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knowledge makes the difference

# Factors Affecting Fish Quality: Focus on Farmed Salmon

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## What is Fish Quality?

- Quality is many things to different people
  - Consumers
  - Processors
  - Retailers / Food Service
- Quality includes
  - Appearance
  - Texture
  - Eating quality
  - Chemical constituents
  - Food safety
  - Ethical concerns

## Is Fish Quality Important?

- When demand exceeds supply, quality does not pay extra – certification schemes may
- When demand is limiting, then quality is important
- Quality is also important to gain consumer confidence and repeat sales
- If quality varies too much, consumers do not understand this and will purchase something else
- Value added processing can cover a range of quality issues – upgrading poor quality for some products

# Factors Affecting Fish Quality

Which aspects?

- External condition
  - Shape
  - Fins
  - Scales and skin
- Internal condition
  - Fat content
  - Colour and Pigment
  - Gaping
  - Texture
  - Bloodspotting
  - Eating quality
  - Shelf-life
- What can affect these?
  - Genetics
  - Freshwater husbandry
  - Seawater husbandry
  - Nutrition
  - Growth rates
  - Harvest
  - Storage Changes
- There is a lot of variation in what happens in all of these areas (nutrition is probably the least)

# What is Flesh Quality?

## Consumer Assessed

- Appearance
- Eating Quality

## Technological

- Texture
- Processability
  - A lot of value added products made with fish



# Appearance

## External

- Shape
- Cuts and bruises
- Net marks
- Fin and tail erosion
- Eye damage
- Scale loss





# Appearance

## Internal

- Fat – width
- Colour
- Bloodspotting
- Haemorrhages / Bruises
- Vaccine scars
- Gaping



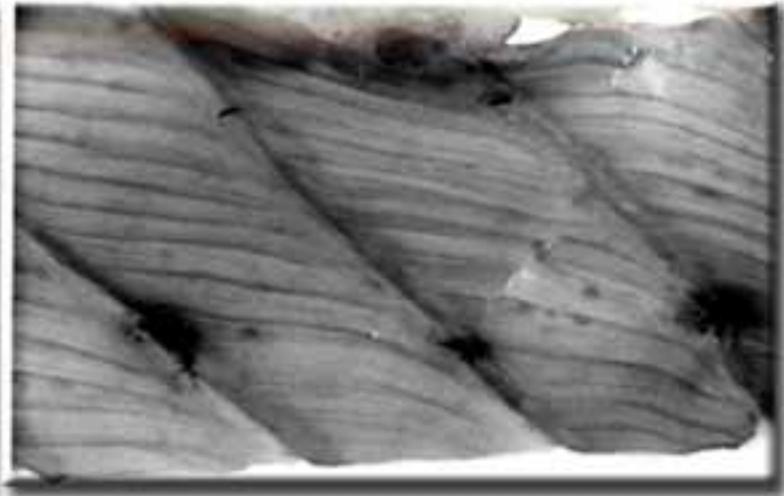
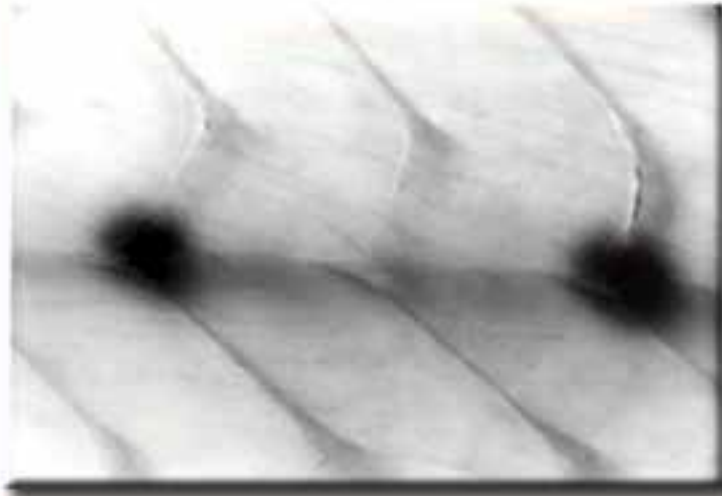
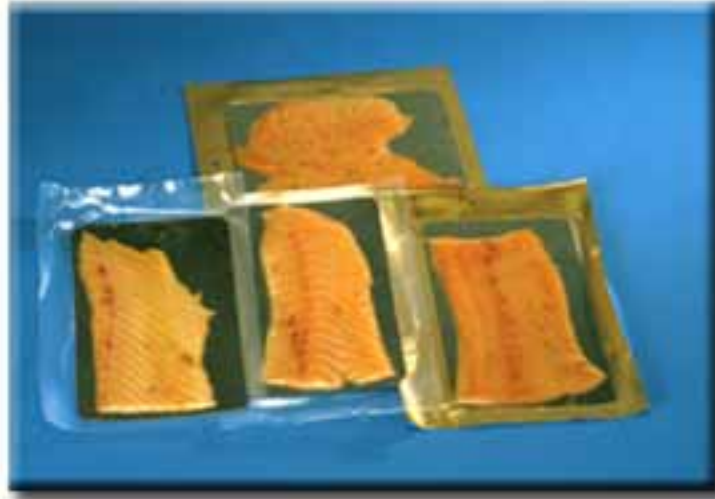
# Texture

- Very important indicator of freshness
- Also essential for all value added products
- Gaping – holes in the product
- Soft flesh – poor yield and rough cuts
- Fatty flesh – poor yield





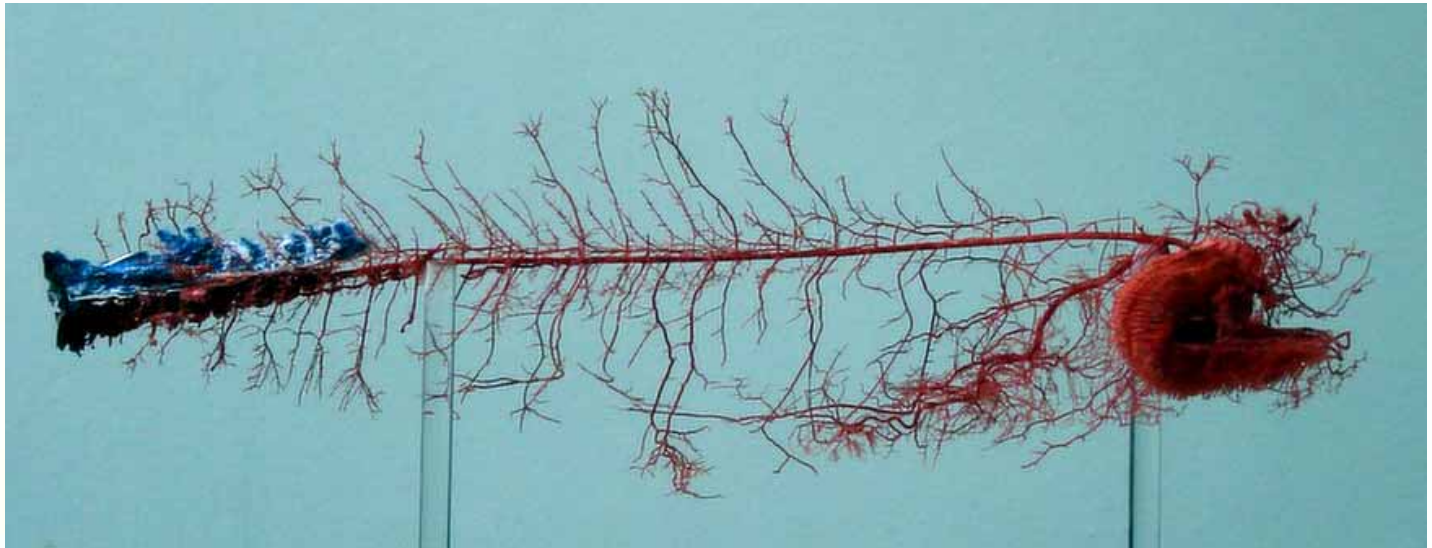
# Bloodspotting



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# Bloodspotting Challenges



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# Vaccine Scars

- Melanin deposits in the muscle and viscera
- Caused by reaction to adjuvants in vaccines



# Technical Quality

- Gaping
- Soft flesh
- Gutting and filleting
- Storage stability
- Freezing
- Salting
- Smoking

# Where is Flesh Quality Affected?





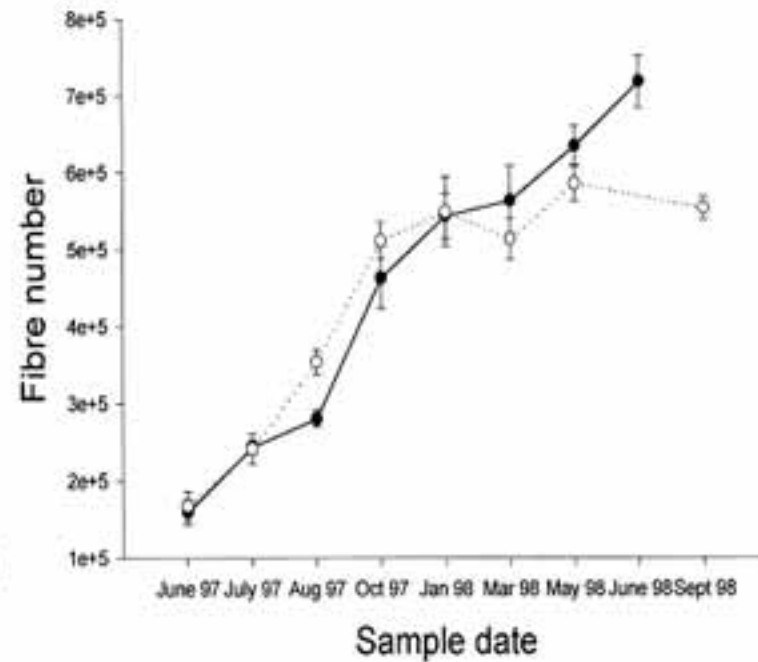
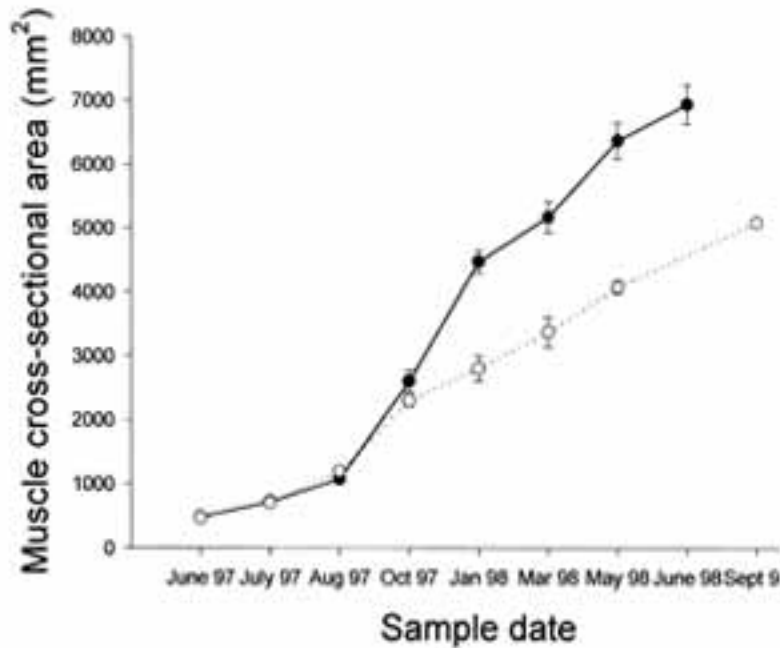


# Genetics

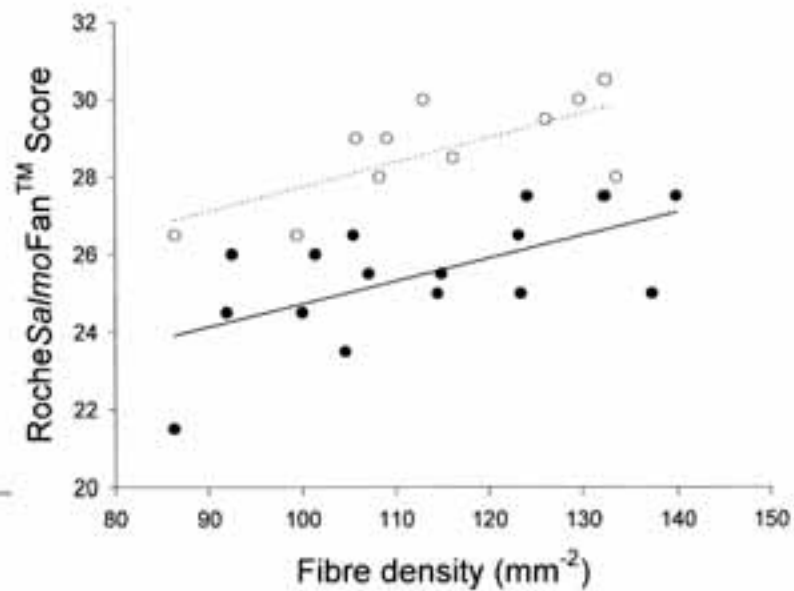
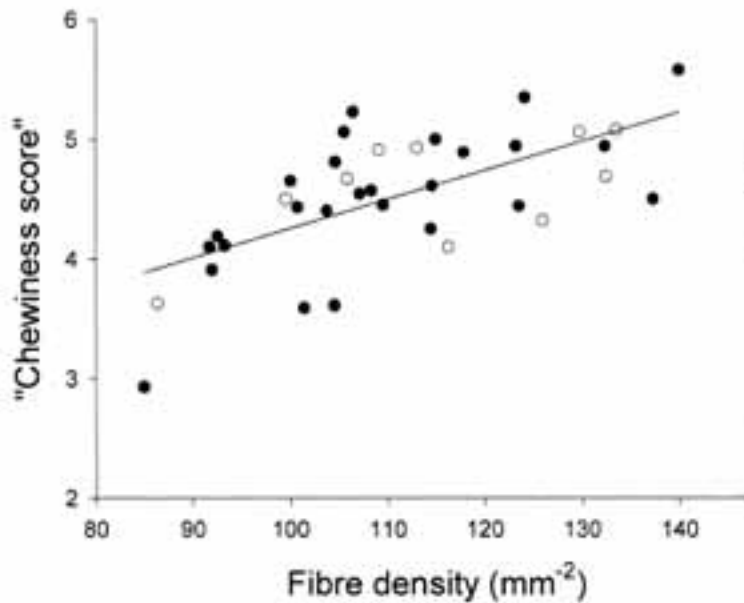
- Growth rates
- Fat
- Colour
- Muscle Fibre Number
  
- Tool for the future
- Need to develop with value chain
- Target strains for diets



# Stock on Muscle Fibre Number and Area



# Why is Fibre Number Important?

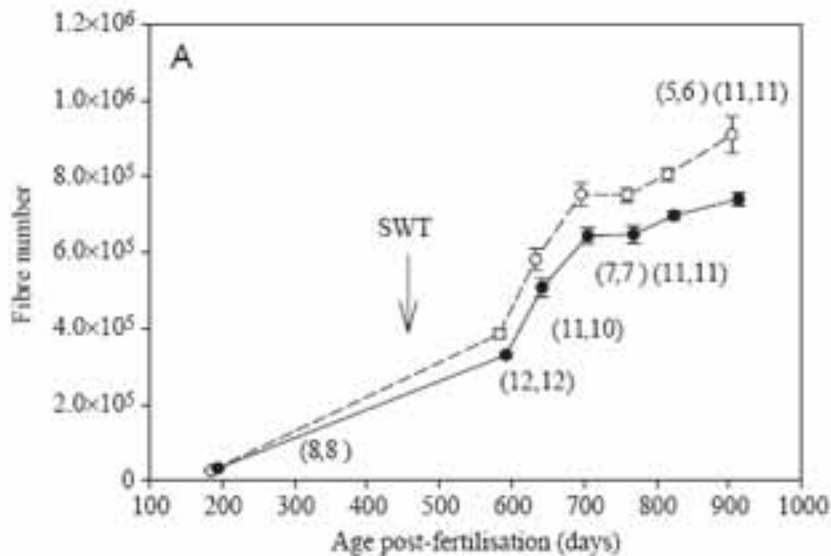


# Egg Incubation Temp

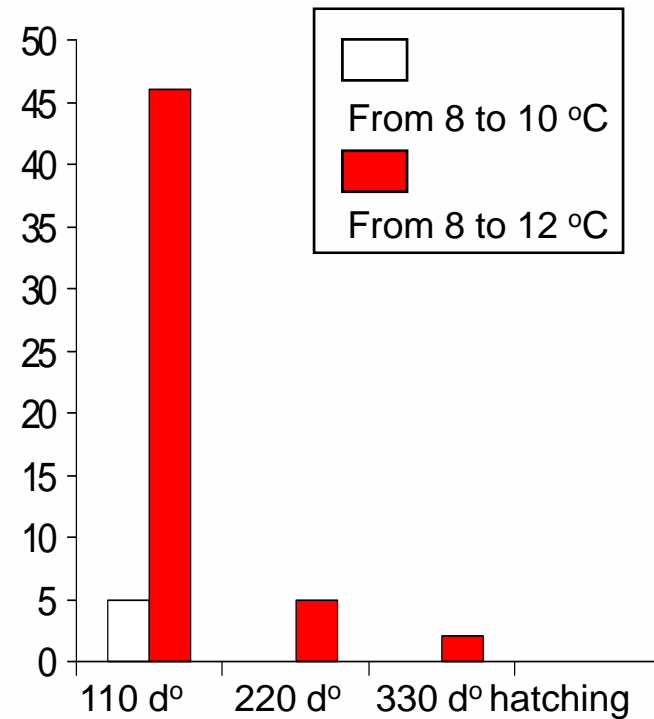
- Range of temps from 2°C to over 10°C been used
- Found that over 8°C and sudden temp fluctuations can cause range of deformities
- Affects muscle fibre number later in life
- Muscle fibre can be affected throughout life, but most strongly affected at this stage
- Affects gene expression
- Higher temp, rates are faster, perhaps not giving enough time for impact of expression
- Could explain some of the deformities observed

# Effect of Incubation Temperature

Muscle Fibre Number  
8 C or 5 to 7°C



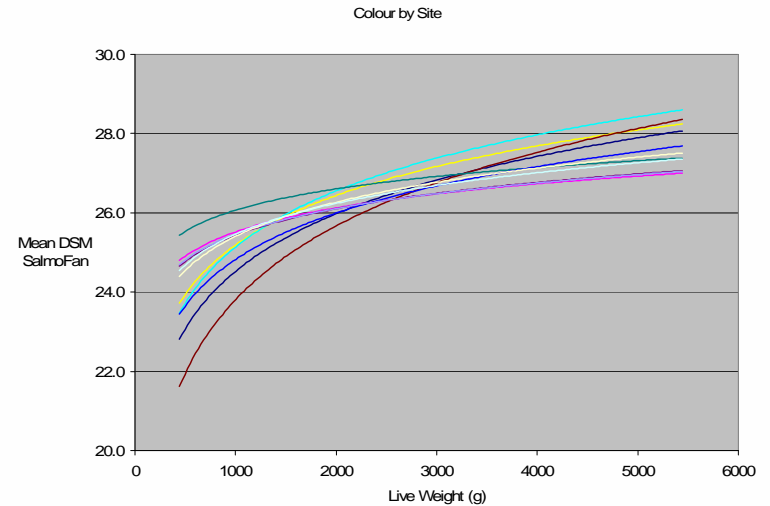
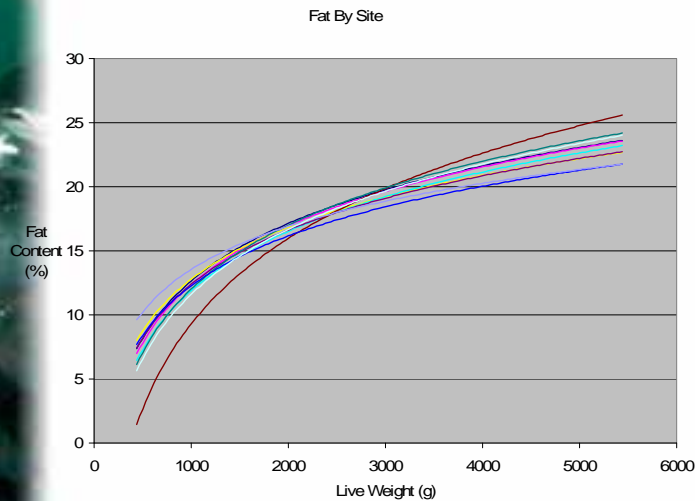
Visceral Deformities  
Incubation Temps



Temperature increased at:

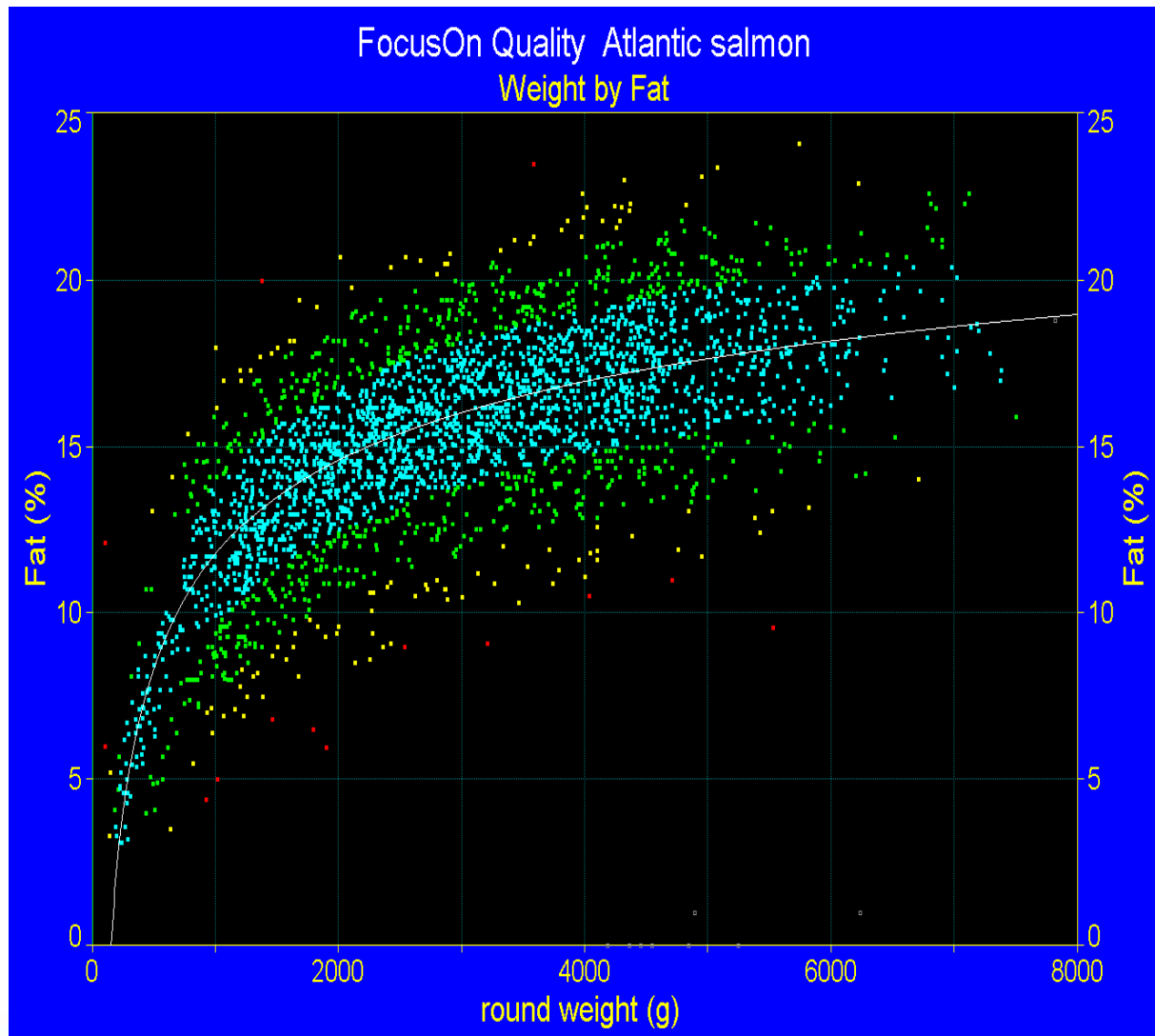
# Farm Site

- Variation between sites – on top of stocks
- Probably due to environmental differences
- Well shown by company monitoring program



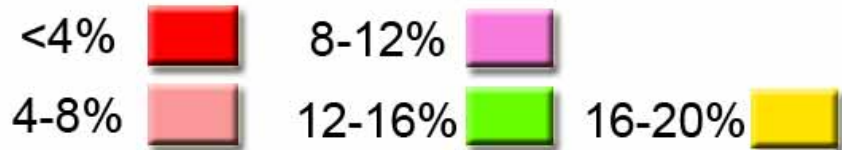
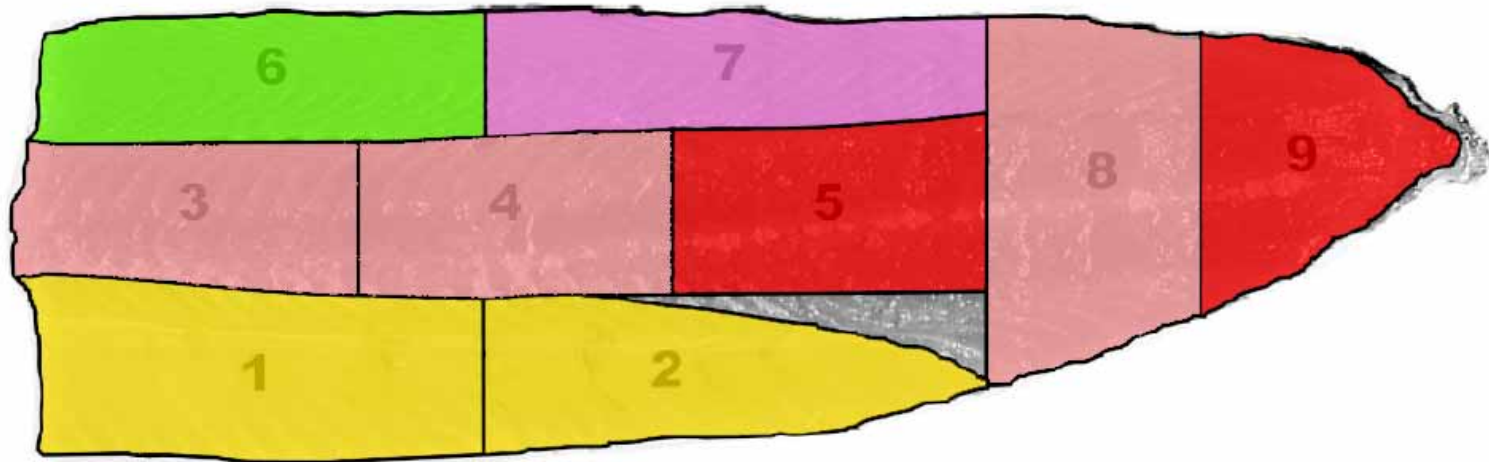


# ATS: Fat content by Live Weight





# Fat in Salmon Fillet

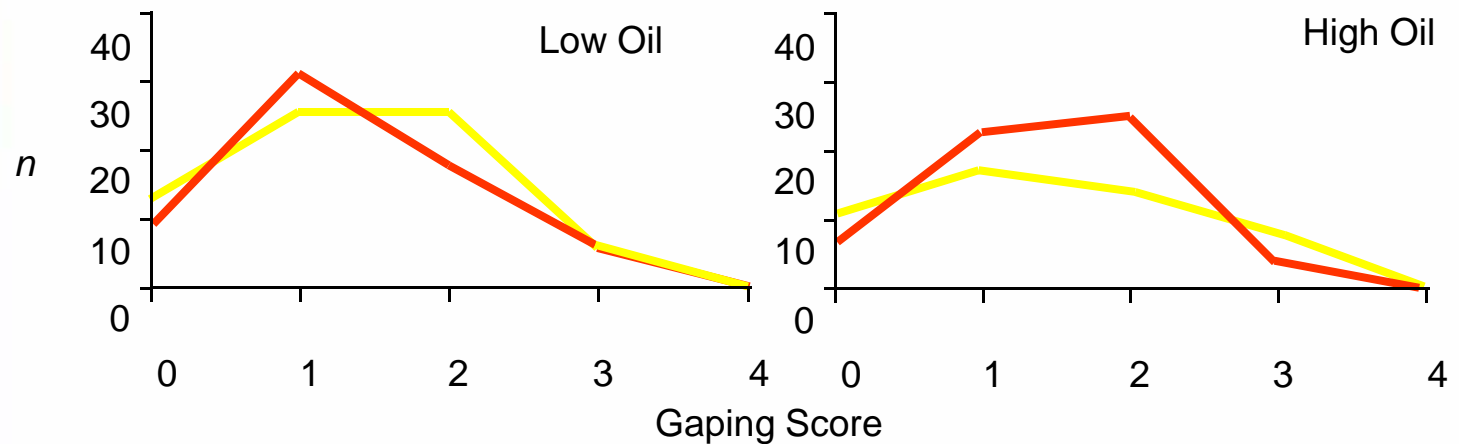


## Gaping / Soft Texture

- Fish are soft generally compare to meat
- Low amount of collagen, etc
- More likely to gape
- Working with customers to develop diets to reduce gaping
- Fixer diet to reduce severe gaping

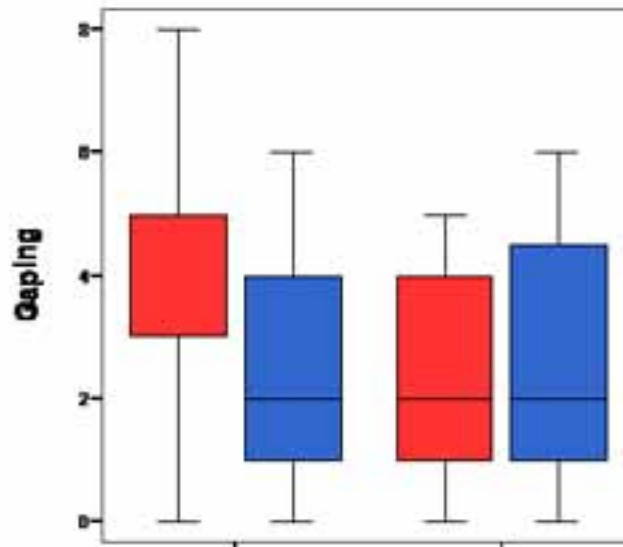
# EWOS Trial Results

- Effect of increased dietary oil on gaping
- Low Oil showed more gaping than High Oil
- But lots of variation within treatments



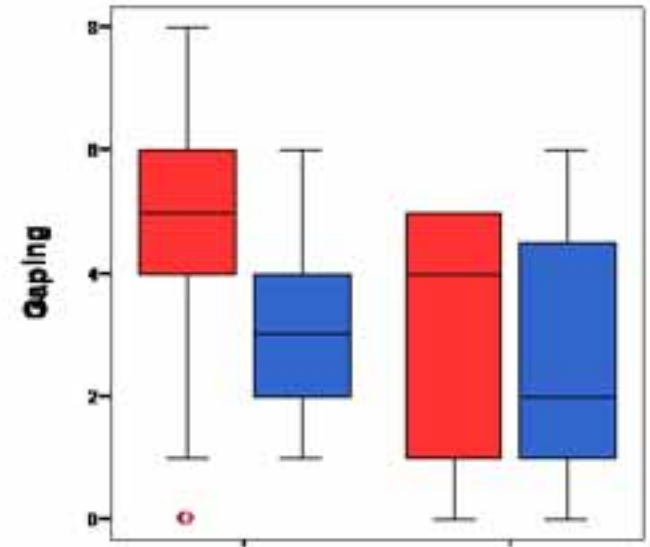
# Diet on Gaping

Gaping Score  
TGC > 0



Dietary Treatment

Gaping Score  
TGC > 1.5



Dietary Treatment

An underwater photograph showing a large school of salmon swimming in clear, greenish water. The fish are densely packed and appear to be moving in a coordinated manner. The lighting is bright, creating a shimmering effect on the water and the scales of the fish. A white, rounded rectangular banner is overlaid on the upper part of the image, containing the word "Starvation".

# Starvation

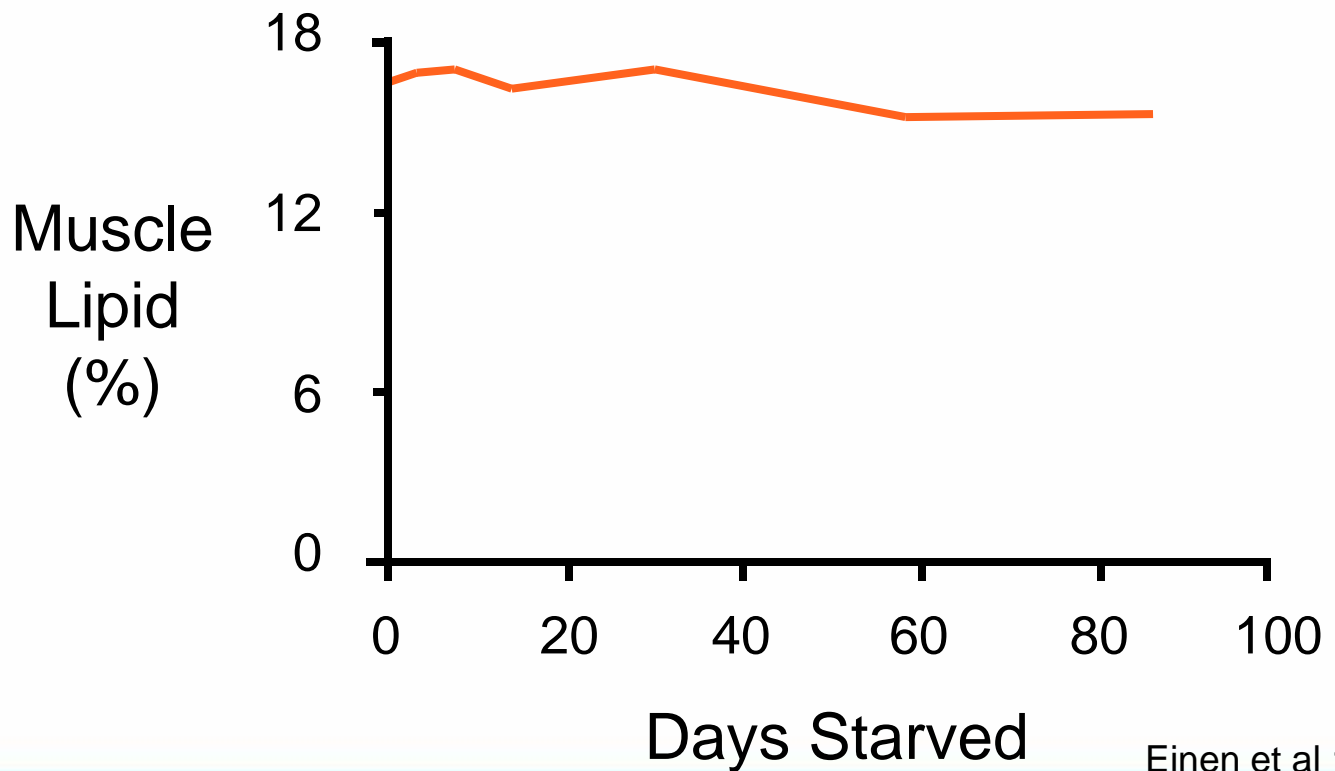
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# Fat Content

Body composition remains unaffected





A nighttime photograph of a fishing boat at sea. The boat is illuminated by warm yellow lights, and a large orange net is visible in the water. The net is held up by a series of floats. The water is dark, and the lights from the boat create a strong reflection on the surface. A white, rounded rectangular banner is overlaid on the image, containing the word "Harvest".

# Harvest

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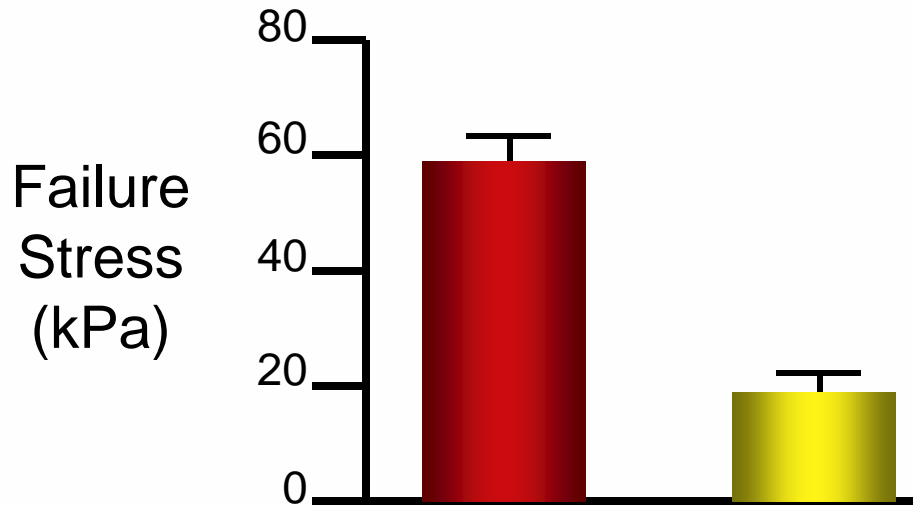
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# Harvest Requirements

- Need a system which keeps the fish calm throughout – stress and activity at any stage will downgrade
  - Trained staff
  - Good systems – keep fish activity low and kill fish rapidly, without stress (good welfare)
  - Monitoring and feedback
- Activity results in muscle lactic acid build up
  - Decreased time to rigor onset
  - Firmer rigor – greater rigor force on muscle
  - Change in muscle protein conformation
  - Loss of colour and translucency
  - Loss of texture and muscle strength



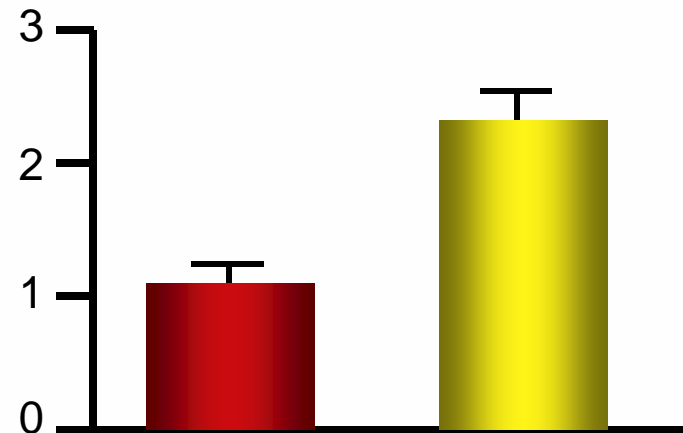
# Change in muscle strength



Less likely to break



Gaping Score



## Harvest Impacts

- Big driver on rigor onset
  - Possible to be 60h pre-rigor
  - Commercially can send fish into full rigor in 45min
  - Best times seen between 30 and 40h
  - Full system control required
- This has a big impact on processing times
- Must not process in rigor or get gaping and poor yields



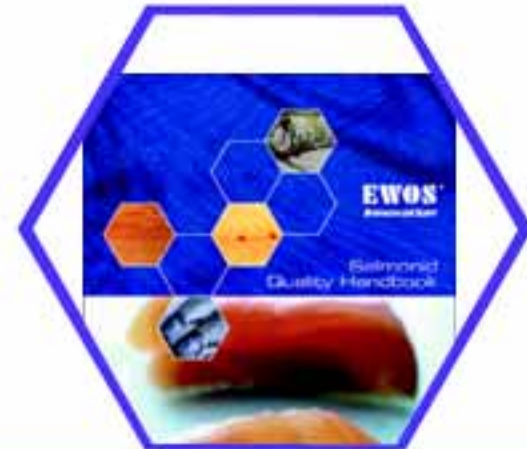
A large white platter filled with salmon sashimi, arranged in a circular pattern. In the center, there are three small white bowls containing dipping sauces: one with dark soy sauce, one with light-colored sauce, and one with green garnish. The background shows a kitchen setting with a green cutting board and other ingredients.

# Quality Conclusions



# Quality is Very Complex

- Lots of factors throughout the value chain affect quality
- Lots of interactions
- Training and awareness at any one point is essential



# The Value Chain is the Strongest Tool

