



MØREFORSKING

Higher share of superior quality salt cured and dried cod (*Gadus Morhua*), when using ice slurry during processing on board long liners.

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## Content:

- Short about the project
- Results production onboard long liner and further production of salt cured and dried cod
- Summary



# Short presentation of the project:

- A cooperate project between industry and fleet
- Financed by
  - Innovation Norway,
  - The Norwegian Seafood Research Fund - FHF
  - Møre and Romsdal County

## The overall objective:

- develop methods for bleeding that ensures good quality of cod for use in salt cured and dried cod industry
  - operating systems for the long line
  - temperature regimes in production on board
  - how this affect the quality of manufactured salt cured and dried cod



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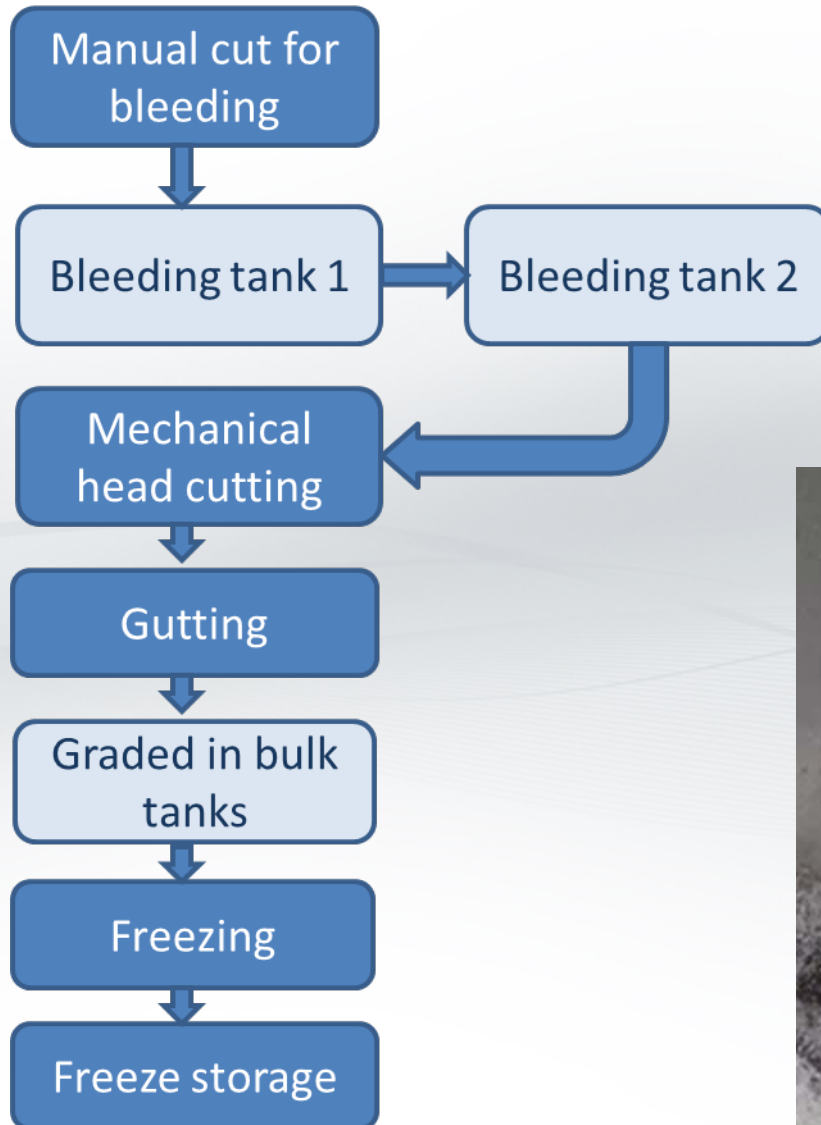


Figure 1: Ice slurry in the production line on board the long liner

# Processing onboard

- Raw material: cod 2,5 – 5 kg
- Bleeding time: 30 min
- Measuring temperature in fish and tanks during production
- Series produced:

| Series | Type                      | Description   |
|--------|---------------------------|---|
| 1      | Control                   | Seawater in bleeding and bulk tanks (normal operation of the long line)                   |
| 2      | Increased water flow      | Increased seawater flow in bleeding tanks (otherwise treated as control)                  |
| 3      | Seawater and ice slurry   | Seawater in bleeding tank and ice slurry in bulk tank (normal operation of the long line) |
| 4      | Ice slurry and ice slurry | Ice slurry in bleeding- and bulk tanks (normal operation of the long line)                |
| 5      | Change in hauling speed   | From 55 hooks/min to 40 hooks/min. Seawater in bleeding and bulk tanks                    |

## Overview of temperature conditions

| Series                    | Temp. bleeding tank 1 (°C) | Temp. bleeding tank 2 (°C) | Temp. bulk tank (°C) | Temp. fish going in to bleeding tank (°C) | Temp. fish going in to bulk tank (°C) | Temp. fish before freezing (°C) |
|---------------------------|----------------------------|----------------------------|----------------------|---|---------------------------------------|---------------------------------|
| Control                   | 5,2                        | 5,2                        | 5,4                  | 2,8                                       | 4,3                                   | 5,1                             |
| Increased water flow      | 5,6                        | 5,5                        | 5,8                  | 2,0                                       | 4,6                                   | 5,3                             |
| Seawater and ice slurry   | 5,4                        | 5,4                        | -0,6                 | 3,7                                       | 5,1                                   | 1,5                             |
| Ice slurry and ice slurry | 2,5                        |                            | -0,7                 | 3,3                                       | 3,1                                   | 0,3                             |
| Change in hauling speed   | 6,1                        | 6,2                        | 6,4                  | 2,4                                       |                                       | 6,5                             |

## Quantity of fish produced in each series

| Series                    | Survey 1 kg | Survey 2 kg | Total kg |
|---------------------------|-------------|-------------|----------|
| Control                   | 1824        | 3120        | 4944     |
| Increased water flow      |             | 5520        | 5520     |
| Seawater and ice slurry   | 1872        | 3456        | 5328     |
| Ice slurry and ice slurry | 2496        | 3360        | 5856     |
| Change in hauling speed   |             | 1032        | 1032     |

## Production of salt cured and dried cod

- Cod cold stored for 3 months
- Thawed approx. 18 hours at approx. 0 – 0,5 °C
- Pickle salted 14 days at 7,9 – 9,7 °C
- Matured for 14 days at 1,2 – 2,2 °C
- Dried for 3 days at 22 °C
- Stored at approx. 2 °C for 3 months



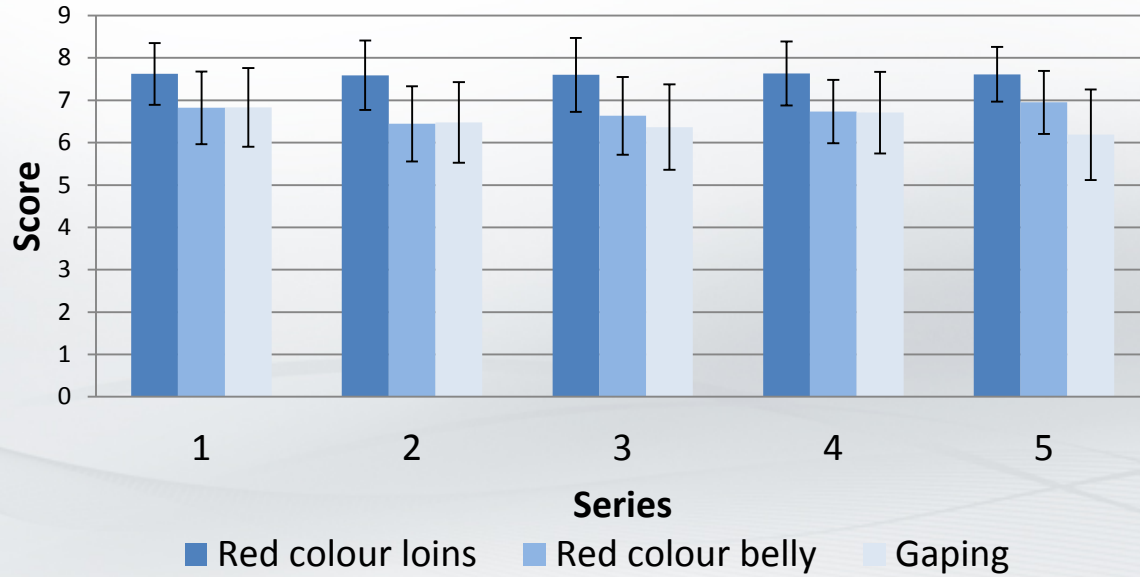
## Several measures were done:

- Instrumental texture measurement
- Procedure for sensory evaluation
- Instrumental colour measurement
- Yield
- pH
- Temperature
- Sorted in superior and universal groups by qualified workers
- A smaller rehydration and shelf-life study was conducted
- Water and salt content in loin.





### Raw material (split cod) description



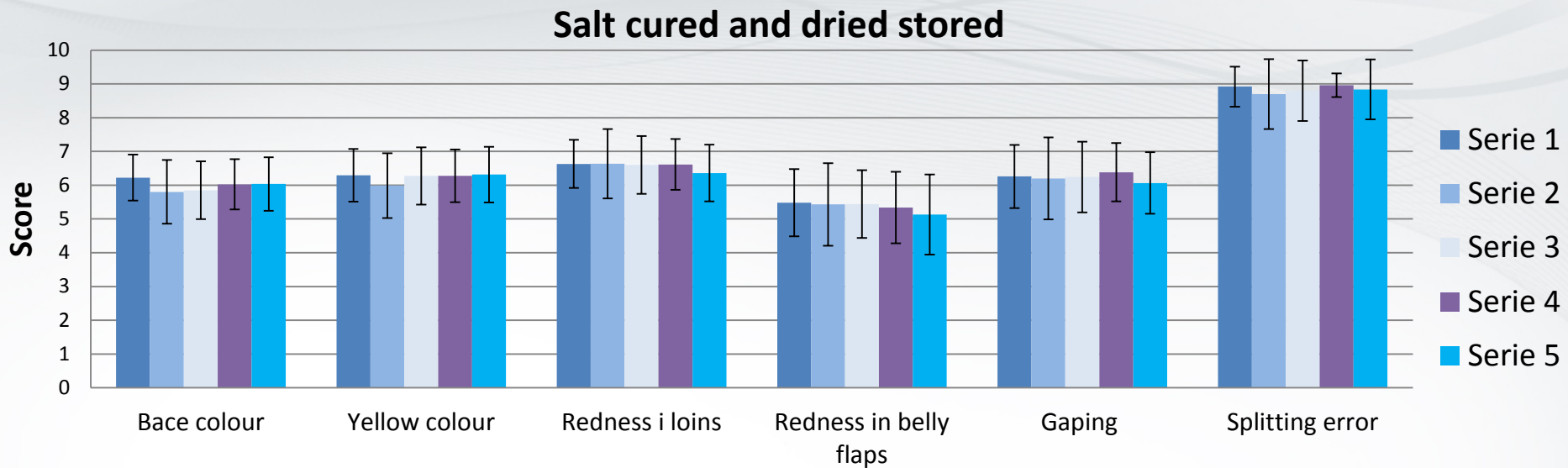
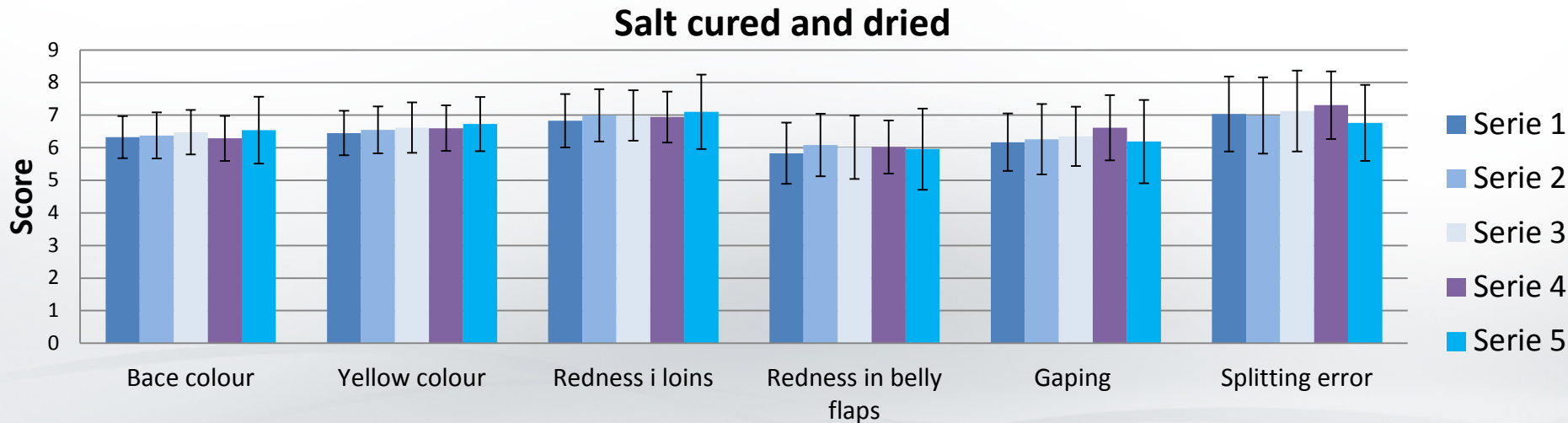
SPSS: one-way anova

| Series   | pH   | Temperature (°C) | Weight (gram) |
|----------|------|------------------|---------------|
| 1 (n=45) | 6,86 | 0,2              | 3076          |
| 2 (n=45) | 6,74 | 1,4              | 3142          |
| 3 (n=45) | 6,98 | 0,5              | 3044          |
| 4 (n=45) | 7,02 | 1,6              | 2908          |
| 5 (n=40) | 6,88 | 7,5              | 3187          |



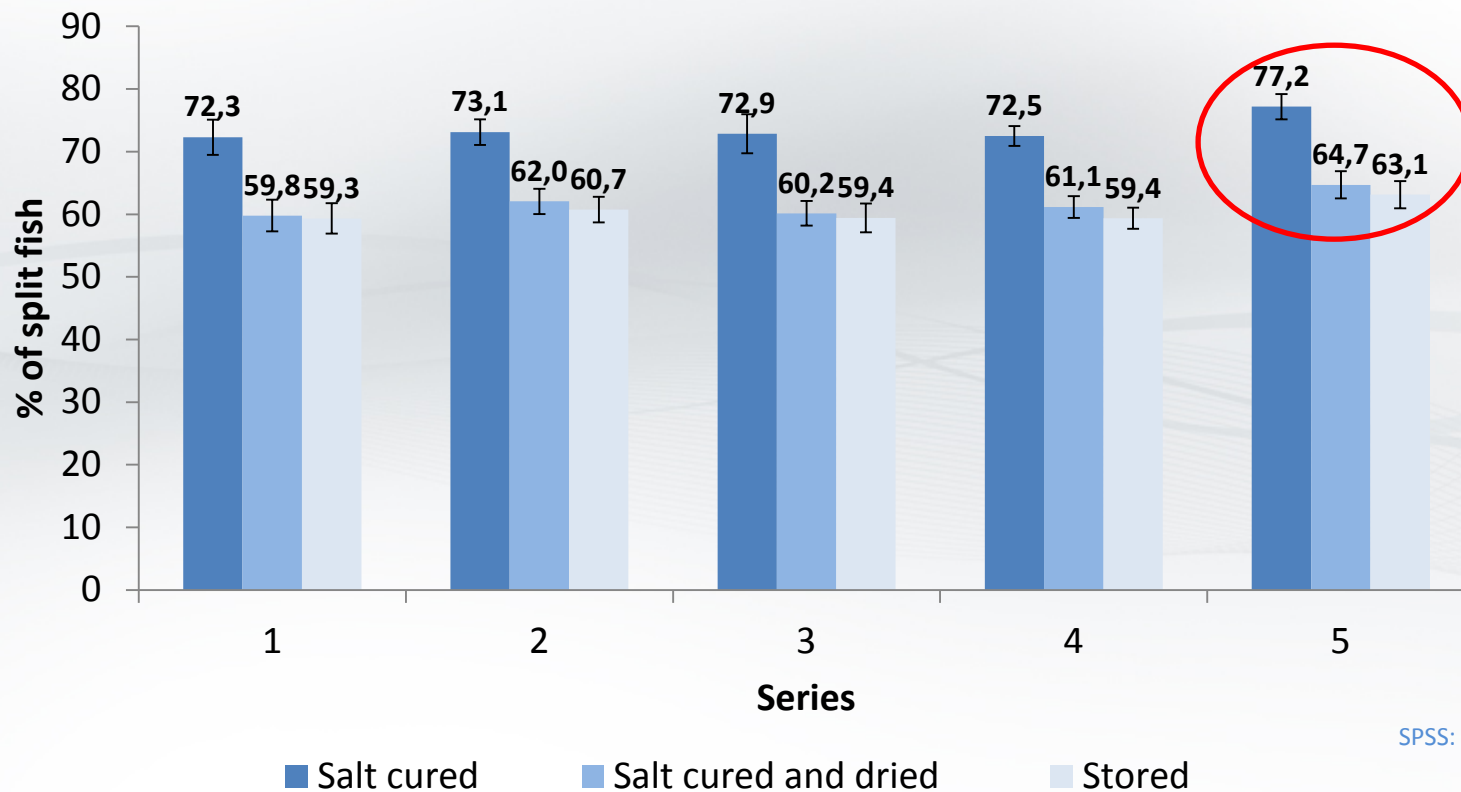
*Series 1: Control. Series 2: Increased water flow. Series 3: Seawater and ice slurry. Series 4: Ice slurry and ice slurry. Series 5: Change in hauling speed*

# Sensory assessments



*Series 1: Control. Series 2: Increased water flow. Series 3: Seawater and ice slurry. Series 4: Ice slurry and ice slurry. Series 5: Change in hauling speed*

# Yield



*Series 1: Control. Series 2: Increased water flow. Series 3: Seawater and ice slurry. Series 4: Ice slurry and ice slurry. Series 5: Change in hauling speed*

# Commercial sorting

|                        | Salt cured and dried cod |                      |                         |                           |                         |
|------------------------|--------------------------|----------------------|-------------------------|---------------------------|-------------------------|
|                        | Control                  | Increased water flow | Seawater and ice slurry | Ice slurry and ice slurry | Change in hauling speed |
| Share of Superior (%)  | 91                       | 93                   | 88                      | 93                        | 88                      |
| Share of Universal (%) | 9                        | 7                    | 12                      | 7                         | 12                      |
| Blood errors (%)       | 75                       | 66                   | 76                      | 78                        | 74                      |
| Gaping/tearing (%)     | 25                       | 34                   | 24                      | 22                        | 26                      |

# Summary

- Greater share of superior quality using ice slurry in bleeding and bulk tanks
- Lower share of blood error using higher water flow in bleeding tank
- Positive effects from lowering temperatures
- Higher yield when thawing fish in higher seawater temperature?





*Thank you for listening*

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