

Blue biomasses as future protein sources?



DANISH
TECHNOLOGICAL
INSTITUTE

it's all about innovation

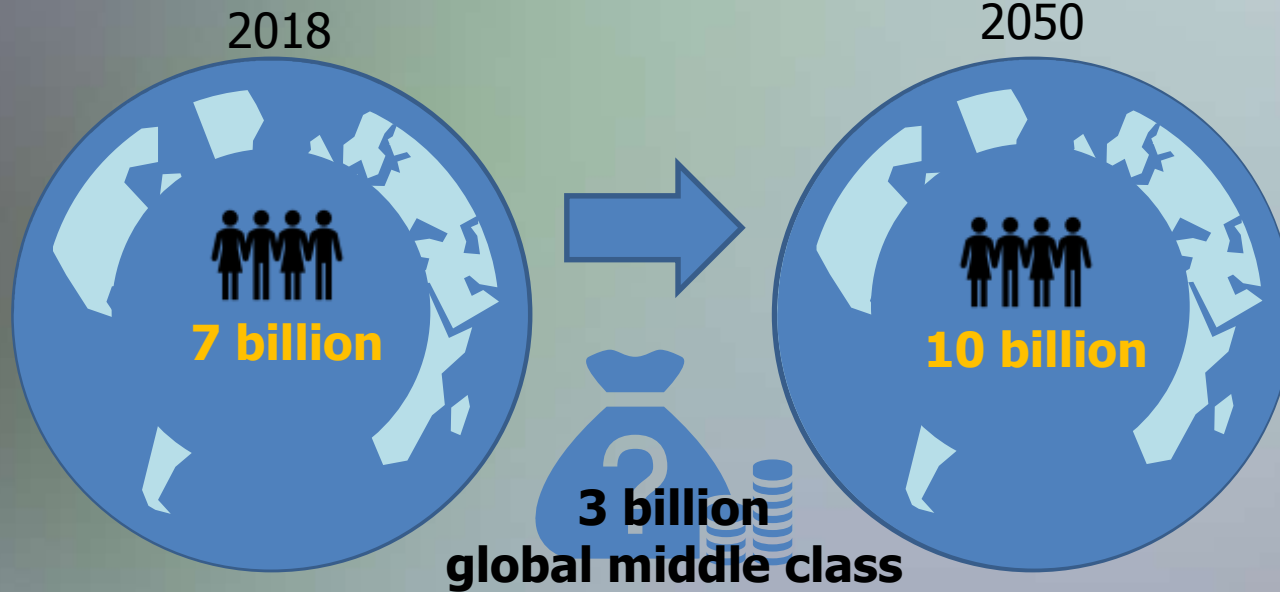


Lars Jørgensen, Danish Technological Institute

The Global challenge

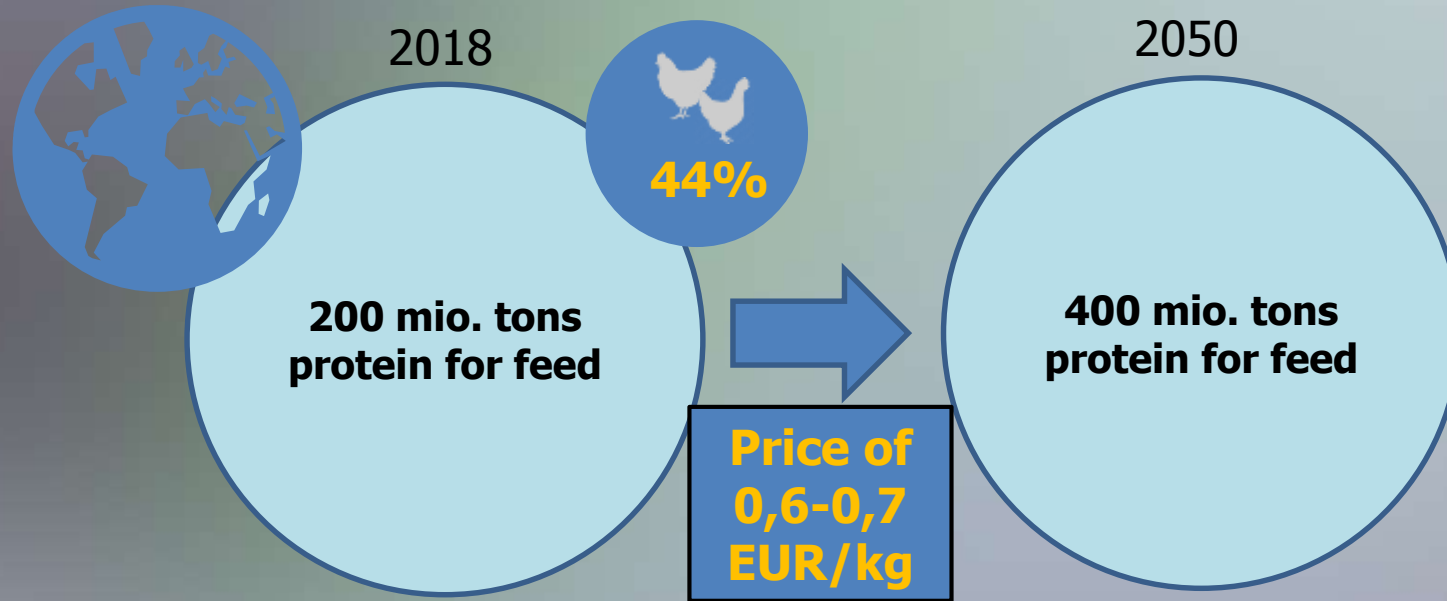


DANISH
TECHNOLOGICAL
INSTITUTE



= increased demand for food, incl. meat/protein

Protein for livestock feed



Source: FAO

Now – soy protein main source
- high environmental load, land use, greenhouse gasses, deforestation..

How to solve this?

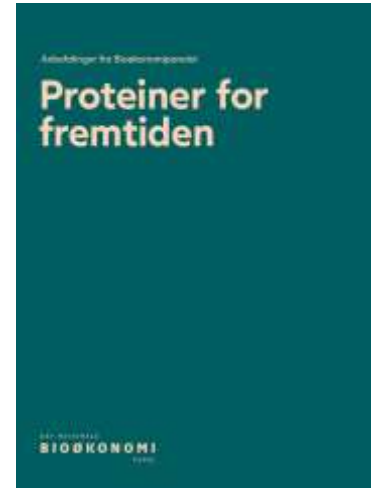
- More efficient production
- Less waste
- Circular economy – bio economy
 - Re-use of residual and waste streams
- New protein sources and value chains
- Recent recommendations from The Danish National Bio Economy panel
 - Increased funding to R&D and innovation
 - More public/private/RTO partnerships
 - Focus on sustainable protein production chains
 - National and EU focus

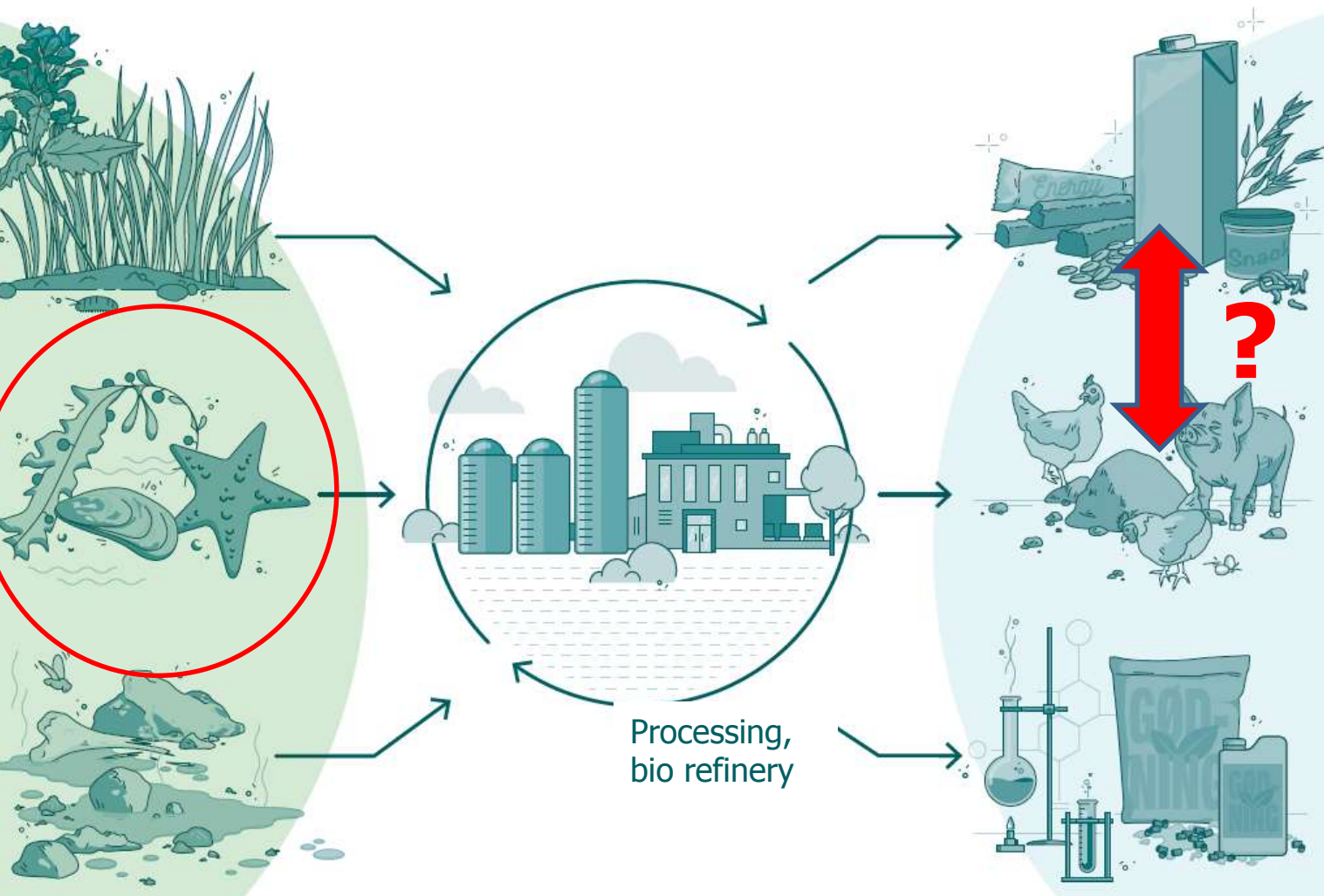


DANISH
TECHNOLOGICAL
INSTITUTE



Ministry of Environment
and Food of Denmark





DANISH
TECHNOLOGICAL
INSTITUTE

Blue biomasses?

- Sea is covering 71 % of the Earth
 - Not competing with the high demand for arable land
- Fish, mussels, seaweed, microlage, other
- Only fishing is exploited to a significant degree
- But – must avoid the same mistakes as on land...
- Must be sustainable!



Fish



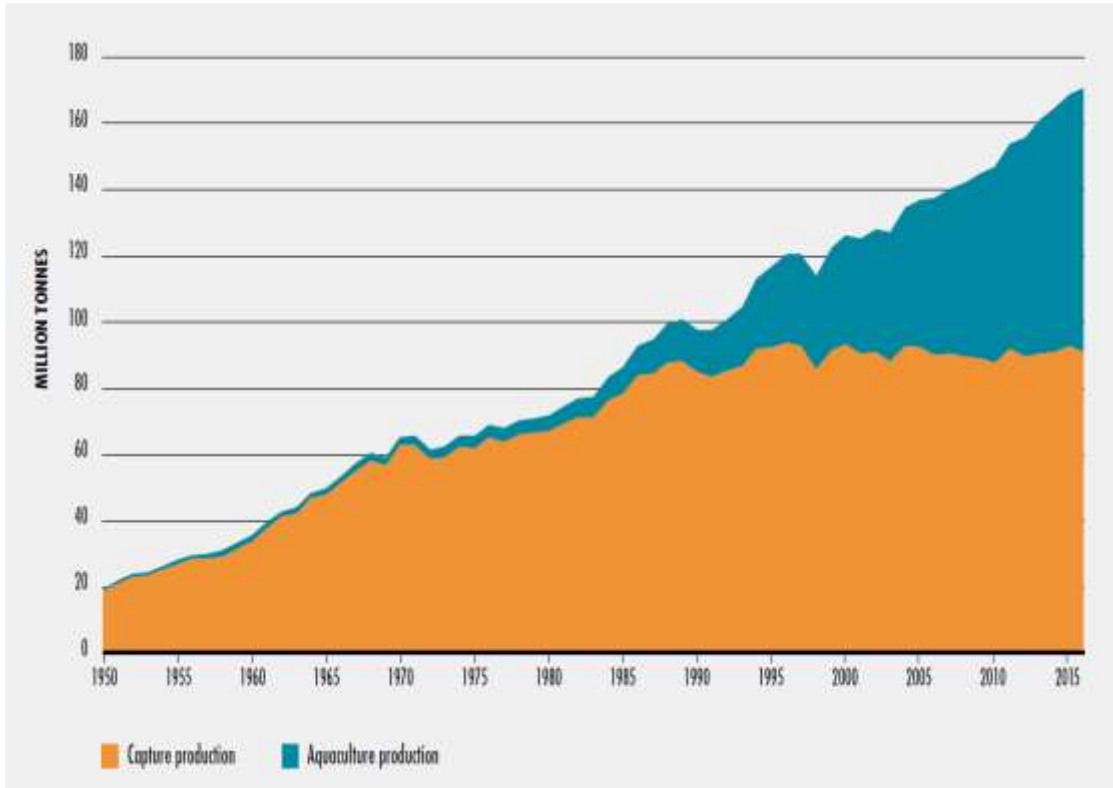
- Excellent nutritional value, high protein, oils
- Efficient feed conversion compared to other animal sources
- Low water use and CO₂ emission
- Expensive – for food more than feed



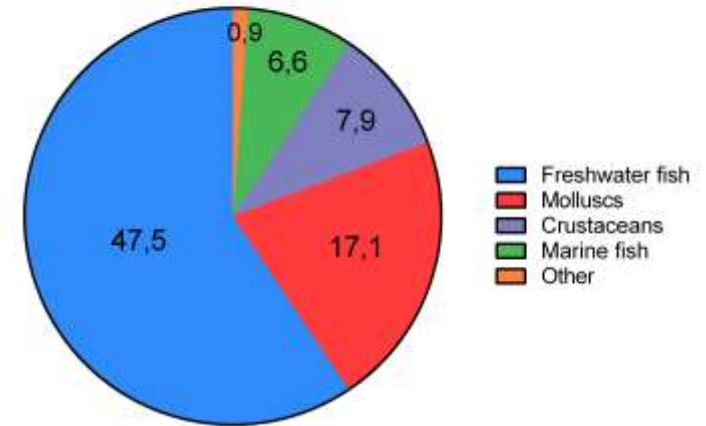
Fish



DANISH
TECHNOLOGICAL



World Aquaculture Production 2016
Million tonnes

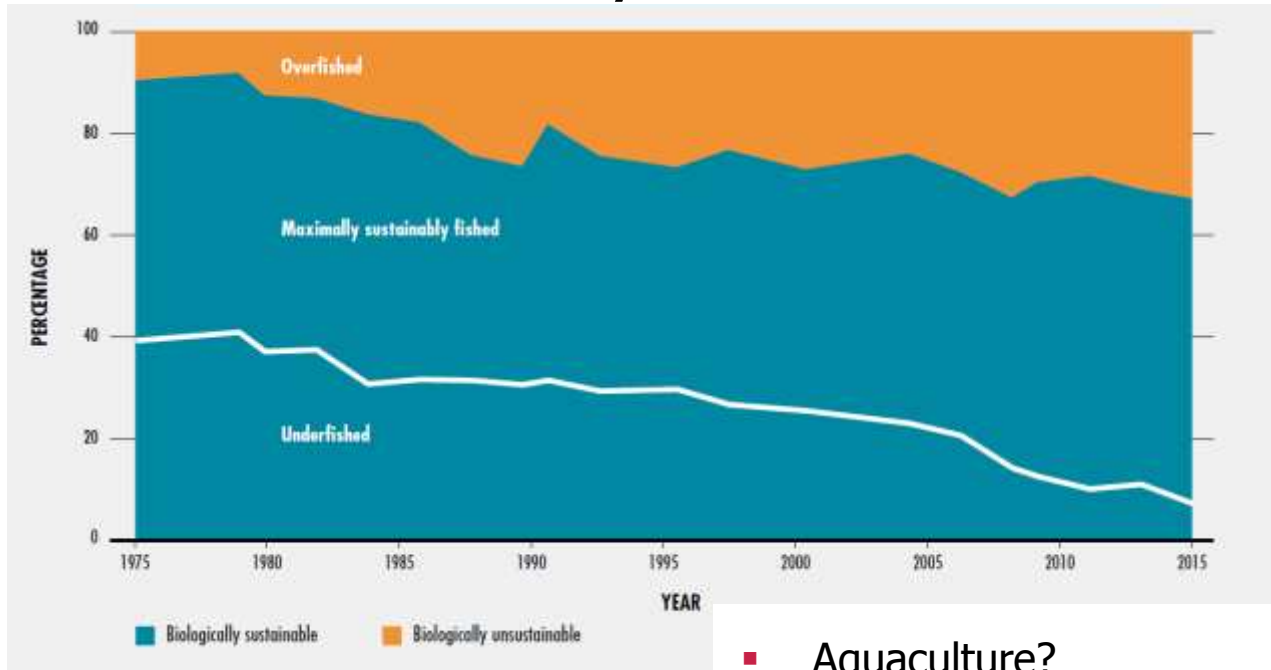


Source: FAO – The state of world fisheries and aquaculture 2018

Fish – sustainability?



DANISH
TECHNOLOGICAL
INSTITUTE



Source: FAO – The state of world fisheries and aquaculture 2018

- Aquaculture?
- Big potential as protein source
- Production at sea - issues with nutrient discharge
- Land based or closed (RAS) is costly

Seaweed



DANISH
TECHNOLOGICAL
INSTITUTE

- Varying protein content; 3 – 47%
- Rich source for various carbohydrates
- Low fat, but e.g. omega-3
- 29 mio. tons produced globally, 99% in Asia
- Can be produced or harvested from natural populations
 - Beach cast
- Takes up nutrients from the sea
 - Compensation measure in aquaculture
- Produces oxygen
- Possible benefits when used as feed
 - Reduction in methane emission from cattle



Seaweed - challenges

- Seasonal
- Iodine content
- Effect on marine environment?
- Need for technological development
 - Harvesting, processing, storage



Mussels

- Good source of protein – 15-20%
- Widely produced for human consumption
- Regarded as suitable for animal feed
 - – comparable to fishmeal
- Mussels are filtrators
 - 5-7 l water/h
 - Particles > 2-5 μm
 - Extract nutrients
 - Filtration improve transparency of water
 - Compensation measure in aquaculture



DANISH
TECHNOLOGICAL
INSTITUTE

Mussels contra seaweed, Denmark



DANISH
TECHNOLOGICAL
INSTITUTE



Better
off Blue

MUSSELS

1-1,3 % N/ww
600-900 kg N/ha/year
30-50 kg P/ha/year
10-13 Euro/kg N

Added Value:

Transparency of water
P
Biodiversity
Jobs and resources

Conflicts:

Sedimentation
Area

SEAWEED

0,1-0,7 %N/ww
3-39 kg N/ha/year
0,5-1,6 kg P/ha/year
75-110 Euro/kg N

Added Value:

Biodiversity
P
Jobs and resources

Conflicts:

Area



Other?

- Basically anything containing protein is possible..
- Example - Starfish
 - Problem in mussel fishing and production
 - EU has approved catch in areas with mussel production
 - Meal comparable to fishmeal – 38% protein
 - High calcium – suitable for poultry
 - Removal of nutrients
 - Processing is a challenge for now



Microalgae

- Very high potential growth rate
- High protein content, 50-60%
 - High content of oils – omega-3
- Can be used for bioremediation of nutrients and CO₂
 - Residual and waste streams in industry and agriculture
- Potential production 5-10 times higher than soy beans per hectare – under Nordic conditions
- No need for arable land



DANISH
TECHNOLOGICAL
INSTITUTE



Microalgae - challenges



DANISH
TECHNOLOGICAL
INSTITUTE

- New technology – and not yet for feed
- 5000 tons per year globally
 - – mainly dietary supplements and other high-value compounds
- Production systems are costly
 - - target price for feed is low
- Harvesting is expensive
 - – very small organisms..
- Risk of contamination if produced on waste





- There are big potentials in blue biomasses
- Some are more developed than other
- Need for technological development in production systems
- Questions?

Thank you!

Contact: lrj@teknologisk.dk