Interreg Baltic Sea Region

Co-funded by the European Union

BLUE ECONOMY

TETRAS

TETRAS Technology Transfer in RAS for Business

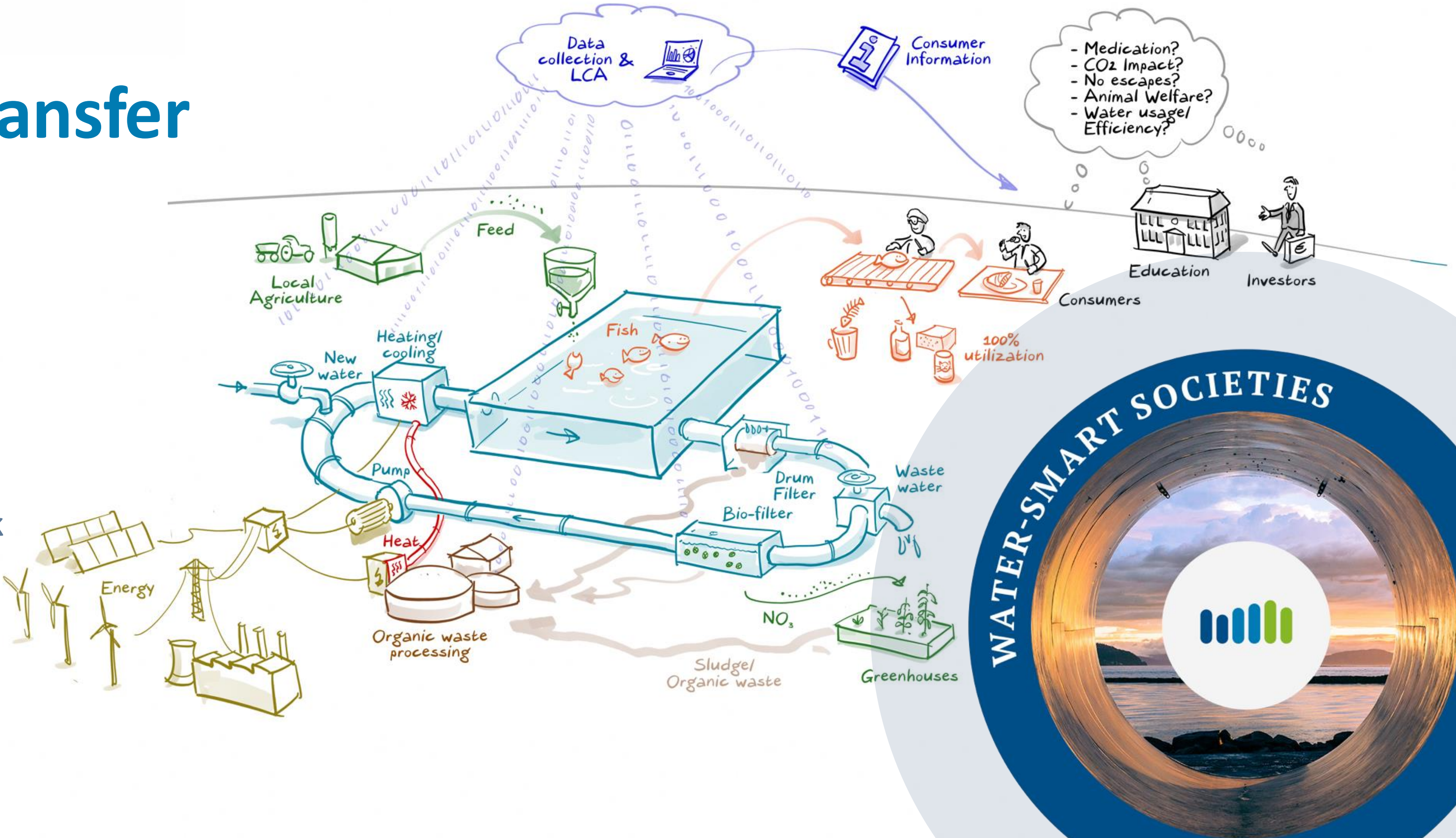
Danish Bioeconomy Conference |

6 November 2025

Freya Robinson – SUBMARINER Network

Per Dolmer – Blue Research

interreg-baltic.eu/project/tetras



Budget
3 Million EUR
(80% Financing)

Duration
36 months
01.2023 – 12.2025

Consortium
10 partners
LT • DE • DK • EE • PL

Solutions
4 pilots
LT • DK • EE

Coordinated by

KLAIPĖDA SCIENCE AND TECHNOLOGY PARK

Project Partners

SUBMARINER NETWORK

Klaipeda University

Blue research

GULDBORGSUND

University of Gdańsk

IVIA EXPAND YOUR BUSINESS

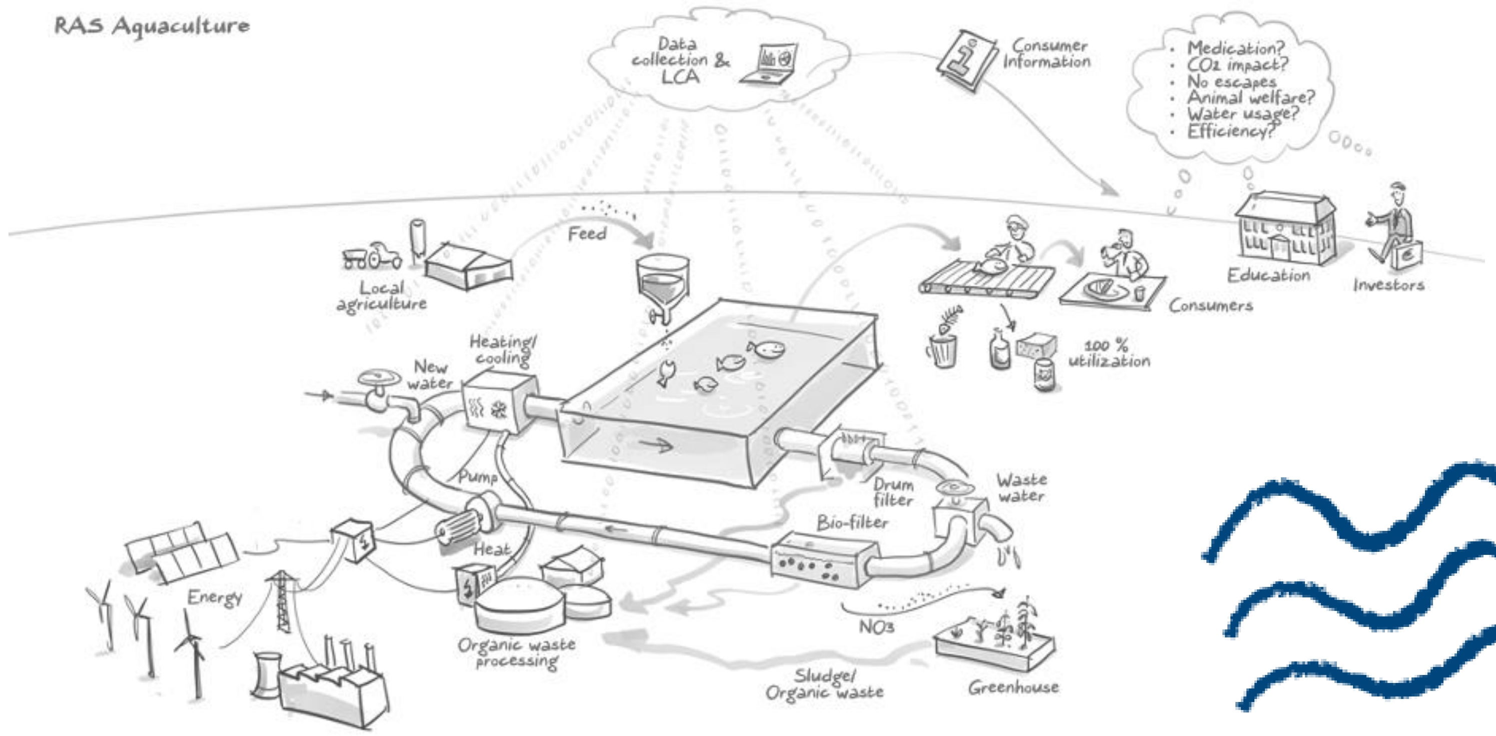
/Business Lolland-Falster

akola GROUP

HOCHSCHULE WISMAR UNIVERSITY OF APPLIED SCIENCES TECHNOLOGY, BUSINESS AND DESIGN

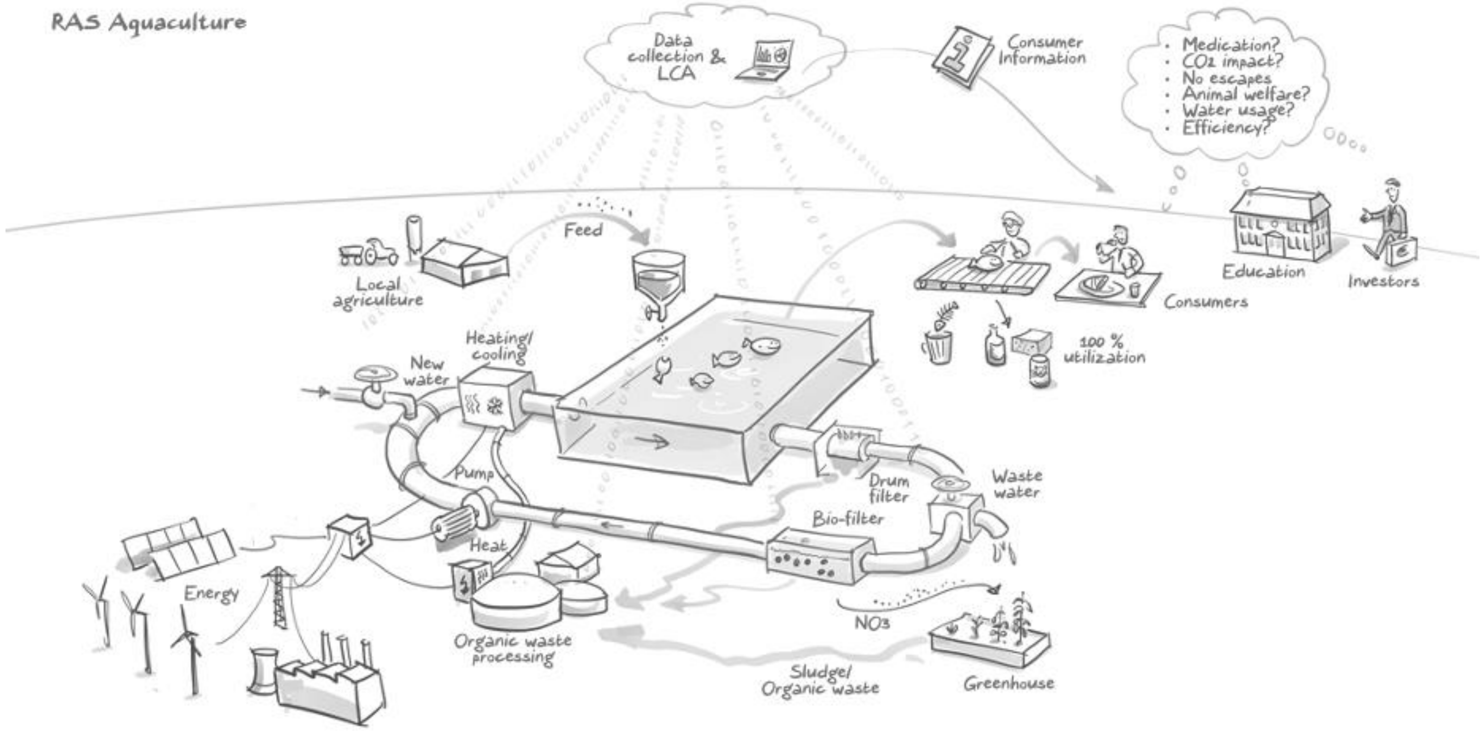
Overall Challenge

- RAS are a **costly technology**, with **high investments for installation and operation**. Setting new investments needs careful planning and good conditions to ensure their sustainability.
- **Location, access and discharge of water, energy security, labor access, and consumer acceptance** are key factors that determine the success criteria of a RAS farm.



Overall Challenge

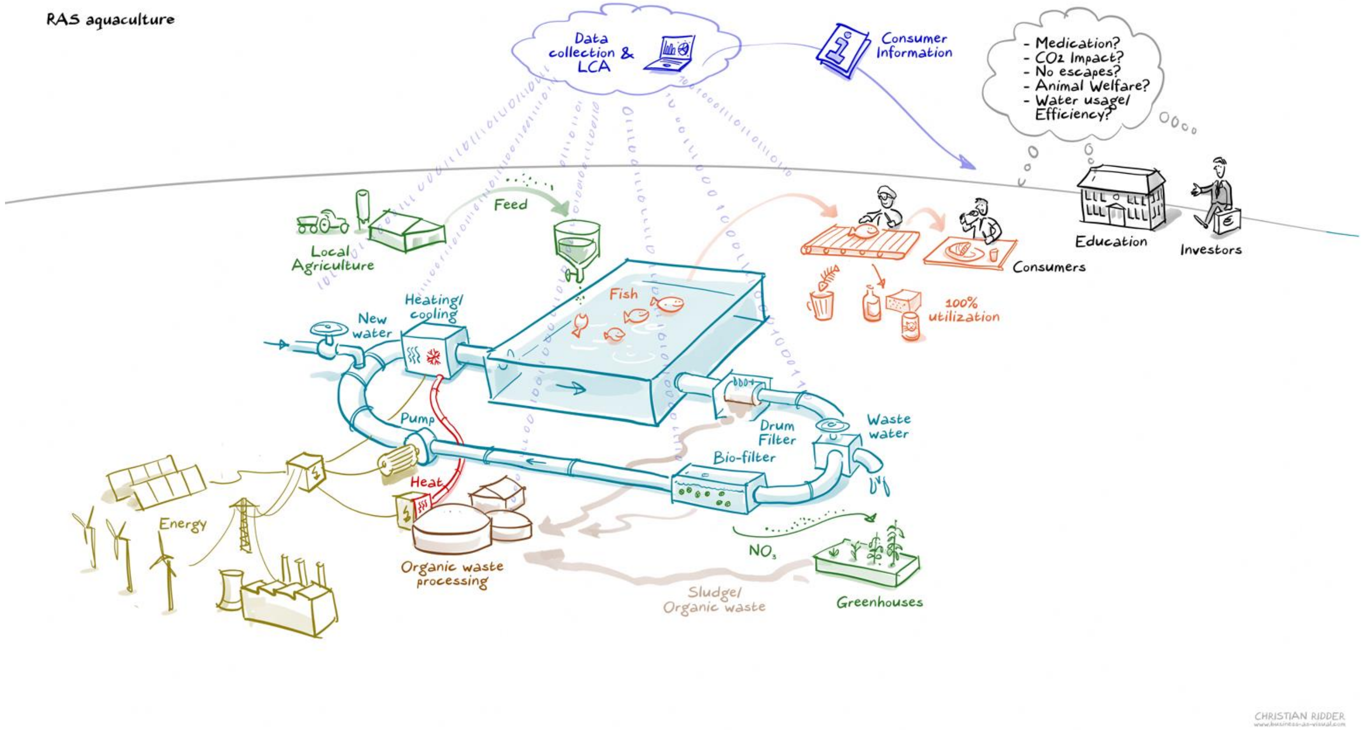
To support RAS, as a promising scalable sustainable food-producing sector, **we need to understand how various settings and factors impact a RAS business model and its environmental footprint**, and then **showcase tools that can best be used to improve the sustainability of RAS industry** in practice, also transfer knowledge to other regions/countries to promote new investments.



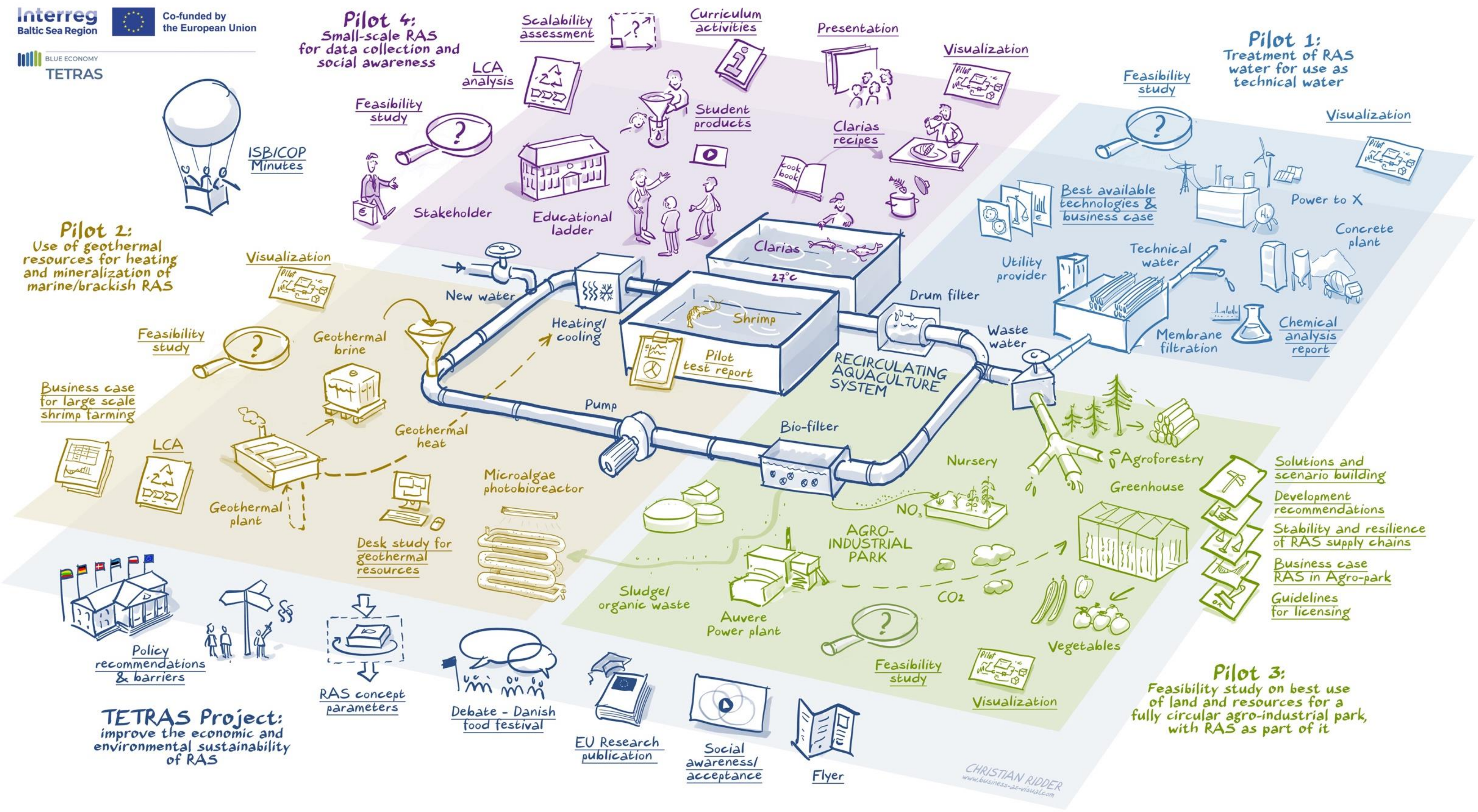
TETRAS aims to **improve the economic and environmental sustainability of recirculating aquaculture systems (RAS)** by demonstrating new concepts of **industrial symbiosis** where RAS systems are placed strategically or combined with industrial processes to increase resource efficiency (i.e. water, energy) while producing affordable and healthy food.

One process's waste or residual is another process's resource.

Additionally, TETRAS will develop tools and standards to assess and monitor RAS and promote investment, implementation, and expansion of these food production systems.

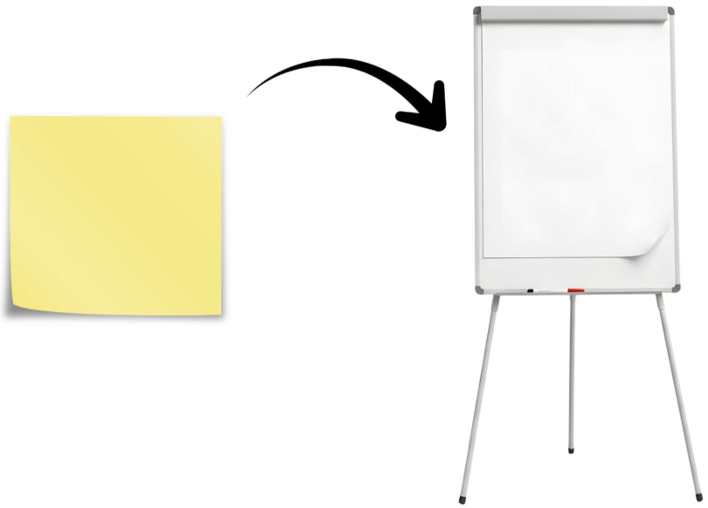


Portfolio of solutions



Discussion Facilitation

- Collect questions, thoughts, input on sticky notes
- Place on A3 paper



- Think about what is needed going forward to support the RAS sector…

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Contacts

www.interreg-baltic.eu/project/tetras/

fr@submariner-network.eu

TETRAS BSR

TETRAS – PILOT 1

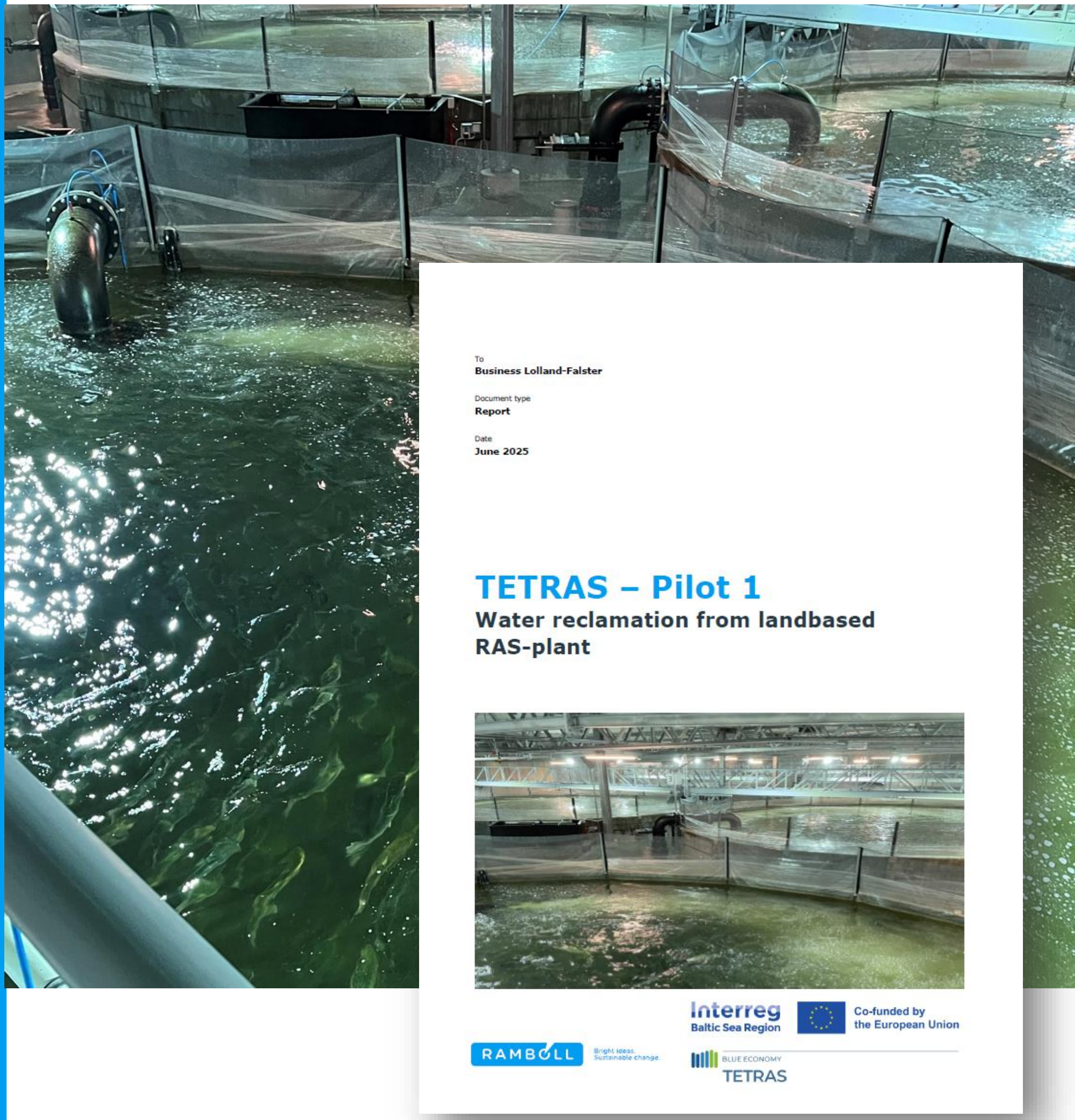
Water reclamation from landbased RAS-plant

06.11.2025
Final TETRAS Event
Danish Bio-Economy Conference

Sylvie Braekevelt

Mie Højborg Thomsen

Caroline Elisabeth Flyger



RAMBOLL

Introduction to Tetras Pilot 1

Pilot 1 Objectives

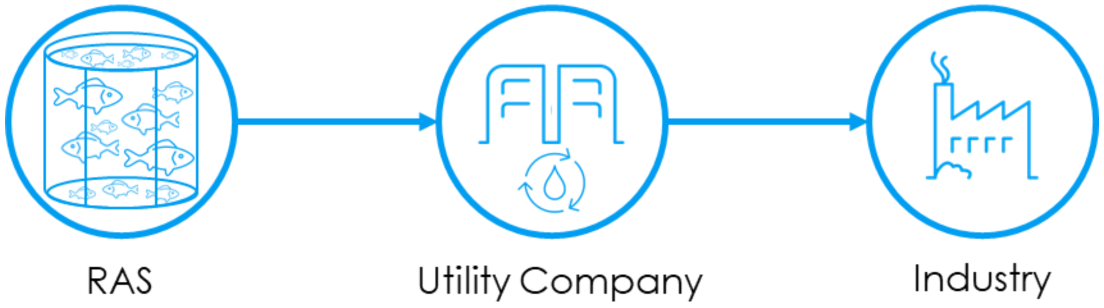
- Demonstrate water reclamation from RAS (Recirculating Aquaculture Systems)
- Use membrane technology for purification
- Evaluate the reuse of RAS wastewater as technical water for other industries
- Examine economic feasibility of a full-scale RAS plant

Key Technologies Tested

- Ceramic Ultrafiltration (CUF)
- Reverse Osmosis (RO)
- Membrane Distillation (MD)

Why This Matters (Business Drivers)

- Stricter discharge regulations and water scarcity increase operational risk.
- Circular water solutions reduce freshwater intake, improve compliance, and strengthen ESG.
- RAS growth demands reliable non-potable technical water for industrial uses.



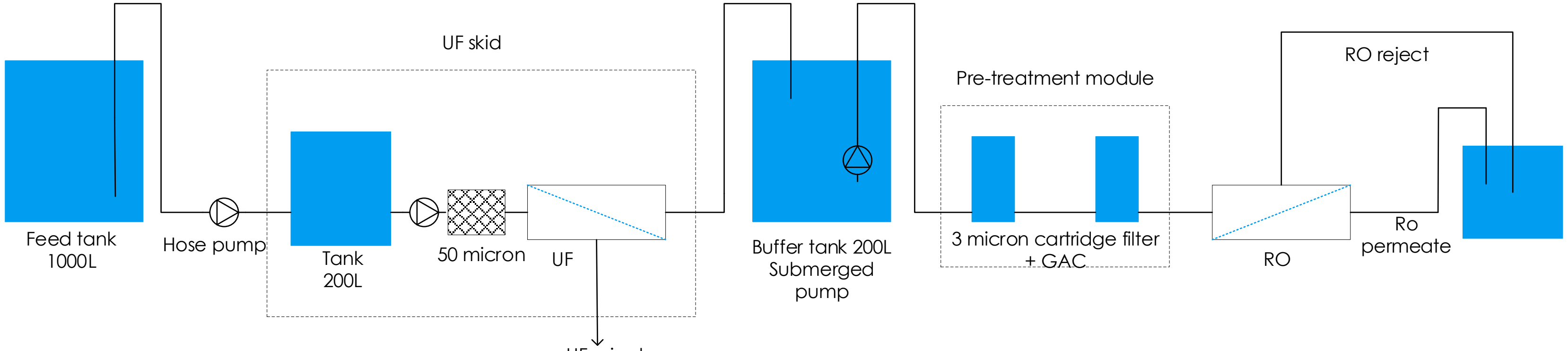
The test set-up

Objective & Scope

Produce technical water of near-drinking quality from RAS wastewater using membranes (CUF, RO, MD)

Pilot Test Setup

- **Step 1: Pretreatment –** Mechanical filtration & activated carbon
- **Step 2: Ultrafiltration (UF)** – Ceramic membranes for suspended solids removal
- **Step 3: Reverse Osmosis (RO)** – High-recovery desalination process
- **Step 4: Membrane Distillation (MD) [Additional Test]** – Evaluating alternative desalination



RAMBOLL

Test location: Skagen Salmon – RAS Facility

Overview of Skagen Salmon:

- Established in **2020**, **state of the art saltwater-based RAS facility**
- Produces **3,800 tons of salmon per year** (~1 million fish)

Water Management & Treatment:

- Multi-step treatment process:
  - **Mechanical filtration (drum filter, 50 µm)**
  - **Biological filtration (MBBR) & fine polishing**
  - **Deoxygenation & ozonation** for disinfection

External wastewater treatment before discharge to Skagerrak

- Discharges **150 m³ wastewater per hour**
- **90% reduction** in nitrogen & phosphorus discharge through treatment

RAMBOLL

Results showing satisfying permeate water qualities

Permeate Water Composition & Quality

•RO Permeate (65% Recovery):

- Conductivity reduced from **1700 mS/m to 25 mS/m**
- Chloride reduced from **14,000 mg/l to 55 mg/l** (below drinking water limit)
- Ammonia **< 1 mg/l**, requiring further validation

•Membrane Distillation (MD) Permeate:

- **High purity water**, low conductivity (**0.26 mS/m**)
- Chloride **<1 mg/l**, well within safe limits
- **Ammonia (2.1 mg/l) exceeds drinking water standards**

RAMBØLL

High quality water offers plenty of opportunities for reuse

Application Potential for Permeate Waters in Lolland-Falster

1.Industrial Use:

1. **Cooling Systems:** Prevents scaling & corrosion
2. **Cleaning & High-Pressure Cleaning:** Leaves no residues
3. **Concrete Production:** Ensures durability & strength

2.Energy & PtX Technologies:

Hydrogen Production: Need further purification to meet ultra-pure water (UPW) requirements

The reuse water does not fully meet Danish drinking water standards

- Minor adjustments necessary to comply: ammonia stripping and pH adjustment

RAMBOLL

Reject Water: Risks and Reuse Pathways

Limitations

- **Not suitable for agriculture:** can be used as fertilizer, rich in nutrients (nitrogen), but high salinity and chloride could harm soil health.
- **Not suitable for biogas production**: High salt levels and low biodegradable organic matter hinder anaerobic digestion.
- **Cannot be discharge to sea:** High chloride, nitrogen, and metals require additional treatment for compliance with environmental regulations
- **Require treatment before discharge to local:** High salinity, ammonia, and heavy metals disrupt treatment processes and require advanced technologies for regulatory compliance

Potential Solutions:

- Dilution with fresh water to reduce salinity.
- Use of salt-tolerant crops (halophytes) for specific regions.
- Treatment technologies to remove heavy metals (e.g., filtration, adsorption).
- Ammonia management strategies (e.g., volatilization).

Perspectives to turn the pilot into commercial projects

- Conduct comprehensive technical and economic assessments for full-scale installation.
  Include sensitivity to energy price, recovery rate,
  and membrane life.

- Determine reject water strategy and manage risk
  - Map regulatory landscape for treatment & discharge in the Baltic Region
  - Finalize realistic pathways for the reject water
  - Quantify reject water treatment costs

- Water quality: validate ammonia removal to meet Danish drinking water limits

What it takes to move on

- Continued coastal RAS **site access** for assessments and test validations.

- **Vendor engagement** for water treatment technology incl. ammonia stripping: partner with several to build integrated offers. Offer turnkey and quick-turn pilots to accelerate adoption.

- **Joint workshops with regulators/utilities about reject water management**: regulatory drivers to go hand in hand with engagements to improve regional water resilience in vulnerable regions with high potential (e.g. Lolland-Falster)

- Detailed design and **local business cases** including reject water

Thank You!

📅 06.11.2025
Final TETRAS Event
Danish Bio-Economy Conference

Sylvie Braekevelt - sybt@ramboll.dk
Mie Højborg Thomsen
Caroline Elisabeth Flyger

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Geothermal Water in RAS: Business Plan Perspectives (Shrimp)

Danish Bioeconomy Conference |

6 November 2025

Matas Zubas – Akola Group

Nerijus Nika – Marine Research Institute of Klaipeda

akola GROUP

Klaipeda University
Marine Research Institute

WATER-SMART SOCIETIES

interreg-baltic.eu/project/tetras

Synopsis

Completed actions

Analyzed geothermal heat & mineralization impacts; validated in Pilot-2; modeled 100/300/1000mt facilities.

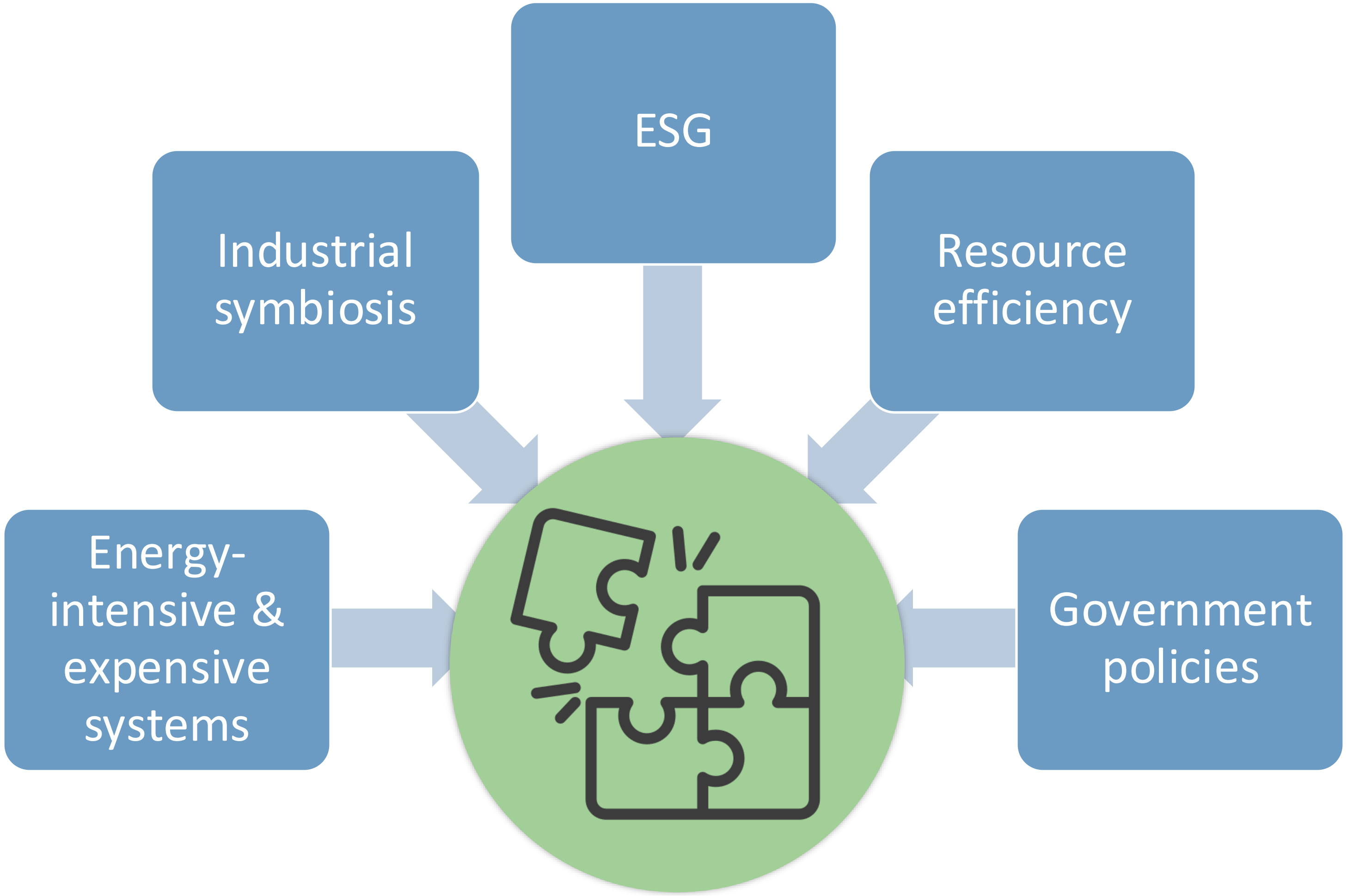
Results

Potential economic impact; system stability maintained; ambiguities

Future prospects

Geothermal availability; Integration potential; Estimates for go/ no-go gates.

Context: Why This Matters



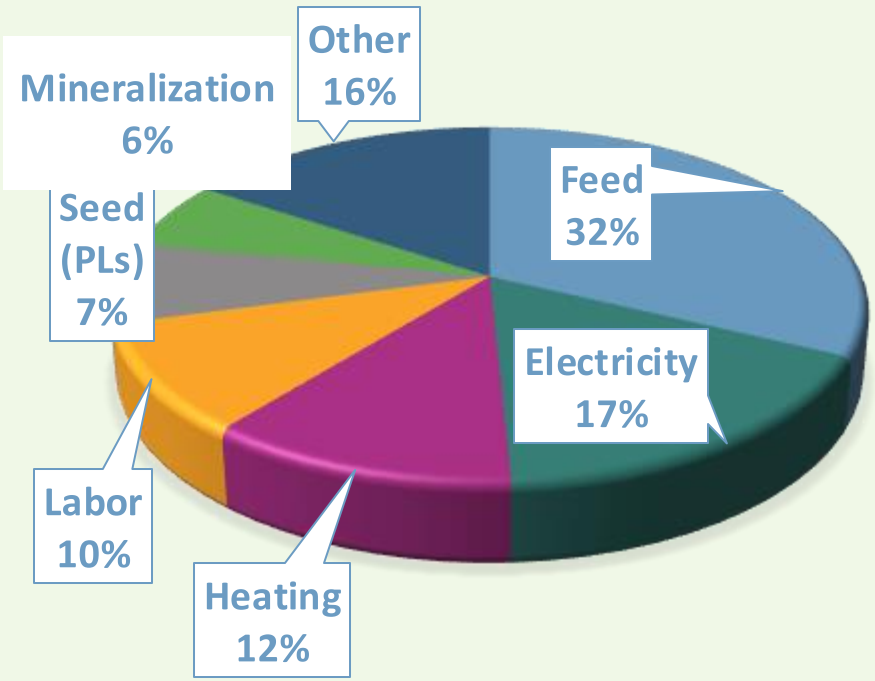
Shrimp RAS Basics - What Matters to Shrimp

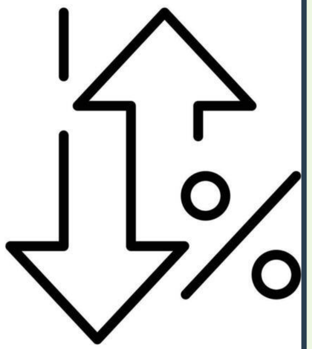
Stable physics = stable biology = stable economics.

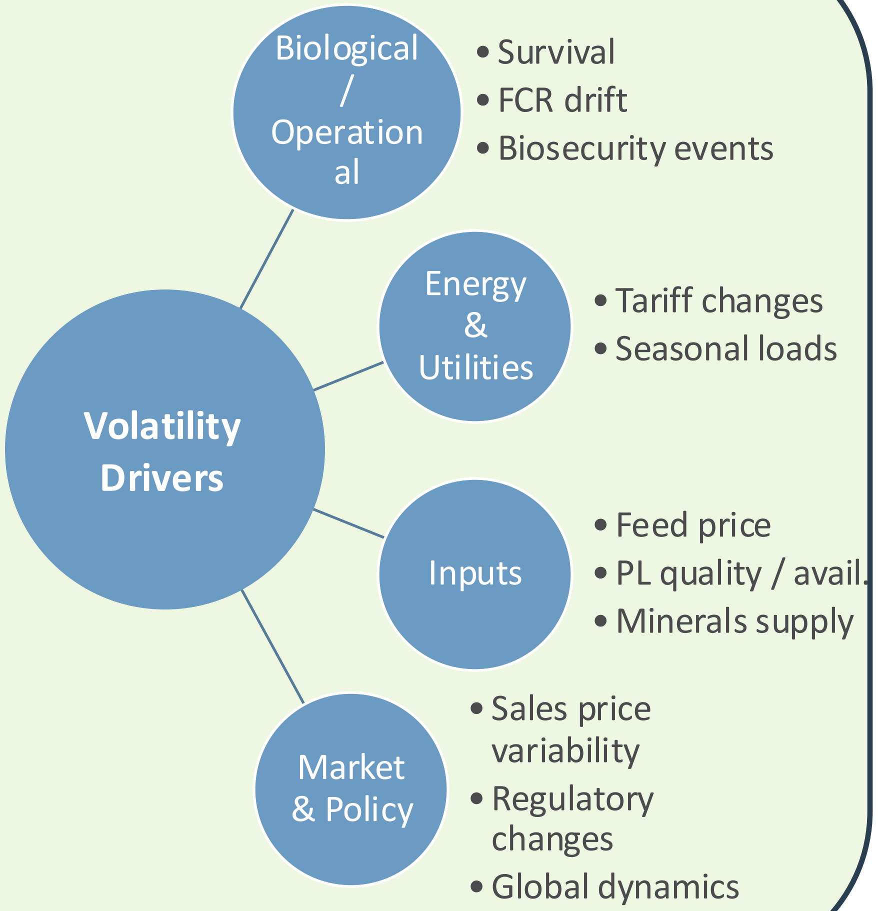
Water Temperature (°C)	27-29
Salinity (ppt)	15-20
Dissolved O2 (mg/L)	5-7
pH	7.5 – 8.5
Alkalinity (mg/L)	120-180
Ammonia (mg/L)	<5
CO2 levels (mg/L)	50-100

Growth Rate (g/week)	1.5 - 2.5
FCR	1.5 – 1.7
Survival Rate (%)	65 - 75

Shrimp RAS - Costs and Volatility Drivers

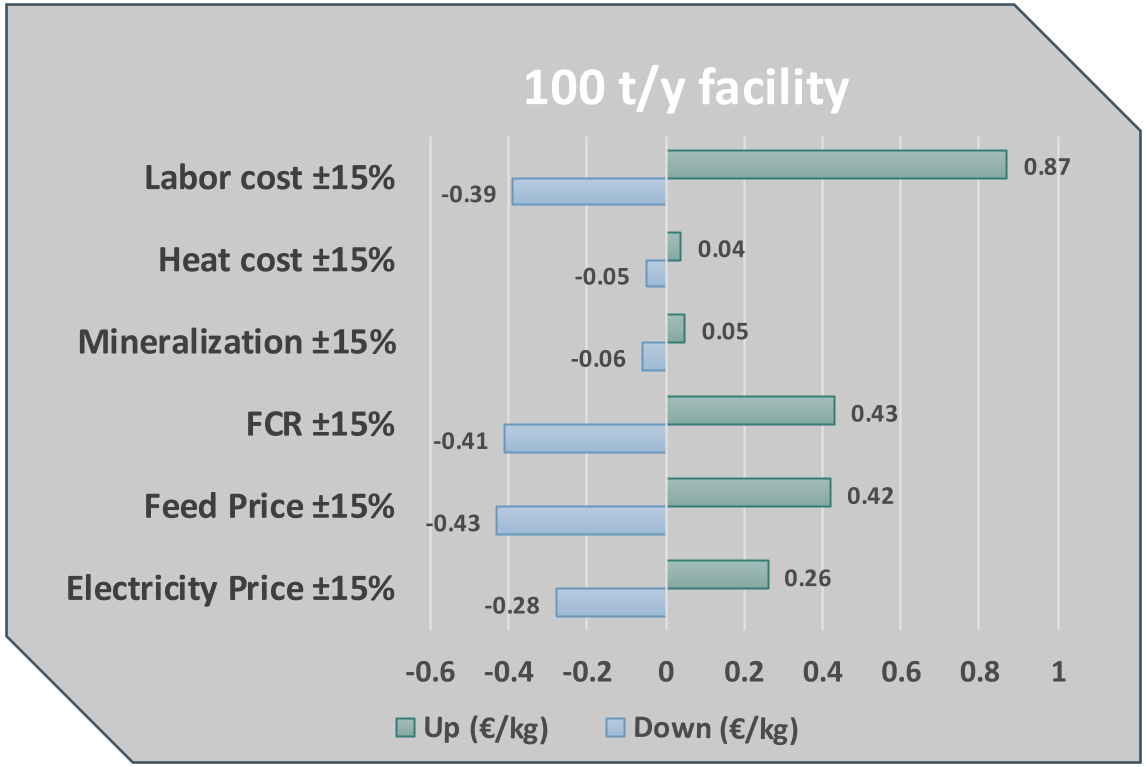


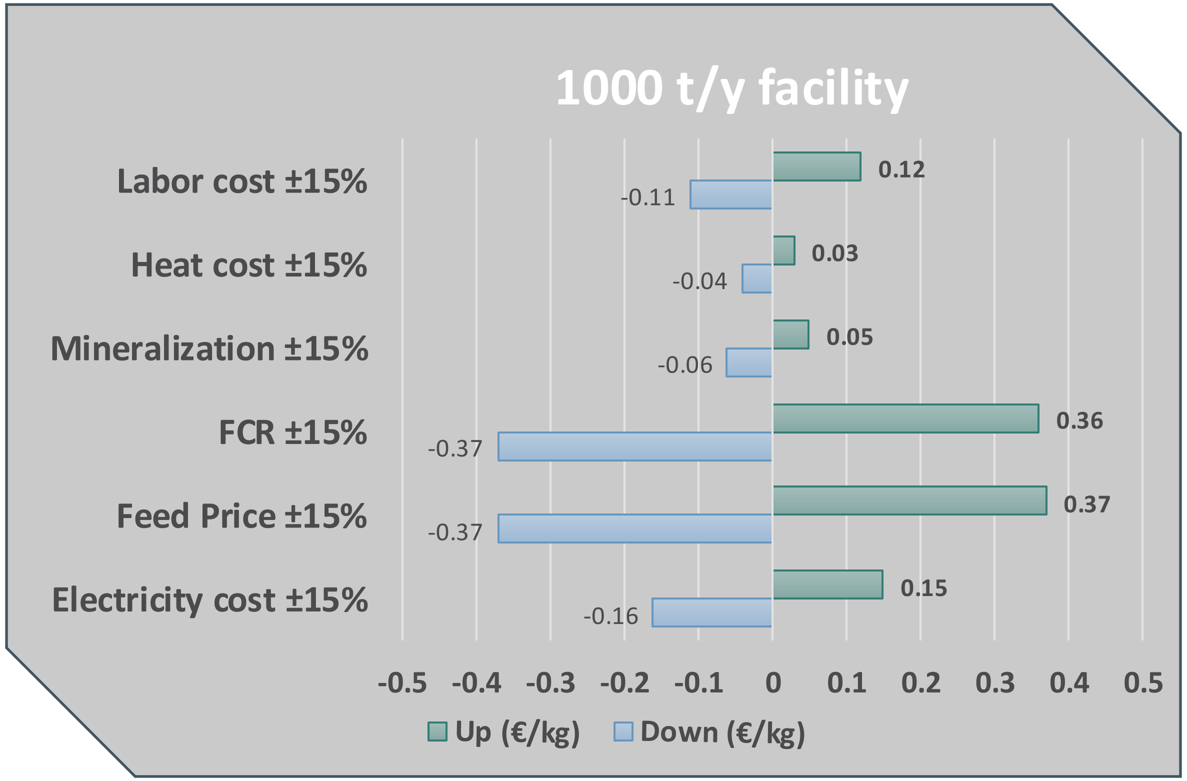




COGS split is based on industry averages and can vary.

Shrimp RAS - Cost Volatility Impact on COGS



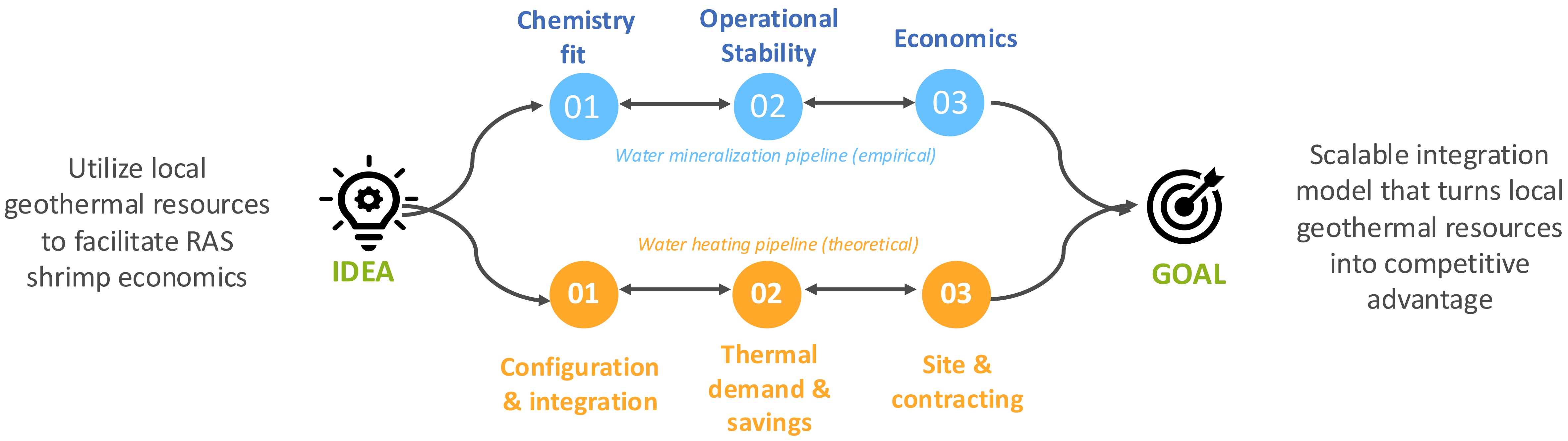


6 personnel total
17 (t / person)

18 personnel total
55 (t / person)

Geothermal Resources: Two Tracks

- Blue track - Pilot 2 empirical data
- Orange track – theoretical desk study



Geothermal: How It Fits In

Operational Targets	• Salinity 15-20 ppt • Alkalinity 120-180
Potential Impact	• Net eur/m3 for new-water mineralization vs synthetic mix
KPIs to Watch	• Stability (ph/alk/N) • Survivability • eFCR
Constraints	• Site-specific chemistry • Pretreatment SOP (if needed)

Operational Targets	• Maintain 27-29 C • Culture water + Building
Potential Impact	• Effective eur/kWh • Heat pumps, HEX losses, O&M, amortized tie-in CAPEX
KPIs to watch	• Thermal kWh/kg • Resource Stability
Constraints	• Source availability • Source parameters • Priority alignment (cascading)

Pilot-2 Snapshot & Learnings

Goals

Evaluate biological, economical, technical aspects of geothermal brine use in RAS

Hypothesis

Positive economic impact by shared resource utilization; water parameter stability

Results

Stable growth metrics; suitable water quality; positive economic impact

Limitations

Control variables; small scale pilot; uncertain replication at scale

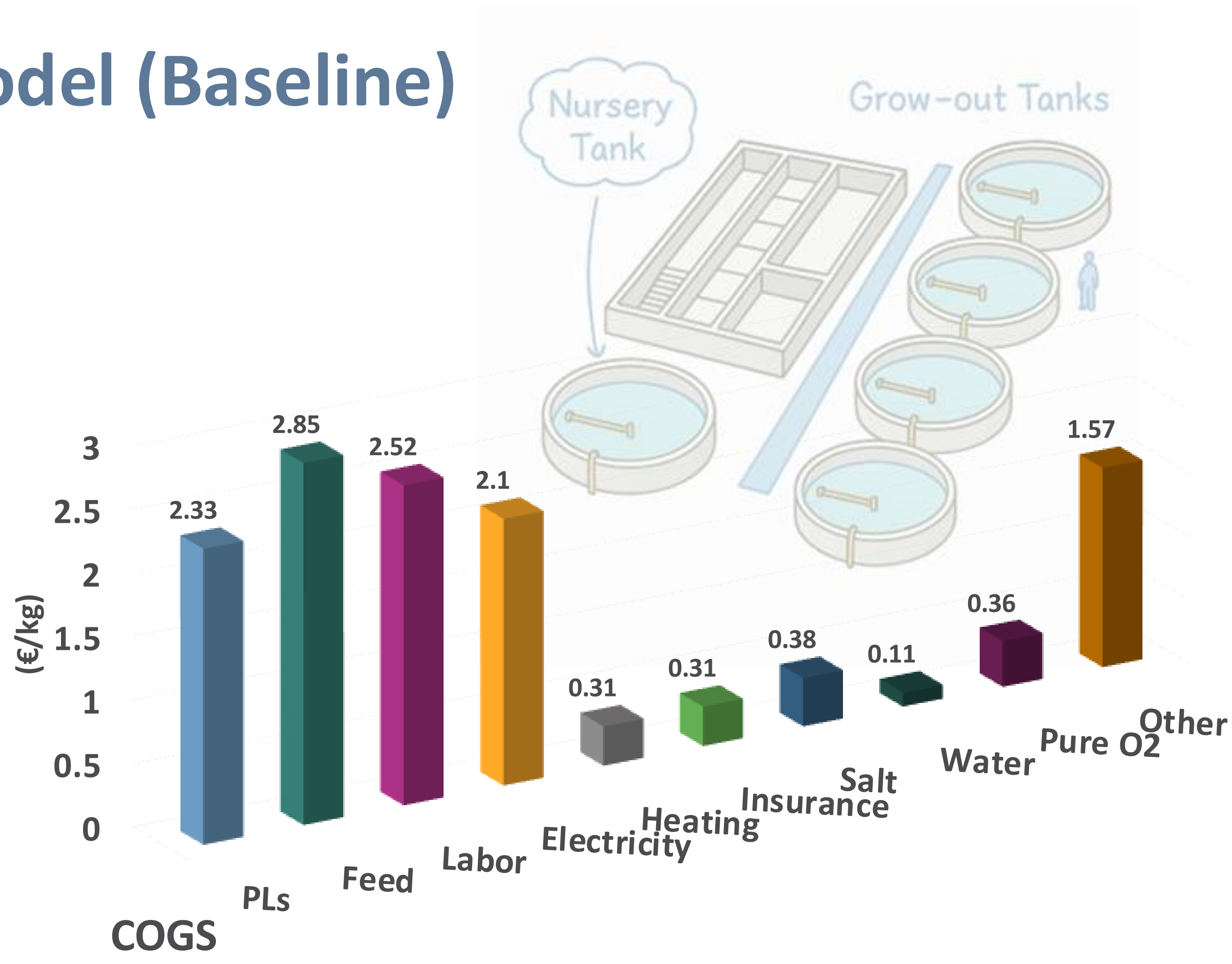
Experimental Data

Metrics / KPIs	Control (w. LCSM*)	Geothermal Brine 1	Geothermal Brine 2
FCR	1.71	1.52	1.5
Survivability (%)	33	63	42
Growth Rate (g/day)	0.22	0.2	0.29
Dissolved O2 (%)	70	70	93
Salinity Average (PPT)	22	20.5	23

*LCSM – Low Cost Salt Mixture (Na, K, Ca, Mg)

Modular RAS Farm Model (Baseline)

Capacity / output (MT/y)
100 (3 modules)
Total System Volume (m3)
2100
Daily Water Intake (%)
1.5 - 3
Stocking Density (kg/m3)
15
Recirculation rate (%)
95-98



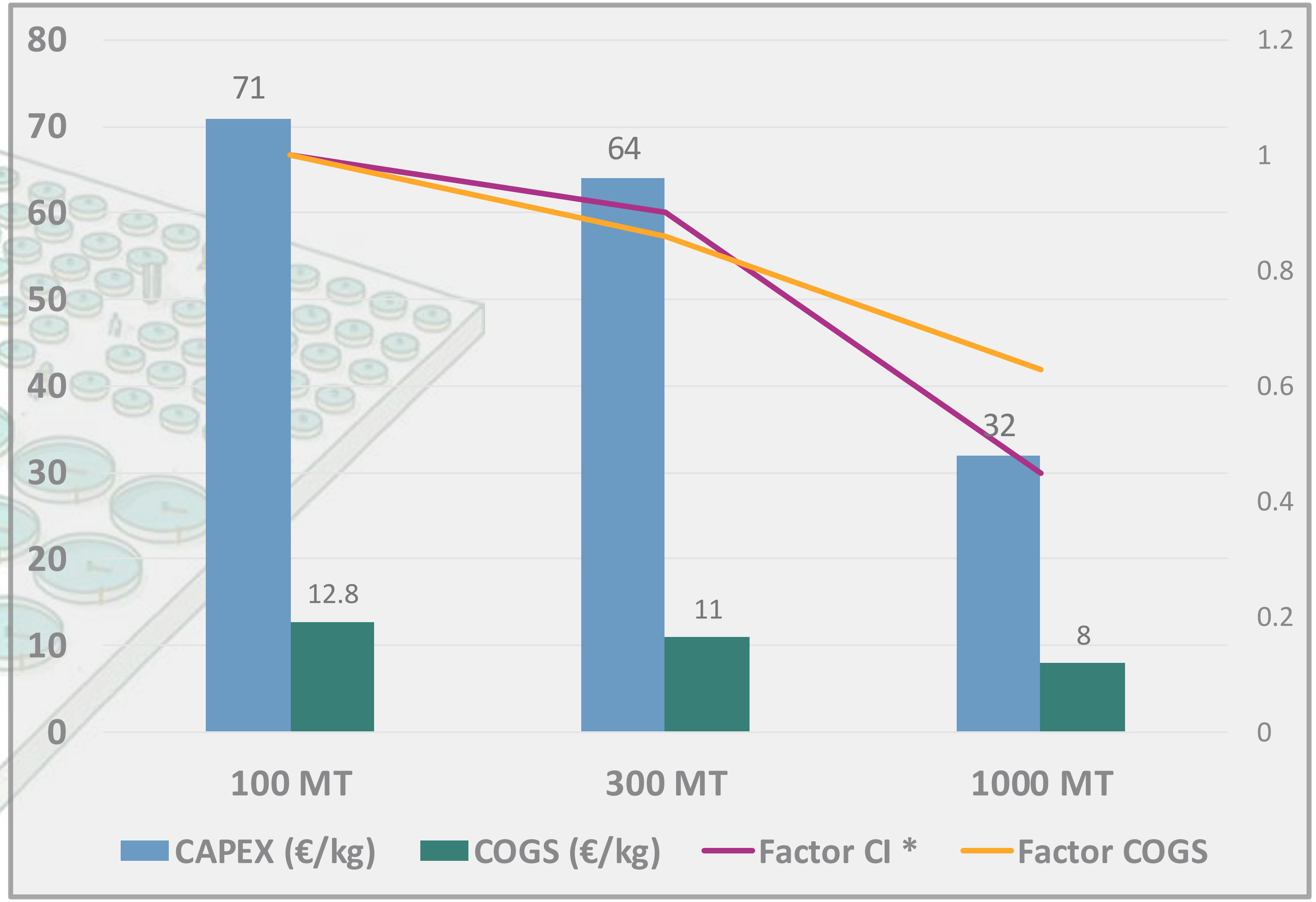
Design and performance targets are based on commercially proven pilot RAS practices and Akola's engineering synthesis.

Favorable Scale Economies

Modular Design

Shared Capacities

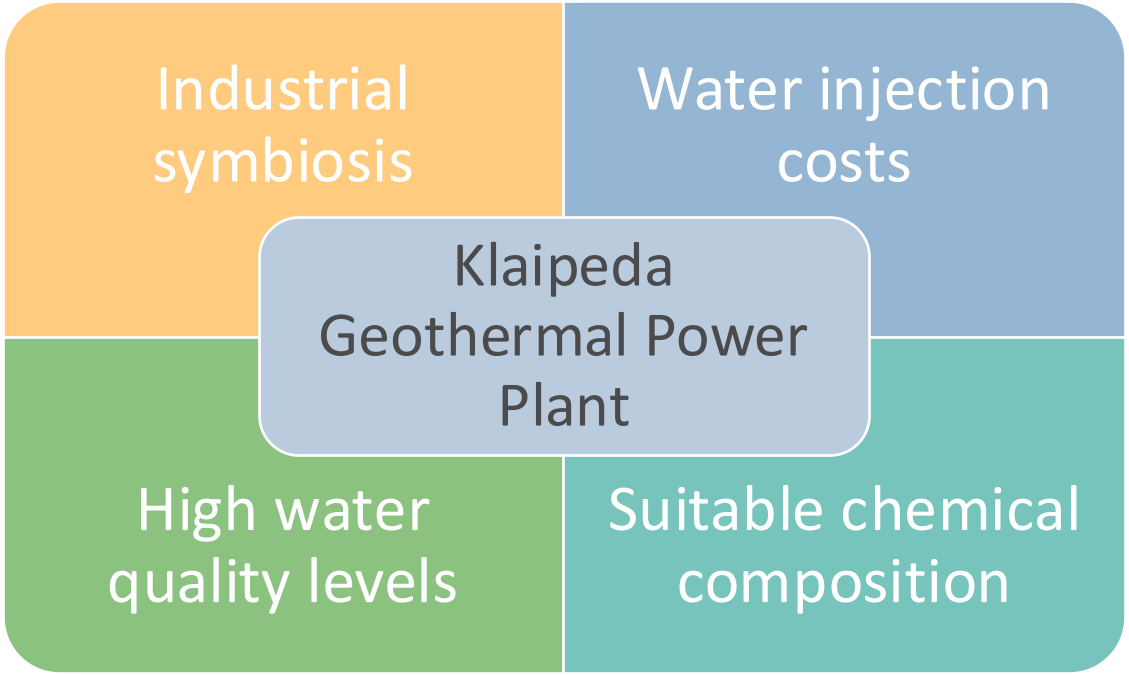
Resource Efficiency

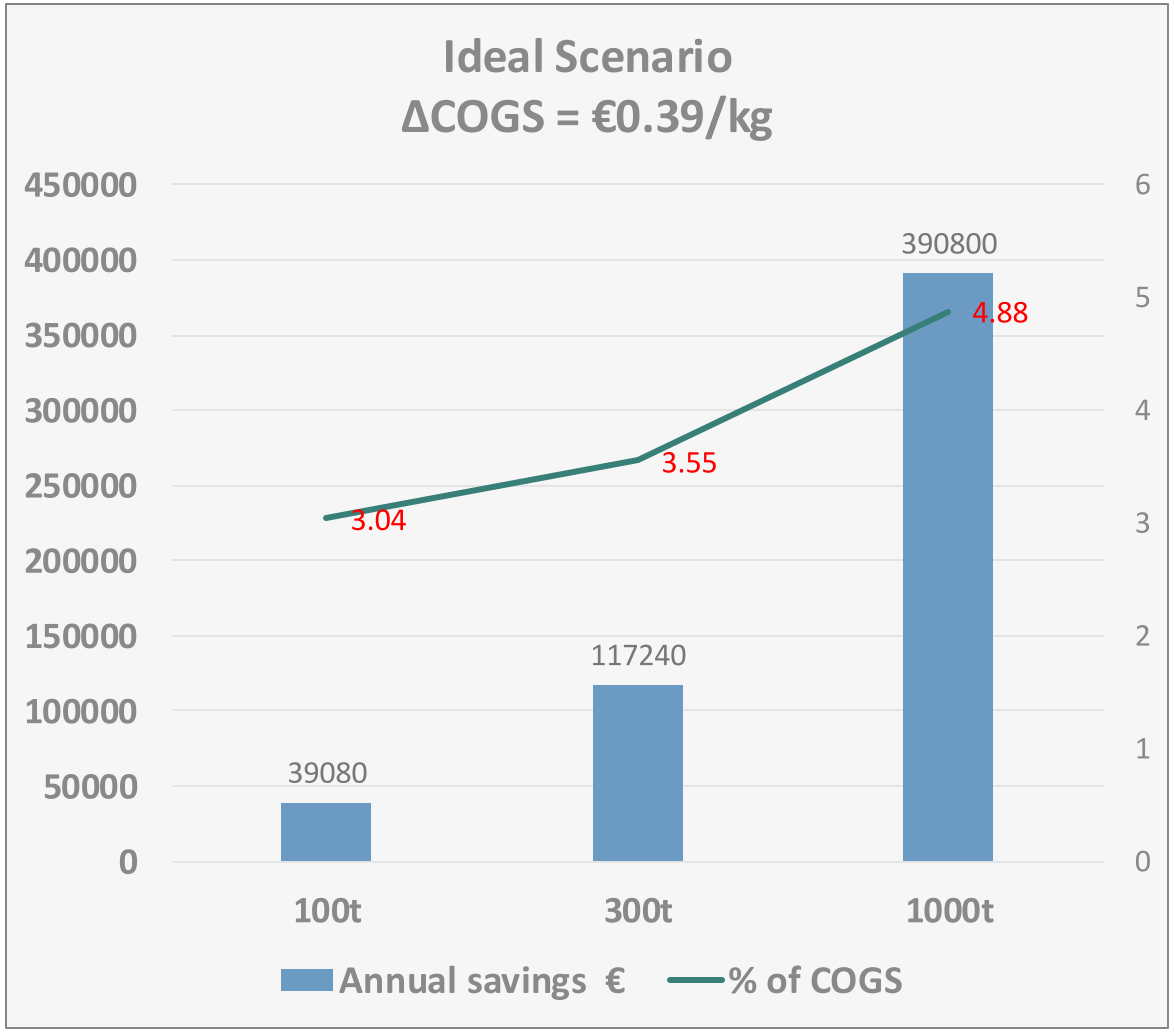


*Indicative (assumed) “less-than-linear” CAPEX due to shared infrastructure, more efficient system design etc.

Economic Lever A - Mineralization Impact

Source justification





Economic Lever B—Heat Impact (theoretical)

Prerequisites

- Source availability
- Accessibility potential
- Parameter compatibility
- Regulatory influence

Scenario	Tin>Tout (°C)	ΔT	Flow (L/s)	Availability	Usable heat (MWh/y)	Pumping (MWh/y)
S1 Warm Well	55>35	20	0.5	0.95	282.4	1.89
S2 Plant effluent	45>30	15	0.8	0.95	338.9	3.02
S4 Low temp, high flow	35>28	7	2.0	0.95	395.4	7.55
S5 High temp, low flow	65>40	25	0.3	0.95	211.8	1.13
S6 Seasonal	45>30	15	1.0	0.70	313.2	2.78
S7 Ideah high-capacity	75>35	40	2.5	0.98	2.913	9.74

*Scenarios based on geothermal resource locations

Risks & Guardrails

Mineralization

- Chemistry drift
- Trace contaminants
- QA SOPs

Heating

- Availability & stability
- Seasonal load matching
- Redundancy systems
- CAPEX

Regulatory

- Brine handling
- Resource coupling

Economics

- Cost mitigation
- Payback rate

Recommendations

Stabilize the platform

- Robust, economically viable RAS technology at scale

Quantify resource integration value

- Calculate economic potential and risks

Validate ESG and permits

- Evaluate sustainability / environmental impact

Anchor demand and finance

Contract the exposures

- Pursue term sheets from resource supply

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TETRAS BSR

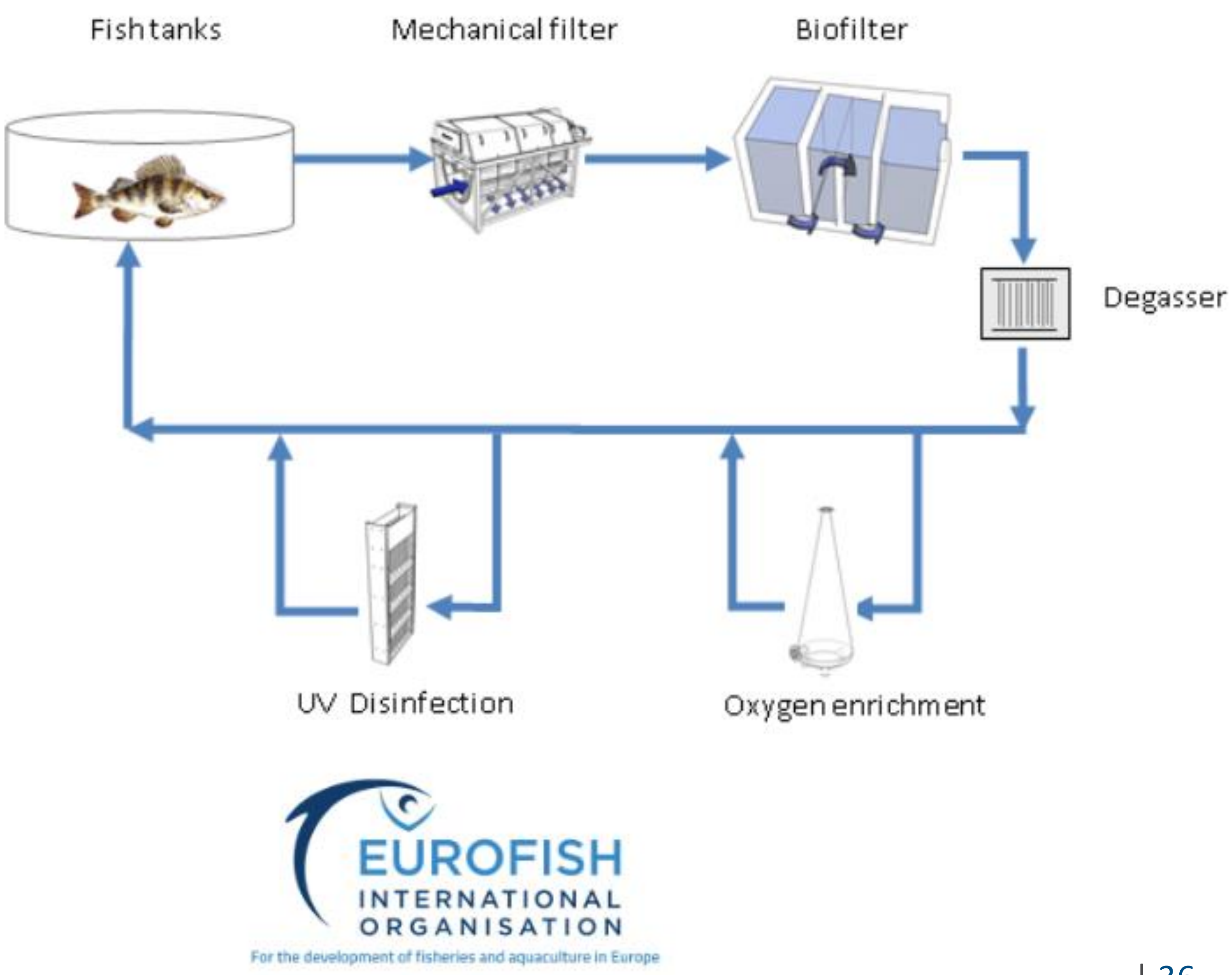
RAS
as an educational tool

Lisette Larsen, Teacher in Biology, Bioteknology and PLS , CELF

RAS

Recirculation Aquaculture Systems

Fishfarming



Clarias gariepinus

- no scales but bone plates instead
- They have sensitive whiskers
- Analyses of the fish meat
    - Fatty acids and protein
    - Fish and health

Merkurs Plads

- Technical High School
- Business High School
- EUX Business
- EUX Technic
- EUD
- 10.th grade

Biology C

- Investigation of Clarias anatomi and Life cyklus
- Growth experiments with Fish Water

Af ShanKamley - Eget arbejde, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=97856065, gills from Clarias

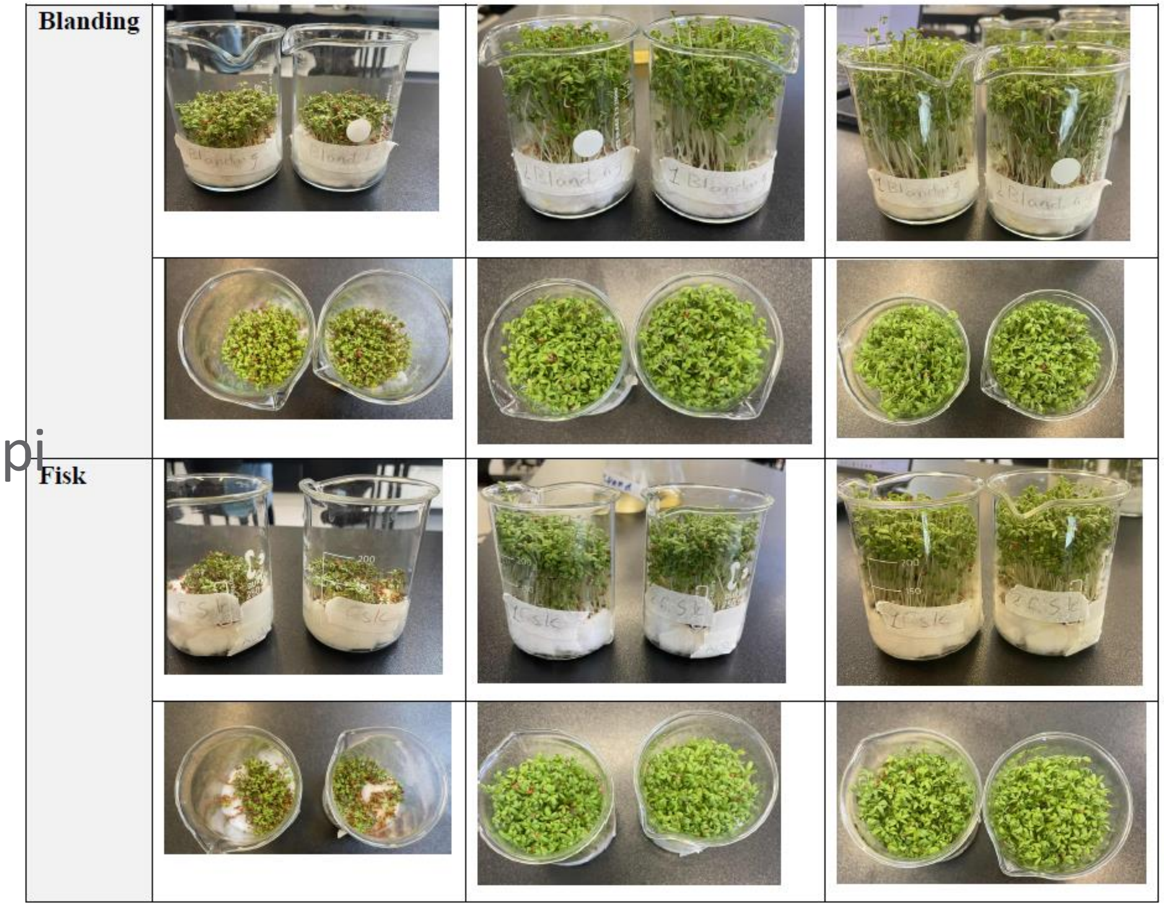
Biotechnology A

Water quality

- Phosphat and nitrat
- pH, temperature
- visuel Measurements and mikroskopi

The environmental impact

- Produktion of food in general
- Sustainability



THE GLOBAL GOALS

PLS (Proces, food and Health)

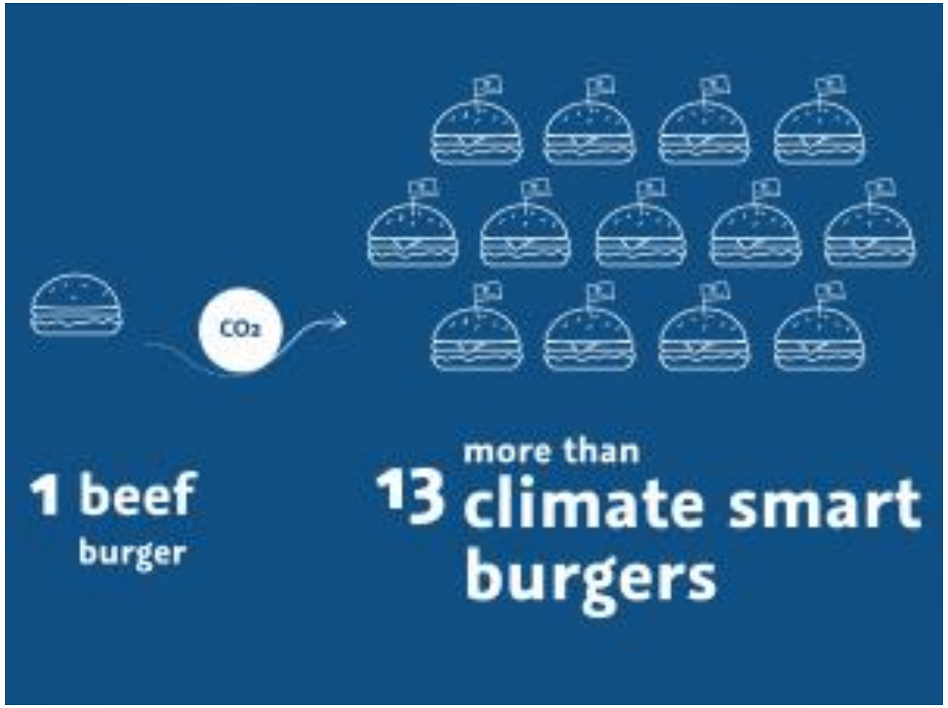
Visit in Sweden
October 2024

Gårdsfisk fish farming in sweden

PLS (Proces, food and Health)

From Clairas ”Caviar” to the diner table.

- The Farming proces.
- Economic and sustainability
- Analyses of the fish meat
- Fatty acids and protein
- Gelatin and leather
- Fish and health



https://denblaaplanet.dk/from-ocean-to-plate/

Communication and IT

Investigating target groups and how to market Clarias.
Develop PR materials
Working with logo, competition.

https://www.gardsfisk.se/produkter/ryggbit-av-gardsclarias

https://www.tripadvisor.com/Tourism-g3576942-Temanggung_Central_Java_Java-Vacations.html

Kringelborg

Vocational education and training

- Retail, trade and office
- Food and service
- Construction and plant
- Mechanics, engines, transport and storage
- Engineering and energy

Nutrition assistants and Chefs

This is not a Salmon, the meat is different

- Training of new fillet technics

Table 1. Chemical composition of catfish meat (wet weight bases)

Parameters	Catfish
Moisture %	71.30 ± 0.15
Protein %	19.03 ± 0.46
Fat %	8.10 ± 0.09
Ash%	1.05 ± 0.14
Carbohydrate %	0.52±0.12
Caloric value (kcal/100 g)	151.1±0.08

Nutritional Value of African Catfish (Clariasgariepinus) MeatH. E. Abdel- Mobdy1*, H. A. Abdel-Aal2, S. L. Souzan2 and A. G. Nassar1

Nutrition assistants and Chefs

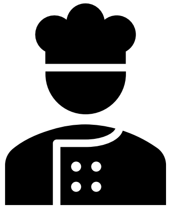
Experimenting with the Meat and creation of new dishes.

Educational ladder

Knowledge growth

Experience Sharing

From delicacy to everyday food



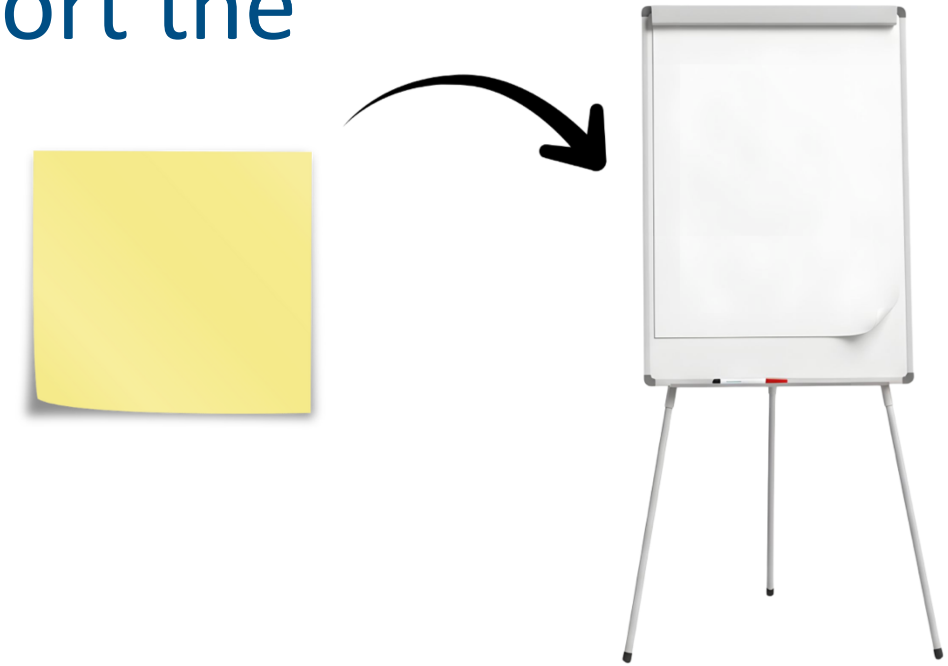
From mammal farming to fish farming

Thank you for your time

Questions?

Reflection Time and Discussion

- Place Questions and thoughts on A3 paper
- Think about what is needed going forward to support the RAS sector...



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Environmental performance of semi-commercial RAS in Lithuania and Denmark

Nykøbing Falster | Novembre 6th 2025

Michele Zoli – University of Milan

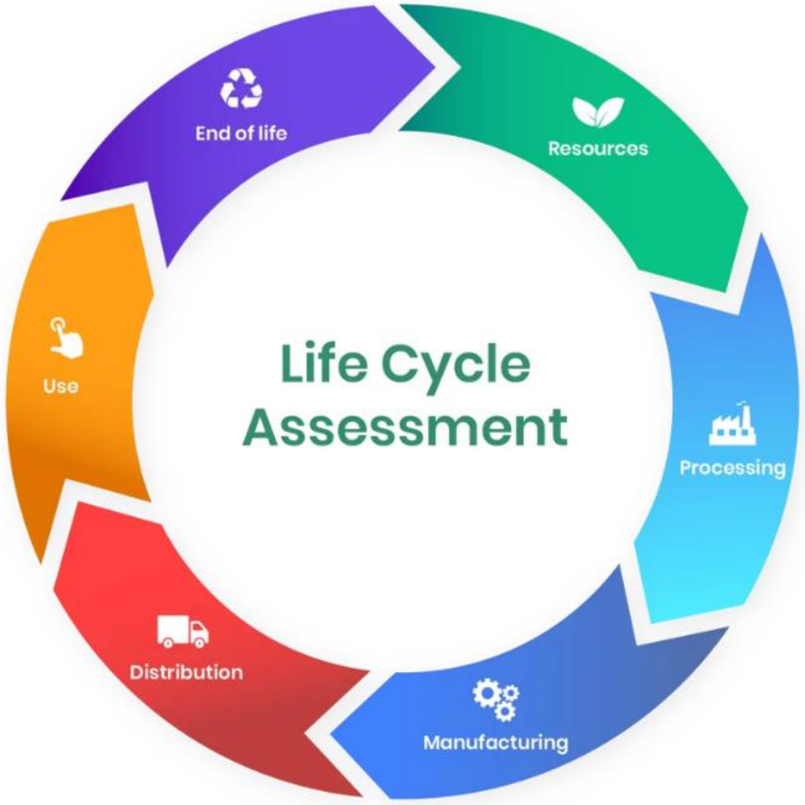
interreg-baltic.eu/project/tetras

Aim of this study

Environmental impact assessment

- Quantify the environmental impact of the RAS facility for shrimp production in Lithuania (University of Klaipeda);
- Quantify the environmental impact of the RAS facility for *Clarias gariepinus* production in Denmark;
- Identify the main hotspots of these two systems;
- Suggest mitigation strategies and provide guidance for future developments

Life Cycle Assessment approach



LCA

Life Cycle Assessment is the most used methodology to evaluate environmental performances of products (processes or services). It is standardized approach (ISO 14040/14044) and it considers the entire life cycle of products, from the extraction of raw materials to the management of waste.

LCA consists in the evaluation of mass (production factors, emissions of pollutants into the environment and waste production) and energy flows characterizing the analysed process.

LCA OUTPUTS:

Quantification of different impact categories: carbon footprint, water footprint, etc.

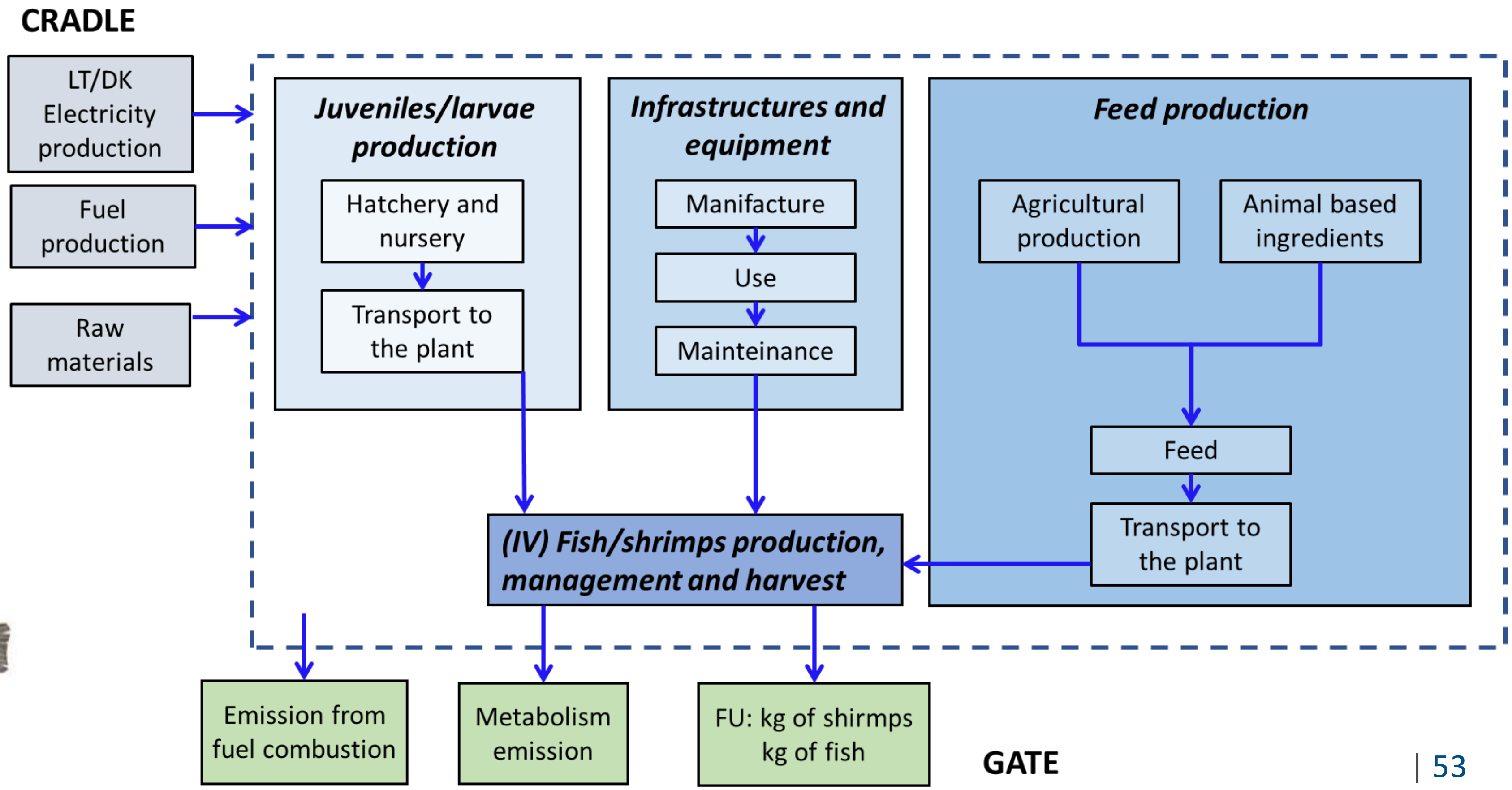
Goal and scope definition

Functional unit: Mass-based FU: ➡ 1 kg of live shrimps

1 kg of live *Clarias*

System boundaries:

From cradle to gate



Analysed system

Shrimps rearing

- Experimetal facilities in Klaipeda;
- Use of geothermal water;
- Electricity from Lithuanian network;
- Liquid oxygen supply
- From post larvae to commercial size
- 8 different feeds
- 7 tanks

Clarias rearing

- Municipality of Guldborgsund;
- Demostative plant
- Electricity from Denmark network;
- No liquid oxygen – air blower
- From 100g to about 1.5kg;
- One feed
- 2 tanks

Life Cycle Inventory

Primary data

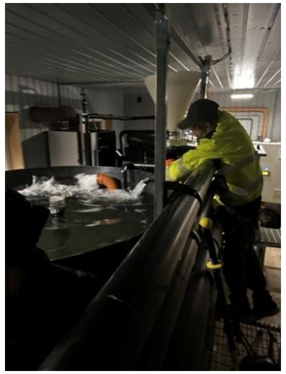
Primary data directly collected and related to the case studies analyzed. Measured data, experimental data. They refer to:

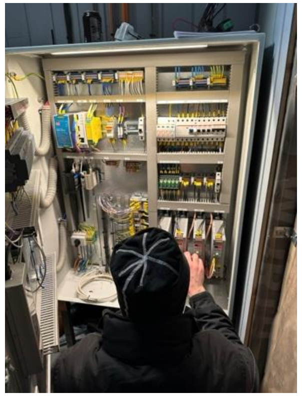
- Final production
- FCR
- Mortality
- Feed provided
- Energy consumption
- Liquid oxygen
- Consumption of other prod. factors
- System set-up

Secondary data

Secondary data collected from LCA database, scientific literature, model estimation:

- Feed ingredient inclusions
- Background material
- Energy modelling
- Juveniles modelling
- Metabolism emission (mass balance model)





Life Cycle Inventory

Shrimps rearing

Parameters	unit	1st cycle	2nd cycle
Cycle duration	days	80	92
Juveniles	kg	0.6	0.24
Juveniles transport	km	1,474	1,474
Freshwater	m^3	68	60
Geothermal water	m^3	30	8
Liquid oxygen	kg	45.38	19.95
Electricity	kWh	578.39	252.23
Mortality	%	53	58
FCR	/	1.53	1.54
Emissions			
Ammonia	kg	2.49	1.19
N ureic	kg	1.34	0.64
N solid	kg	2.20	0.83
Phosphate	kg	1.90	1.02
P solid	kg	1.29	0.57
Biomass output			
Shrimps	kg	119.01	51.9

Clarias rearing

Parameters	Unit	Value
Cycle duration	days	201
Juveniles	kg	60
Juveniles single weight	kg	0.1
Total plant volume	m^3	9.5
Water daily recirculation	m^3	9.025
Daily added freshwater	m^3	0.475
Oxygen concentration	mg/l	2.5
Disinfectants (H2O2 footbath)	l	1
Disinfectant - H2O2 hand pump	l	5
Bicarbonate of Soda	kg	107
Sea salt	kg	18
Electricity	kWh	10,275.9
Mortality	%	10
FCR	/	1.05
Emissions		
Ammonia	kg	0.39
N ammonium	kg	17.95
Nitrate	kg	10.89
N solid	kg	8.15
Phosphate	kg	1.62
P solid	kg	3.67
Biomass output		
Fish live weight	kg	842.5
Wastewater	m^3	104.9

- In addition all the info related to feed composition and infrastructures

Life Cycle Impact assessment

EF3.1 Method

- Acidification (AC);
- Climate change(CC);
- Freshwater ecotoxicity (ECOTOX);
- Particulate matter formation (PM);
- Eutrophication freshwater, Terrestrial and Marine (FE, TE, ME);
- Human toxicity – carcinogenic effect (HT_c);
- Human toxicity – non carcinogenic effect (HT_nc);
- Ozone layer depletion (OD);
- Photochemical ozone formation (POF);
- Fossil resources use (FRD);
- Mineral and metal resources use (MRD);
- Cumulative energy demand (CED);
- Net Primary Production Use (NNPU).

Results - 1 kg of shrimps

	Unit	1st	2nd
AC	mol H+ eq	0.06	0.08
CC	kg CO2 eq	8.91	10.82
FEx	CTUe	176.85	204.93
PM	disease inc.*10-5	0.07	0.09
ME	kg N eq	0.03	0.04
FE	kg P eq	0.02	0.02
TE	mol N eq	0.14	0.16
HT-c	CTUh*10-6	0.01	0.01
HT-nc	CTUh*10-6	0.39	0.26
OD	mg CFC11 eq	0.69	0.75
POF	kg NMVOC eq	0.04	0.04
RU-f	MJ	125.51	159.67
RU-mm	g Sb eq	0.11	0.23
WU	m3 depriv.	32.58	32.04
CED	MJ eq	165.19	203.23
NPPU	kg C	3,11	3.82

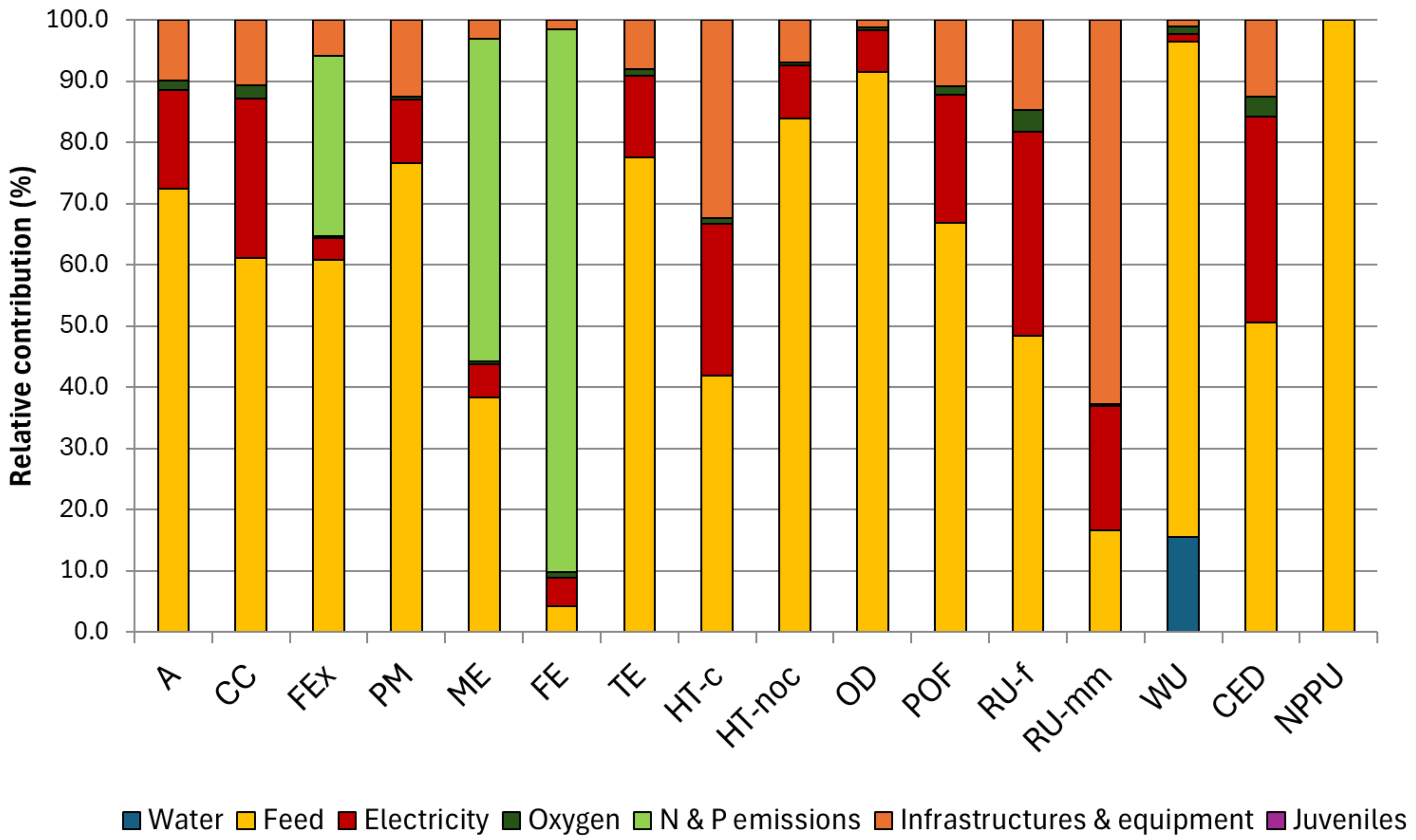
First cycle better than second one

Carbon footprint slightly high compared to literature:

- Cao et al., 2011: 2.7-5.3 kg CO_2 eq;
- Al Eissa et al., 2022: 4 kg CO_2 eq;
- Sun et al., 2023: 4.41-4.97 kg CO_2 eq.

A: Acidification; CC: Climate change; FEx: Freshwater ecotoxicity; PM: Particulate matter formation; ME: Marine eutrophication; FE: Freshwater eutrophication; TE: Terrestrial eutrophication; HT-c: Human toxicity, cancer effects; HT-nc: Human toxicity, non-cancer effects; OD: Ozone depletion; POF: Photochemical ozone formation; RU-f: Resource use, fossils; RU-mm: Resource use, minerals and metals; CED: Cumulative energy demand; NPPU: Net Primary Production Use.

Contribution analysis



Feed is the main hotspot in most categories: 72% A, 62% CC, 76%PM, 50% CED

Electricity impacts for26% del CC, 33% RU-f, 33.6% CED

Infrastructures are main responsibles for RU-mm (63%) and HT-c (33%)

N and P emissions impact on FEx (30%), ME (53%) and FE (87%).

Results – 1 kg of *Clarias*

	Unit	1st
AC	mol H+ eq	0.03
CC	kg CO2 eq	4.50
FEx	CTUe	131.85
PM	disease inc.*10-5	0.27
ME	kg N eq	0.03
FE	kg P eq	0.01
TE	mol N eq	0.09
HT-c	CTUh*10-6	0.35
HT-nc	CTUh*10-6	0.12
OD	mg CFC11 eq	0.31
POF	kg NMVOC eq	0.31
RU-f	MJ	0.02
RU-mm	g Sb eq	65.54
WU	m3 depriv.	9.21
CED	MJ eq	3.36
NPPU	kg C	1.01

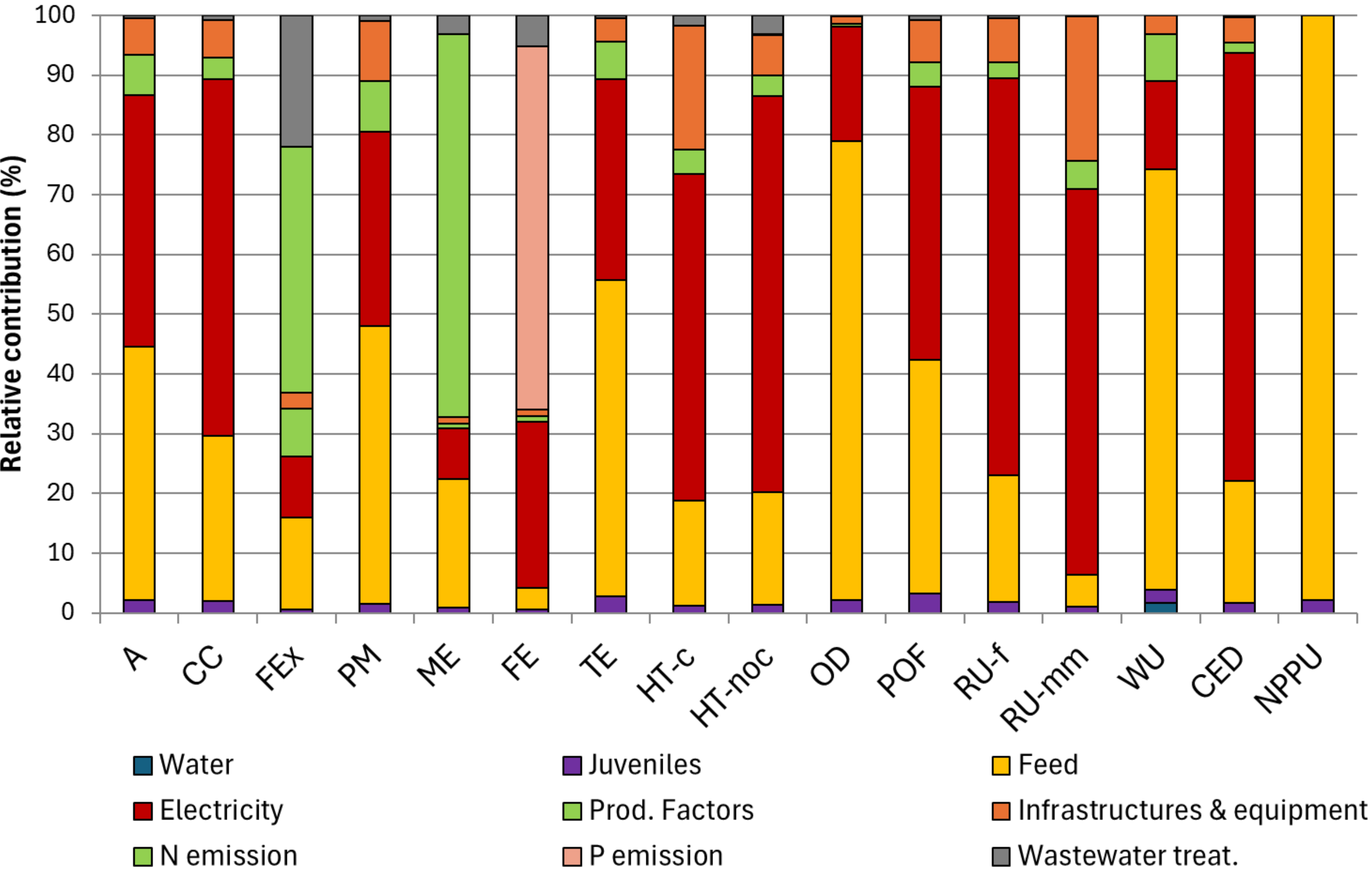
Results are in line with previous studies

Carbon footprint from literature:

- Cao et al., 2011: 2.7-5.3 kg CO_2 eq;
- Al Eissa et al., 2022: 4 kg CO_2 eq;
- Sun et al., 2023: 4.41-4.97 kg CO_2 eq.

A: Acidification; CC: Climate change; FEx: Freshwater ecotoxicity; PM: Particulate matter formation; ME: Marine eutrophication; FE: Freshwater eutrophication; TE: Terrestrial eutrophication; HT-c: Human toxicity, cancer effects; HT-nc: Human toxicity, non-cancer effects; OD: Ozone depletion; POF: Photochemical ozone formation; RU-f: Resource use, fossils; RU-mm: Resource use, minerals and metals; CED: Cumulative energy demand.

Contribution analysis



Electricity is the main hotspot in most categories: 43% A, 60% CC, 66% RU-f OD, 66% RU-mm, 72% CED.

Feed represents the total of NPPU (98%), the 77% (OD) and «only» 28% of CC.

Infrastructures mainly affect PM (10%), HT-c (20%), RU-mm (24%).

N and P emissions impacts on FEx (42%), ME (64%) and FE (61%).

Discussion & conclusions

Shrimps rearing

- There is definitely a production scale effect;
- In any case, the percentage results of the contribution analysis are consistent with the literature;
- Room of improvements → electricity, oxygen, feed.

Clarias rearing

- Overall good environmental performance;
- The analysis can be extended to the fillet and all co-products (although data on their economic value would be required);
- Room of improvements → electricity, system expansion.

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Klaipeda University

University of Gdańsk

GULDBORGSUND

UNIVERSITÀ DEGLI STUDI DI MILANO

THANK YOU FOR YOUR ATTENTION

Michele Zoli

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This work was supported by the Interreg Programme


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GRILLA SOM OM DU STULIT DEN
ANDRA BULLAR
ANDRA BULLAR
ANDRA BULLAR
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NEVER NOT RIMMA
FISH FOR THE WIN!
gardsfisk.se
EN RÖDSTRIMMA HOPP
SIMMA OLUGNT
FISK

The Gårdsfisk way

Fish fry

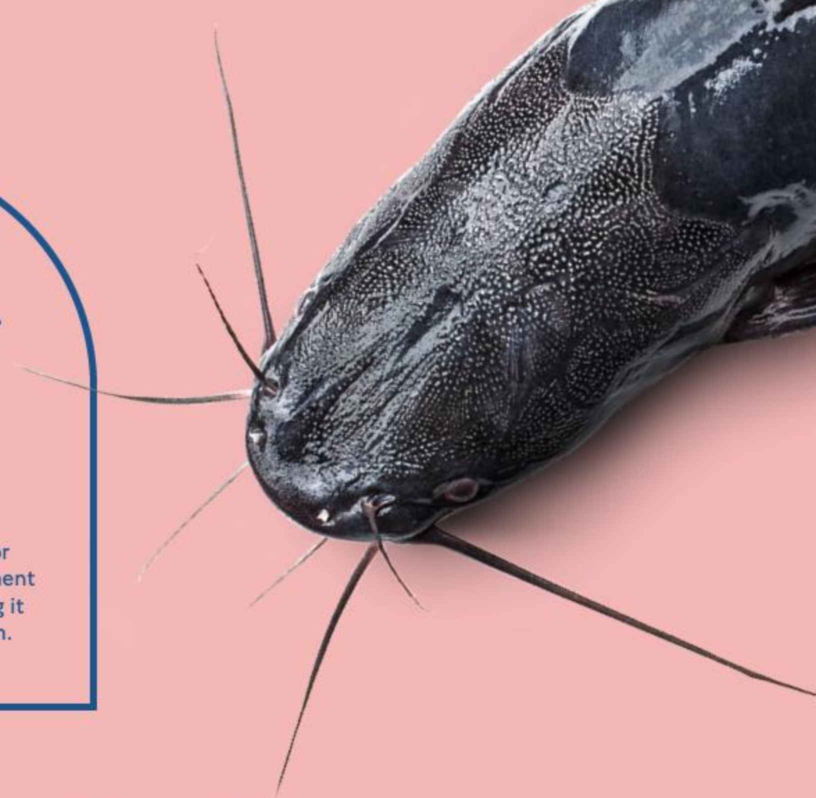
The fish is hatched on our farm in Skåne and later on moved to the farmer where they live in pools inside the barn.

At the farm

The farmer now has a new animal that provides nourishment to the fields outside.

Closed-loop

The fish pool water is used for watering the crops. Fish excrement is the perfect manure - making it an almost closed-loop system.



CLARIAS FÄRDIGA GÅRD!

Fresh

We have chosen freshwater species to be able to use the waste water on the fields. And all fish excrement turns into manure.

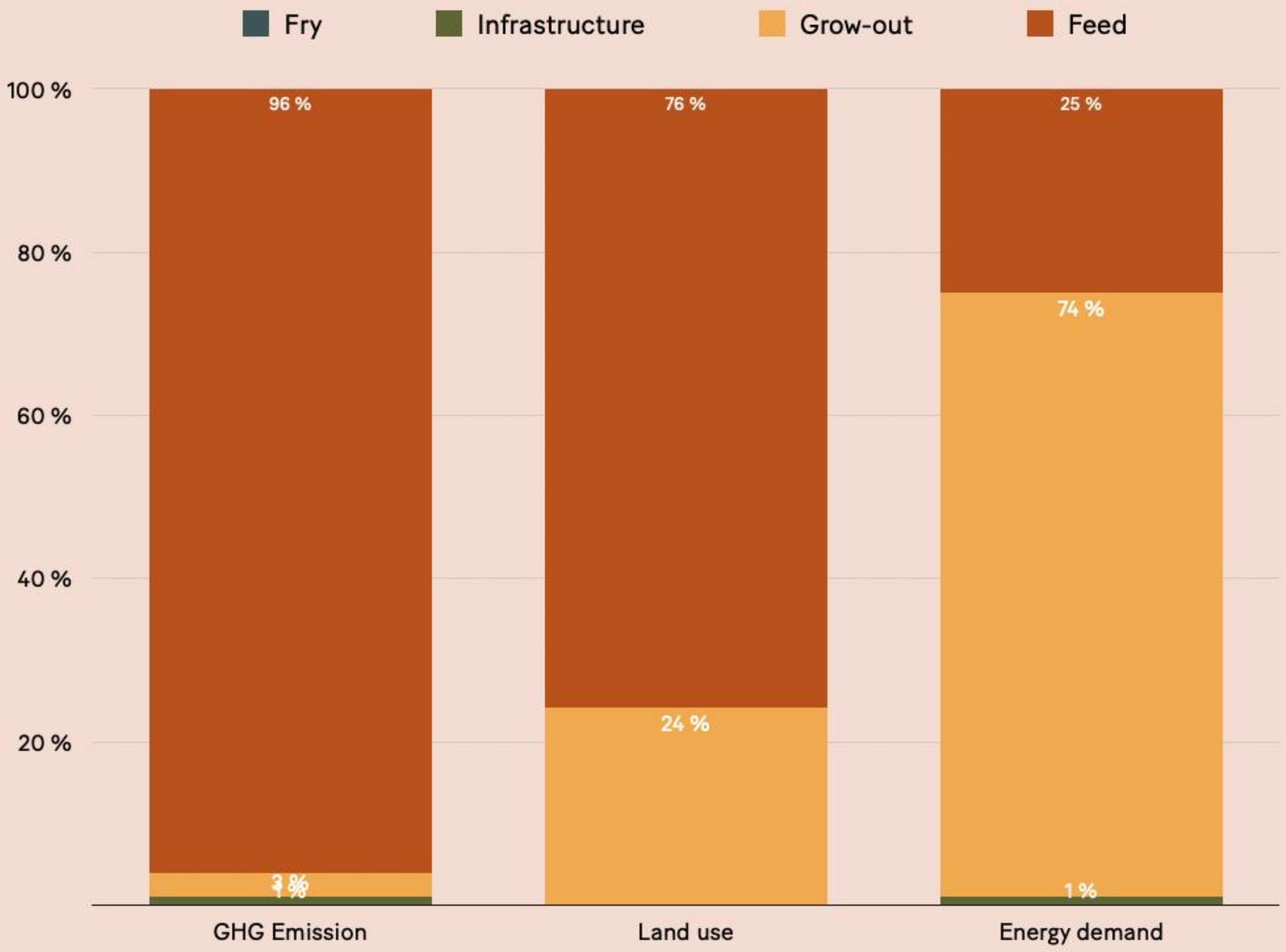
Robust

Our fishes thrive in shoal and can live together without getting sick. They have never required medication.

Omnivore

They can to a large extent be fed with vegetables and don't need to eat as much fish as other fish species.

GÅRDSFISK LCA - 2017



GÅRDSFISK AFRICAN CATFISH

2,8

Co2e/kg

Possible Improvements

FEED

A vegetarian feed would lower the c02e with ≈28%.

Also, removing soy would decrease it further.

BY PRODUCTS

The result is only calculated on fillets (50%). When we can use by-products (now converted to bio-gas), the overall CO2e, land use and Energy demand will decrease with 50%.

ENERGY (done)

Used in the calculation is the Swedish energy mix. Swapping to renewable energy would decrease everything further.

Source: Recirculating Aquaculture Is Possible without Major Energy Tradeoff: Life Cycle Assessment of Warmwater Fish Farming in Sweden

Thank You!

ANDREAS GRANATH

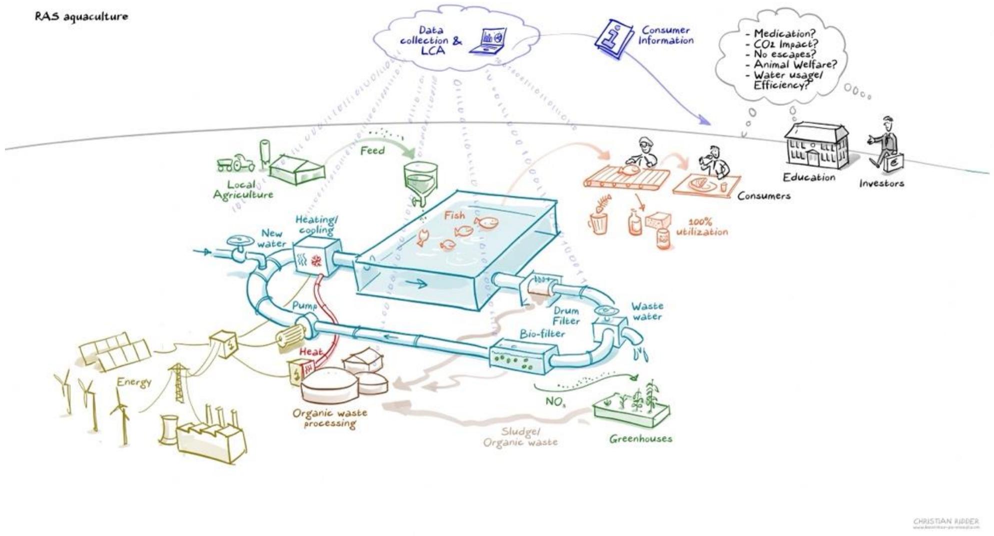
andreas@gardsfisk.se

GÅRDSFISK®

Big Data Transformation in Aquaculture

How Big Data Drives Technological Innovation

Dr Monika Klein & Dr Laima Gerlitz
WISMAR



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Big data refers to large and complex sets of data that are difficult to collect, store, process, and analyze using traditional data management tools or methods.

It's not just about size — big data is defined by several key characteristics often summarized as the "**5 Vs**":

Volume – The sheer amount of data being generated (e.g., terabytes or petabytes from social media, sensors, transactions, etc.).

Velocity – The speed at which data is created and needs to be processed (e.g., real-time streams from IoT devices).

Variety – The different types of data: structured (databases), semi-structured (JSON, XML), and unstructured (text, video, images).

Veracity – The reliability and accuracy of data; big data often includes "noisy" or uncertain information.

Value – The potential of the data to generate insights or business benefits once analyzed.

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Introduction to Big Data in Aquaculture

Big Data in aquaculture refers to collecting, analyzing, and applying large volumes of data from sensors, IoT devices, feeding systems, and environmental monitoring.

Enables better management, sustainability, and decision-making in fish farming operations.

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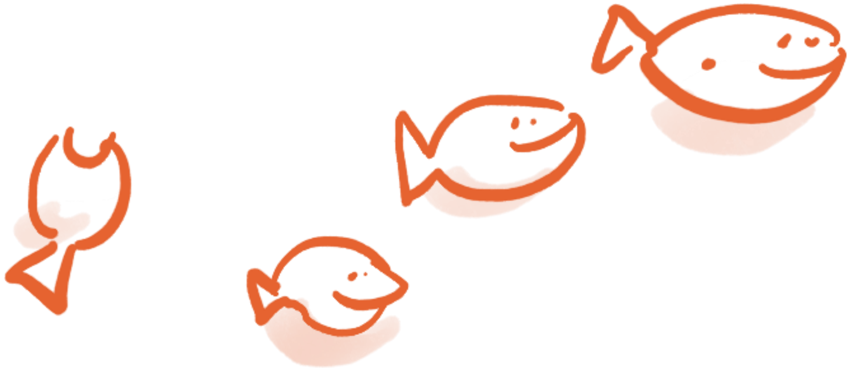
How Big Data Drives Technological Transformation



- **Smart Farming (Precision Aquaculture)**
- Using **IoT devices** and **AI analytics**, farmers can monitor real-time conditions in ponds or cages.
- Data-driven automation adjusts **feeding rates, oxygenation, and water flow** automatically.
- This reduces waste and improves growth rates.

- **Example:**
If oxygen levels drop, a smart system activates aerators before fish are stressed – minimizing mortality.

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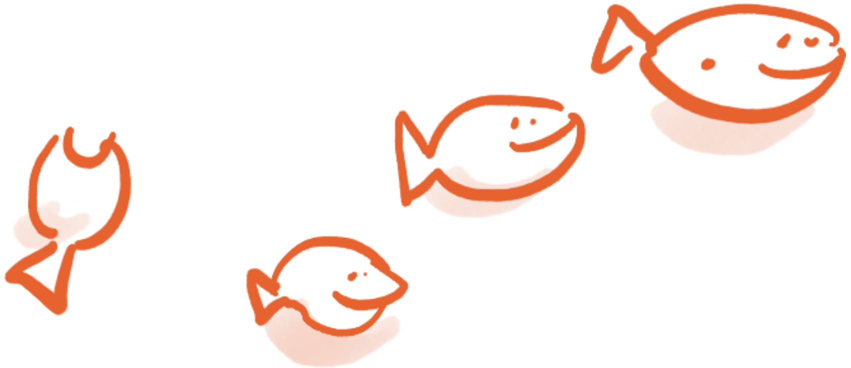
How Big Data Drives Technological Transformation



- **Predictive Analytics for Fish Health**
- Big data models can **predict disease outbreaks** by analyzing environmental changes, feeding behavior, and historical trends.

- Early warnings enable preventive actions, reducing the need for antibiotics and saving stock.

- **Example:**

Example:
AI systems in salmon farms detect early signs of sea lice infestations using image data from underwater cameras.

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How Big Data Drives Technological Transformation

- **Sustainable Resource Management**

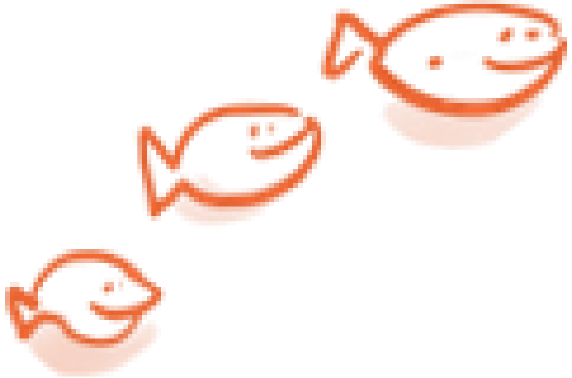
- Data helps optimize water and feed use, improving resource efficiency.

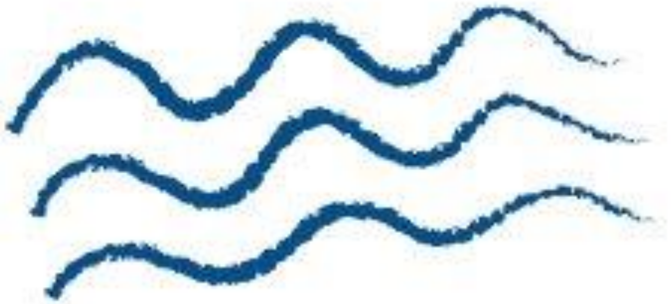
- Analyzing patterns across farms reveals **best practices for sustainability**
- and **reduces environmental impact**.

- **Example:**

Comparing data across regions can show which farms use less feed per kilogram of fish,

- promoting eco-friendly operations.





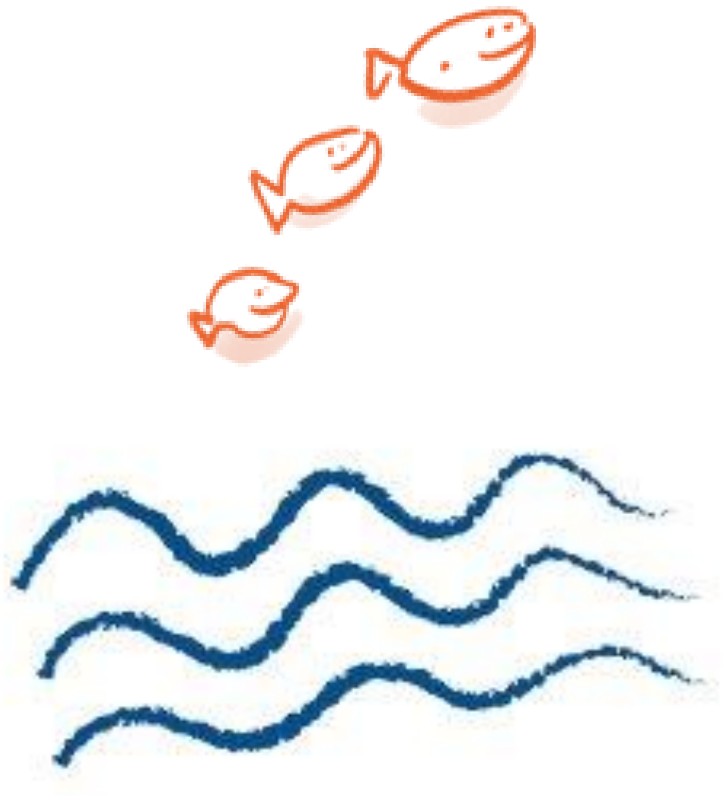
How Big Data Drives Technological Transformation

- **Supply Chain and Market Intelligence**

- Big data integrates production with **supply chain and market data**, improving logistics and pricing.

- Predictive analytics forecast **demand trends**, helping producers time harvests for higher profits.

- **Example:**
Retail and consumption data can guide when to harvest shrimp or tilapia to match
- peak demand in export markets.



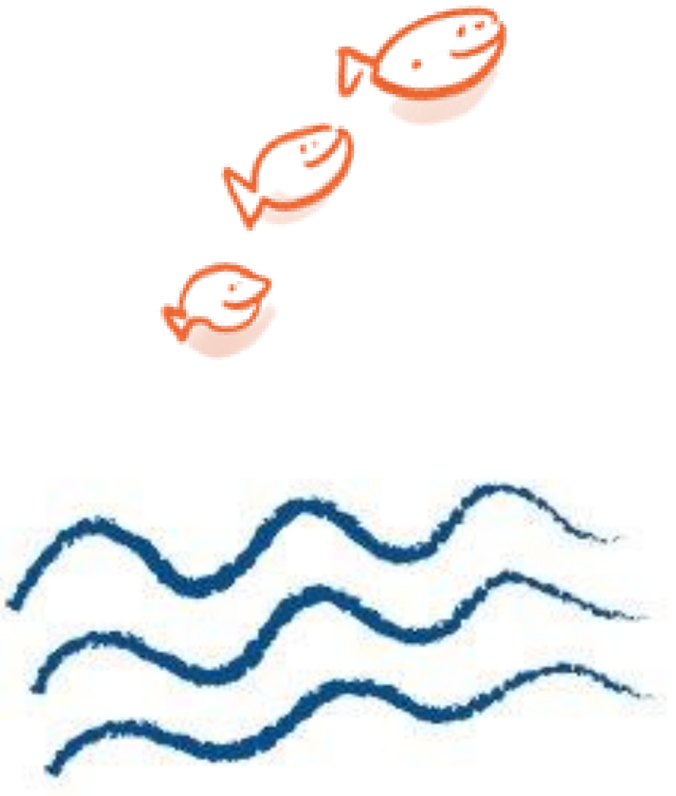
Technological Transformation Through Big Data

1. Smart Farming (Precision Aquaculture): Real-time monitoring and automated feeding.

2. Predictive Analytics: Early detection of diseases and stress conditions.

3. Sustainable Resource Management: Optimizing feed and water use for eco-friendly operations.

4. Supply Chain Integration: Data-driven logistics and market alignment.



Big Data and Business Innovation

New Business Models

Data-as-a-Service: Companies can sell or share data insights (e.g., environmental monitoring platforms).

Subscription-based analytics platforms for small-scale fish farmers.

Enhanced Product Traceability

Blockchain + big data ensure full traceability from hatchery to plate.

Builds consumer trust and meets global sustainability standards.

Personalized Nutrition and Breeding

Using genetic and feed intake data, companies can create custom feed formulas and optimized breeding programs, improving productivity and quality.

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Benefits of Big Data in Aquaculture

Improved productivity and reduced losses.

Enhanced sustainability and reduced environmental impact.

Better disease management and animal welfare.

Increased profitability and competitive advantage.

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Conclusion

Big Data transforms aquaculture from traditional farming into a smart, connected industry. It fosters technological innovation, sustainable growth, and data-driven business models, ensuring long-term profitability and environmental stewardship.

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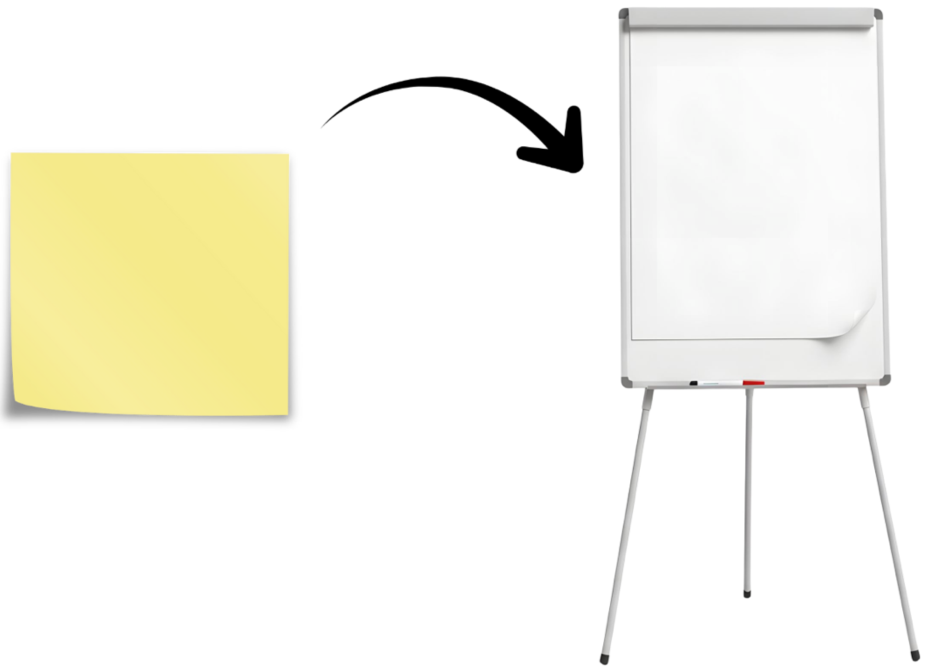
Q&A and Discussion

- Place Questions and thoughts on A3 paper
- Conclusions
- Barriers



Capacity Survey

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Please complete our survey

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