Photo: Petra Granholm

Baltic blue mussels – a challenging resource to explore for feed and food applications

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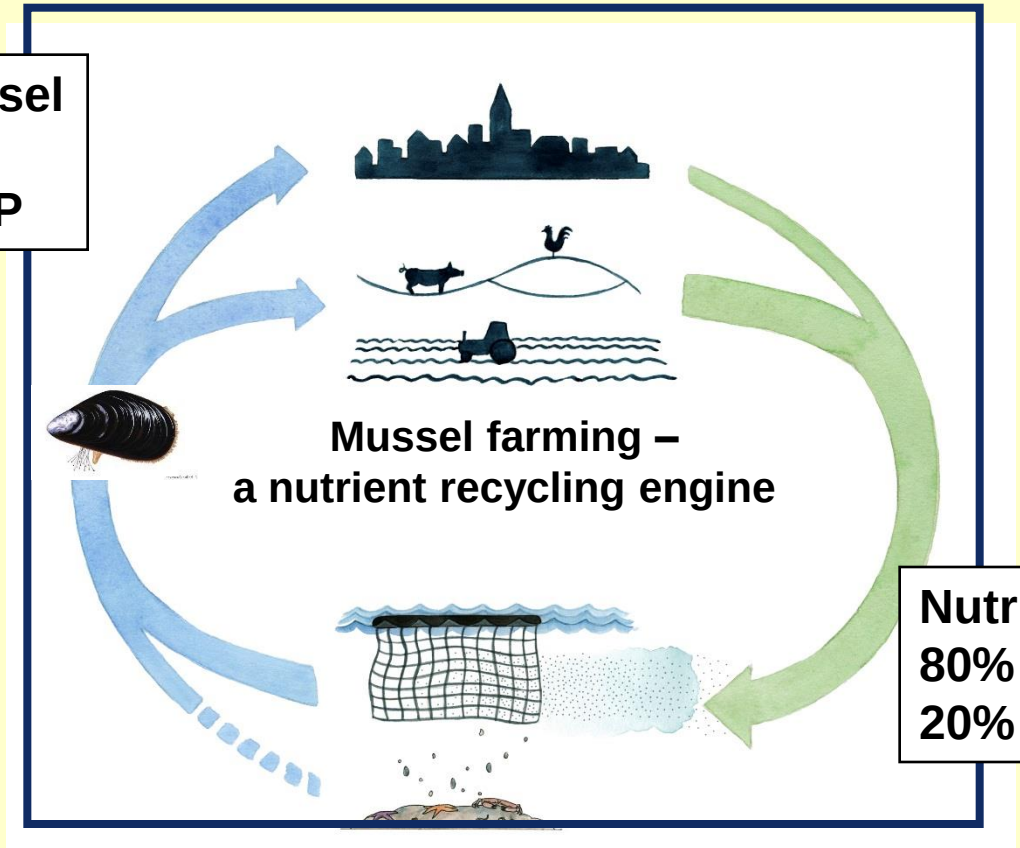
The Agro-Aqua recycling of nutrients by mussel farming

A harvested mussel contains ca:
1 % N and 0.1 % P

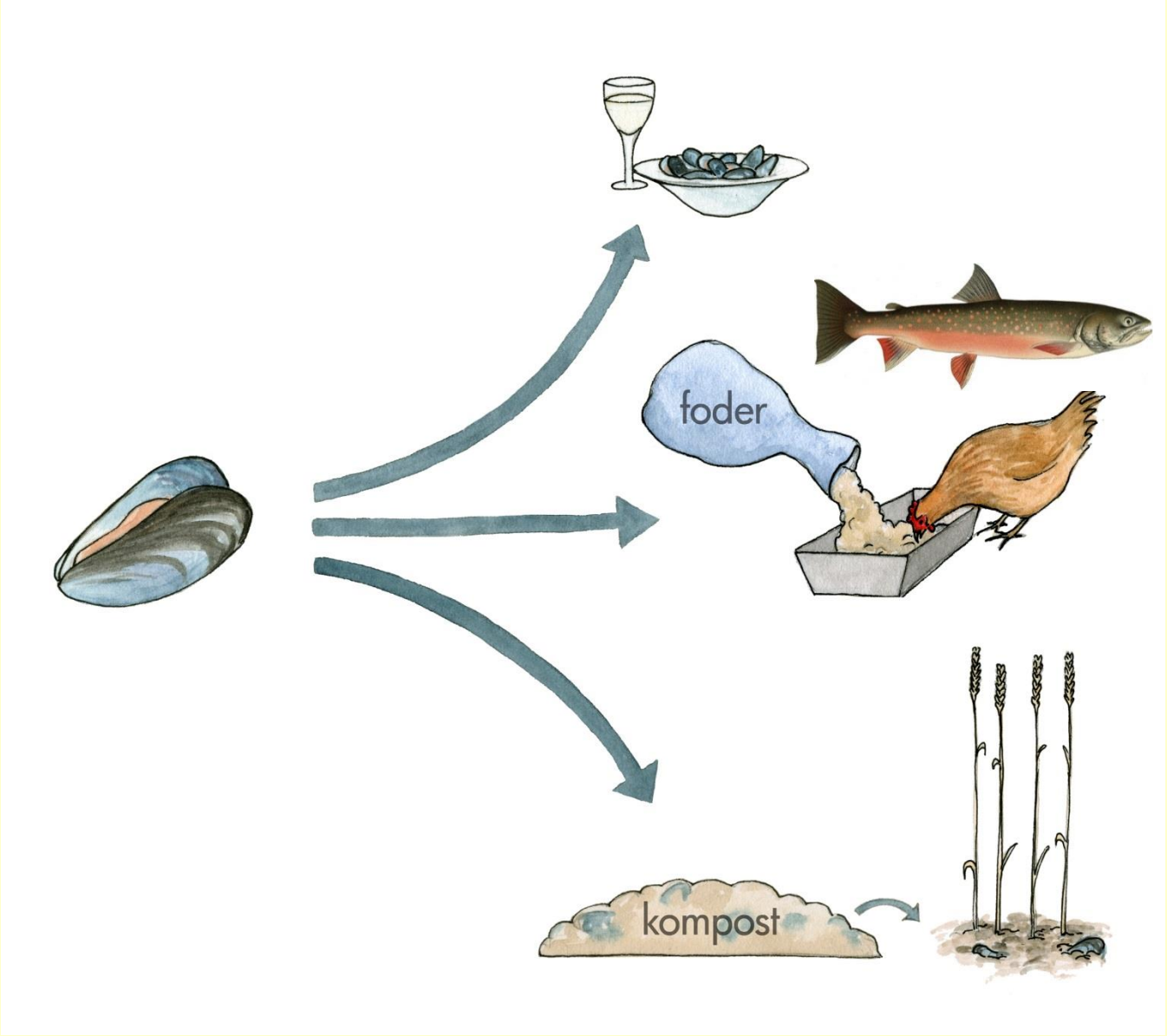


Nutrients to the sea:
80% diffuse sources,
20% point sources.

Why recycle nutrients?

Nitrogen (N) is energy demanding and climate driving to produce.
Phosphorus (P) is a limited resource on a global scale.

The possible uses of mussels



Market

Seafood

Feed

Fertilizer

Illustration: Maj Persson

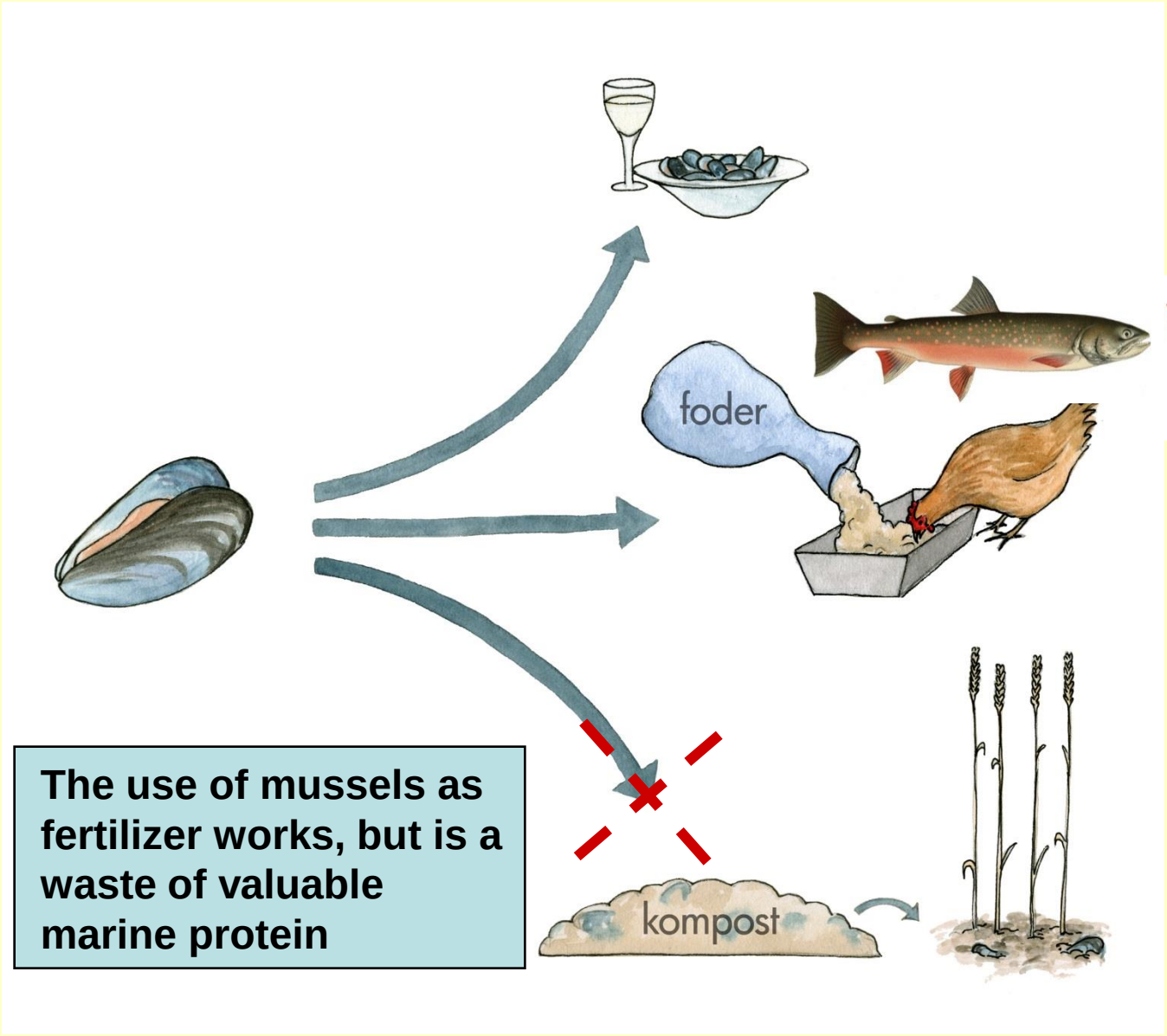
Farm trial using fresh mussels as fertilizer

Composting mussels using straw

Composting mussels using bark

Compost trial in Lysekil, September 2007. Each pile is ca 35 m^3.

The possible uses of mussels



Market

Seafood

Feed

Fertilizer

The use of mussels as fertilizer works, but is a waste of valuable marine protein

Illustration: Maj Persson

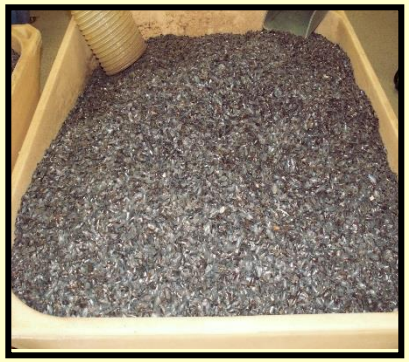
Mussel meal manufacturing using a drum dryer

Input

Drying through heating and agitation

Dry meat and shells

Sorting and separation



Dry shells with some dry meat

+

Mussel meal with shell pieces

Pilot plant for manufacturing mussel meal

Location: Ellös, Sweden
Project period: 2009 – 2013
Capacity: ca 500 kg fresh mussels per 24 h
Technique: rotating drum dryer

The drum dryer with surronding equipment

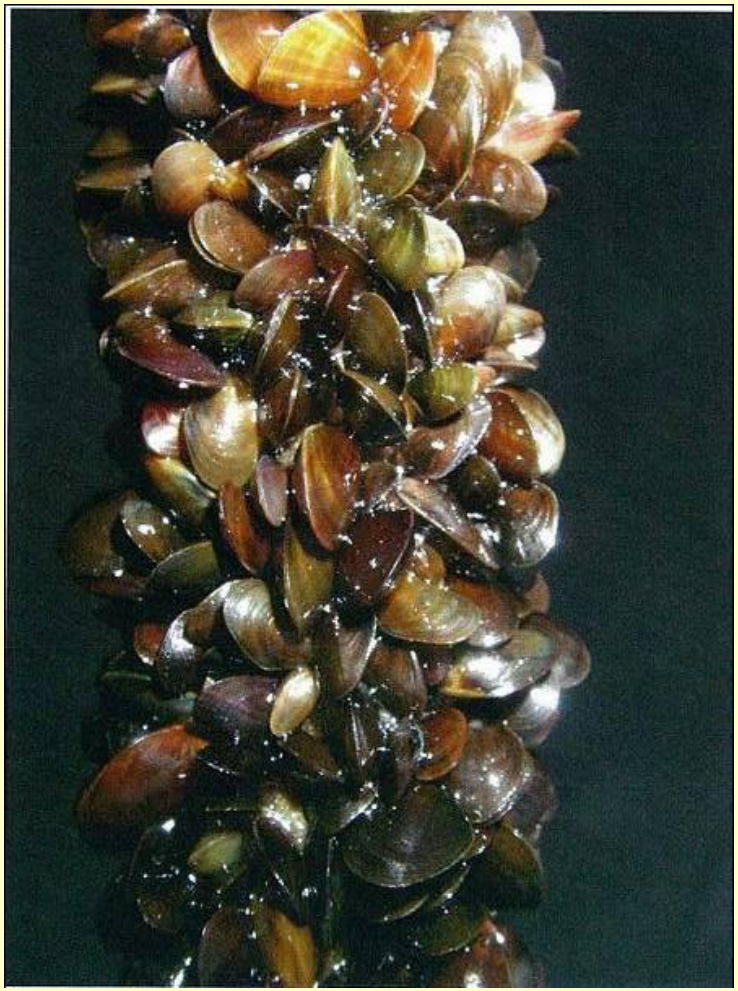
Using fresh mussels, the dried mussel meat will contain a certain amount of crushed shells. The amount of shell pieces will be large when fragile Baltic mussels are processed.

Steamed and pealed mussel meat

Steamed mussel meat

Steamed and pealed marine seafood mussel meat can be used for mussel feed production. This is a high quality product, but is too expensive.
Most likely, it is not an option to use Baltic small and fragile mussels this way.

Baltic mussels are small and fragile



An alternative method to steaming has been developed. This method, which is more suitable for making mussel feed, liquifies the mussel meat. Further, this method is cheaper and less energy consuming compared to steaming. It is also possible to remove the shells.

Mussel meal manufacturing using a lysis process (patent pending)

Cracking and dewatering

Lysis through heating and agitation

Shells

Draining of suspension

Dewatering and separation

Heating and drying

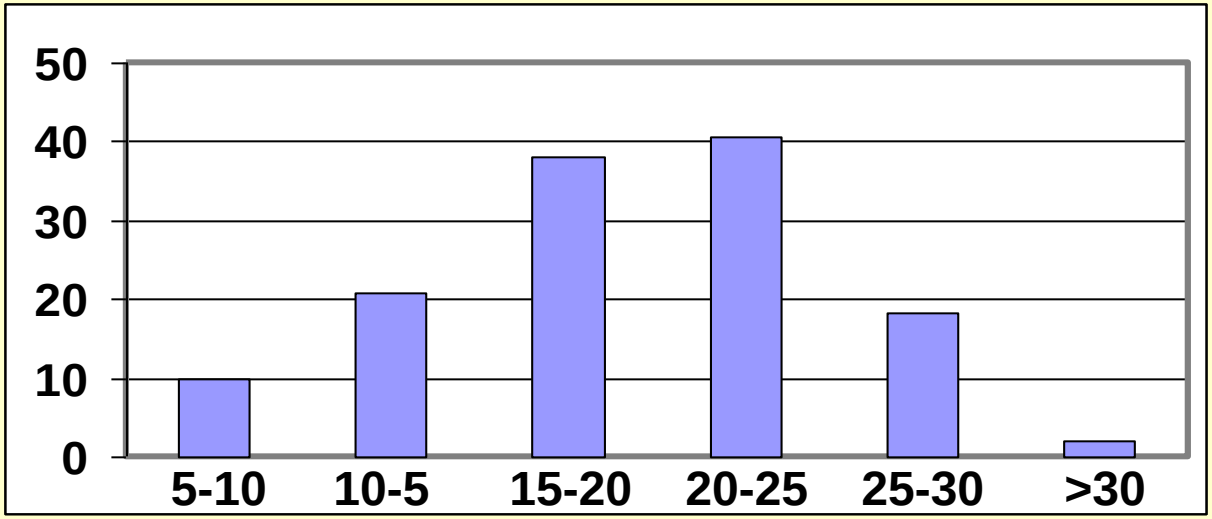
Mussel meal of high quality

Inventor: Odd Lindahl

Pilot mussel farm at Kämpinge, Åland, October 2012

Kumlinge mussels, december 2012

size distribution (n = 7)



After cooking		After drying		After burning	
Meat %	Shell %	Meat %	Shell %	Meat %	Shell %
17,3	35,3	4,0	25,9	0,4	22,8

Ca content in dry shells = 35 %

Mussel shell – a perfect component in feeds and for liming on farm- and woodland

Bio-fertilizer – a new product using Baltic mussel shells

Trial making mussel meal of Zebra mussel (*Dreissena polymorpha*)

Mussel meal can replace fish meal

Steamed mussel meat **Standard feed**

Mussel feed gives a strong yolk colour

Colour on LaRoche scale
6 - 9
12 - 14
15 -

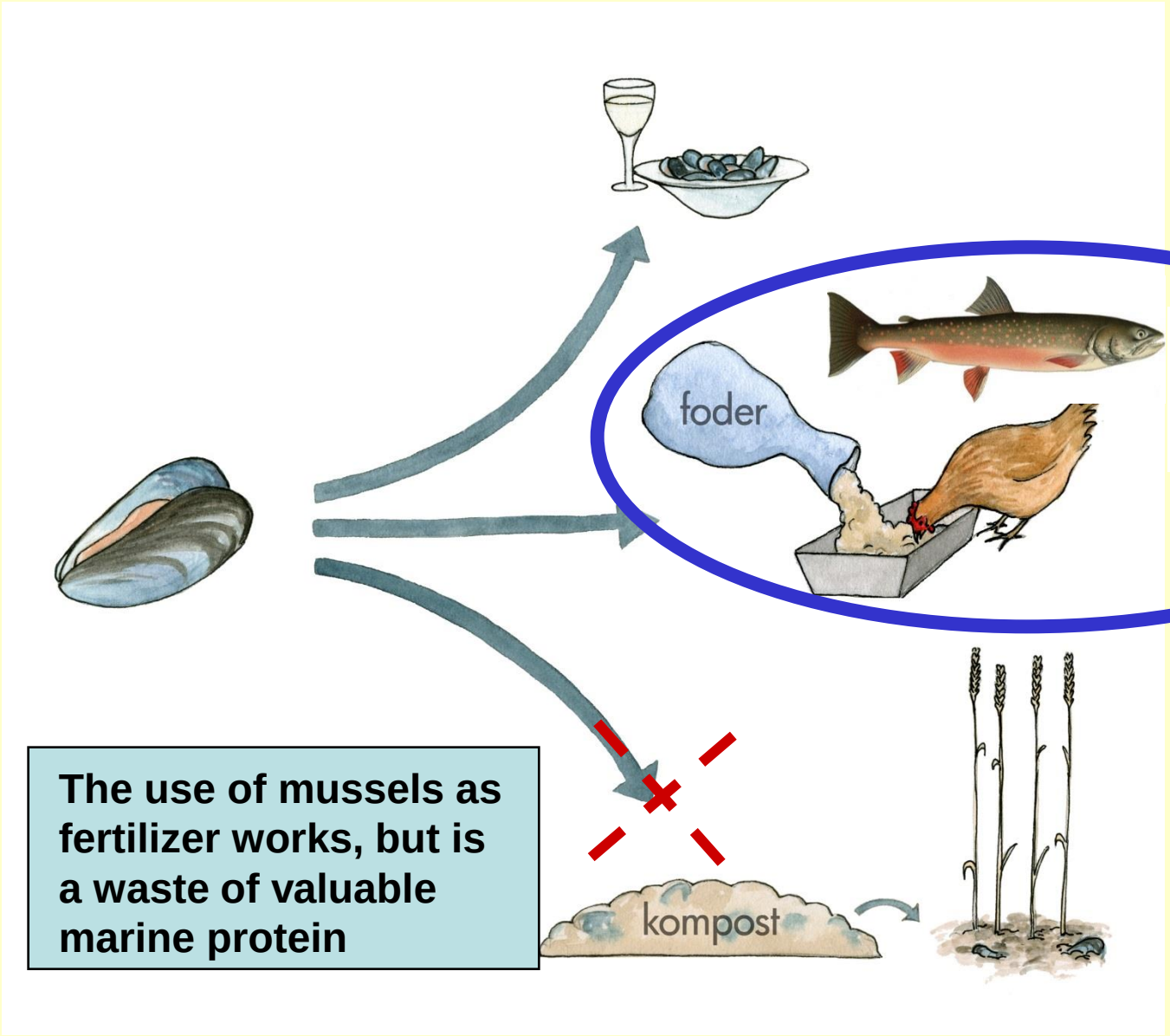
Mussel meal for chicken breed

Organic pig production trial

Mussel meal has been tested on artic char, trout, and atlantic salmon

Mussel meal has also been tested on Catfish, Tilapia, Norwegian and baby European lobster

The possible uses of mussels



Market

Traditional seafood

Feed

Fertilizer

The use of mussels as fertilizer works, but is a waste of valuable marine protein

Illustration: Maj Persson

Mussels - delicious, healthy, festive

but Baltic mussles are in general too small

Mussel meal manufacturing using a lysis process (patent pending)

Cracking

Lysis through heating and agitation

Shells

Draining of suspension

Dewatering and separation

Heating and drying

Mussel paste

Mussel meal of high quality

Inventor: Odd Lindahl

A new product –
a protein bar with mussel paste

Mussel sausage

The possible uses of Baltic mussels

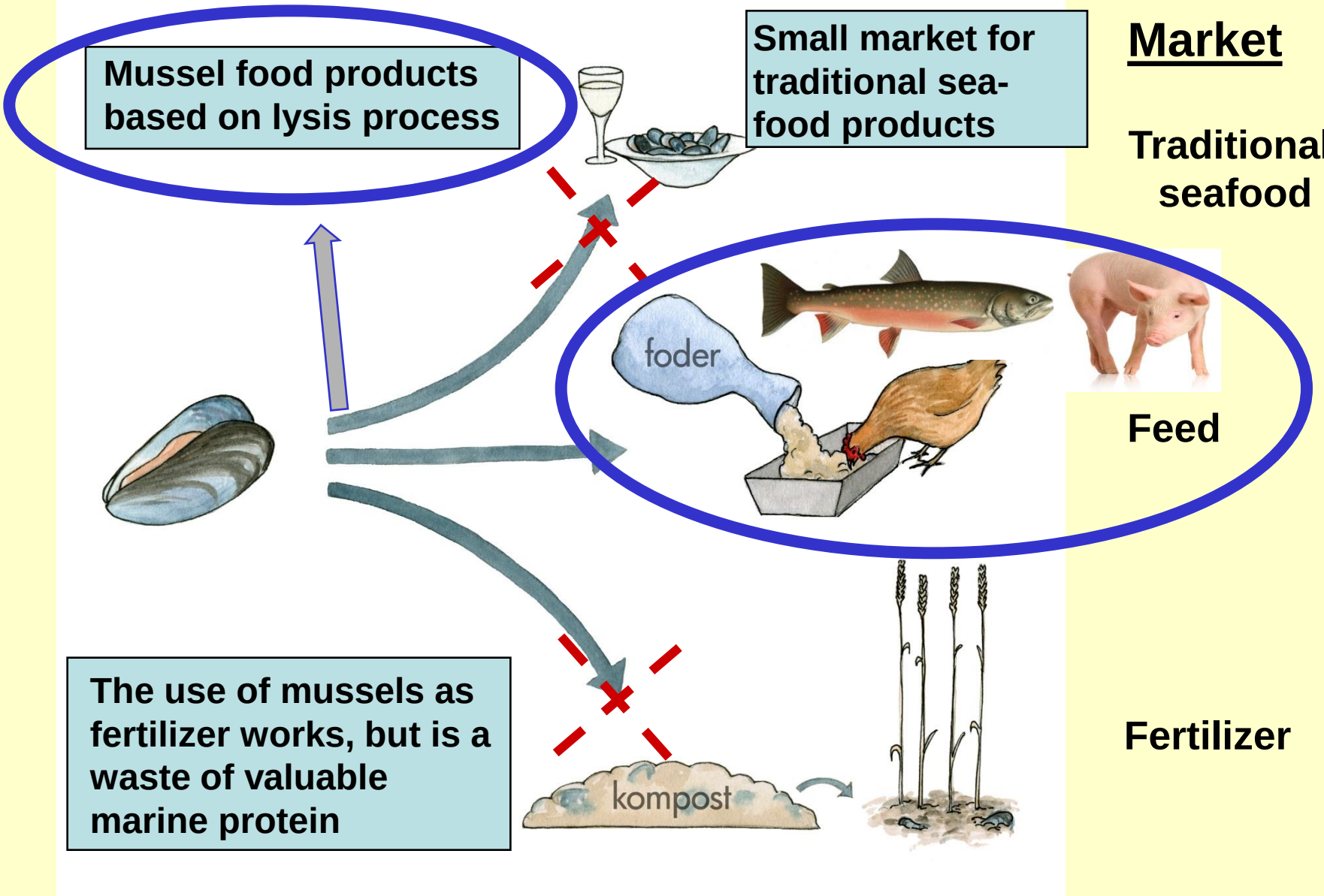


Illustration: Maj Persson

Technical summary of mussel feed production:

- **Possible to use small and fragile mussels of Baltic origin**
- **The mussel meal is of high quality**
- **Mussel meal can be used in feed for a number of mono-gastric animals**
- **Mussel shells (Ca), astaxanthin and micro-nutrients are added values**

Technical summary of mussel food production:

- **Possible to use small and fragile mussels of Baltic origin**
- **Mussel meal and paste can be used in a variety of food products of different kinds**
- **The content of heavy metals and other unvanted substances must be carefully investigated and controlled**

Bridging the gap between the production cost and the markets

The mussel farmer gets paid for the environmental benefit performed.

A win-win situation can thereby be created between society, environment and aquaculture.

But how shall the mussel farmer get paid? And who is going to pay?

Mussel farming –
a win-win measure for environment, society and industry and hopefully also for the Baltic.

Thank you for your attention!

Musselfeed