Nofima
Norwegian Institute of Food, Fisheries and Aquaculture Research

Taste-neutral proteins from mackerel

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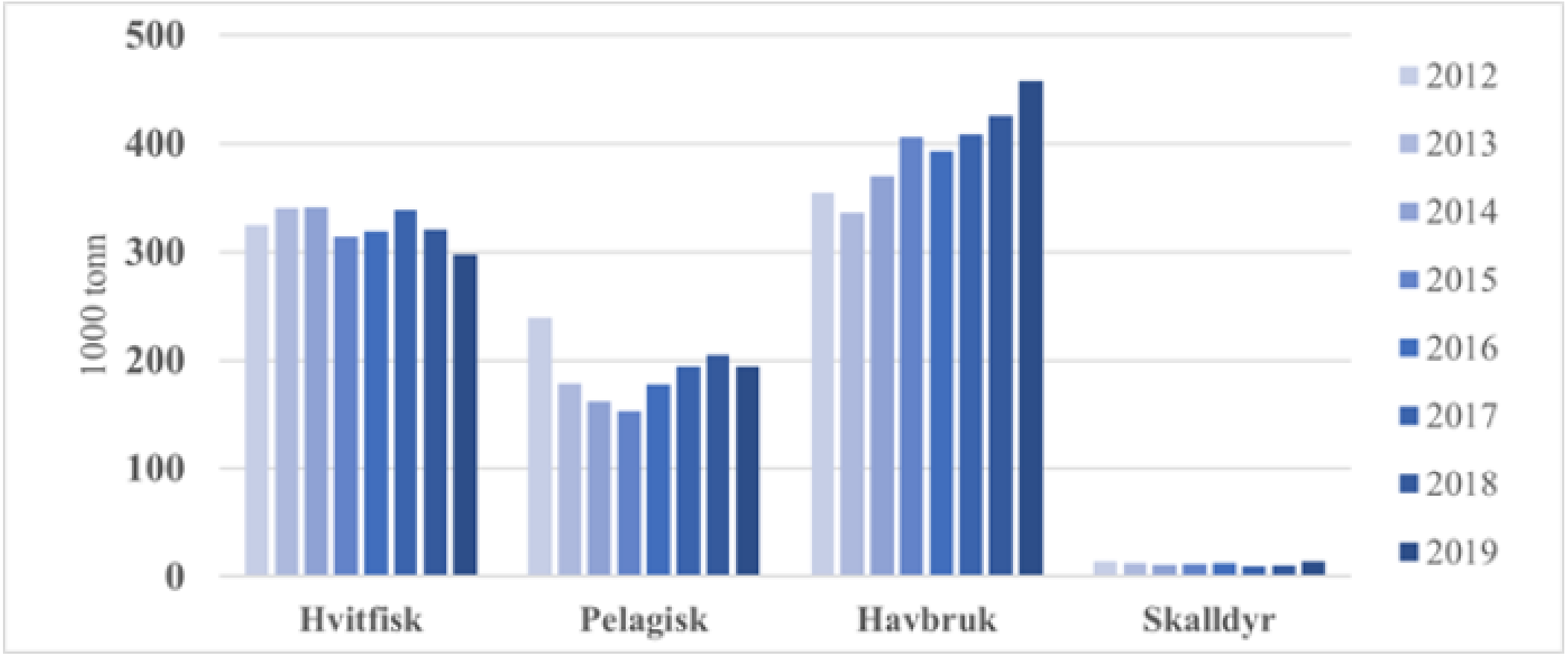
SME

Background

- FHF – Norwegian Seafood Research Fund
- Industry (i.e., Pelagia)
- Research institutes/environments
- Development of knowledge & technology for increased utilization of Mackerel
- Today;
  - only 2-4% of Norway's mackerel is processed into fillets
  - Remaining; 350.000 tonnes are exported
- Large part of the residual raw material is lost
- Focuses on increased value creation of protein products for human consumption from mackerel residual fiber.

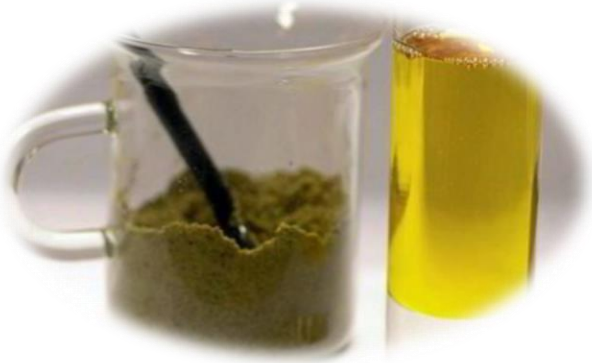
Development of available rest raw material



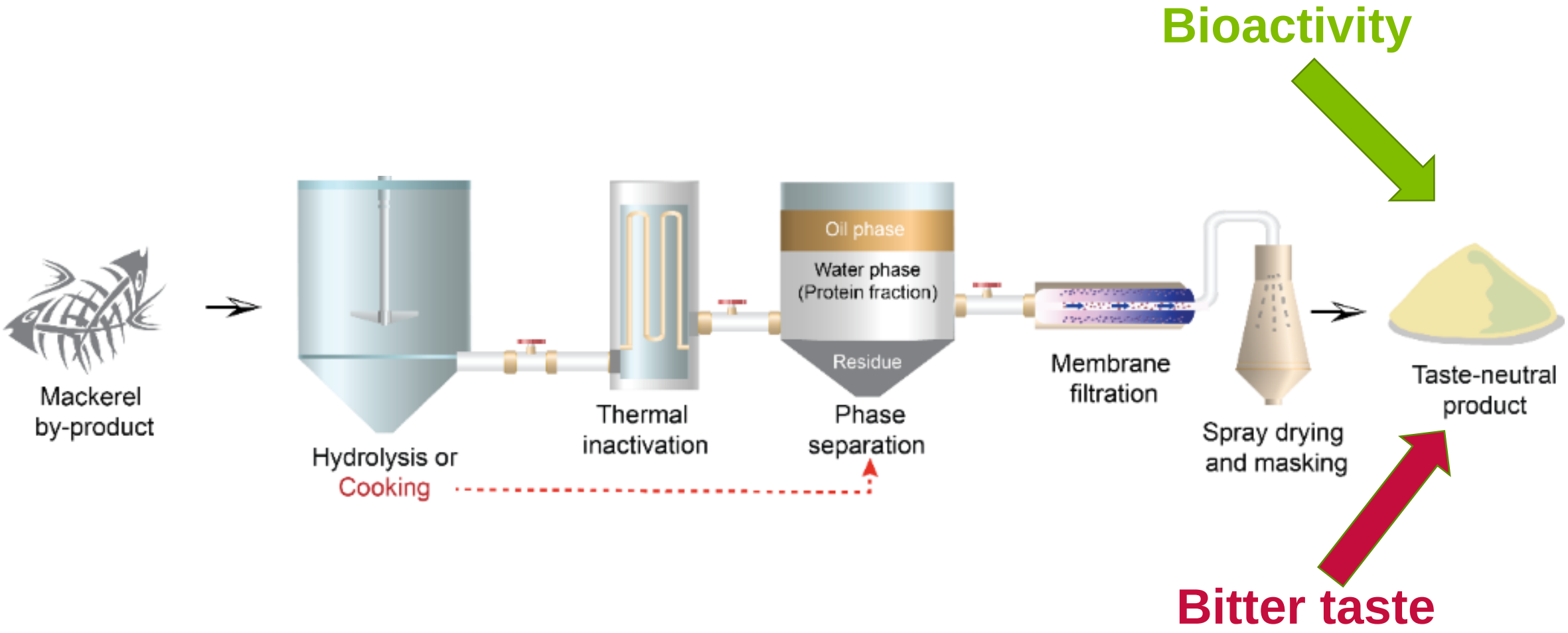
Source: Fiskeridirektoratet, ssb, Norges sjømatråd, Sintef (www.fhf.no)

Background

- A traditional fish oil and fishmeal production process



Enzymatic protein hydrolysis



Taste-neutral proteins from mackerel (SMELL)

What

- To develop a process to produce an odor- and taste-neutral protein concentrate from mackerel offal

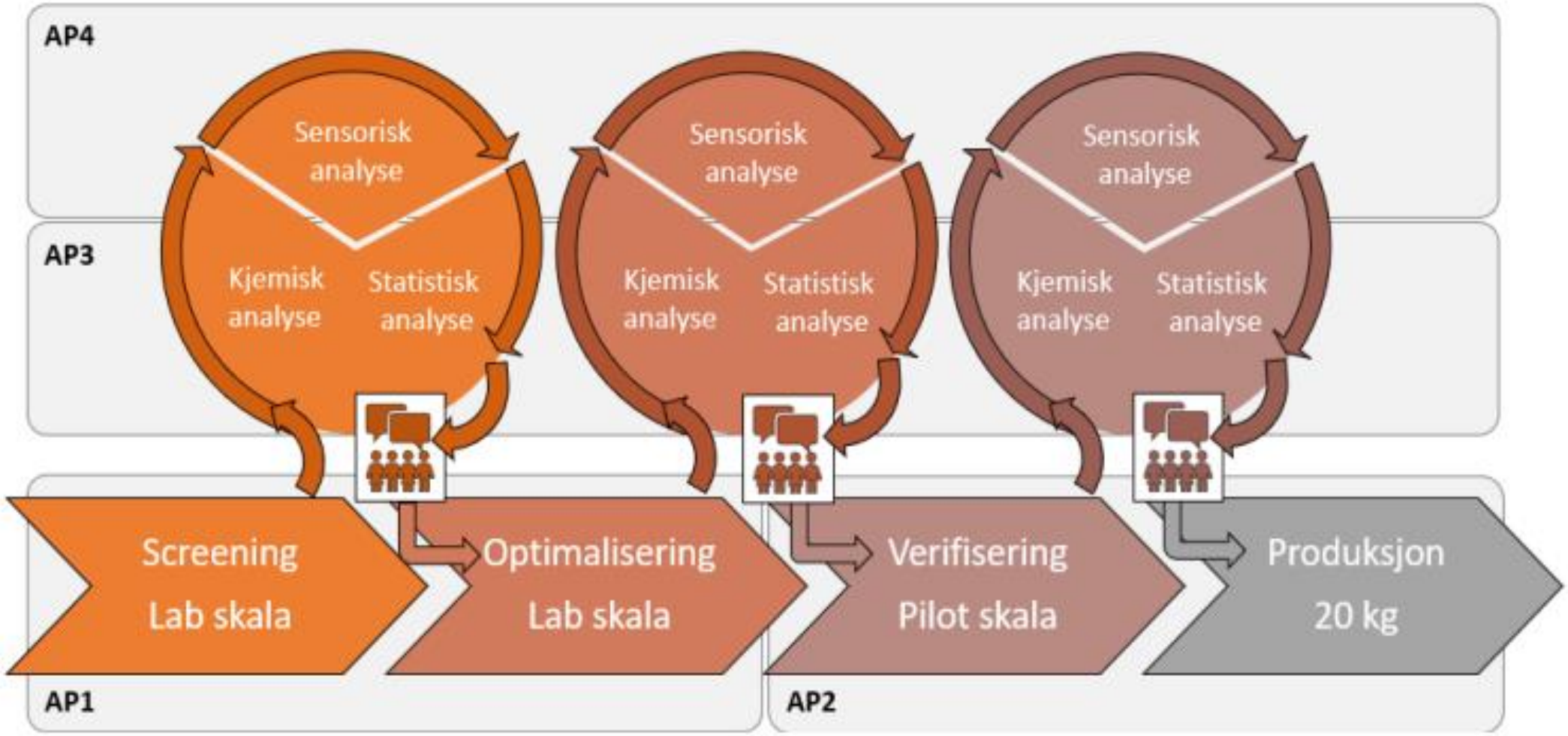
How

- Enzymatic protein hydrolysis

Who

- Nofima
- Sintef
- Pelagia
- FHF (Norwegian Seafood Research Fund)

The project structure and methods



Lab scale

1. Enzymatic protein hydrolysis
2. Processing of glue water

➢ Taste profile, quality and protein yield

3. Membrane filtration

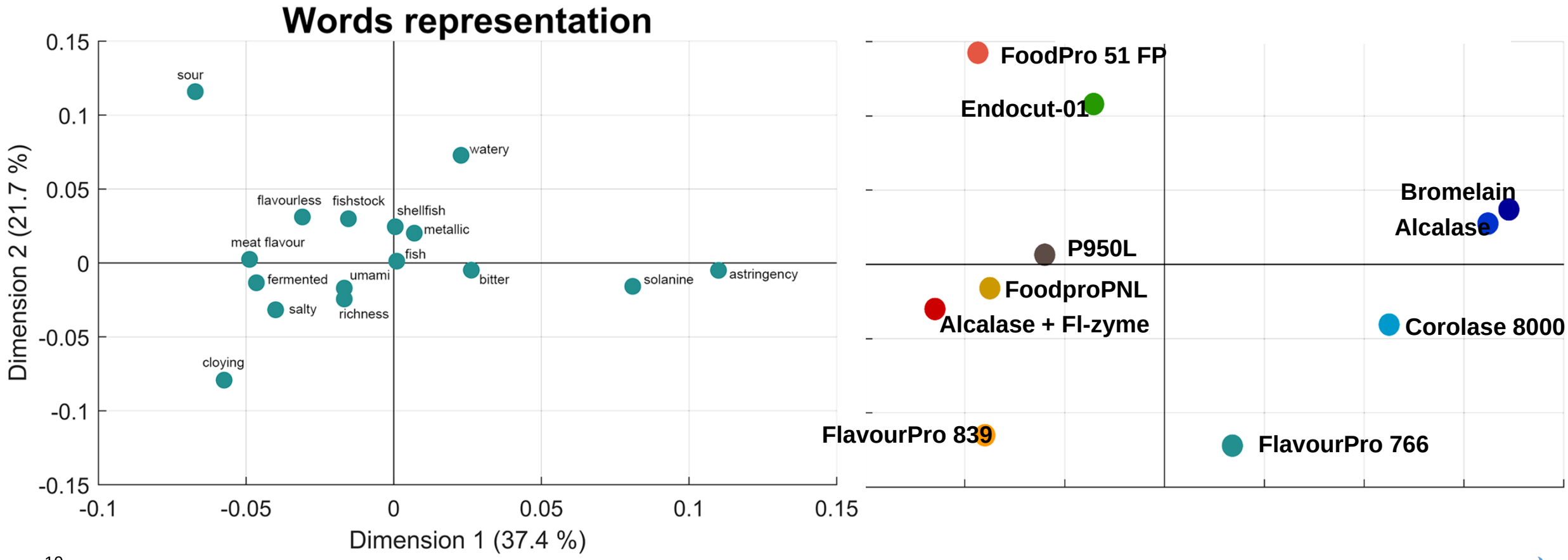
Lab scale screening

Tabell 5 Tørrstoffutbytte og proteinutbytte av hydrolysat og pris på proteasene

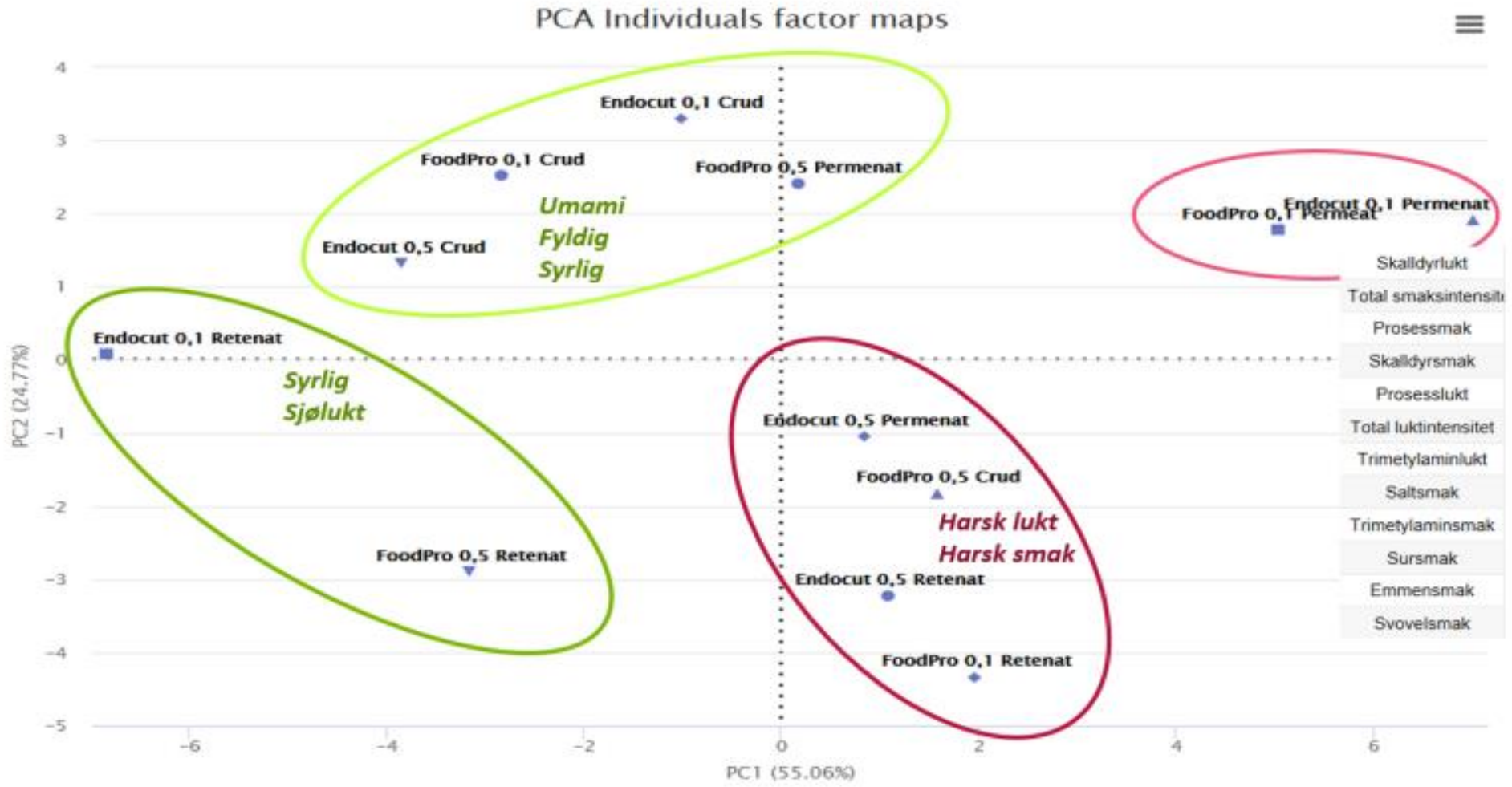
Enzym	Utbytte tørrvekt	Utbytte protein	Pris (dato for når pristilbud ble sendt)
Bromelain	27 %	52 %	55,25 $/kg (mars 2016)
Alcalase	24 %	44 %	397,8 kr/kg (juni 2019)
Flavourpro 839	21 %	37 %	125,2 £/kg (aug 2019)
Corolase 8000	20 %	37 %	28,5 €/kg (mai 2018)
Flavourpro 766	19 %	33 %	62,2 £/kg (aug 2019)
Promod 950L	18 %	32 %	11,04 £/kg (aug 2019)
Endocut 01	17 %	30 %	24 €/kg (aug 2019)
FoodPro 51 FP	16 %	29 %	1106,00 DKK/kg (juli 2019)
FoodPro PNL	15 %	27 %	152,5 DKK/kg (juli 2019)
Alcalase 30 min + Flavourzyme	15 %	26 %	1069 kr/kg (fl.z) (juni 2019)

Projective mapping - 10 proteases

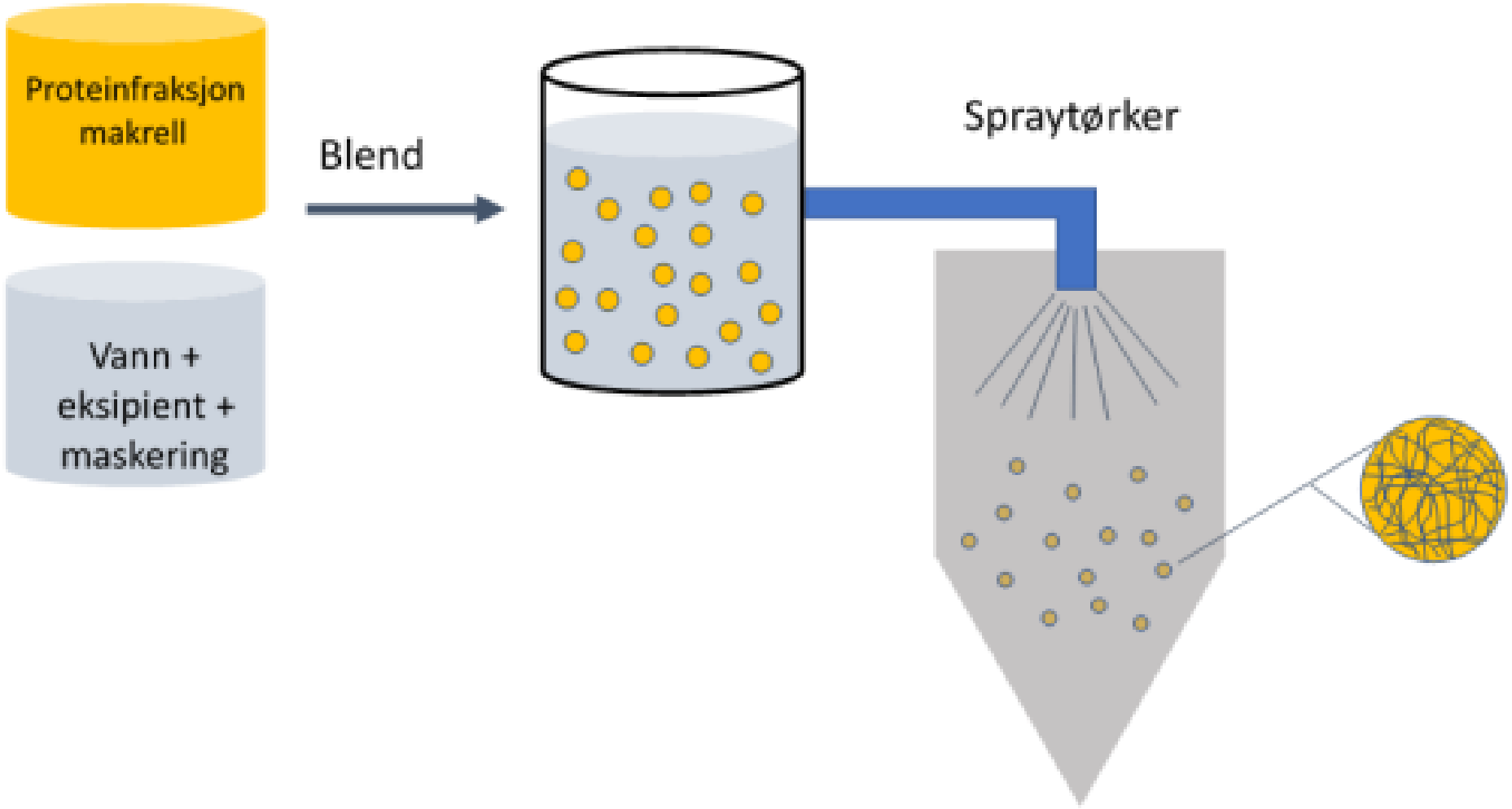
Results from the sensory panel at Nofima



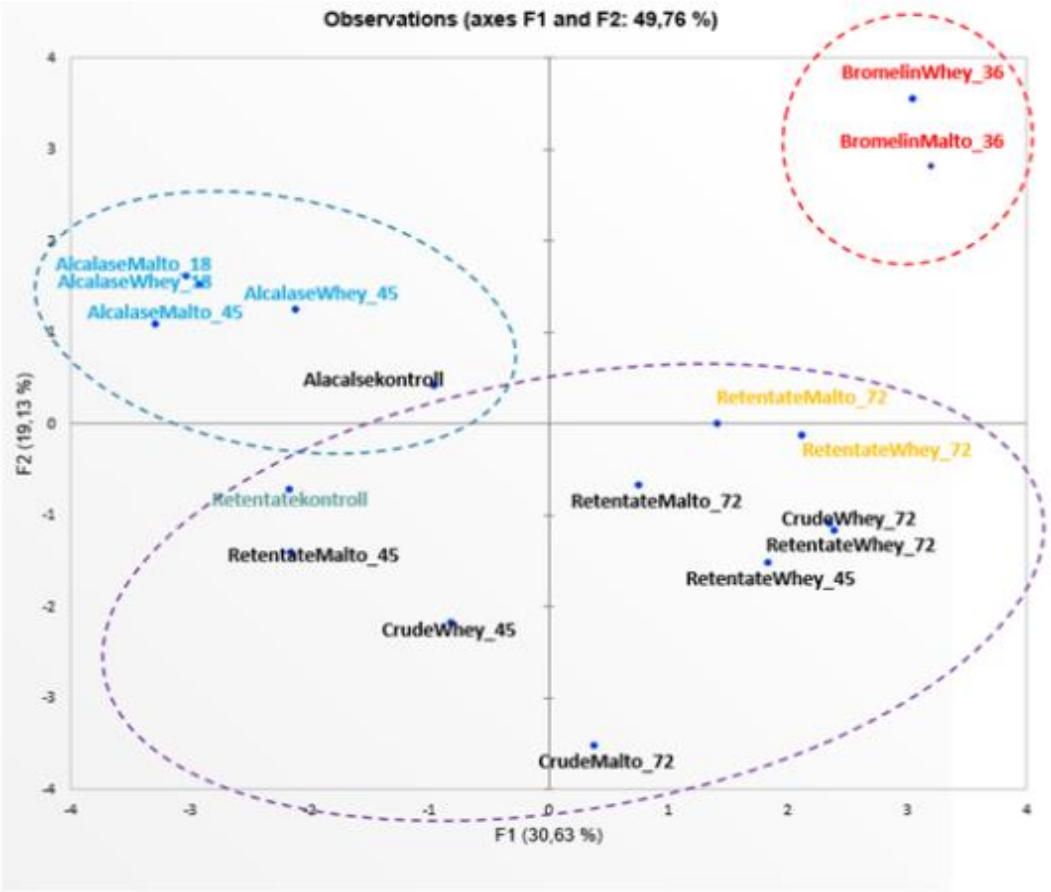
Pilot processing
PCA plot of hydrolysates from Endocut 01 and Foodpro PNL



Masking


Proteinfraksjon makrell
Vann + eksipient + maskering
Blend
Spraytørker

Masked hydrolysates from lab scale production

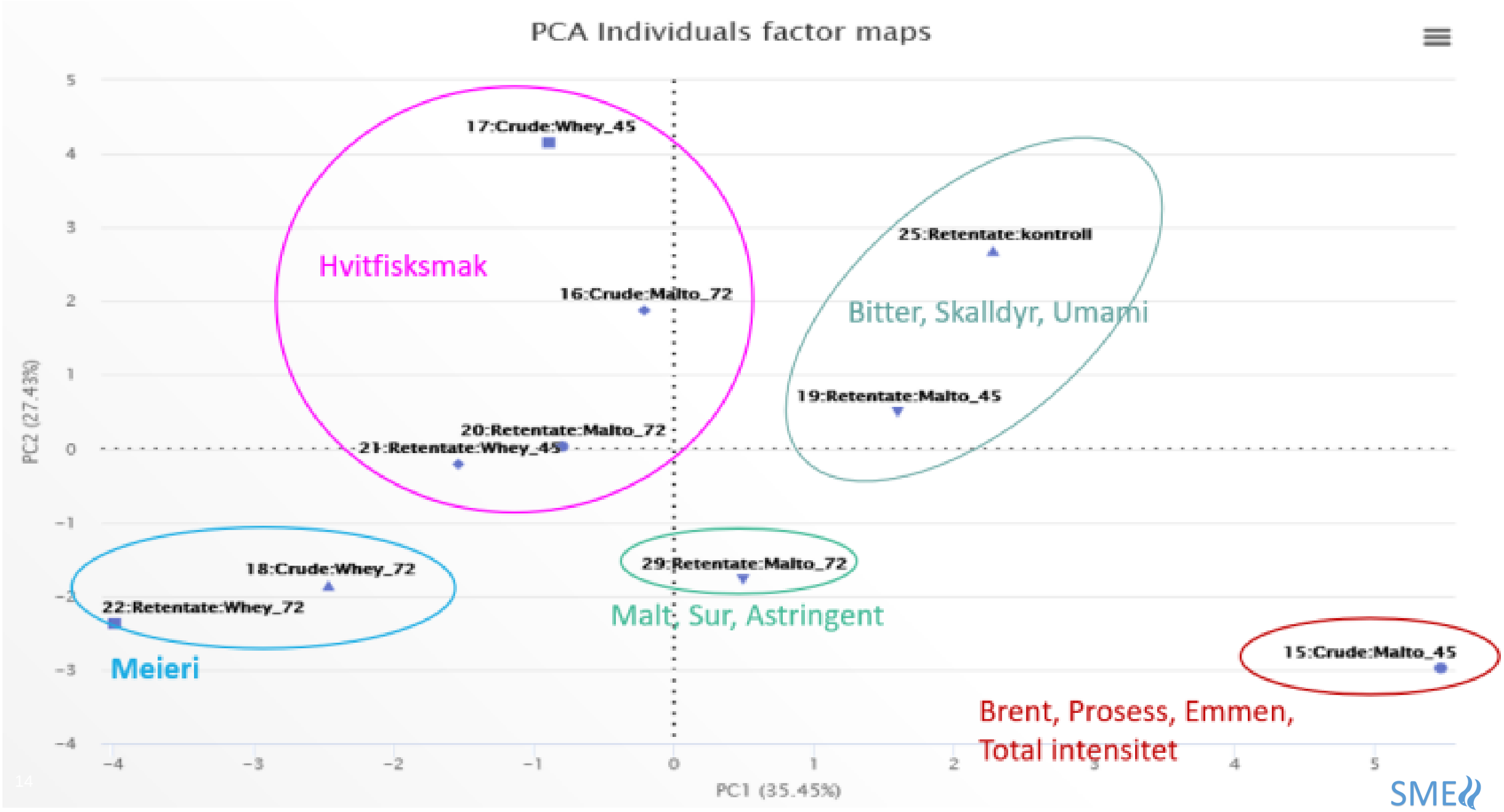


Enzymes:

- Alcalase
- Bromalaine
- EndoCut Retentate
- EndoCut Crude

Masking components:

- Whey – High & Low
- Maltodextrin – High & Low
- Yellow samples were added citric acid in addition


PCA Individuals factor maps
17:Crude:Whey_45
Hvitfisksmak
16:Crude:Malto_72
25:Retentate:kontroll
Bitter, Skalldyr, Umami
19:Retentate:Malto_45
20:Retentate:Malto_72
21:Retentate:Whey_45
18:Crude:Whey_72
22:Retentate:Whey_72
Meieri
29:Retentate:Malto_72
Malt, Sur, Astringent
15:Crude:Malto_45
Brent, Prosess, Emmen,
Total intensitet
PC2 (27.43%)
PC1 (35.45%)

Main findings

1. Choice of **protease affects the bitter taste** of the protein fractions from hydrolysis
2. It is possible to produce hydrolysate with low bitterness from mackerel back.
3. **Nanofiltering** is effective in removing ash, small molecules and TMA from mackerel hydrolysate and mackerel stick water
4. **Lipophilic peptides** and/or amino acids correlate with intensity of **bitter taste** in mackerel hydrolysates, and development and implementation of methodology to remove these can contribute to even better taste
5. It is necessary to develop tools to **control protein and fat oxidation** during processing
6. It is possible to produce a mackerel hydrolysate that has a lower total flavor intensity, bitter taste and fishy taste than a commercially relevant product (based on salmon) on a pilot scale, but it is difficult to scale up to an **industrial scale**, and further trials are needed before further implementation in industry.
7. It is possible to produce **masked spray-dried hydrolysate** with binders for testing in taste panels and it is possible to control binding between whey protein, hydrolysates and gum arabic with pH.