

Session 3: Effective fish handling systems



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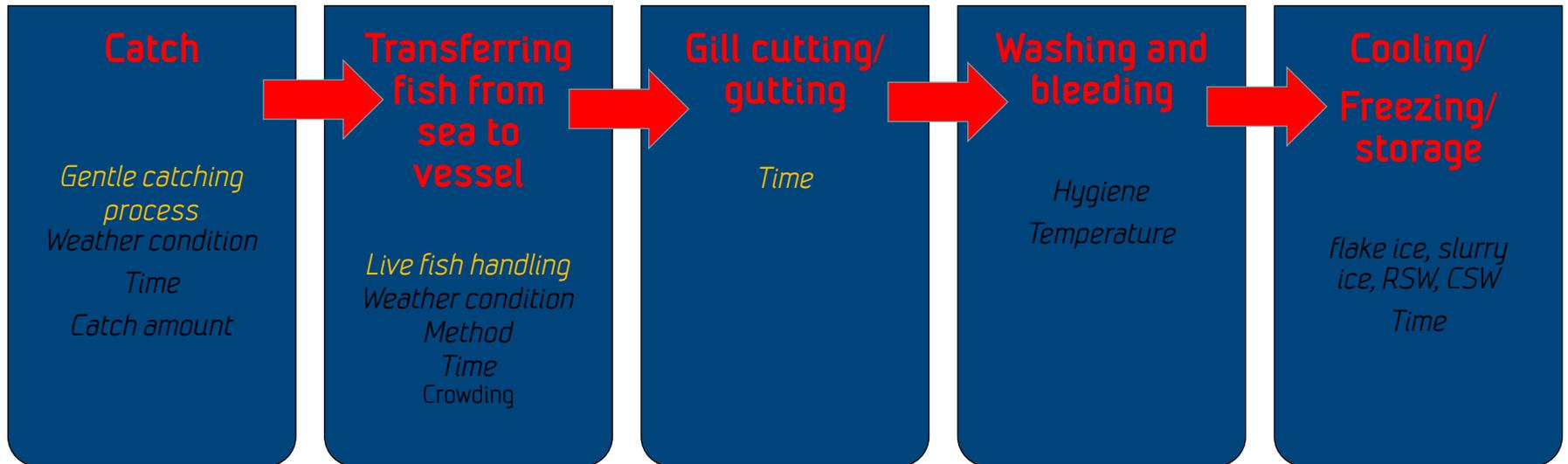
Topics presented

- i. Fish slaughtering systems (including stunning and bleeding)
 - ii. Cooling systems and storage
- Focus on cod, haddock and saithe
 - Main objective:
 - To improve the fish quality and the EHS (environment, health and safety) for the fishermen and to make the fish handling system more effective

Fish handling systems onboard – Critical factors

Slaughtering process

Storage



Improper catch handling and chilling of fish: Possible effects on flesh quality

- External damages (e.g. scale loss, skin marks)
- Blood spots/ discolouration in the fillet
- Soft flesh
- Fillet gaping
- Reduced freshness
- Paler skin and flesh (depending on species)
- Excessive drip loss and reduced water holding capacity (through flesh when cooked)

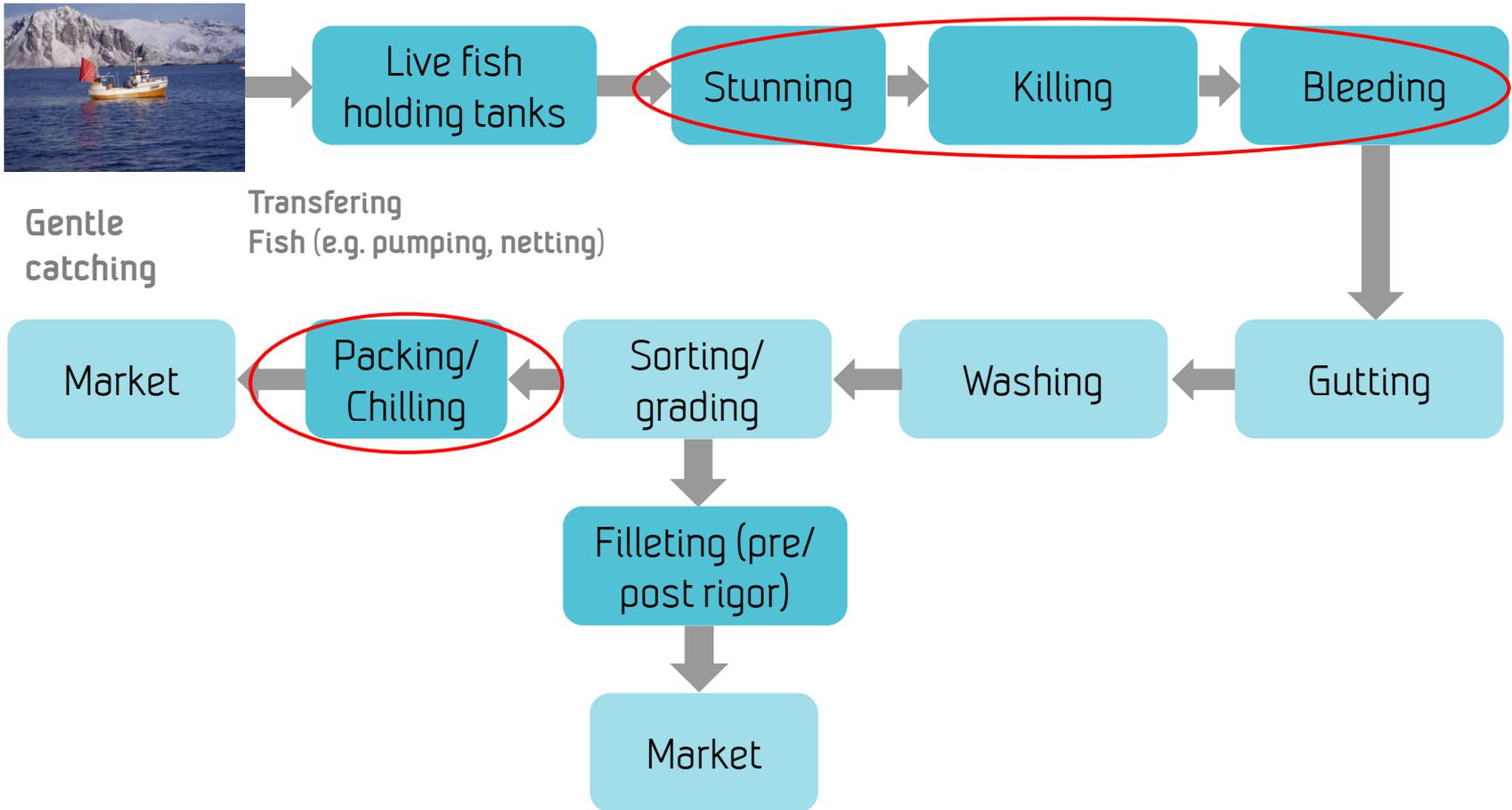
(Approx. 7-10 days ice storage: Spoilage, microorganisms, TMA, lipid oxidation, etc)



Improper catch handling and chilling of fish: Consequences for fish processing industry

- Lower yield and fillet quality
 - Production problems (e.g. soft texture)
 - Loss of freshness - Reduced shelf life
 - Low cost products
 - Reduced profitability in the processing industry
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- **Improved catch handling may improve fillet quality and increase yield.**
 - **Changing attitudes directed towards quality rather than quantity may therefore contribute to more sustainable fisheries**

Future processing line



Catching process

- Large catches – difficult to control catch sizes
- Fishermen's attitude...?



50 tonn til "Gunnar K"

"Gunnar K" fra Myre har satt ny ferskfiskerekord av en kystbåt i Myre havn. Den kom opp med 50 tonn i kveld.



Transferring fish from sea to vessel



- Different methods:
 - Pumping
 - Toggling
 - Dragging

Typical damage
due to pumping

Electrical stunning

The principle

Electrical stunning makes it possible to immediately further process the fish after it is taken on board.

Advantages

- Fish welfare – branding and consumer demands
- Shorter time period from catch to processing
- EHS (environment, health and safety) Improved safety and less heavy manual work for the fishermen
- **A way of achieving proper bleeding of fish on board!**

Disadvantage

- Shorter pre-rigor period
- Space demanding (prototype: approx. 0.4×0.4×1.0 m)
- More research are needed to optimization for different species and fish sizes



SINTEF + Seaside

Fish behaviour observations during recovery from electrostunning

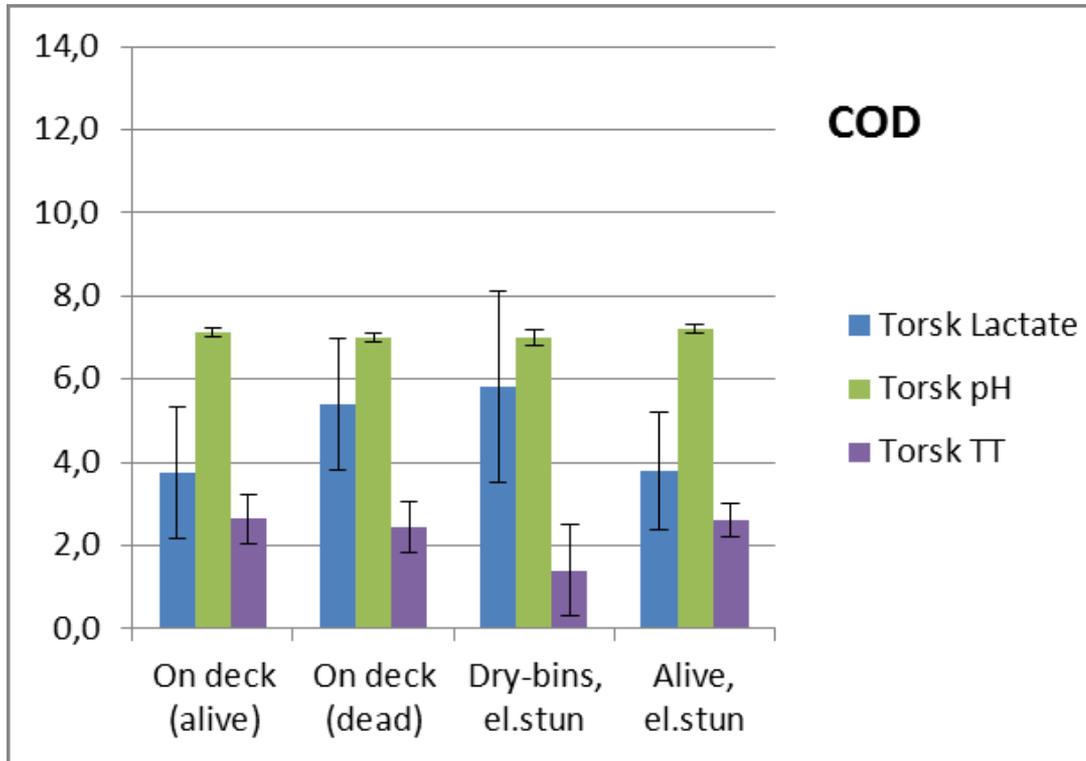
| Totals | n | Swimming | | Balance | | Breath | | VOR | |
|---------|----|----------|------|---------|------|--------|------|-------|------|
| | | 0=some | 1=no | 0=some | 1=no | 0=some | 1=no | 0=yes | 1=no |
| Cod | 63 | 0 | 63 | 1 | 62 | 4 | 59 | 5 | 29 |
| Haddock | 20 | 0 | 20 | 0 | 20 | 2 | 18 | 0 | 10 |

Fish behaviour observations:

- 'Eye roll' (VOR)
- Swimming activity
- Balance
- Breath

➤ **2 % not properly stunned**

Cod – Blood lactate, pH and twitch tester



Cod:

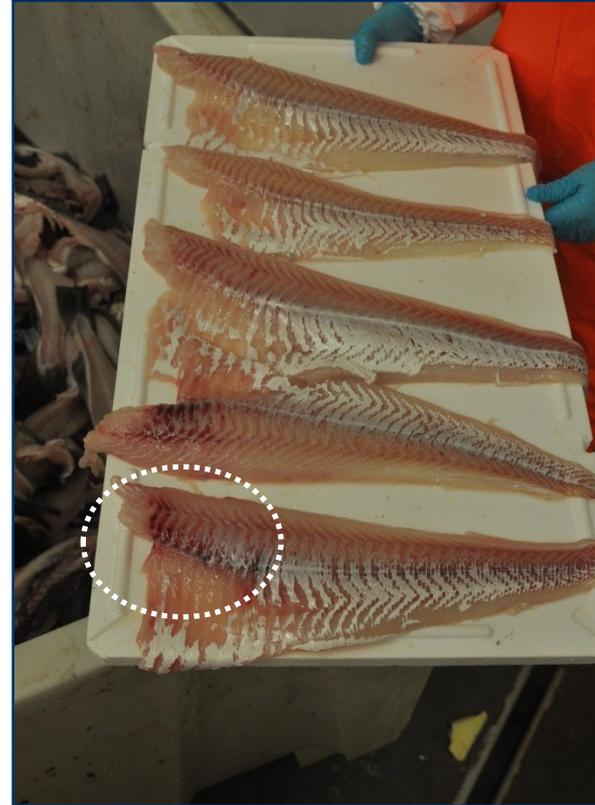
- Blood lactate: 3.7-5.8
- Initial muscle-pH: 7.0 – 7.2
- Twitch response: 1.4 – 2.6

- No sign. differences between the treatments
- The catching process had partially exhausted the fish

Twitch response, score (0-2): 2 = Strong twitch; whole body twitch, 1 = Weaker twitch; in (small) restricted areas of the fish surface, 0 = No twitch.

Bleeding and gutting

Focus area: Improving bleeding routines



Problem: Inadequate bleeding, blood spots in the filets

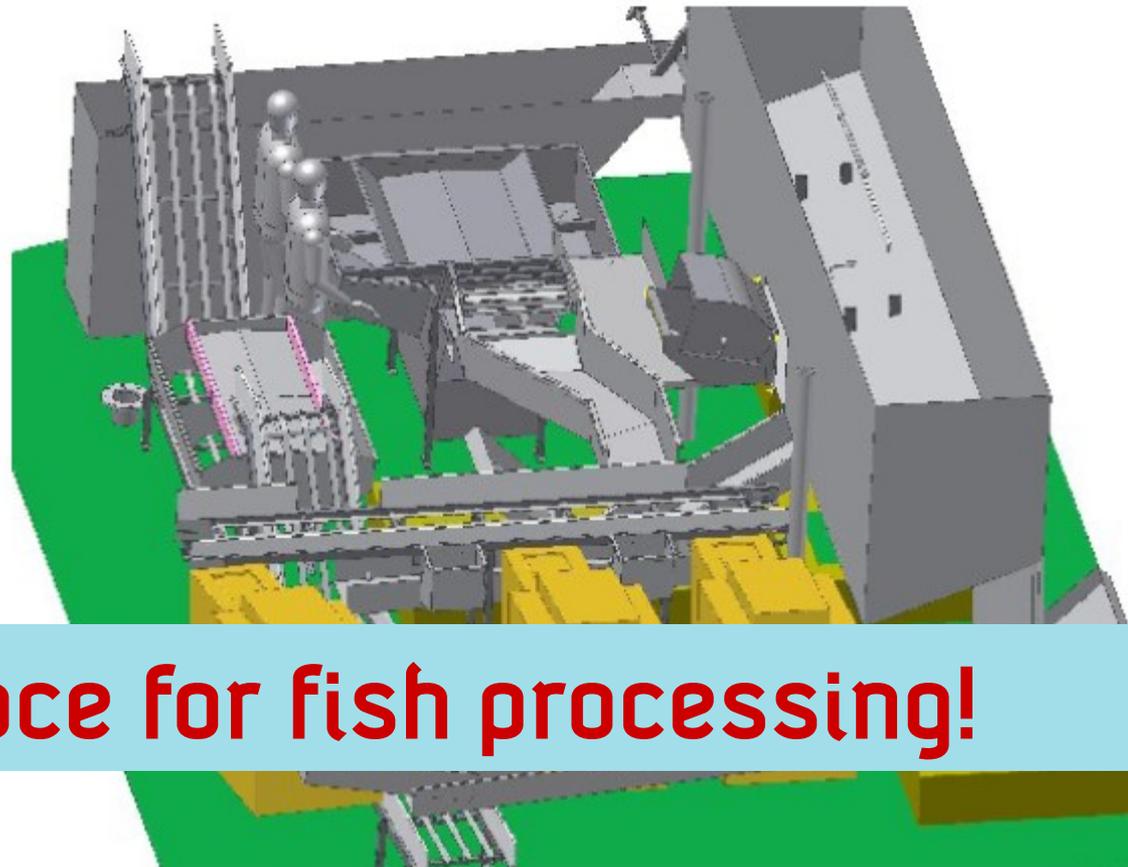
Good bleeding: Immediate bleeding of live fish (or no later than 30 min post mortem)

Automatic gill cutting – also onboard vessels



Design of vessel

Drawing of a modern 28 m fishing vessel with 4 m space for processing of fish



Leave space for fish processing!

Proper chilling

- Goal: To improve the cooling conditions for wild fish – a faster chilling rate ($< 0^{\circ}\text{C}$) and maintains of the low temperature from catch to market
- Different methods can be used (ice, RSW, slurry ice etc)

Slurry ice

- Ice-water mixtures with added salt to achieve subzero temperatures, for instance seawater
- Suspension containing typically 25-30% small ice crystals
- Temperature is a function of the salinity in the mixture, typically -2°C
- Partial freezing



Erikson et al, unpublished

Piñeiro et al, 2004

Super-chilling

Advantages

- Faster chilling than traditional flake ice
- Less physical damages of fish compared to traditional flake ice
- Easier to work with
- Better gill odour
- Lower
 - microbial activity
 - biochemical degradation
 - lipid oxidation (after 19 days of storage)

Disadvantages

- Structure changes – texture?
- Faster glycolysis and enzymatic reactions – protein denaturation
- Excessive drip loss
- Cold stiffness
- Uptake of salt
- Cloudy eyes
- Lower water holding capacity
- **Temperature must be kept constant!**

Conclusion – effective fish handling systems

- Improved fishing gears – gentle capture and reduced catch sizes
 - *Time and amount of fish in the gear are critical factors!*
- New gentle handling systems
 - *New systems for catch loading*
 - *New live fish handling systems – keeping fish alive until bleeding!*
 - *Immediate and gentle fish handling on board to achieve a proper bleeding*
 - *Introduction of a stunning method facilitates rapid fish handling*
 - *Automation and sorting systems*
 - *Space on board for fish processing*
 - *Ergonomically design*
- Good chilling is important. The use of new technologies needs to be optimized.