Handling of raw materials from sea to production side

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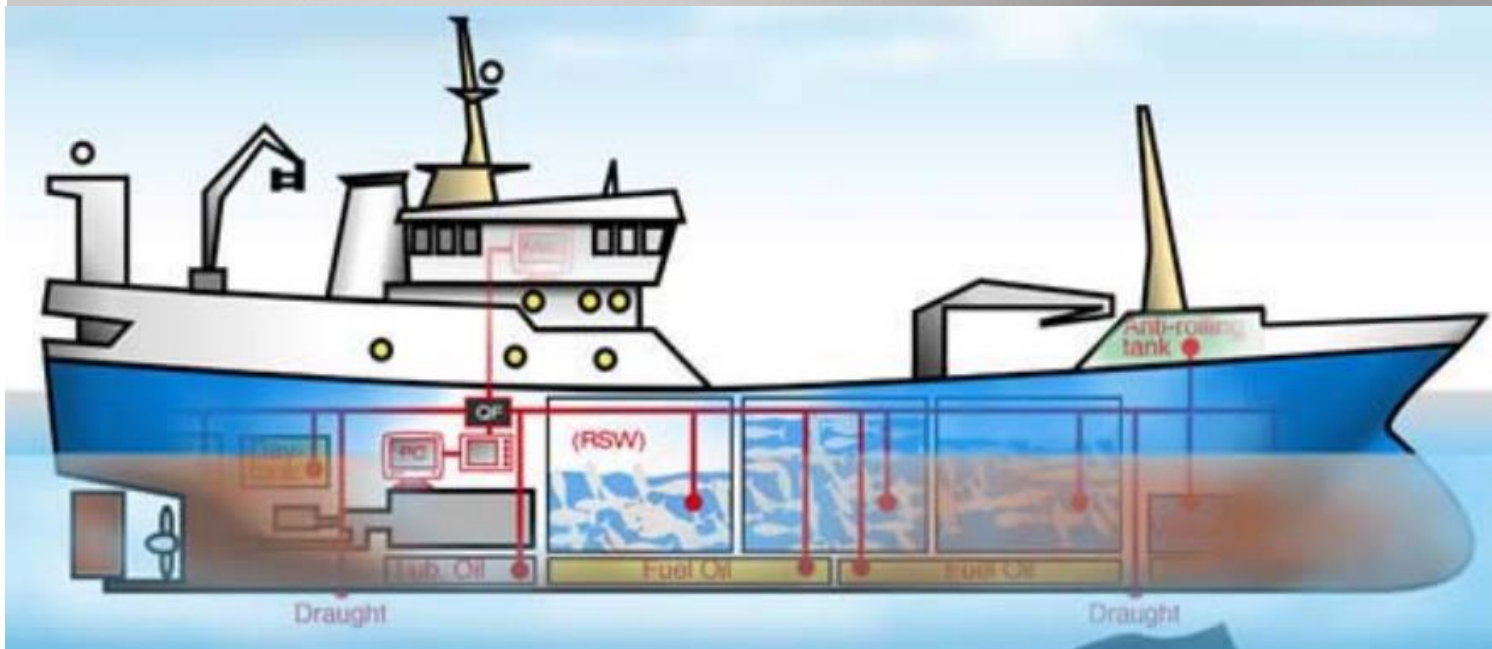
Coverage - 3 Questions

1. How do fishing practices affect raw material quality?

2. How does storage temperature affect raw material quality and shelf life?

3. How does salinity in the seawater affect raw material quality?

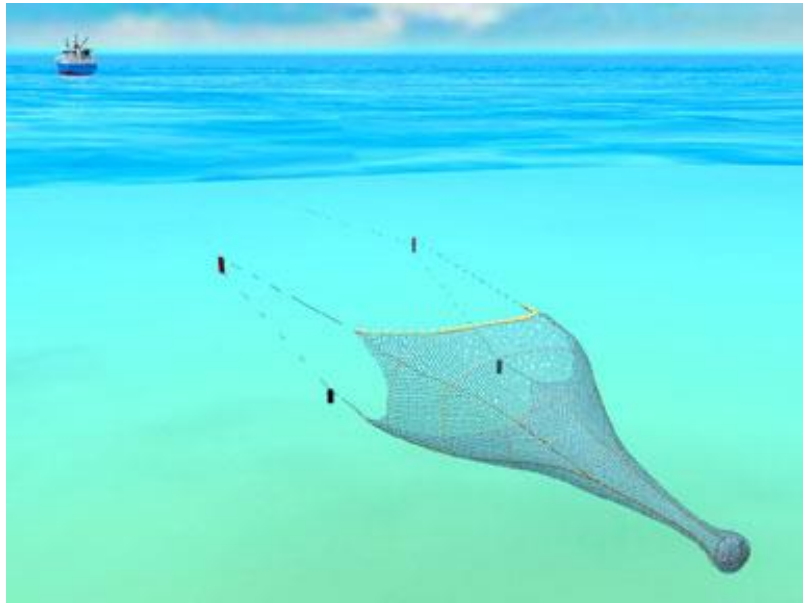
Pelagic industry



Fishing gear

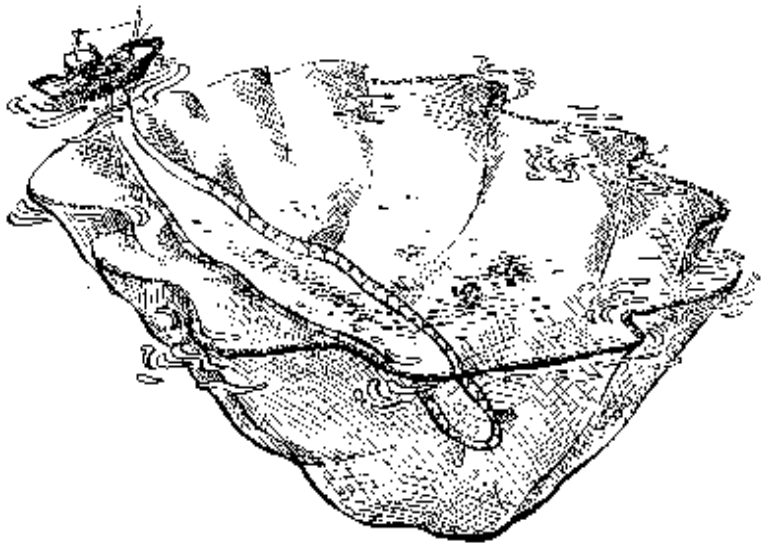
Pelagic trawl - Mid water trawl

- Pelagic trawls are designed to target fish in the mid- and surface water, such as herring, hoki and mackerel.



Purse seine

- Are used to target dense schools of single-species pelagic (midwater) fish like tuna and mackerel.
- A vertical net ‘curtain’ is used to surround the school of fish, the bottom of which is then drawn together to enclose the fish.
- Purse-seine fishing in open water is generally considered to be an efficient form of fishing. It has no contact with the seabed and the fish is not under the same stress as in trawls.



How do fishing practices affect raw material quality ?

Pelagic trawl - Mid water trawl

- **Towing time**

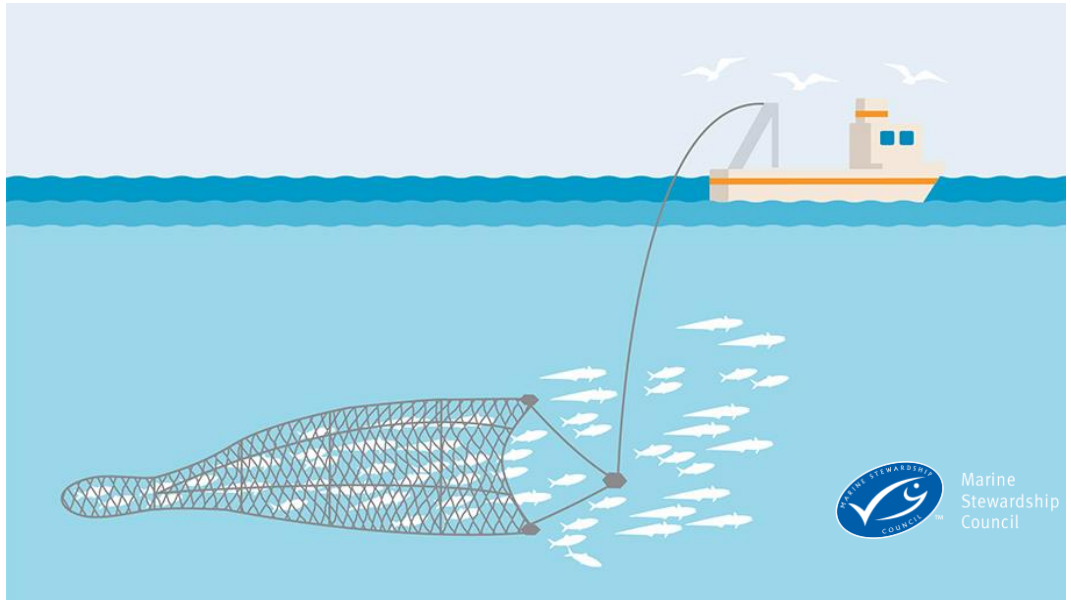
If towing time is too long the fish will be under pressure for too long. This pressure, can deform the fish and disrupt the stomach creating access for enzymes and bacteria which start digesting the fish. The result is fish with high TVN.

- **Amount of fish in each haul**

When too much fish is in the haul, the fish gets crushed to the outer surface of the net under a grate pressure which creates wounds and damages. These wounds then create access for salt into the fish resulting in saltier fish.

- **Towing speed**

If the trawl is towed to fast the fish will become exhausted, the fish prepares for higher energy consumptions and adrenaline is released into the blood. More blood is pumped into the muscles and the blood clotting time decreases. This creates condition for enzymes to start working. This is not as crucial when fishing for fishmeal. However, the pressure on existing fish in the trawl will be grater.



How do fishing practices affect raw material quality ?

Purse seine trawl

- **Where the trawl is hauled**

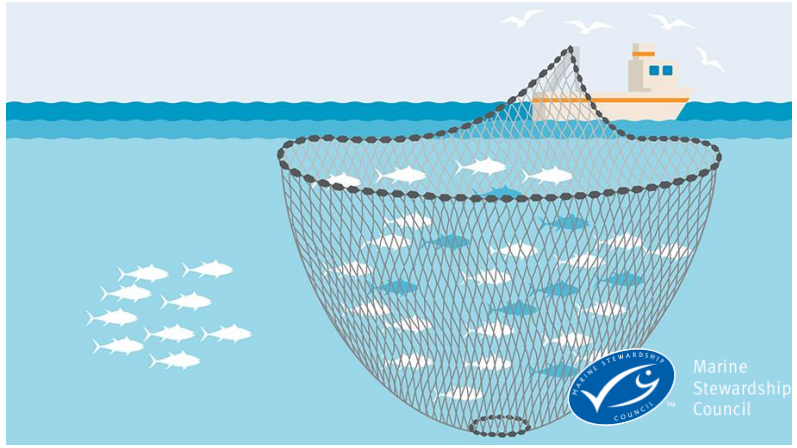
Experiments have shown that it gives better results to haul the net up at the back of the boat. When the trawls are hauled up against the side of the boat the waves push the trawl against the boat, which can cause damages on the fish.

- **The speed fish is pumped from the net**

- **The pumps and equipment used**

- **Fishing gear**

Large knots in the fish net can damage fish.



Cooling systems – Pelagic industry

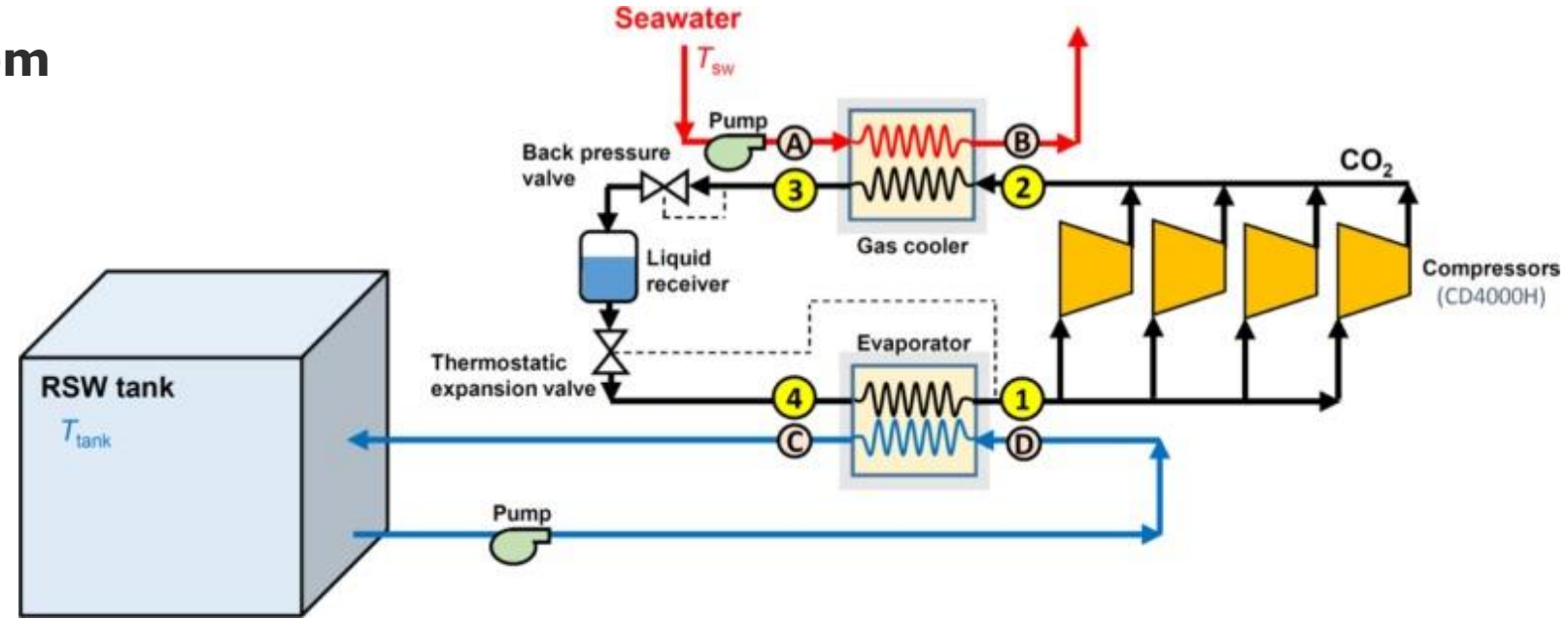
Refrigerated sea water system (RSW)

- **Chill the seawater**

It's important to chill the seawater in the fish tanks before the fish enters the tank to promote faster cooling.

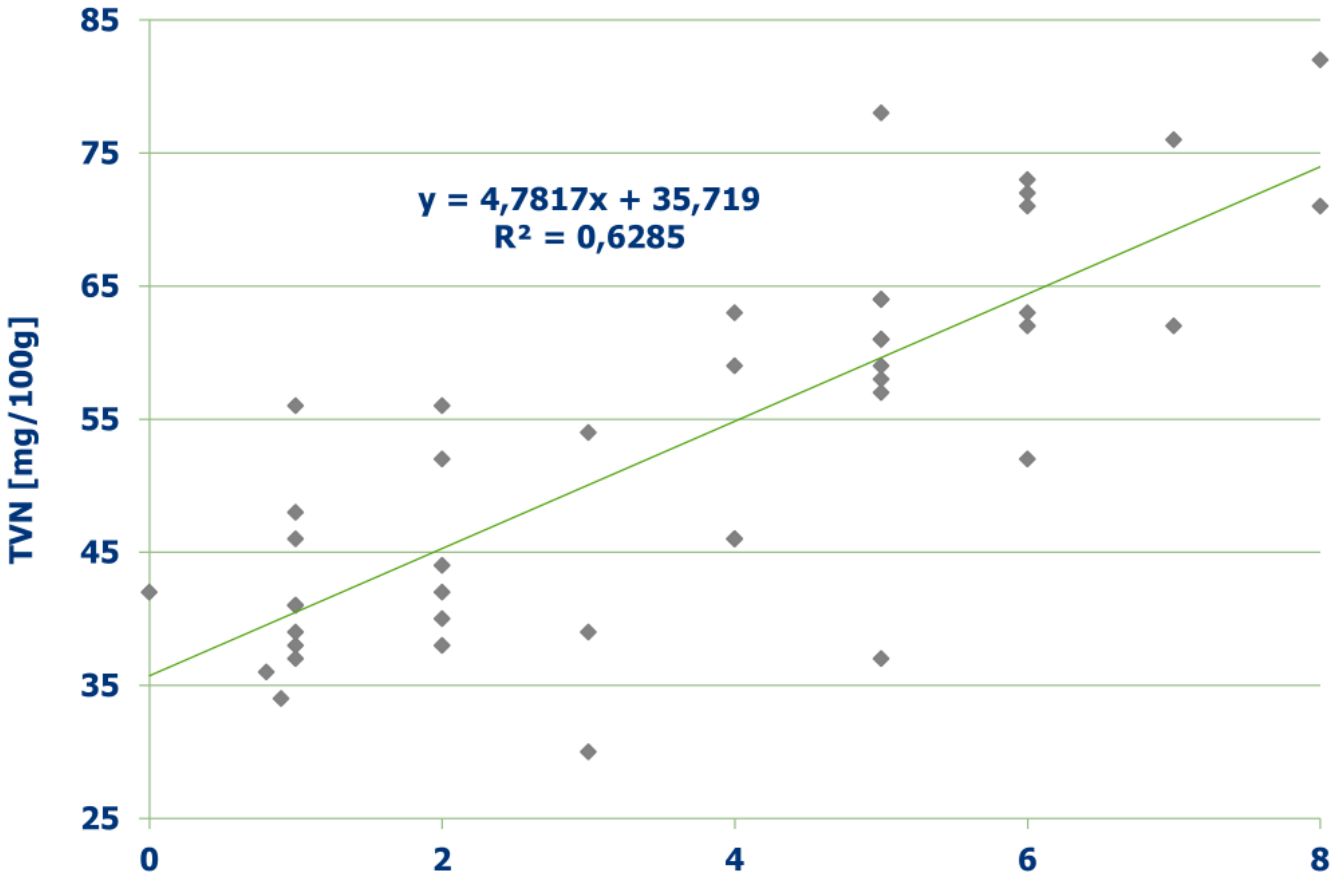
- **Ratio of fish vs. seawater in the tanks**

The ratio of fish vs seawater should be 50% for optimal results.



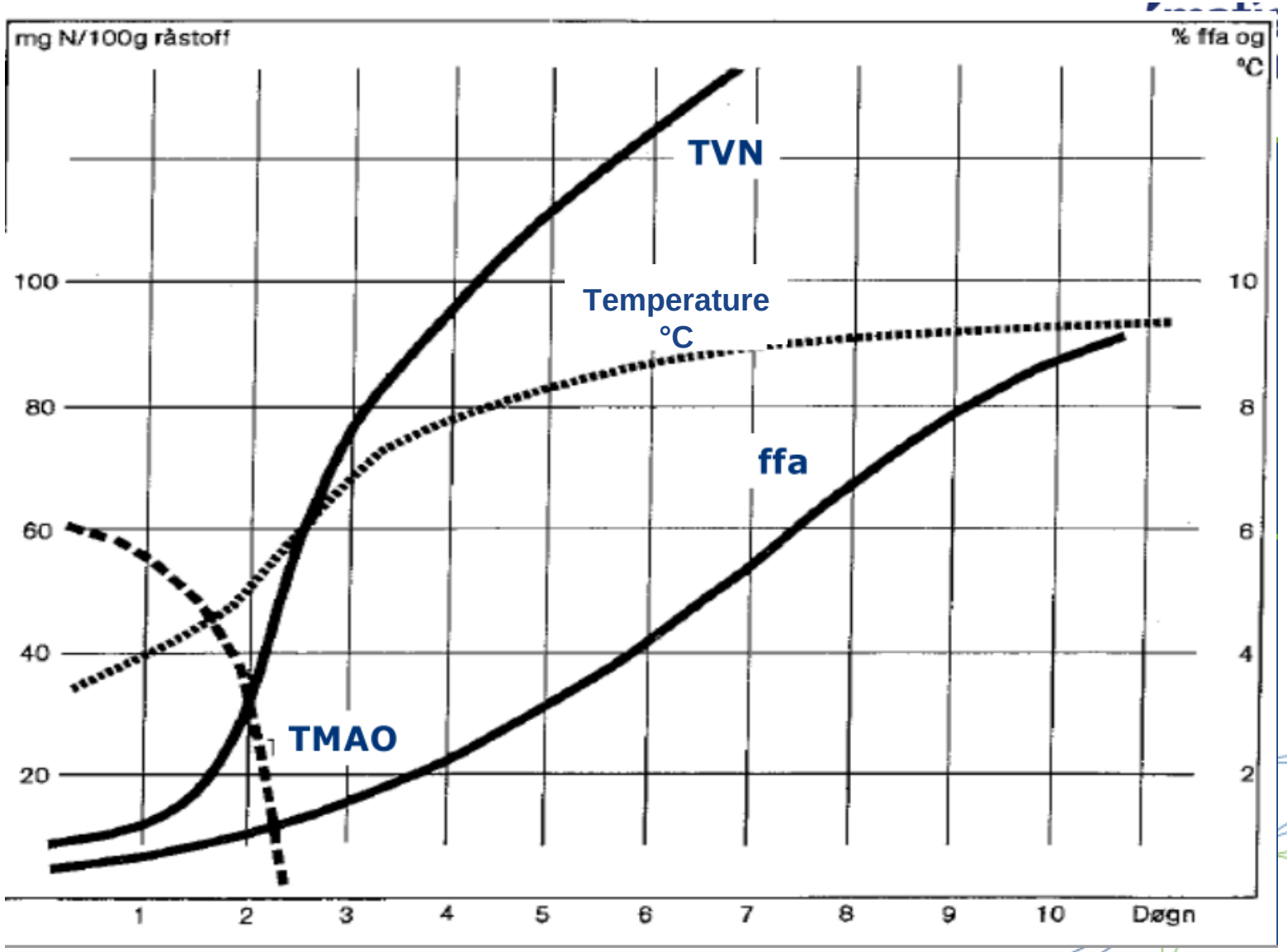
Brodal, E., Jack, S., & Eik, O. (2018). Transient model of an RSW system with CO 2 refrigeration – A study of overall performance Étude de la performance globale du modéle transitoire d ' un systéme d ' eau de mer réfrigérée au CO2, *86*, 344–355. https://doi.org/10.1016/j.ijrefrig.2017.11.002

How does storage temperature affect raw material quality?



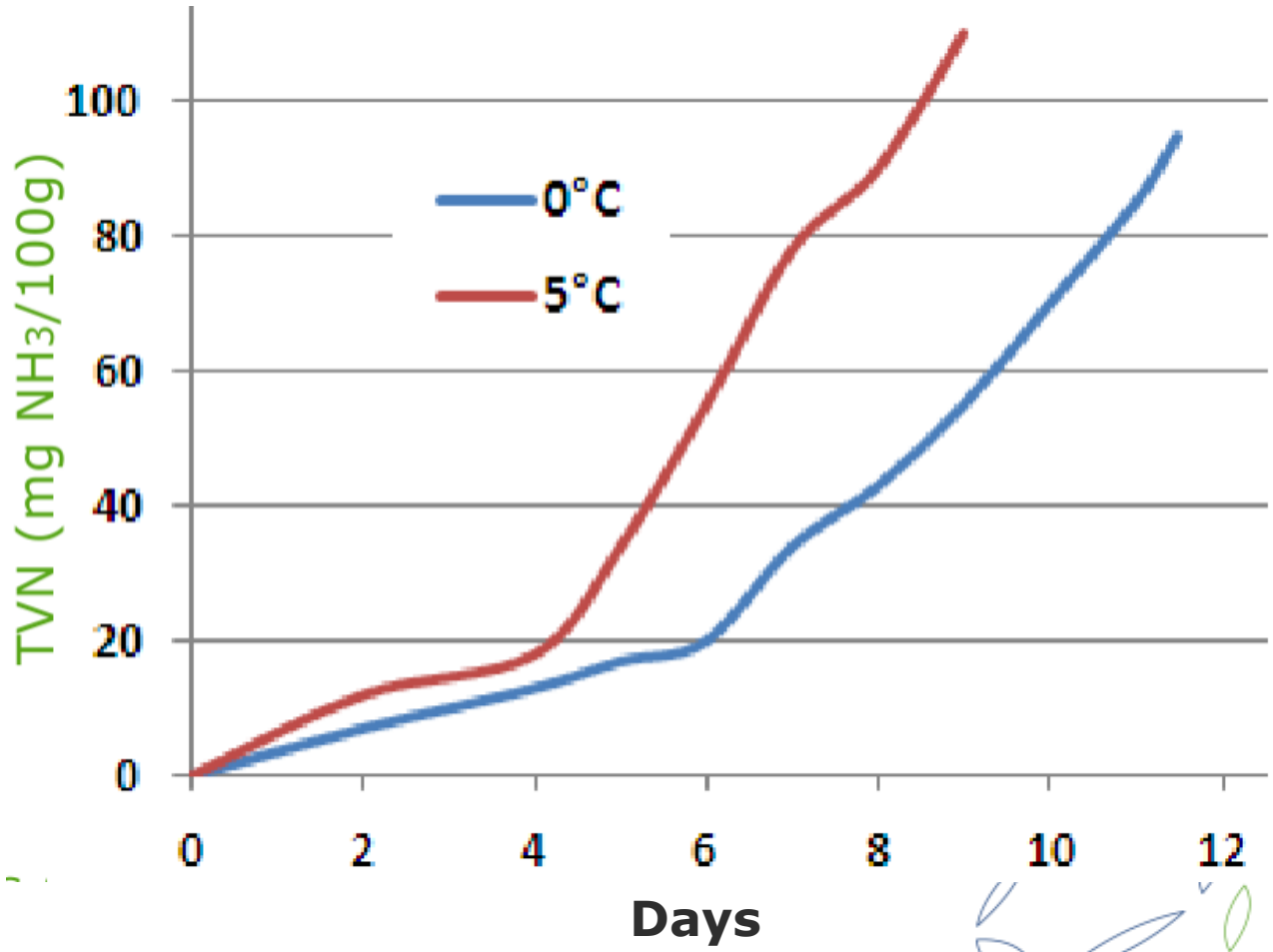
How does storage temperature affect raw material quality ?

Capelin



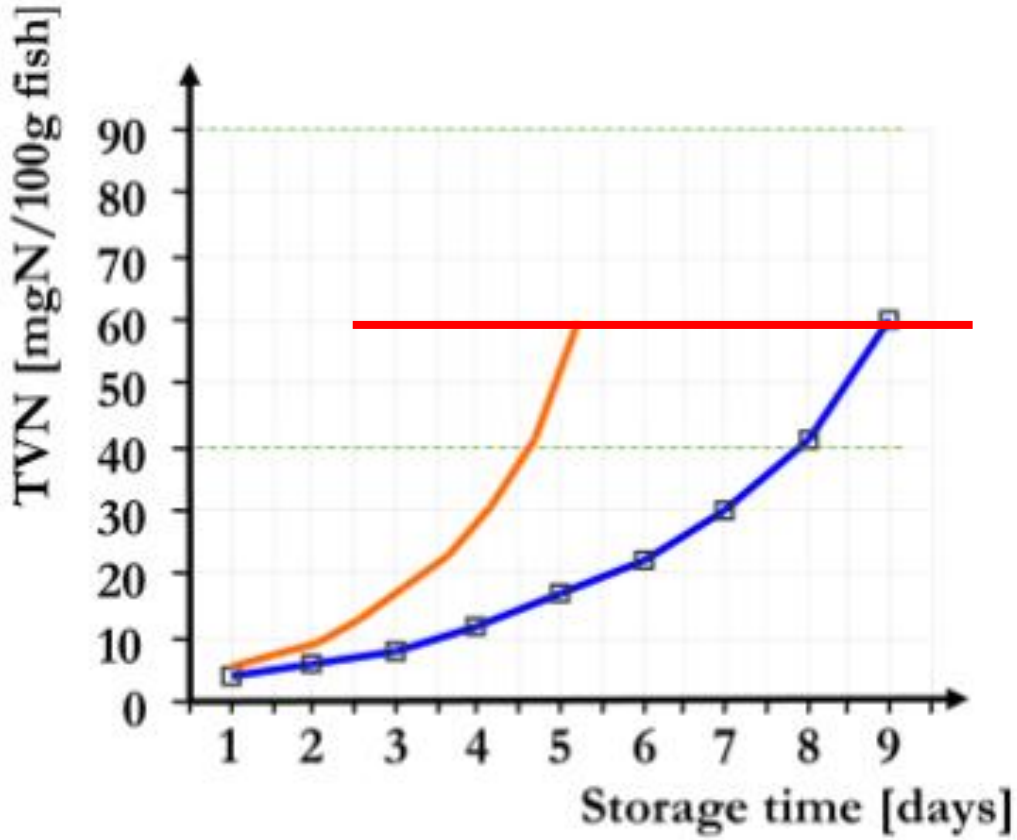
How does storage temperature affect raw material quality and shelf life?

TVN development in Capelin, stored at 0°C and 5°C



How does storage temperature affect raw material quality and shelf life?

TVN development for Blue Whiting, stored at 0°C and 5°C

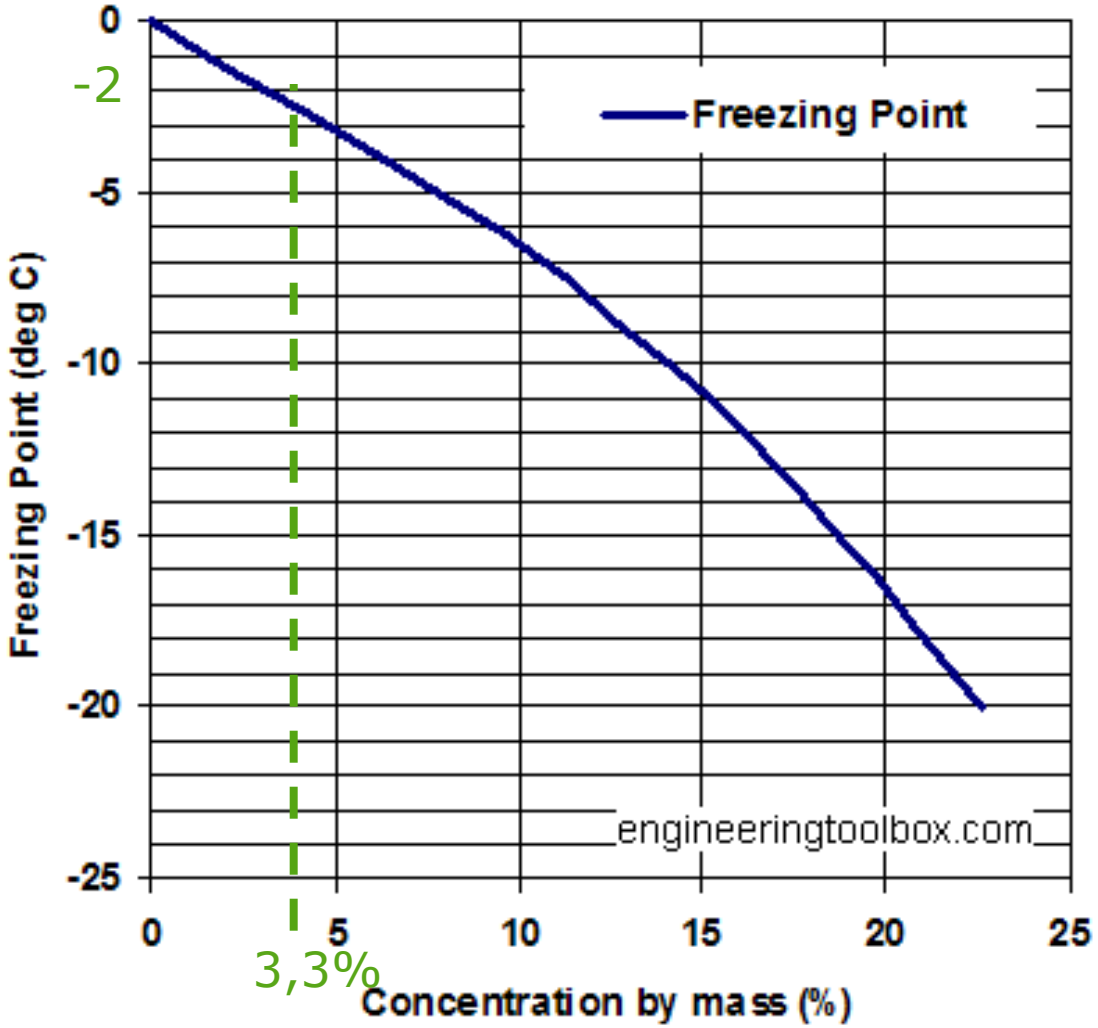


How does salinity in the seawater affect raw material quality ?

- Seawater is used to lower the freezing point of water. That allows for cooling the sea below zero(-2°C) promoting faster cooling.

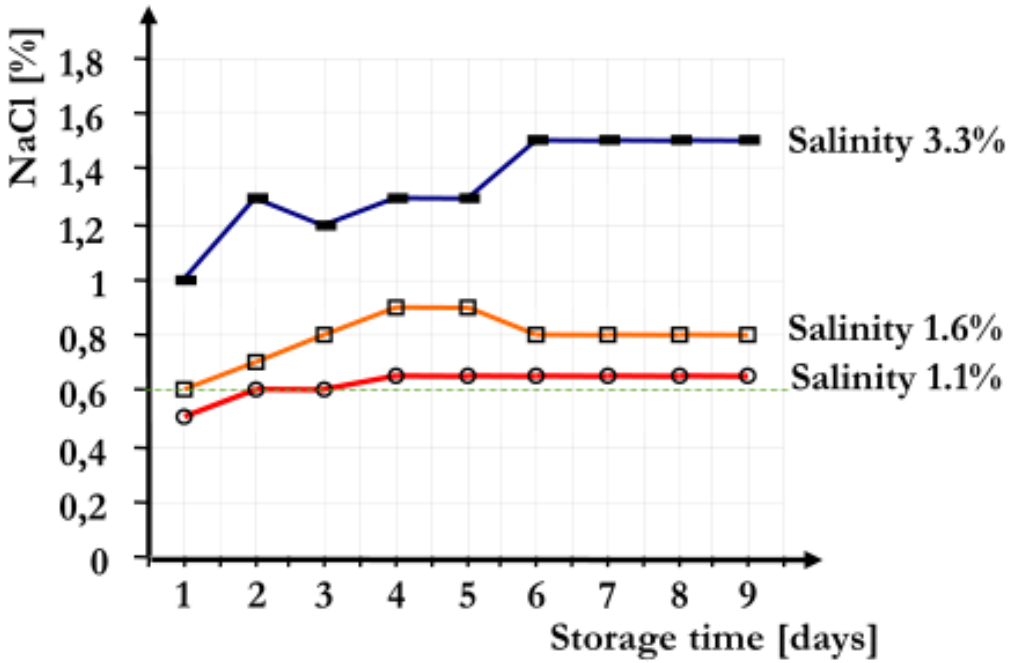
- Intention is to partially freeze the water in the fish guts.

- If seawater was not used the temperature of the water would never go lower than 1°C and the raw material would not be cooled further down than to 2 to 5°C
- Seawater is often used in mixture with fresh water

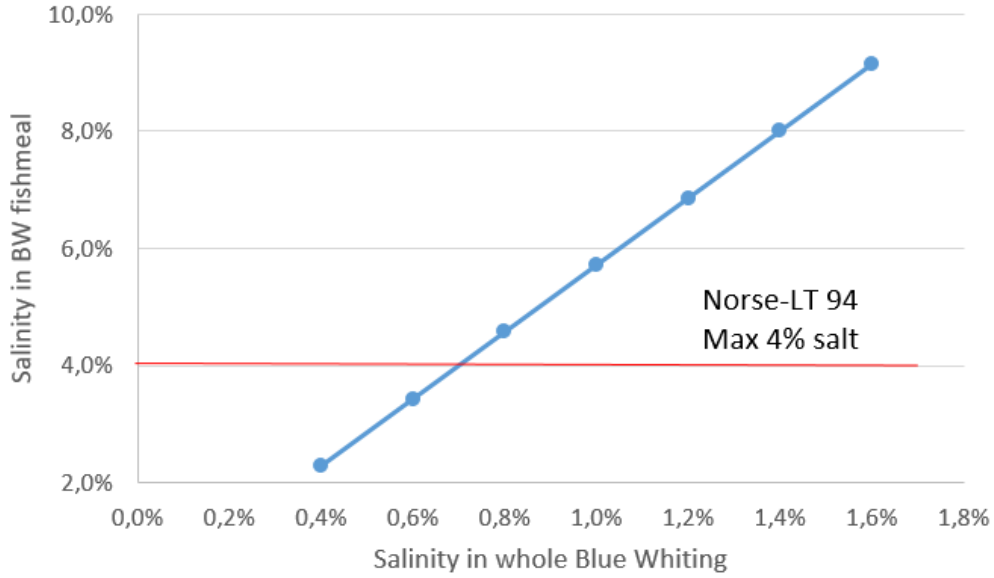


How does salinity in the seawater affect raw material quality ?

Salinity in the seawater and in whole Blue Whiting



- Storage temperature 0°C



How does salinity in the seawater affect raw material quality ?

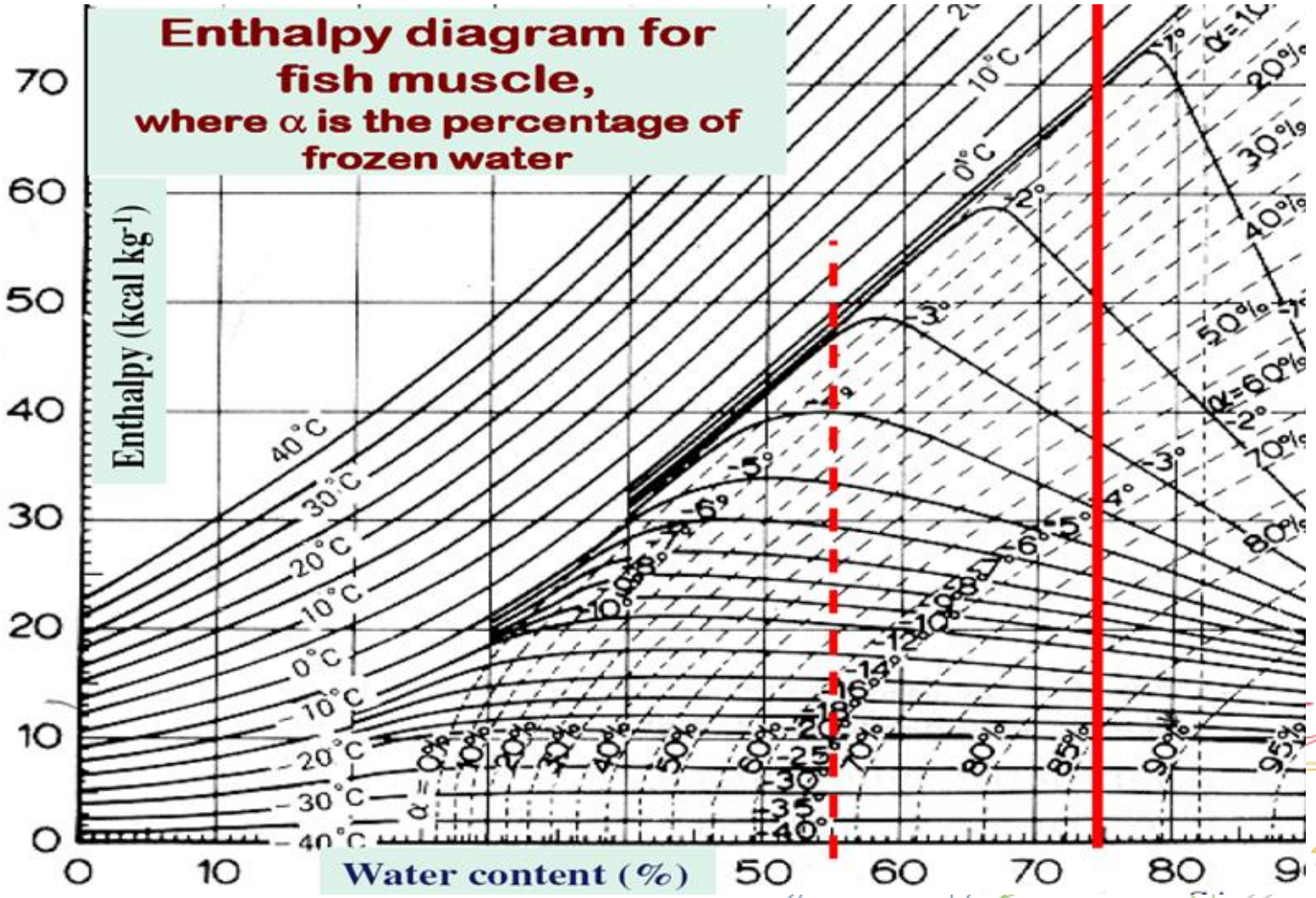
- **Mackerel cooled down to -2°C in RSW system**
  - 100% seawater (3,3-3,5% salt)
  - Below 0,5 % Salt in RM
  - Fishmeal wit salt below 3%
- **Lean fish is more sensitive**
  - Blue whiting, capelin
  - Especially after spawning season

Superchilling

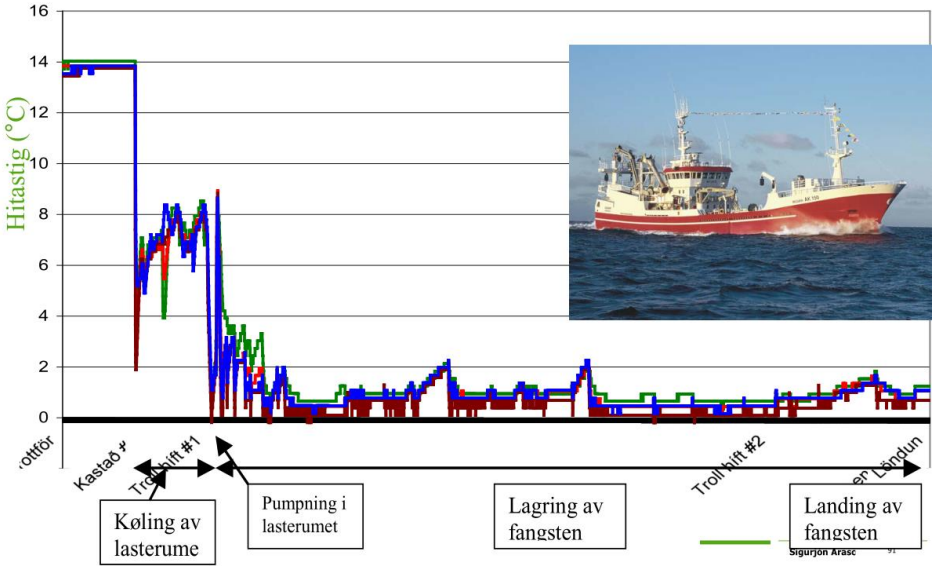
Muscle: Water content 54%
Begin of ice phase formation at -2,5 - -3°C

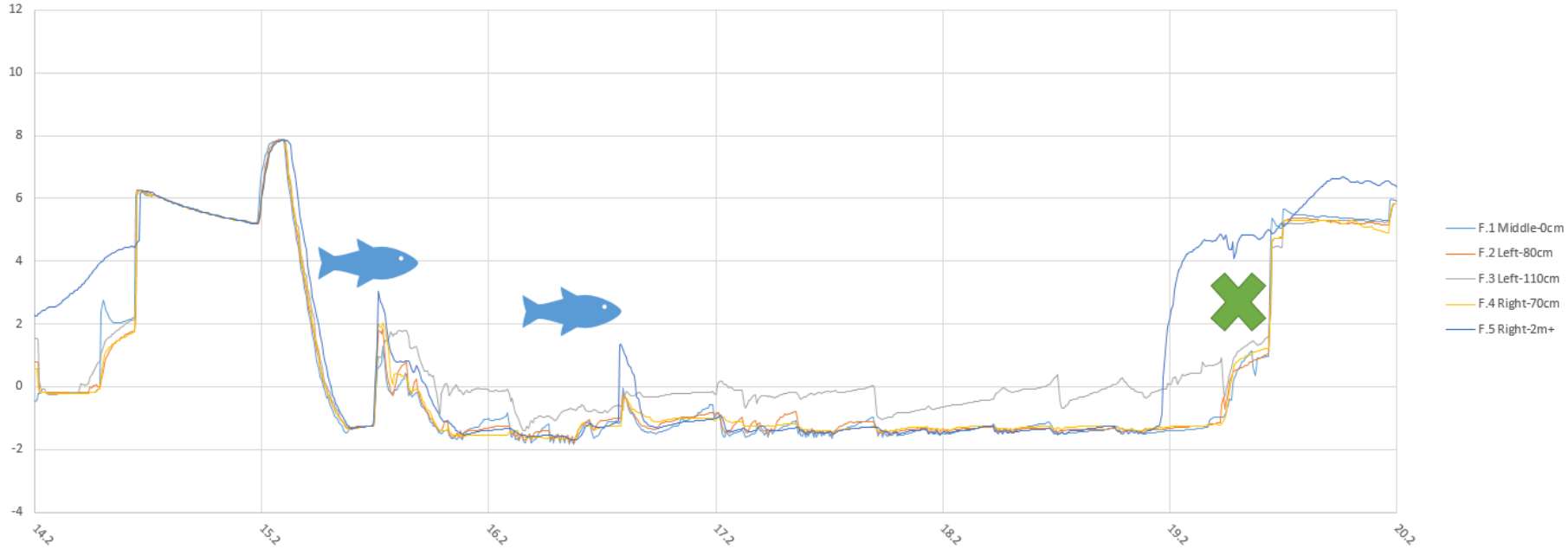
Viscera: Water content 73%
Begin of ice phase formation at -1- -1,5°C

- Mackerel -2°C
  - Muscle 0-5% frozen
  - Viscera 30%



Projects at Matís





First and last

Future studies

1. How important is the salt content in fishmeal in terms of quality, fish growth and feed intake?

1. How much salt do lean fish species take up when superchilled in seawater at -2°C?

1. Is it economical to land superchilled raw material for fishmeal?

1. How can we further improve the quality of lean fish species?