

Effect of temperature during early life stages on the development of malformations in cod

Project period 2004-2005

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RTD: AKVAFORSK

Experimental setup:

Different temperature regimes from first feeding onwards:

- Constant 12°C
- Constant 8°C
- Gradual increase temperature increase from 6-12°C during 7 weeks
- 4 replicates per treatment
- The fish was followed until approximately 50 gram size
- 75 fish were x-rayed per tank

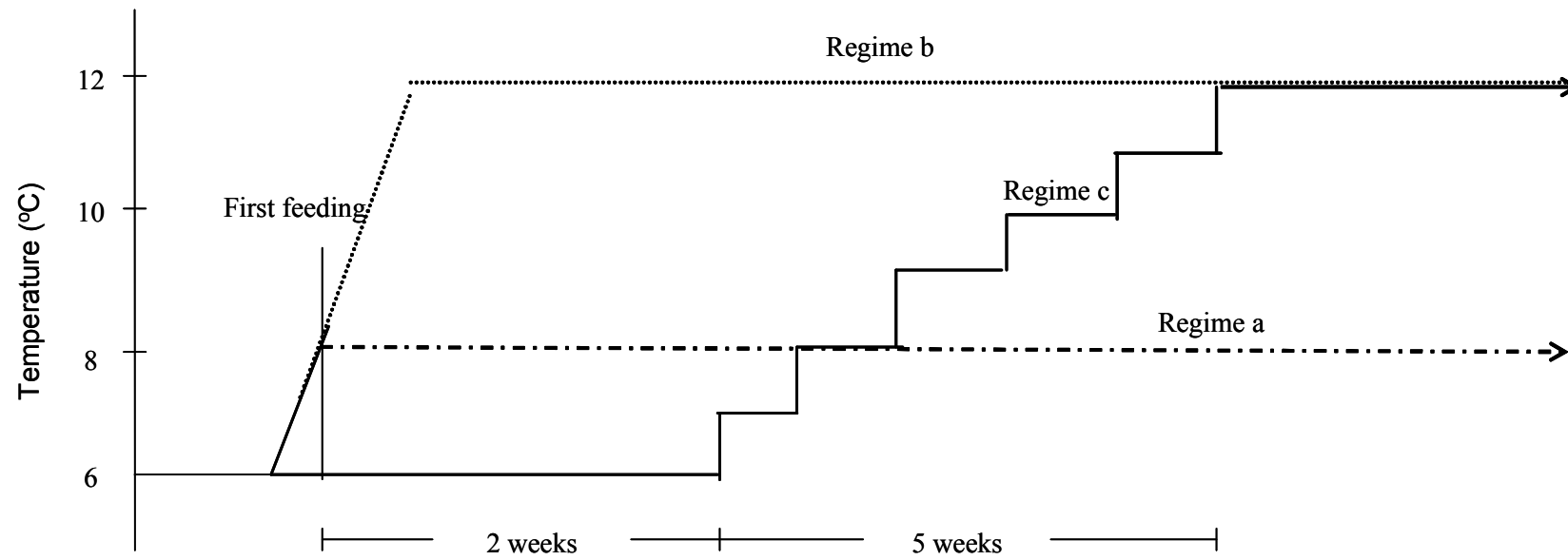
Experimental setup II:

- First feeding was done in 95 L circular flat-bottomed tanks
- Conservative feeding regime:
 - 38 days enriched rotifers
 - Days 39-50: mixed feeding rotifers and *Artemia*
 - Days 80-97: mixed feeding *Artemia* and dry feed
- Algapaste of *Isochrysis* and *Pavlova* was used during the entire live feed period

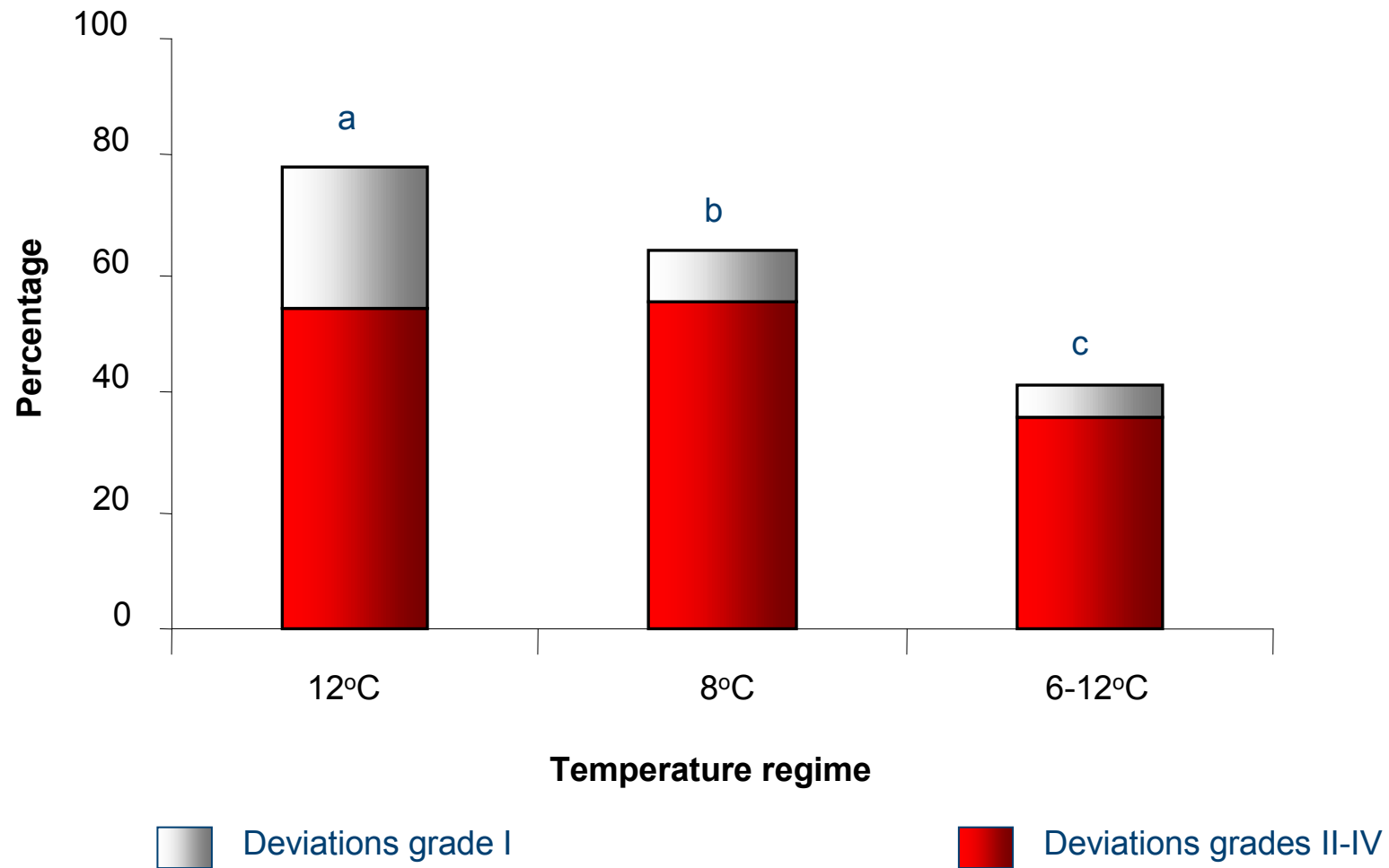
Recordings:

- Temperature (continuous logging)
- Final weight after 7 months of feeding
- Deformities after 7 months of feeding (radiography)

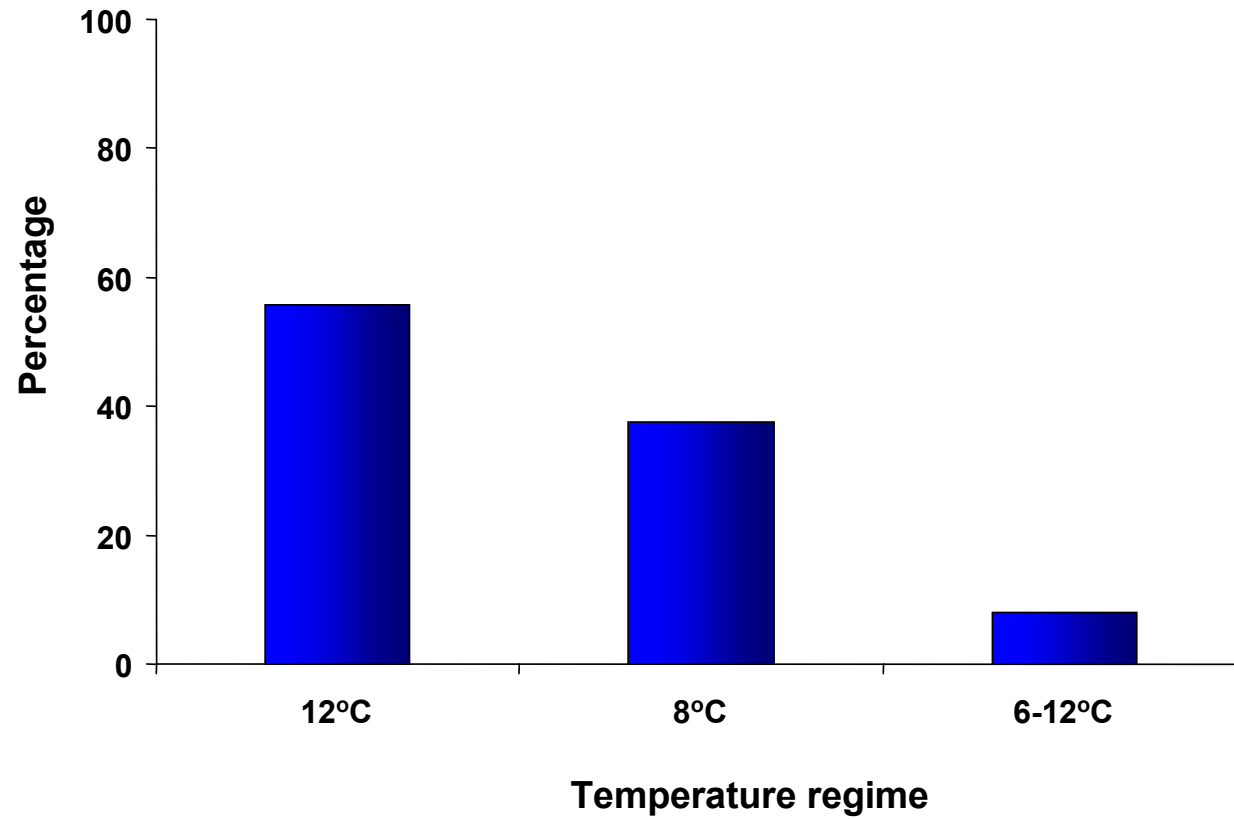
Experimental set up



Frequency of fish with recorded deviations



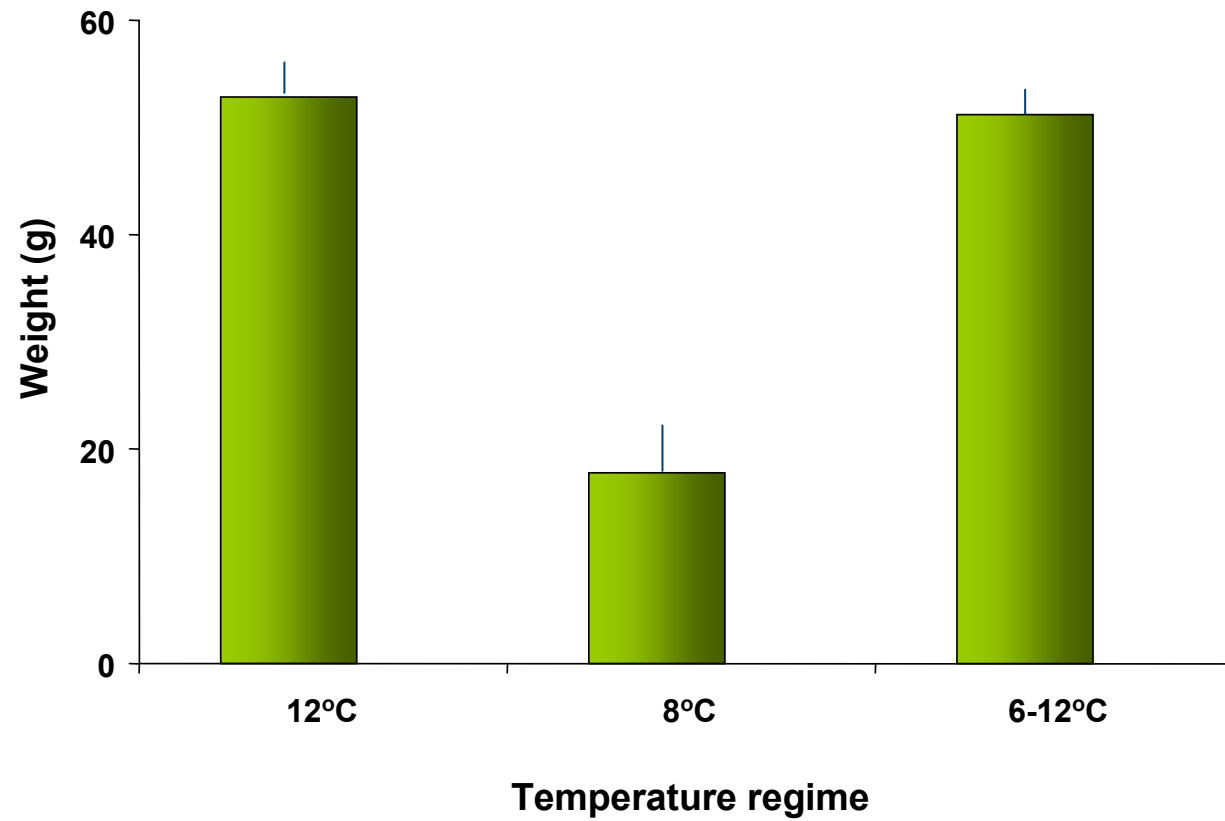
Frequency of “star gazers”



Incidences and grades of kyphosis to the neck at different temperatures

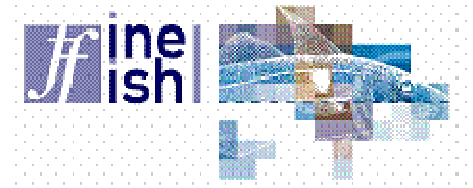
Temperature regime	12 °C	8°C	6-12°C
Grade			
I	30.3 %	23.3 %	7.9
II	14.2 %	12,0 %	-
III	7.8 %	2.1 %	-
IV	-	-	-

Final weight



Conclusions:

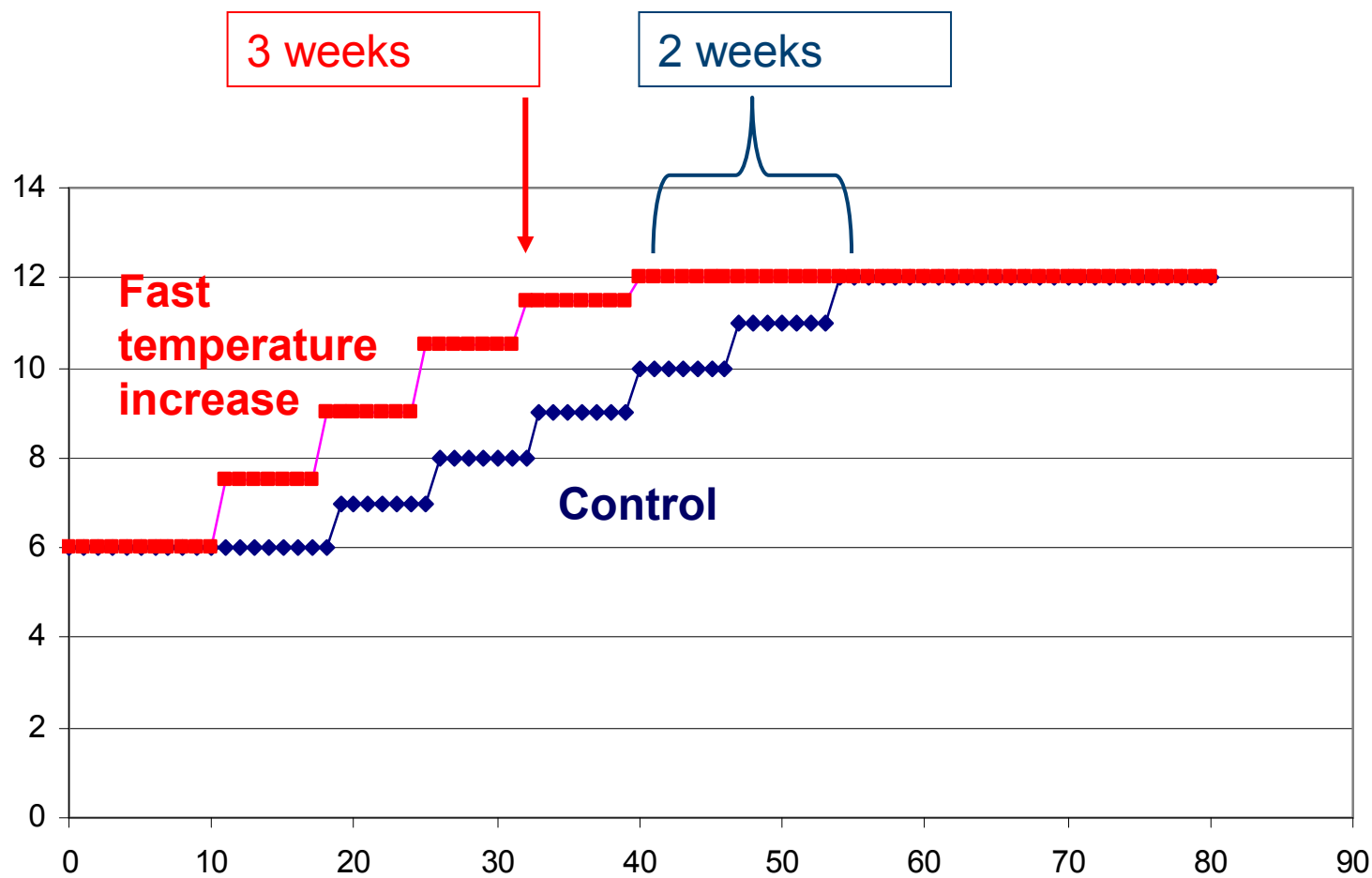
- Frequency of fish with deviations increased with increasing start feeding temperature
- Frequency of "star gazers" increased with increasing start feeding temperature
- There was no difference in growth between constant 8°C and gradual increase from 6-12°C
- Frequency of fish with good growth and less deviations was achieved by a gradual increase from 6-12°C

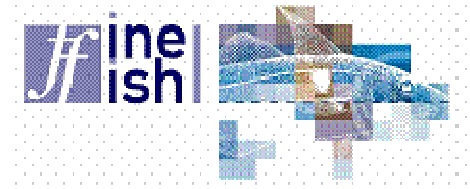


2007

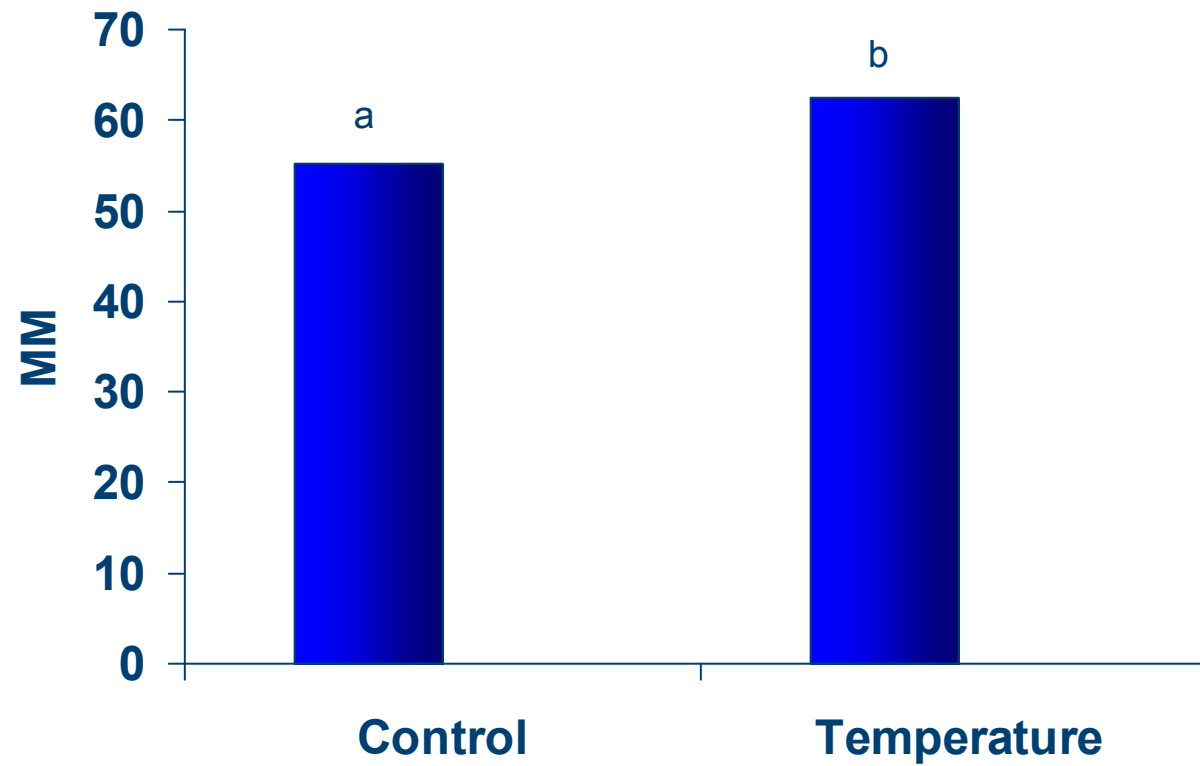
The best temperature regime from 2005 was used as control (gradual increase from 6 to 12°C during 7 weeks)

In the experimental treatment the temperature was increased more rapidly (5 weeks)



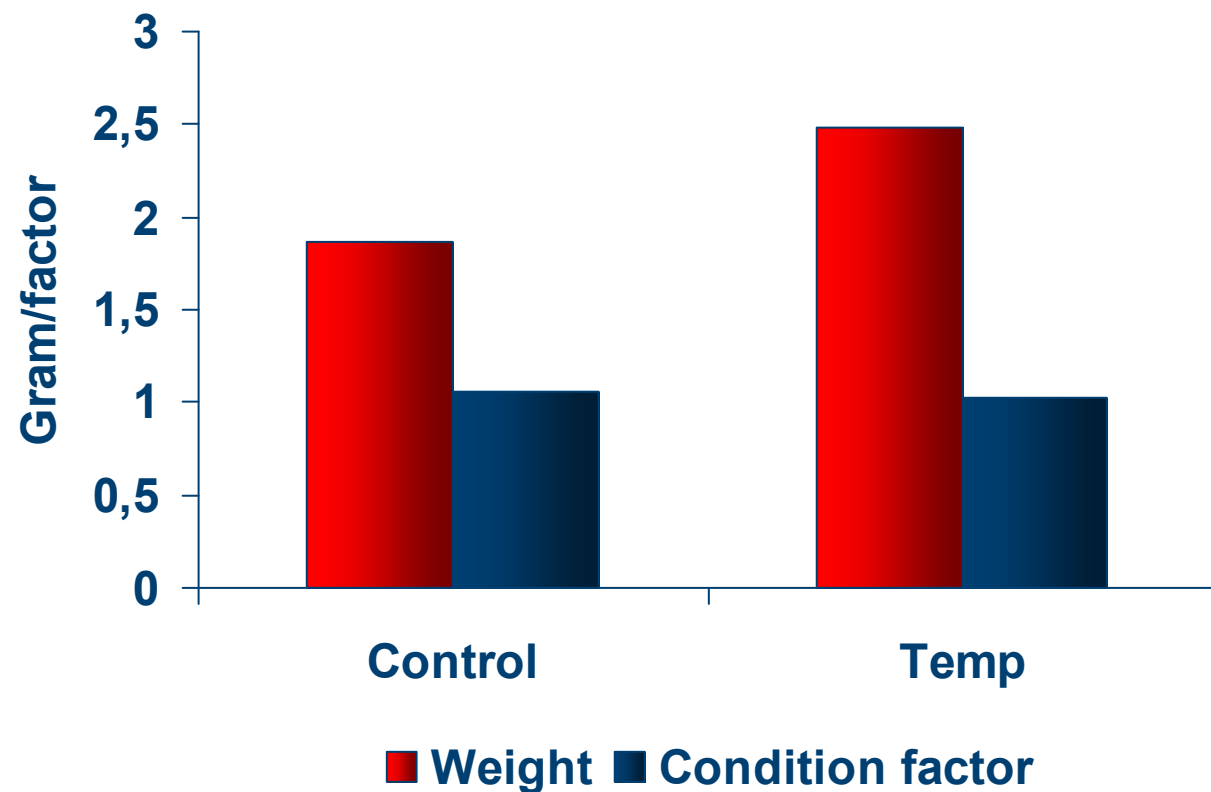


Total length



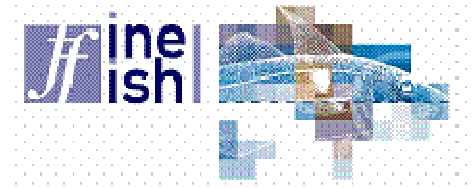
Wet weight and condition factor

No significant differences



Skeletal deformities

Percentage	Control	Temp.
Deformed fish	13,1	16,7
Bent neck	17,9	21,9
Lordosis	2,0	0,0



Conclusions:

- The more rapid temperature increase gave significantly longer fish, but no difference in weight or condition factor
- At the more rapid temperature the percentage of fish displaying skeletal deviations was 3.6% higher than in the control group
- Percentage of fish with bent necks was ~3% higher at the more rapid temperature regime
- Percentage of fish with lordosis was low in both groups; 2% in the control group and 0% in the rapid temperature group

Still best overall result with the control regime, but the long term effects need to be studied