

# Preservation of raw material

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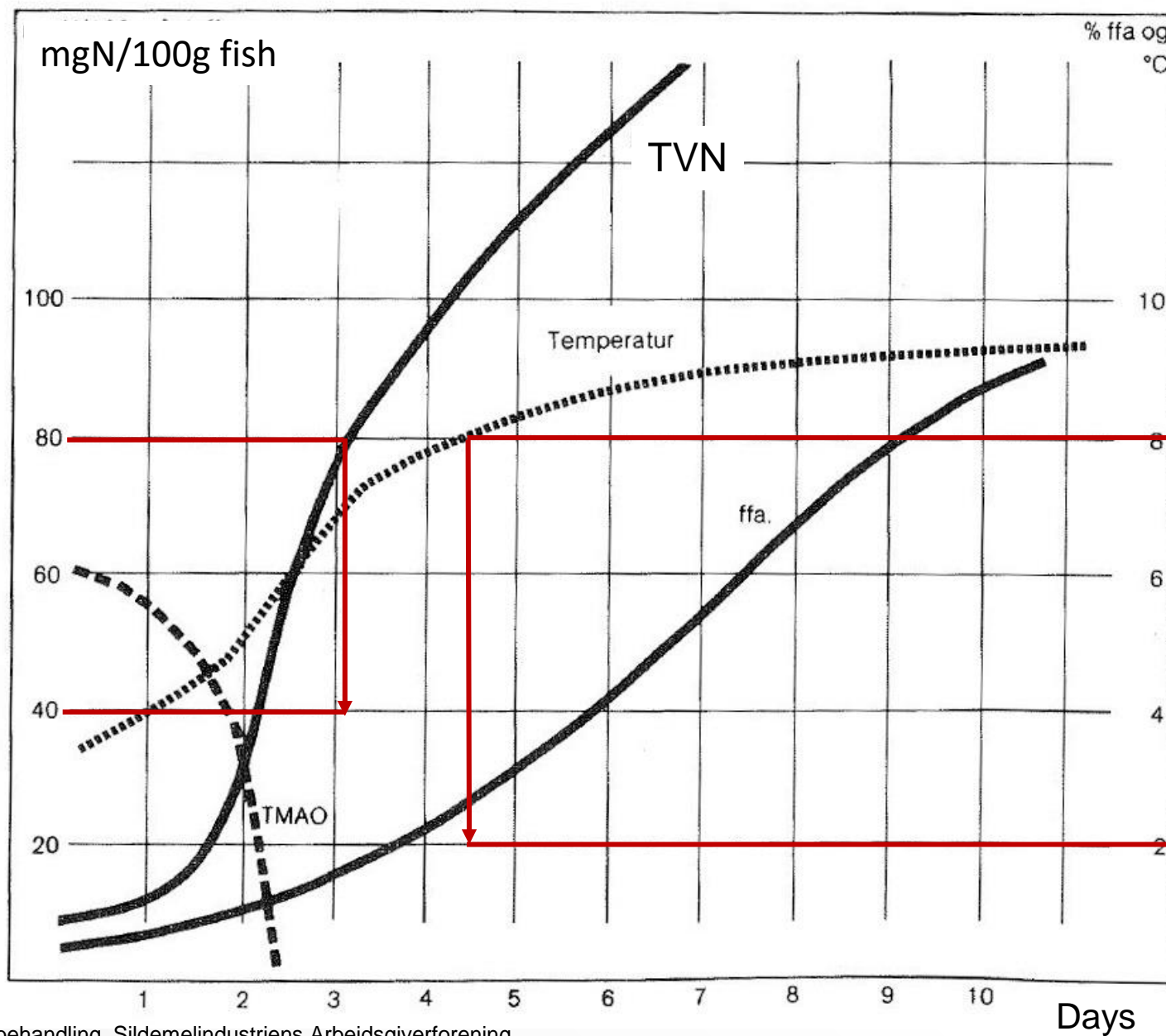
# Presentation outline

- Introduction
- Refrigerated seawater (RSW)
- Refrigerated fresh water (RFW)
- Chemical preservation

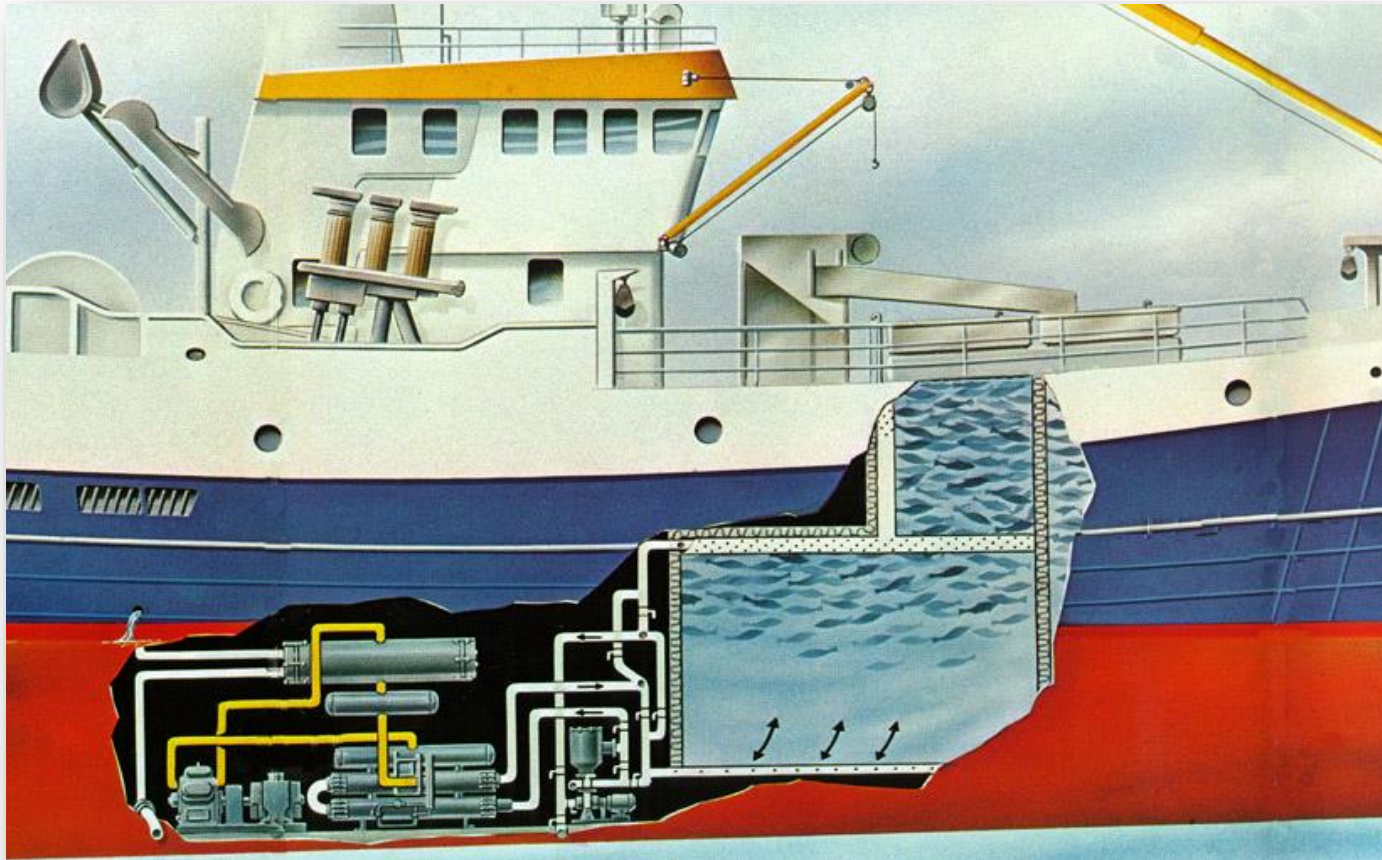
# Introduction

- Fish is a highly perishable product and spoilage begins as soon as the fish dies.
- Initially, quality loss is due to biochemical reactions caused by endogenous enzymes. This “autolysis” liberates amino acids, fatty acids and other low-MW compounds, which in turn promotes microbial growth.
- Microorganisms cause spoilage by decomposing such compounds while liberating volatile and/or poisonous compounds.
- Total volatile nitrogen (TVN), consisting mainly of trimethylamine (TMA) and ammonia ( $\text{NH}_3$ ), is used as a quality criterion for fish meal raw material.

# Spoilage of capelin



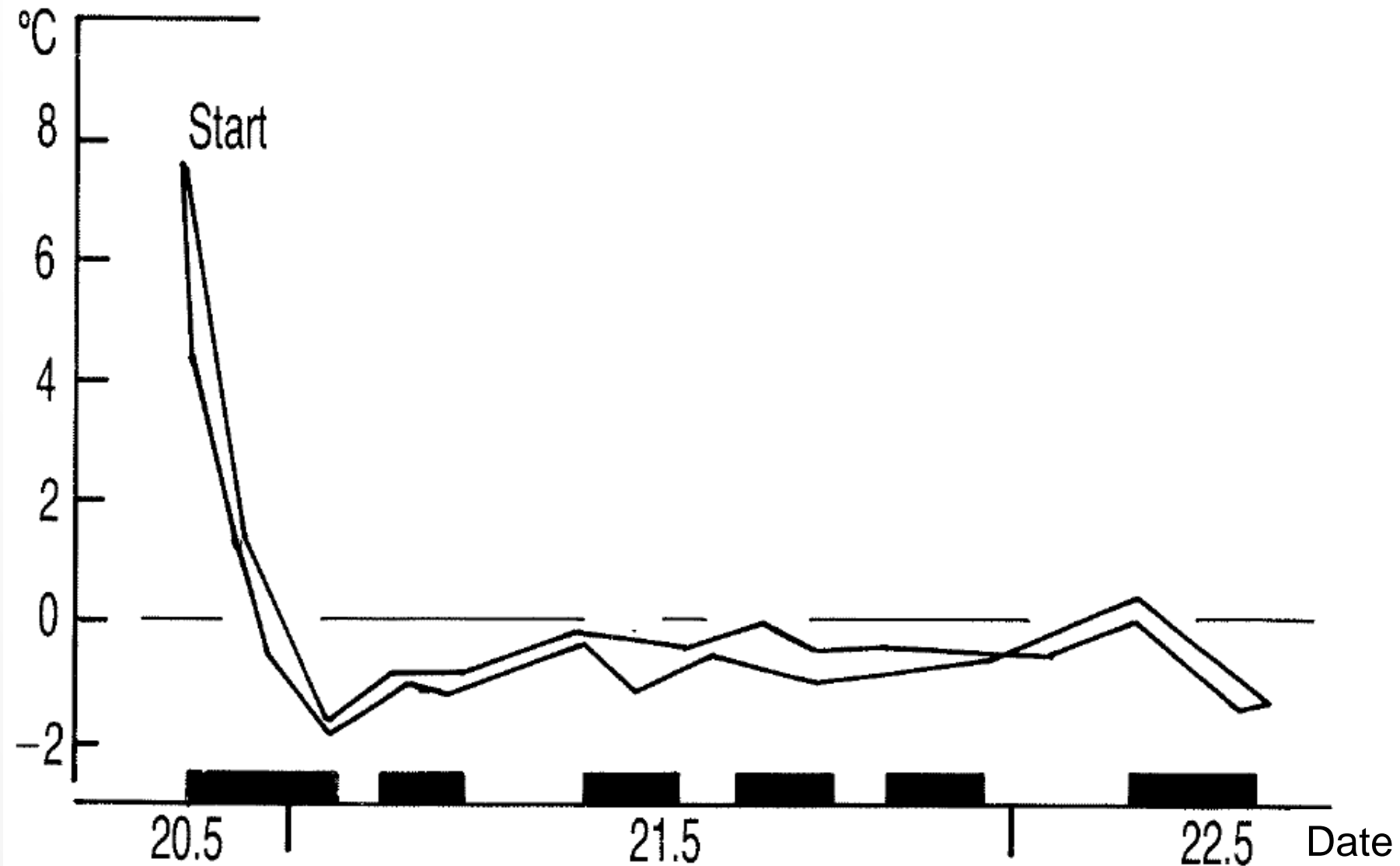
# Refrigerated seawater (RSW)



<https://www.teknotherm.no/fisheries/fisheries-systems/rsw-systems/>

- RSW is commonly used onboard pelagic fishing vessels.
- The fish is rapidly cooled to a temperature close to the freezing point of seawater (-2 °C).
- It is an effective and cost-saving method for preserving the fish

# Temperature in a RSW tank during cooling of blue whiting



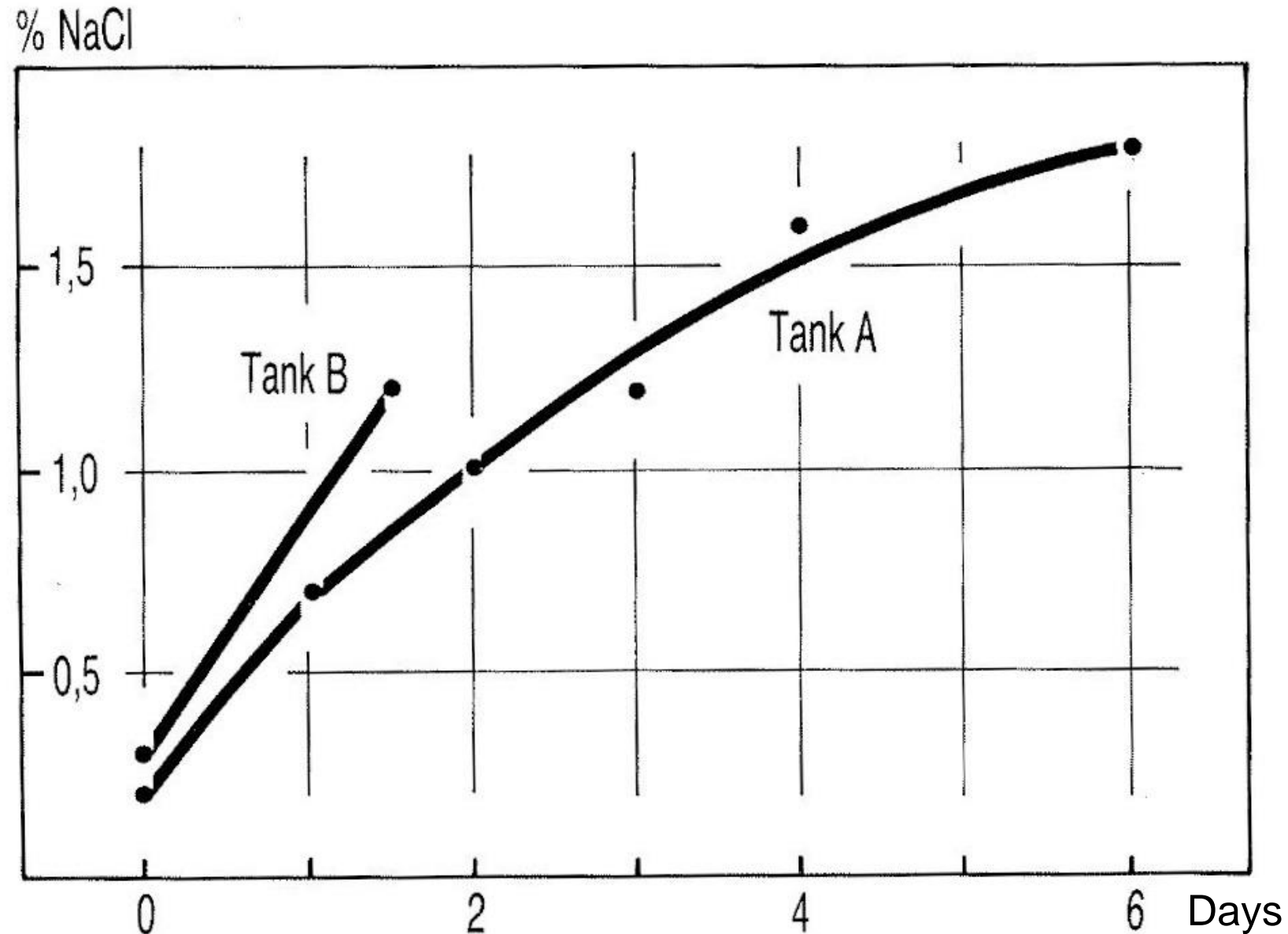
one disadvantage:  
salt absorption in fish tissues  
leading to high salt concentration in the fishmeal



[https://en.wikipedia.org/wiki/Fishing\\_trawler](https://en.wikipedia.org/wiki/Fishing_trawler)



# Salt absorption of blue whiting during RSW – cooling





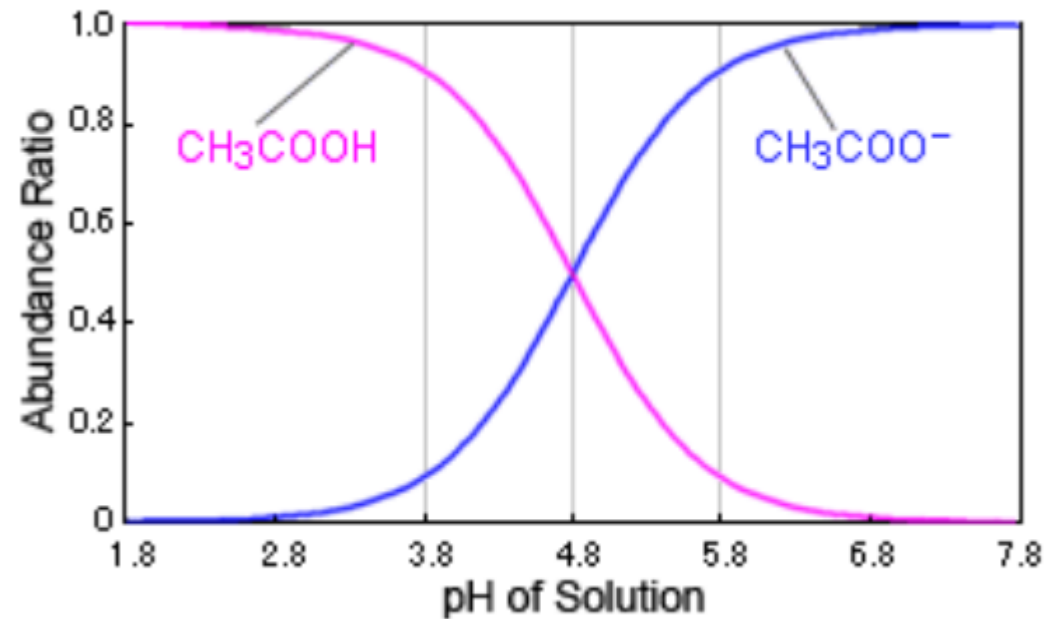
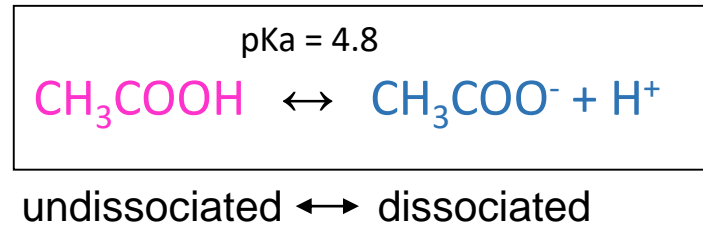
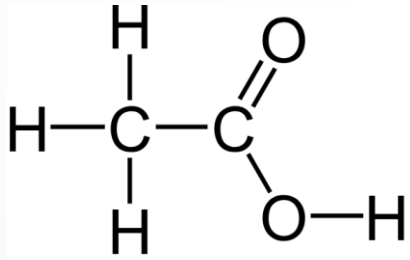
# Refrigerated fresh water (RFW)

- Alternatives to RSW is ice-chilled seawater or RFW

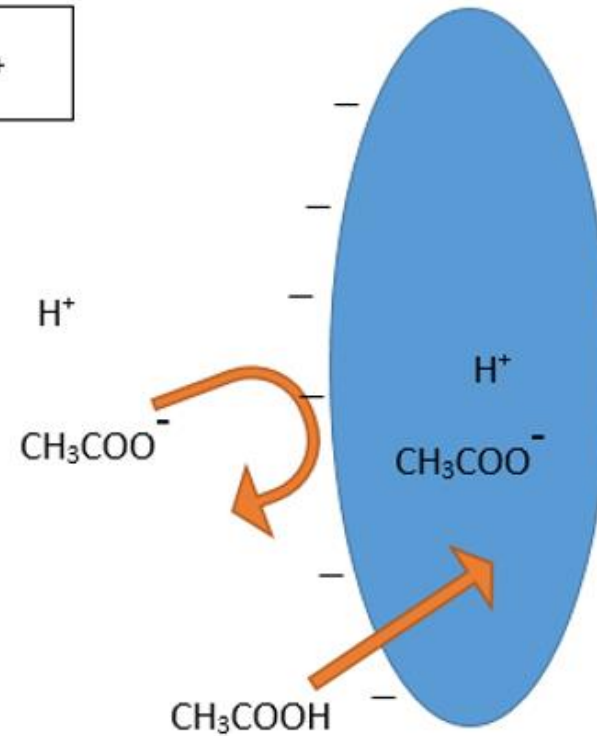
## Chemical preservation

- Previously, agents like formaldehyde and nitrite were widely used
- In Norway, low concentrations of acetic acid (approximately 0.2 %) in combination with RFW is used
- Acetic acid can not be combined with RSW because some marine bacteria are able to convert seawater sulphate to toxic  $H_2S$  gas in the presence of acetate (Nygaard, Nofima®, unpublished data)

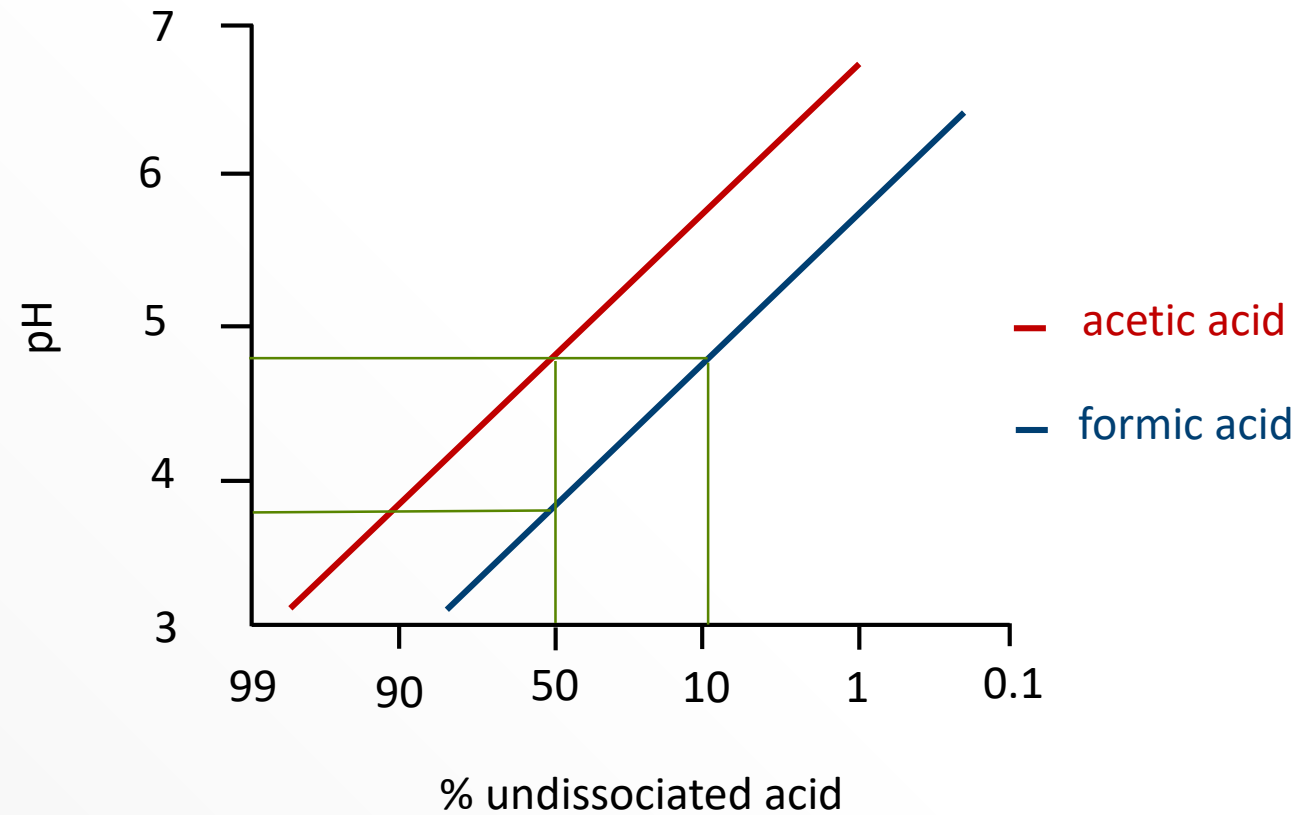
# Acetic acid



# Acetic acid - Mode of action



# Dissociation as a function of pH for acetic acid and formic acid



Nygaard., H. 1987. Konserveringsforsøk med forskjellige organiske syrer. SSF-rapport B428

# Conclusion

- RSW It is an effective and cost-saving method for preserving the fish
  - A disadvantage salt absorption in fish tissues leading to high salt concentration in the fishmeal
  - Acetic acid can not be combined with RSW because some marine bacteria are able to convert seawater sulphate to toxic  $H_2S$  gas in the presence of acetate
- Alternatives to RSW is ice-chilled seawater or RFW
- In Norway, acetic acid combined with RFW is used due to its high antimicrobial activity at relatively high pH, and because of reduced problems with salt absorption and  $H_2S$  formation

# Research challenges

- New methods for shelf life extension of bulk-stored whole fish
- New methods for shelf life extension of bulk-stored rest raw material from the consumer industry

# Thank you for your attention!

