

# Mads van Deurs

Nordshell, Denmark - consultancy company

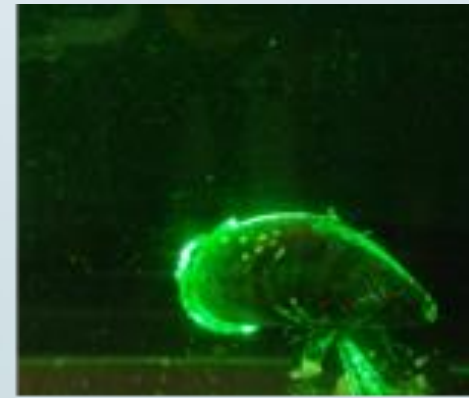
Smart Farm AS, Norway - part-time employed

Experience from establishing and running a commercial mussel farm and processing factory

Aquaculture: Farming techniques, biology and environment. Blue shell mussels and seaweed

Partner in several R/D projects

Freelance establishing mussel farms in EU and Asia



# Blue Growth potential

- in Estonian costal waters

Aquaculture in the Baltic Sea

Mitigation of Nutrients

Large scale mussel farming

Economy, market, environment

Other species



# Challenges in Baltic Sea

- Low growth (salinity)
- Ice during winter
- High labour cost
- Market situation
- **Advantage: Nutrients for free!**



# Mitigation mussels

- One mussel filter 6 liters or more per hour
- One farm have maybe 36 mio mussels filtrating 24/7
- Converting dissolved nutrients via plankton to mussel biomass
- Mussels contains 1-2% N & 0,1% P



Dissolved nutrients



Plankton

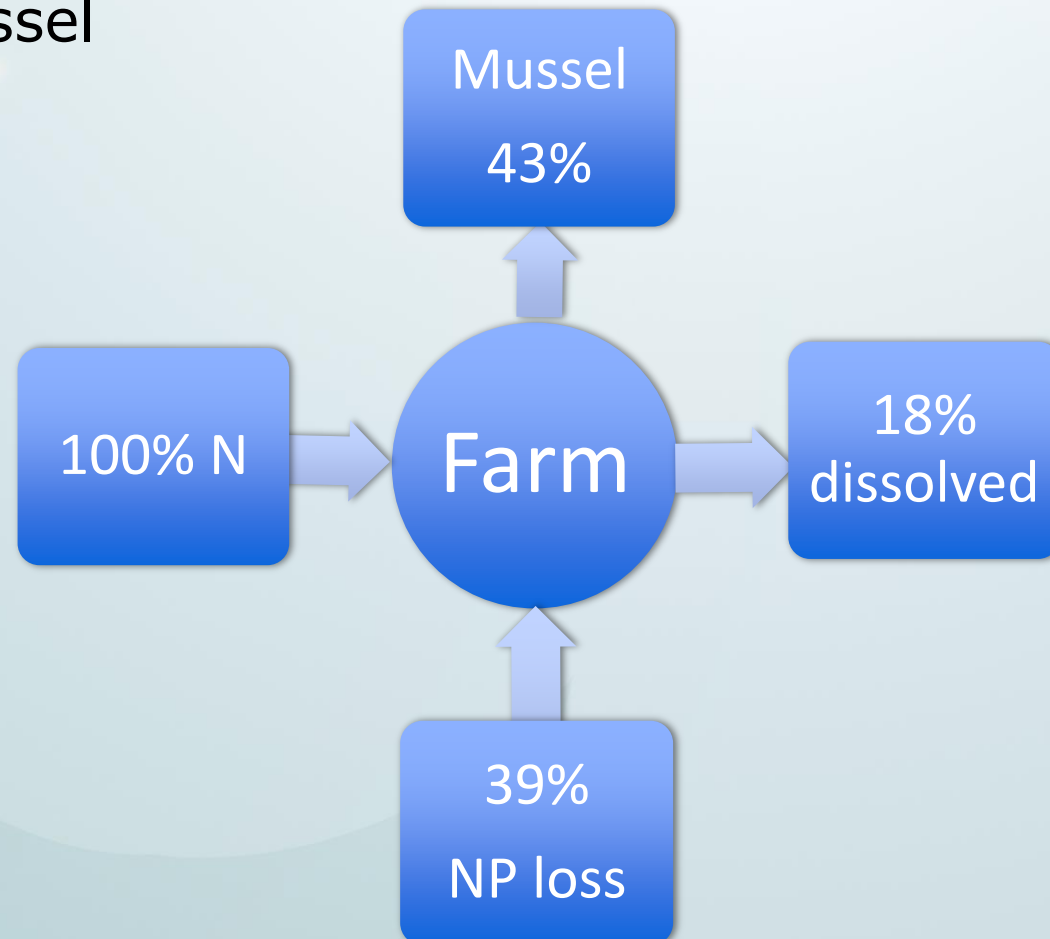


Mussels



# Balance new activities

- Fish farming will add nutrients to the sea
- This can be balanced with mussel and seaweed production
- Area for the nitrogen balance
- Political decision how to support the mitigation
- Equal price as land based mitigation (14,8 € / kg N)



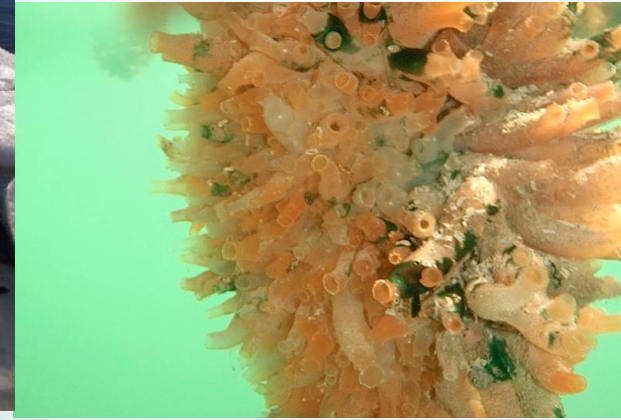
# Requirements to mussel farming system

- Must be able to up-scale
- Must have low labour input
- Must have a low production cost on the harvested mussels
- Must be suitable for Baltic Sea conditions
- Must show positive result from existing business



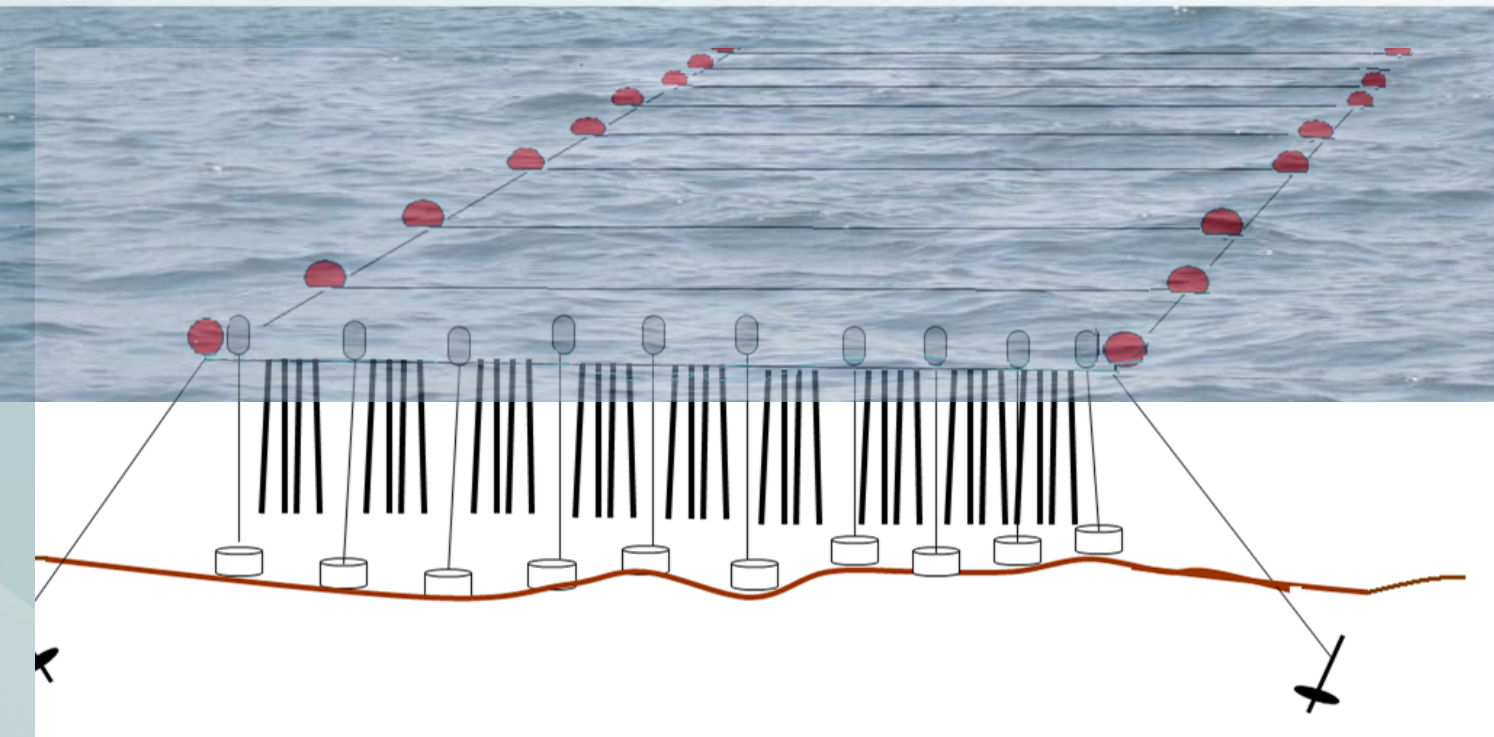
# Fouling and predators

- Eider duck
- Starfish
- Barnacles
- Tunicates
- Ice



# Longlines

- Simple system
- Well tested and developed during decades
- Can produce very fine mussels
- Can be submerged





- High quality - continuously improved
- Long lifetime. Protofarm from 2000 is still in the sea
- Low operating cost
- All operations done under water
- Installed in the following extremes:
  - ice covered fjords
  - in strong tidal sites (4 knots / 200 cm/sec. current)
  - Open waters with 7 meters significant high waves



- The Smartunits are assembled on land and launched at sea
- The Smartunits are towed to the farm site
- Mooring and installation is done under supervision

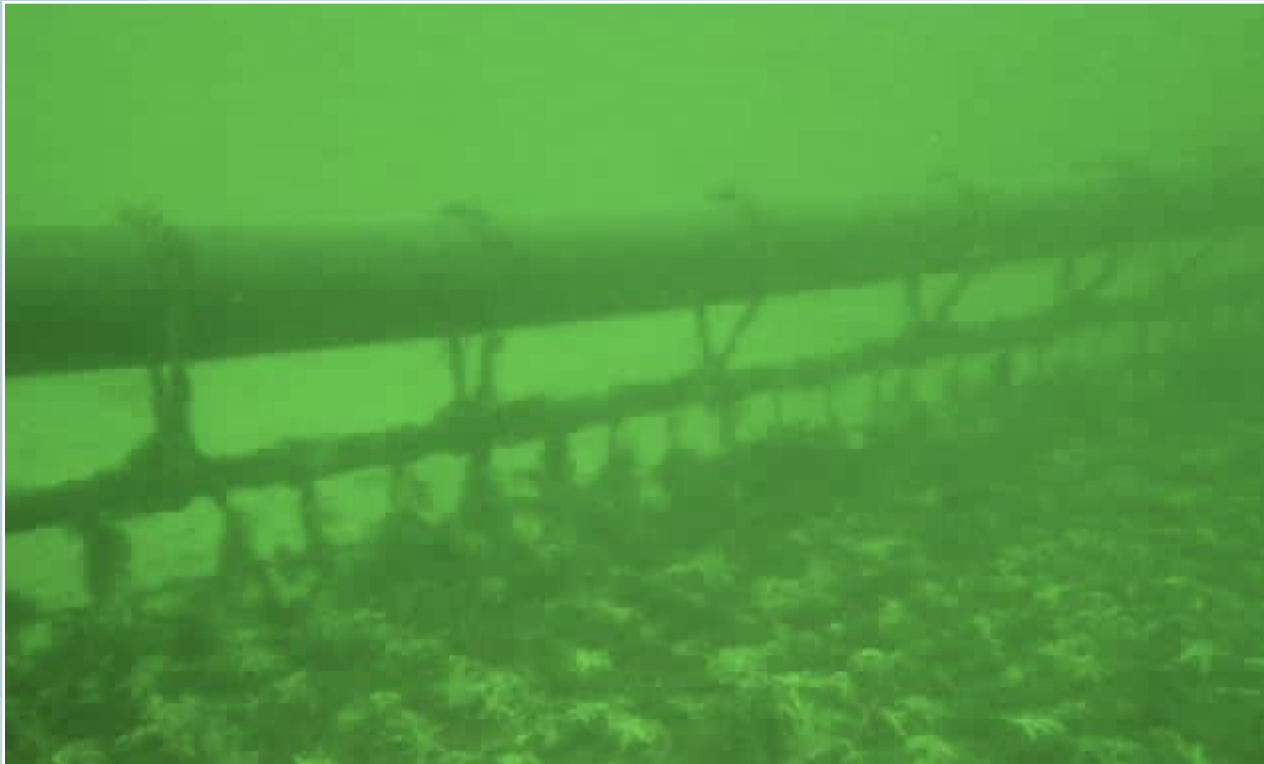


Mussels settle and grow on the net

Predator removal, thinning and harvesting is done by machine - under water



The Smartunits can be submerged during ice cover



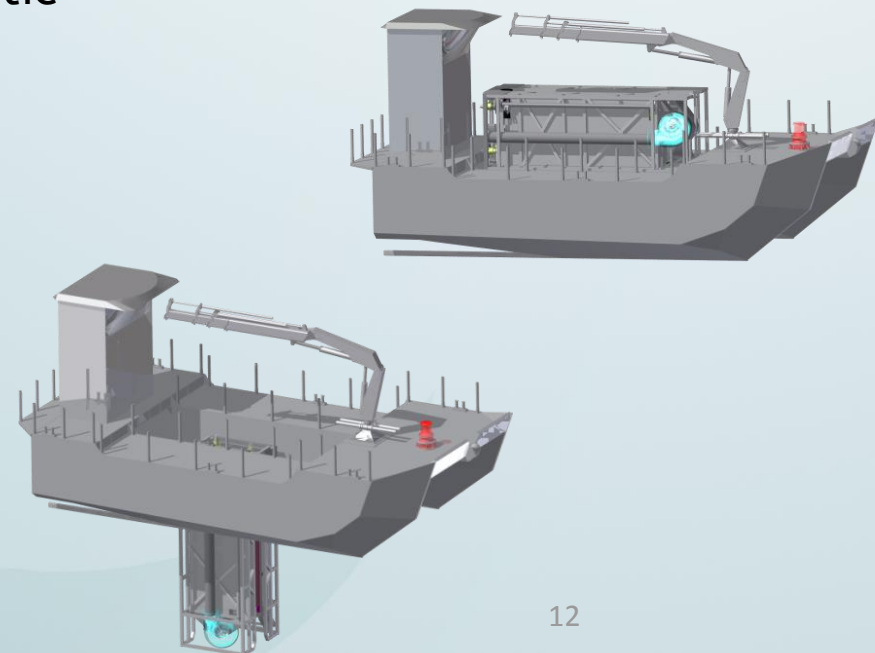
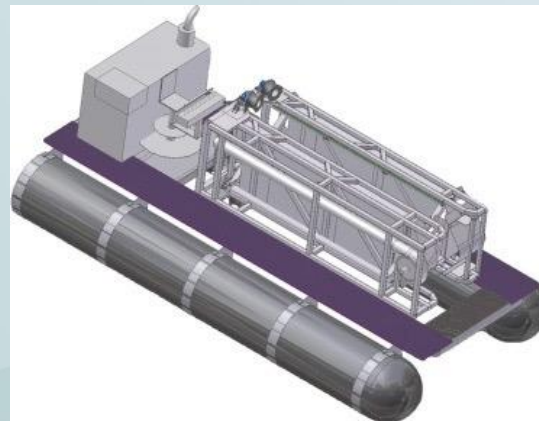
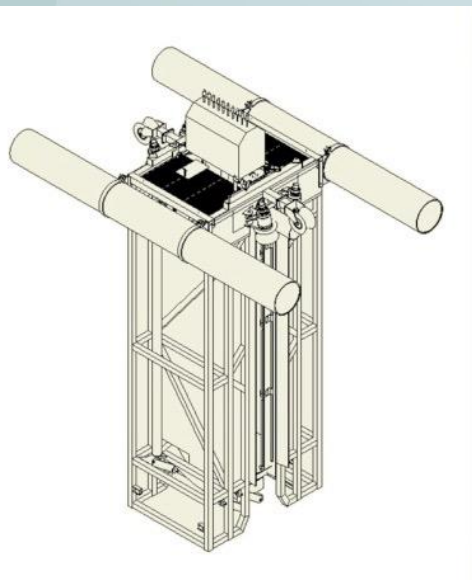
# Specialised machines

Basic for the harvesting machine:

- Cleaning nets before settlement of mussels
- Starfish and barnacle removal
- Thinning
- Harvesting

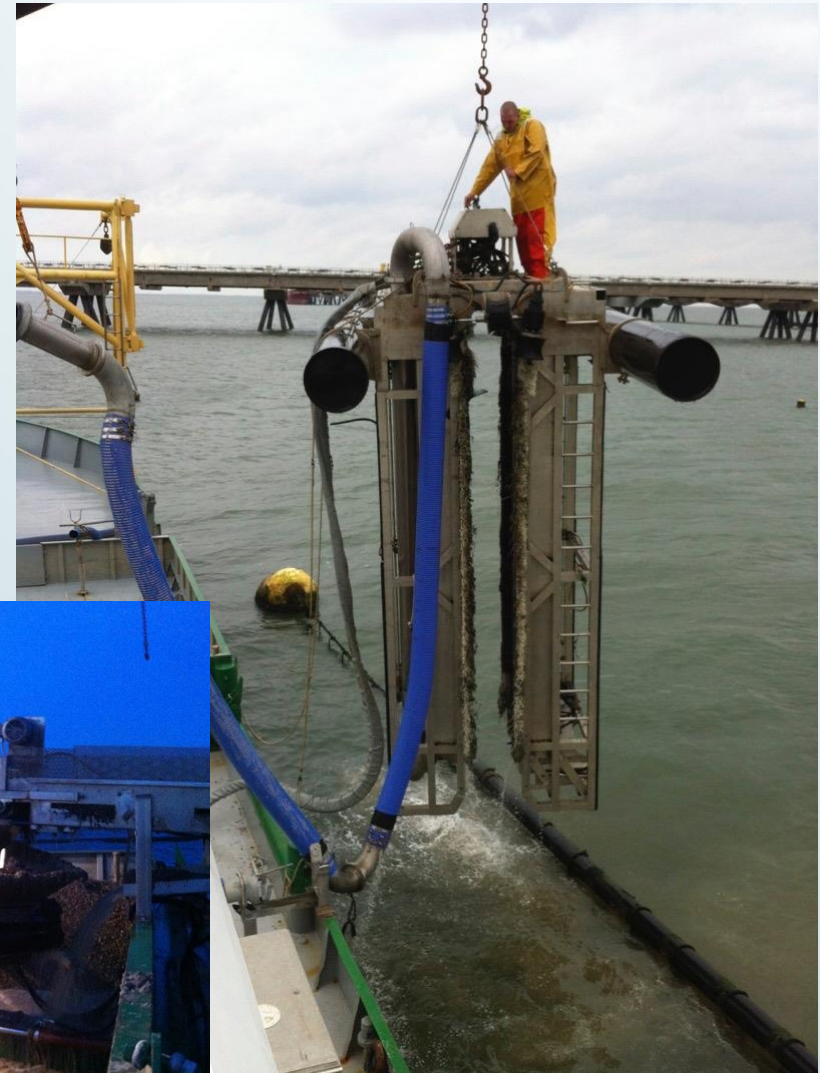
Depending on scale of production and infrastructure, the machine can be custom designed into the following units:

- Harvesting machine to be operated from boat
- Scooterversion. Selfpowered with limited carrying capacity
- Catamaran with increased capacity and logistic



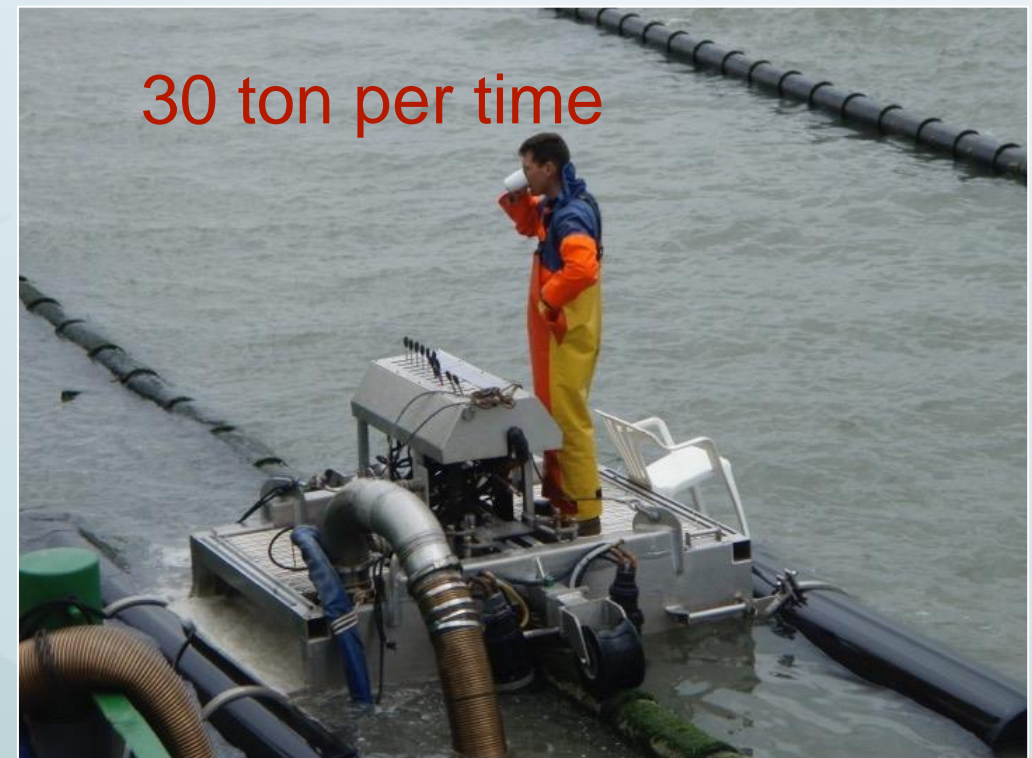
# Harvesting

- The machine is lowered over the unit
- Mussels are pumped on board



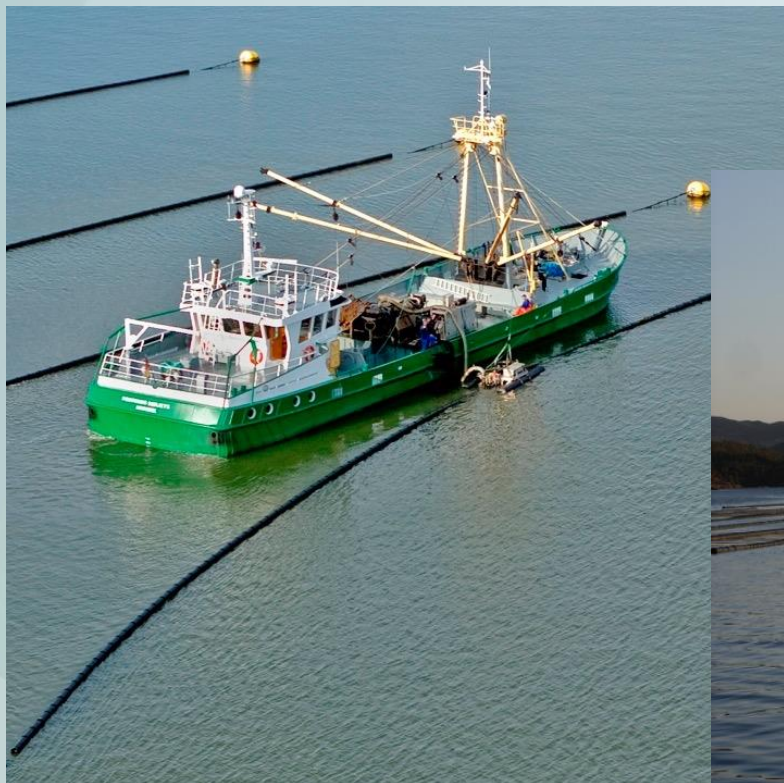
# Capacity

- 30 tons per hour
- Depending on time shifting to the next unit
- Depending on efficient handling of the mussels onboard
- All operations are controlled by operator
- Result: Low cost per ton



# Example from Germany

- Production from May to October
- First harvest in August (30%)
- Second harvest in October (70%)
- 236 Smartunits
- 4.000 tons per year



# Complete solution

- Consultancy during planning
- Tailor made smartunits for optimised growth
- Husbandry- and harvesting machine
- Complete mooring systems
- Navigational markers
- Fence against eider duck
- Continuously service and follow up





# Experience from Åland

Youtube video: <http://youtu.be/oGMnOmHDI7A>



# Case studies

## Smart Farm



- A. 25 smart-units, 2 employees
- B. 300 smart-units, 3-4 employees
- C. 800 smart-units (SDU-study)

Basic investment in harvesting machine and boat  
Cycle is important in calculations  
Sailing distance to port  
Logistic and planning



# A. 25 smartunits

## - investment

25 smart-units	342 350 €
Moorings	144 600 €
Mobilization	9 500 €
Boat	400 000 €
Harvestingmachine	230 000 €
Dinghy	8 000 €
<b>Total</b>	<b>1 134 450 €</b>



# A. 25 smartunits

## 625 ton per cycle



<b>Sales.</b> 25 units x 25.000 kg x 0,6 €	345 000 €
<b>Variable cost.</b> Material, fuel etc.	16 000 €
<b>Direct cost.</b> Manpower, admin, insurance, buildings, maintenance	125 617 €
<b>Depreciation.</b> 10% x 1 134 445 €	113 445 €
<b>Result</b> before tax and finance cost	119 938 €
<b>Chash flow</b>	233 383€
Payback period	<b>4,86 years</b>

## B. 300 smartunits - investment

300 smart-units	4 108 200 €
Moorings	1.735.200
Boat	400.000
Harvestingmachin e	230.000
Dinghy	8.000
<b>Total</b>	<b>6 481 400€</b>



# B. 300 smartunits

## 7.500 ton per cycle



<b>Sales Revenue.</b> 300 units x 25.000 kg x 0,6 €	4 500 000 €
<b>Variable cost.</b> Material, fuel etc.	192 000 €
<b>Direct cost.</b> Manpower, admin, insurance, buildings, maintenance	325 421 €
<b>Depriciation.</b> 10% x 6 481 400 €	648 140 €
<b>Result</b> before tax and finance cost	3 334 439 €
<b>Chash flow</b>	3 982 579 €
Payback period	<b>1,63 years</b>

# C. 800 Smart-units

## Feasibility study - Great Belt (Storebælt)

Source: "ASSESSMENT OF FINANCIAL FEASIBILITY OF FARMING BLUE MUSSEL IN THE GREAT BELT BY THE 'SMART FARM SYSTEM" Report from SDU (University of Southern Denmark)



Investment in one harvesting unit  
(Catamaran)



Can harvest 200 days per year

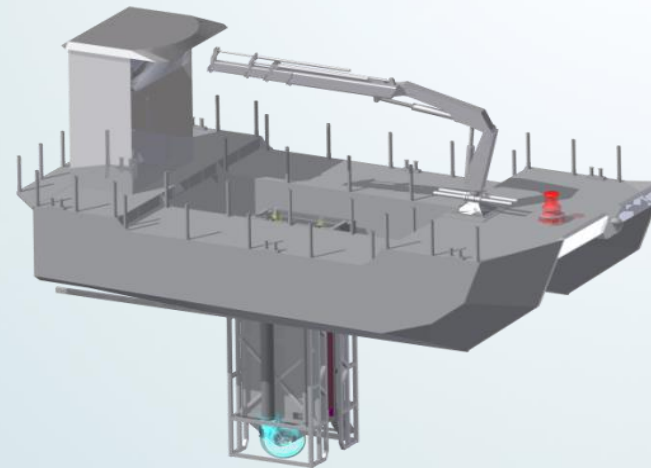


and 100 ton per day



20.000 ton per year  
(25 ton x 800 units)

Can fit into 6-7 farms of  
700 x 300 meter



## C. Economy



Source: "ASSESSMENT OF FINANCIAL FEASIBILITY OF FARMING BLUE MUSSEL IN THE GREAT BELT BY THE 'SMART FARM SYSTEM" Report from SDU (University of Southern Denmark)

- Investment in 800 units, moorings, nav. marking, boats, harvesting machine, logistic is 18 mio. €
- Operation cost every year is 1 mio €
- Production is 16-20.000 ton per year.
- Turn over if 0,25 € per kg is 4-5 mio. € per year to cover operation cost, write off, investment return...



## Basics to keep in mind

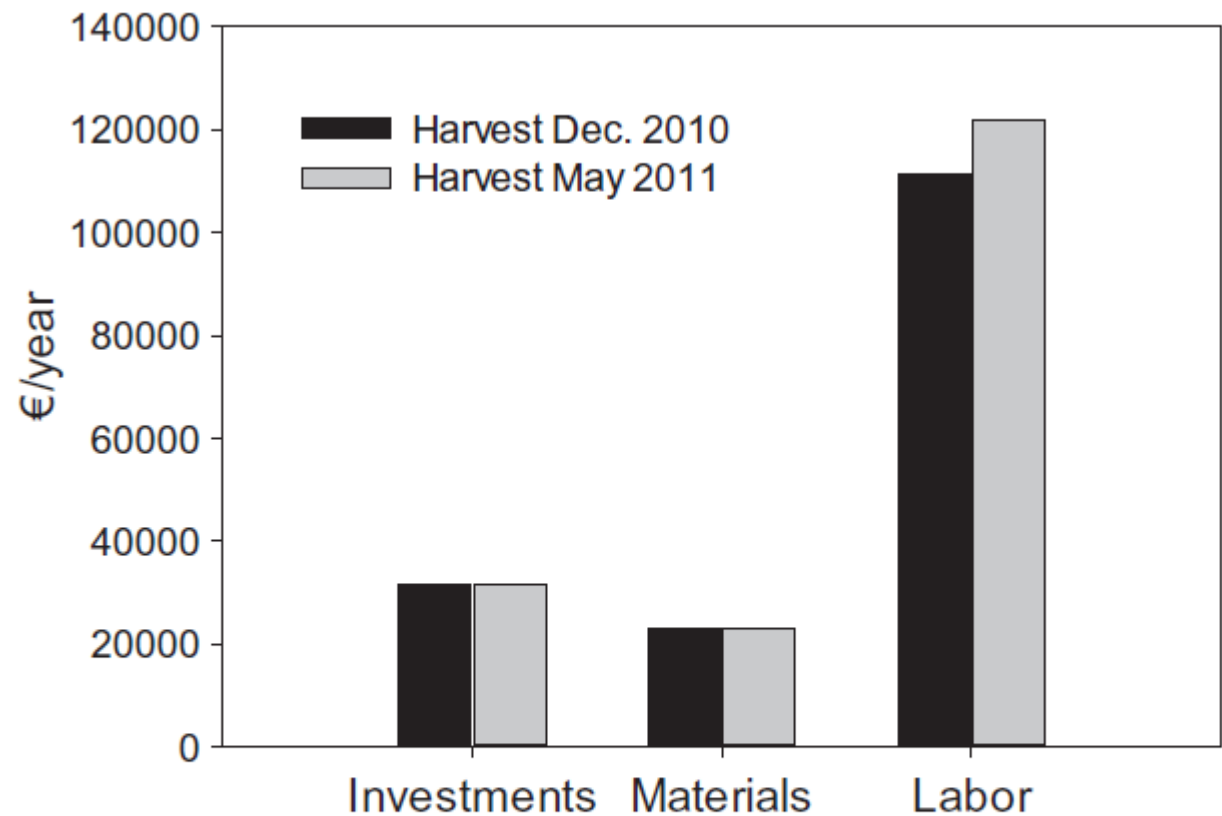
- The investment / write off has to be covered by profit from the production
- There must be a demand for the mussels
- Investigate the market volume and price
- Calculate the production price carefully
- Fixed expenses are the same for small and big farm (boat, analyses, administration etc.)
- There can be a financial compensation for the N/P removal

# Based on modern technology



Market will drive the development.

Politicians to lead the way



**Fig. 3.** Distribution of costs (in €/yr) for producing mitigation mussels. Costs are shown for mussel harvest in December 2010 (December 2010, 900 tons) and May 2011 (May 2011, 1100 tons).

# Seaweed as resource

- Fishing & cultivation



Production of seaweed  
will remove nutrients

Culture methods are  
not tested in full scale

Valuable compounds  
from the sea

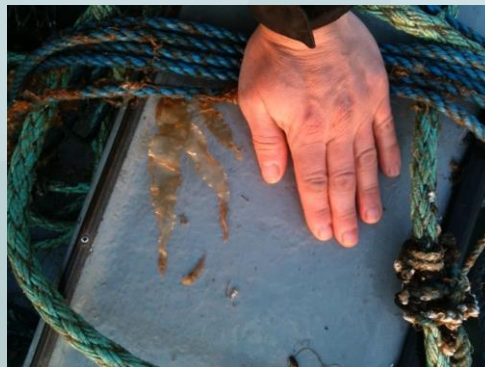
# Growing seaweed has just started



Making a culture form the nature



Seeding on lines for ongrowing



# The use of seaweed

- Natural food additive (E407-E418)
- Human consumption
- Fertilizer and feed
- Cosmetic and medical
- Biofuel



Carrageenan E407



# As feed

## Fish feed

Better growth

Better meat color

Better taste

Less fish meal

## Farm animals

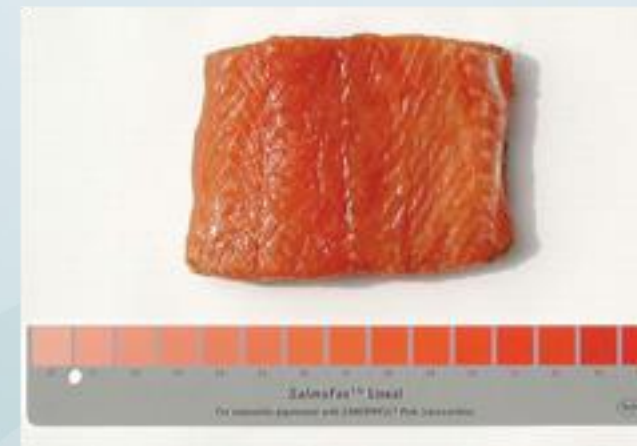
Less infection (piglets)

Higher birth weight (sheep)

Better wool (sheep)

Higher milk yield (cows)

Less space on land for cultivating feed



# Europe & Asia



# World production

## Seaweed culture



World production around 30 mio. tons per year (FAO 2012)

EU only 0,03% of this

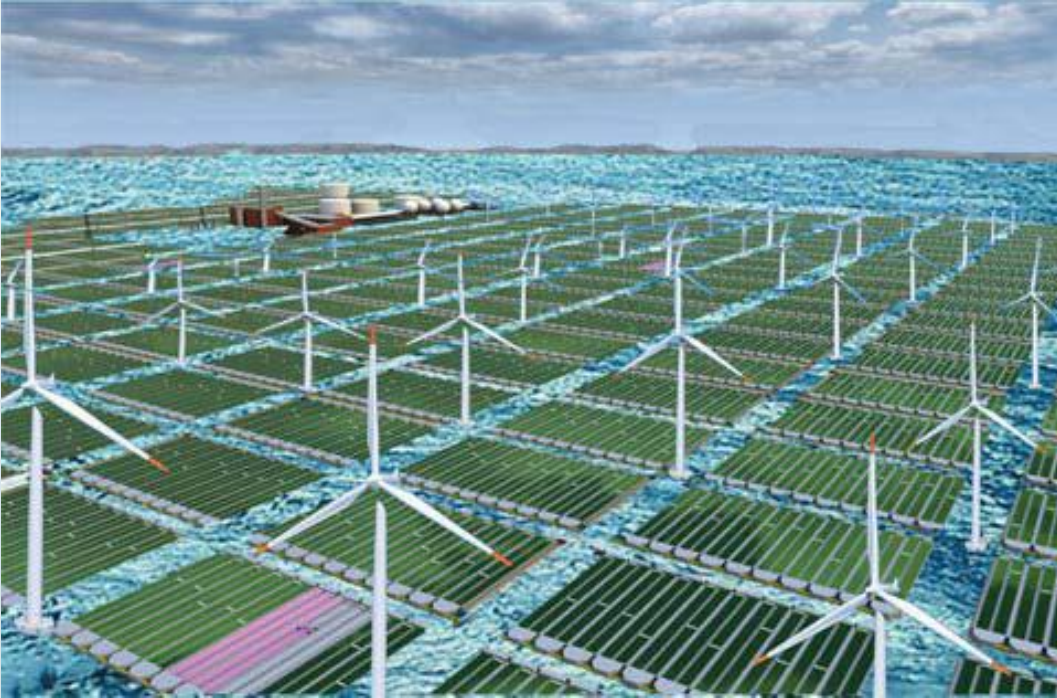
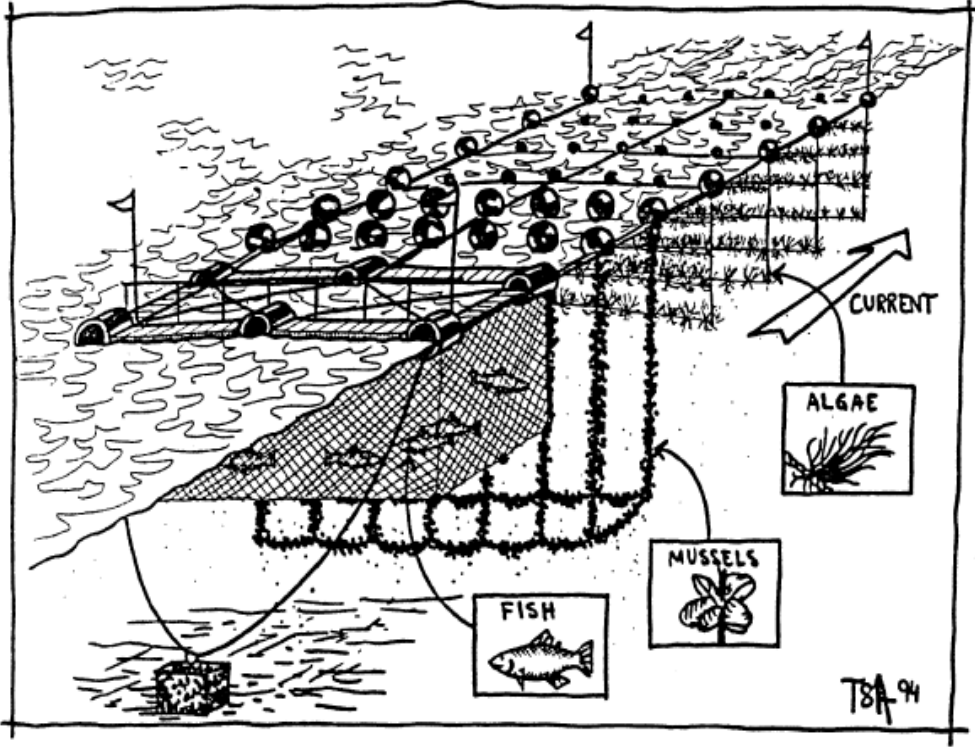
Collecting, fishing and aquaculture





# Polyculture & future

Growing focus on opportunities at sea  
Projects and market must lead the way  
Better use of the given resources



1% of Danish marine territory = 1.050 km<sup>2</sup>  
Remove 100.000 ton nitrogen and create  
values for 15 billion EURO / år.

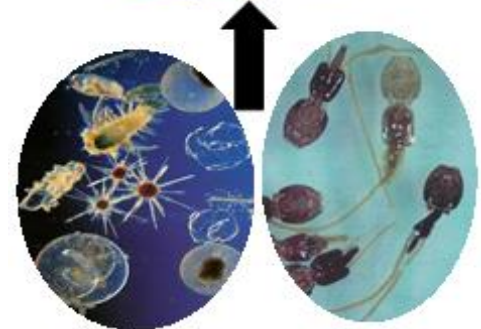






# Mussels

Valuable protein from the Baltic Sea



Thank you

