Special feed production from pelagic production.

Sigurjón Arason
Chief Engineer, Matís ohf. Professor, University of Iceland
Stefán Þór Eysteinsson
Project Manager, Matís ohf

The Nordic Salmon Workshop in Thorlakshofn, 27th of October.

AG-Fisk

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Basis of feed production

- **Needs of the fish**
  - Nutrients for maintenance and growth (Protein, amino acids, fatty acids, vitamins and minerals)
  - Energy for the metabolism
- Role of raw materials in feed formulation
  - Supply nutrients
  - Ensure enough energy
  - Minimize content of anti nutritional factors and harmful substances to the fish and the consumer

NB! All organisms deposit protein according to their genetic makeup? → Not specific need for certain raw- materials

2

Optimization of feed

Know the nutritional needs:
- Crude protein (Nitrogen)
- Indispensable amino acids
- Indispensable fatty acids*
- Vitamins and minerals

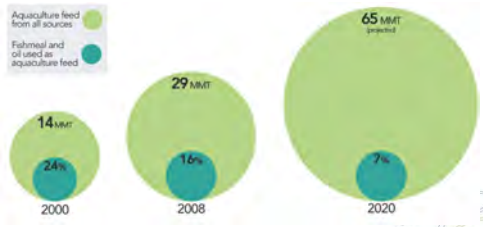
Know the composition of raw materials:
- Nutrient content
- Availability of the nutrients
- Presence of anti nutritional factors

3

Fish meal production (FAO 2014)

4

Growth of commercial aquaculture feed use.



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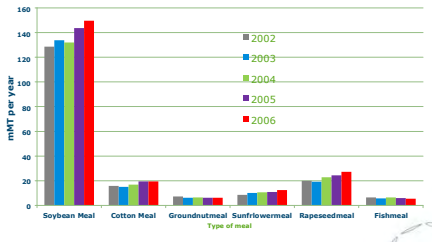
World production of some protein raw materials



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Raw materials for fish meal

- Whole fish
  - Fish that is not suitable for human consumption
- By catch
  - Low value fish caught together with more valuable fish
- By products from fish processing
  - Heads, bones, skin, trimmings and viscera

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Quality of raw materials for fish meal

- Nutritional quality:
  - Water
  - Protein
  - Lipid
  - Ash
- Freshness
  - Total Volatile Nitrogen TVN

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Effects of spoilage on quality of the raw material

- Protein fraction
  - Degradation (reducing protein content)
  - Increase in solubility (reducing utilisation?)
  - Forming of biogenic amines (affects palatability and nutritive value)
- Lipid fraction
  - Effect on free fatty acids (opens up for oxidation of lipid)
  - Oxidation of oils (deposits for rancidity/reduces nutritive value and feed intake)

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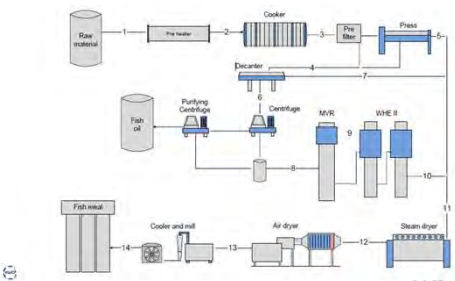
The meal and oil factory



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Quality criteria of fish meal

- Protein content
- Protein digestibility
- Lipid content
- Water soluble protein
- TVN
- NH3-N
- Biogenic amines (Histamine)
- Classifications:
  - LT/SUPERIOR
  - SPECIAL
  - STANDARD

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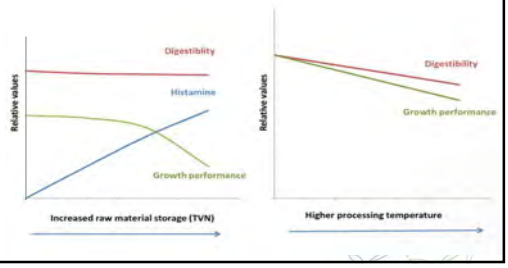
Effect of RM freshness and drying temp. on nutritive value of fish meal



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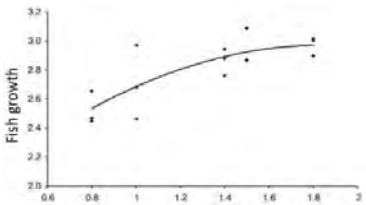
Effect of soluble protein on nutritive value



Taurine is a measure for liquid fraction

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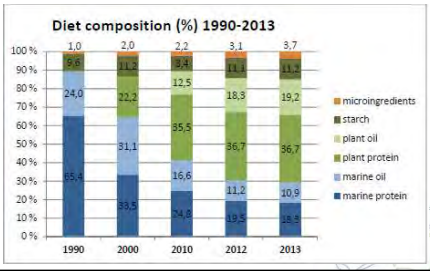
Use of fishmeal in carnivorous fish feed over time (Salmon diets in Norway) (Ytrestöl et al 2014)



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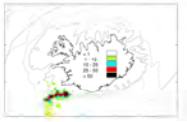
Pearlside experimental fishery

- **2008-2011**
  - Initially 17 ships licensed
  - Catching
  - Bycatch
  - Processing woes



(MFRI, 2012)

Catches
- 2009 – 46 thousand. t
- 2010 – 18 thousand. t
- 2011 – 9 thousand. t

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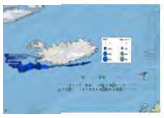
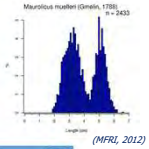
Pearlside Research

- **2010**
  - Single winter survey
  - Biomass estimation
  - TAC at 30 thousand tonnes



(MFRI, 2012)



(MFRI, 2012)

	Total
Area (NM²)	12475
Echo abundance	5508
Mean length (SL, cm)	3.72
Mean weight (g)	1.01
Number (billions)	342
Biomass (thous. tonnes)	248

(MFRI, 2012)

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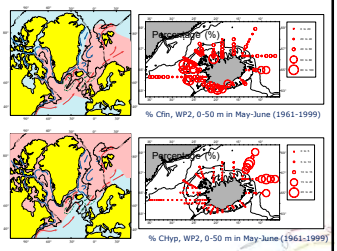
Calanus research

- Two main species
- Distribution
- Biomass
- Harvesting



(Astthorsson, 2007)

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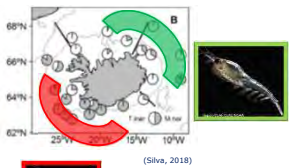
Krill research

- Four main species
  - *Meganyctiphanes norvegica*
  - *Thysanoessa raschii*
  - *T. inermis*
  - *T. longicaudata*
- Biomass



(Silva, 2018)

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Krill experimental fishery

- Ísafjarðardjúp
- 2013
  - Small trials
  - *T. raschii*
- 2018
  - Summer and autumn trials
  - *T. raschii*
  - Bycatch
- 2021
  - Active experimental license



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The Functional Properties of Fishmeal - The Effects of processing

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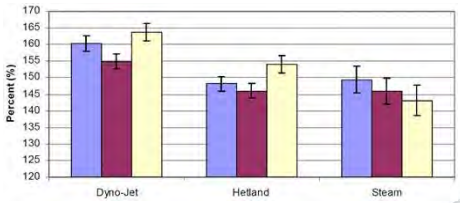
Dryer Comparison - Water-Binding Capacity of Capelin fishmeal



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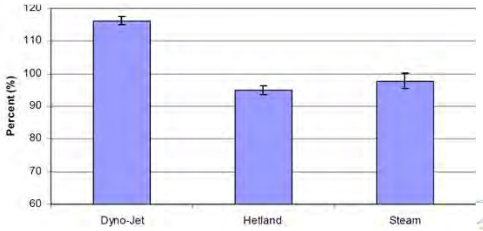
Dryer Comparison - Oil-Binding Capacity of Capelin fishmeal



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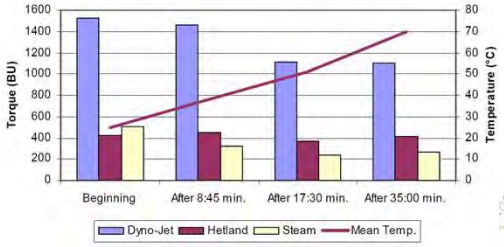
Dryer Comparison - Viscosity (Brabender Viscograph E) of Capelin fishmeal



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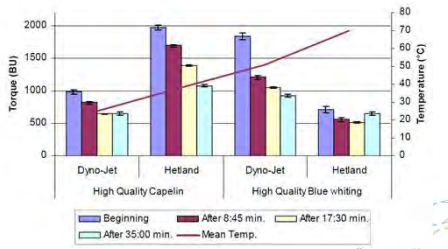
Viscosity results (Viscograph E). High quality capelin and blue whiting fishmeal .



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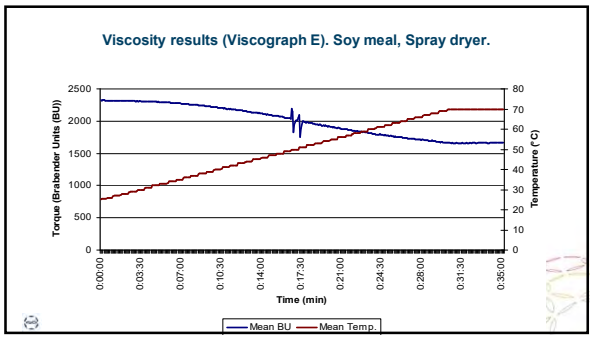

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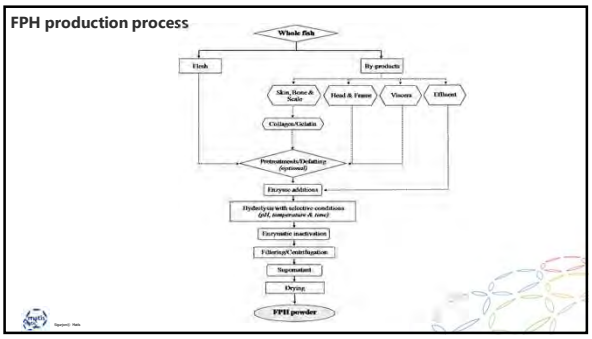

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Biorefinery

- New processing equipment
- Easily changeable processing line
- Mobility
- Improved services by Matís for the Icelandic food industry
- Increased utilization of raw materials for innovation
- Development of technological solutions and value creation

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„The missing link"

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Biorefinery

- Separation
- Membrane filtration
- Spray drying
- Production of:
  - Oils
  - Bioactive compounds
  - Protein powders

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Other equipment

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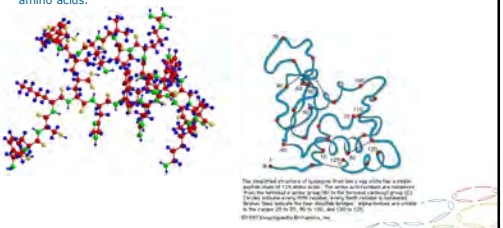
The molecular structure of a peptide (a small protein) consists of a sequence of amino acids.



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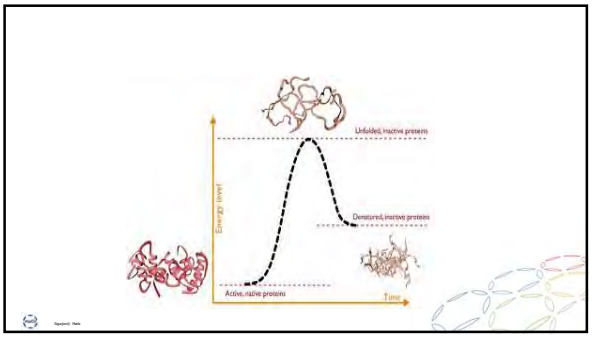

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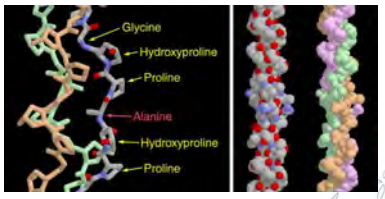
Collagen Triple Helix



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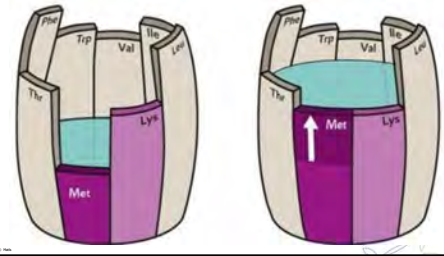
The "Liebig barrel" illustrates the limitation of protein - the lack of an essential amino acid. The shortest stave represents the first limiting amino acid.



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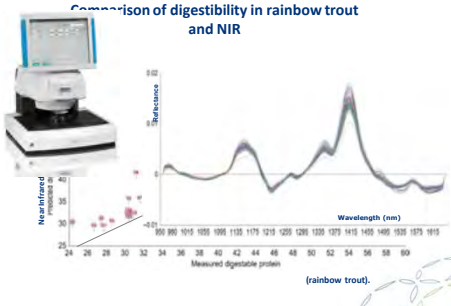
Comparison of digestibility in rainbow trout and NIR



(rainbow trout).

(Glencross, 2015)

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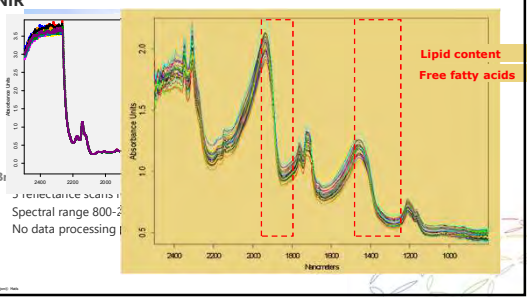
NIR



- Spectral range 800-
- No data processing

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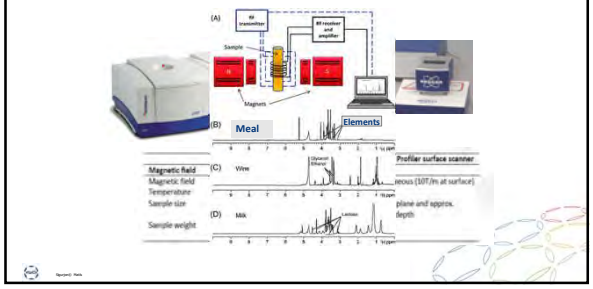
NMR spectroscopy. (Nuclear magnetic resonance)



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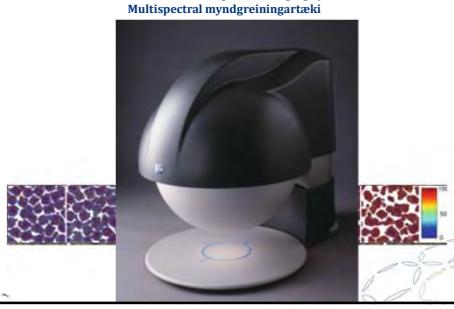
VideometerLab Multispectral Imaging System
Multispectral myndgreiningartæki



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Takk fyrir

Thank you

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