GAIN
Green Aquaculture Intensification

SUMMER SCHOOL

FROM AUGUST 30TH TO SEPTEMBER 3RD

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773330 (GAIN)

GAIN Green Aquaculture Intensification SUMMER SCHOOL

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Value Chain Analysis Salmon in Norway and Carp in Poland

A comparison between a industrial and cultural supply chain

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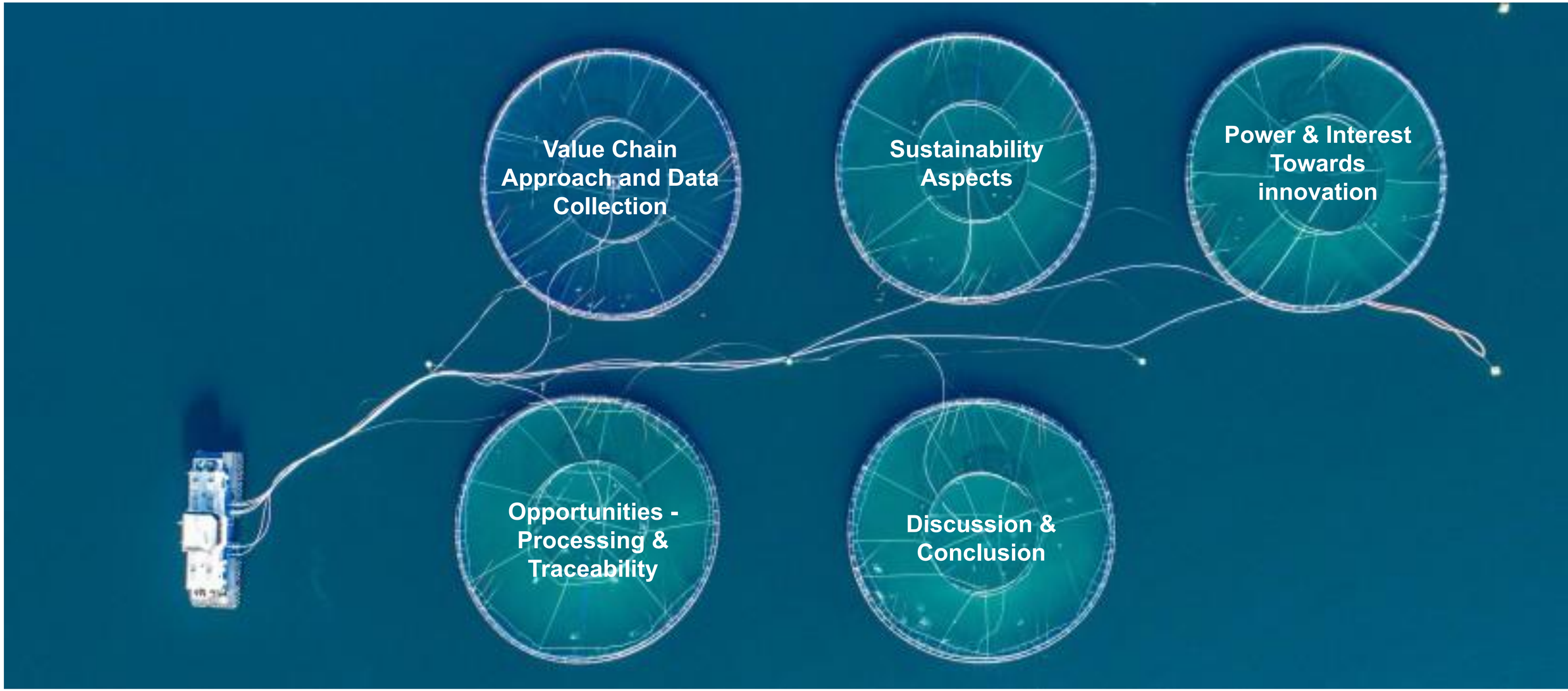

Value Chain Approach and Data Collection
Sustainability Aspects
Power & Interest Towards innovation
Opportunities - Processing & Traceability
Discussion & Conclusion

Value Chain Analysis

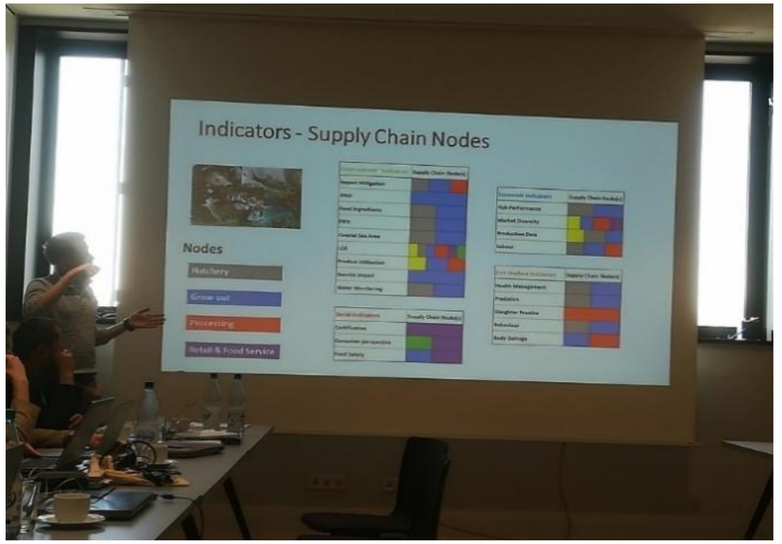
- *Explores the relationships between different value chain actors and stakeholders and the movement of goods and services*

- Understanding of different parts of the value chain and how they interact
- Who drives innovation? (Power and Interest)

  → Who are the “lead firms”?
- Where are the bottlenecks for growth/ eco-intensification?
- Where is value added?

Initial survey preparation

- Workshop with partners from several countries
- Expert in value chain analysis and sustainability aspects (LCA)
  - Structure of aquaculture value chains – define sample frame
  - List of provisional indicators
    - ease of data collection
    - relevance to the industry



(semi-)structured survey

- Primary data collection
- Sensitive data collection relies on building relationships

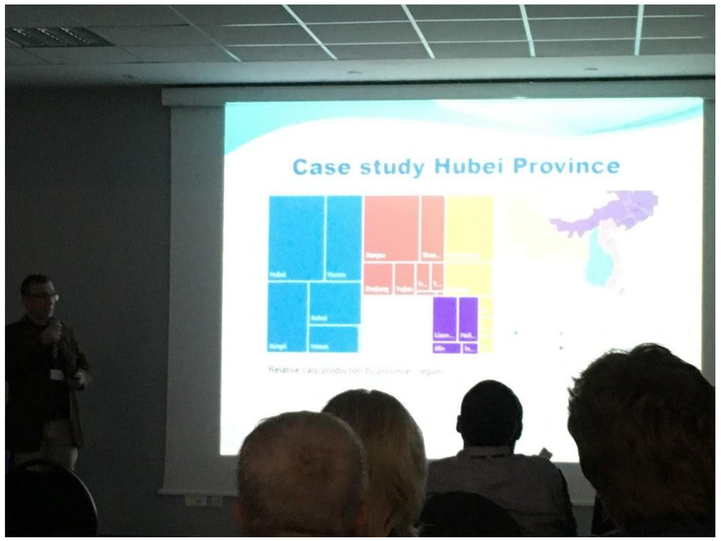
- Results VCA survey followed up by 2 rounds of Delphi Expert Consultation

Stakeholder	VCA
Grow out	✔
Hatcheries	✔
Processors (1° and 2°)	✔
Feed mills	✔
By-product industry	✔
Associations	✔
R & D facilities	✔
Distribution	✔
Retail	✔
NGOs	✔
Academia	✔

Survey distribution

- Work with partners to identify key stakeholders; GIFAS, ZUT, UNIVE, AFBI
- Use their networks to engage with industry and wider stakeholders
- Pilot surveys

  ⟶ Broaden surveys through “snowball” networking over 3 month field work per country



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EU+EEA aquaculture production 2018, FishStatj

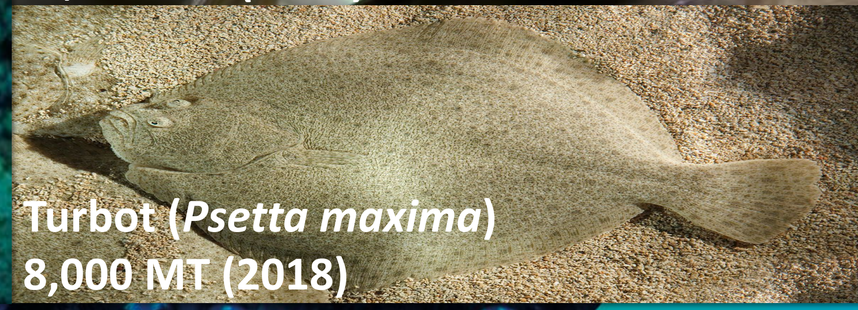
Atlantic Salmon (*Salmo Salar*)
1.47 MMT (2018)

Rainbow Trout
(*Oncorhynchus mykiss*)
243,000 MT (2018)

European Seabass
(*Dicentrarchus labrax*)
84,000 MT (2018)

Gilthead Bream (*Sparus Aurata*)
92,000 MT (2018)

Common Carp (*Cyprinus carpio*)
75,000 MT (2018)



Turbot (*Psetta maxima*)
8,000 MT (2018)

EU+EEA aquaculture production 2018, FishStati

Why focus on salmon (Norway) and carp (Poland)

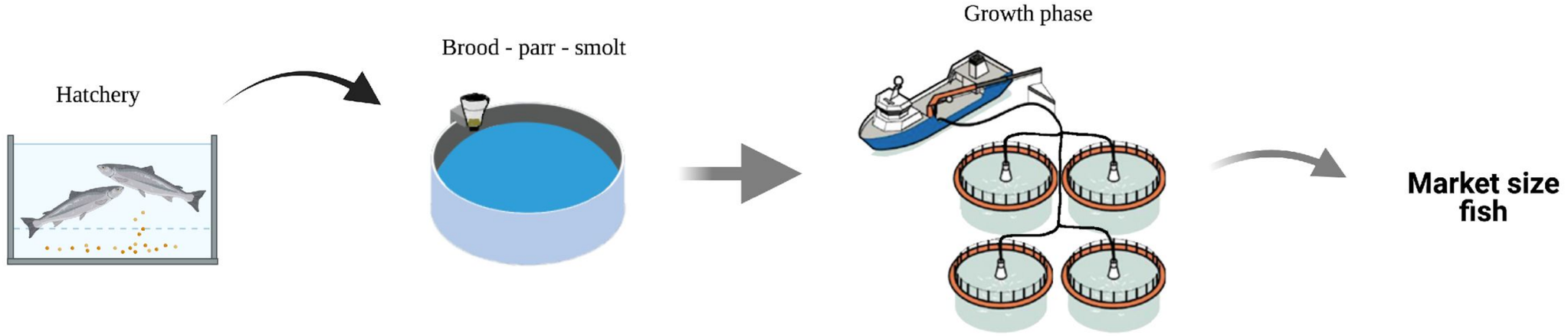
- Industrial vs landscape fish
- Overseas secondary processing
- Major role for Poland as secondary processor to utilize high value aquaculture fish by-products
- Marine vs freshwater


The fish site

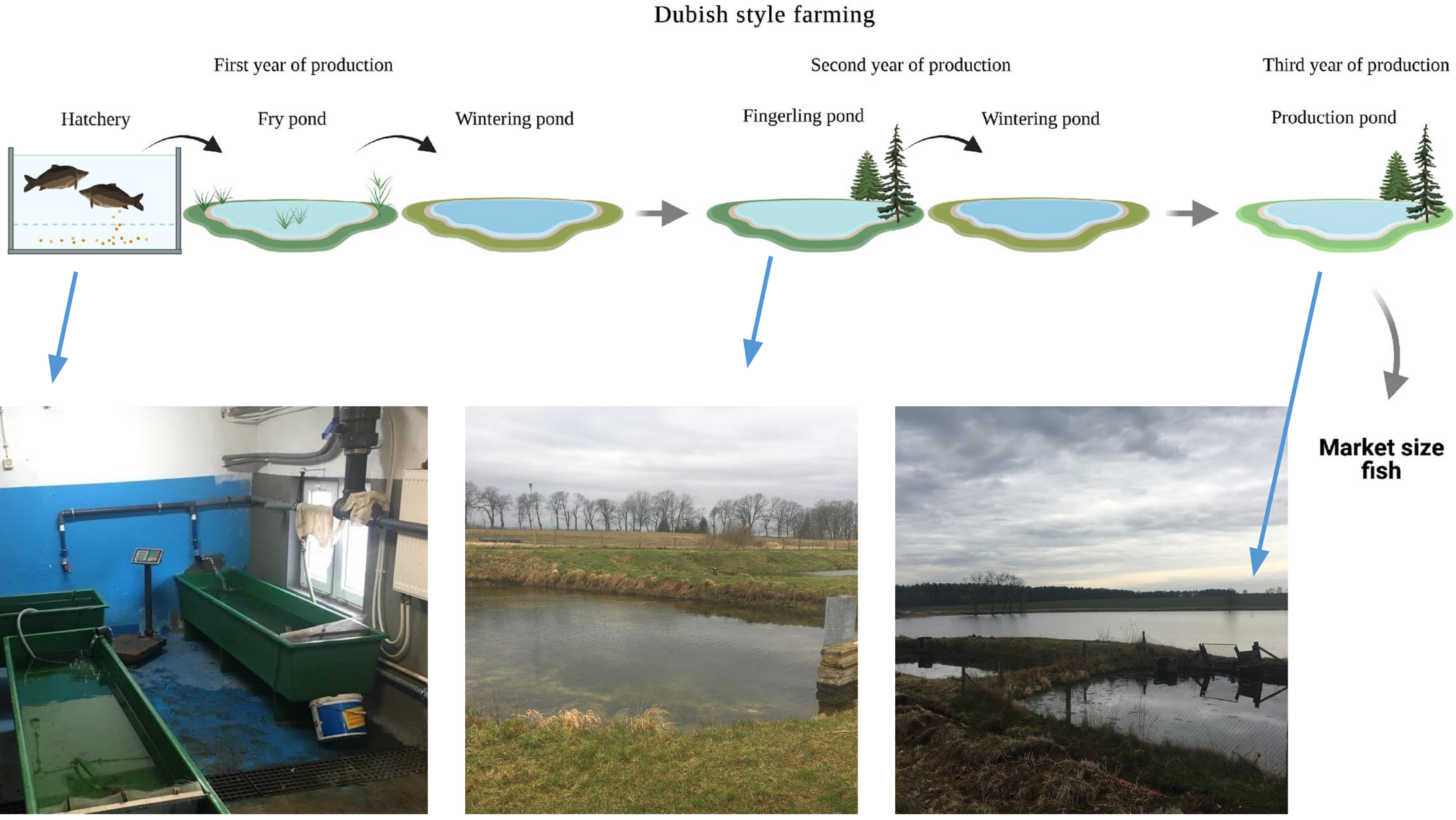

The Mili

Which one do you consider sustainable?

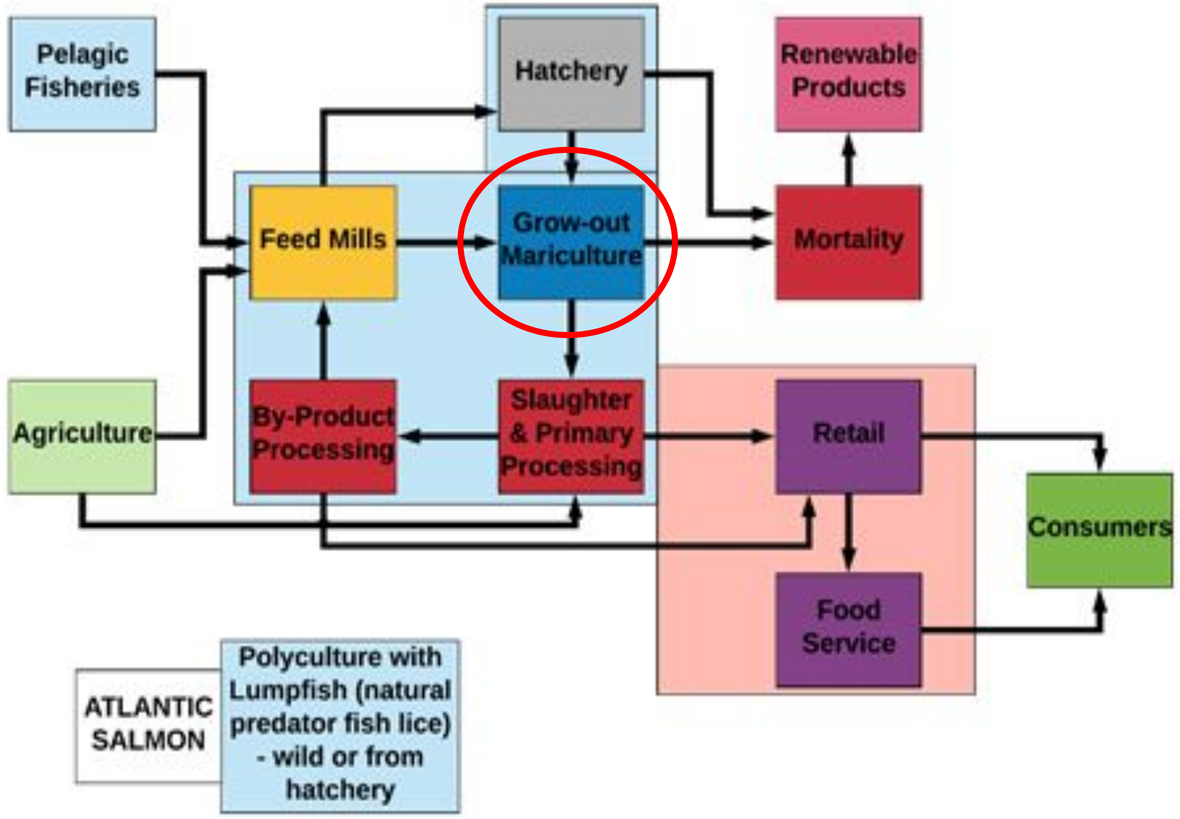
Salmon production

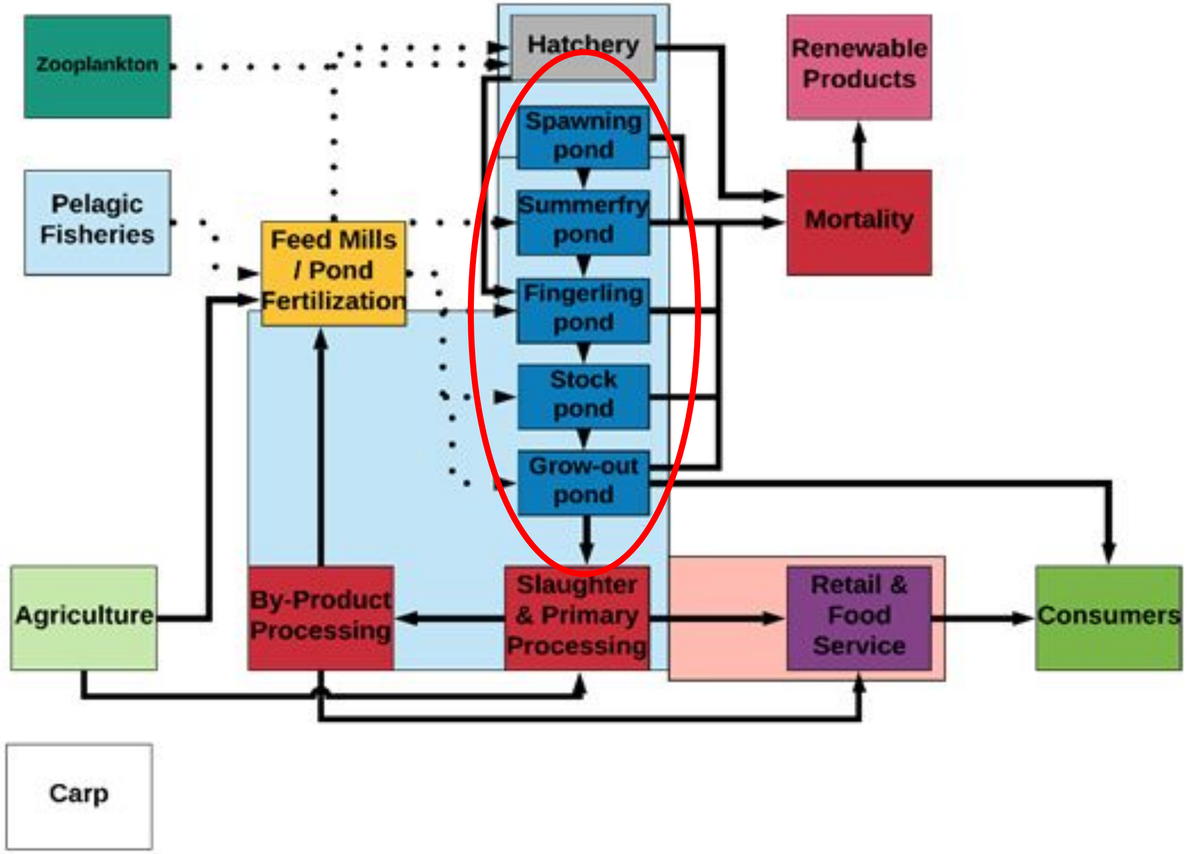


Carp production



Value chain salmon & carp





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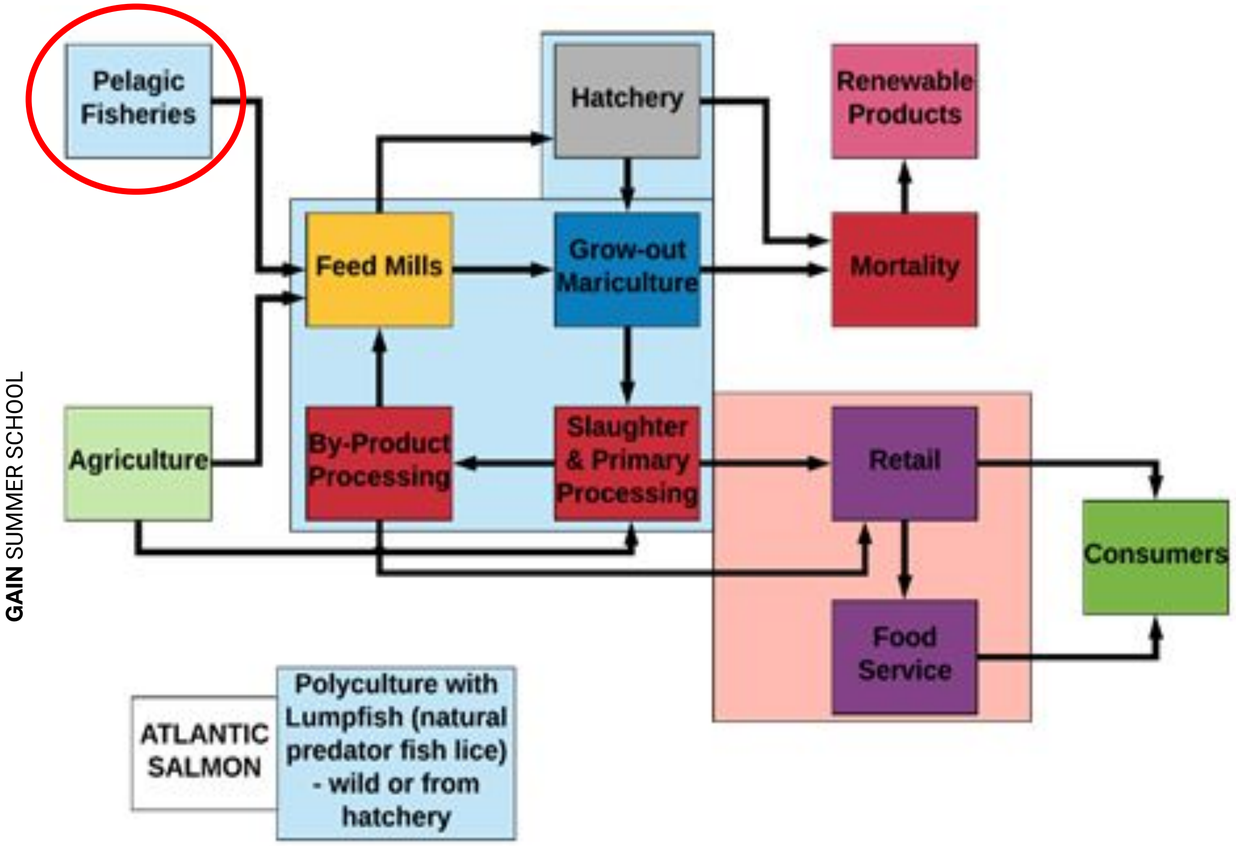

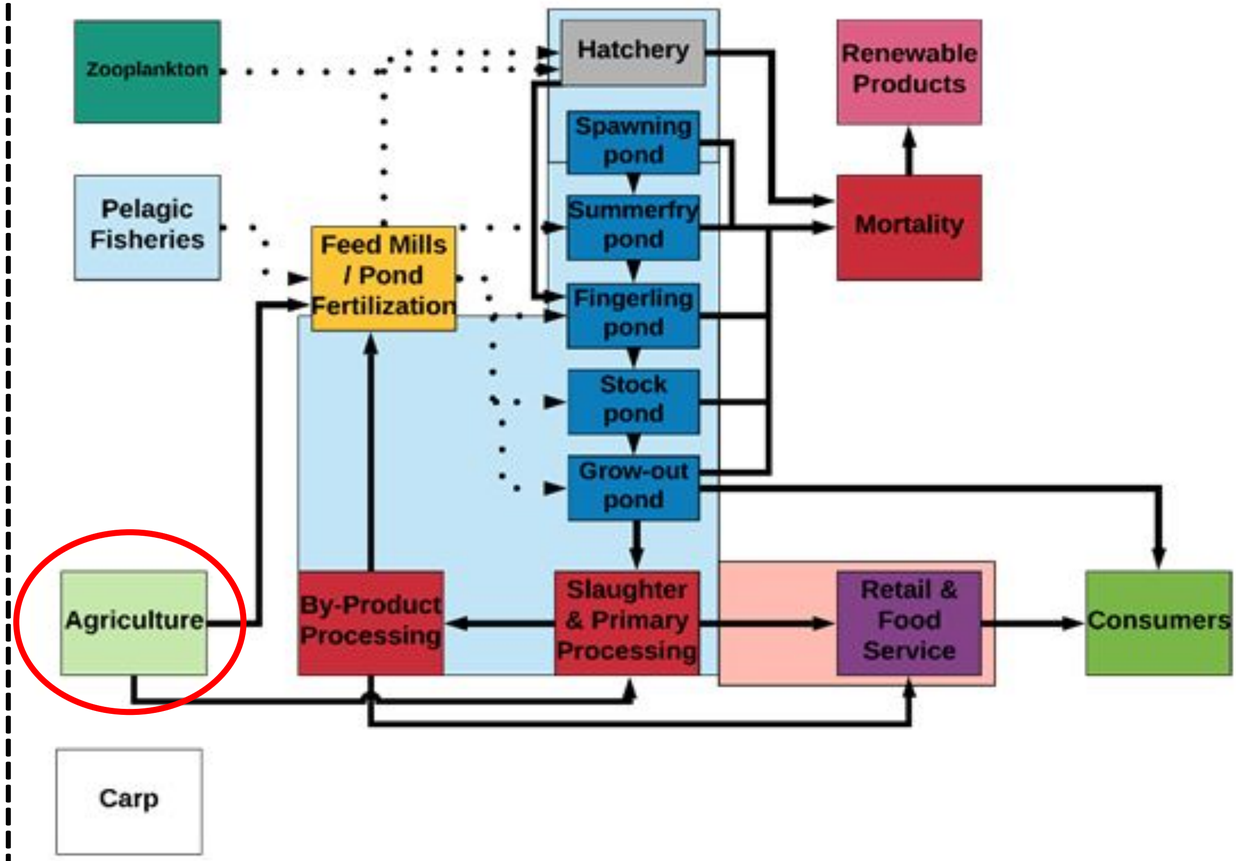

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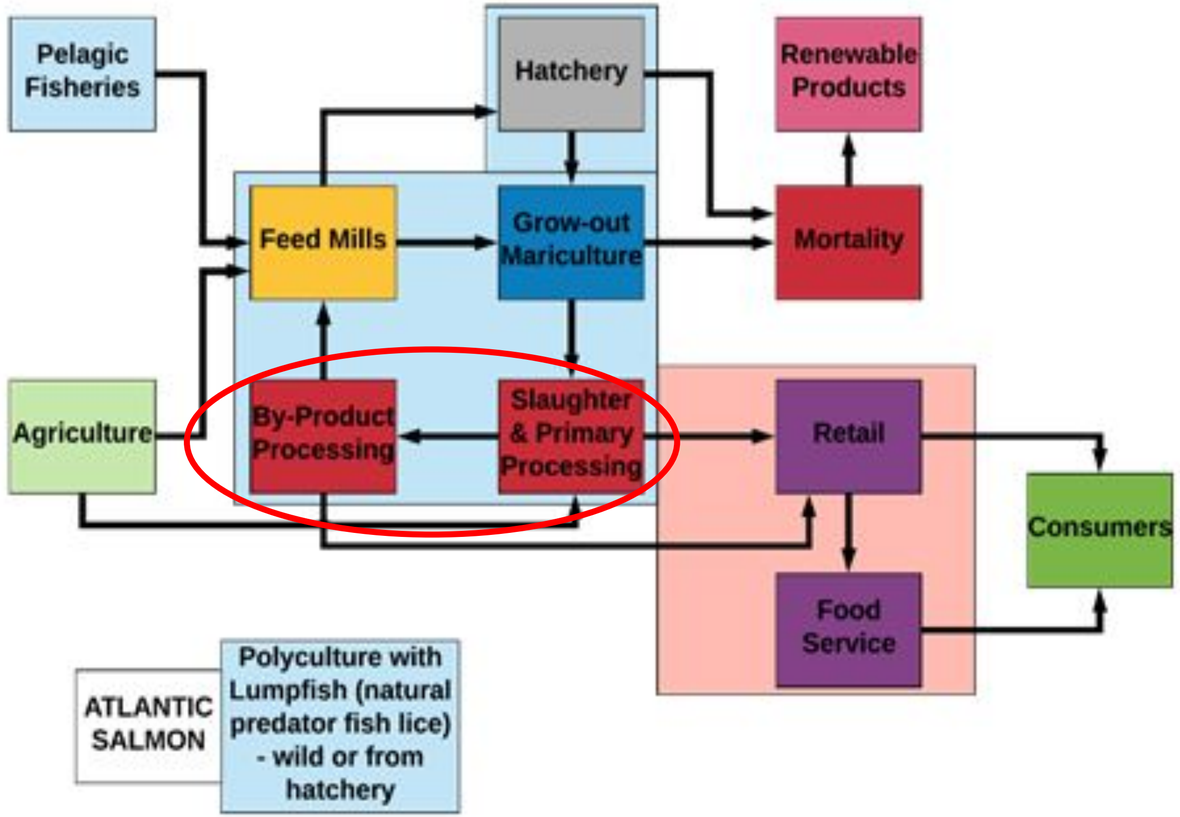

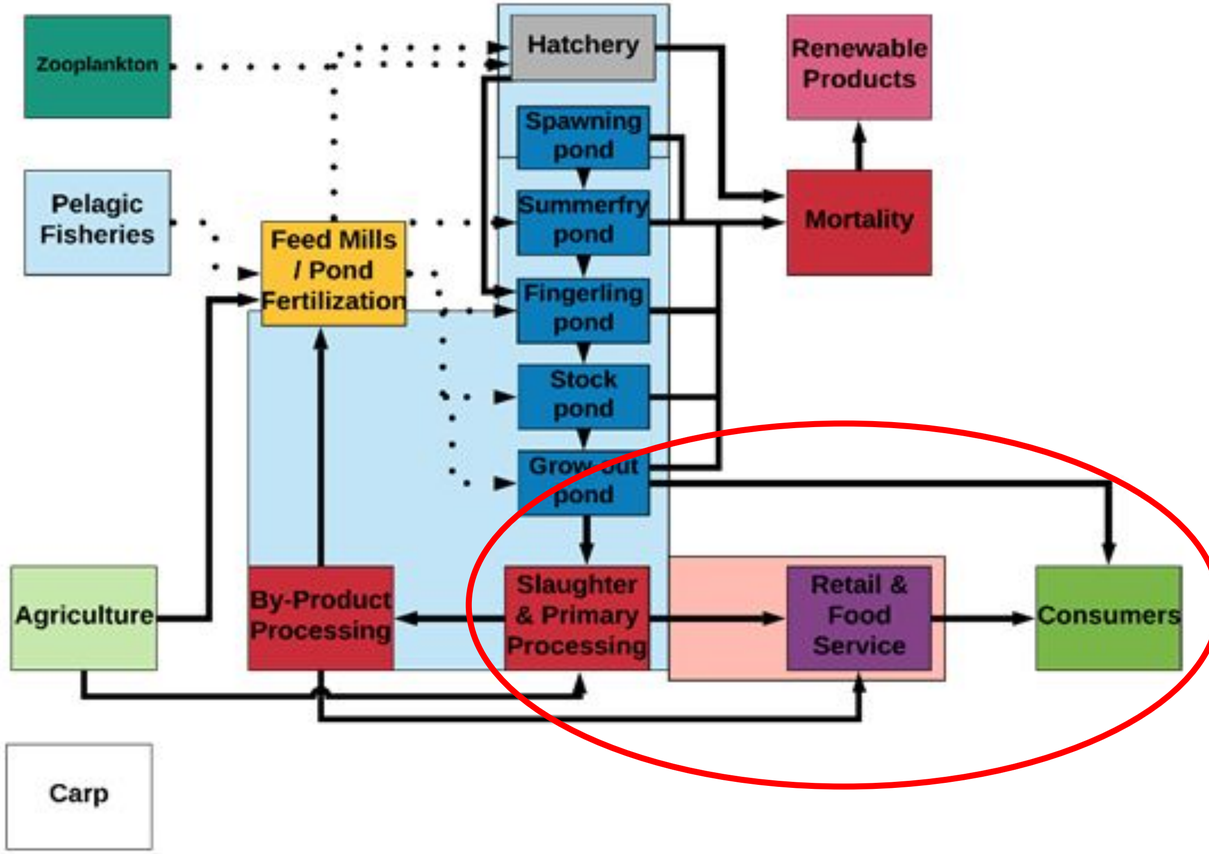

Outcomes of Norway and Poland VCA regarding sustainability factors

Sustainability Factors		
Negative	**Positive**	**Uncertain**
Salmon lice (terms of growth limitations and final product) (4x)	Connecting to main electricity net, less energy use (7x)	Aquafeed ingredients – e.g., soy / potential of novel ingredients (3x)
Limiting allowance medicines (3x)	Feed ingredients, sourcing, and novel feed ingredients (6x)	Production limits (Government) (2x)
Marine ingredient substitutes health and nutritional value (3x)	Resource efficiency (e.g., FCR) of the industry (5x)	Consumer perception towards salmon (bad media image) (2x)

Sustainability Factors		
Negative	**Positive**	**Uncertain**
Climate change (e.g., relation to water availability) (4x)	EU funds for support programs and external assistance (5x)	Climate change - temperature, fish growth) (3x)
Animal predation (increased by low water surface) (4x)	Increase in output of (primary) processing sector (4x)	Policy (national regulations often cannot keep up with R&D) (2x)
Price of water to fill ponds (3x)	Extensive – natural/low waste and energy (4x)	Consumer preferences relatively unknown (2x)

Scoring of Sustainability Indicators through Delphi (Norway)

Economic

Indicators about the economic efficiency of the farm (12):

- eFCR
- Fish rejection at processing
- Input Efficiency and Cost Ratio
- Mortality, kg%
- Innovation value addition
- Market diversity
- Etc.

Environmental

Indicators from LCA (7):

- Global Warming Pot.
- Acidification Pot.
- Eutrophication Pot.
- Land Use
- Etc

Other Indicators (12):

- Fish-in-fish-out (FIFO)
- Recycling by-products
- Nutrients release
- Feed efficiency

Social

Indicators about the working conditions on the fish farm (7):

- Labour structure
- Wage structure
- Employment (FTE eq)
- Labour effort/output
- Employee risk and Safety
- Certification
- Etc.

Fish Welfare

Indicators about the living conditions of fish on the farm (12):

- Fish welfare training
- Active body damage observation
- Mortality, number
- Predation prevention
- Stocking density
- Growth rate
- Slaughter practice score

Sustainability challenges & opportunities

Sustainability challenges & opportunities

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Sustainability challenges & opportunities

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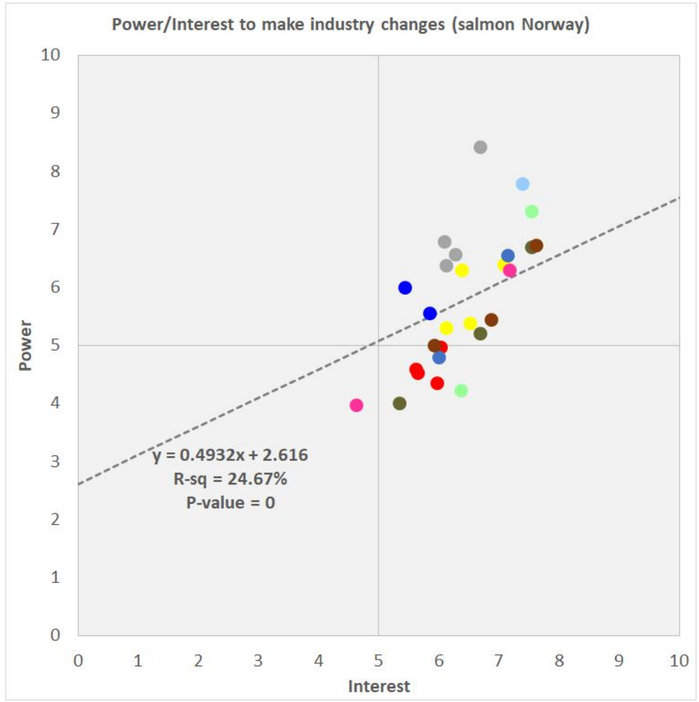
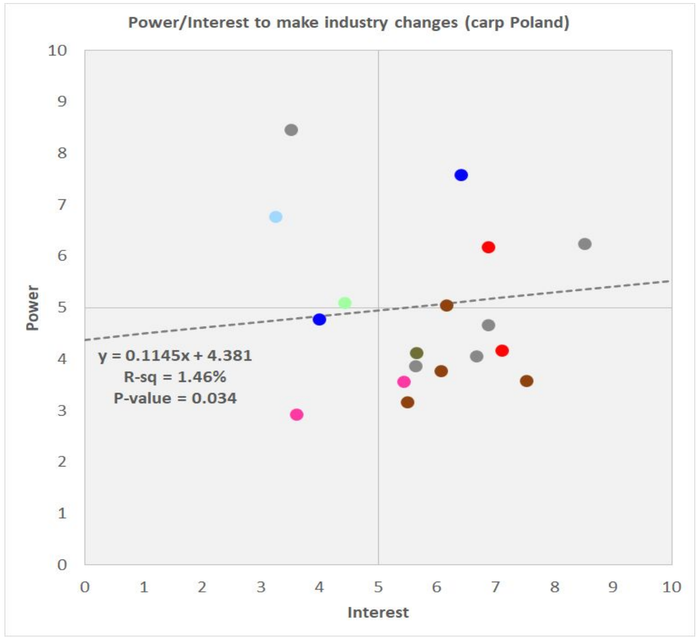
Power and interest

GAIN innovation MAX SCORE 6	Average
Use of big data for welfare	5.52
Use of big data management and support	5.27
Micro algae as a feed ingredient	5.21
Insect protein as a feed ingredient	5.21
Macro algae as a feed ingredient	5.15
Processing by-products for feed	5.15
Hydrolysed fish proteins	4.61
Single cell proteins	4.24



Nodes
Early life stage
Grow-out
Processing
Integrated
Grow-out
Trade
Health
Feed (ingredients)
Education
Equipment
Third

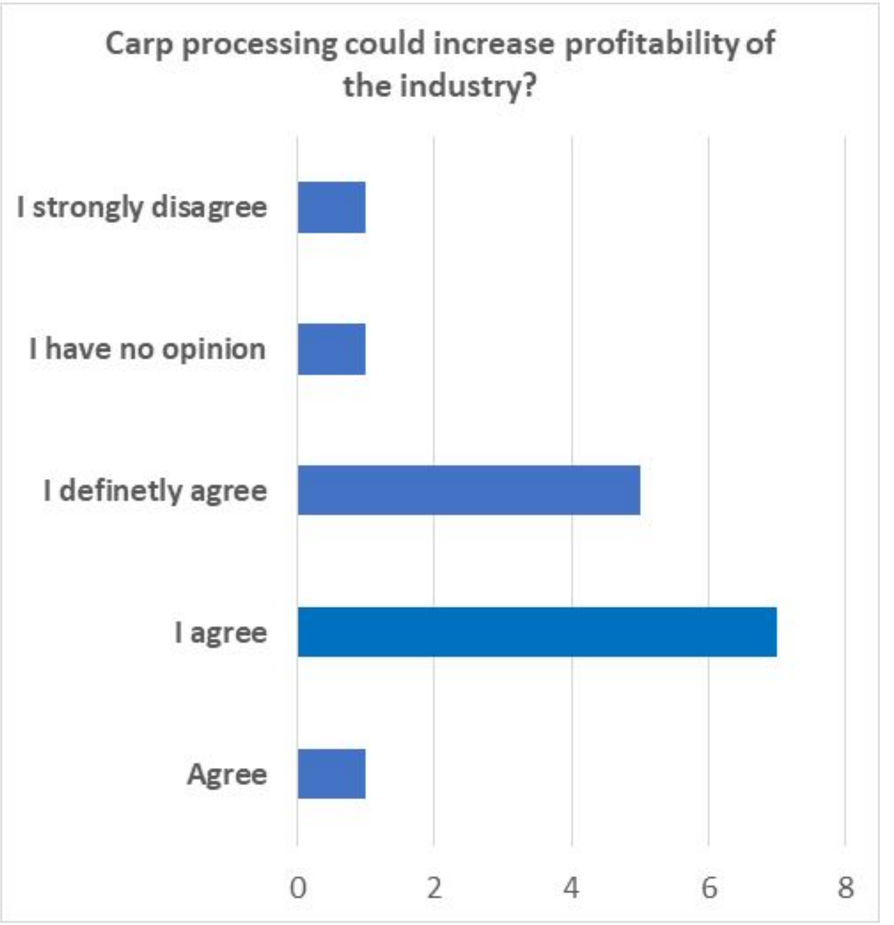
GAIN innovations MAX SCORE 6	Average
Processing by-products for feed	4.40
Sludge for fertiliser	3.87
By-products for cosmetics/nutraceuticals	3.60
Insect proteins	3.53
Micro algae	3.13
Macro algae	3.00



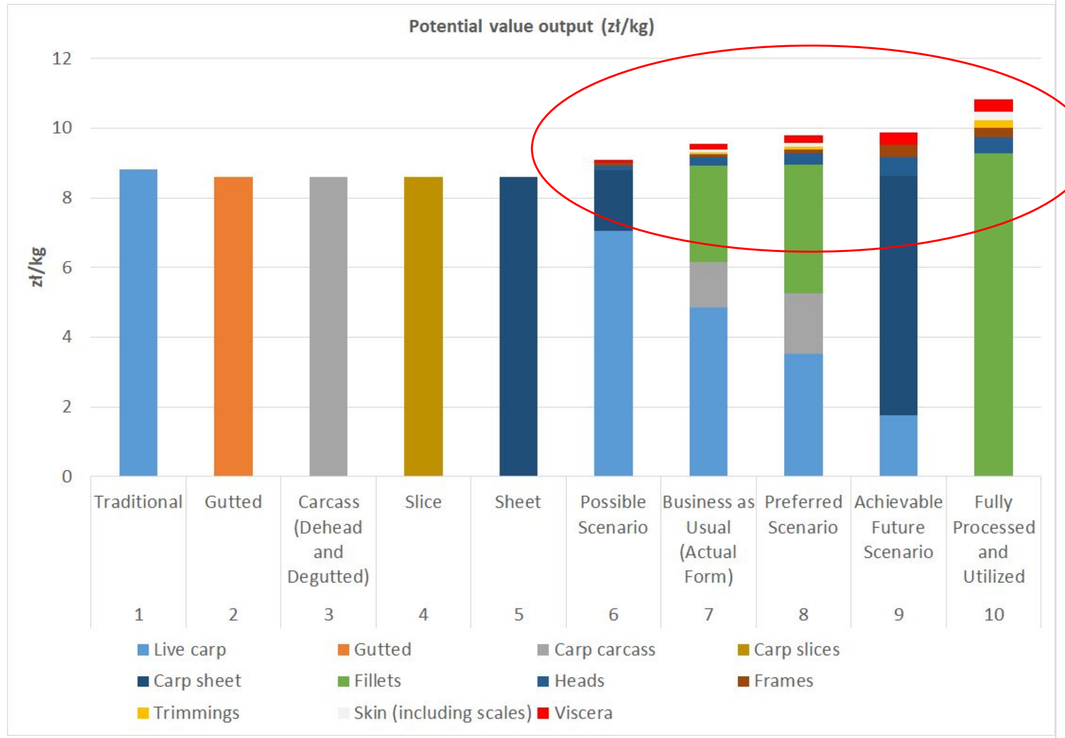
Nodes
Grow-out
Feed (Ingredients)
Processing
Trade
Equipment
Health
Education
Third parties

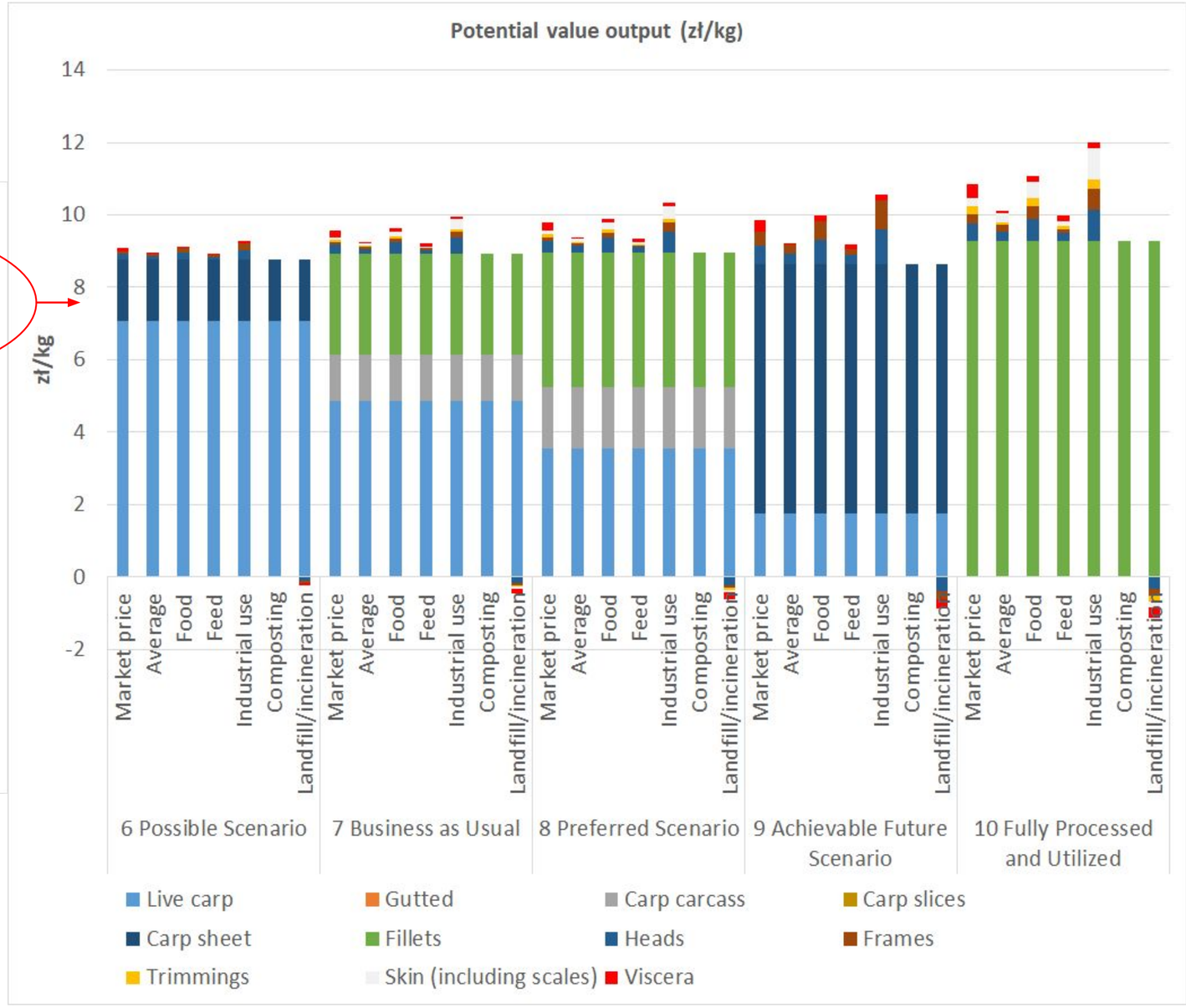
Product diversification

Processing opportunities for carp in Poland



Outcomes Carp Processing Model





- Why is a better understanding of the supply chain important?

→ <u>Example in relation to the circular economy.</u>

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The Need for Traceability in the Seafood Industry

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The Need for Traceability in the Seafood Industry

-Global seafood trade

-Mislabelling (e.g., 20% in pilot study in US) Oceana, 2019

1. Species substitution (pangasius sold as cod)
2. Farmed shrimp sold as wild shrimp

Seafood Adobe Stock

The Need for Traceability in the Seafood Industry

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-IUU (20% world catch, up to 50% in some areas) S. Widjaja et al. 2019.

China Dialogue Ocean, 2018

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-IUU (20% world catch, up to 50% in some areas S. Widjaja et al. 2019.

-Legislation (focus on fish by-products)

1. Intra-species feeding
2. Safety and contamination issues

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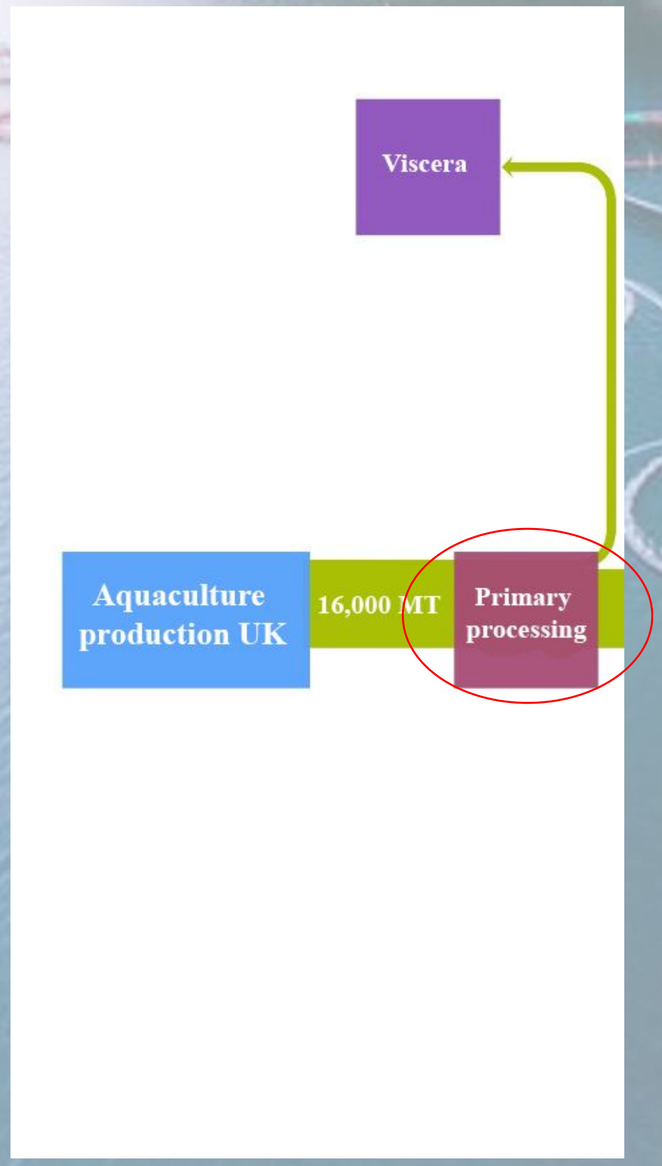
UK Atlantic Salmon aquaculture (2018) – Where are the by-products coming from?



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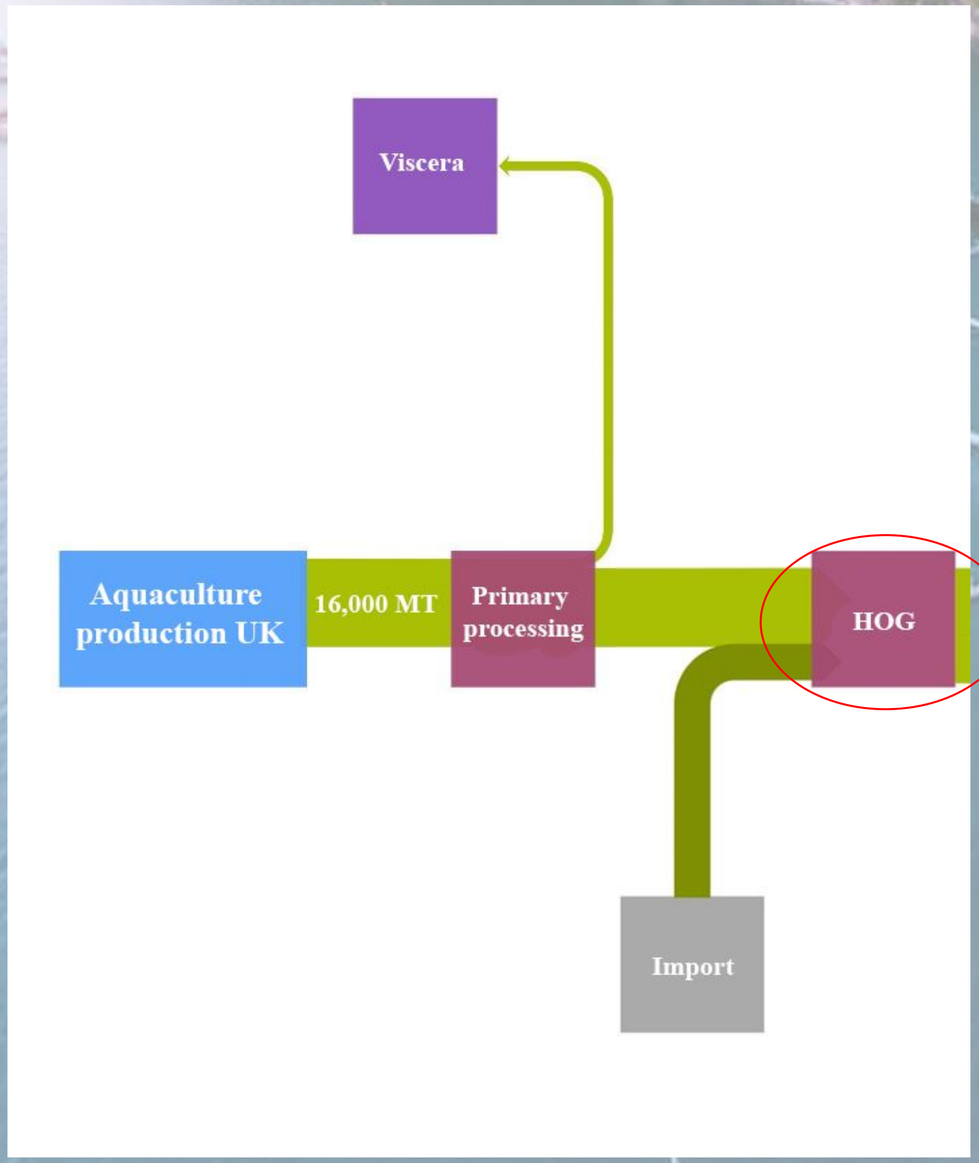

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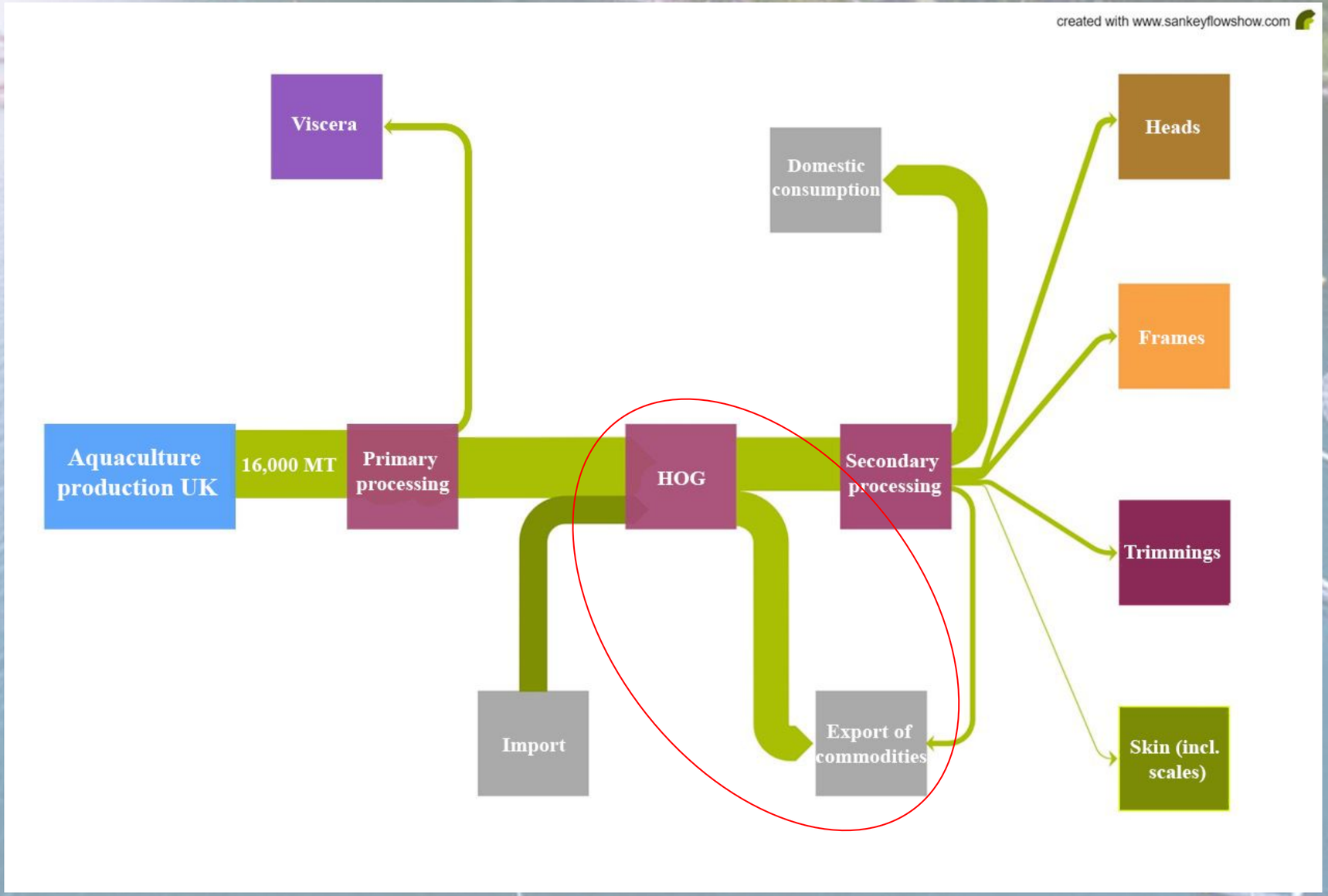

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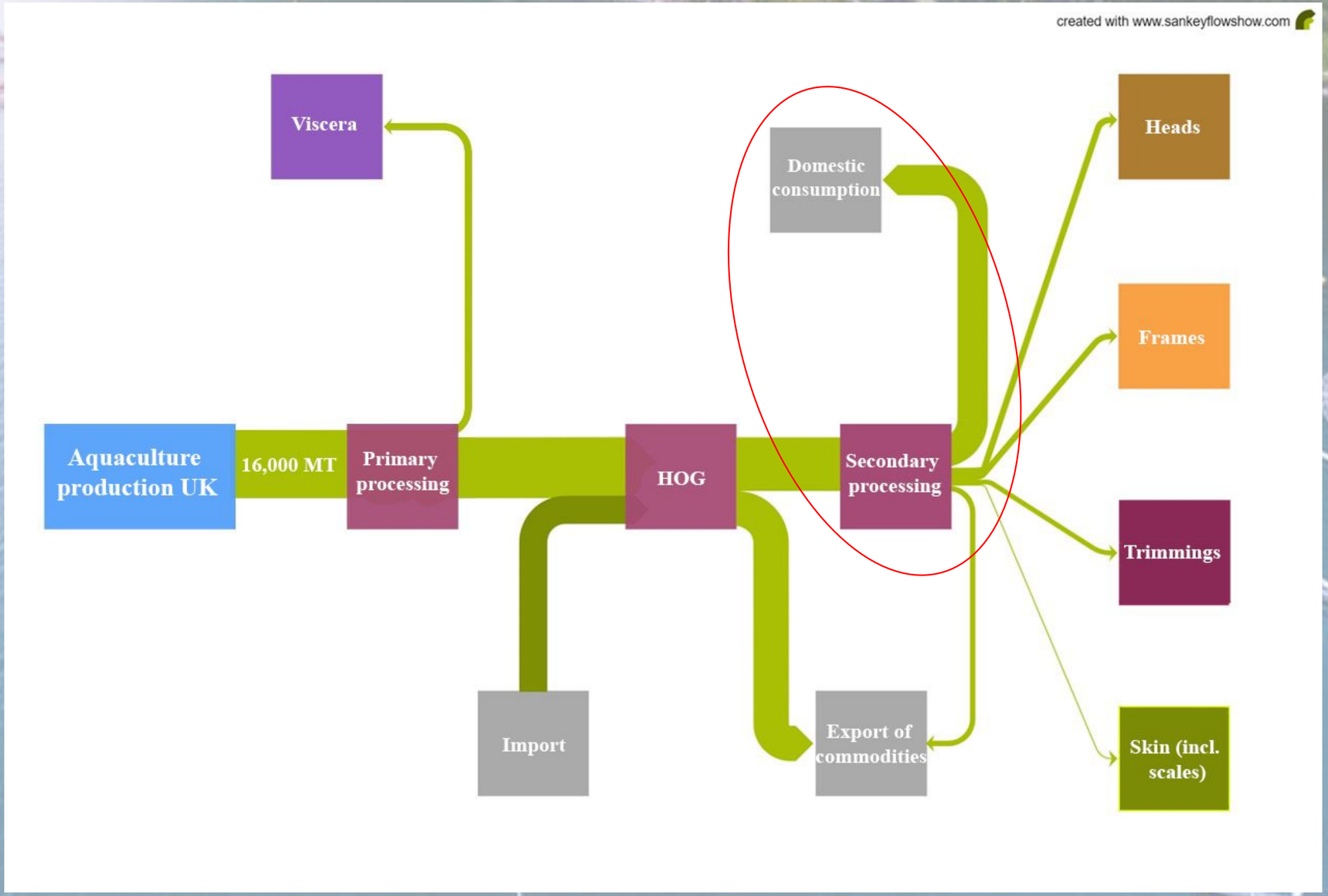

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What about the Norwegian Atlantic Salmon production and Processing?

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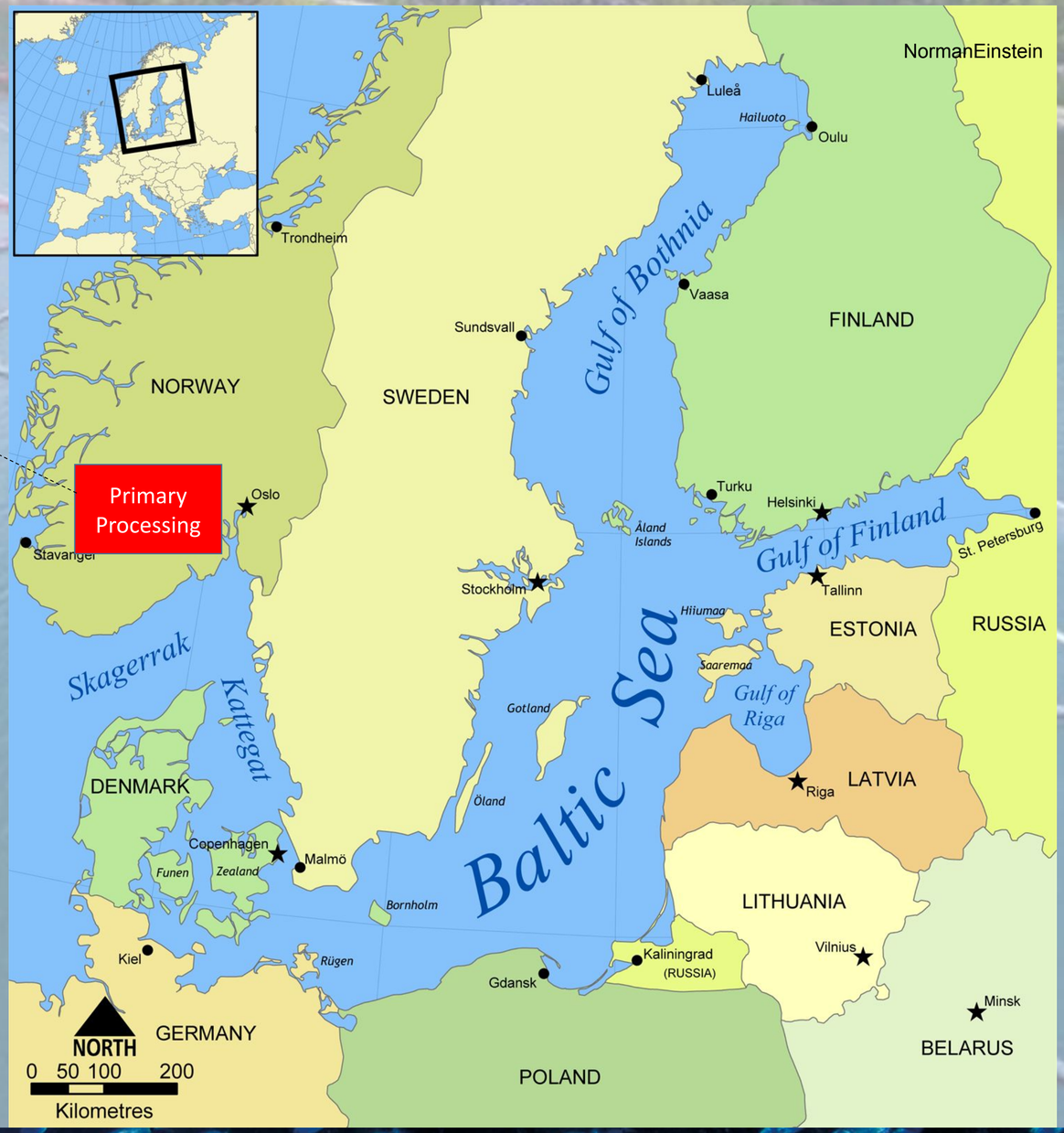
Norway Atlantic Salmon Processing – Socio-Economic Spill-Overs

Viscera

Primary Processing



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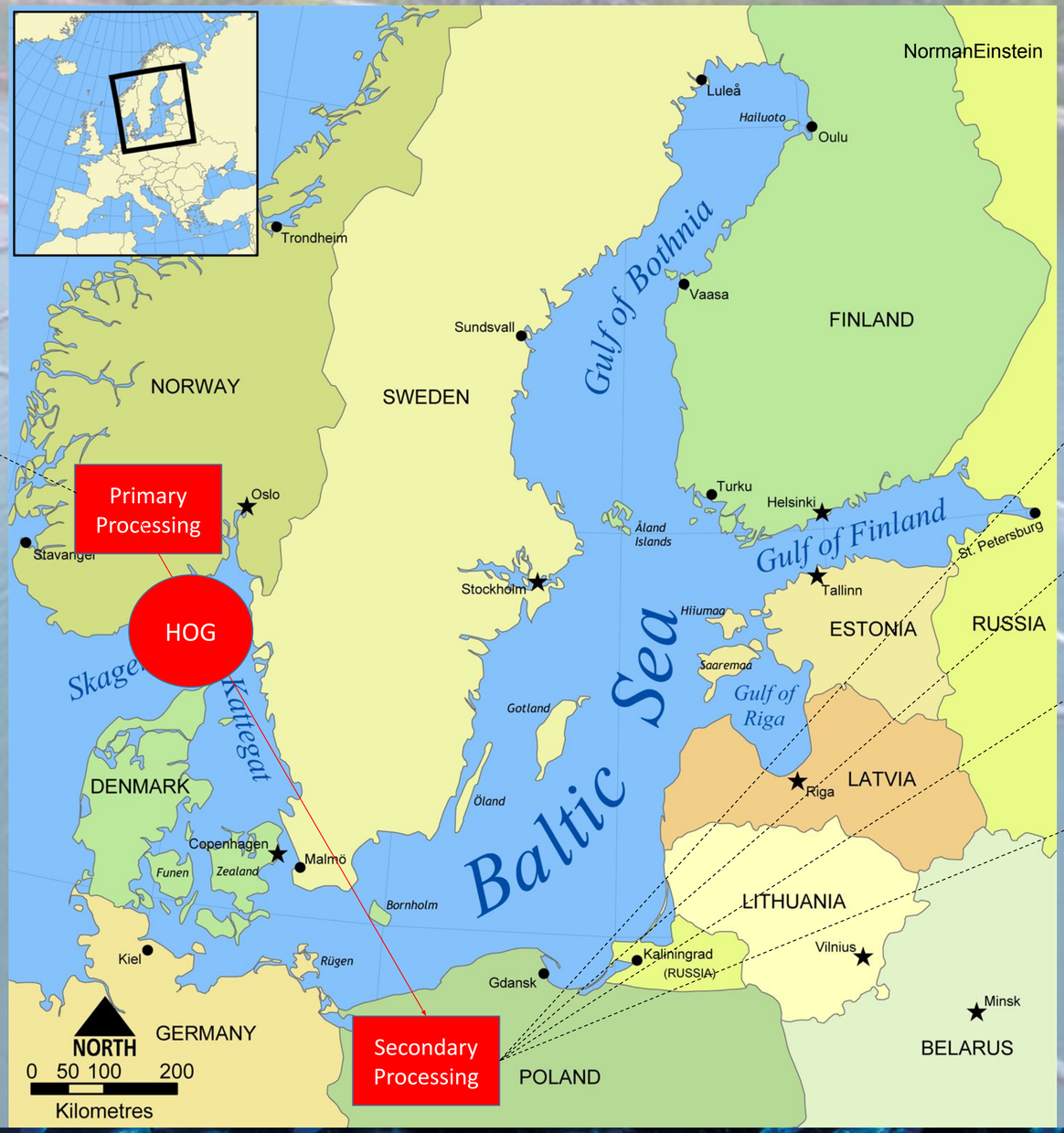
Norway Atlantic Salmon Processing – Socio-Economic Spill-Overs



Viscera

Primary Processing

HOG

Secondary Processing

Heads

Frames

Trimmings

Skin (incl. scales

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… has your perception of sustainability of carp vs salmon farming changed?

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