Climate footprint and strategic value of marine ingredients

James Hinchcliffe,

Biologist of EFFOP, Marine Nutrients Europe

Market advisory council

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EFFOP – Marine Nutrients Europe: An overview

Who We Are

We represent Europe's leading fish protein and fish oil producing nations. Together, we work to:

- Sustain and strengthen the blue value chain
- Advance circularity within the blue economy
- Safeguard our sector's contribution to the global food system

EFFOP – Marine Nutrients Europe brings together national industry associations and companies from 13 European countries.

Our Membership

Producer Members
National associations and individual producers dedicated to fishmeal and fish oil production across Europe.

Associated Members
Companies and organisations whose activities — including business operations, technological research, and product development — are directly linked to the marine ingredients sector.

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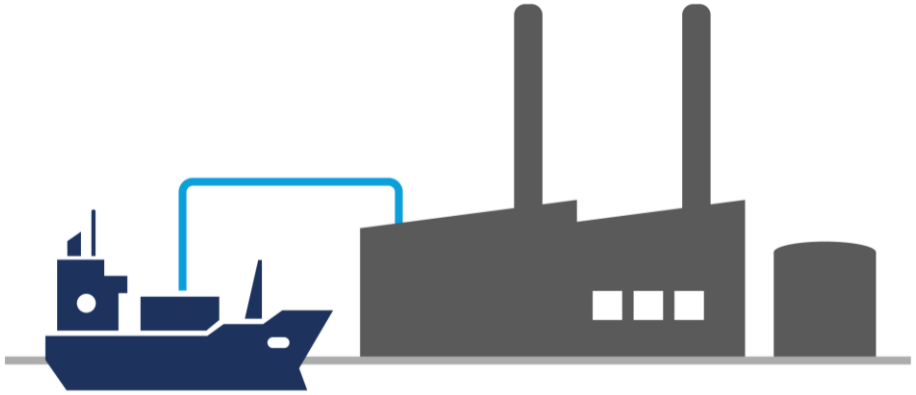
A key player in the aquaculture value chain



2024 Production

Fishmeal Production: 565,531 tonnes

Fish Oil Production: 145,294 tonnes

2020 – 2024 Average

Fishmeal Production: 594,059 tonnes

Fish Oil Production: 186,083 tonnes

EFFOP members source from a variety of stocks and collectively handle nearly 3 million tonnes of raw material annually.

Total Raw Material Received 2024: 2,924,522 tonnes

Material Composition:

- **Whole fish: 69.3% (≈ 2,029,672 tonnes)**
- **Trimmings: 30.7% (≈ 894,850 tonnes)**

EFFOP's Position in the Aquaculture Value Chain

EFFOP members purchase and **process** small pelagics and by-products into high-value marine ingredients that supplies aquafeeds

For our members, stock development and management decisions directly affect:

- Raw material availability
- Production volumes
- Certification status and market access
- Price formation in marine ingredient markets

Upstream – Fisheries

Scientific advice provided annually by ICES

Various fish stocks harvested in European waters by coastal states

Midstream – Marine Ingredient Production (EFFOP Members)

Purchase whole-fish raw material and by-product raw material

Process into fish protein and fish oil

Ensure quality control, traceability, and certification compliance

Supply high-value marine nutrients to aquafeed producer

Downstream – Feed & Aquaculture

Marine ingredients incorporated into aquafeed formulations

Support fish health, growth performance, and welfare

Enable production of farmed seafood for global markets

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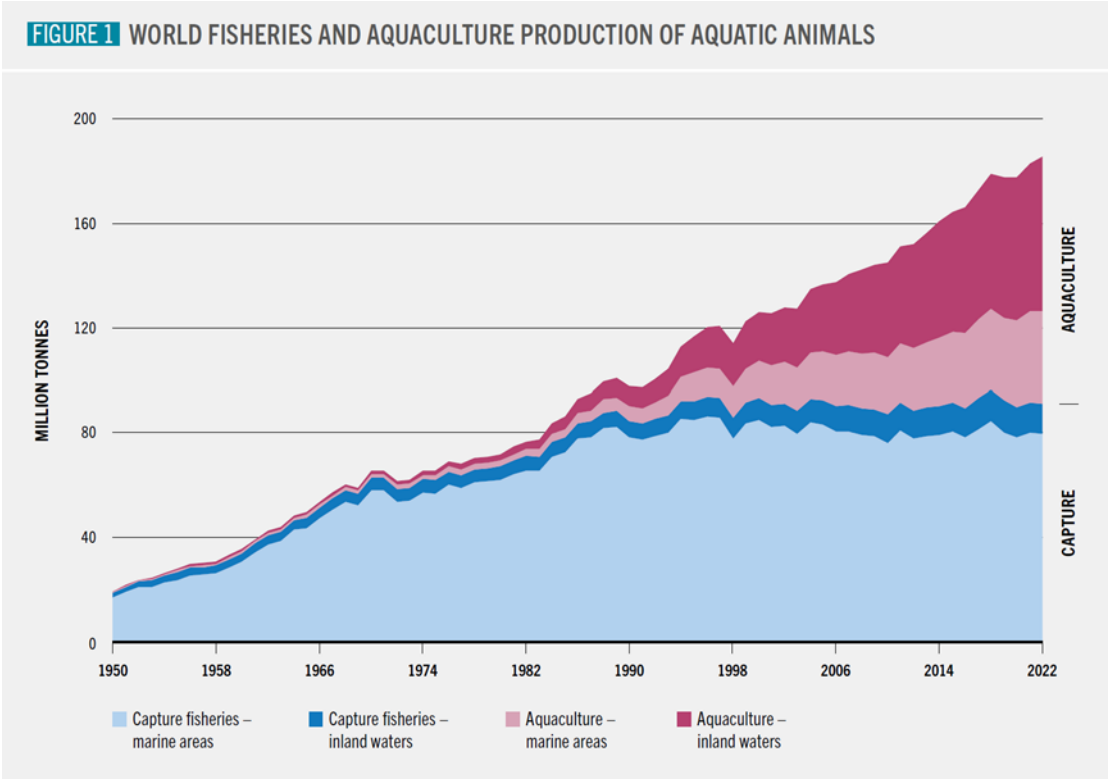
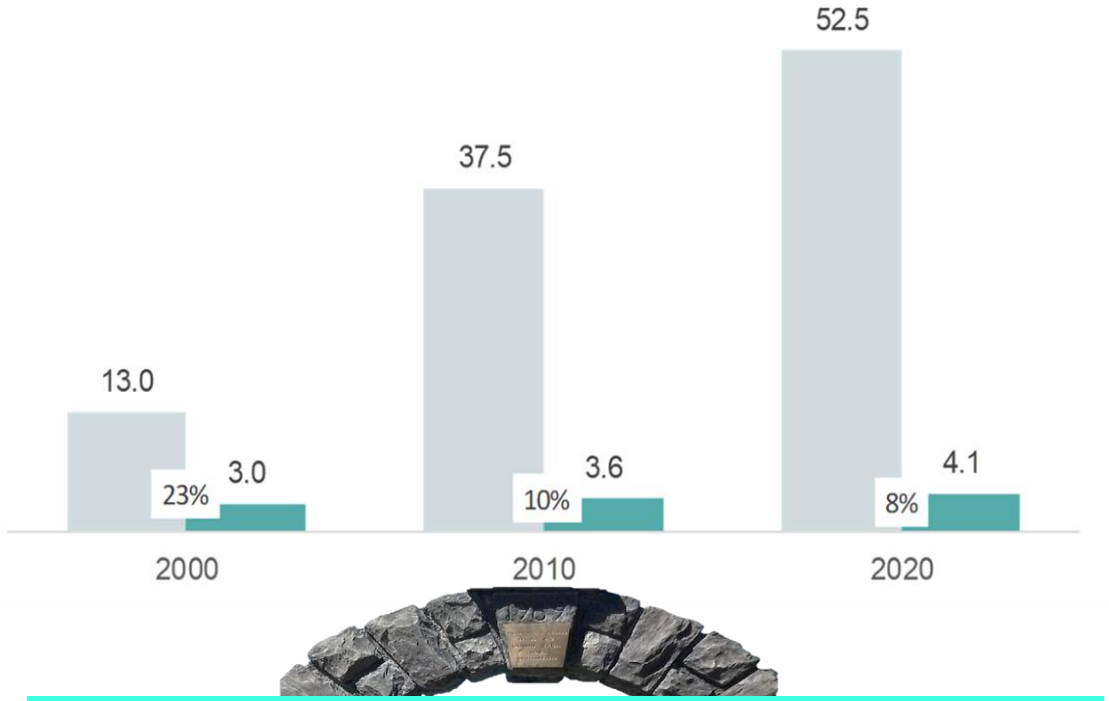
Marine Ingredients are crucial for food production



Over the past twenty years we have seen unprecedented growth in the aquaculture production sector

Global aquafeed production and fishmeal use by aquaculture from 2000 to 2020. Source: ***IFFO***



Fishmeal and fish oil have played a critical role in supporting this growth as the keystone ingredients that underpinned the development of feeds

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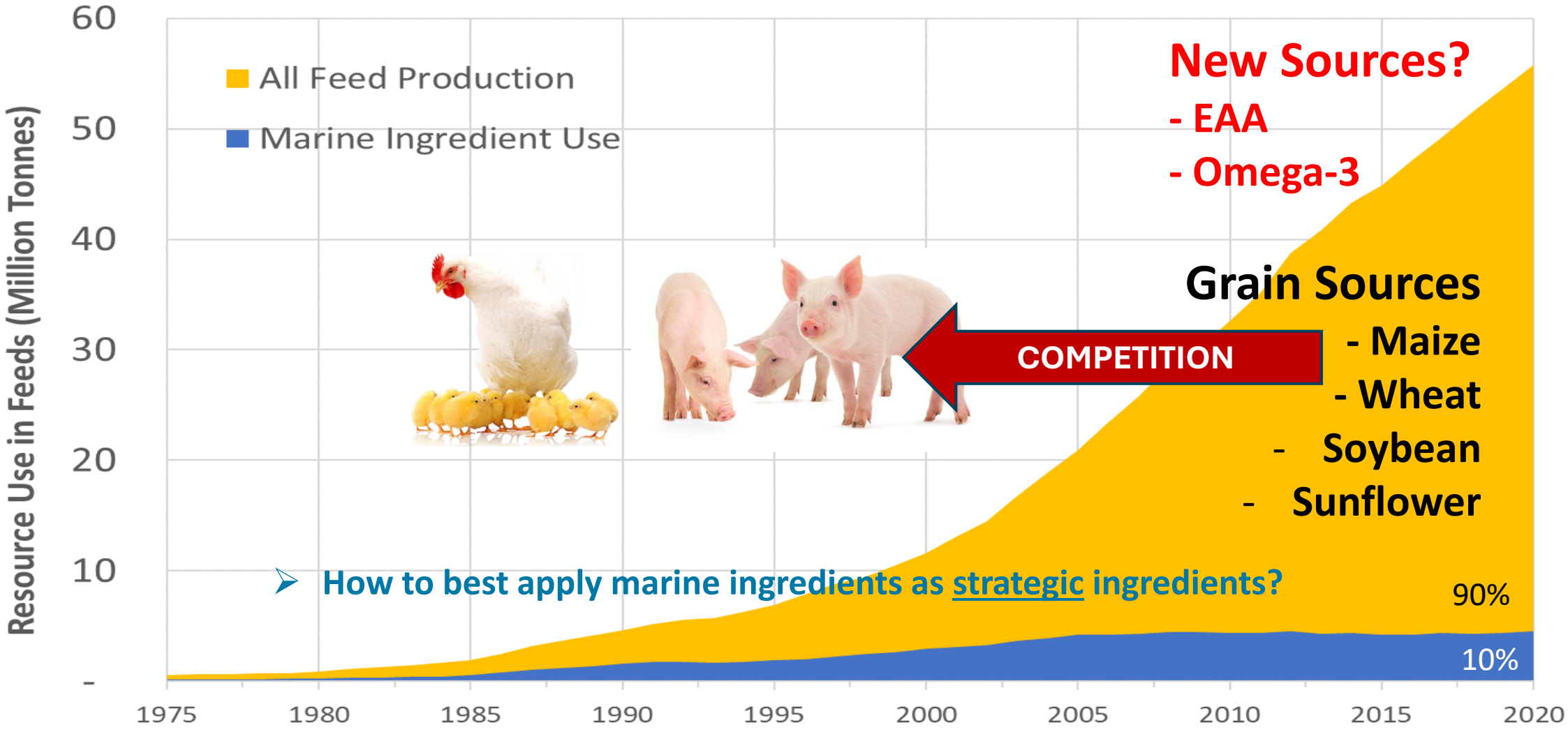
Future Aquaculture Needs **NEW** Ingredients



Glencross et al., (2023). Harvesting the benefits of nutritional research to address global challenges in the 21st century. Journal of the World Aquaculture Society, 54(2), 343-363.

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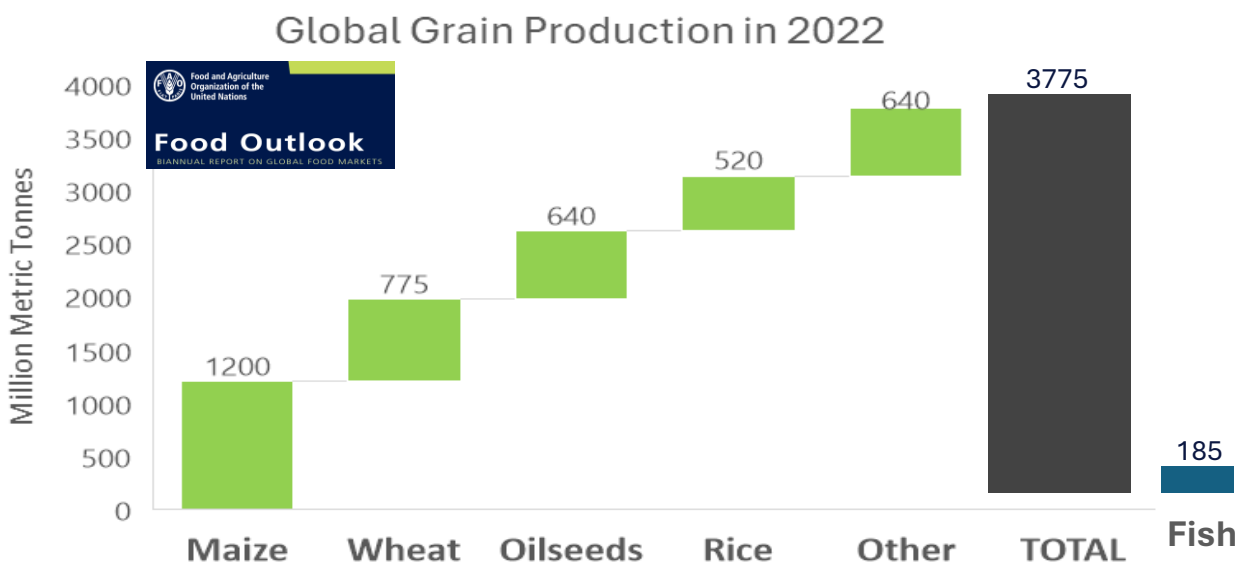
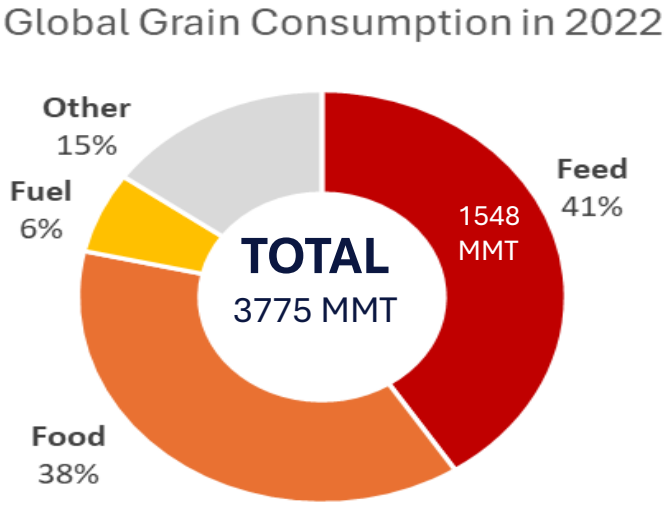
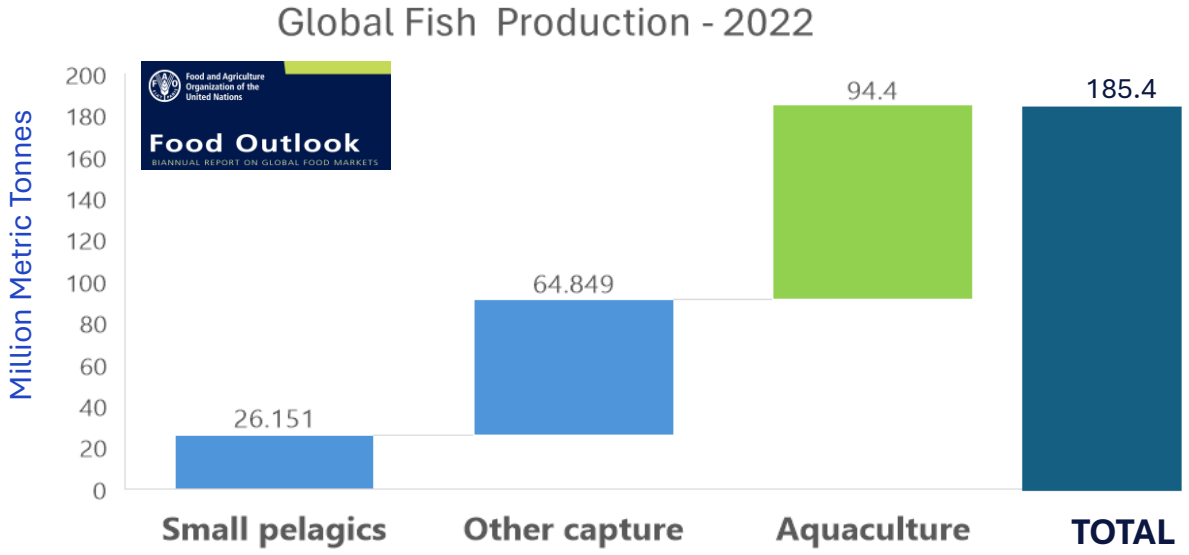
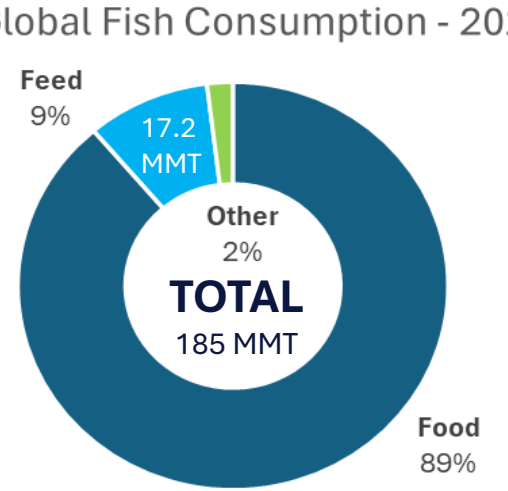
Global Feed–Food Production and Use





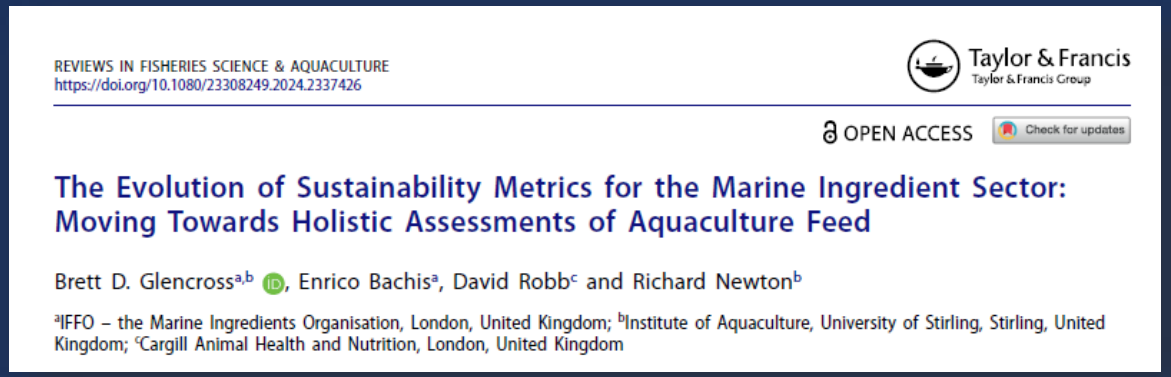




What Does “Sustainability” Mean?

- There is NO agreed definition.
- Former Chief Economist for the World Bank, Herman E. Daly proposed the following three operational rules defining the condition of ecological (thermodynamic) sustainability:

1. **Non-renewable resources** such as minerals and fossil fuels must be used no faster than renewable substitutes for them can be put into place.
2. **Pollution and wastes** must be emitted no faster than natural systems can absorb them, recycle them, or render them harmless.
3. **Renewable resources** such as fish, soil, and groundwater must be used no faster than the rate at which they regenerate.



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The Evolution of Sustainability Metrics for the Marine Ingredient Sector: Moving Towards Holistic Assessments of Aquaculture Feed

Brett D. Glencross[a,b], Enrico Bachis[a], David Robb[c] and Richard Newton[b]

[a]IFFO – the Marine Ingredients Organisation, London, United Kingdom; [b]Institute of Aquaculture, University of Stirling, Stirling, United Kingdom; [c]Cargill Animal Health and Nutrition, London, United Kingdom

“Sustainability is a journey not a destination”

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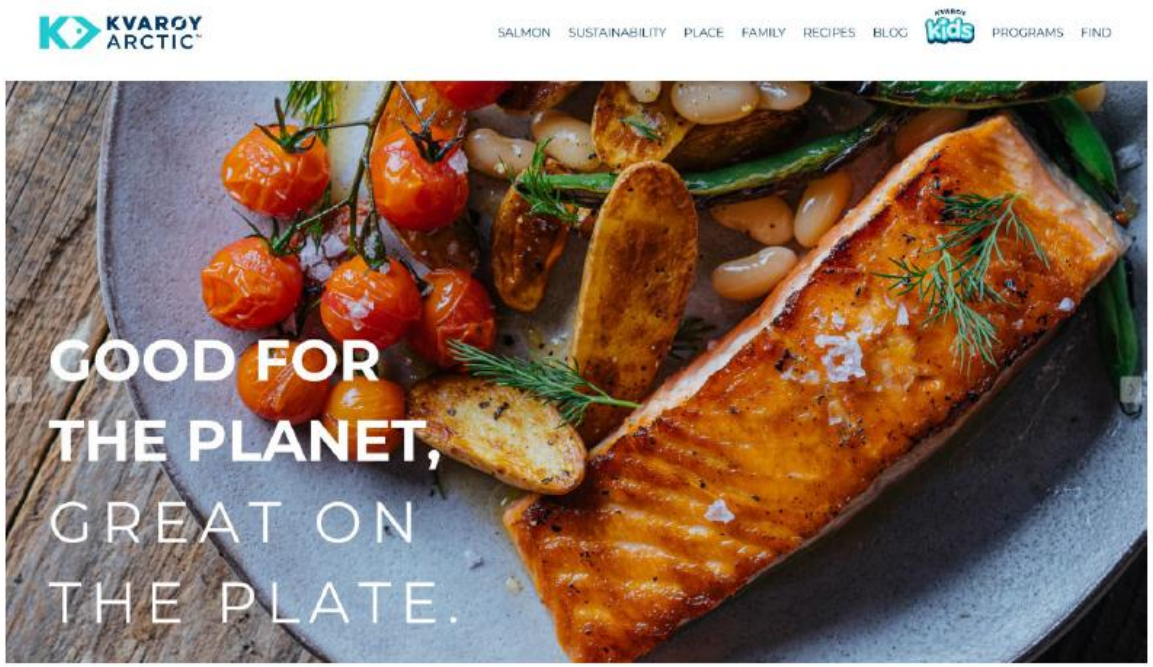
Fish Farmers are Increasingly Conscious of their Footprint...



REDUCING OUR FOOTPRINT

It isn't easy to run a sustainable operation. We realize everything we do effects our environment and local resources. We are committed to doing more today to ensure the impact of our company and our industry is less in the future.

CARBON FOOTPRINT

Kvarøy Arctic	**2.1kg CO2eq/kg**
Organic Salmon	**2.5kg CO2eq/kg**
Farmed Salmon (Overall)	**3.5kg CO2eq/kg**

The total amount of emissions with effect on climate change (greenhouse gases) to produce one kilo of farmed fish. Emissions are expressed as equivalents to carbon dioxide (CO2).

WATER FOOTPRINT

Kvarøy Arctic	**1,500L/kg**
Organic Salmon	**1,500L/kg**
Farmed Salmon (Overall)	**2,000L/kg**

The total amount of fresh water used to produce one kilo farmed fish. Fresh water use is expressed in liters (L).

DATA COURTESY OF BIOMAR GROUP

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Increasing Importance of Sustainability…

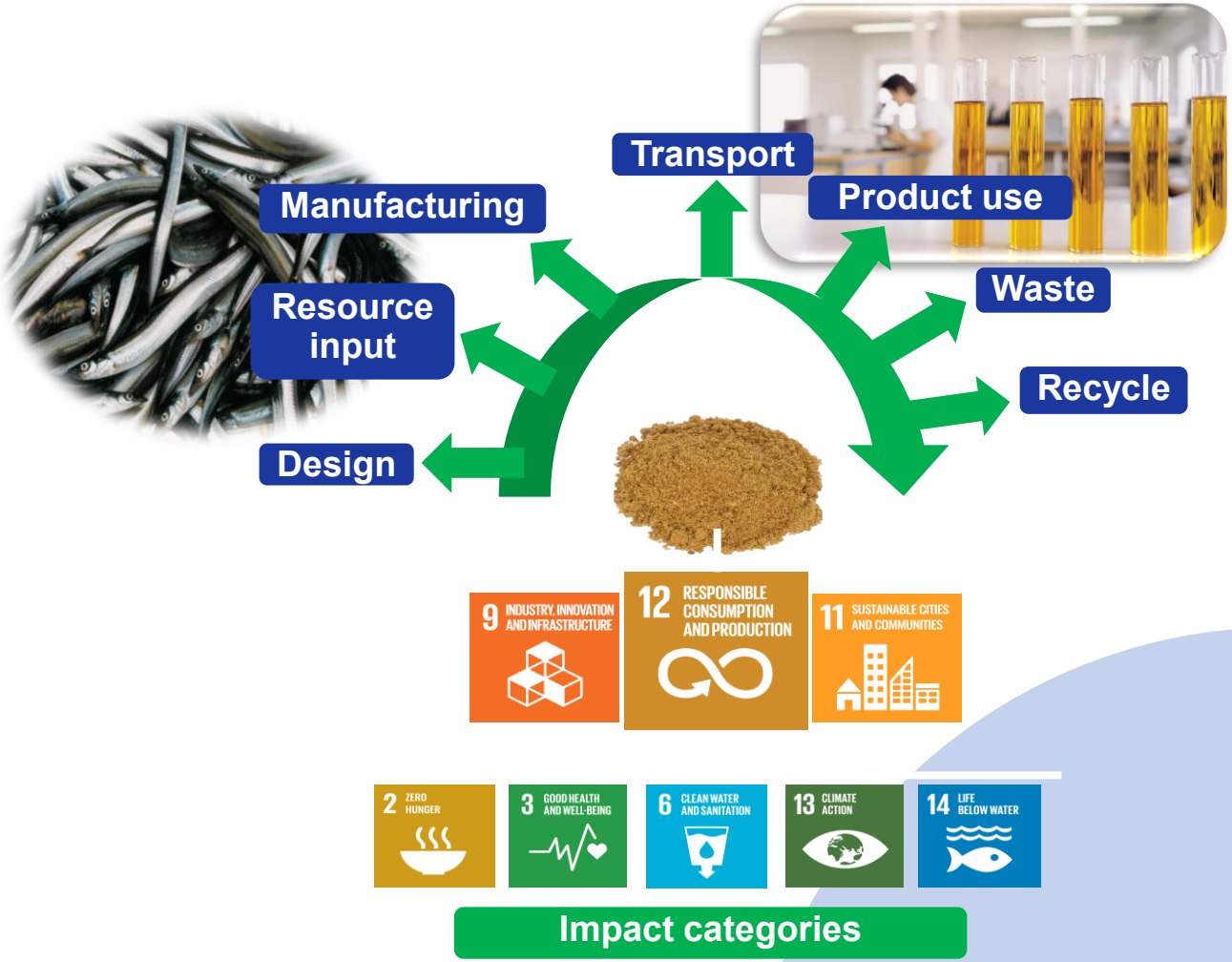
For something to be managed though, you need an **effective means of measuring it**.

Life Cycle Assessment (LCA) has emerged as the most **accepted method to objectively assess** the range of environmental effects assignable to products and services.

It requires **data collection** associated with:

- Inputs (resource use) / Outputs (emissions)
- Designated material flows
- Assigned environmental costs

Can be based either on **Secondary data** (scientific papers/reports) or **Primary data** (actual data).



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The devil is the detail: new aquafeed research reveals hidden environmental trade-offs

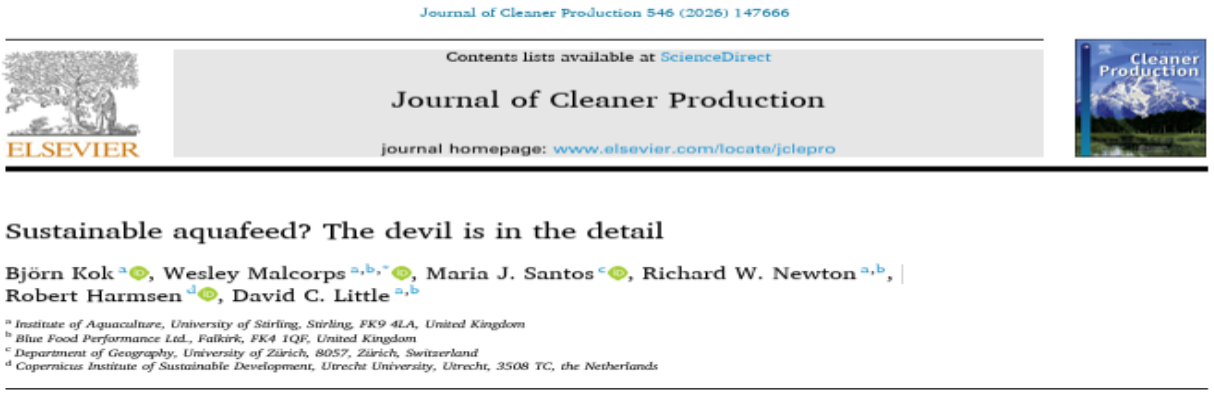
Between 2000 and 2020, European aquaculture production nearly doubled, increasing from 1.15 million tonnes to 2.17 million tonnes of key species including Atlantic salmon, trout, seabream and seabass.

During the same period, the inclusion of marine ingredients in feeds declined sharply and was replaced largely by plant-based ingredients such as soy protein concentrate and rapeseed oil.

The result has been a mixed environmental picture. While the use of wild fish in feed decreased by around 13% overall, other environmental indicators increased significantly. These include:

Global warming potential: **+314%**

- Land use: **+594%**
- Water consumption: **+236%**
- Marine eutrophication: **+630%**
- Freshwater eutrophication: **+468**



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Sustainable aquafeed? The devil is in the detail

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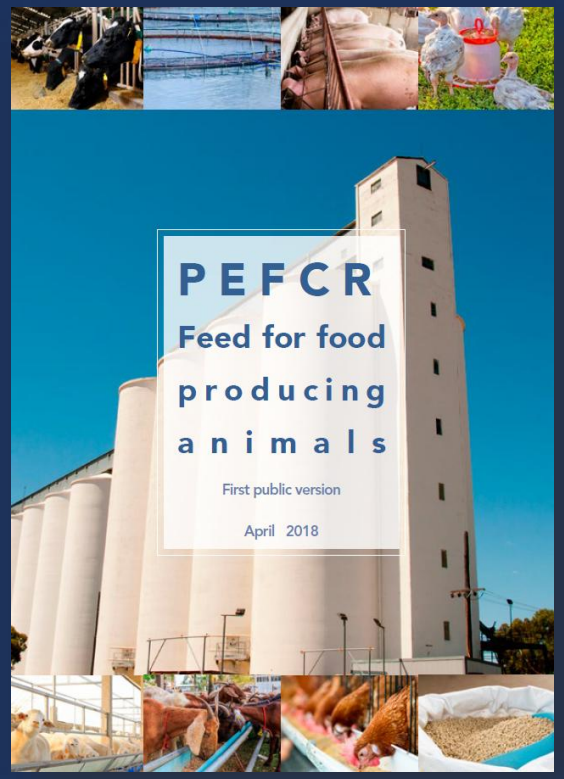
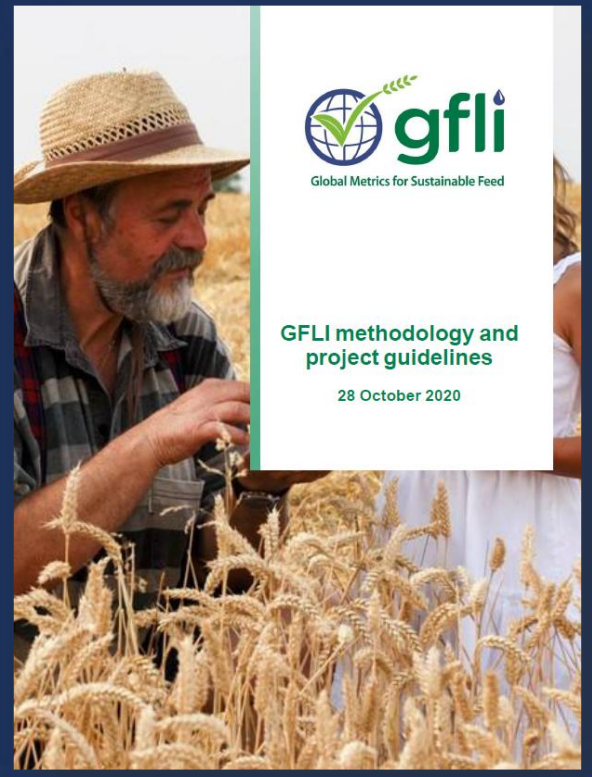
Making the LCA Process Transparent…

- How you plan and how you collect the data can have **important effects on the interpretation**. **<u>There needs to be standardisation</u>**

- There have been various attempts to set some standards;
  - ISO initiated this (ISO 14040/14044), but the guidelines are not overly restrictive.
  - EC initiated the development of the Product Environmental Footprint Categorisation Rules (PEFCR).

- GFLI established as an independent repository with standardised database and tools and (v2.0) has close to 1500 ingredients.





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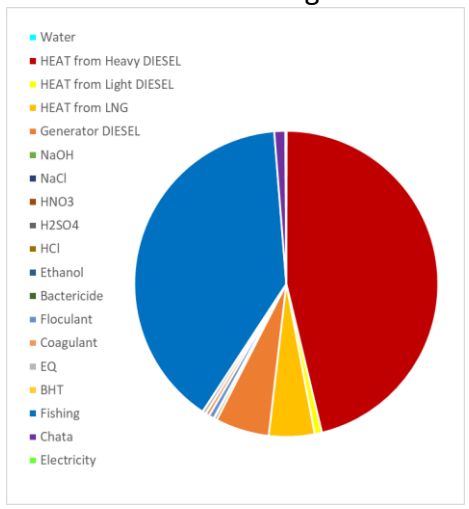
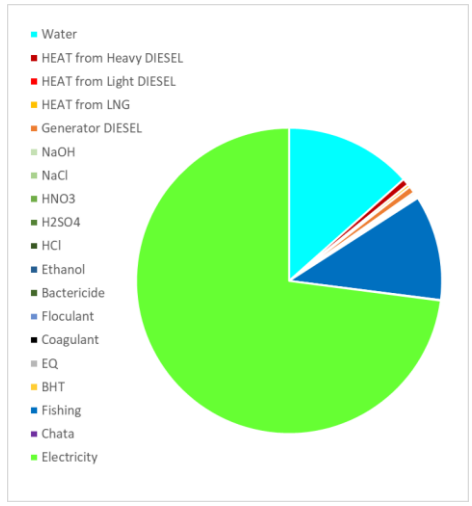
Attributional Analysis of Primary LCA Data…

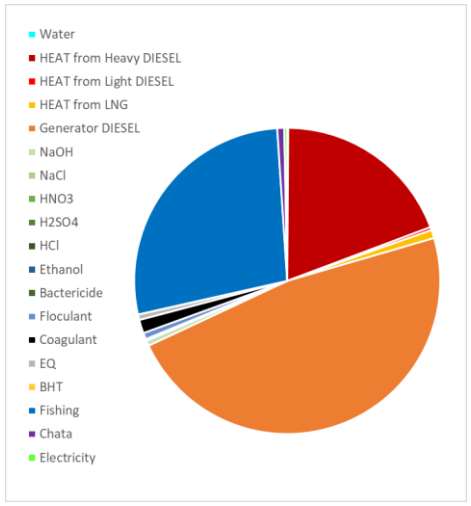
Climate Change



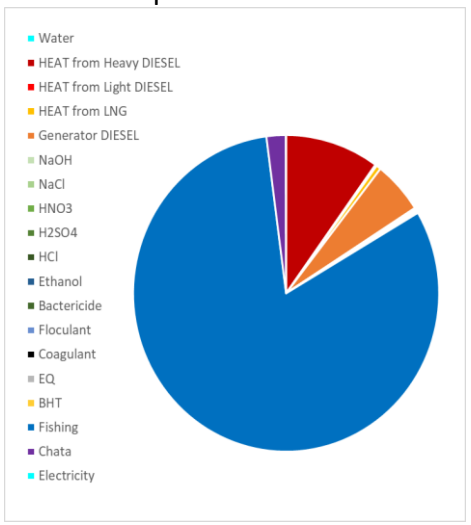
Water Use



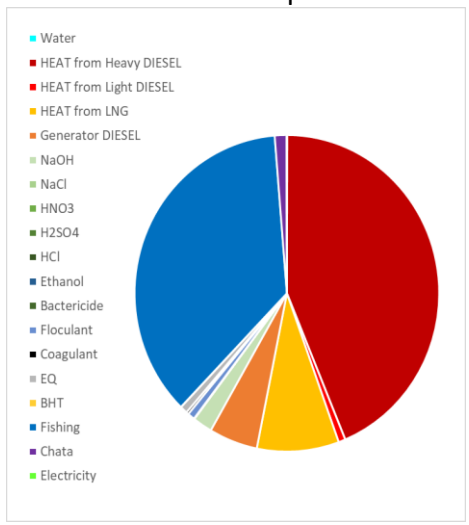
Land Use



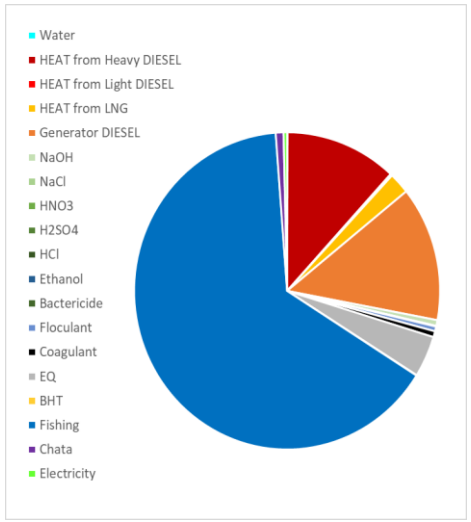
Eutrophication - Marine



Ozone Depletion

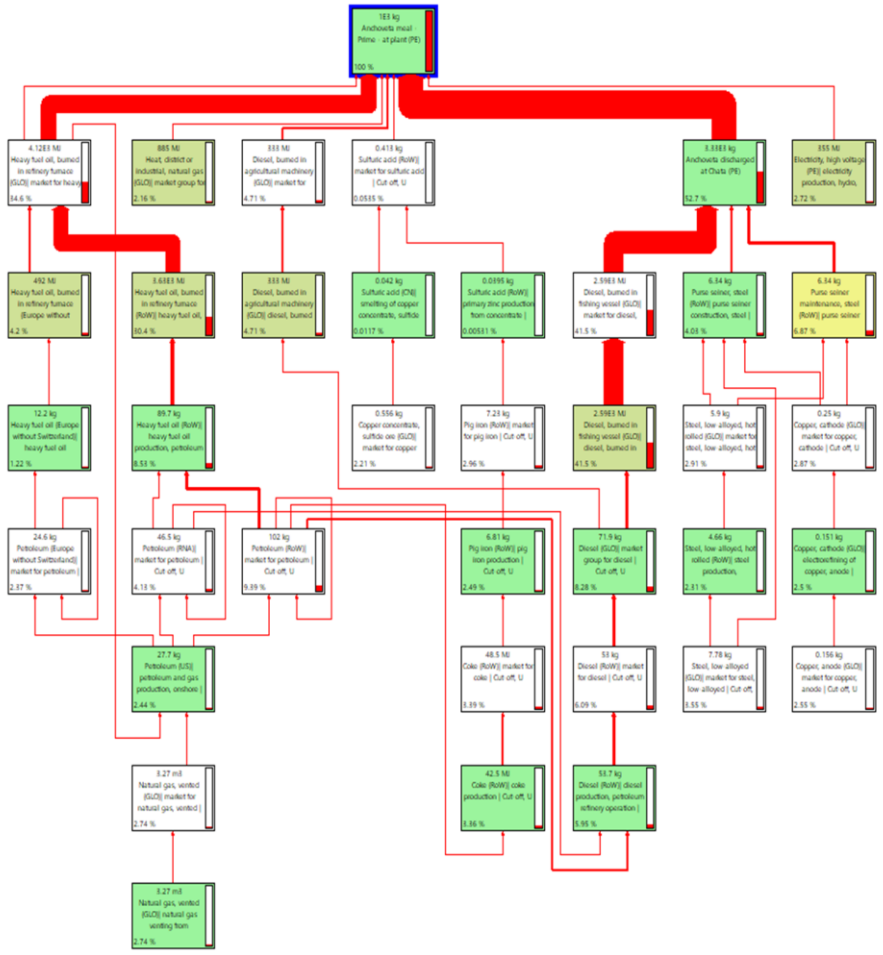


Human Toxicity - Cancer



RENDERING

Climate Change



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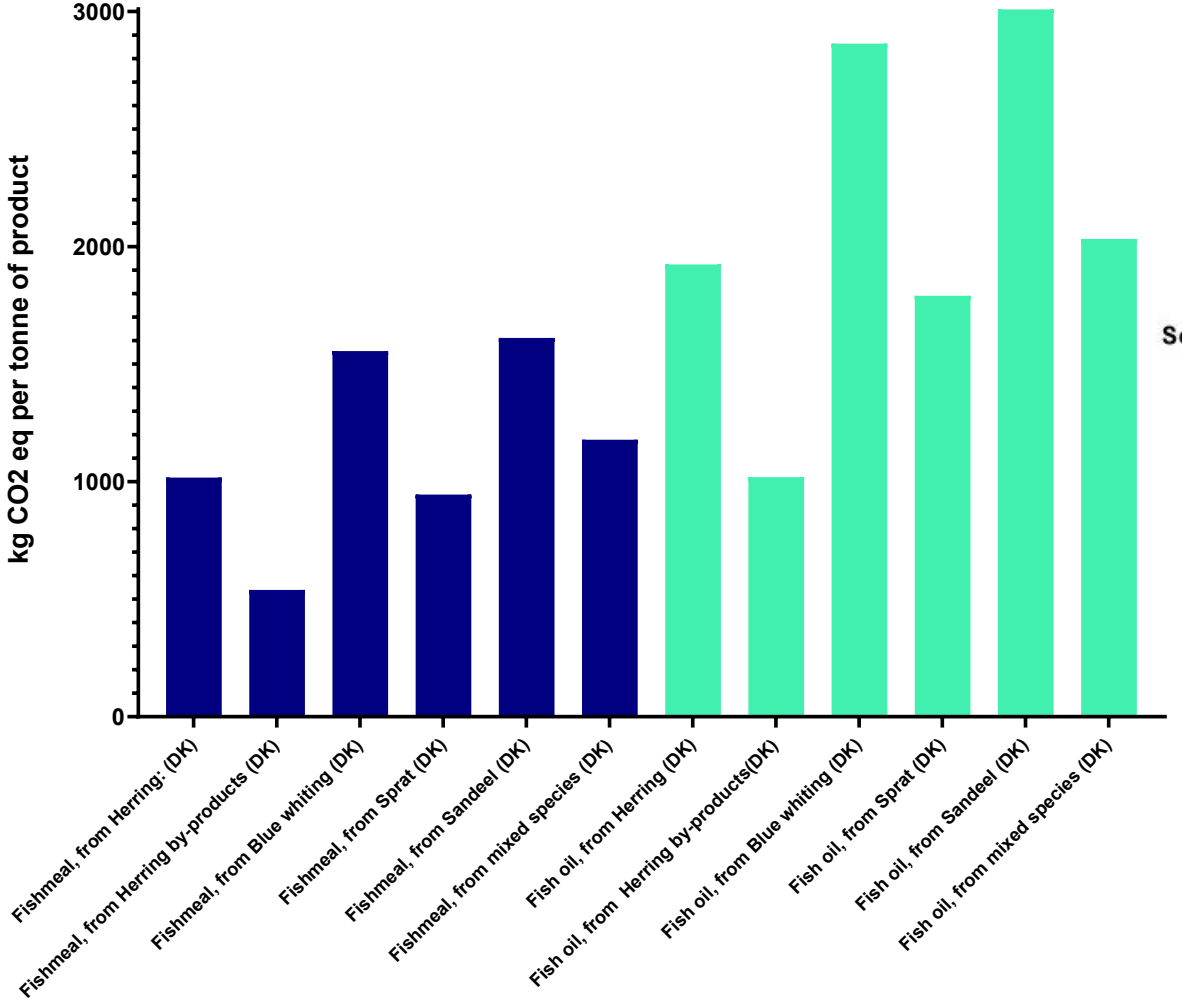
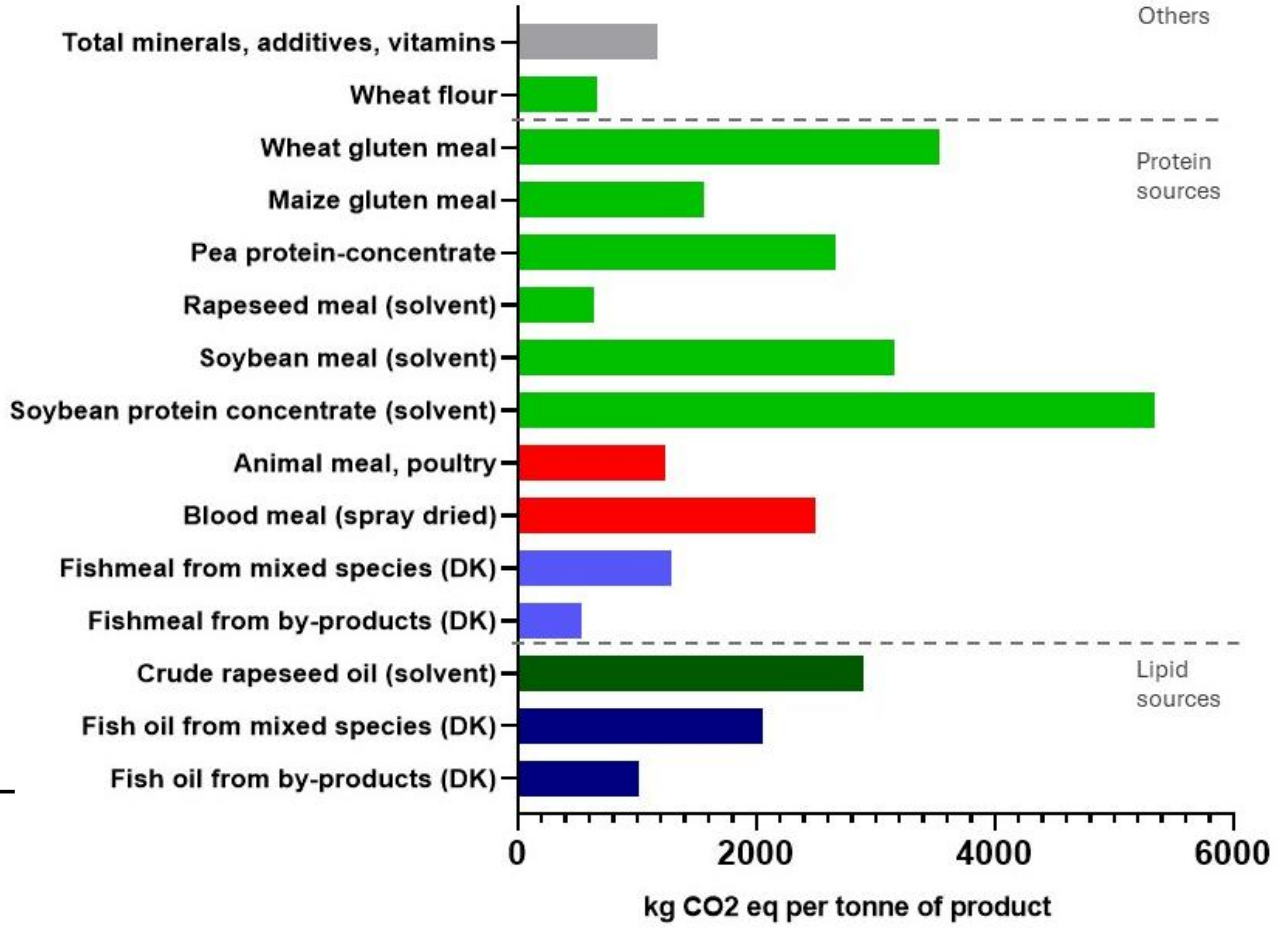
Primary Data LCA from the Danish industry

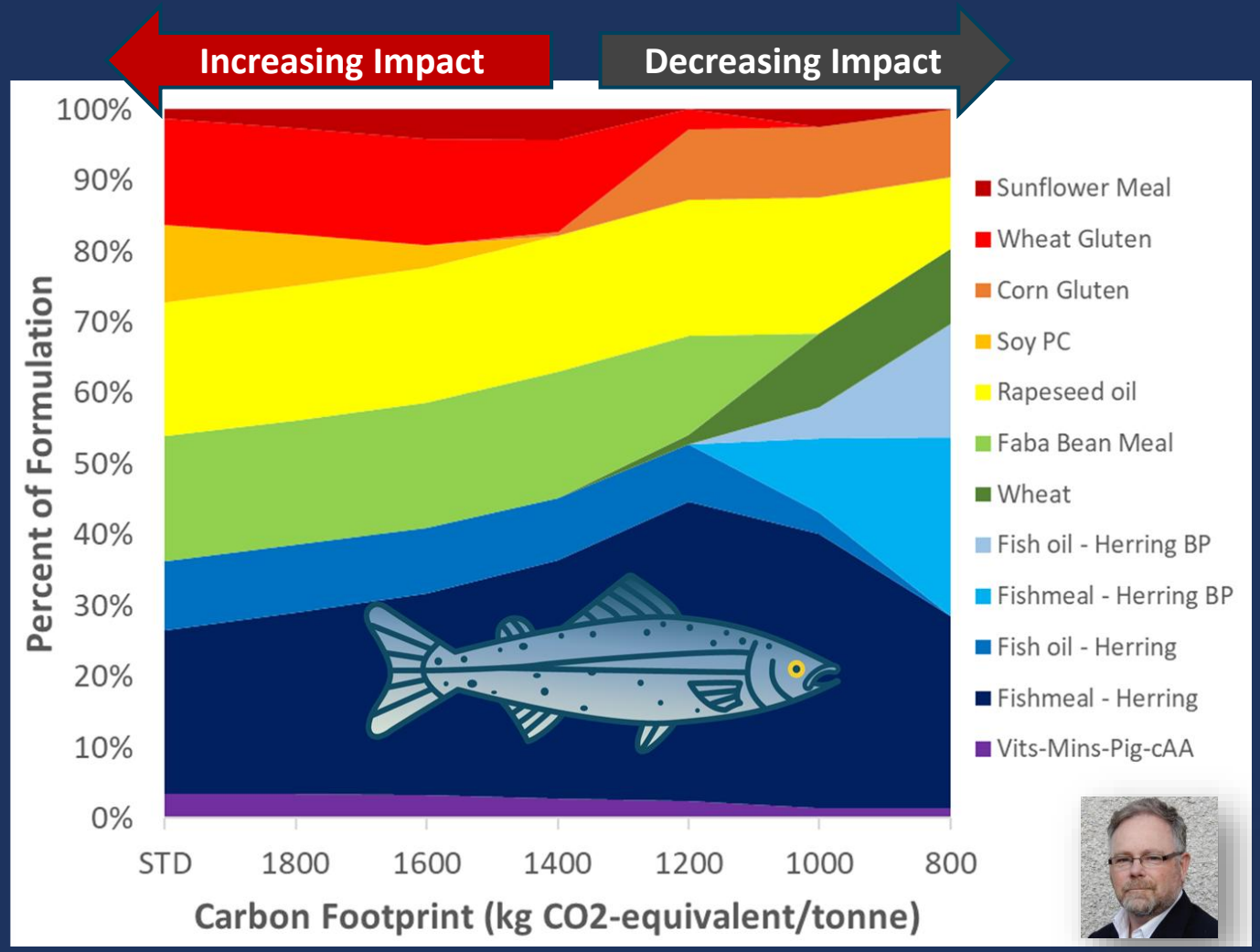




Marine Ingredients Denmark

Circular (?) Ingredient Options

Using LCA Data as a Formulation Constraint



- A standard (STD) salmon feed (DP36%:DE20kJ/g) has a Carbon Footprint (CF) of about **1978 kg CO2.eq / tonne feed**.
- Formulating on CF has some **clear effects on ingredient preference**.
- Reducing the CF to 1340 kg CO2.eq / tonne feed increases formulation **costs by 1.2% for a 33% decrease in CF**.
- **Primary data** from ingredient suppliers is increasingly being sought by the feed producers as values **can vary markedly**.

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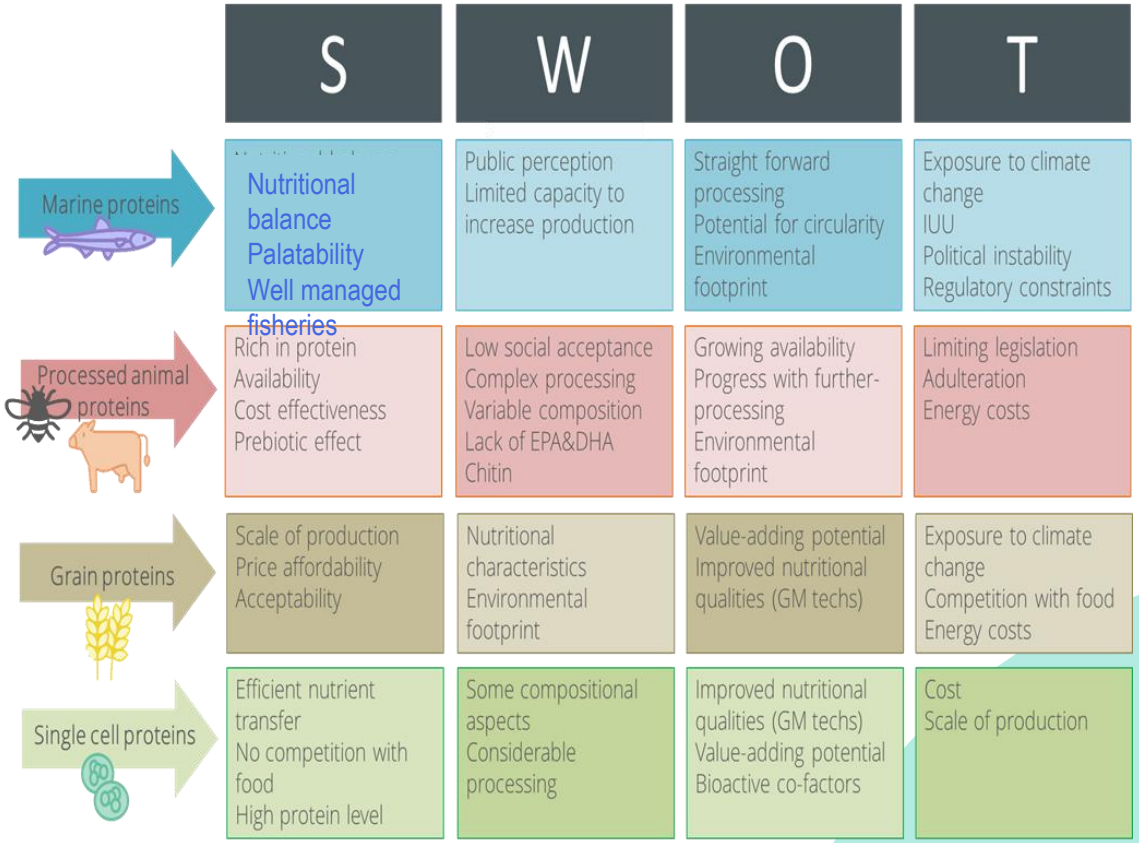
All Ingredients Have S.W.O.T's

All ingredients have strengths and weaknesses. There is no such thing as **the perfect ingredient.**

By understanding the positives and negatives of each ingredient, it becomes possible to increase adaptability in responding to the various opportunities for using different ingredients.

Complementarity is critical as both research and industry enters a era of **Precision nutrition**



Glencross et al., (2024). A SWOT analysis of the use of marine, grain, terrestrial-animal and novel protein ingredients in aquaculture feeds. *Reviews in Fisheries Science and Aquaculture*, DOI:10.1080/23308249.2024.2315049.

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In summary

- **Ingredient Use is Changing…**
  - Grains underpin the majority of aquafeed production AND this will continue.
  - Marine ingredients have become a strategic resource.
- **What Does Sustainability REALLY Mean?**
  - All food production produces waste, the issue is how to **valorise it.**
  - We should prioritize food application, but feed application is good next option.
  - Various simple metrics
- **Future Challenges…**
  - You can only MANAGE what you can MEASURE.
  - We need a holistic assessment that is performed in a standardised method that will empower judicious decisions about our resource uses
- **Marine Ingredients in LCA**
  - Low Co2 footprint compared to other ingredients found in the GFLI
  - By-products are a promising low co2 and fully circular resource

Marine Ingredients
Denmark