GAIN
Green Aquaculture Intensification

On The Horizon
EATiP Aquaculture Project
Dissemination Service

Sustainability assessments of European aquaculture within the GAIN project

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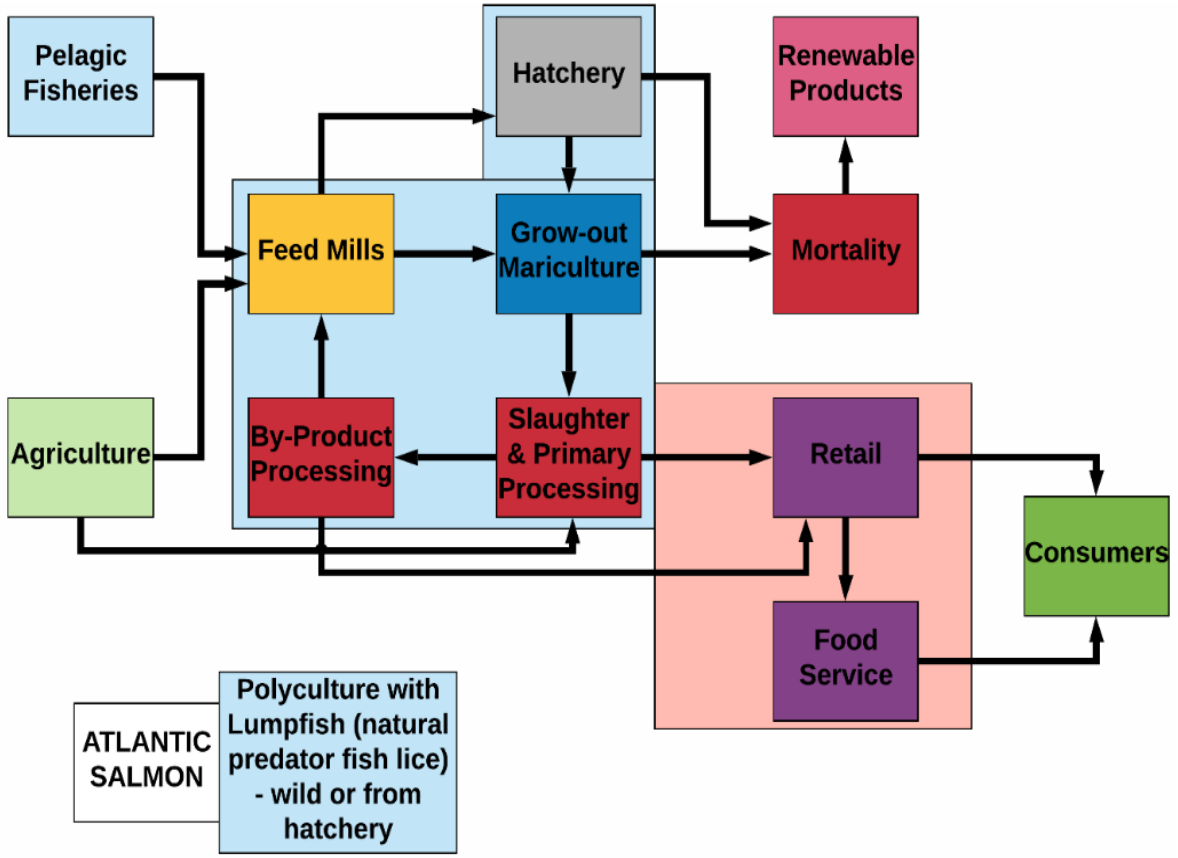
COMPREHENSIVE SUSTAINABILITY ASSESSMENT

- Measure the trade-offs between environment, economic or social impacts
- …and welfare “One Health”
- On-farm or through the value chain?
- Local to consumers, regional, or global impacts?
- Retail and consumer organisations want more transparency over responsible sourcing of products
- Value chain actors want more traceability concerning sustainability

LIFE CYCLE ASSESSMENT AND VALUE CHAIN ASSESSMENT APPROACH

- LCA – measures accumulated environmental impacts throughout a supply chain
- VCA – explores the relationships between different value chain actors and stakeholders and the movement of goods and services
- Related but difficult to integrate



STAKEHOLDER VALIDATED APPROACH (CO-CREATION)

Development of sustainability indicators

- Extensive stakeholder and expert consultation programme to develop indicators and surveys

Economic

Indicators about the economic efficiency of aquaculture (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)
- Chemicals Use
- Benthic impact
- Etc.

Social

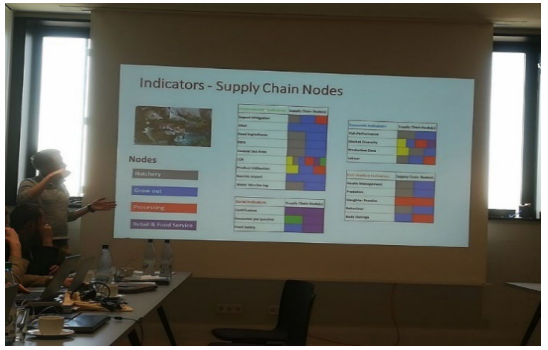
Indicators about the working conditions in aquaculture facilities (7):

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

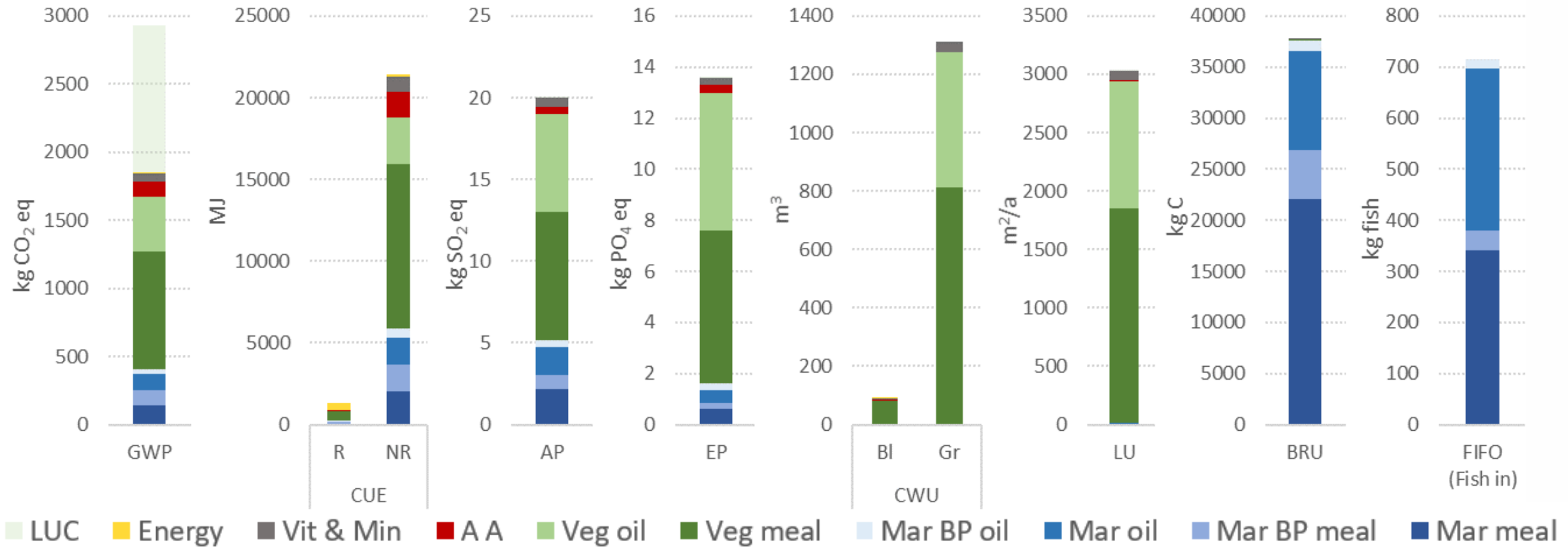
Fish Welfare

Indicators about treatment of animals on far and at slughter (12):

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

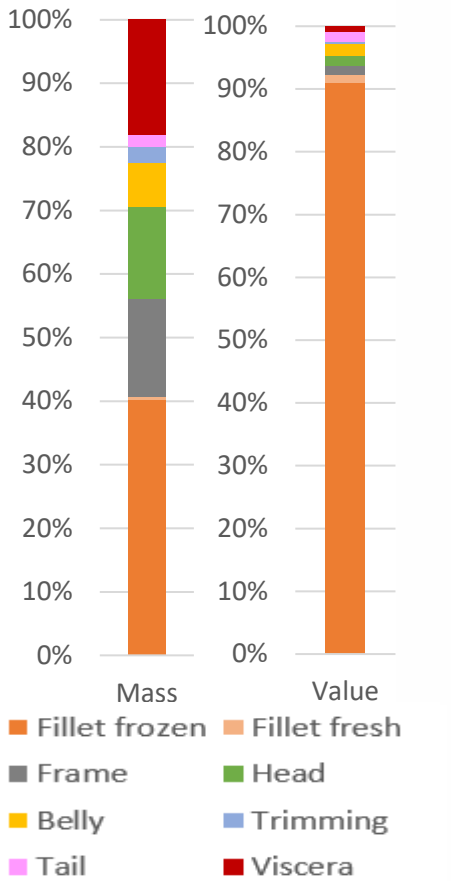


INDUSTRY BENCHMARKING - SUSTAINABILITY INDICATORS EXAMPLES – 1 TONNE SALMON FEED

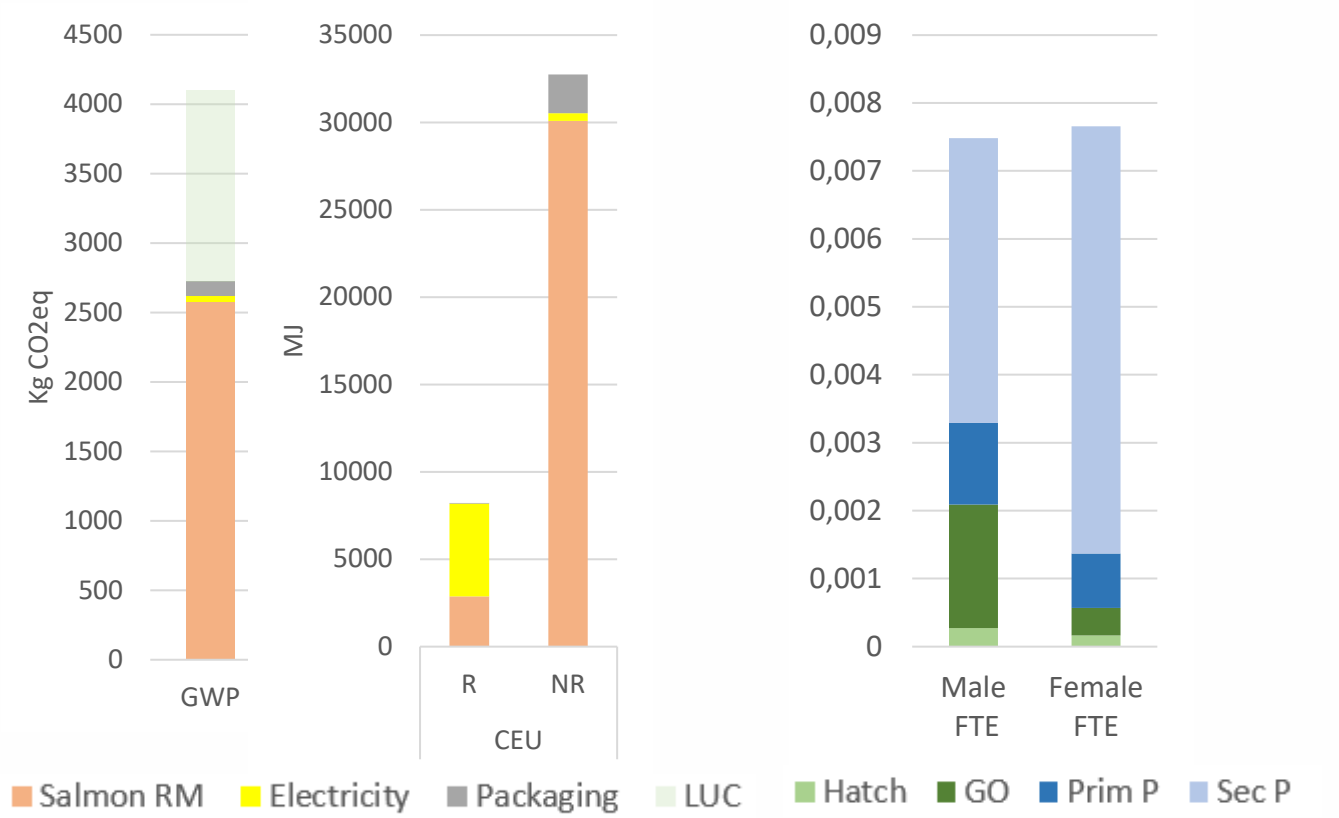


GWP – Global Warming Potential, CEU = Cumulative Energy Demand (Renewable and Non-Renewable), AP - Acidification Potential, EP – Eutrophication Potential, CWU – Cumulative Water Use (Green and Blue), LU – Land Use, BRU – Biotic Resource Use, FIFO – Fish In: Fish Out, LUC – Land Use Change, AA – Amino Acids, Mar – Marine

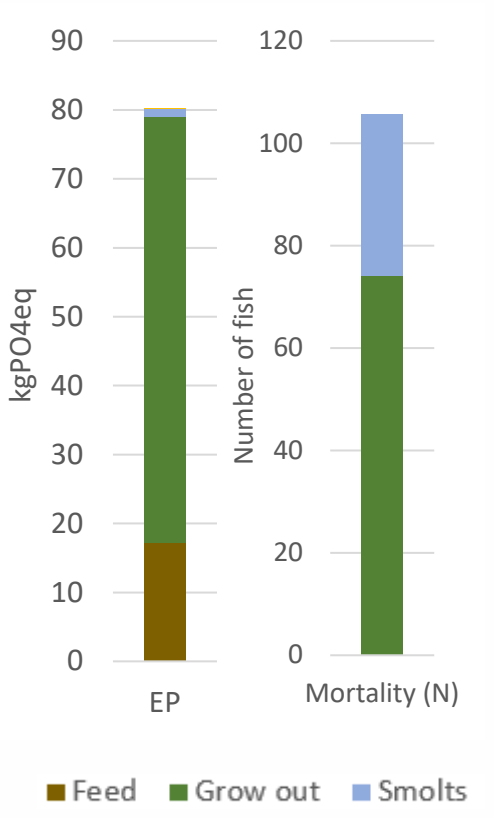
INDUSTRY BENCHMARKING - SUSTAINABILITY INDICATORS EXAMPLES – 1 TONNE SALMON



Proportion of different Norwegian salmon processing co-products by mass and value



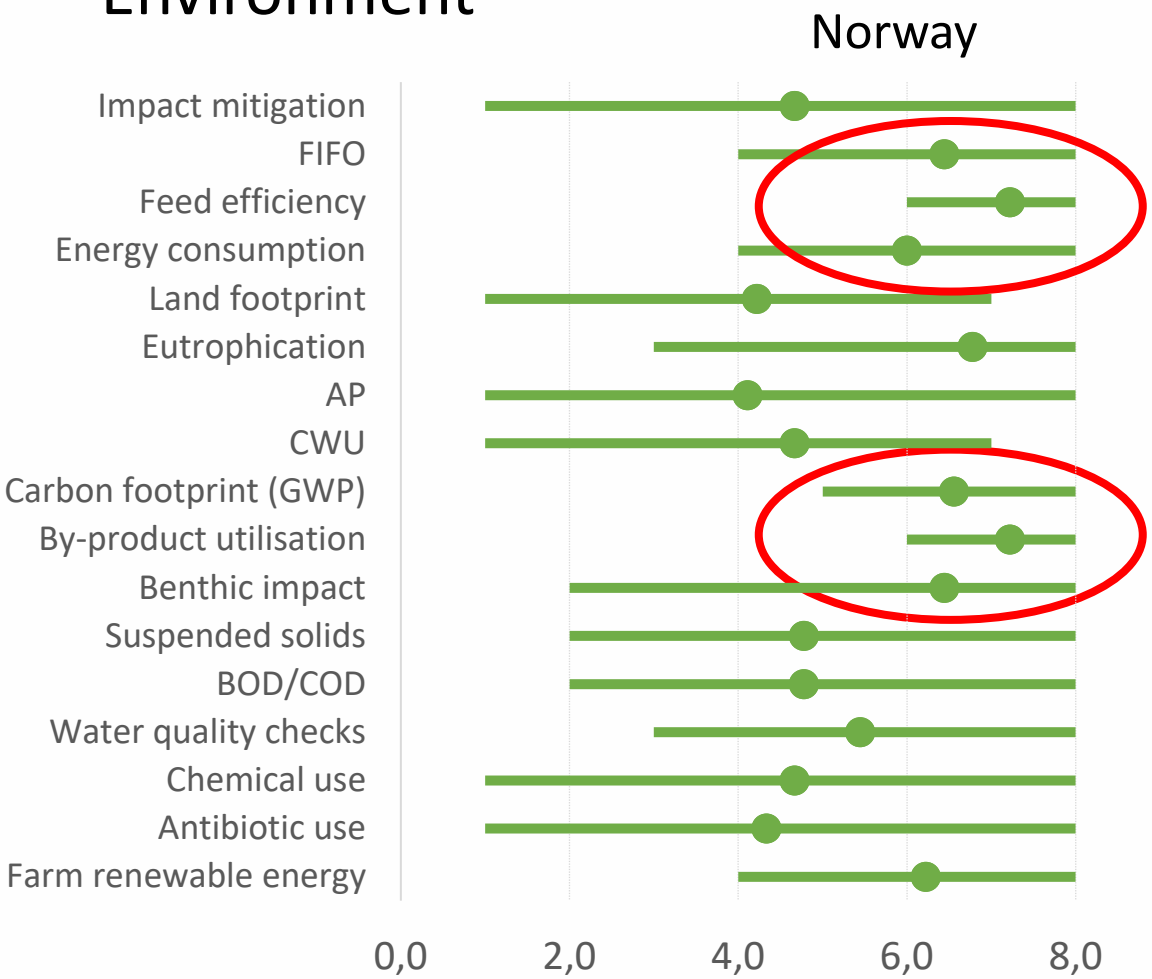
Processing of Norwegian salmon, per tonne of salmon raw material (RM) and male and female full-time employment (FTE) equivalents throughout the value chain (GO = grow out, Prim P and Sec P = Primary and Secondary processing respectively).



Selected sustainability indicators from LCA of Norwegian salmon benchmark data. One tonne of salmon at farm gate.

STAKEHOLDER ENGAGEMENT TO WEIGHT INDICATORS

- Environment



- Stakeholders were invited to score sustainability indicators before compiling into an index
- E.g. environmental indicators

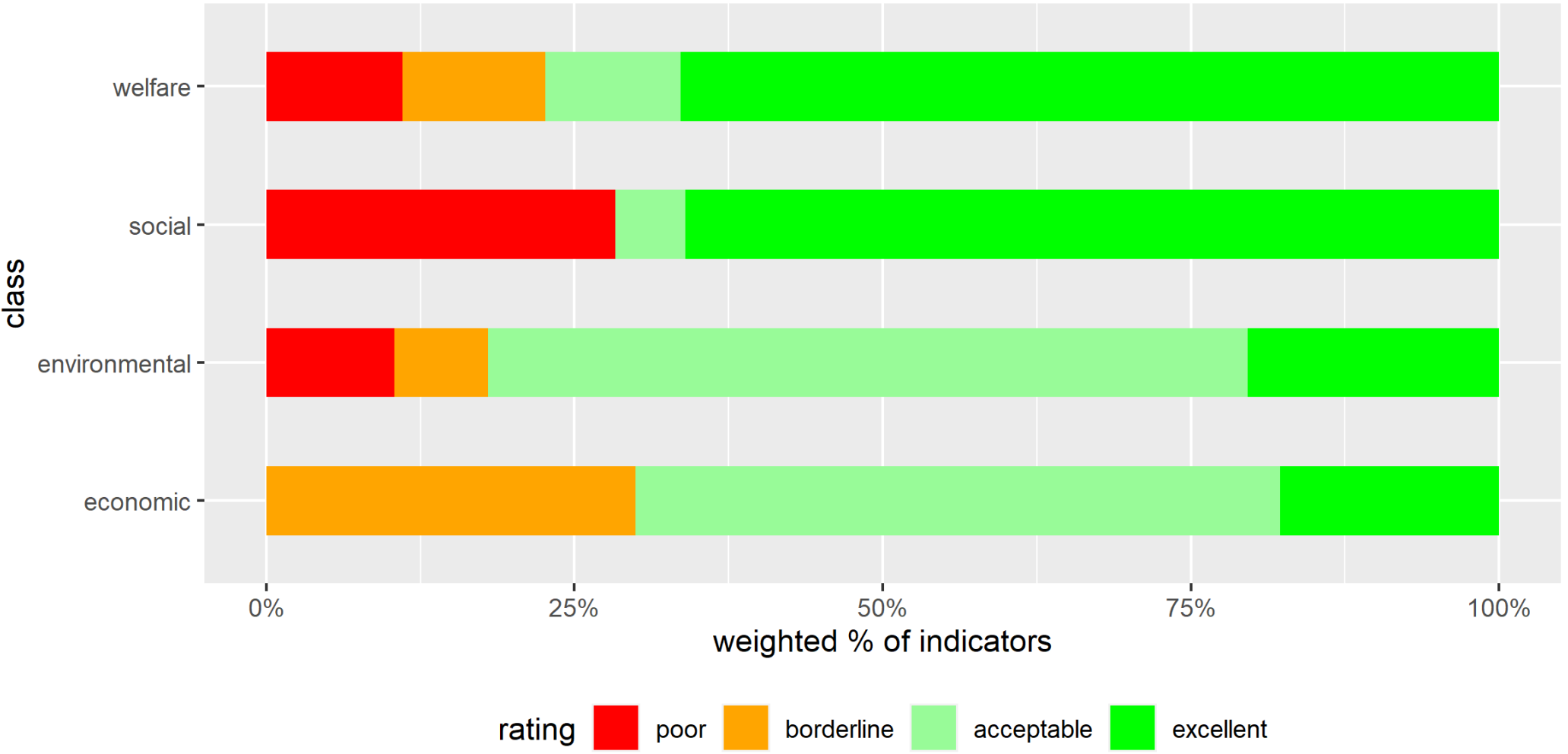
- By-product use, FIFO, Feed, Energy, Benthic impact and Eutrophication in Norway

COMPILATION OF INDICATORS INTO THE SUSTAINABILITY MATRIX

Assign traffic light scoring thresholds to indicator values based on literature and expert opinion

Indicator	Unit	Wt	Poor	Borderline	Acceptable	Good	Ave score
Amount of production on electricity	%	6.2	<3	3 to 10	10 to 20	>20	20
Antibiotic.use	Number	4.3	>0	>0	>0	0	0
Water.quality.checks	%	5.4	<7	<15	15 to 50	>50	62
Benthic.impact	$g/m^2/yr$	6.4	>900	700-900	300-700	<300	1098
By-product.utilisation	%	7.2	<60	60 to 70	70 to 90	>90	80.35
Carbon.footprint.(GWP)	kg CO_2 eq	6.6	>3000	2500 to 3000	1800 to 2500	<1800	2599
CWU	m2	4.7	>2500	1500 to 2500	1000 to 1500	<1000	1811
AP	kg SO_2 eq	4.1	>40	30 to 40	20 to 30	<20	26.2
Eutrophication	kg PO_4--- eq	6.8	>120	100 to 120	80 to 100	<80	79.7
Land.footprint	m2a	4.2	>5000	4000 to 5000	2000 to 4000	<2000	3898
Energy.consumption - EROI	%	6.0	<.2	.2 to .3	.3 to .4	>.4	3.94
FIFO	kg Fish In /kg	6.4	>1.3	1.1 to 1.3	0.9 - 1.1	<0.9	0.96
Impact.mitigation	average number	4.7	0	0 to 2	2 to 3	>3	2.92

FINAL INDEX IS A TRAFFIC LIGHT SYSTEM FOR EACH SUSTAINABILITY AREA



Norwegian salmon EISI

CONCLUSIONS

- Sustainability indices can be constructed for a wide range of indicators but....
- Further industry validation, indicator weighting and threshold values required
- Better spread of indicators – (socio economic)
- Application to more diverse production systems.
- Applicability and consistency to industry

THANK YOU!

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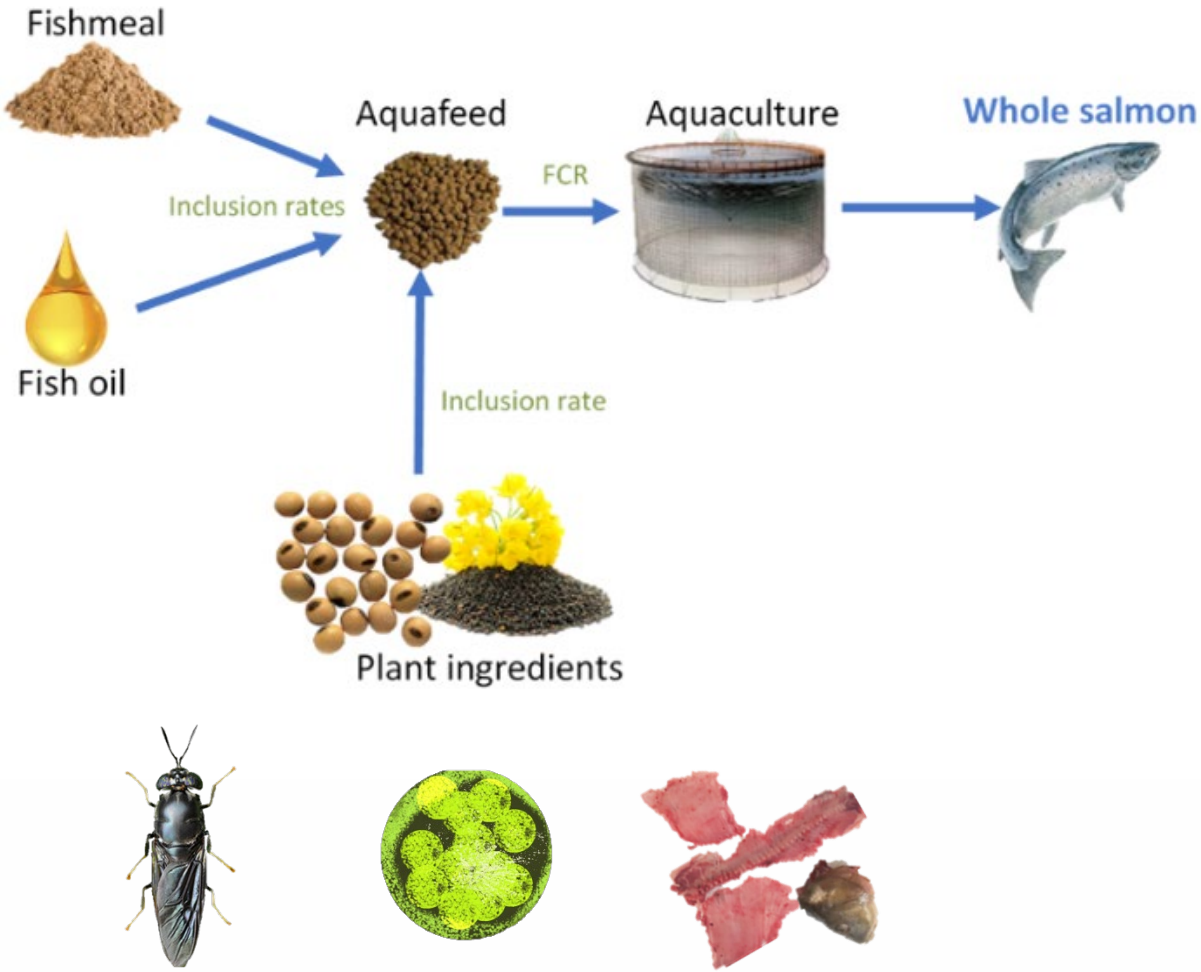
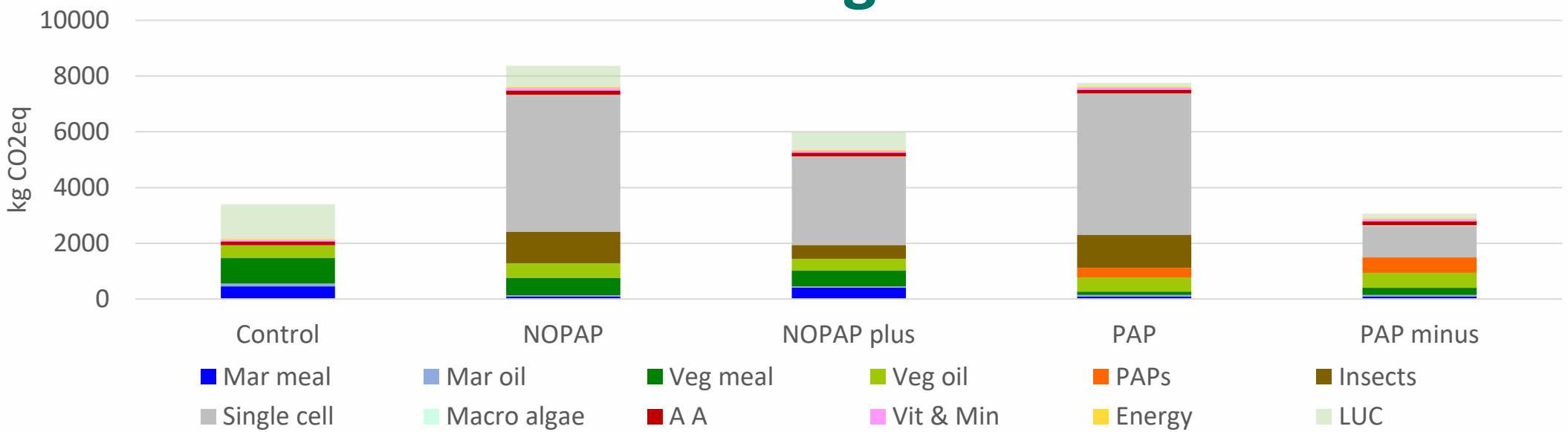
Independently validated assessments of innovations

- In most fed aquaculture production systems, feed contributes to >95% of carbon, water and land footprints
- It is imperative to be efficient with the use of feed, i.e. reduce FCRs
- …and to procure feed ingredients from sustainable and responsible sources
- Ever increasing pool of ingredients on the market
- Many claims and counter claims – Policies and sustainability credentials are not always clear - Greenwash?!



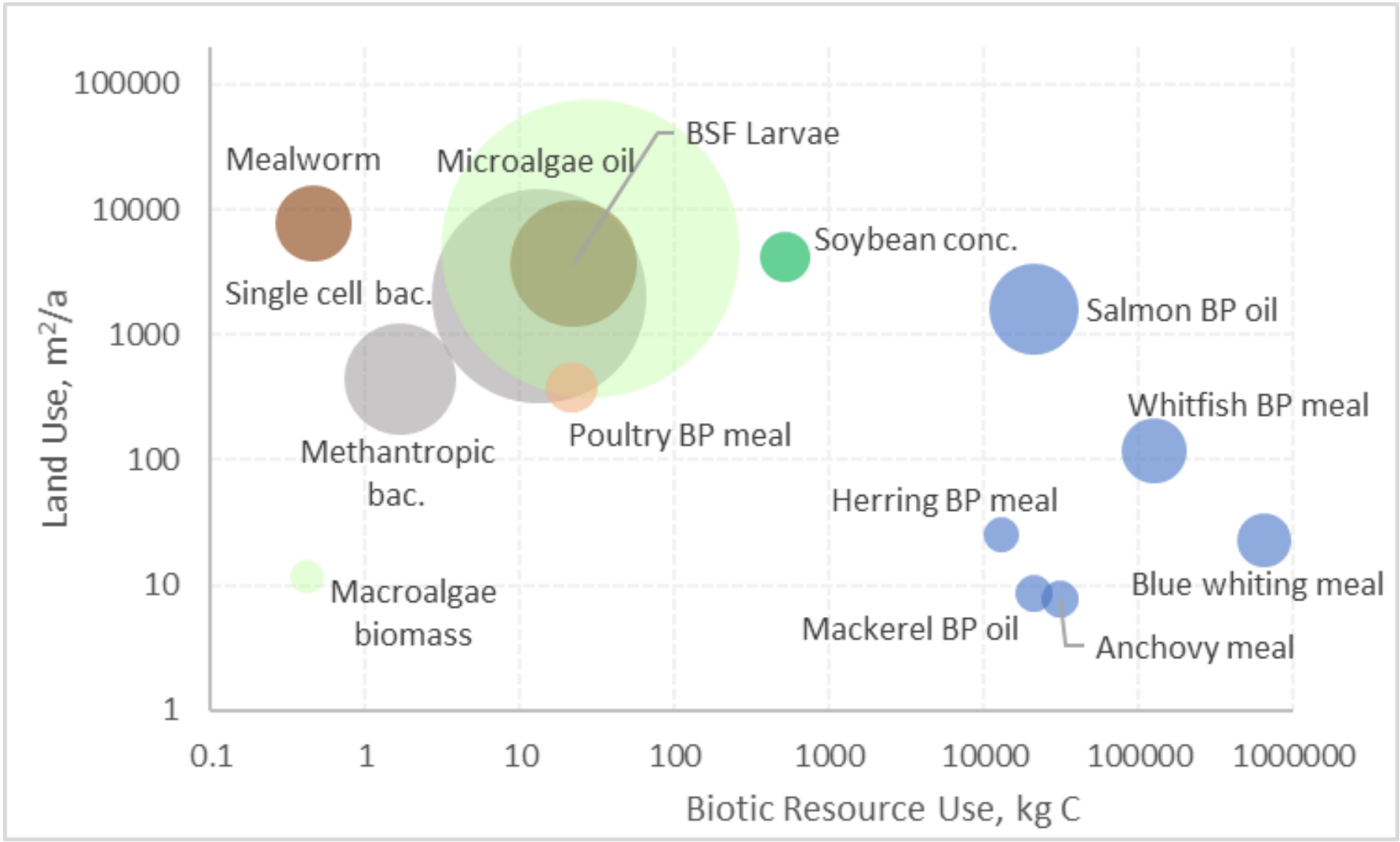
EISI sustainability Indicators – 1 tonne salmon from trial feeds
Global Warming Potential



- GWP generally higher than control for trial diets
- Only PAP minus is comparable to control when including LUC
- Single cell (micro algae protein and oil) are large contributors

Trade off between feed ingredient impacts

- Marine ingredients- high BRU, low LU and GWP (bubble size)
- Soy – medium BRU, high LU and low GWP
- Novel ingredients – low BRU, high land and some very high GWP
- PAPs – low BRU, LU and GWP
- Macroalgae – very low BRU, LU and GWP



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