

Underyearling production strategies

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Time is money

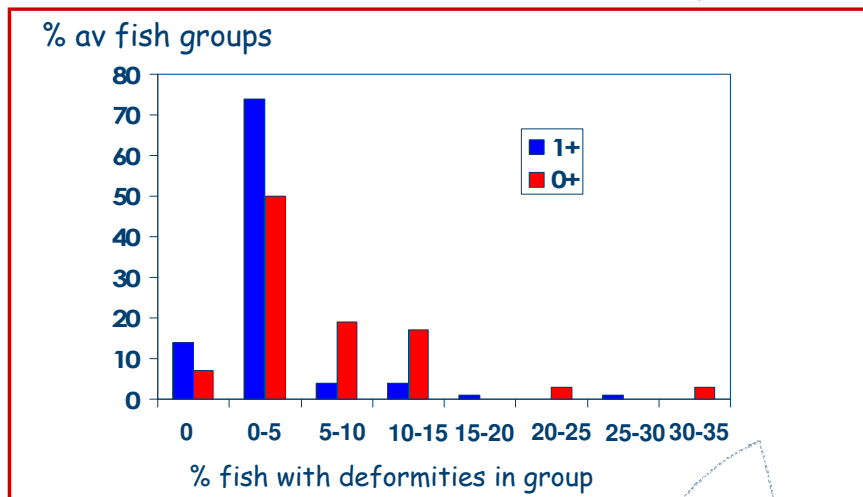
- Present situation:
 - Of the 200+ mill smolts per year in Norway, 30-50% are underyearlings (0+)
 - Expected to increase
- Pressure towards early seawater transfer
 - Oktober >> august ?
- Pressure towards bigger smolts
- The time table doesn't add up!

Time conflict

- First feeding to start photomanipulation: 5 months?
- Photomanipulation to seawater transfer: 3 months?
- Size recommendation, vaccination: > 40g?
- Temperature recommendation, vaccination:
- Early egg delivery?
- Is it possible to cut some corners?
- What are the consequences?

Prevalence of deformities

Field data, commercial farms, mid-Norway 2003



1+: 3,2% of fish with recorded deformities at 1,5-2 kg
88% of groups had <5% fish with deformities

0+: 6,5% of fish with recorded deformities at 1,5-2 kg
57% of groups had <5% fish with deformities

"The underyearling project"

- Project objectives
 - To identify risk factors for deformities in production of underyearlings
 - To study cardiac development as well as skeletal development
 - Observations of small and rounded or abnormally shaped hearts in large fish



 Nofima

Exp. 1 Temperature in parr stage

- Temperature in parr stage
 - Temperature recommendations of 12°C from first feeding and throughout juvenile stage
 - Pressure from producers: What about 13°C? 13,5°C? 14°C?
- Experiment
 - 12°C, 13°C or 14°C from first feeding to start photomanipulation (20g)
 - Common rearing at 12°C through photomanipulation, seawater period in common cage
- Not conclusive, 12>13<14 °C
- Some potential sources of error

 Nofima

Time is money, but how much can be gained by increasing temperature?

- Calculations done based on Skrettings Club-N growth tables
- In Nofima Sunndalsøra, we predict growth within +/- a few days with these tables
- From 0,2 to 20g:
 - 12°C 18 weeks
 - 13°C 16-17 weeks
 - 14°C 15 weeks
- The BIG difference:
 - At 14°C, the fish get a quick start, but slow down later
 - At 12°C, the fish starts slower, but maintain a steady speed
- Is it worth the risk?



Exp 2 Temperature during smoltification

- What are the effects of high temperatures during photomanipulation and smoltification?
- Especially relevant in underyearling production:
 - Winter signal (12D:12L) will normally occur during summer when natural temperatures are high

12D:12L	24L
12°C	12°C
16°C	16°C
12°C	16°C
16°C	12°C



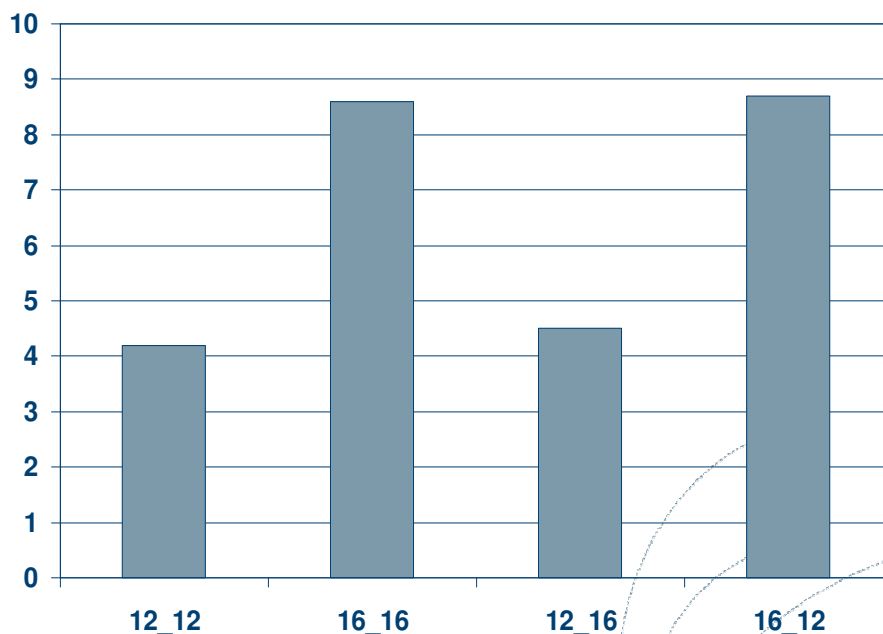
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		24L	
		12°C	16°C
12D:12L	12°C	12-12	12-16
	16°C	16-12	16-16

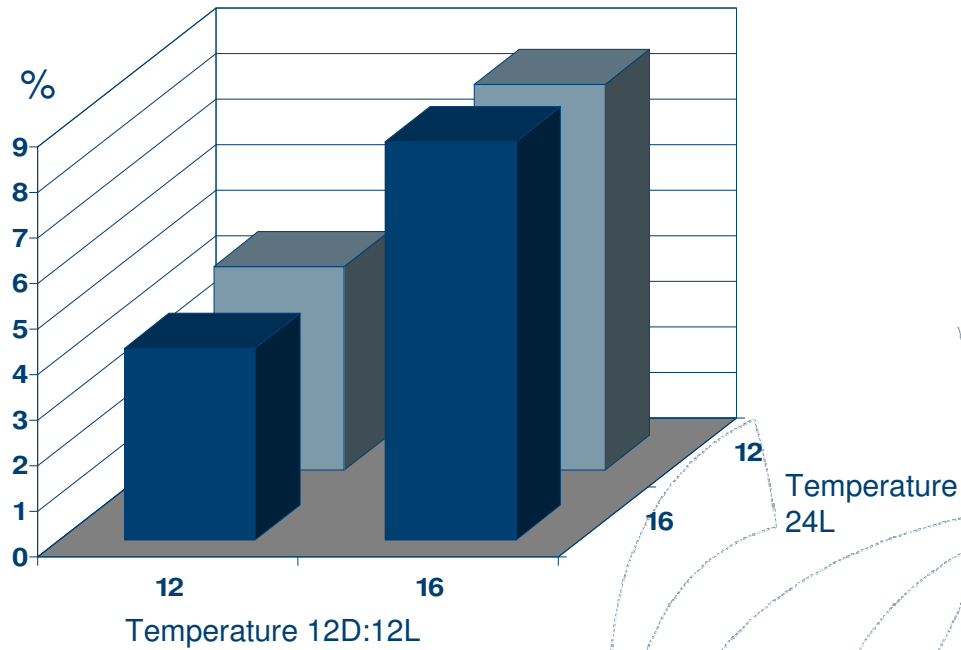


Spinal deformities at harvest in A. salmon underyearlings Effect of temperature regime during smoltification



Spinal deformities at harvest in A. salmon underyearlings

Effect of temperature regime during smoltification



Cardiosomatic index in A. salmon smolts

CSI: Heart weight relative to body weight

		24L	
12D:12L		12	16
12		0,1165	0,1003
16		0,0982	0,1095

Exp 3 Procedures during photomanipulation

1. Epidemiology data:

Vaccination during 24L doubled the risk of spinal deformities at harvest compared to vaccination during 12D:12L

2. Observations from commercial production:

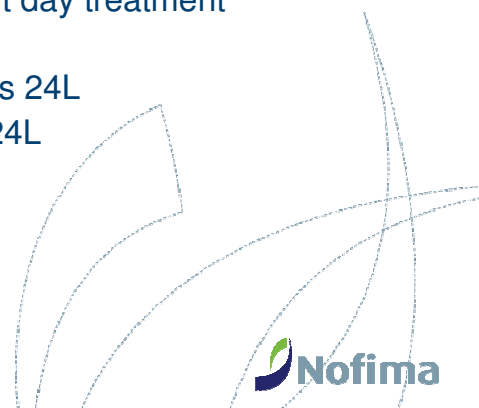
Pressure towards a shorter 12D:12L period
6 weeks > 5weeks > ??



Exp 3 Procedures during photomanipulation

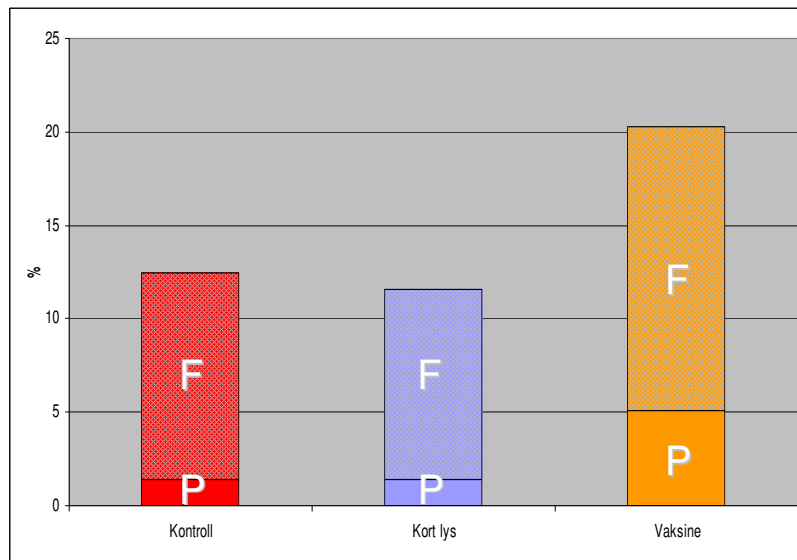
- Experiment started at start of photomanipulation, mean weight 21g
- **Control** 6 weeks 12D:12L, 6 weeks 24L
Vaccination at end of short day treatment
- **Short winter** 4 weeks 12D:12L, 8 weeks 24L
Vaccination at end of short day treatment
- **Timing of vaccination**
6 weeks 12D:12L, 6 weeks 24L
Vaccination first week of 24L

3 og 3 parallel groups, common sea cage
Harvest at ca 3,5 kg



Spinal deformities at harvest

Effects of deviations from standard smoltification procedures (0+)

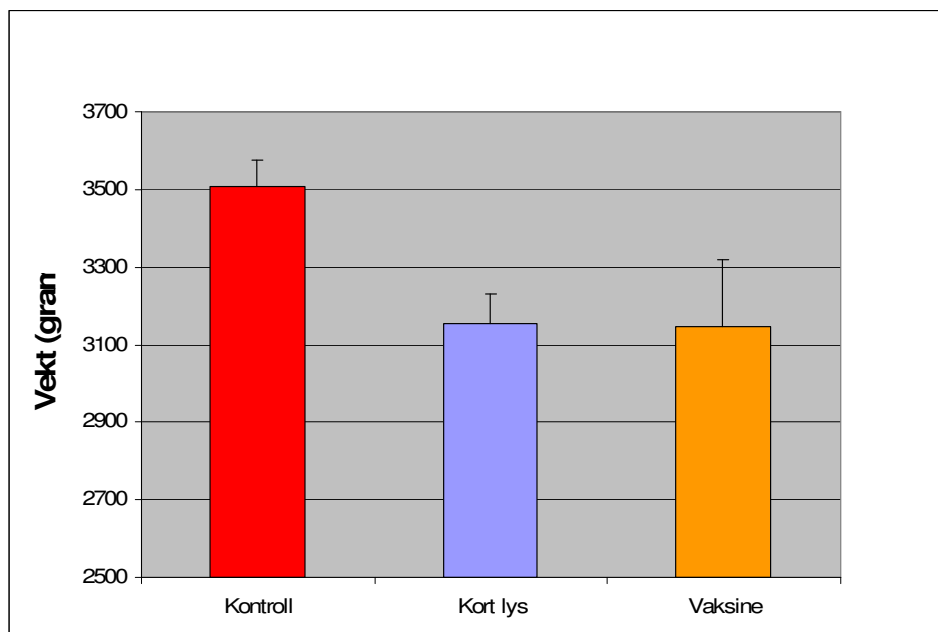


F: Fusjoner
P: Platyspondyli



Weight at harvest

Effects of deviations from standard smoltification procedures (0+)



Exp 4 Water quality during photomanipulation

- Based on observations that growth rate during smoltification is variable and unpredictable and generally not well monitored
 - Biomass may be poorly controlled
 - Water supply may be unpredictable
 - Oxygen supply control may be poor
- Max biomass in underyearling production during summer when natural temperatures are at the highest
- Max biomass in underyearling production at a time when yearlings start gaining weight and water supply may be short
- "Just waiting to send the fish off"



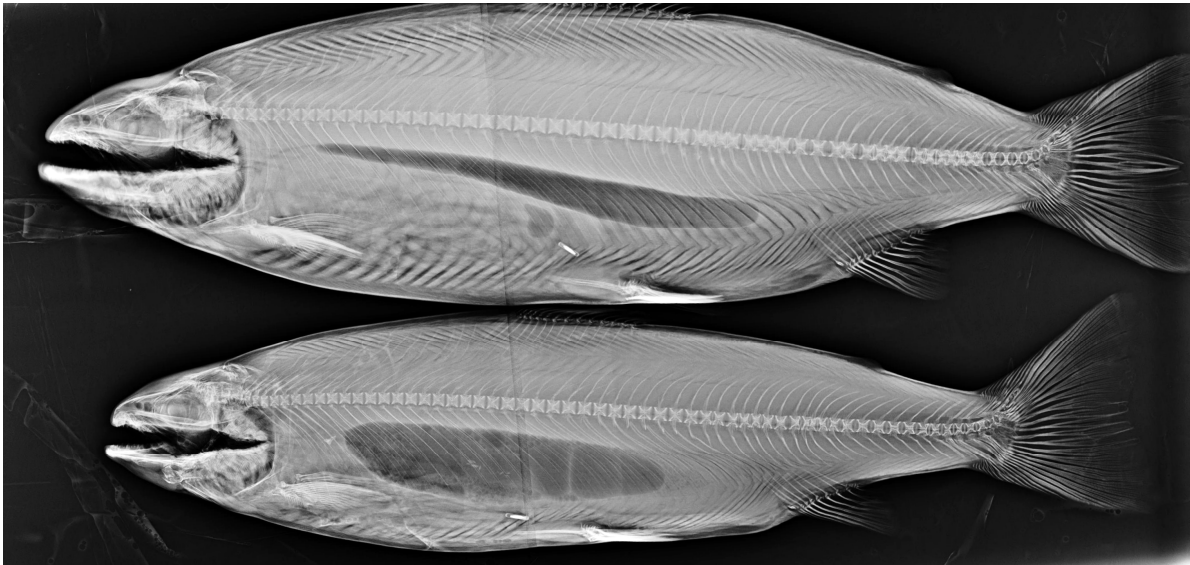
Water quality, experimental setup

- Control Low biomass, no oxygen supply
- Normox High biomass, oxygen added to 80-90% saturation in outlet water
- Hyperox High biomass, oxygen added in excess, 110-130% in outlet water
- Water temperature controlled at 12°C
- Oxygen supply adjusted manually, based on daily O₂ readings



Water quality, results

- High number of fish with "true" platyspondylia



Water quality, results

- Fish with platyspondylia
 - Highest in the high density, normox group
 - Double, compared to the control and hyperox
- There are still some things we don't understand!
- More to be learned from this material
- The normox group suffered the highest variation in O₂ saturation during 12D:12L, from close to hypoxia during light hours with feeding, to hyperoxia during dark hours with no feeding