

The growth and survival of *Listeria* in ready-to-use salt cured cod

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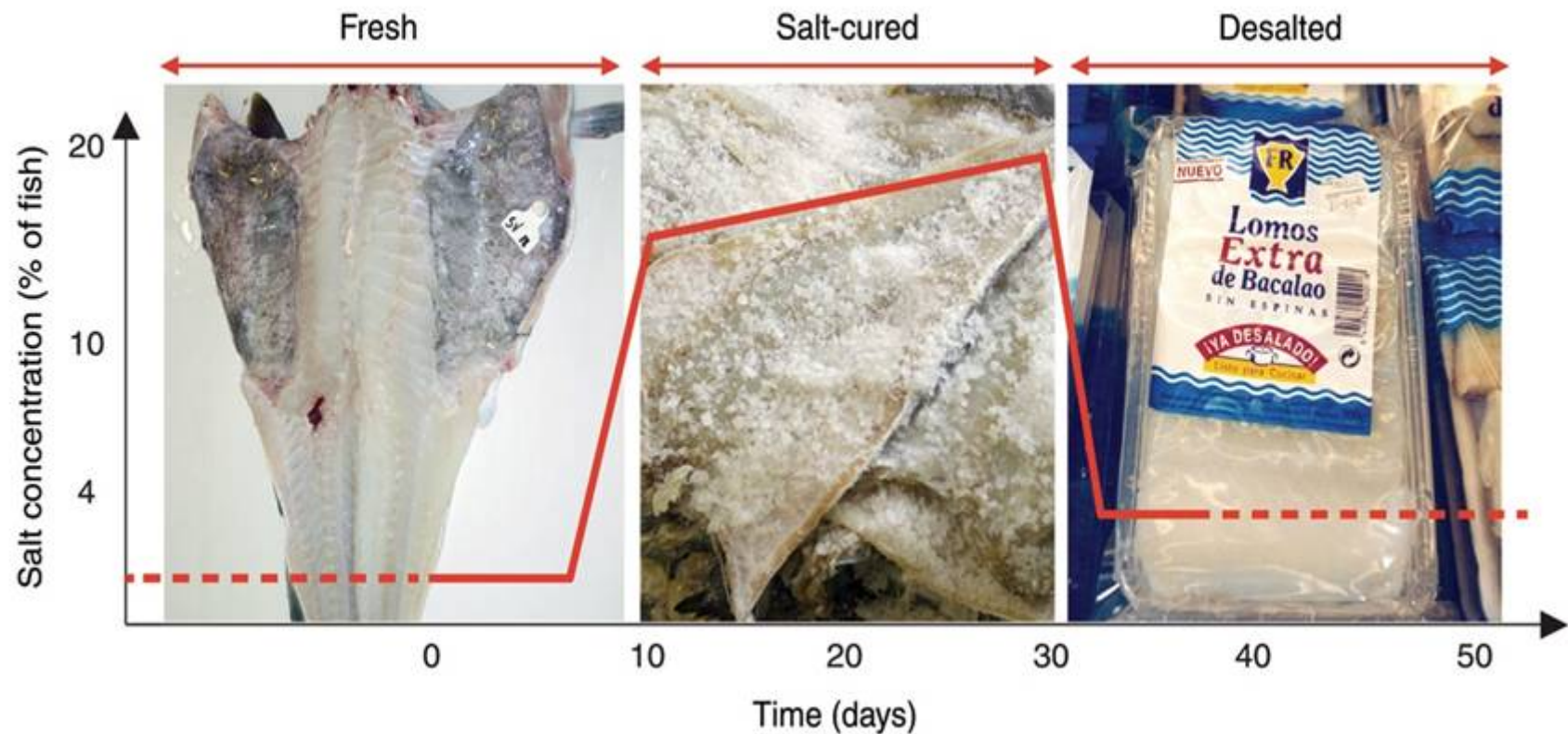
Introduction

- **Previously shown: *Listeria* spp. can survive during the salt-curing process of cod** (Lorentzen et al 2005).

So what:

- **Is it likely that this can entail a health threat for consumers?**

Salt-cured cod products



Salt-cured cod must be rehydrated to reduce the salt content from 20 % to 2-4 % before consumption

Main objectives

- Study the growth and survival of *Listeria spp* during processing of ready-to-use salt-cured cod:
 - At different inoculation levels
 - At chilled and abuse storage temperature
 - Inoculated prior to salt-curing compared to inoculation during the desalting step

Listeria

- Any fresh food product of animal or plant origin may harbor varying numbers of *Listeria (monocytogenes)*
- Numbers often very low, below 10 cfu/g
- Infective dose suggested to be as low as 10^2 cfu for immunocompromised hosts, but in the range 10^4 - 10^7 for healthy hosts
- The human health risk is related to level of *Listeria*

Materials and methods

- Fresh cod used as raw material
- Sample size of approximately 2x2x3 cm with skin
- *Listeria innocua* used as indicator for *Listeria monocytogenes*

Microbiological methods

- Total viable count was determined using Plate Count Agar added 3 % NaCl
- Palcam *Listeria* agar base as selective medium for *Listeria* spp. (ISO 11290-01)

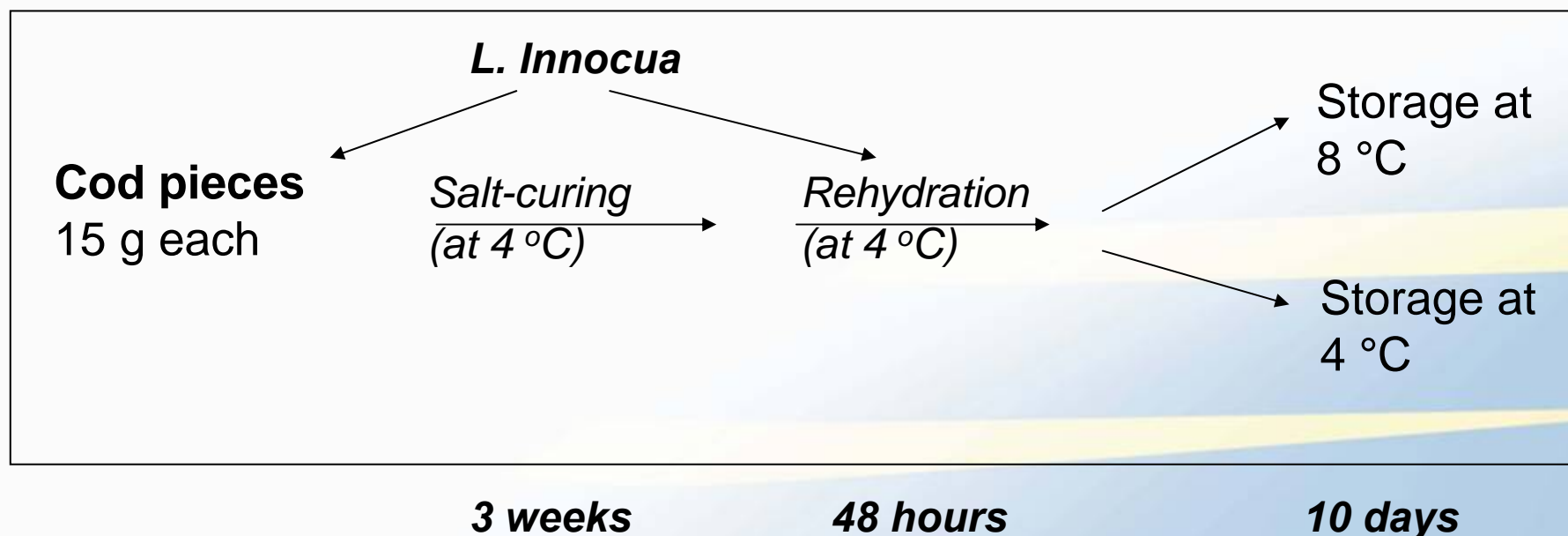
Sensory evaluation

- **At each sampling point during storage of the desalted cod, a sensory evaluation was carried out:**
 - **Appearance**
 - **Smell**
 - **Texture**

Product shelf life

- **The shelf life of the desalted cod products were determined based on two criteria:**
 - **When the product reached the total allowable level of bacteria (5×10^6 cfu/g) (Norwegian Food Safety Authority)**
 - **Detection of decreased sensory quality of the product (mainly product smell)**

Experiment overview



Uninoculated fresh cod treated accordingly (as control)

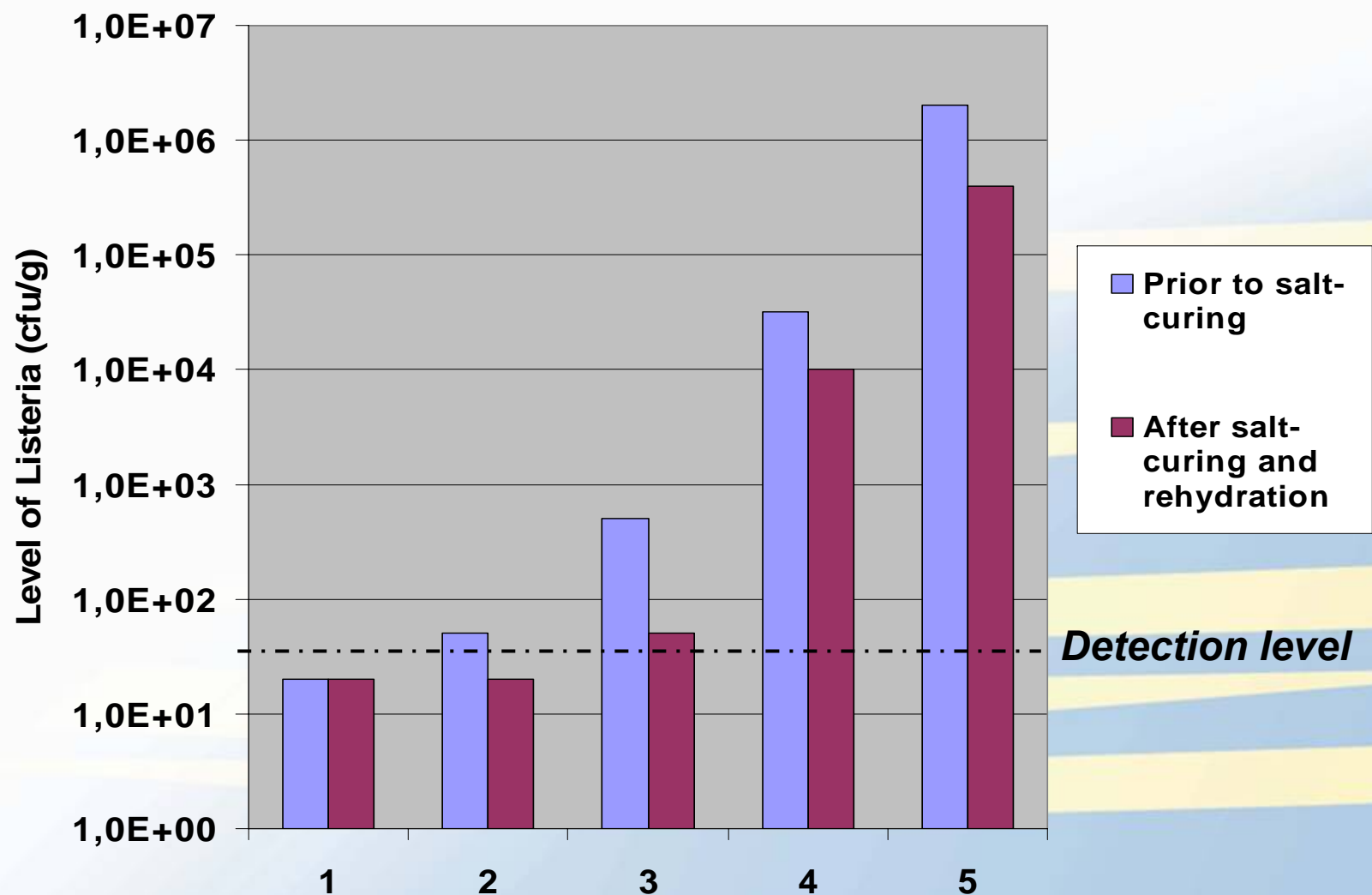
Experiment 1

- **Inoculation of fresh fish:**

Study the survival and growth of *Listeria* in desalted cod stored at high (8 °C) and low (4 °C) temperatures.

***Listeria* inoculated in the range log 1-
log 6 prior to salt-curing.**

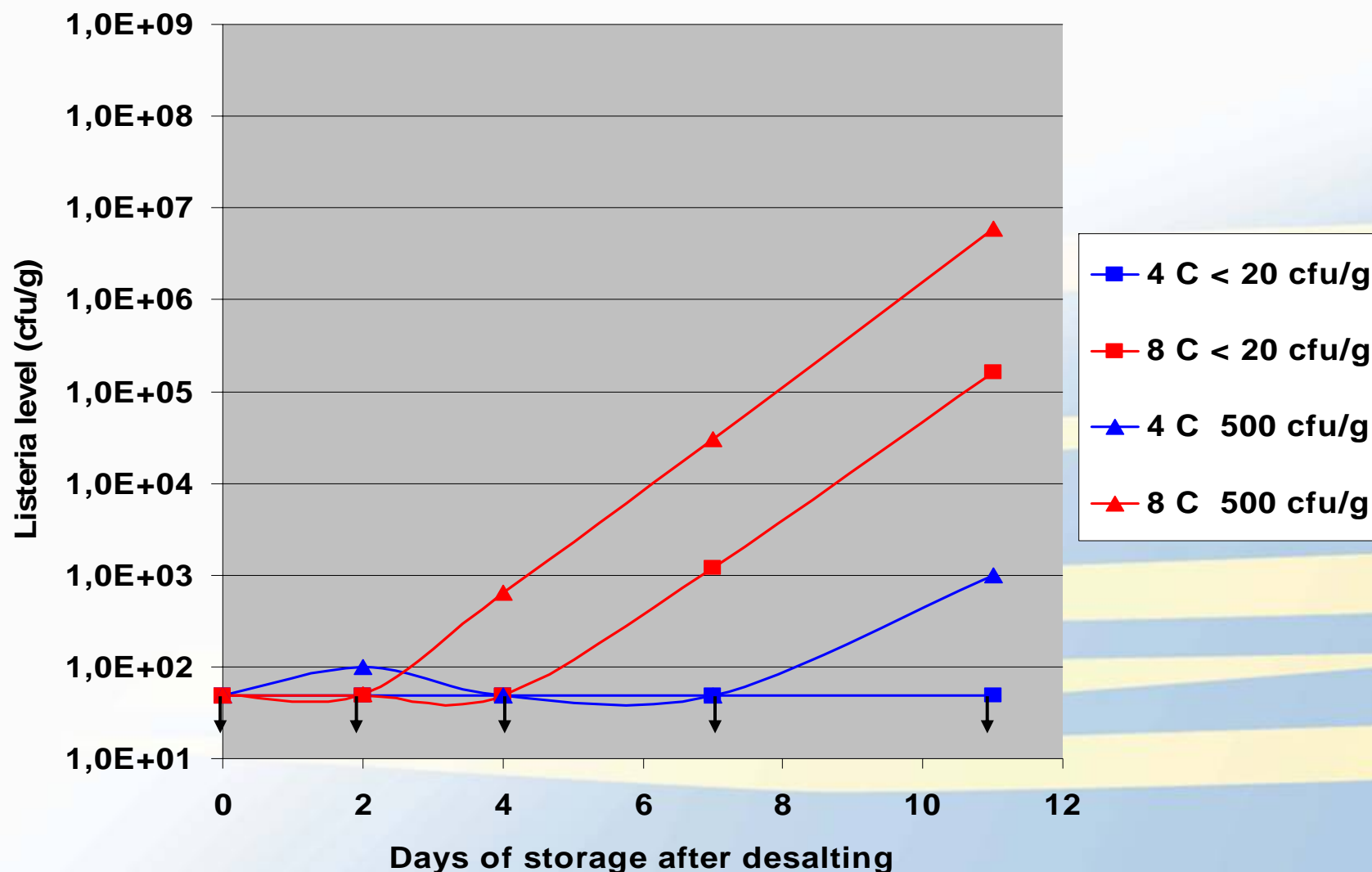
Survival of *L.innocua* for levels ranging from log 1 – log 6



Results- Survival

- *Listeria* survives the salt-curing process when inoculated in both high and low numbers
- During salt-curing, the level of *Listeria* decreases less than log 1 for all inoculation levels tested

Growth of salt-stressed *L. innocua* in rehydrated salt-cured cod during storage



Results- Growth (i)

- *Listeria* that is introduced prior to salt-curing, grows well in the desalted product.
- Also when present in very low numbers, the level of *Listeria* can reach high levels (log 5) when stored at 8 C

Results- Growth (ii)

- *Low levels of Listeria (log 1)*
 - After desalting, growth is detected at 8 °C but not 4 °C for up to 10 days of storage
- *Moderate levels of Listeria (log 2)*
 - After desalting, growth is registered at both low and high temperatures

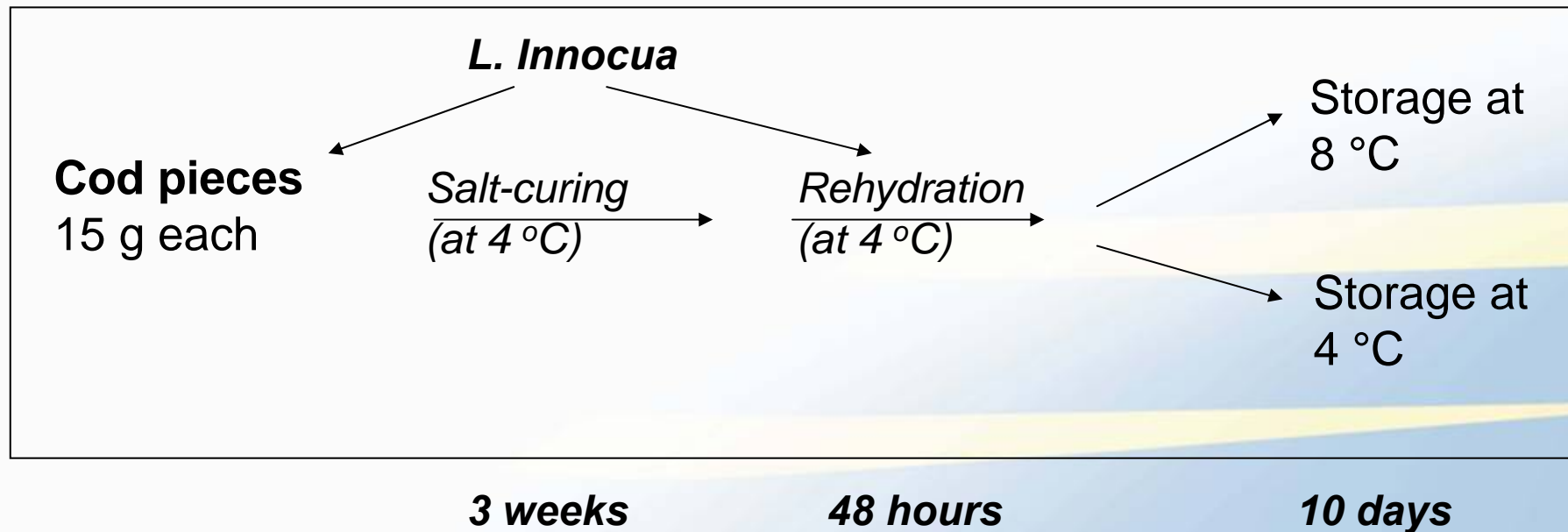
Main experiment 2

- **Inoculation during rehydration:**

Compare the survival and growth of *Listeria* at different inoculation points in the processing of desalted cod

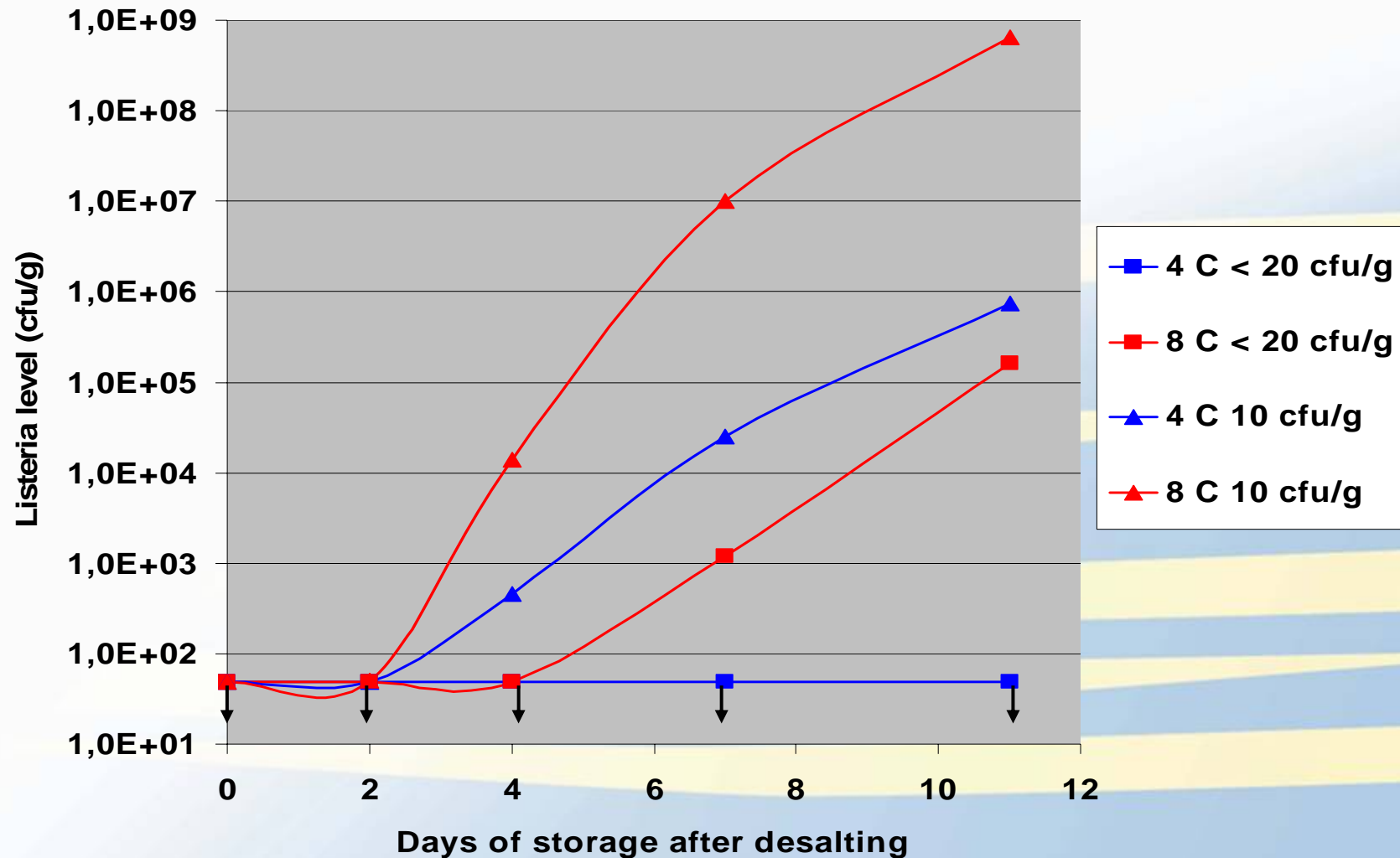
***Listeria* inoculated in low levels (log 1) prior to salt-curing or in the desalting process.**

Experiment overview



Uninoculated fresh cod treated accordingly (as control)

Inoculation prior to salt-curing (■) or during desalting (▲)



Results- Inoculation point

- *Listeria* has a significantly shorter lag phase when contamination takes place during desalting
- When inoculated during desalting, high levels of *Listeria* are found also when stored at 4 °C

Results- Shelf life of desalted cod samples, contamination level of *L. Innocua* log 1

	Contaminated prior to salt-curing	Contaminated during desalting
<i>Lag phase at 4 °C</i>	10 days	2 days
<i>Shelf life at 4 °C</i>	7 days	7 days
<i>Lag phase at 8 °C</i>	4 days	2 days
<i>Shelf life at 8 °C</i>	4 days	5 days

Red numbers: L. innocua higher than 100 cfu/g fish

Conclusion

- The lag period of *Listeria* in desalted cod:
 - is dependent on the contamination history and the storage temperature
 - is considerably shorter when *Listeria* is introduced to the fish during desalting compared to the raw material prior to salt-curing

Conclusion

- *Listeria* survives the salt-curing process also when in low numbers (log 1), but did not reach infective doses within the shelf life of the product in this trial.
- However, when *Listeria* was inoculated during desalting, infective doses of *Listeria* was reached within the shelf life of the ready-to-use desalted cod product

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