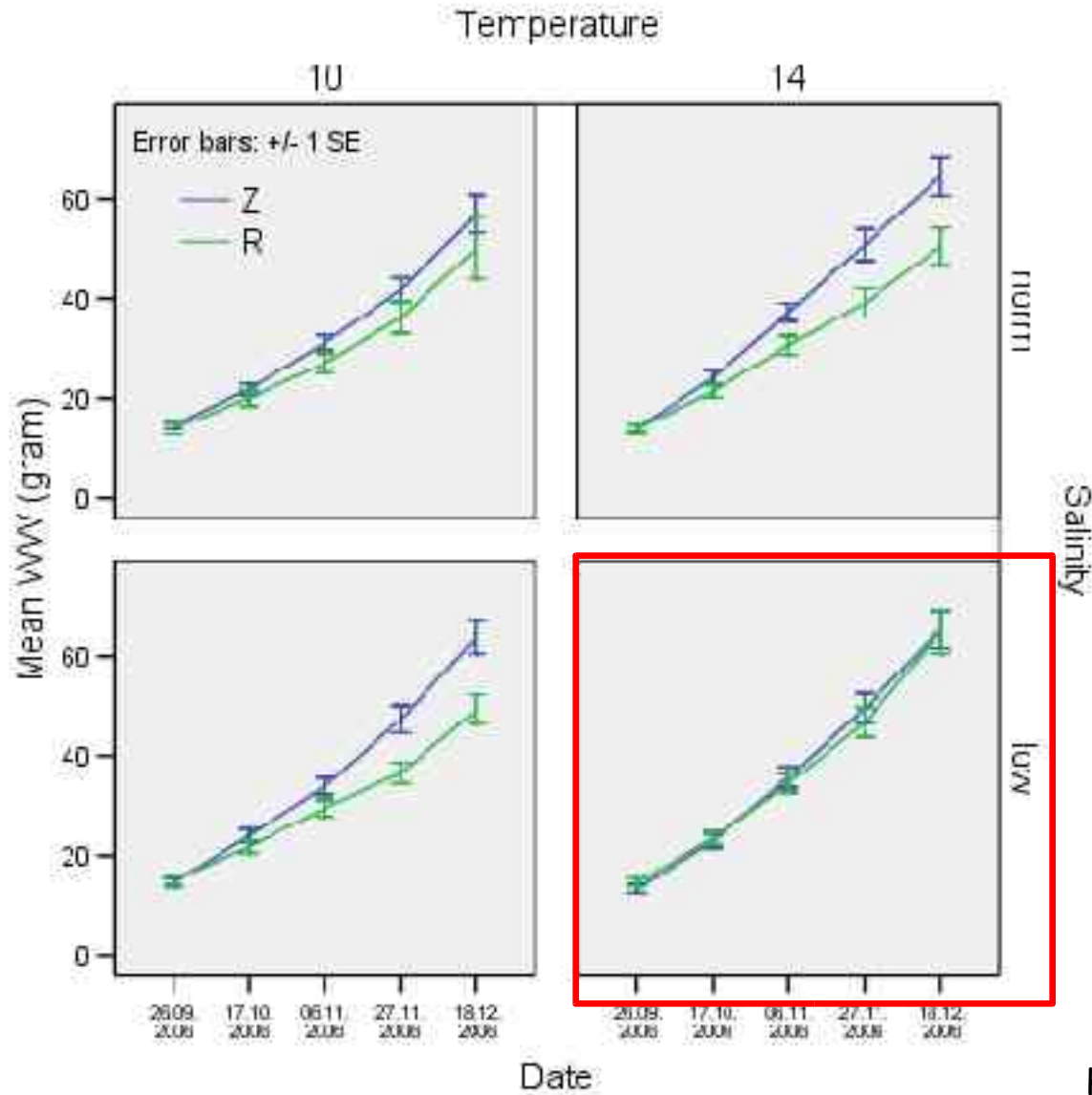


Zooplankton fed fish show higher SGR's under control conditions and at chronically high ammonia exposure

Growth difference most pronounced under least favourable rearing conditions ($127 \mu\text{g}\cdot\text{L}^{-1}$ UIA-N)

Koedijk et al. (in press)

Juvenile performance different T and S



Z-fish (juveniles) perform better under different conditions, but no effects when conditions are optimal

Optimal environment??



Conclusions - Startfeeding methods

- Startfeeding methods have large impacts during the whole lifecycle
 - Higher growth (20-30% difference)
 - Approx. 20% size difference at slaughter
 - Higher feed intake (20%) and feed conversion (22%)
 - Deformities more frequent in fish startfed on rotifers (4% vs. 14%)
 - Higher ammonia tolerance in zooplankton group
 - First feeding diet determines the adaptative response to changes in salinity



Optimal early rearing:

**Longterm effect of
temperature and
photoperiod**

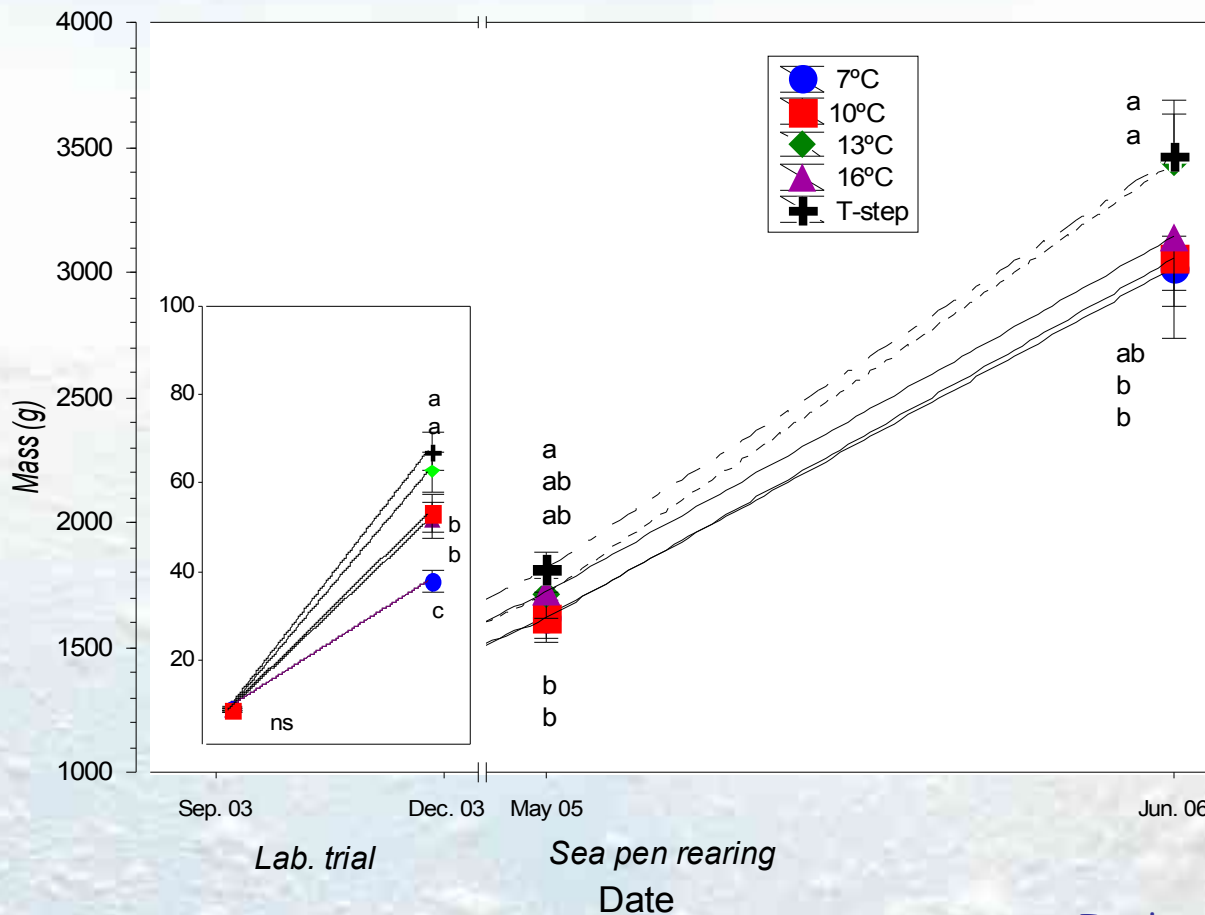


Methods

- Juvenile cod reared at different temperatures for three months
- 7, 10, 13 and 16°C, T-step group (16 → 13 → 10°C)
- Juvenile cod reared at different photoperiods (LDN vs. LD24:0) for three months
- Juveniles moved to sea pens and followed until slaughter (30 mnd)



Long term effect of temperature on growth

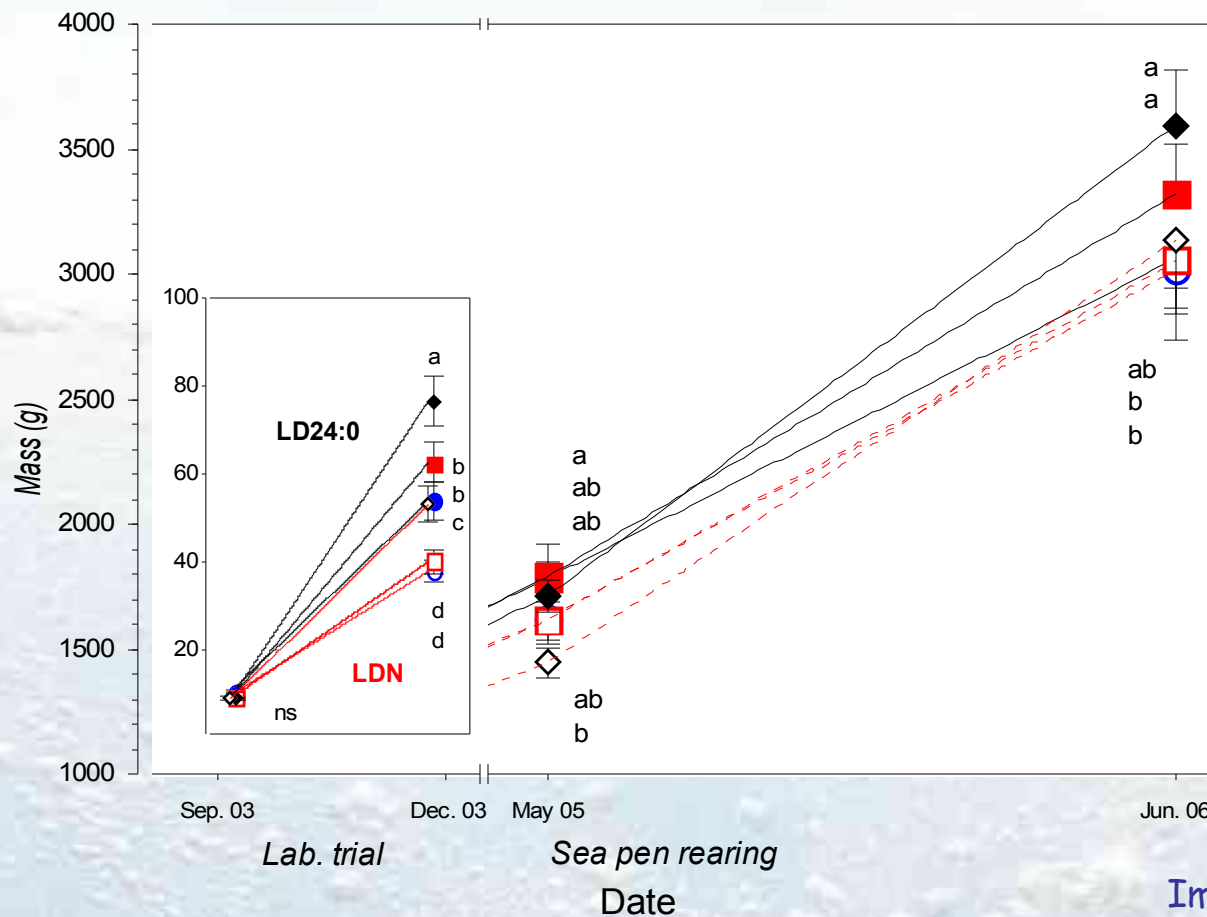


15-20%
difference

Imslund et al. (2007)



Long term effect of photoperiod on growth



10-22%
difference

Imsland et al. (2007)



Main findings - temperature and photoperiods

- Growth difference after three month lab trial is persistent and can be tracked throughout the on-growing period
 - Optimal temperature conditions during the three month period resulted in 15-20 % larger fish at slaughter
 - Continuous light for three months (10-80 g) period resulted in 10-22 % larger fish at slaughter
- Hepato-somatic indices were similar in all groups
- The increased growth did not effect the maturation as gonado-somatic indices were similar in all the original experimental groups



Thank you for your
attention