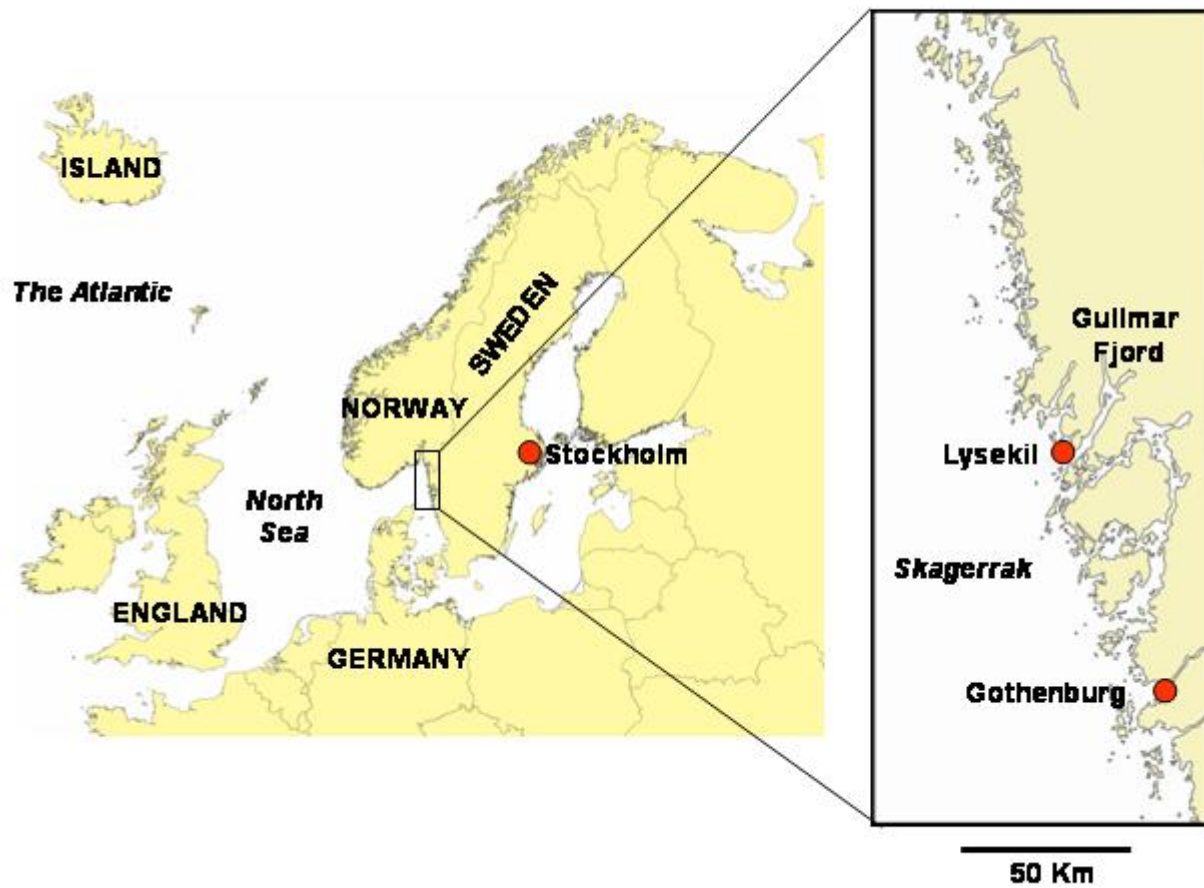


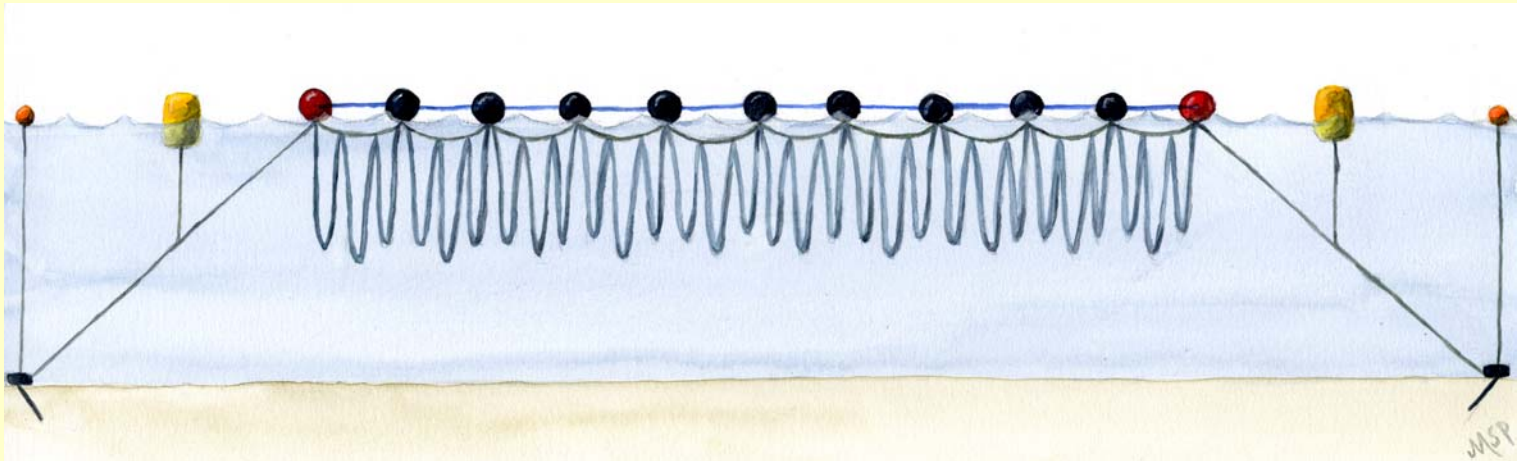
# **Mussel Farming as a tool for remediation of coastal waters – Experiences from Sweden**



**Odd Lindahl  
The Swedish Academy of Sciences,  
Kristineberg Marine Research Station,  
Sweden**



# Principle of a long-line

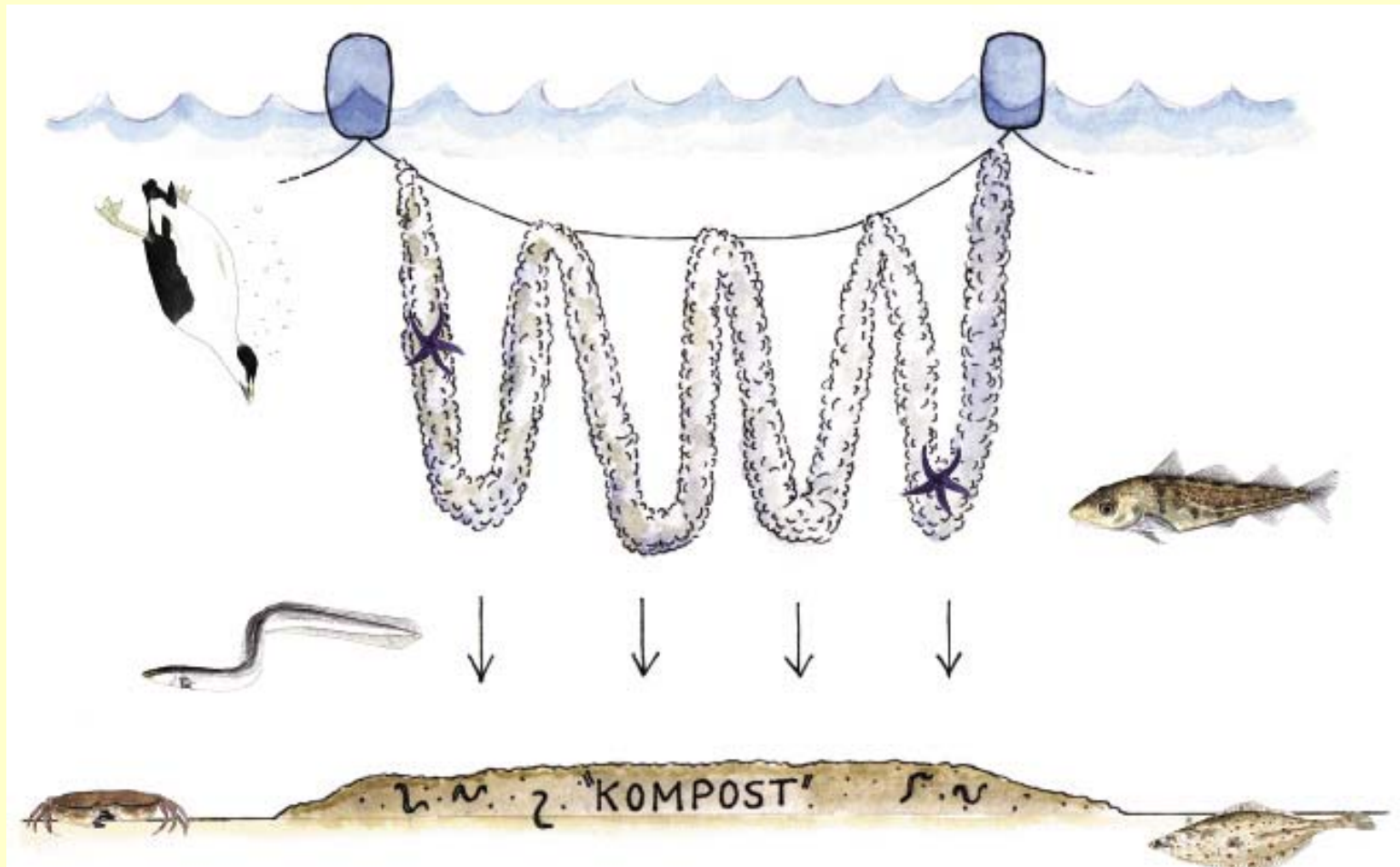






*Photo; Pia & Karl Norling*

# A mussel farm is like an artificiell hard bottom





# On-going studies on long-line farming



**X = test sites**

# The first mussel farm in Kalmarsund



Ljungsnäs, June 2006

# Kalmarsund after 14 months



**Biomass just over one year  
was 4 kg m<sup>-1</sup> mussel-band,  
or 16 kg m<sup>-1</sup> longline.**



# Size after 14 months



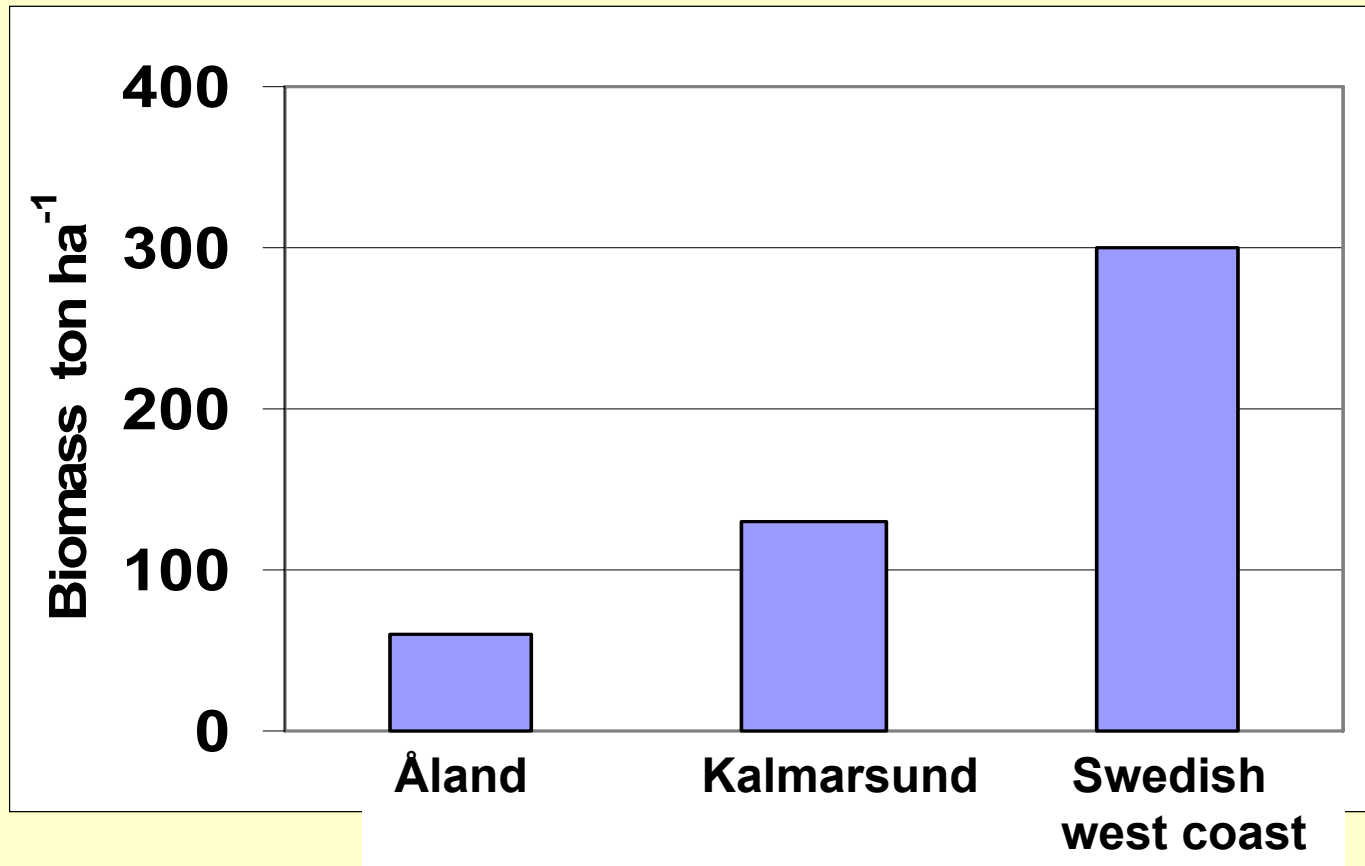


## Mussel farming at Kumlinge, east Åland archipelago

- Biomass after one year was  $1 \text{ kg m}^{-1}$  mussel-band, or  $8 \text{ kg m}^{-1}$  longline.
- Biomass after two years was over  $2 \text{ kg m}^{-1}$  mussel-band, or ca  $20 \text{ kg m}^{-1}$  longline.

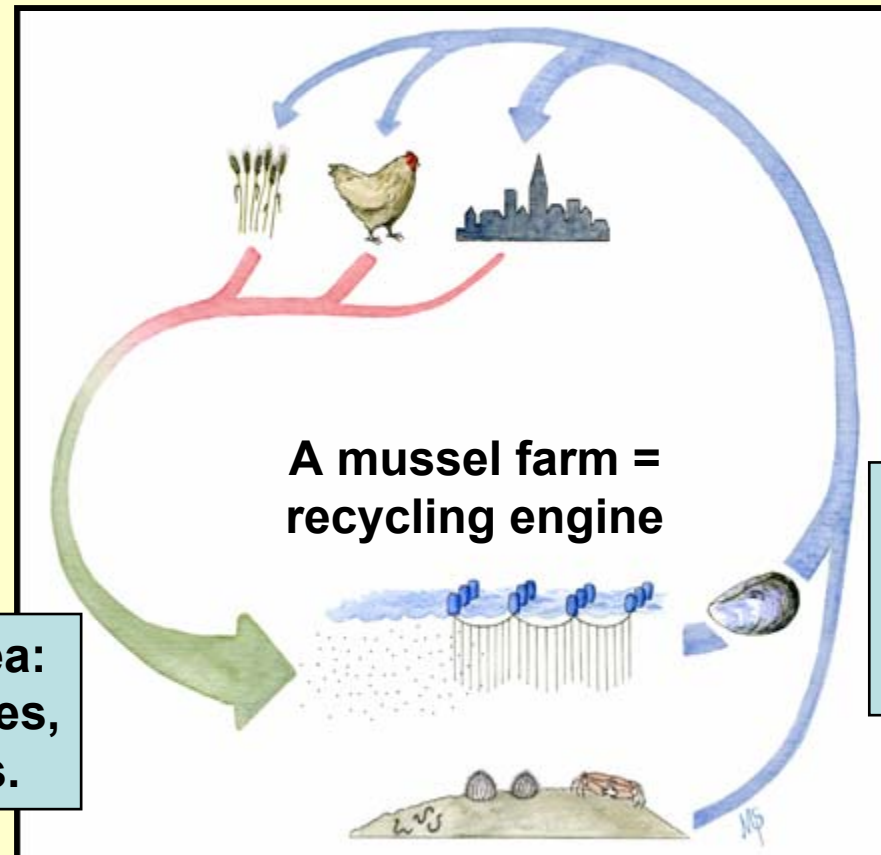
*Torbjörn Engman at Seglinge Forell inspects his mussel farm, which purpose is to compensate for the nutrient emission from the fish farm.*

# Harvest per hectar sea surface





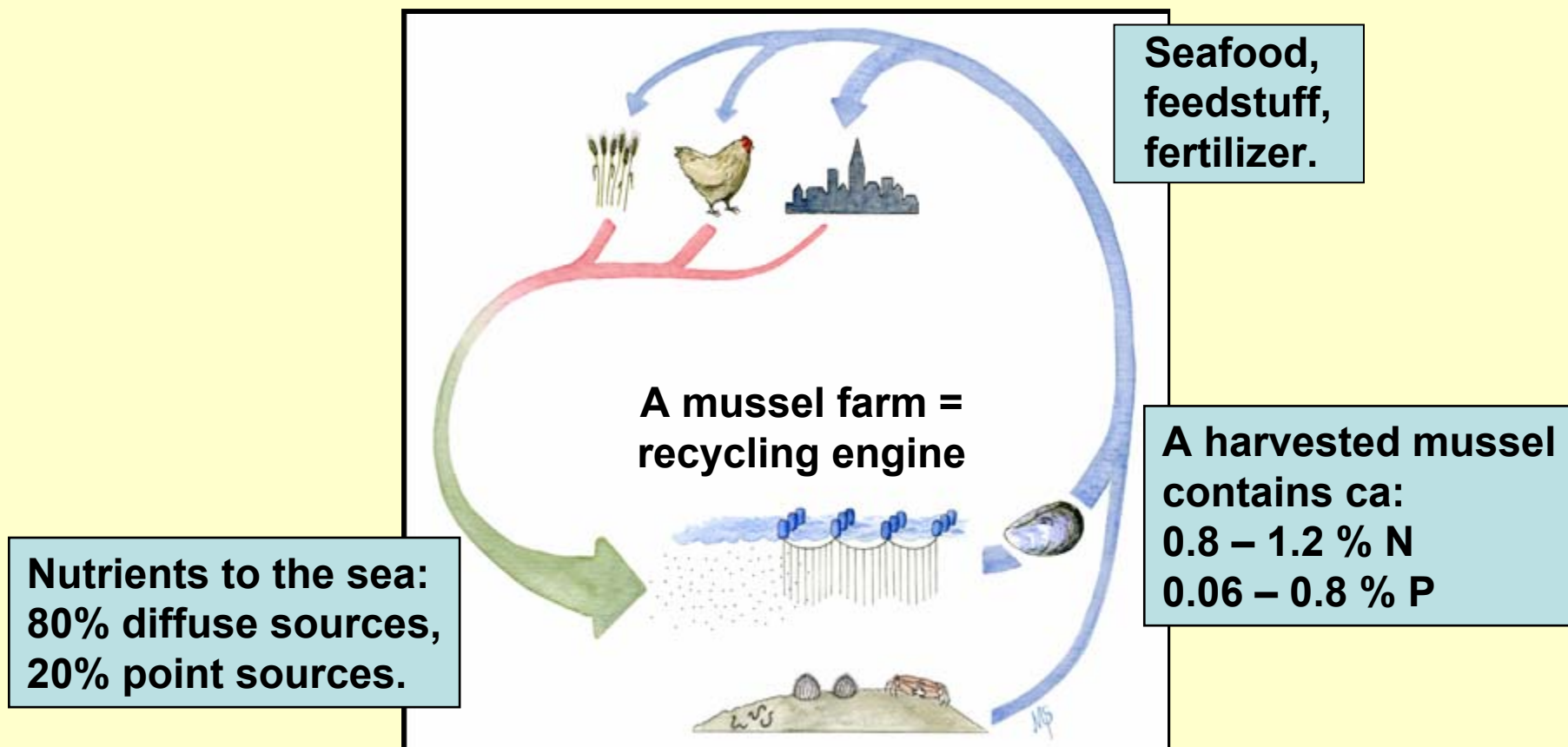
# The Agro-Aqua recycling



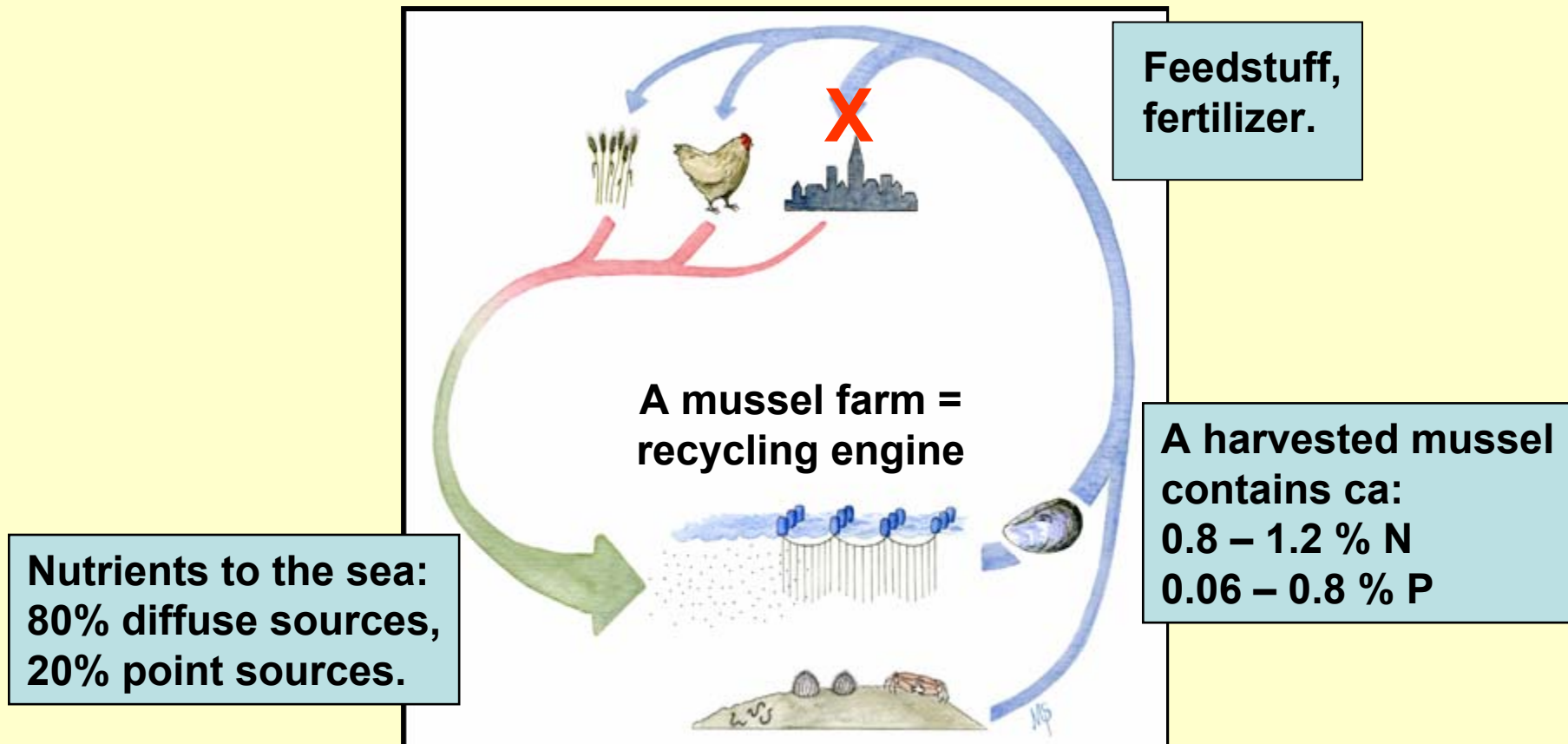
**Nutrients to the sea:  
80% diffuse sources,  
20% point sources.**

**A harvested mussel  
contains ca:  
0.8 – 1.2 % N  
0.06 – 0.8 % P**

# The Agro-Aqua recycling in a marine area



# The Agro-Aqua recycling, in the Baltic





# The Agro-Aqua recycling, in the Baltic

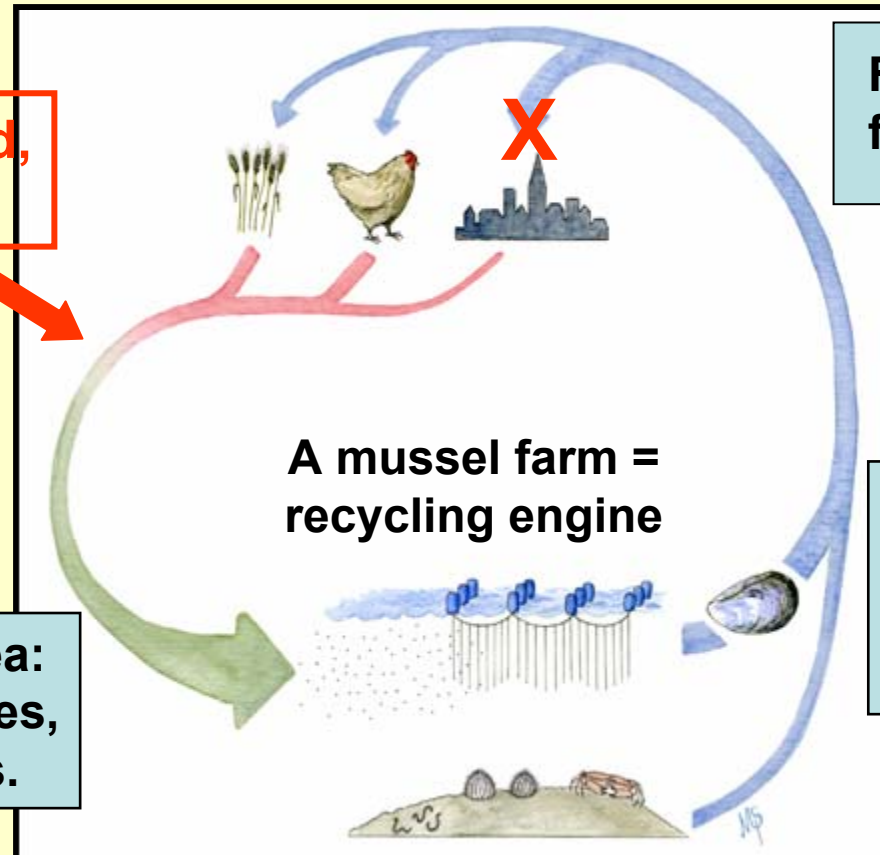
Environmental aid,  
nutrient trading

Feedstuff,  
fertilizer.

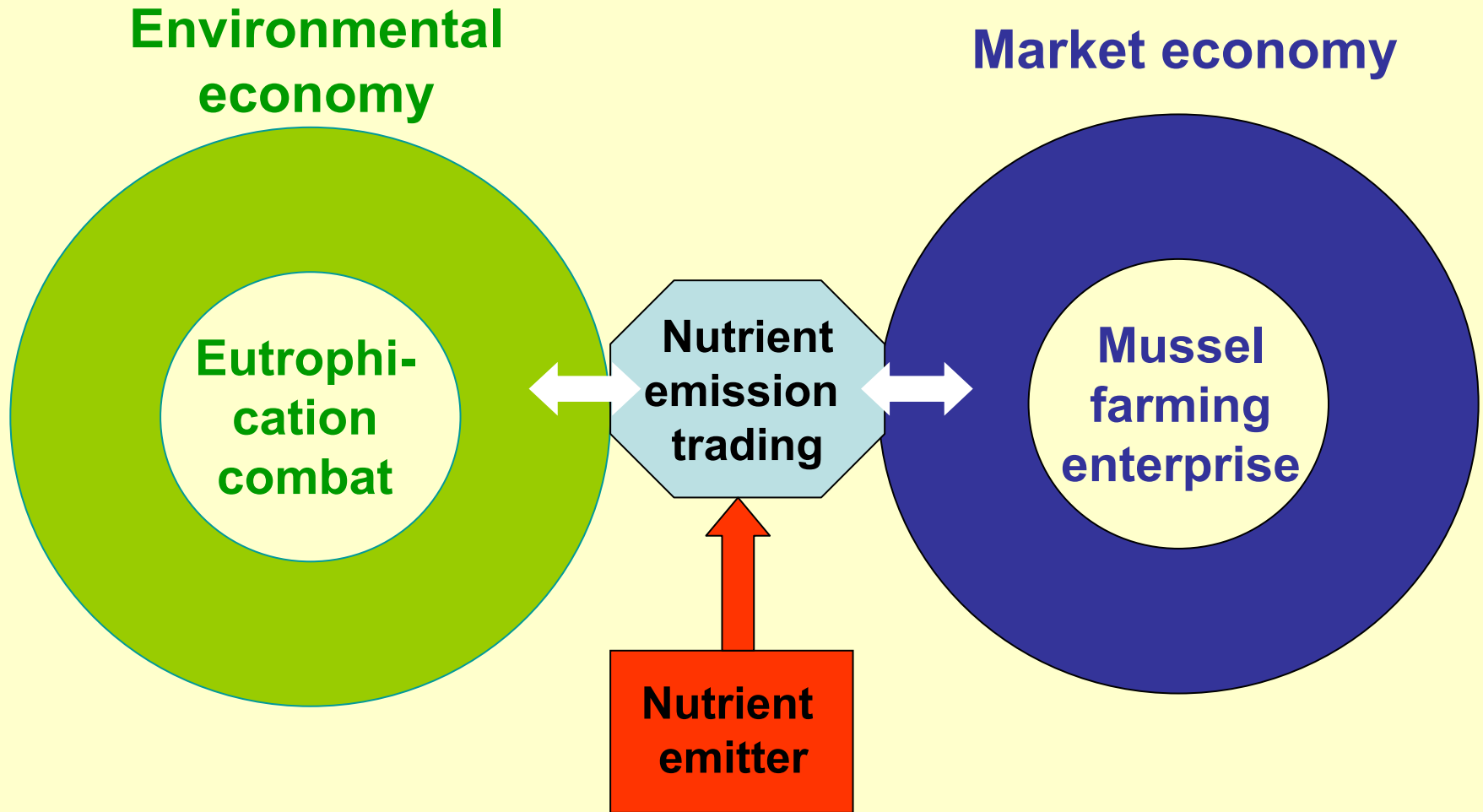
A mussel farm =  
recycling engine

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

A harvested mussel  
contains ca:  
0.8 – 1.2 % N  
0.06 – 0.8 % P



# Nutrient trading as a part of coastal zone management





# Lysekil – the first Swedish case of trading a nutrient discharge

European Community sewage treatment demand:

10 000 p.e. ➡ 70% nitrogen removal

39 ton N

Lysekil sewage treatment plant.  
(70 % N removal)

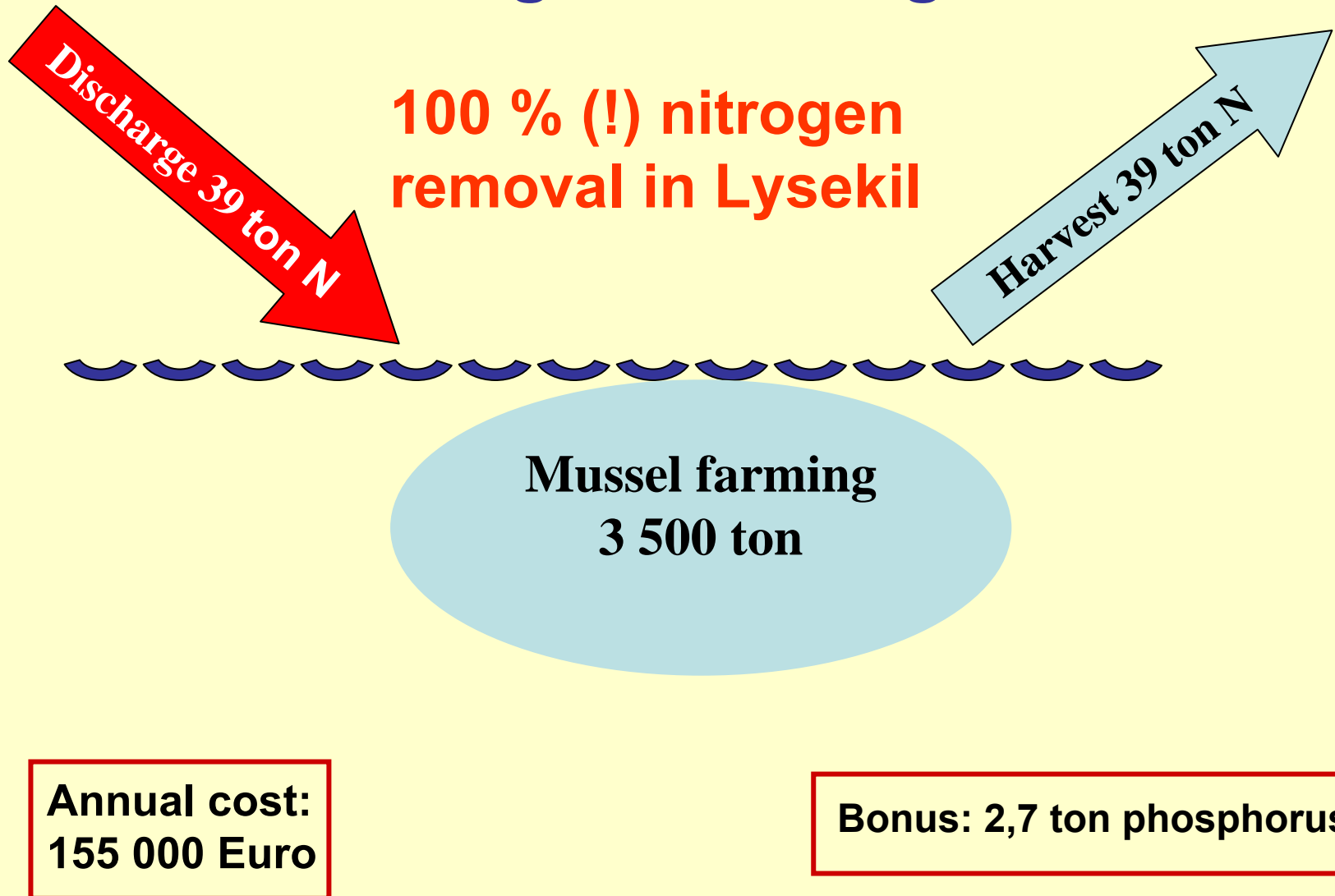
12 ton N

Annual cost:  
230 000 Euro





# Lysekil first in Sweden trading a nitrogen discharge



**What shall we do with thousands  
tons of small mussels?**

## Free choice of feed



**Steamed mussel meat**

**Standard feed**

# Control, 10 % mussel meat and free choice





# Large scale and long term studies at Swedish Agro. Univ.



# The mussel reminder used as a fertilizer





# Composting mussels with straw



# **Why mussel farming to combat eutrophication:**

- ✗ Recirculates nutrients via phytoplankton from sea to land**
- ✗ Environmentally friendly**
- ✗ Cost effective compared to other measures**
- ✗ Especially suitable for diffuse emissions**
- ✗ Flexible and easy to remove**
- ✗ Provides coastal jobs**
- ✗ Long-line mussel farming has a potential in the Baltic**
- ✗ Produces organic feedstuff and fertilizer**

# **Почему марикультуру моллюсков можно рекомендовать для борьбы с эвтрофикацией?**

- Осуществляет через фитопланктон перемещение биогенов из моря на сушу**
- Экологически безопасна**
- Особенно подходит для районов, где происходит диффузная эмиссия биогенов**
- Модули установок гибкие, мобильные , их легко удалять**
- Способствует созданию новых рабочих мест в прибрежных районах**
- В данной модификации имеет потенциал для Балтийского региона**
- Источник экологически чистых кормов и удобрений**



An underwater photograph looking up towards the surface. Bright sunlight filters down from the top right, creating a strong lens flare and illuminating the water. Several dark, vertical, textured structures, possibly kelp or artificial poles, stretch from the bottom towards the surface, creating a sense of depth. The water has a greenish-blue tint.

**Thank you for  
your attention!**



# Harvest per hectar sea surface

## *The Baltic (Åland):*

### First year

60 ton mussel biomass after one year.

Estimated content: 2.4 ton C, 0.5 ton N and 36 kg P

### Second year

160 ton mussel biomass after two years.

Estimated content: 6.4 ton C, 1.3 ton N and 100 kg P

One hectar of mussel farm utilises the primary phytoplankton production from 7.5 ha of sea area.

# Harvest per hectar sea surface

## ***The Baltic (Kalmarsund):***

**130 ton mussels after one year.**

**Estimated content: 5.1 ton C, 1 ton N and 76 kg P**

**One hectar of mussel farm utilises the primary  
phytoplankton production from 16 ha of sea area.**

# Harvest per hectar sea surface

## ***Swedish west coast:***

**Up to 300 ton mussels in 12 to 18 months.**

**Harvests: 12 ton C, 2.4 – 3.6 ton N and 180 – 240 kg P**

**One hectar of mussel farm utilises the primary phytoplankton production from 25 ha of sea area.**



# Estimated marginals costs using mussel farming for N and P harvest

	SEK / kg N	SEK / kg P
Kattegat	0 - 322	0 - 3220
Öresund	0 - 365	0 - 3650
Southern Baltic	64 - 336	640 - 3360
Northern Baltic	134 - 768	1340 - 7680

(From Gren *et al.*, manuscript)