Functional characteristics and storage stability of sea cucumber

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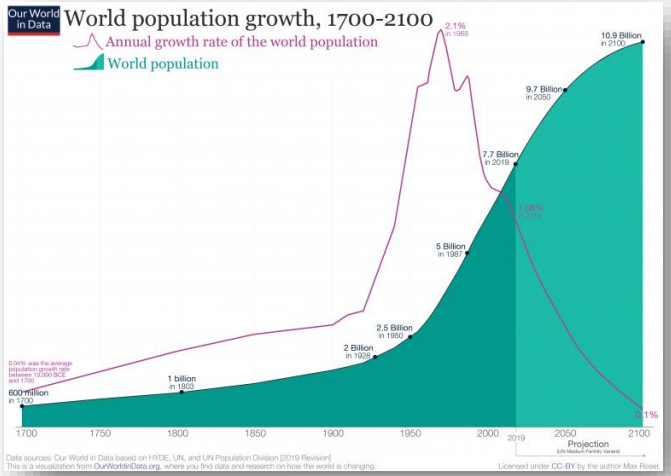
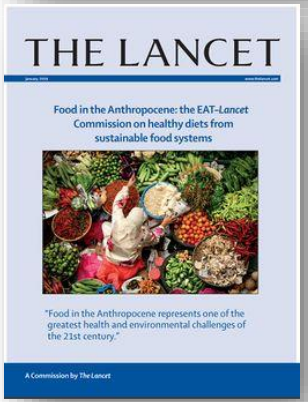
The scene…

- 9.7 billion people in 2050
- Land-based resources are scarce and contribution of sustainable food (and feed) from ocean resources is essential
- Future gains in world marine capture and culture will have to come from expansion and production at lower trophic levels.
- Today’s food production spend 75 % of fresh water
- Today’s food production accounts for 25 % of climate emissions





Red sea cucumber - a source of protein

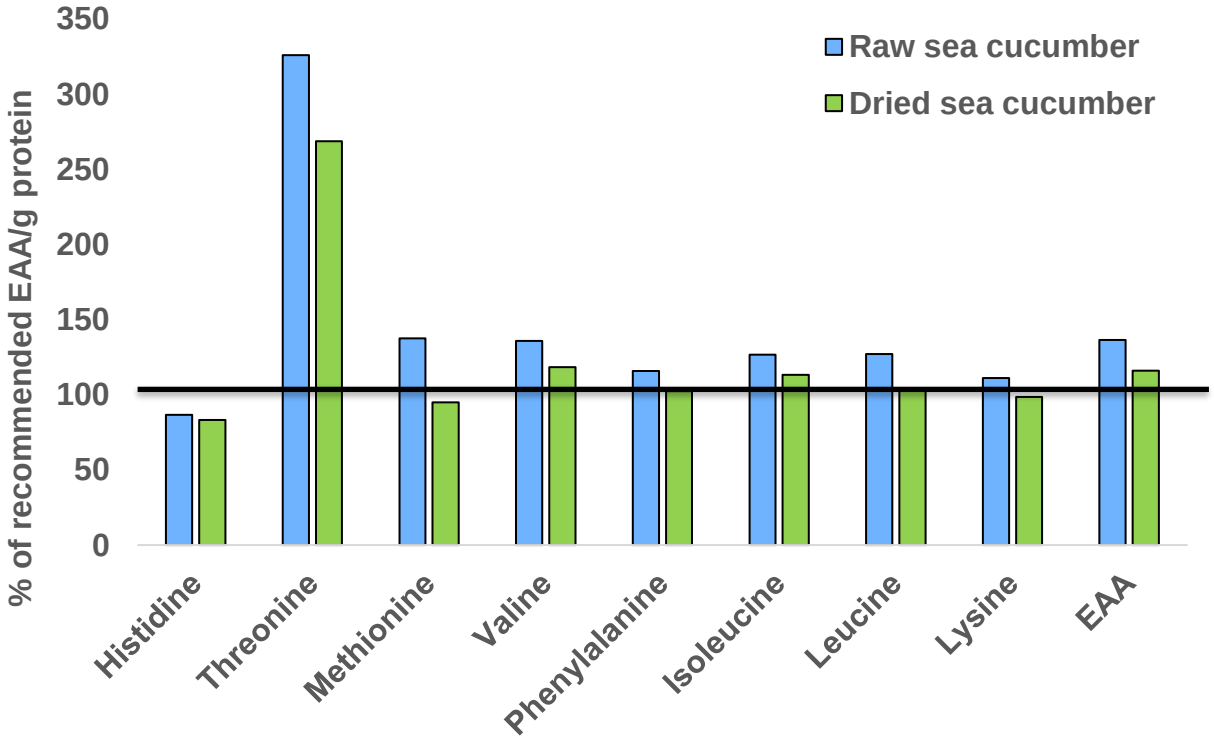
	Raw sea cucumber	Dried sea cucumber
Water	89,6 ± 0,9	3,4 ± 0,2
Protein	4,4 ± 0,7	43,1 ± 2,4
Lipids	1,2 ± 0,4	8,5 ± 2,2
Ash	3,9 ± 0,4	36,2 ± 0,4

Photo: M.C.Kletthagen

Amino acids

Amino acid	Raw sea cucumber (mg/g)	Dried sea cucumber (mg/g)
Histidine	0,4 ± 0,1	3,6 ± 0,3
Threonine	2,4 ± 0,7	17,8 ± 1,2
Methionine	0,7 ± 0,2	4,3 ± 0,5
Valine	1,7 ± 0,5	13,3 ± 0,8
Phenylalanine	1,4 ± 0,4	11,2 ± 0,8
Isoleucine	1,2 ± 0,3	9,8 ± 0,6
Leucine	2,4 ± 0,7	17,7 ± 1,2
Lysine	1,6 ± 0,5	12,8 ± 0,9
Tryptophane*	ND	ND
Aspartic acid	4,7 ± 1,3	34,6 ± 2,4
Glutamic acid	6,2 ± 1,6	43,6 ± 3,2
Serine	2,3 ± 0,7	15,2 ± 1,0
Glysine/arginine	5,6 ± 1,5	79,9 ± 5,8
Alanine	2,5 ± 0,7	18,4 ± 1,2
Tyrosine	1,2 ± 0,3	9,0 ± 1,0
Total amino acids	34,3 ± 3,1	291,2 ± 7,7

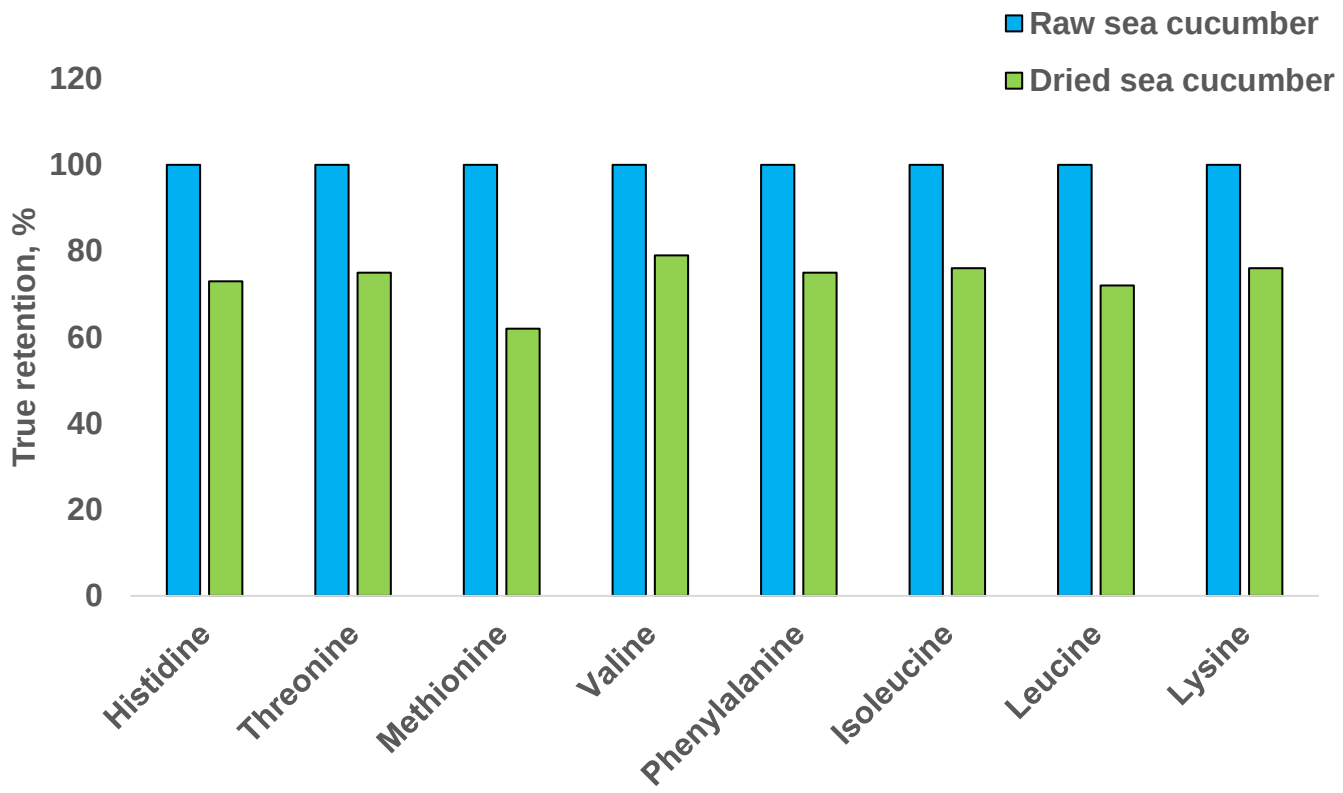
Protein quality



Essential amino acids	mg EAA/g protein
Histidine	15
Isoleucine	30
Leucine	59
Lysine	45
Methionine	16
Valine	39
Tryptophane	6
Phenylalanine	38
Treonine	23
Total EAA	271

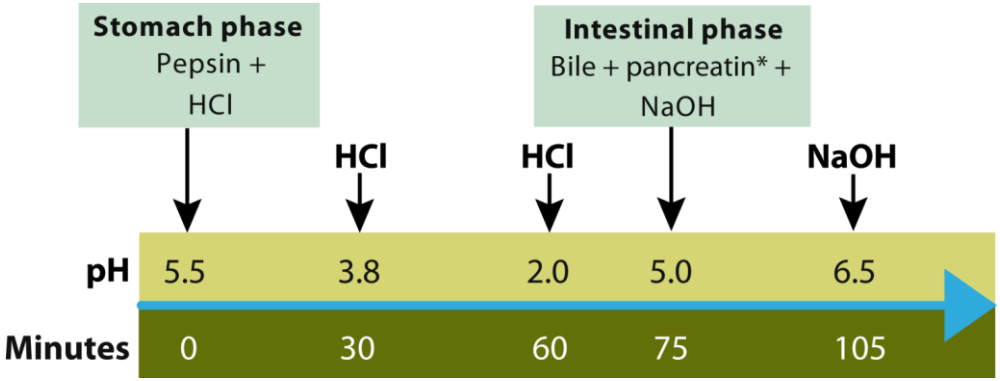
WHO Technical report series, 935

Retention of amino acids

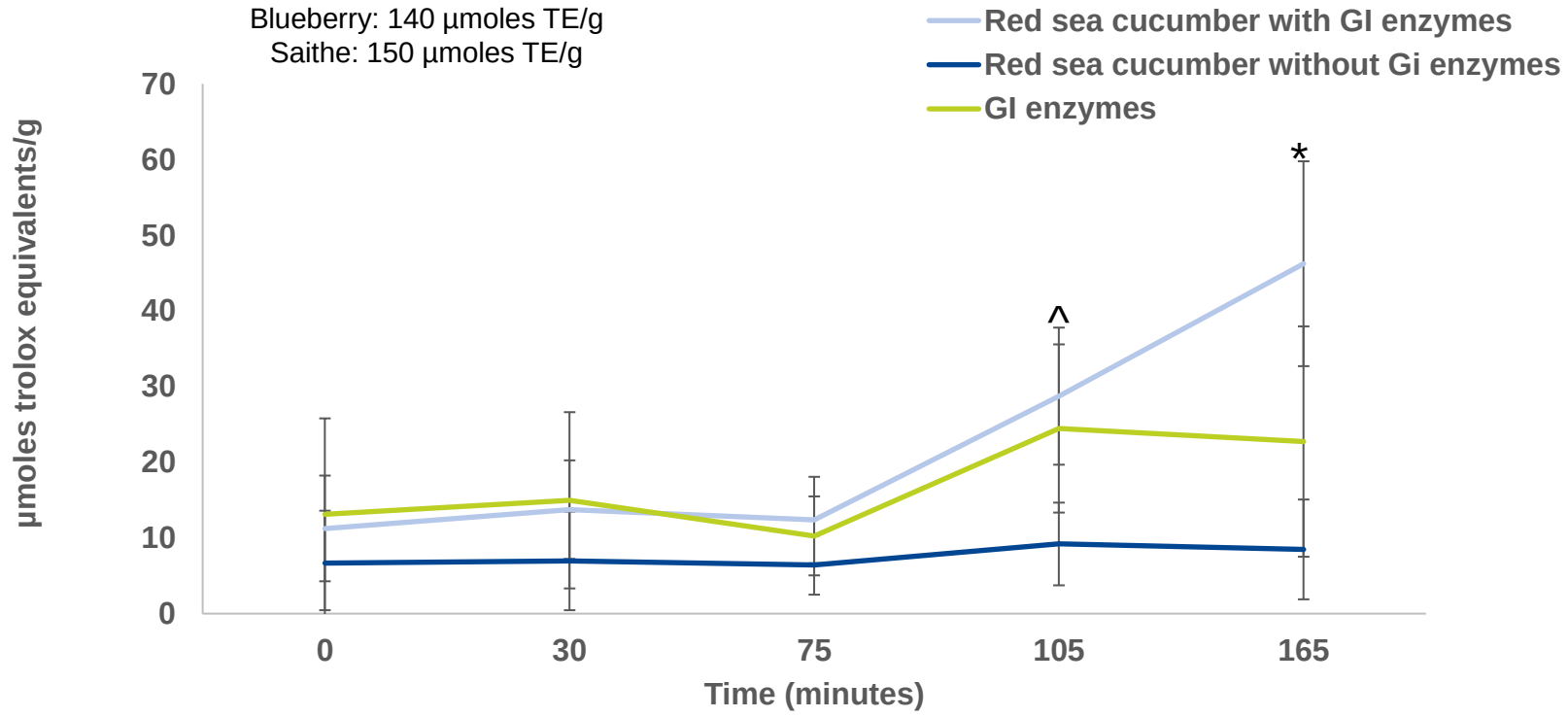


Bioactive peptide

Peptides with effect on: Blood pressure
Oxidative stress
Atherosclerosis
Cholesterol
Weight
Diabetes



Antioxidative capacity, ORAC



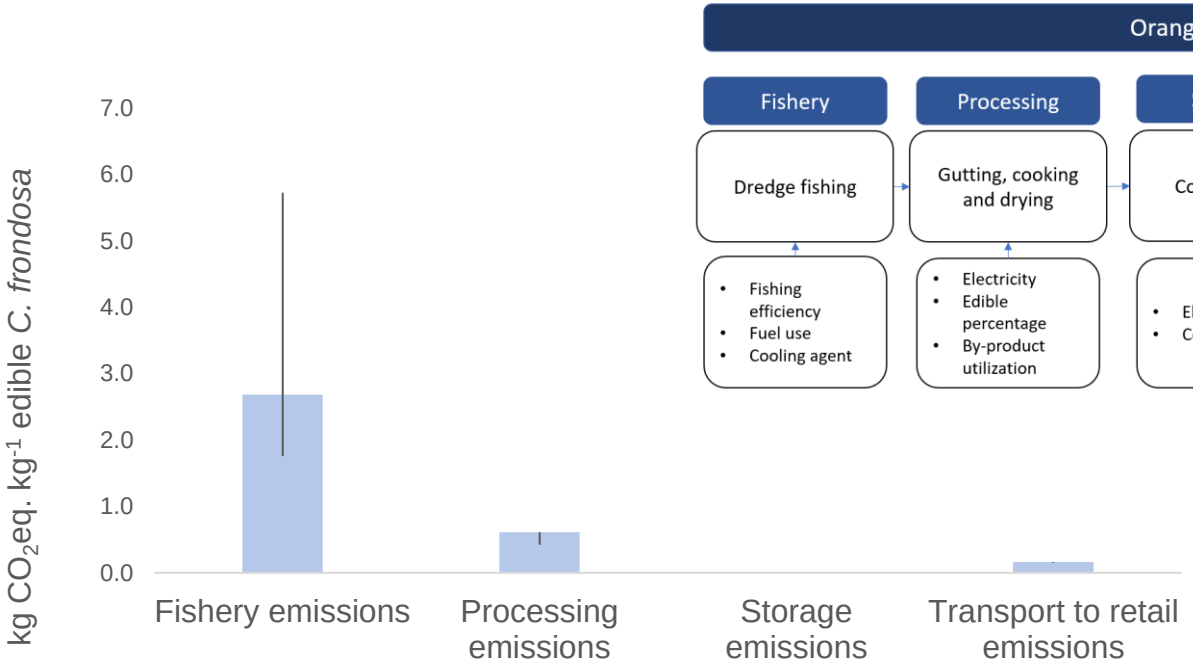
High blood pressure

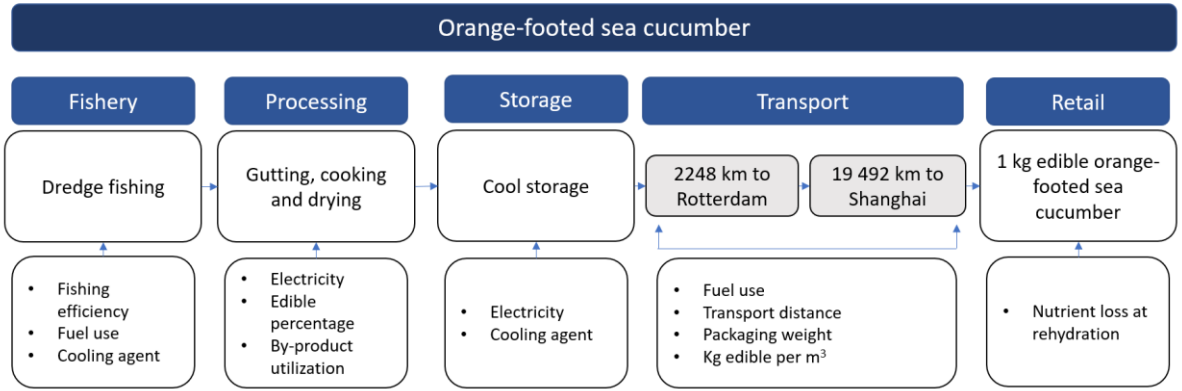
Angiotensin converting enzyme inhibitory effect

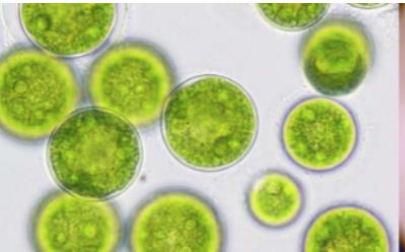
IC_{50} = Concentration inhibiting 50 % of the enzyme activity

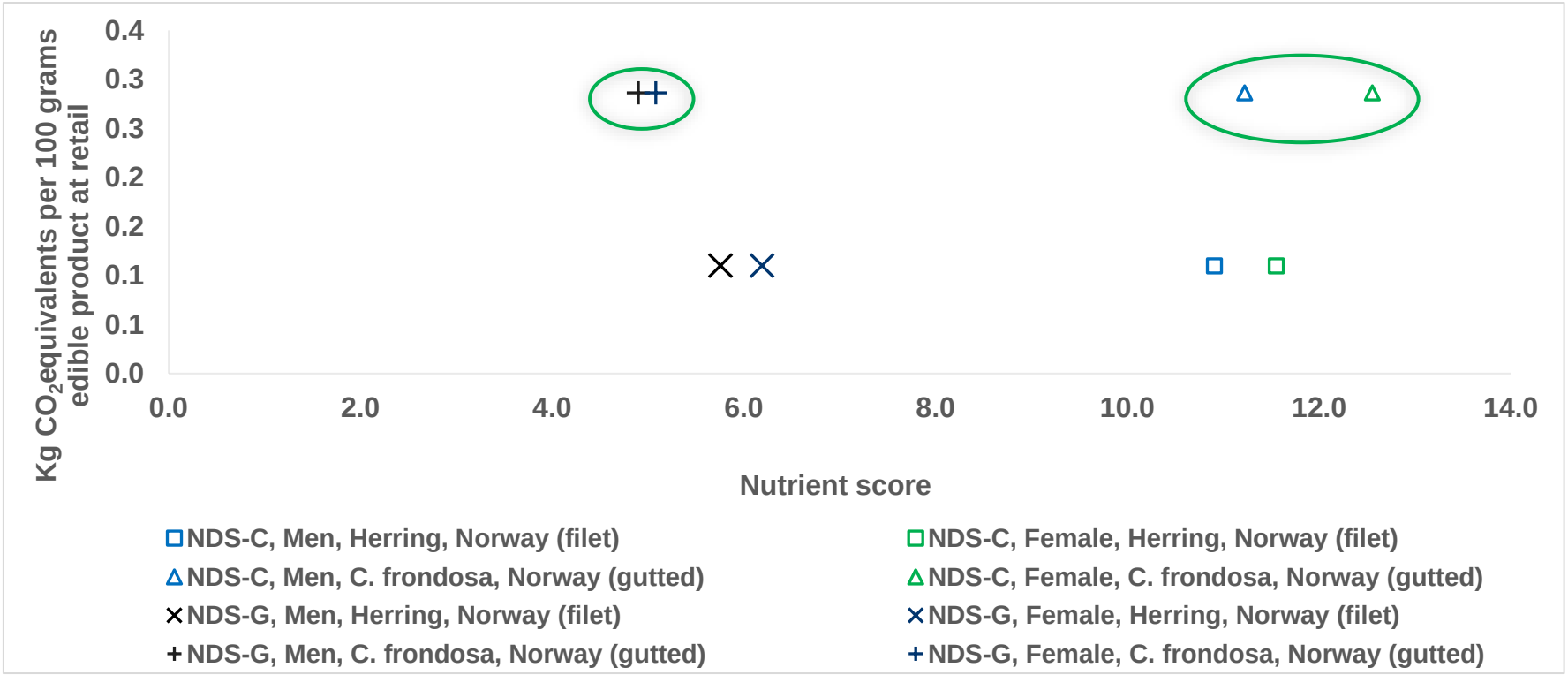
	IC_{50}
Red sea cucumber, dried	23,1 ± 8,5
Red sea cucumber, raw	16,2 ± 4,1
Red sea cucumber, raw + digested	48,6 ± 8,9
Cod and salmon filets	1,6-2,2

Carbon footprint – ongoing project








Kg CO_2equivalents per 100 grams edible product at retail
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Nutrient score
NDS-C, Men, Herring, Norway (filet)
NDS-C, Female, Herring, Norway (filet)
NDS-C, Men, C. frondosa, Norway (gutted)
NDS-C, Female, C. frondosa, Norway (gutted)
NDS-G, Men, Herring, Norway (filet)
NDS-G, Female, Herring, Norway (filet)
NDS-G, Men, C. frondosa, Norway (gutted)
NDS-G, Female, C. frondosa, Norway (gutted)

Storage stability - ongoing project

- 0°C vs 4°C
- Day 0 - day 17
  - Physical parameters
  - Drip loss
  - Microbial count
  - Enzymatic degradation
  - ATP-degradation
  - TMA/TMAO

Future projects and collaborations?

- Bioactivity assays
  - Fresh vs dried
- Sustainability assessments
- Storage stabiliy
- Pre clinical study - atherosclerosis
- Consumer acceptance