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Feed Requirements in Organic Aquaculture

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Introduction

Feed for organic aquaculture production must:

- **Comply with organic principles / EU regulations**
- **Fulfil nutrient requirements, incl. specific amino acids (AA)/fatty acids (FA)**
- **Suit specimen feeding habit**
- **Well-balanced, to secure optimal performance, fish health, high product quality, and low environmental impact**

However, EU organic regulations restrict origin and processing of feed ingredients

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Fishmeal (FM) and Fish oil (FO)

- **Natural ingredients in diets for carnivorous fish and shrimps**
- **Provides required dietary nutrients (all life stages), i.e.**
  - **Amino acids**
  - **$\omega - 3$ Fatty acids**
  - **Cholesterol & phospholipids**
  - **Vitamins and minerals**

➡ **Limited availability / restrictions**

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Sourcing of feed ingredients

Priority in current EU Reg. (carnivorous):

1. **Organic feed products of aquaculture origin**
2. **Fishmeal & fish oil from organic aquaculture trimmings**
3. **Fishmeal & fish oil derived from trimmings of fish caught in sustainable fisheries**
4. **Organic feed material of plant origin (max. 60 %)**
5. **Fishmeal & fish oil derived from fish caught in certified sustainable fisheries (Amendment Reg. 1358/2014)**

Sourcing of feed ingredients

1. Organic feed products of aquaculture origin
2. Fishmeal & fish oil from organic aquaculture trimmings
3. Fishmeal & fish oil derived from trimmings of fish caught in sustainable fisheries

Challenges:

- Organic feed products of aquaculture origin and trimmings from organic aquaculture are only available in limited quantities
- Trimmings are not a well defined product, i.e. variation in protein (AA), lipid (FA), mineral content (high P)
- Trimmings can not be used in feed for the same species

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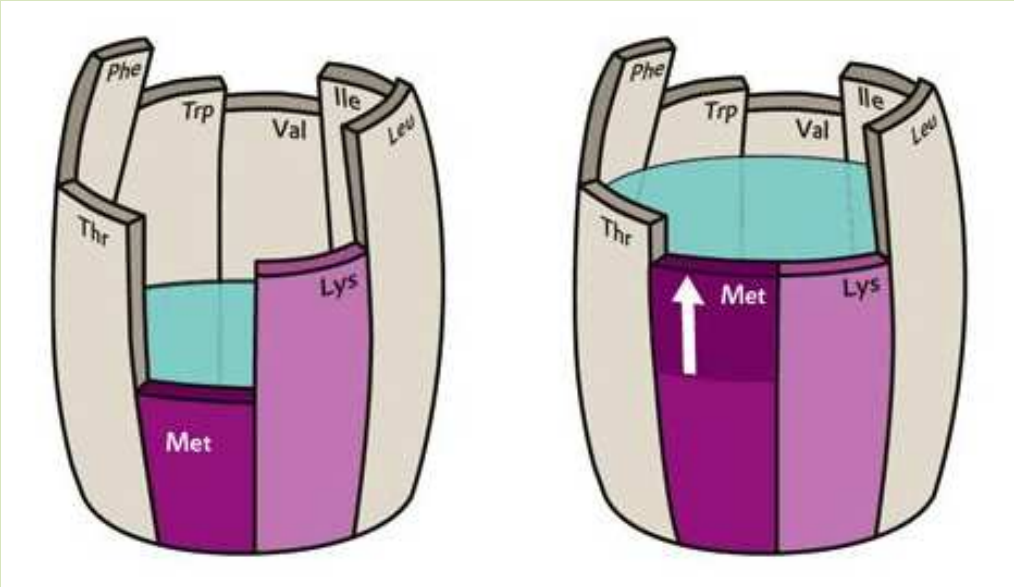
Fishmeal replacement

4. Organic feed material of plant origin (max. 60 %)

Challenge: Inadequate Amino Acid (AA) profile

- **First limiting AA determines performance**
- **Synthetic AA not allowed**
- **Anti-nutrients**
- **Environmental impact**

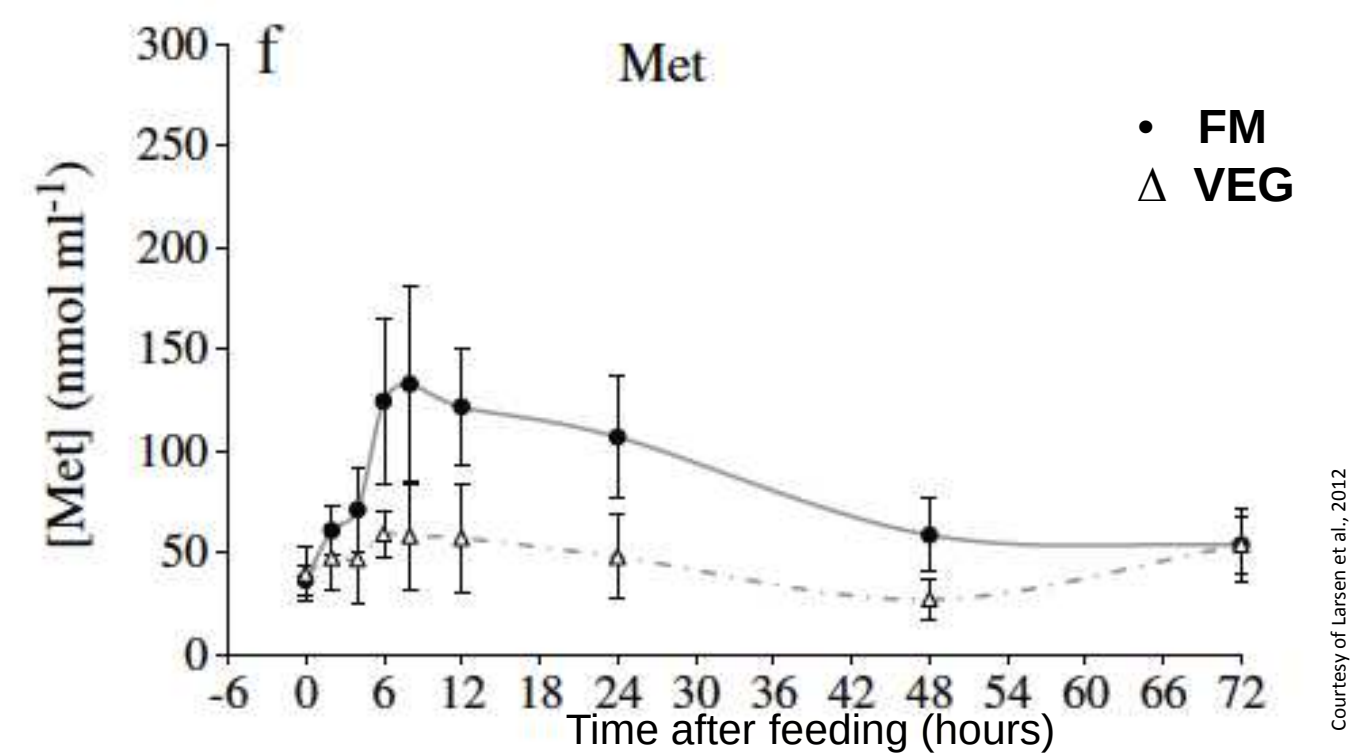


→ **Histidine (fermentation) may supplement salmonid diets (Amendment Reg. 1358/2014)**

Sourcing of feed ingredients

4. Organic feed material of plant origin (max. 60 %)

Challenge: Differences in amino acid up-take pattern between FM and VEG based diets



Courtesy of Larsen et al., 2012

Fish Meal

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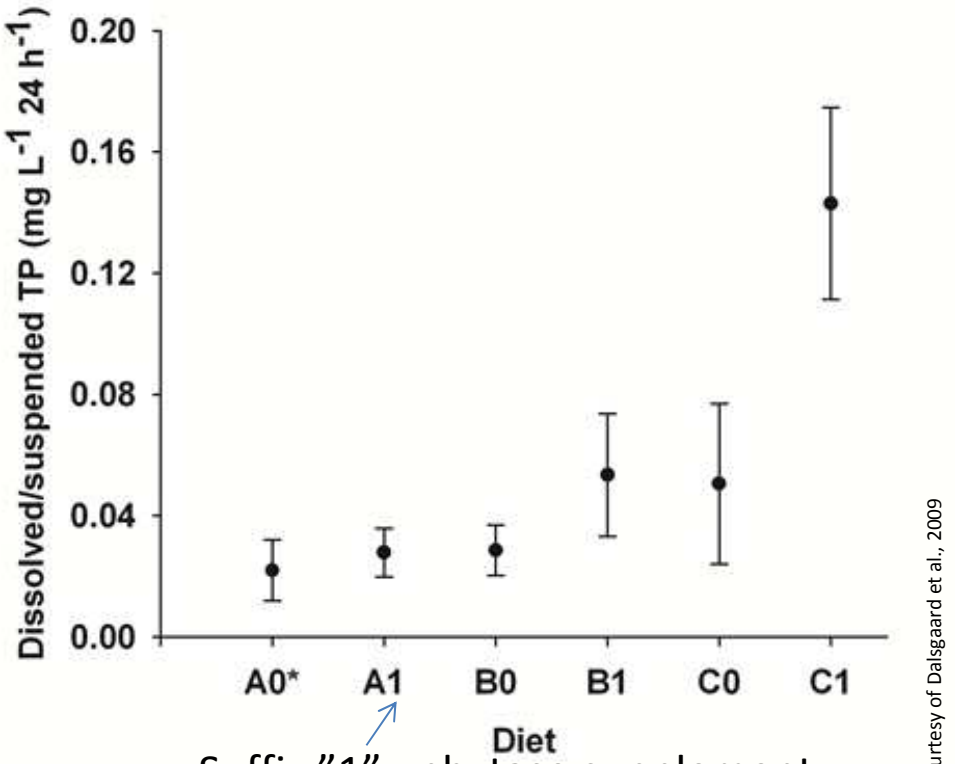
By courtesy of V.J. Larsen

Sourcing of feed ingredients

4. Organic feed material of plant origin (max. 60 %)

Challenge: Limited phosphorus availability in plant ingredients



Suffix ”1” : phytase supplement

Courtesy of Dalsgaard et al., 2009

A, B,C: 0.29 % phytate-P
A: 0.89 % Total-P
B: 0.97 % Total P
C: 1.12 % Total P

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By courtesy of V.J. Larsen

Sourcing of feed ingredients

Amendments by Reg. 1358/2014:

5. Fishmeal & fish oil derived from fish caught in certified sustainable fisheries

- **Supplementary feed for shrimps may comprise max. 25 % fishmeal and 10 % fish oil**
- **Cholesterol may supplement shrimp diets**
- **Conventional phytoplankton and zooplankton may be used as feed in larval rearing of organic juveniles**

Fish oil replacement

- Long chain high unsaturated $\omega - 3$ fatty acids (FA) are unique in fish oil/marine phyto-/zooplankton
- Required in carnivorous fish diets, e.g. EPA and DHA
- Plant oils contain only short chain $\omega - 3$ FAs
  - Limited – if any - innate capacity in carnivorous fish for converting short chain $\omega - 3$ FAs into EPA/DHA

➡ Strategic use of available $\omega 3 -$ FA resources

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Innovative feed ingredients

- **Bacteria, fungi, algae**
  - **Single cell organisms (AA profile ≈ FM)**
  - **Waste may be substrate ≈ recycling nutrients**
  - **Marine micro algae ≈ EPA, DHA etc.**

- **Processed (non-ruminant) Animal Protein (PAP), blood meal**
  - **High protein/adequate AA content**

- **Insect meals**
  - **High protein/adequate AA/(FA) content**
  - **Growth substrate/feed determines composition**
  - **High productivity**

Main perspectives of organic aquaculture feed

- **Diversifying the basket of available feed ingredients to complement the need of optimal diets for organic production, i.e. AA, FA, etc.**
- **Innovation in development of alternative diet sources, e.g. EPA, DHA etc.**
- **Recycling wastes as a resource**

By courtesy of V.J. Larsen


THANK YOU
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