

SESSION 5: FUTURE PROOFING AND SUSTAINABILITY ISSUES WITH AQUAFEEDS



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Future Directions for Marine Ingredients

Abstract

Before the year 2000, it was considered standard to make feeds mostly from marine ingredients such as fishmeal and fish oil. It was common to formulate a shrimp or marine-fish feed using >50% marine ingredients. However, we were aware of the finite limits of marine ingredients and work had already begun across the world to find alternative protein and lipid resources. Significant investment was spent seeking fishmeal and fish oil replacement and some significant outcomes were achieved. Consequently, the sustainability context of using marine ingredients became the new mantra, while the sustainability of the new alternatives was just assumed.

The science of sustainability assessment has also evolved considerably and we have moved on from simplistic indices like the fish-in:fish-out (FIFO) ratio to more holistic assessments like life cycle assessment (LCA) analyses. In doing so, we have come from a position with high levels of marine ingredients that had a pretty good sustainability footprint; with low discharge, low energy use, and little to no reliance land or freshwater and moved to a “terrestrial” approach which has a comparatively higher sustainability cost; with increased demand for energy, higher footprint and uses substantially more land and freshwater. When we further consider the level of third-party certification of the different resources in terms of responsible sourcing and traceability, then marine ingredients clearly stand above the others with more than 50% of global marine ingredient production coming from third-party certification scheme approved producers [www.marin-trust.com/statistics].

So, if the story is not (totally) about sustainability, then what was the original reason we began using alternatives for in the first place? It was actually based on the recognition of constraints to expanding the availability of marine ingredients as aquaculture feed demand grew.

Recent data shows that global fishmeal and fish oil production are beginning to grow again on the back of increased by-product utilisation from both direct-human-consumption fisheries and notably aquaculture production. So, if aquaculture production keeps growing at its current trajectory, what if we can repurpose all the by-products from that sector as it continues to grow as well. Could this show that we would have a growing resource base from which to make future fishmeal and fish oils?

In this presentation, I will present the latest data and observations to show how marine ingredients are increasingly becoming strategic ingredients in the aquaculture feed sector, and how circularity is an increasing contributor to the resource based underpinning marine ingredient supply into the future.



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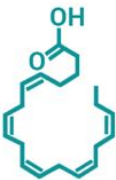
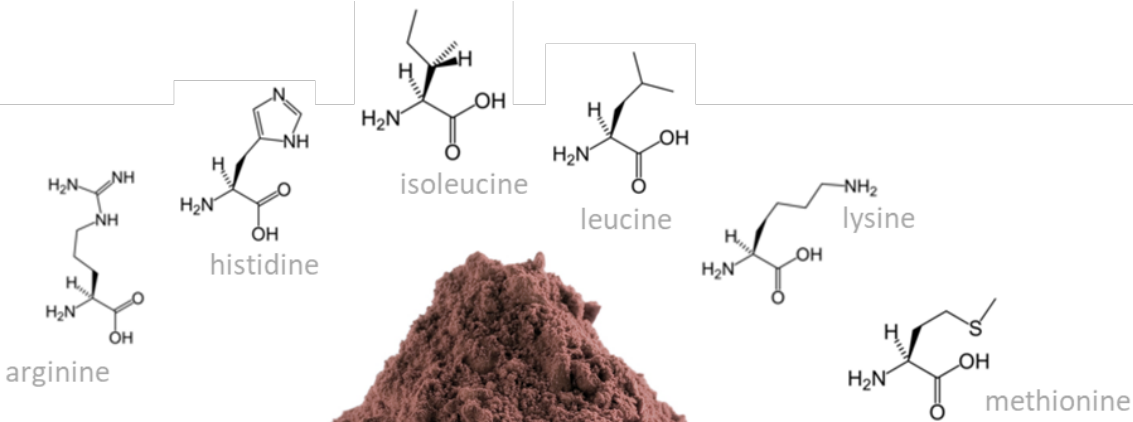
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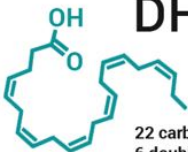
Future Directions for Marine Ingredients

Still One of Nature's Best Nutrient Sources



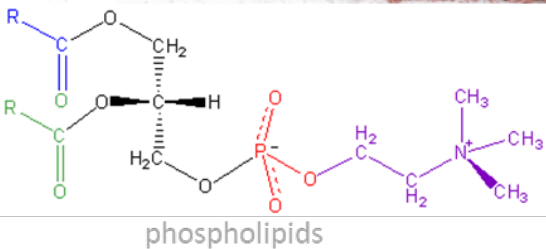
EPA

20 carbon
5 double bonds

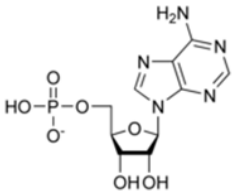


DHA

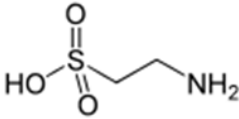
22 carbon
6 double bonds



phospholipids



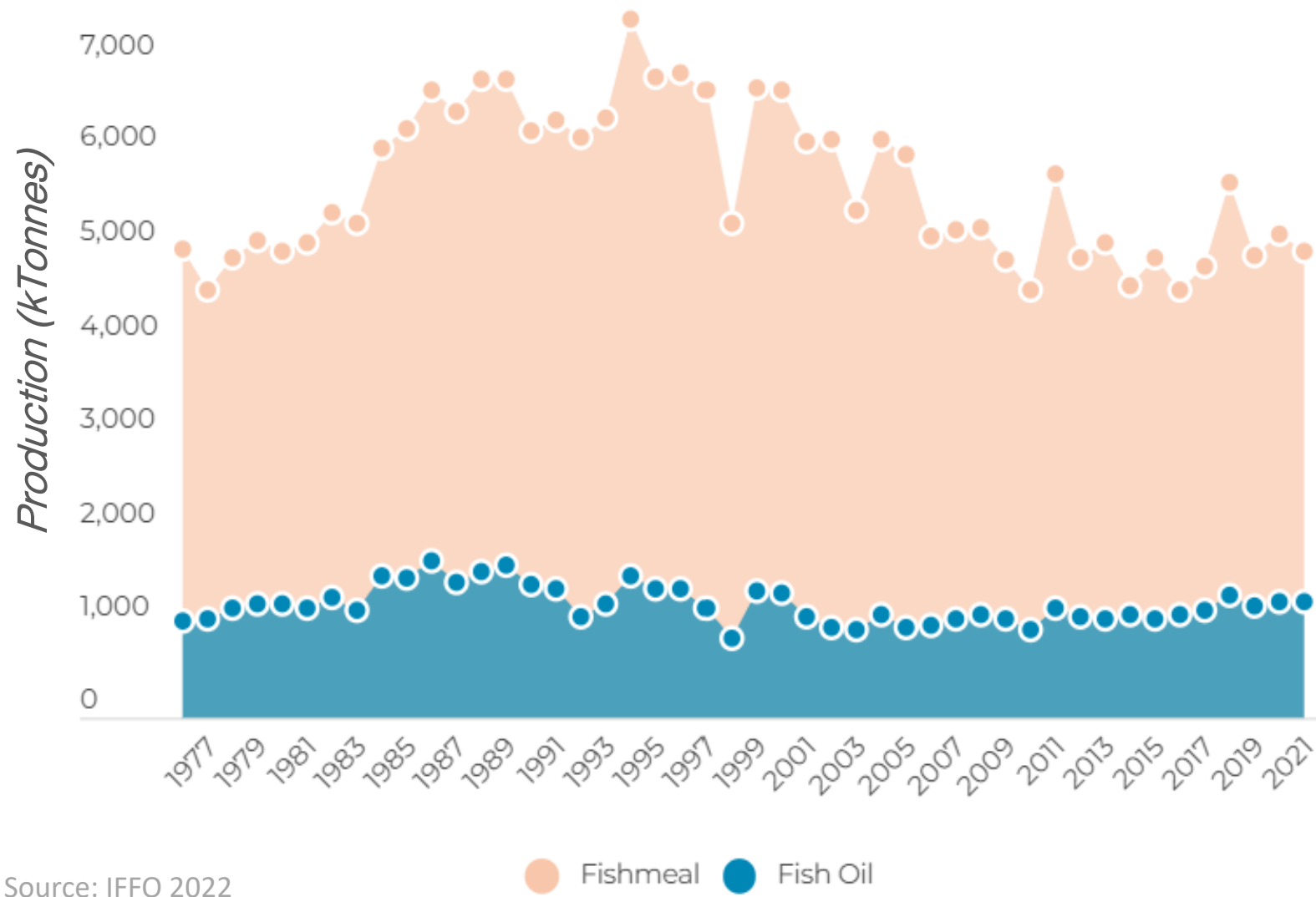
nucleotides



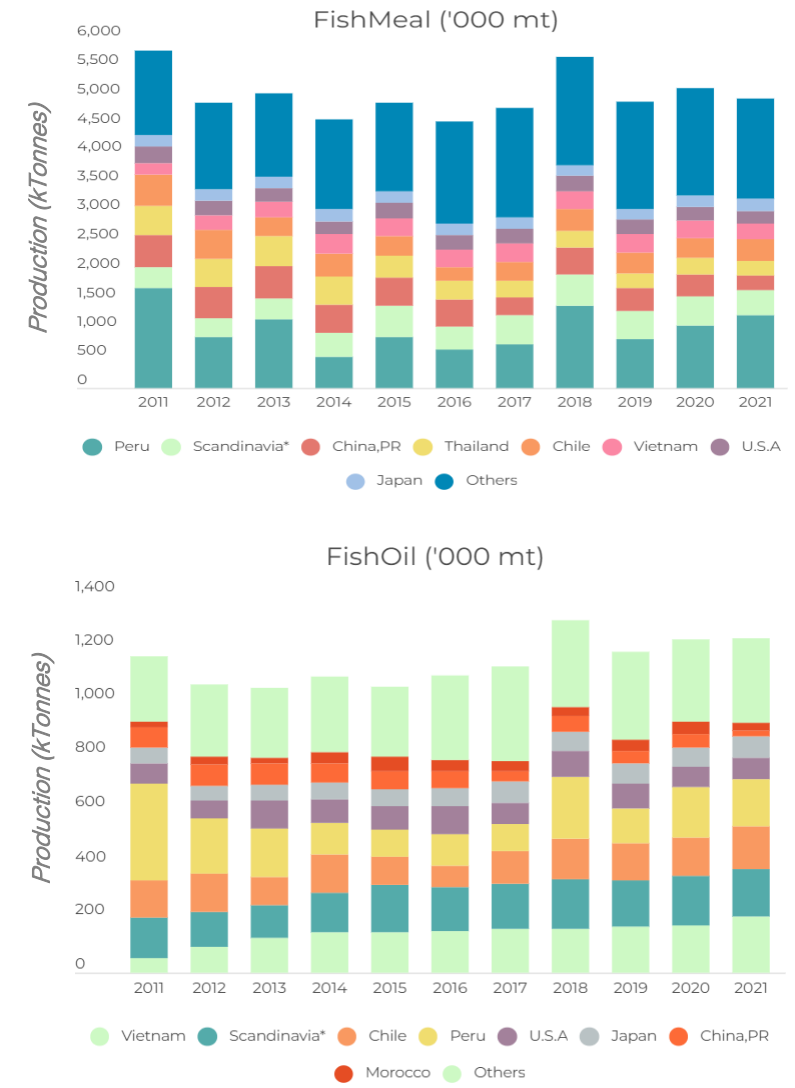
taurine



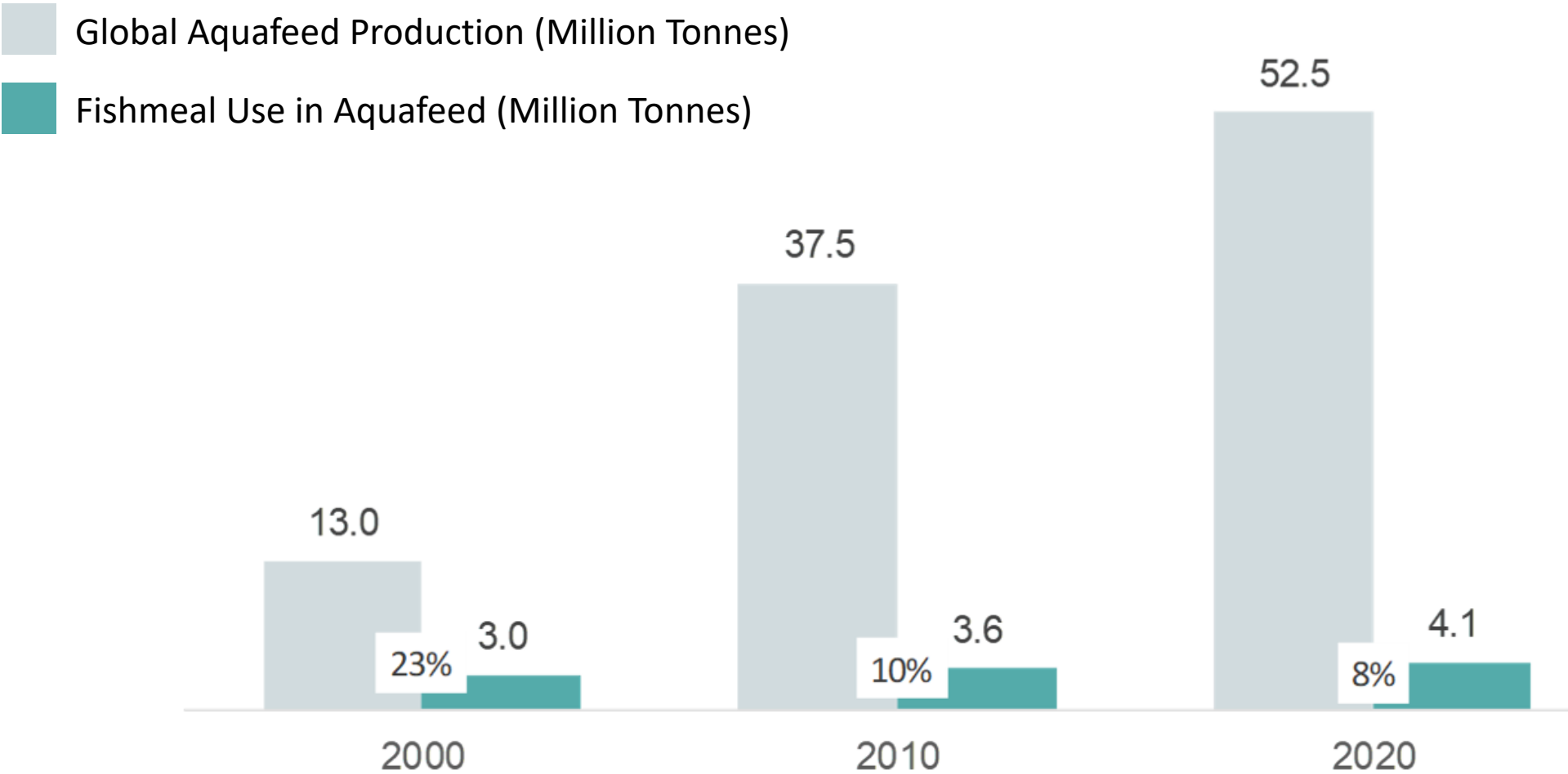
Global Supply



Source: IFFO 2022



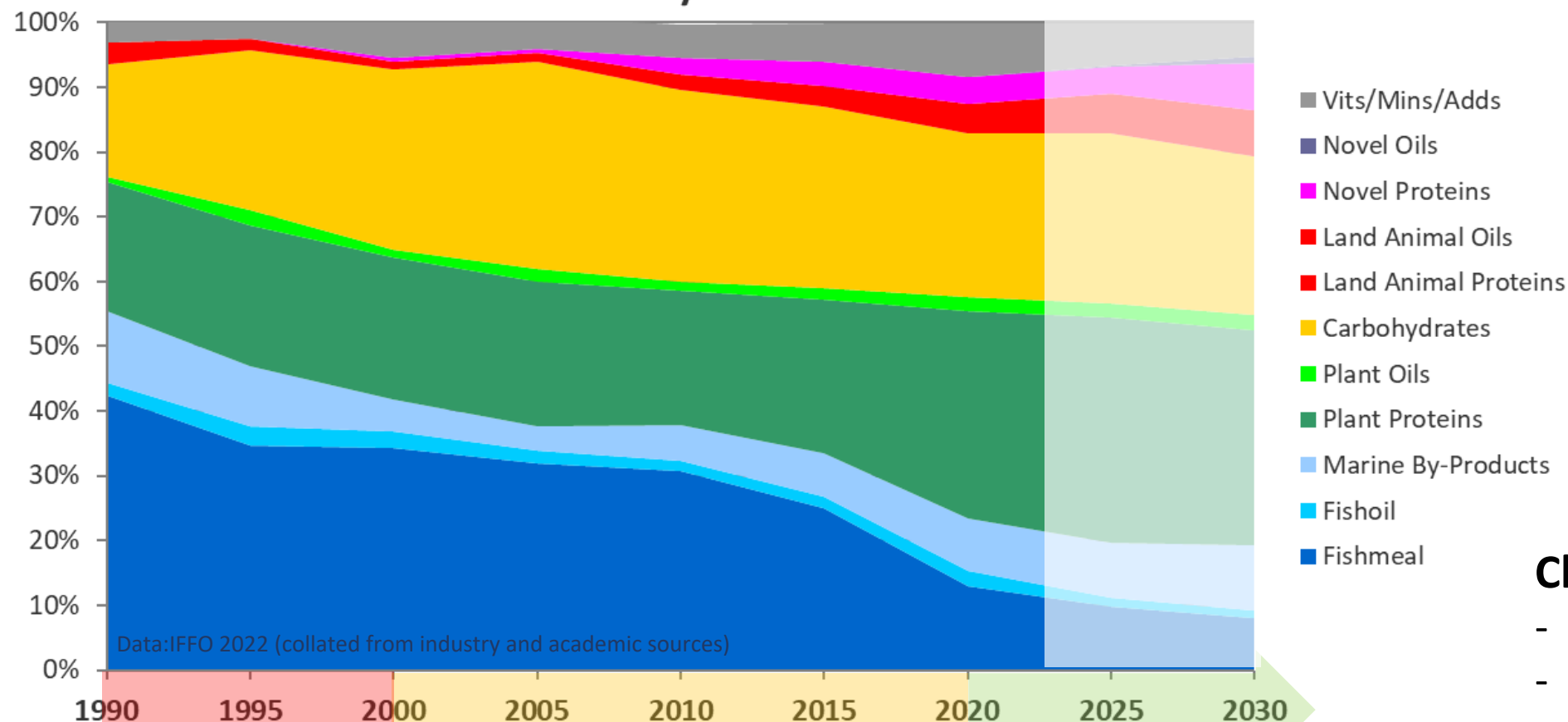
A Strategic Ingredient, No Longer Bulk Nutrient Supply



Source: IFFO 2022

Changing Ingredient Base = Changing Issues

Raw Material Use by SHRIMP Feed Sector



Changing Expectations

- Nutritious
- Enhanced Qualities
- Safe
- Low Cost
- Responsible



Increasing Carbon Footprint

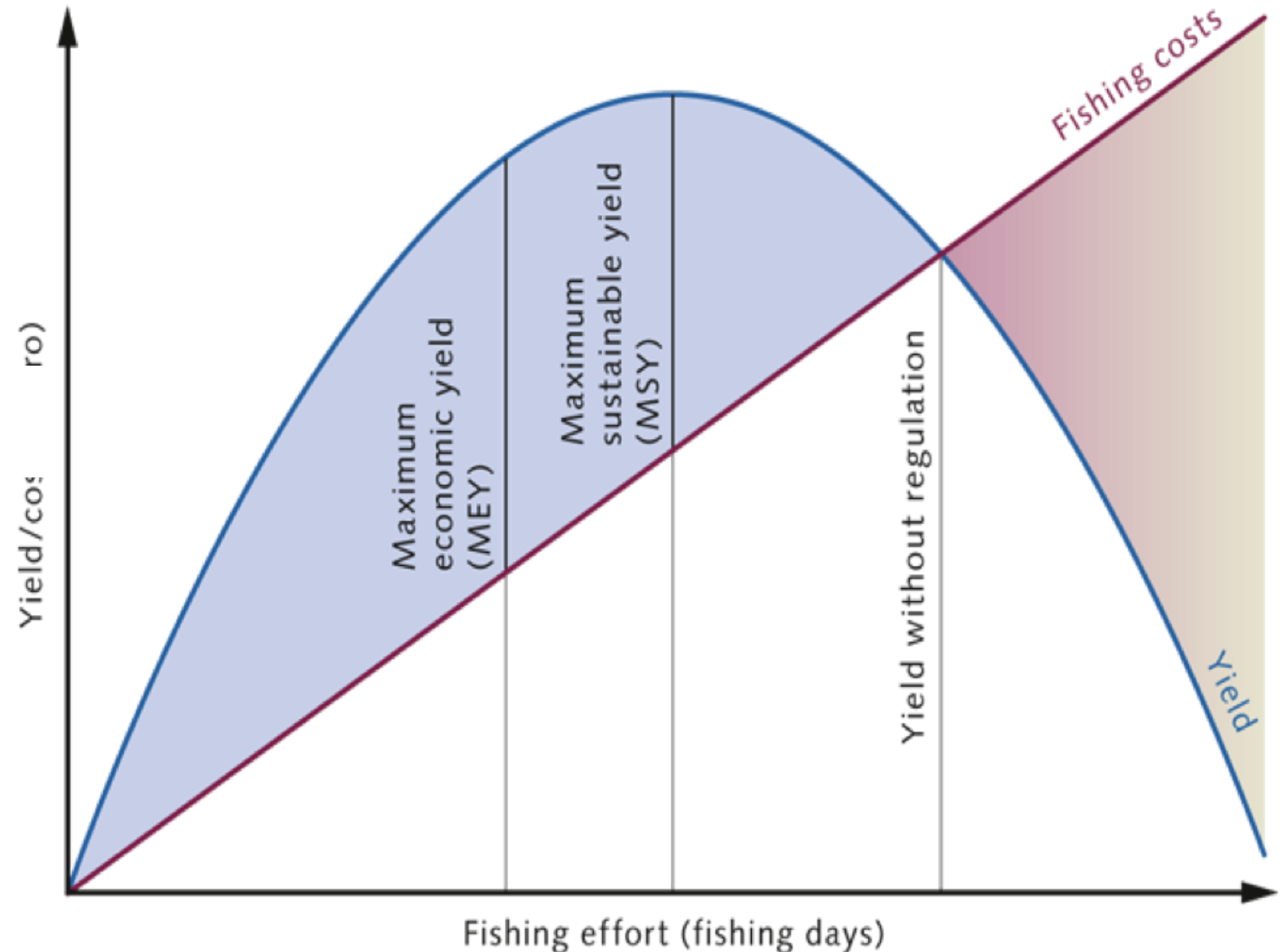
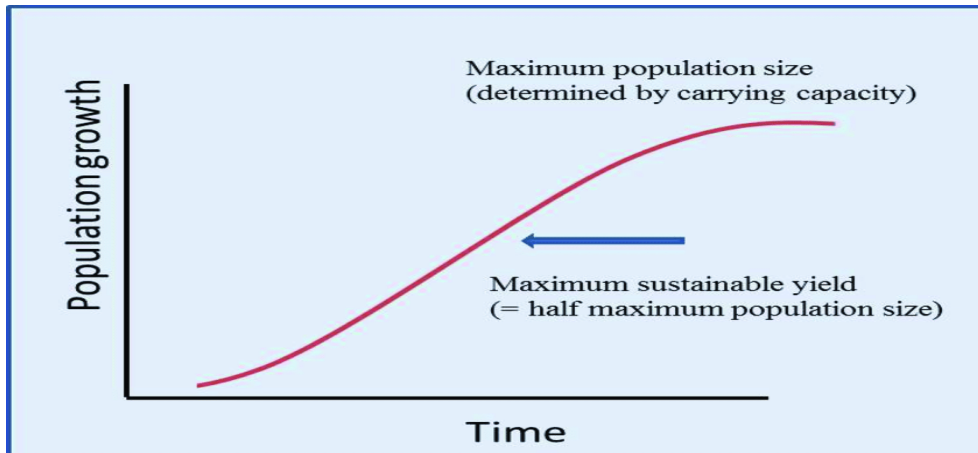


Future?



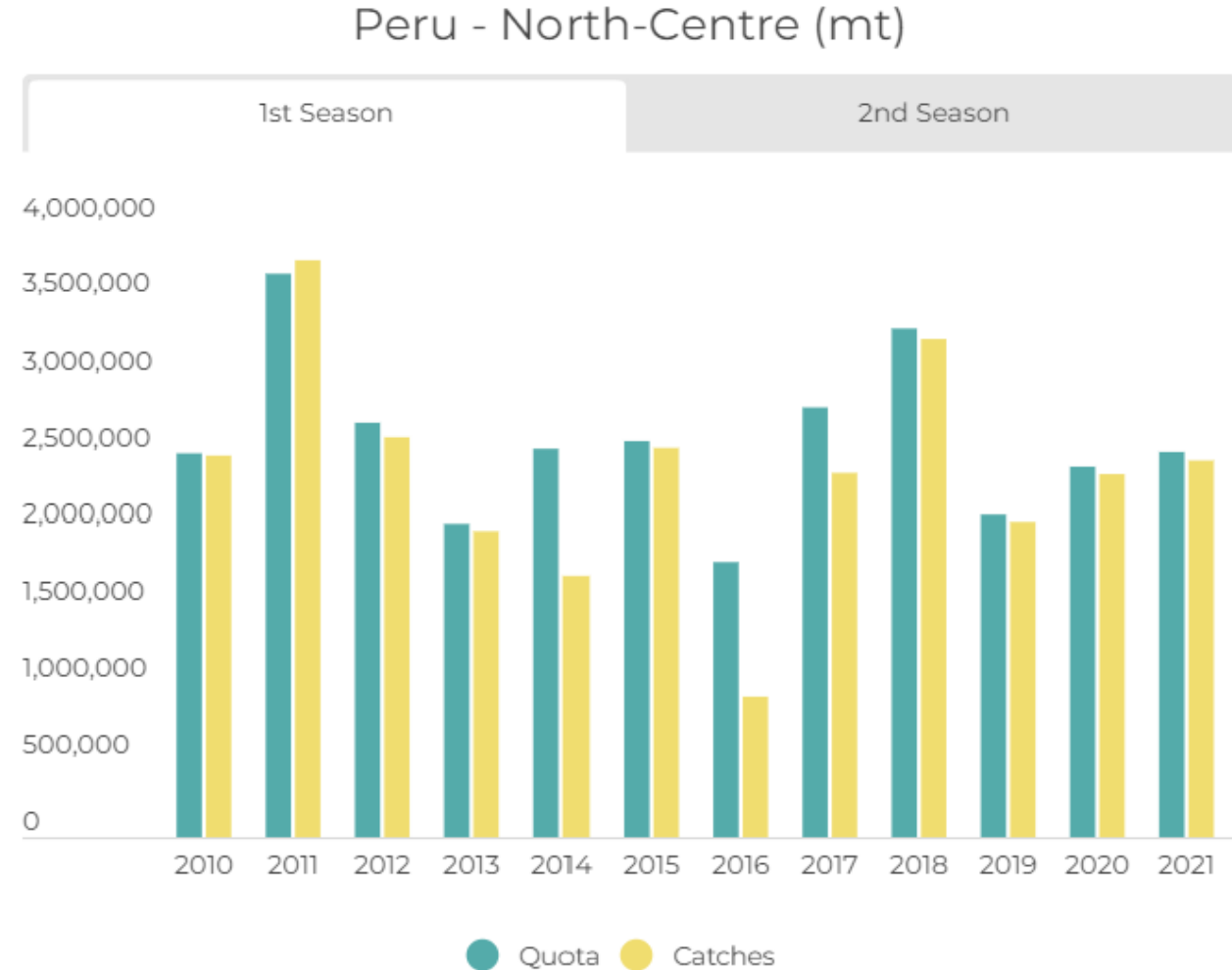
What Does Sustainability Mean in Fisheries?

- The maximum sustainable yield (MSY) for a given fish stock means the highest possible annual catch that can be sustained over time, by keeping the stock at the level producing maximum growth.



Effective Fisheries Management is Critical

- Most fisheries in developed nations of the world are now managed by independently set quotas based on targeting a MSY.
- Modern fishers are regulated to operate within those quota systems.
- There has been a BIG shift in fisheries management over the past 20 years.



Source: Instituto del Mar del Peru (IMARPE).no/en

Small Pelagic Fisheries Are Considered Well Managed

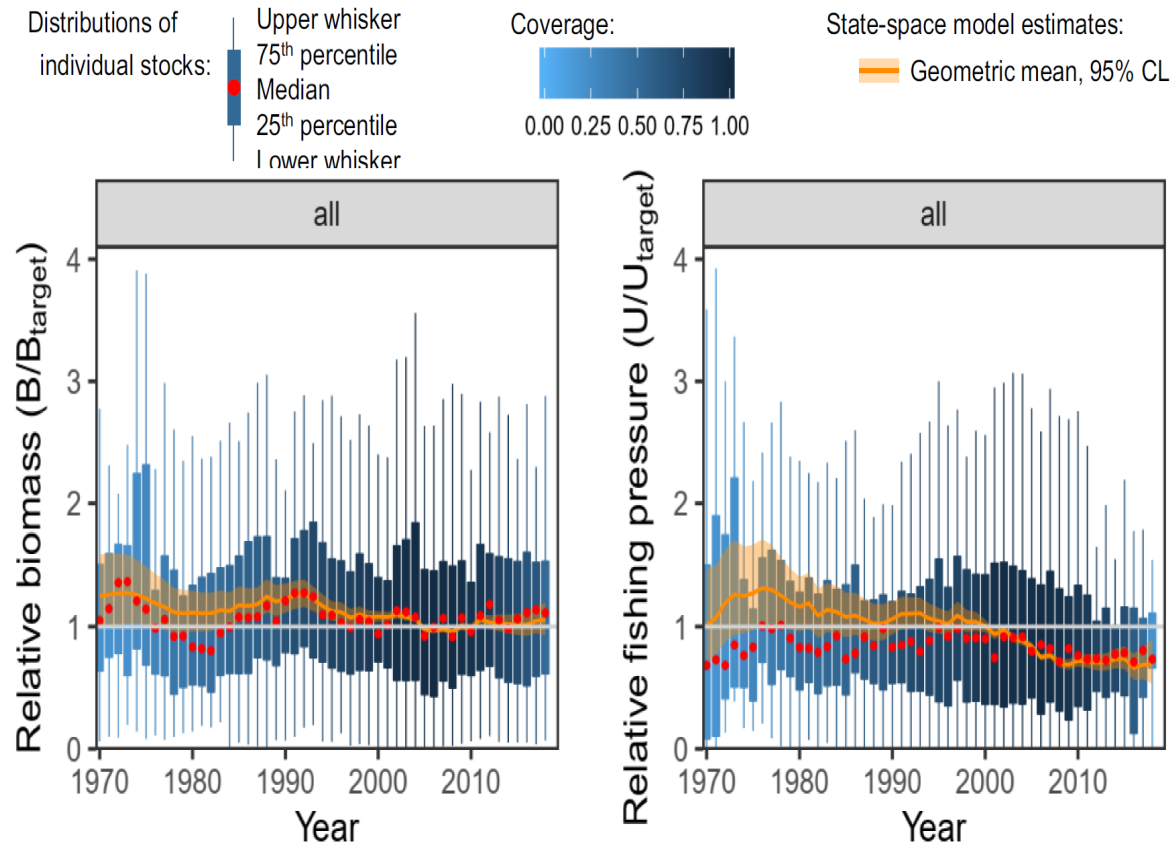


FIGURE 4 Trends in small pelagic fish global estimates from RAMLDB of: (a) relative abundance, B/B_{target} ; and (b) fishing pressure, U/U_{target} , relative to MSY-based or other target reference points from 1970–2018. Geometric mean trend is re-scaled to the median in years of >90% coverage. Shaded bands around mean denote 95% finite population-corrected confidence bounds (applicable to all years with <100% coverage). Red dots show the median of all stocks assessed in that year. Boxplots show distributions of individual stocks in each year, with shading reflecting the fraction of stocks with assessments covering that year. Stocks are equally weighted

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ORIGINAL ARTICLE

FISH and FISHERIES | WILEY

Recent trends in abundance and fishing pressure of agency-assessed small pelagic fish stocks

Ray Hilborn¹ | Claudio C. Buratti² | Erich Díaz Acuña³ | Daniel Hively¹ |
Jeppe Kolding⁴ | Hiroyuki Kurota⁵ | Nicole Baker¹ | Pamela M. Mace⁶ |
Carryn L. de Moor⁷ | Soyoka Muko⁵ | Giacomo Chato Osio^{8,9} | Ana M. Parma¹⁰ |
Juan-Carlos Quiroz¹¹ | Michael C. Melnychuk¹

- Global small pelagic fisheries (anchoveta, sardine, herring, etc) are sustaining their biomasses at expected levels.
- A reduction in fishing pressure has been central to that success.
- Small pelagics are among the MOST sustainable of all fisheries.

The Evolution of Sustainability Metrics

Fish In:Fish Out ratio (FIFO): how much fish is used to produce farmed fish



But all are simplistic assessments of a complex issue



The Forage Fish Dependency Ratio (FFDR): based on the quantity of wild fish used in feeds

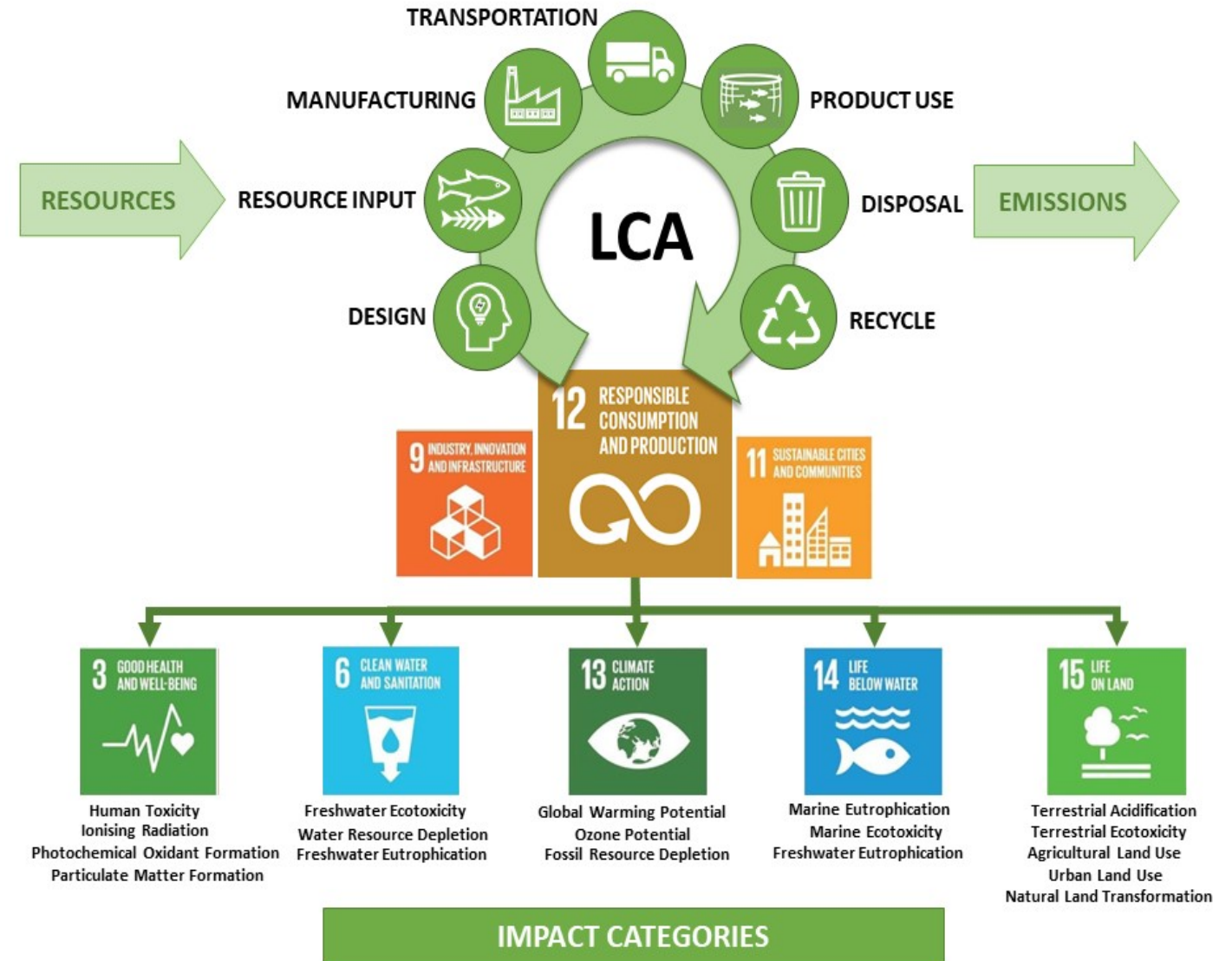


Economic Fish In:Fish Out (eFIFO): applying an economic allocation

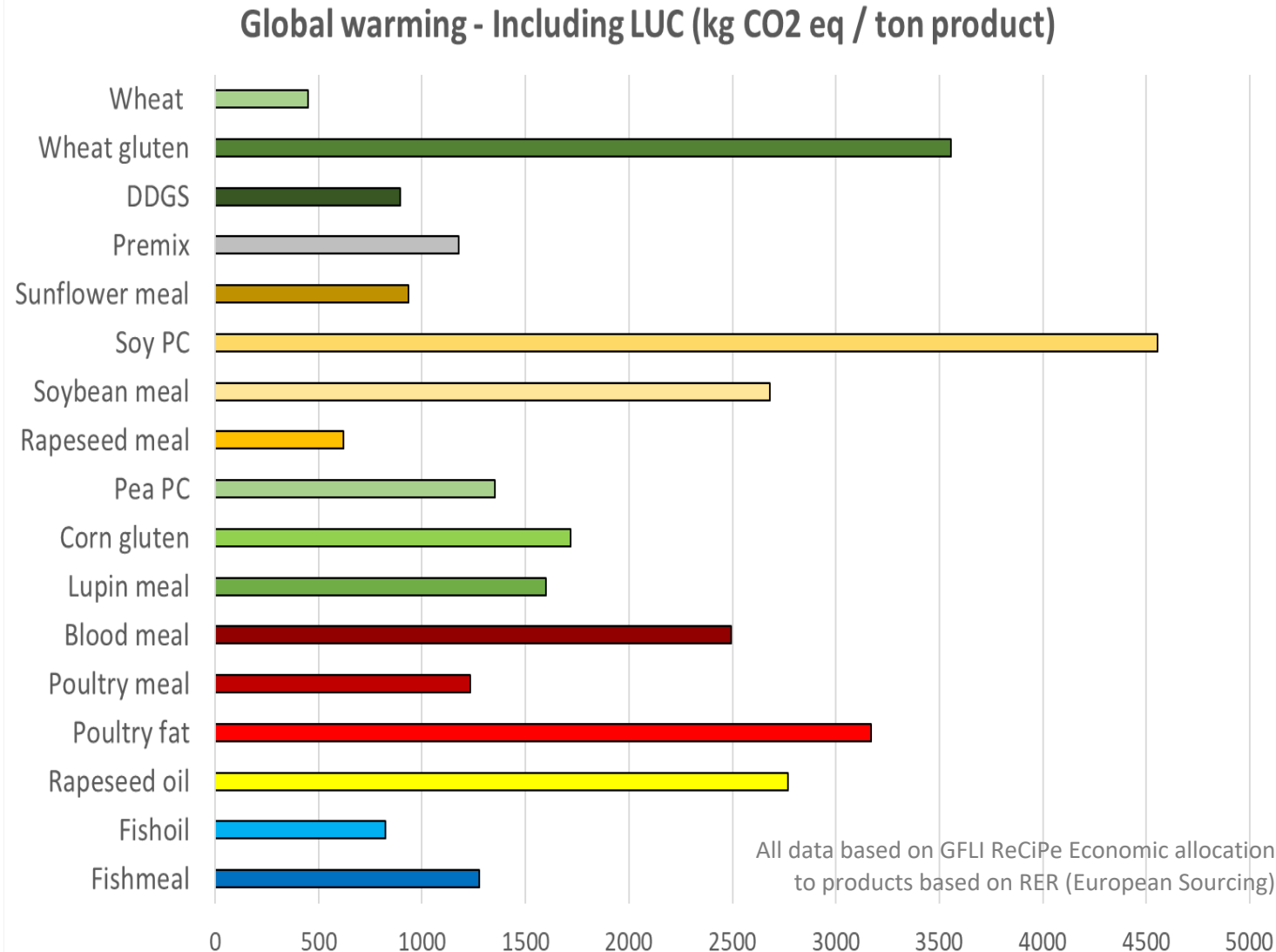


Life Cycle Assessment Approach to Impact Analysis

- Life Cycle Assessment (LCA) aims to compare the full range of environmental effects assignable to products and services by quantifying all inputs and outputs of material flows and assessing how these material flows affect the environment.
- Based on compiling an inventory of relevant energy and material inputs and environmental releases
- Increasingly seen as the “mainstream” way to establish environmental credentials.

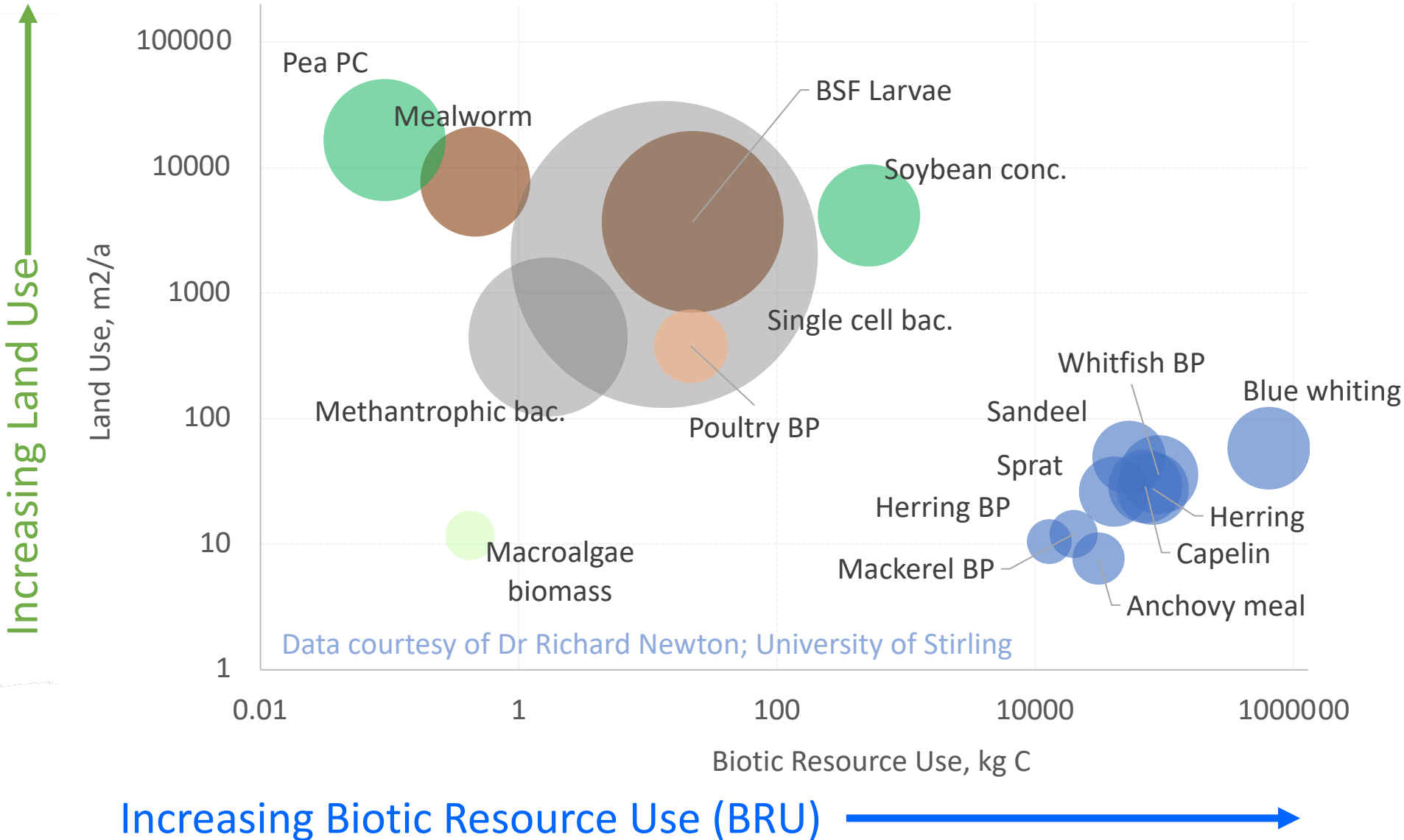


Low Carbon Footprint Ingredients

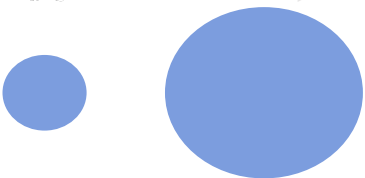


- Increasingly of importance is the environmental footprint of feed ingredients.
- The Global Feed Lifecycle-Assessment Institute (GFLI) acts as an independent database on close to 1000 ingredients.
- A simple examination of the Global Warming Potential (Carbon footprint) shows that marine ingredients compare very favourably.

All Ingredients Have Sustainability Trade-Offs



Bubble size: relative carbon footprint

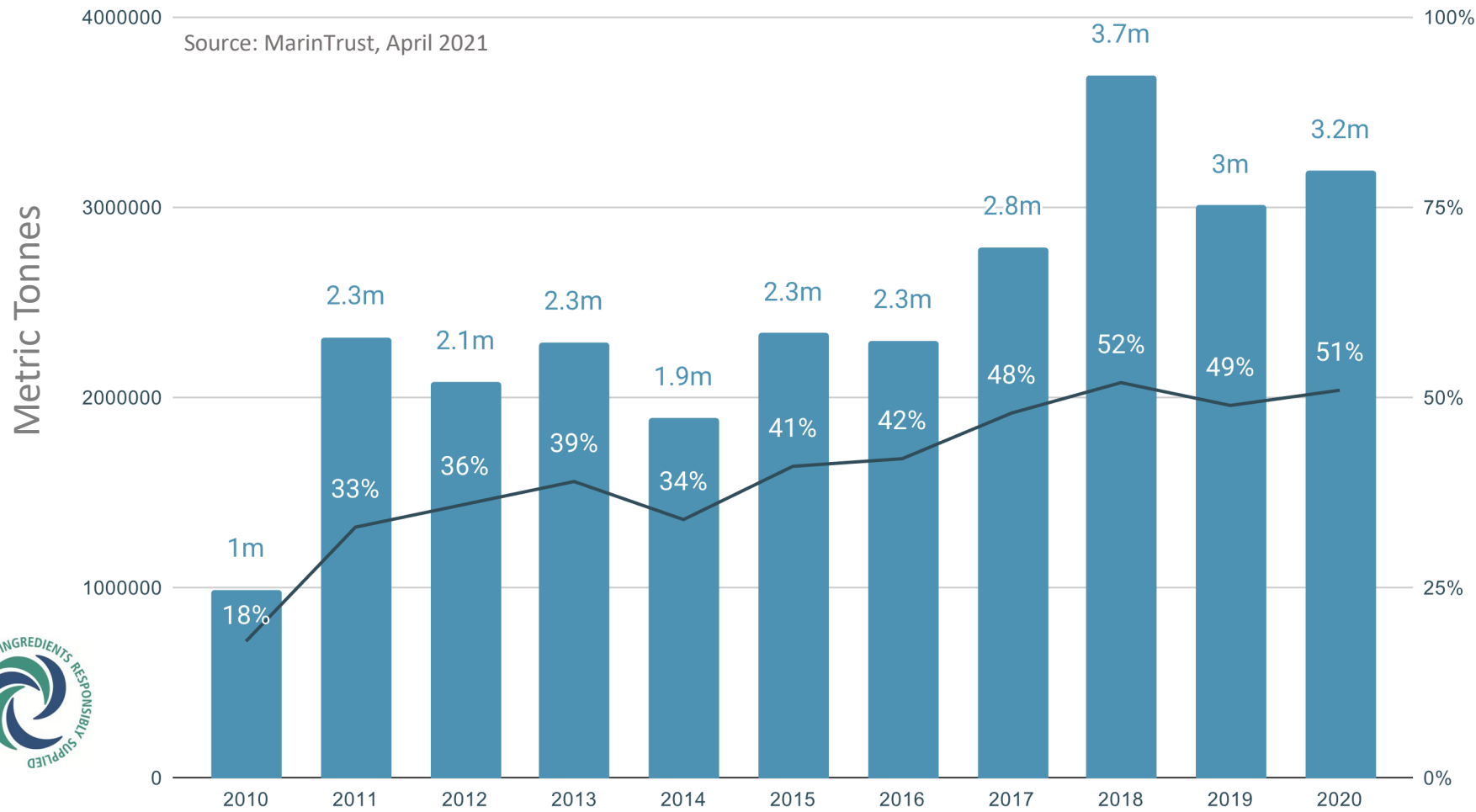


Role of Certification Programs



Let's Consider Scale

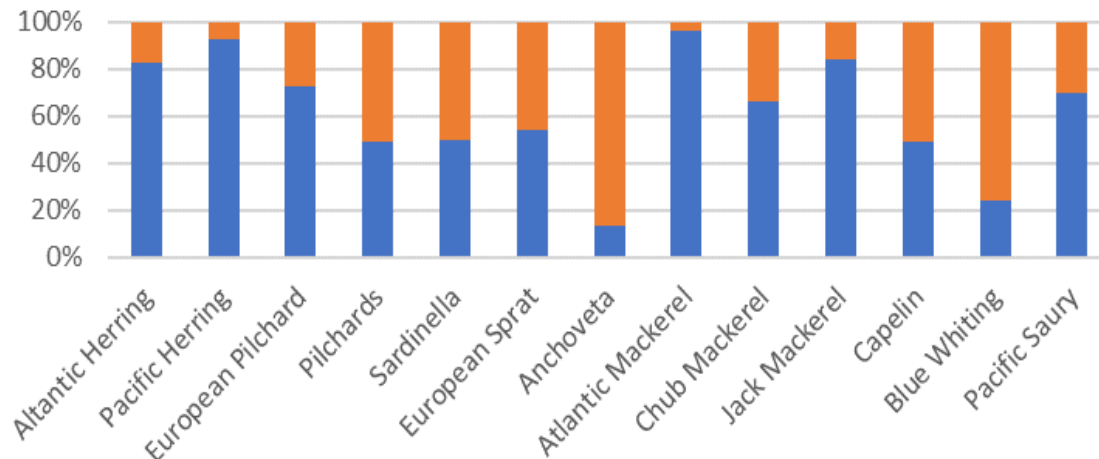
Volume of Certified Production ■ — Percent of Global Production



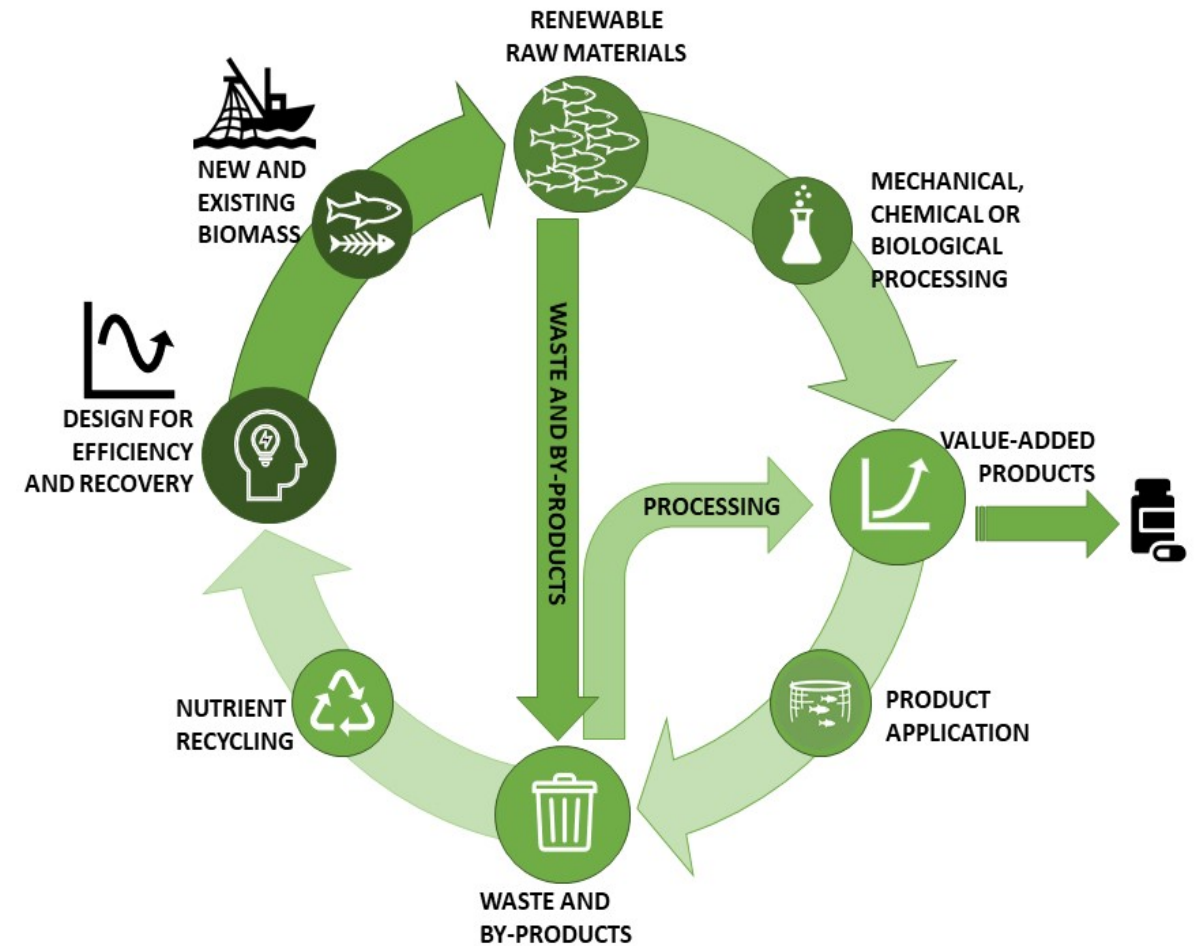
No Such Thing as Waste

- The majority of fish caught and farmed is for human consumption, but less than 50% of that is eaten.
- Fisheries that were once considered forage species are now being redirected to food (DHC), but still supply by-products.

Consumption versus Rendering

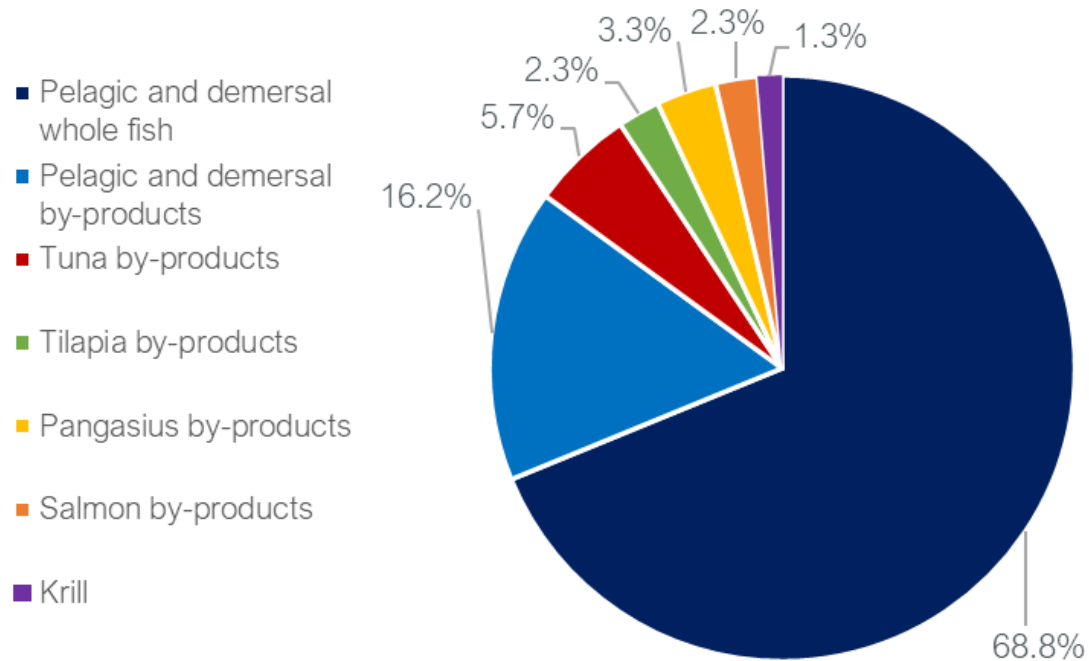


Data: Kontali 2022 ■ DHC ■ Forage

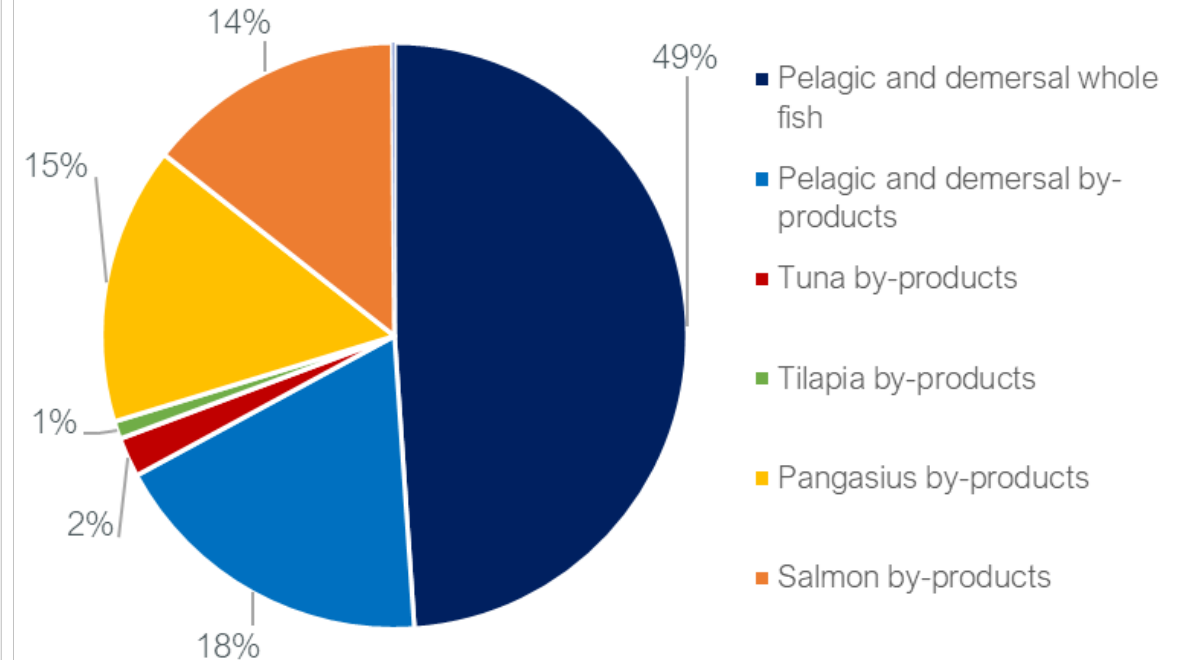


By-Products Increasingly Important

Fishmeal in 2021



Fishoil in 2021



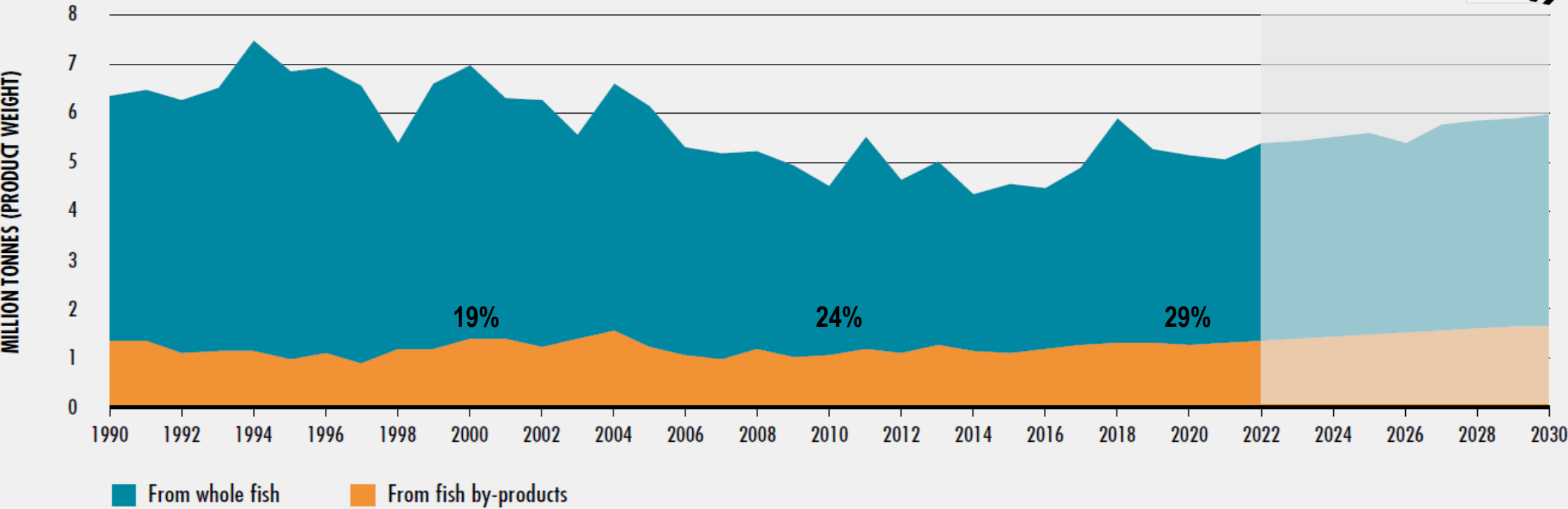
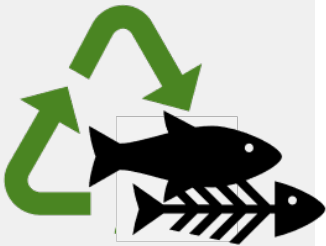
- By-product resources currently supply about 32% of all FMO ~2.0Mtonnes.
 - Aqua: 770 ktonnes
 - Fishery: 1242 ktonnes

Source: IFFO 2022



Marine Ingredient Supply Is Growing From By-Products

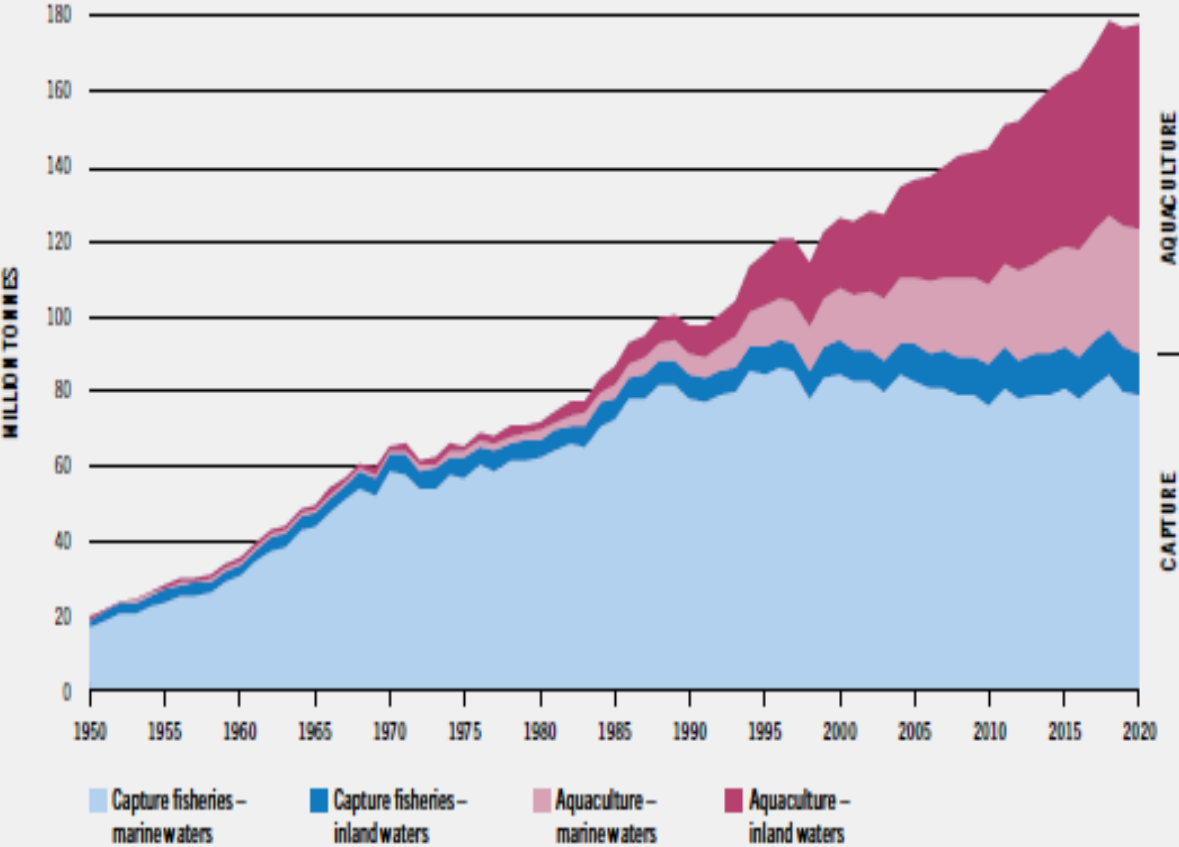
FIGURE 55
WORLD FISHMEAL PRODUCTION, 1990–2030



SOURCE: FAO SOFIA 2020

How Finite are These Resources Really?

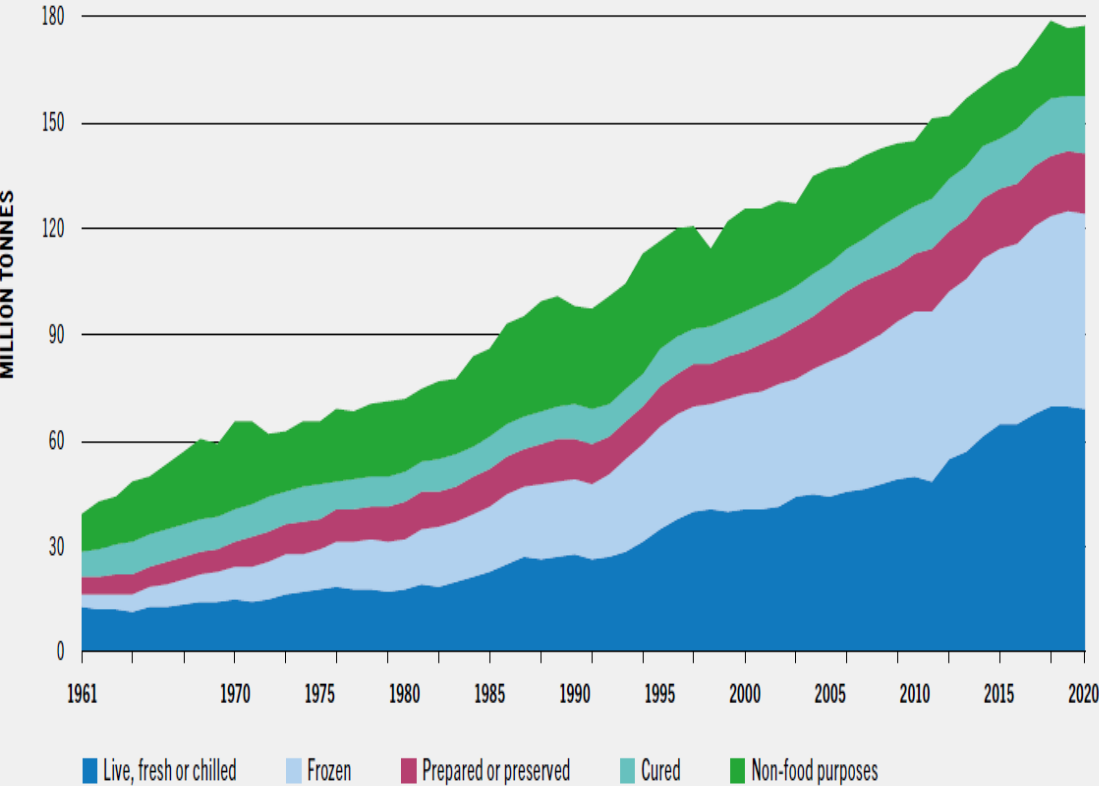
FIGURE 1 WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



NOTES: Excluding aquatic mammals, crocodiles, alligators, caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

Source: FAO SOFIA Report 2022

FIGURE 35 UTILIZATION OF WORLD FISHERIES AND AQUACULTURE PRODUCTION, 1961–2020



NOTES: Excluding aquatic mammals, crocodiles, alligators and caimans and algae. Data expressed in live weight equivalent.
SOURCE: FAO.

Source: FAO SOFIA Report 2022

■ **Still the Nutritional Benchmark**

- Marine ingredients remain highly cost effective sources of important nutrients.
- Supplies have stabilised over the past 10-years.
- Seen as “strategic” ingredients, no longer a bulk supply of nutrients.

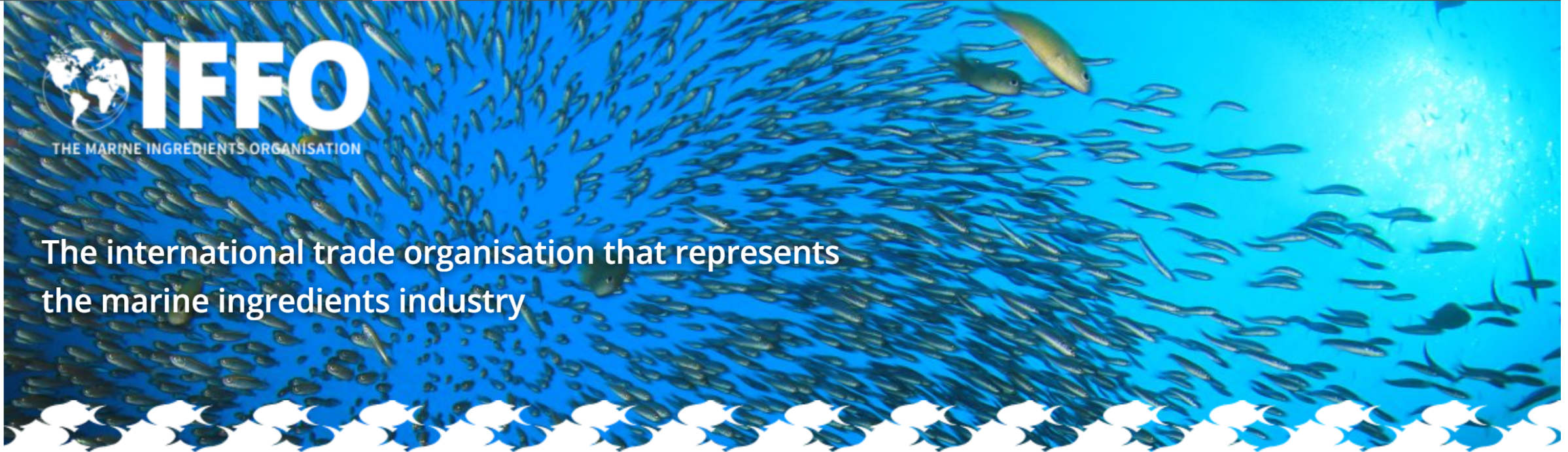
■ **Leading Sustainability**

- Sustainability remains paramount to the industry.
- Small pelagics fisheries are considered among the MOST sustainable of all fisheries.
- Sustainability metrics are moving towards more holistic forms like LCA that show marine ingredients have some significant advantages.

■ **Ensuring Responsible Supply**

- Marine ingredients are one of the most independently certified of all feed ingredients.
- By-Products are becoming a major contributor to production (No such thing as waste).
- Circularity is going to become increasingly important to the industry.
- Increasing aquaculture production provides avenues for sector growth.

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