INSTITUT INTERNATIONAL DU FROID
INTERNATIONAL INSTITUTE OF REFRIGERATION

6th IIR Conference on Sustainability and the Cold Chain

ICCC 2020
NANTES - FRANCE
AUGUST 26-28

ENZYMATIC HYDROLYSIS OF COD HEADS

– effect of freezing and thawing on the quality and composition of protein hydrolysates

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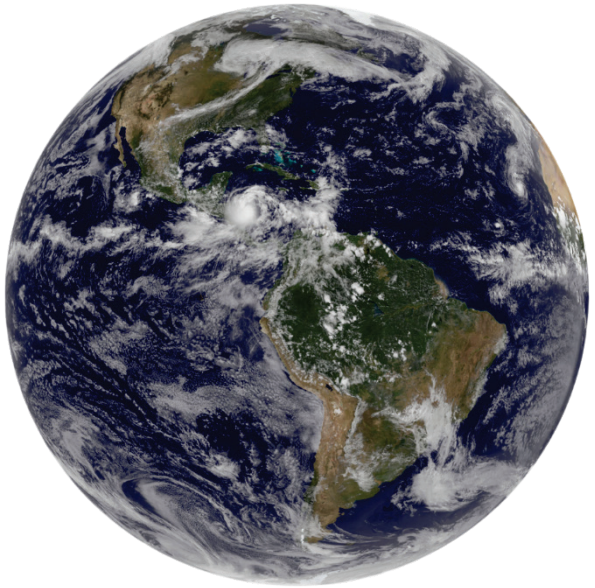
CONTENT

- Background for the study
- Measurement and methods
- Results and discussion
- Conclusion and further work

FOOD GAP

71 % of the earth is water…….

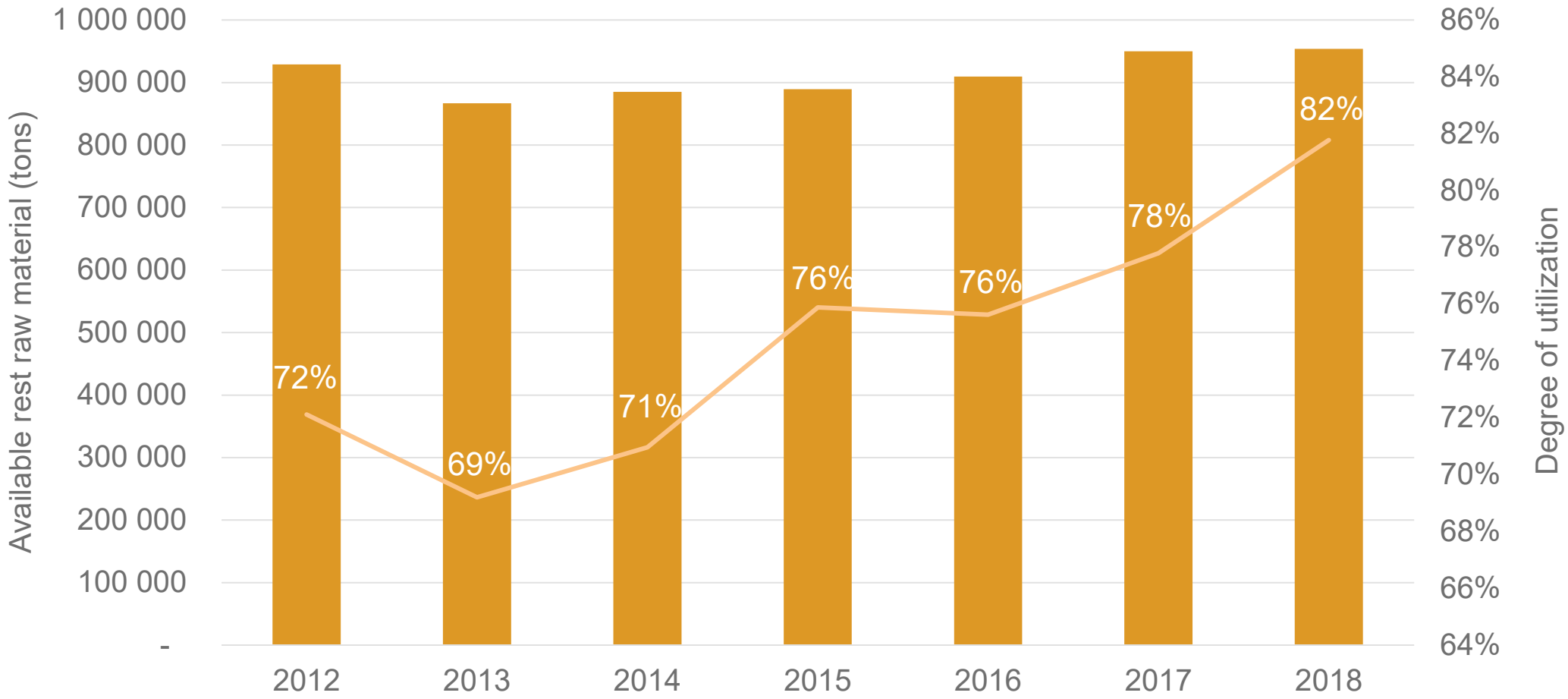


….. but only 2 % of the world food production comes from the ocean

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

…When discards prior to landing are included, 35 percent of global catches are lost or wasted and therefore not utilized…

MARINE REST RAW MATERIAL IN NORWAY



Source: Richardsen, R., Myhre, M., Nystøyl, R., Strandheim, G., & Marthinussen, A. (2019). Analyse marint restråstoff 2018 - Tilgang og anvendelse av marint restråstoff i Norge.

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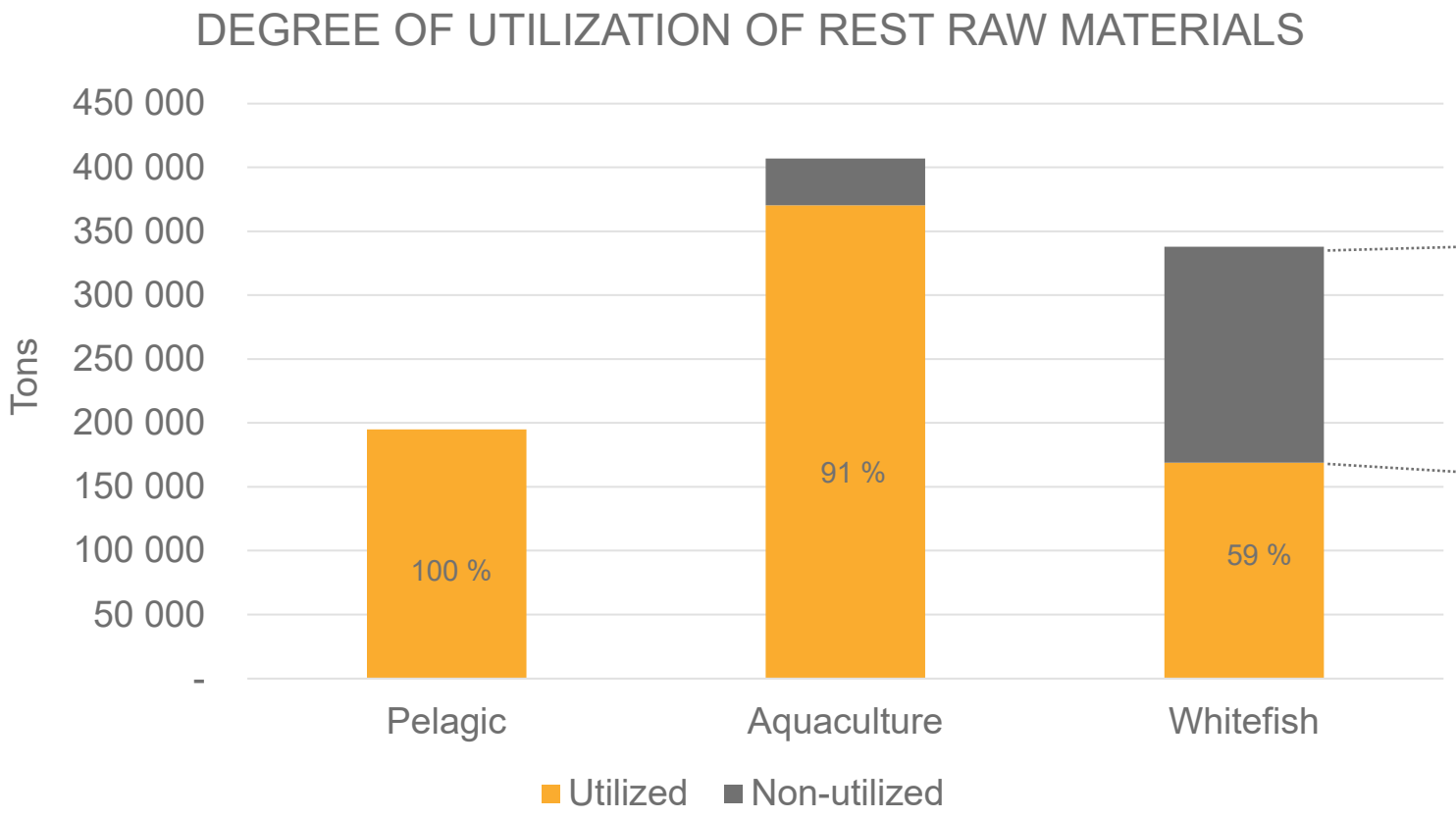

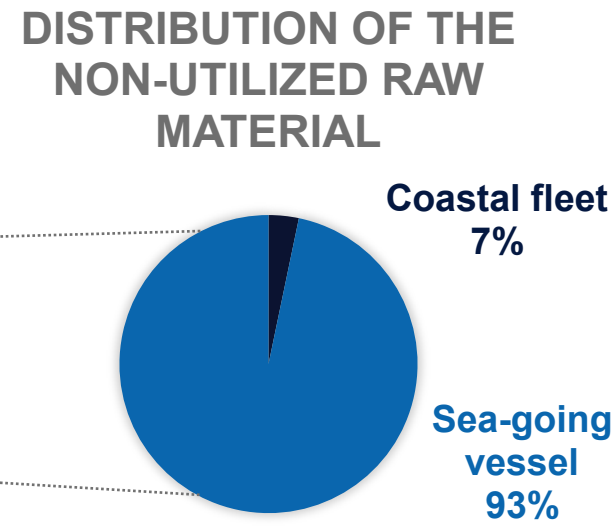

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THE POTENSTIAL IN THE NON-UTILIZED RAW MATERIAL

Non-utilized whitefish rest raw materials
131 700 ton (2018)

6 600 ton lipids

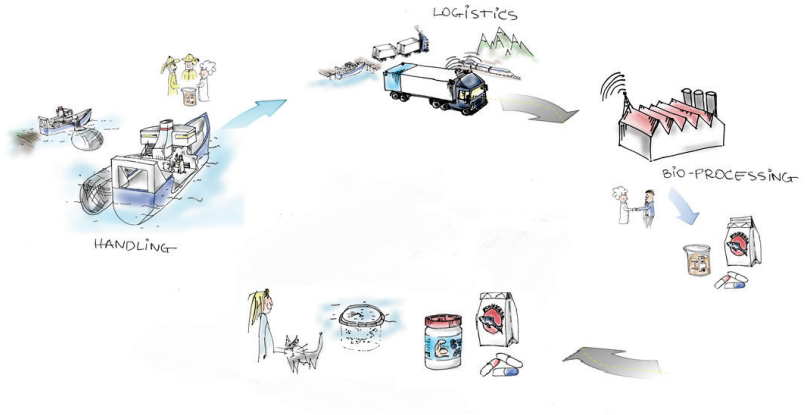
18 500 ton protein

~ 14 million people could get their daily recommende intake (250 mg EPA + DHA) for a whole year

~ 0.8 million people could get their daily requirement of proteins for a whole year

COD HEADS

- Traditionally dried
- Unstable markets
- Can we make high quality proteins?



The Research Council of Norway
CYCLE FOOD - FEED - FERTILIZER - FUEL - FUTURE
SUPREME
NTNU
SINTEF

MEASUREMENTS AND METHODS

RAW MATERIAL

- Atlantic cod (*Gadus morhua*, n = 40) caught by local fishermen in the Trondheim Fjord
- Fresh heads were stored at 4 ºC overnight before processing
- After overnight cold storage, three kg of heads were used for hydrolysis **(FH)** the rest were frozen

FREEZING

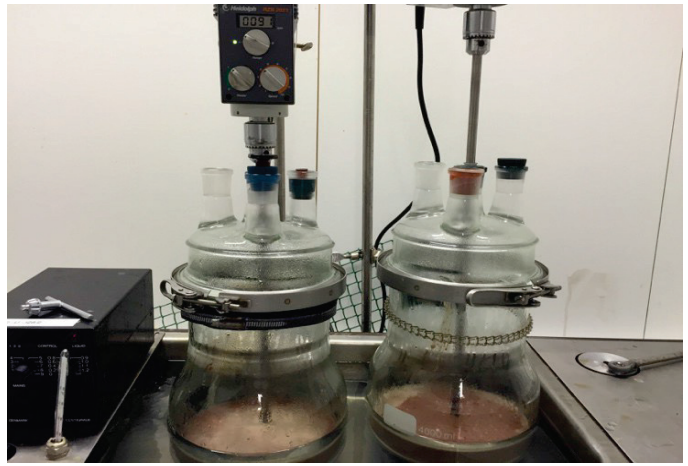
- Whole or minced heads were frozen in an impingement freezer with air temperature of -37 °C for ~ 25 min
- Samples were stored at -20 °C for 20-21 days before thawing

THAWING

- **Whole heads** were thawed in air at 4 °C for 20 hours **(WH-A)** or in water at 6-10 °C for 3 hours **(WH-W)** before mincing and subsequent hydrolysis
- **Minced heads** were thawed in air at 4 °C for 20 hours **(MH-A)** or in water at 6-10 °C for 30 minutes **(MH-W)** before hydrolysis

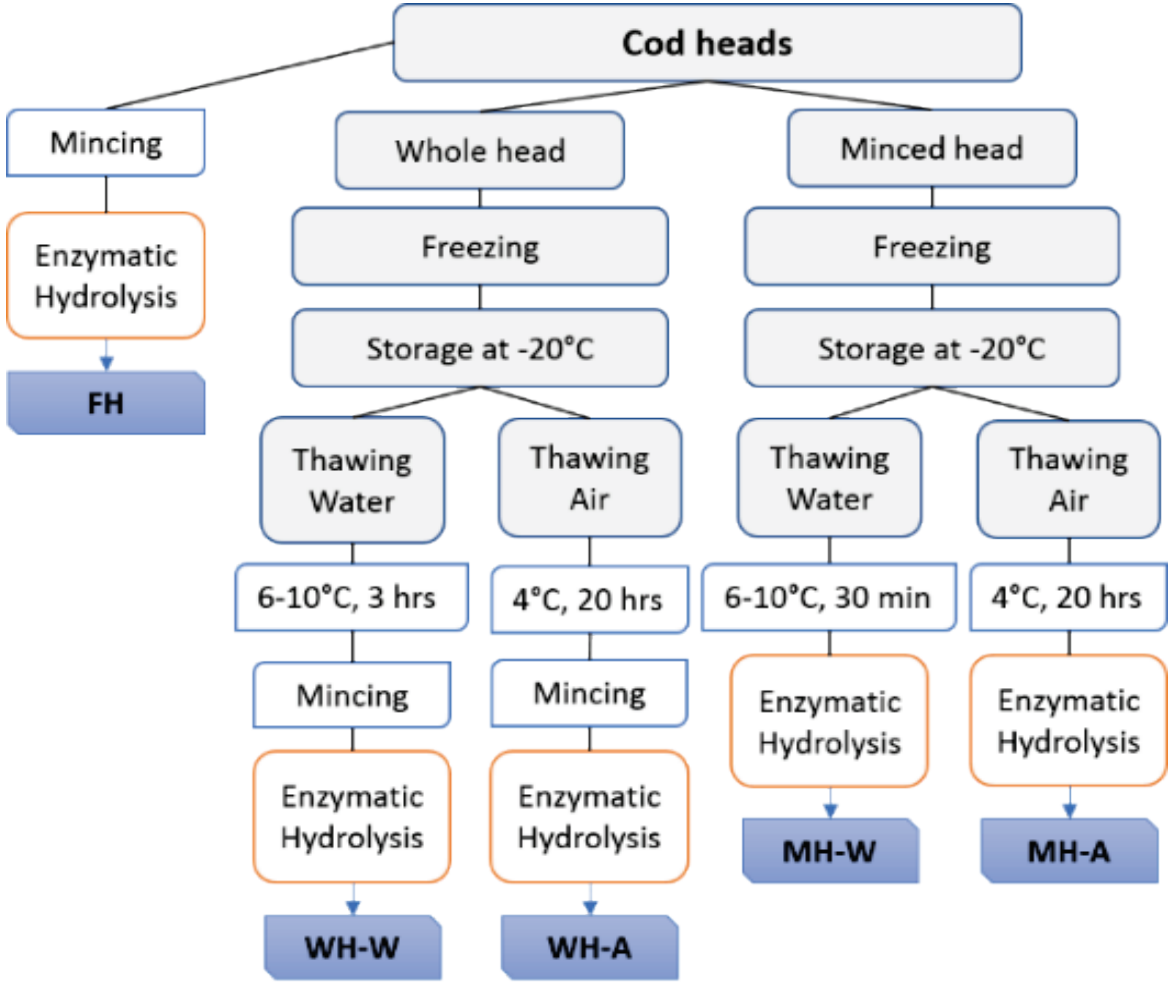
ENZYMATIC HYDROLYSIS

- Minced cod heads from one of the five treatments were mixed with preheated water (ratio 1:1) in a reactor placed in a water bath (~ 50 °C)
- The hydrolysis experiment started when the mixture reached 50 °C by addition of 0.1 % Protamex® and ran for 1 hour before inactivation (90 °C)



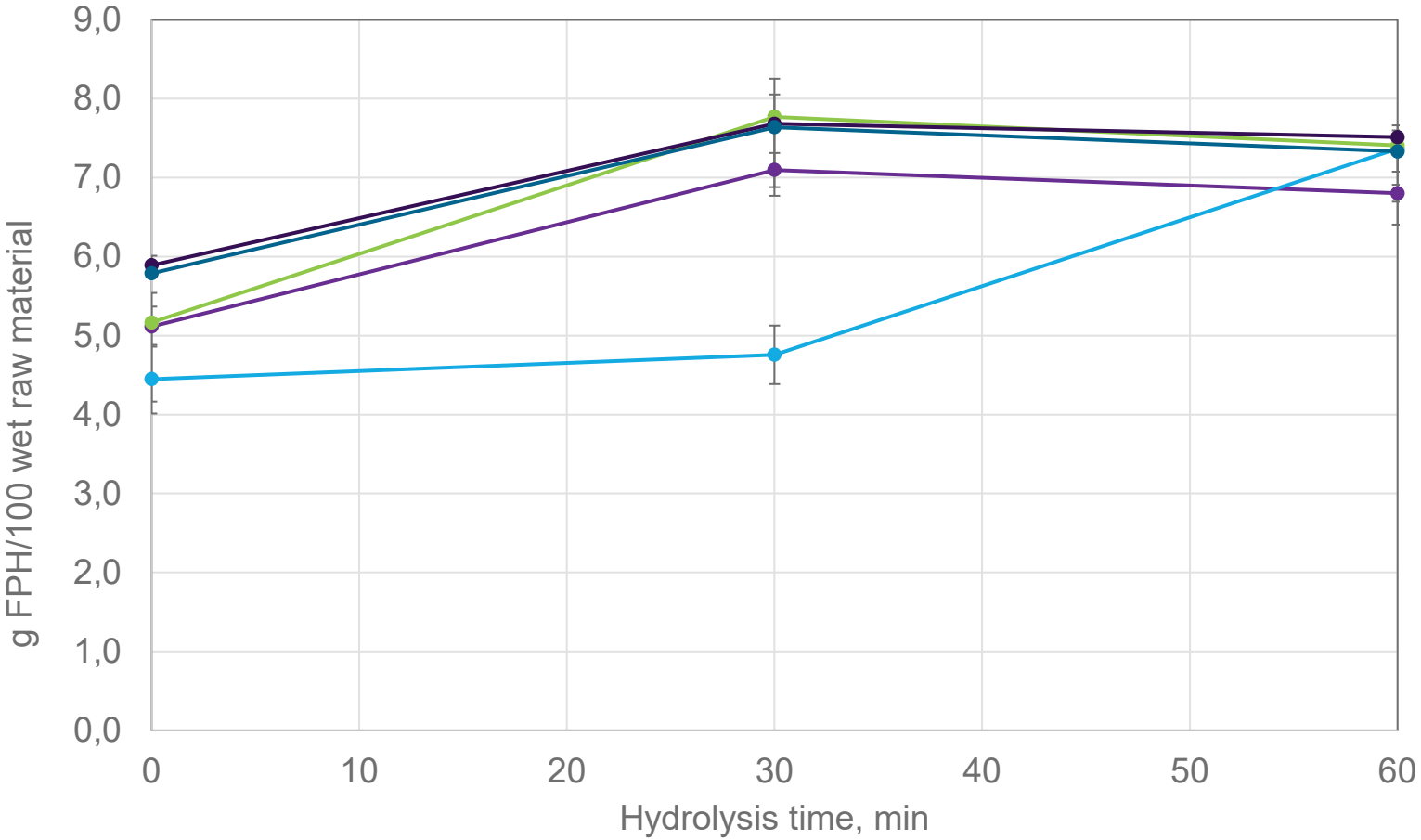
MEASUREMENTS

- Hydrolysis yields
- Chemical composition
- Sensory quality



RESULTS AND DISCUSSION

HYDROLYSIS YIELDS



- Fresh heads (FH)
- Whole heads thawed in water (WH - W)
- Minced heads thawed in water (MH - W)
- Whole heads thawed in water (WH - A)
- Minced heads thawed in air (MH - A)

> Neither freezing, thawing or mincing of the raw material before enzymatic hydrolysis was found to affect the hydrolysis yields (~ 7.3%)

COMPOSITION FPH

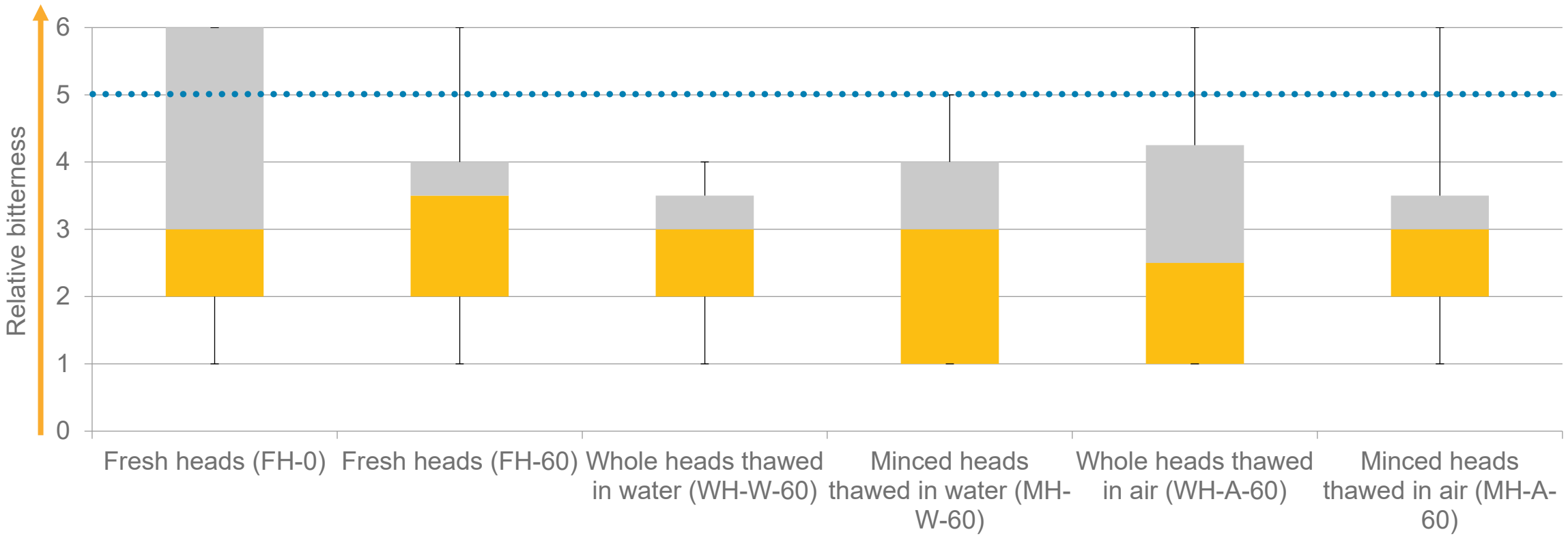
Sample	Protein (g/100g) (n = 8)	Lipids (g/100g) (n = 4)	Ash (g/100g) (n = 4)	Water (g/100g) (n = 4)
FH-60	82.3 ± 1.0^{b}	0.4 ± 0.1^{a}	10.4 ± 0.3^{c}	2.3 ± 0.2
WH-W-60	84.4 ± 0.3^{d}	0.4 ± 0.1^{a}	8.9 ± 0.2^{a}	2.7 ± 0.3
MH-W-60	82.7 ± 0.5^{bc}	0.5 ± 0.1^{a}	9.7 ± 0.4^{b}	3.8 ± 0.4
WH-A-60	81.0 ± 1.0^{a}	0.7 ± 0.1^{b}	9.8 ± 0.3^{bc}	2.9 ± 0.7
MH-A-60	83.5 ± 0.3^{c}	0.4 ± 0.1^{a}	9.9 ± 0.3^{bc}	2.7 ± 1.5
p-value	0.000	0.002	0.000	0.131

“

All FPH analysed in this study had similar and desirable chemical compositions regardless of their pre-treatments (mincing, freezing, thawing), and could be used as valuable components in foods

Foto: Jannicke Remme, SINTEF Ocean

SENSORY EVALUATION



CONCLUSIONS AND FURTHER WORK

- The results show that mincing and freezing of cod heads can be a viable option for on board preservation of rest raw materials with no know negative effects on the quality of FPH
- The FPH from all treatments gave a yield of 7.3%, had high protein content 81-84%, were water soluble and had acceptable taste and smell
- Further work is needed to investigate how this (preservation and/or processing) can be solved on board a commercial - *experiments planned for autumn 2020*

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SINTEF

Thank you

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