EUMOFA TALK

Recirculating Aquaculture Systems (RAS)

Reality on the ground...

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December 7th 2021

Agenda

- RAS key points
- What´s up and down
- Potential and risks
- How to make a success story

Flow-through fish farming

1962

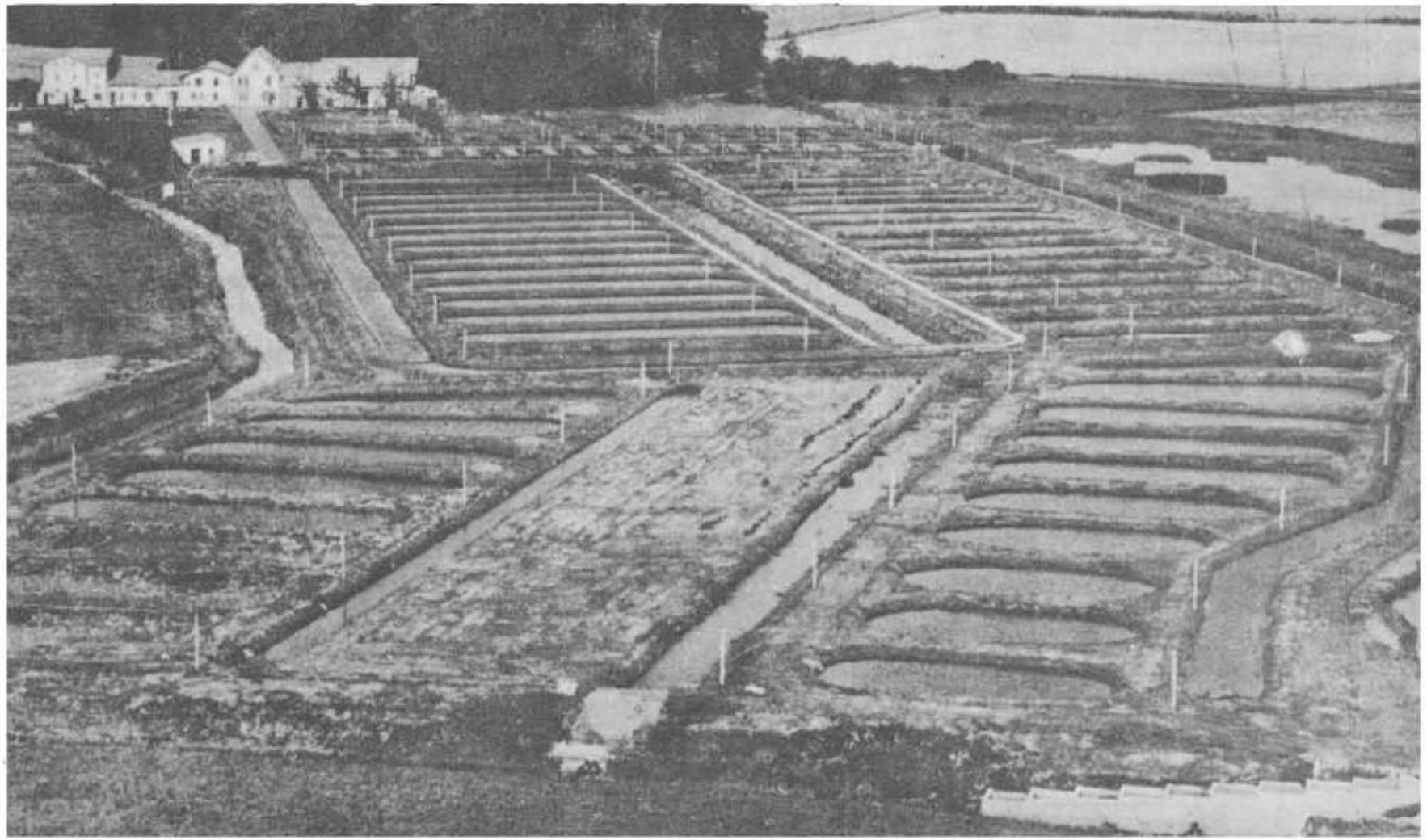


FIGURE 2.--Aerial view of the Danish Trout Research Station in Brøns.

Running a fish farming business

1992

Executing large RAS projects

2022

RAS key points

The benefits of RAS

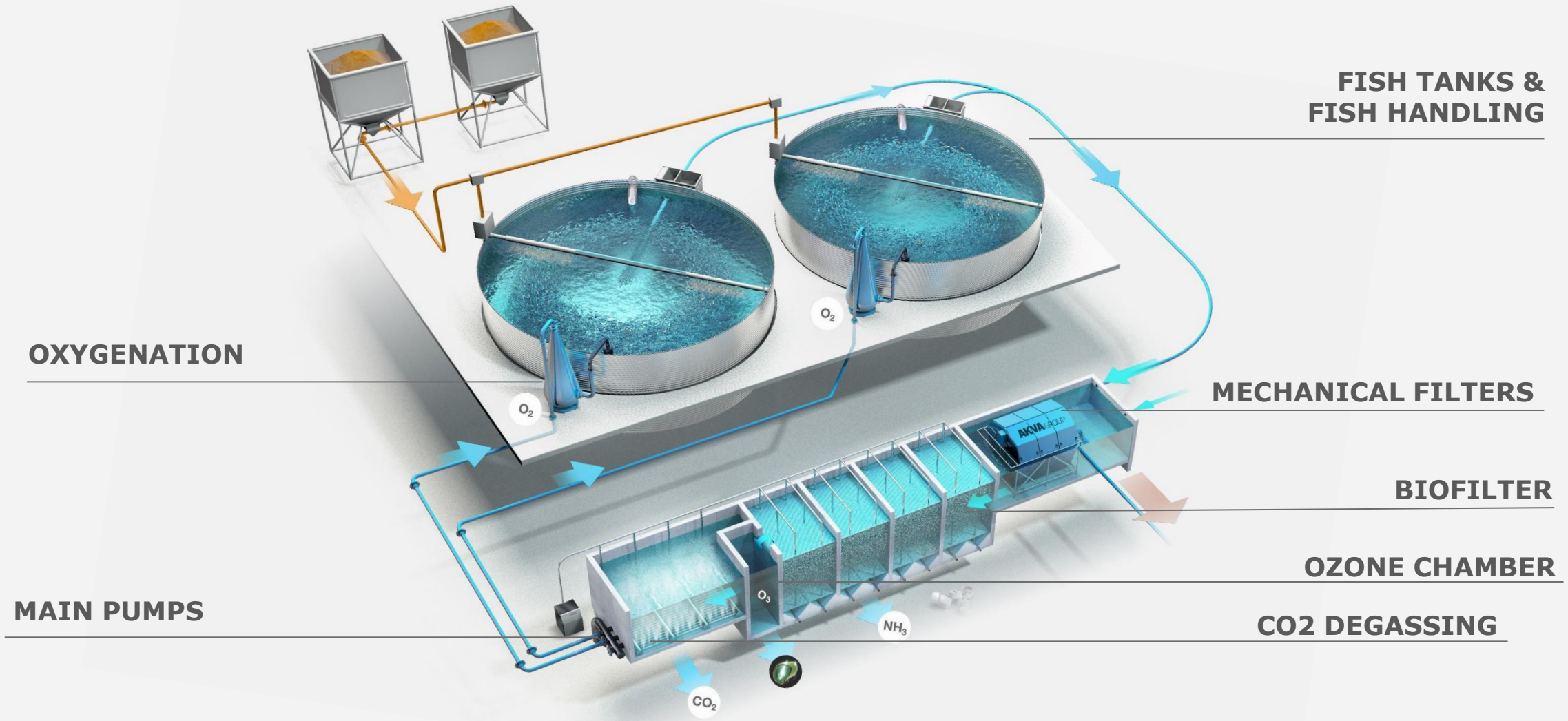
- Fully controlled conditions
- Exact production planning
- High bio-security
- Saving water
- Control of discharge

The challenge

- High CAPEX
- High OPEX
- Requires high farming skills
- Can be hard to make profitable

Arctic Char cross breed

RAS technology (10% new water/day in system)



RAS with Zero Water Concept (1% new water/day in system)

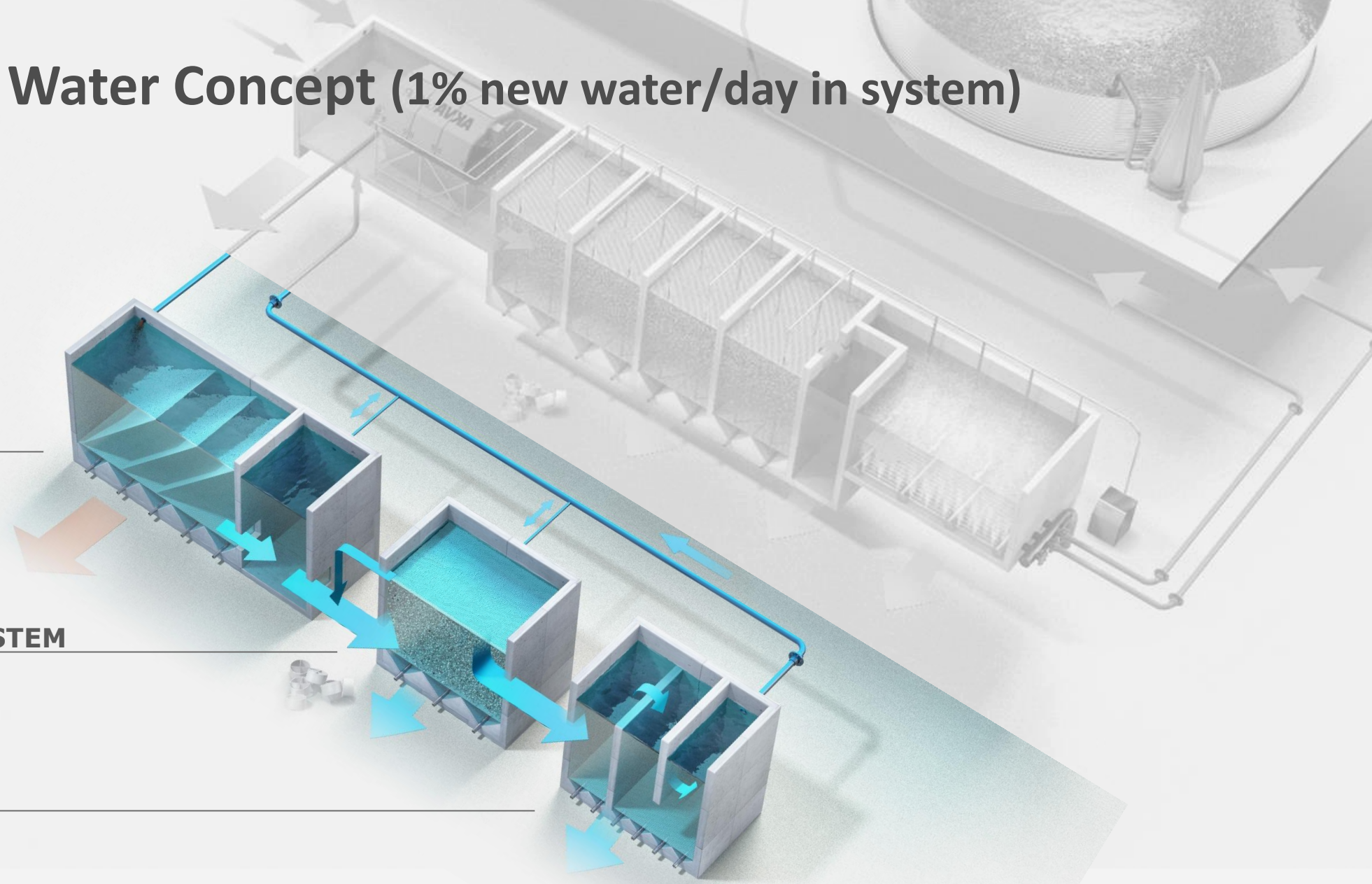
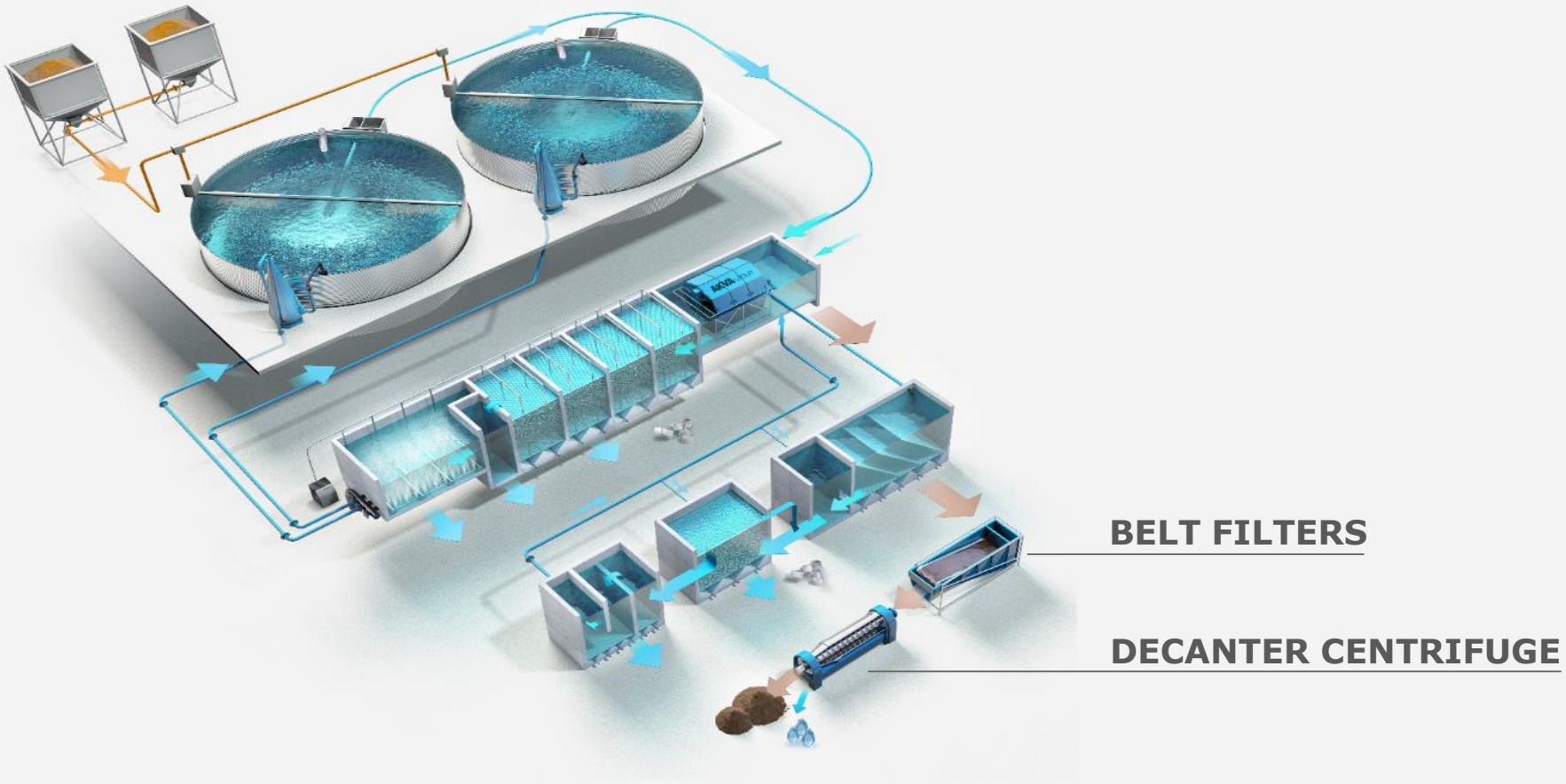


PLATE SEPARATOR

DE-NITRIFICATION SYSTEM

PHOSPHORUS SYSTEM

RAS with Zero Water Concept including sludge handling



Utilizing the fish sludge

Fish sludge for Biogas & Agriculture fertilizer

What´s up and down?

The real strength and the real challenge in RAS

Strength: “Grow big fish when they are small”:

- *Small fish have high growth rates compared to large fish (e.g. 2,5% of bodyweight/day)*
- *Small fish supply is vital for production of the larger fish that makes the profit*

...a good start is halfway to success

Challenge: Growing fish to <u>market size</u>

- *The slower growth in larger fish will cost you (e.g. Only 0,5% of bodyweight/day)*
- *A higher standing stock (the fish biomass) is also costly to keep swimming around..*

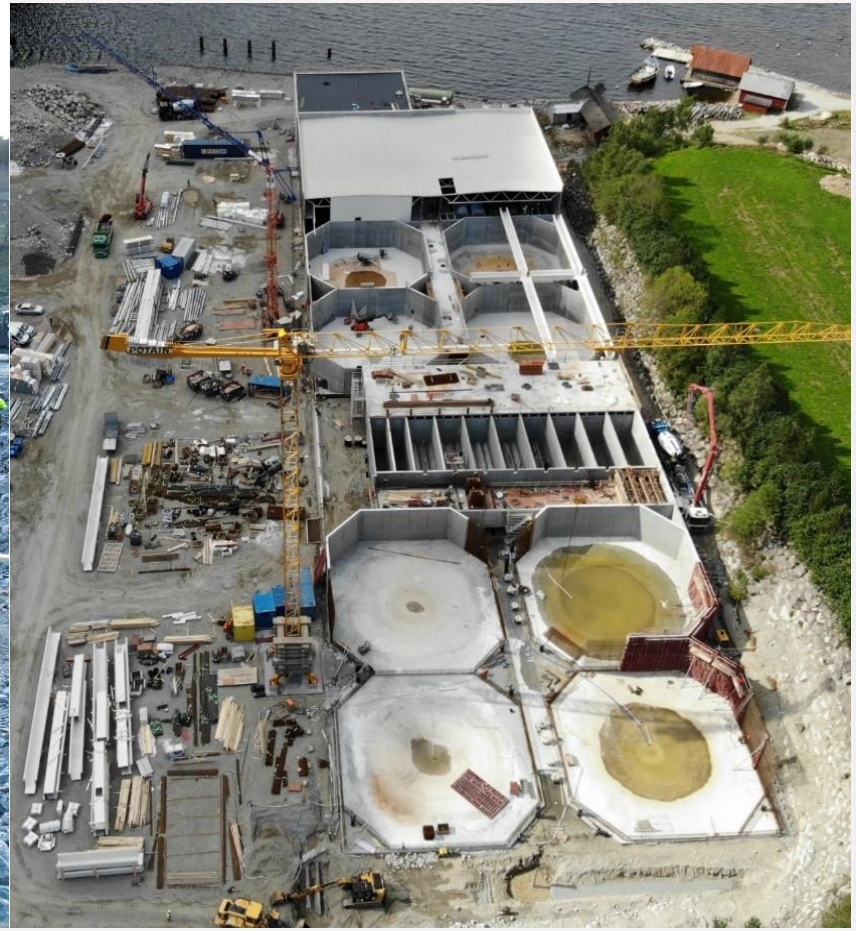
The reality on the ground is:

- Production of ”small fish” for further on-growing is a success
  - *E.g. smolt for salmon farming in cages or bass/bream juveniles in cages at sea*

- Production of market size fish in RAS is hard work to make profitable:
  - The smaller the selling size the better (e.g. portion sized trout)
  - The higher the market price the better (e.g. yellow tail king fish or large salmon)

Potential and risks

Potential: Production of large smolt for cage farming improves production efficiency and reduces time at sea (Norway, Scotland, Faroe Islands..)




AC 850

Potential: The Danish trout RAS model story?
EU farmers: Why should we be going for modern technology?

Copy within the EU? The Danish trout RAS model farms

Risk example: Large salmon in RAS struggles with profitability

- High CAPEX
- High OPEX
- Slow growth rate
- Large salmon 4-5 kg

Other options? Other species?

Special productions close to larger cities

- *Shrimp*
- *Sunshine bass*
- *Yellow tail kingfish (and/or mass production)*
- *Pike perch*
- *other?*

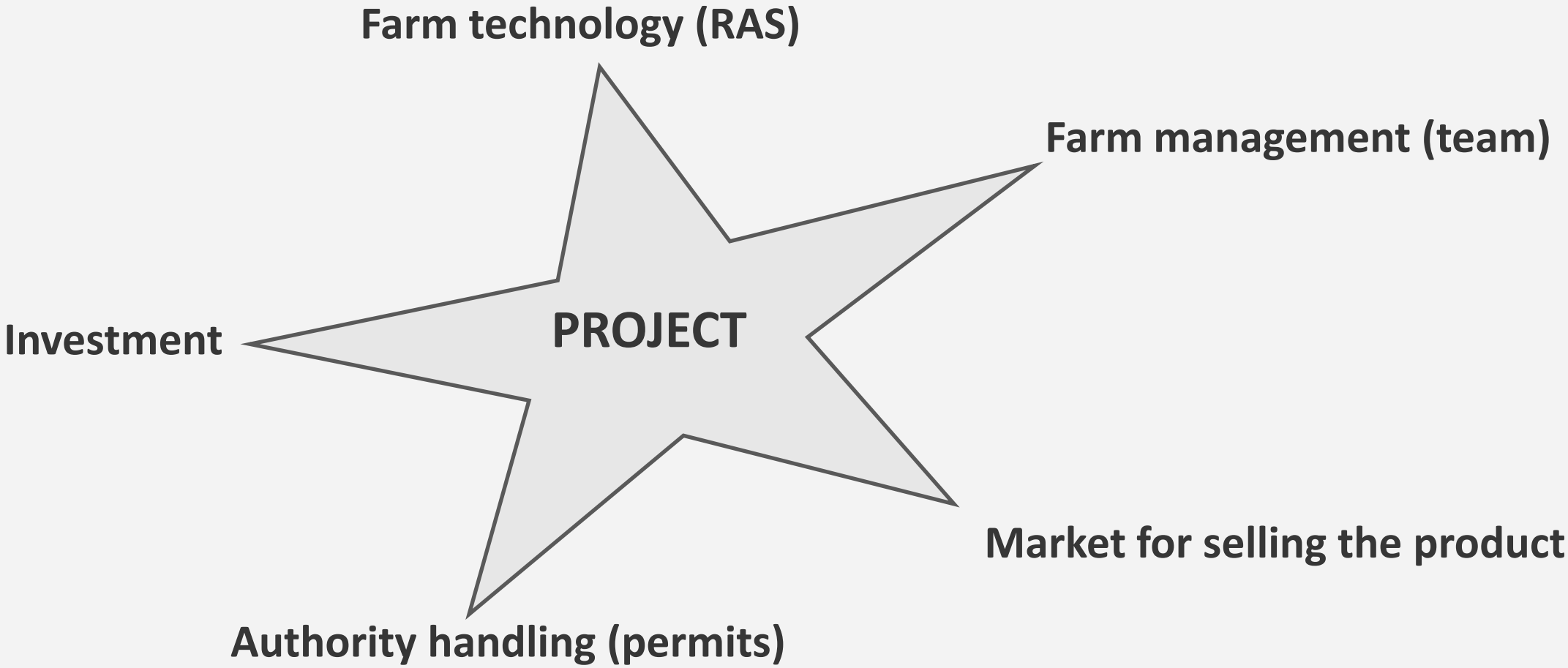
Mass production for hypermarkets

- Rainbow trout
- Arctic charr
- Bass or bream
- Yellow tail
- other?

...subject for discussion

How to make a success story

Assessing the project:

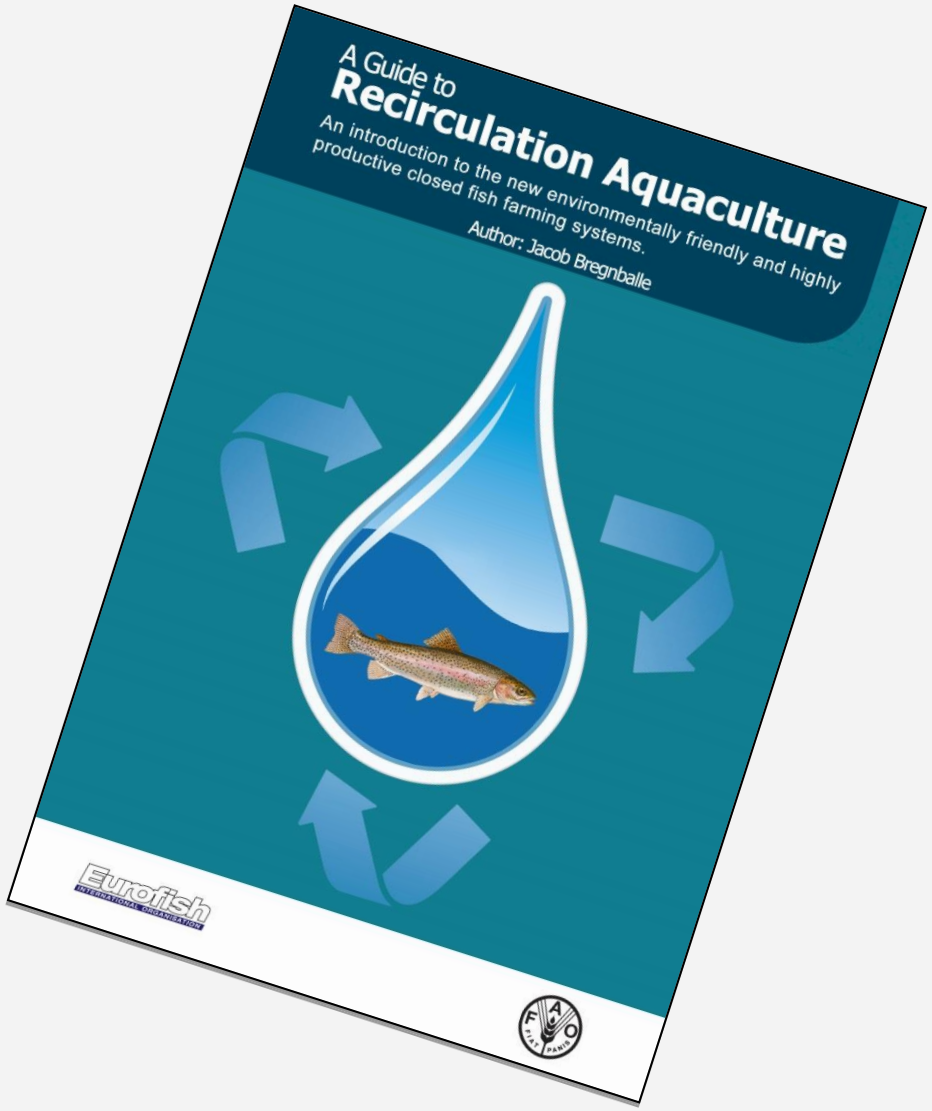


Both sides must be considered

- Small scale farmers (re-using the water)
  - Local supply, organic farming, farm gate sales, recreational..

- Larger industrial productions (using advanced RAS)
  - Large scale at >2.000 tons per year
  - Strong financial backing
  - Marketing of the product is key!

Thank you for your attention!



....working on a 2022 version