Aquaculture2030?

Copernicus Workshop for Fisheries and Aquaculture

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Aquaculture: What do we farm?

Fish 54 mT (61% in value)

Shellfish 17 mT (12 % in value)

FEED

NO FEED

580 species

Incl. plants: half production = non-fed
Excl. plants: 70% based on feed

Crustacea 8 mT (22% in value)

Seaweed **30** mT (5% in value)

Europe (EU28)

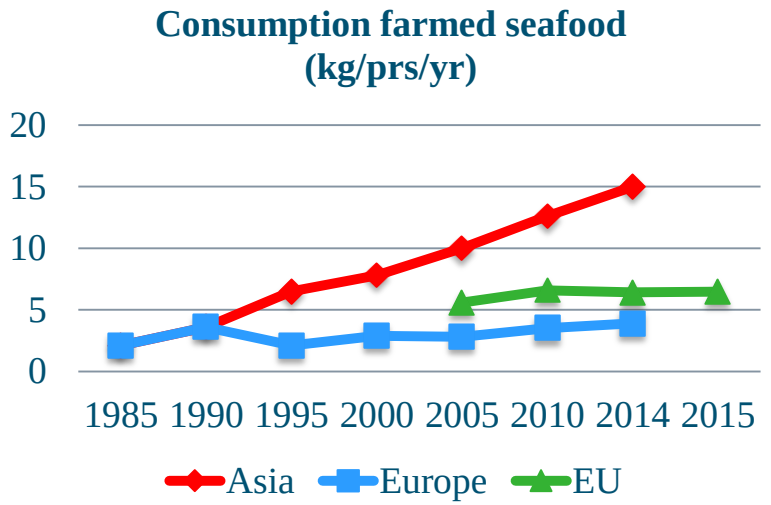
Source: EUMOFA 2017; FAO 2016

Production

- Fisheries: 5.1 Million MT;
- Aquaculture: stable around 1.3 Million MT (~ 4 billion €)

Consumption

- 25,1 kg/capita/yr; (Aquaculture: 6.5kg)
- growth: 8% in 10yr; *25% farming*



Economics

Total trade value: ~30 billion €

Average household expenditure: 107 €/person/yr

The challenge

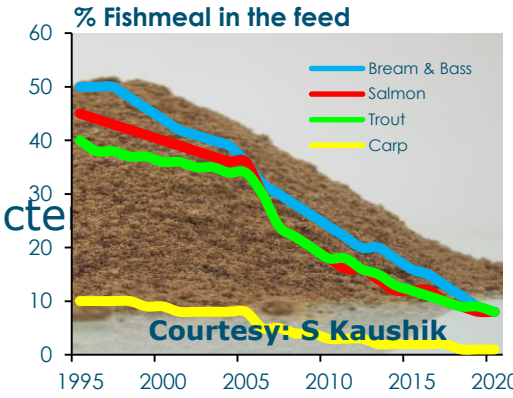
In the next 15-20yrs, ±100 million MT extra seafood needed (*Subasinghe 2014)*

YES, WE CAN:

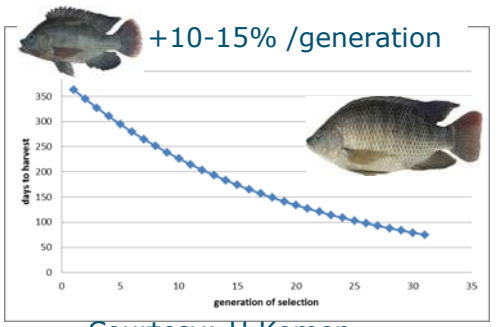
- → **Intensification; industrialization**
- → **Responsible farming**
  - **Improve Health, Welfare, Productivity**
  - **Reduce Environmental Impact**
- → ***Tool: Precision Farming***

The solutions

- **Novel feeds**
  - No Feed-Food claims (insects, algae, **seaweed**, bacte
  - Left-over streams Agro-Food industry



- **Novel breeds**
  - 10%-15% genetic improvement per generation
  - Based on genomics and precision phenotyping



Courtesy: H.Komen

- **Recycling nutrients**
  - RAS
  - Re-use of nutrients by other commodities

    (Building with Nature; IMTA; AquaPonics)

- ***Disruptive technologies (precision farming?)***
  - Novel production systems; sensorica and robotica
  - Genomics, Diseases and Farming = Big Data!
  - Internet of things, artificial intellingence

Future Land-based Farming: RAS

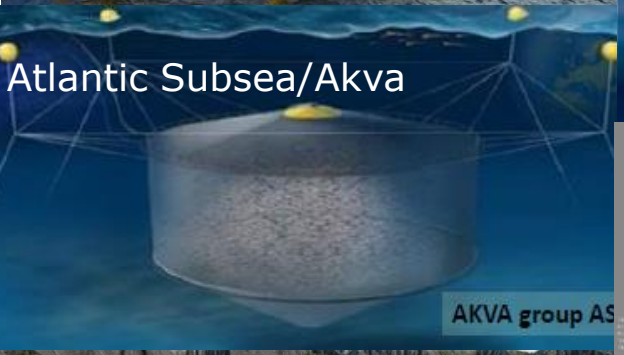
integration of water purification and aquaculture

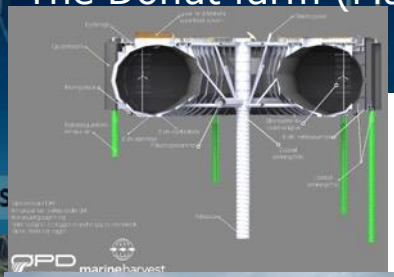
- Quite closed, very automated, nearly fully controlled
- Water use varies from 1500~40Liter per kg of fish produced
- High Biosecurity (disease control; escapes)
- Highly reduced environmental impact

Future sea-based farming: go off-shore!

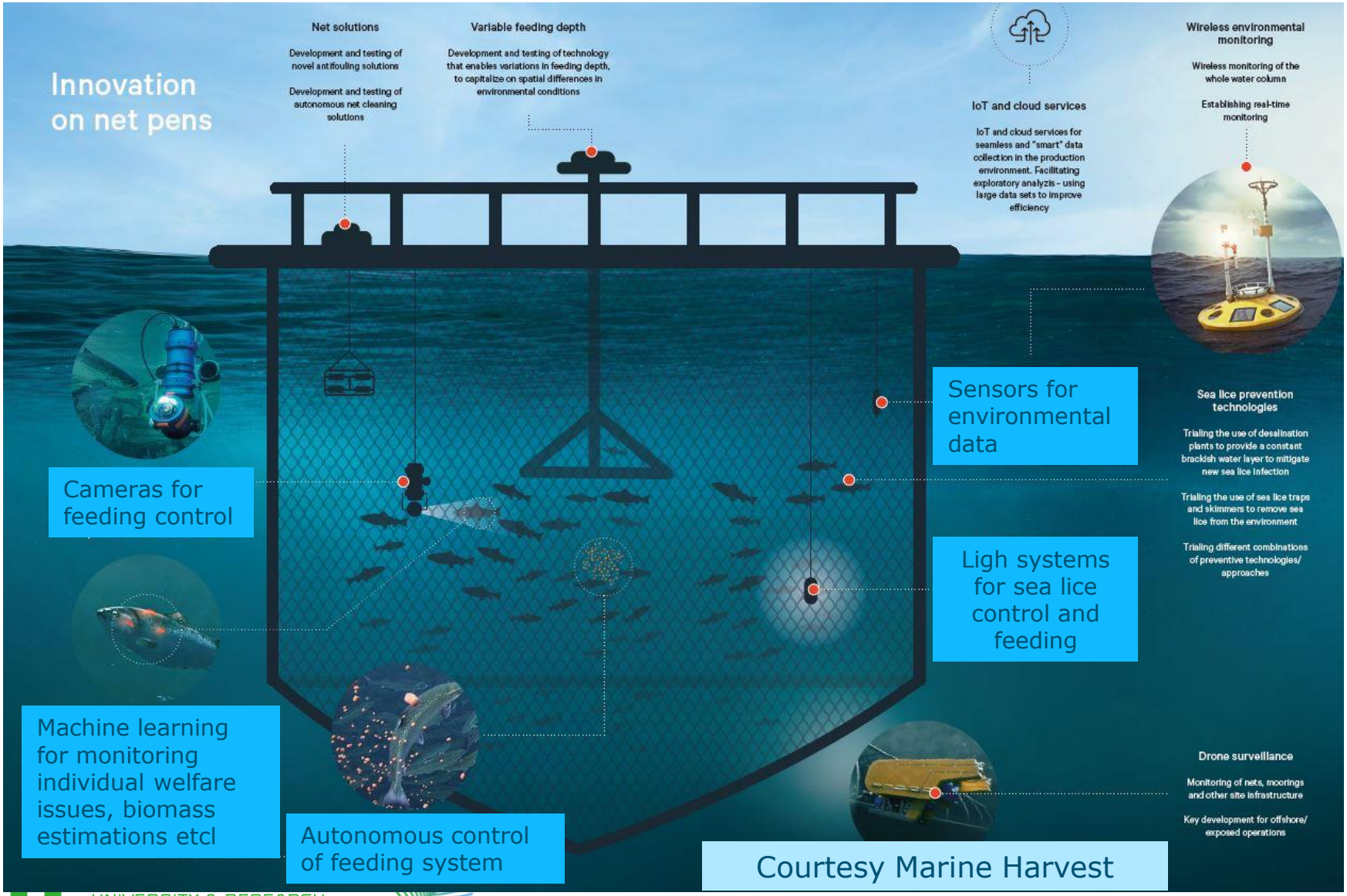
Salmon

Tropical marine fish





Current technologies in net pens



Elements in a PFF system

Based on Berckmans 2004; Føre et al, 2018

- Monitoring → sensor technology
  - Animal (Behaviour; physiology; genomics; zootechnics)
  - Enviromental (Waterquality, pathogens, pollutants, etc)

- Interpretation & Predicting how animal responses change

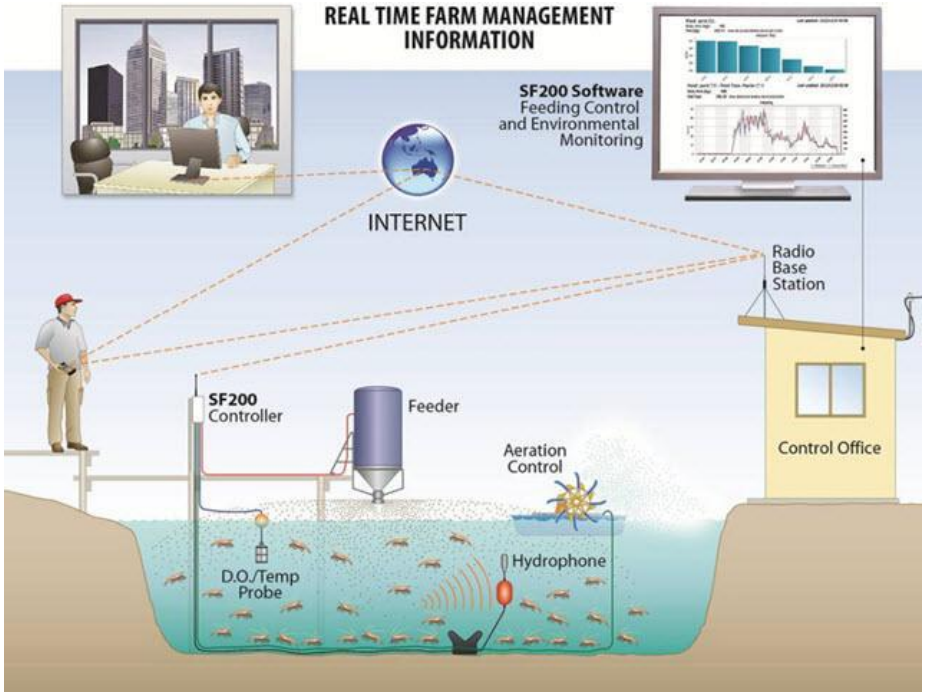
  → Modeling, Artificial intelligence

- Decisions and automatisation

  → Artificial intelligence; Internet of Things; Robots

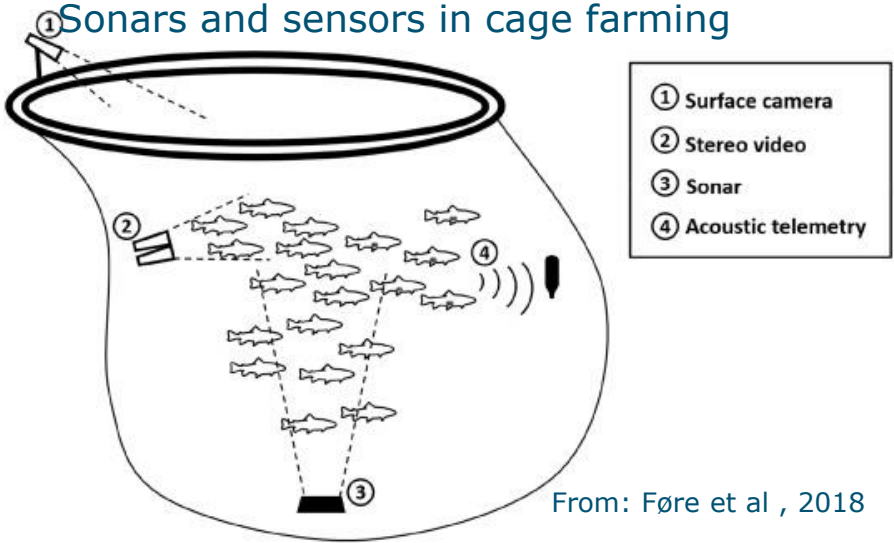
Sensor technology being used

AQ1 hydro accoustic feeding system for shrimp



Pentair VAKI system for continuous biomass measurement

Sonars and sensors in cage farming



From: Føre et al , 2018

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Need for improved risk management

- Daily routine work and periodical operations must become less dependent on close human intervention
- **ROVs, AUVs** and other remote controlled or autonomous systems are increasingly used

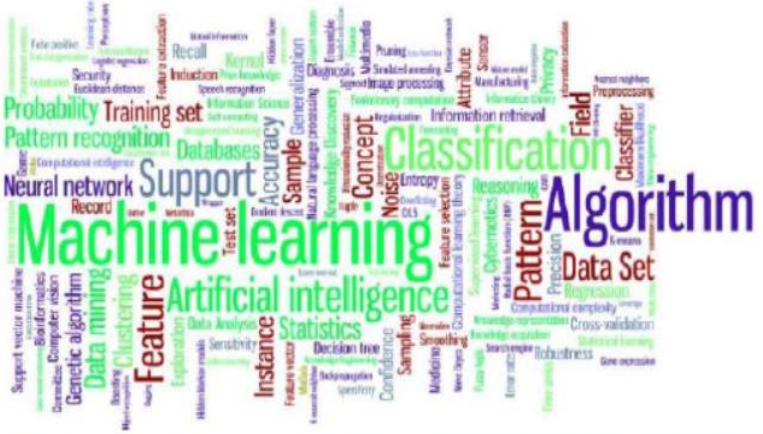
Photo: Marine Research Institute

Courtesy: P.Sorgeloos

Artificial Intelligence applications

Developments in artificial intelligence and automation – huge potential for the salmon industry

- *Sensoring*
- *Imaging*
- *Big data*
- *Machine learning*



- *Understanding behavioral changes…responses to what, impacts*
- *Identifying situations with good growth potentials..*
- *Identifying risk periods…reduced apetite, poor growth, feed waste, susceptibility for diseases*
- *Risks for stress on the population, how to avoid it..*
- *Monitoring the stock- Taking out runts- Treating for lice- Further improved feeding control*

Question marks

- Developments in salmon farming,

What about family farms?

- Developments in #sensor technology;

  need for more AI approaches, combining genomics, disease incidences, behaviour, drug use

- IP and privacy regulations needed

Thanks !

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