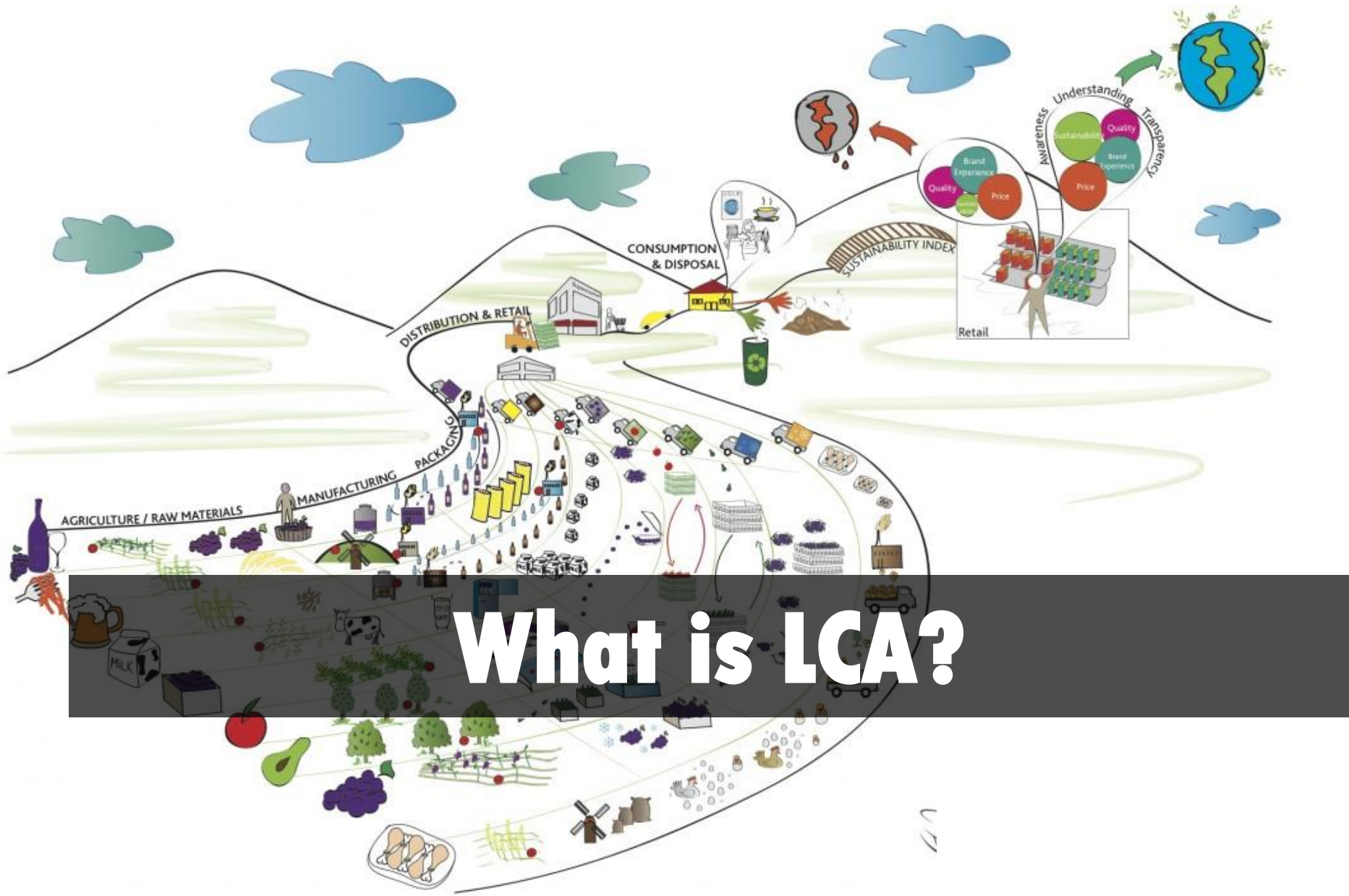




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What is LCA? (I)

- A tool to map and quantify the environmental impacts that a product causes through its life cycle, from cradle-to-grave.
- Where an economic assessment book keeps monetary flow, and map where values are generated, the LCA book keep mass and energy flows and map where environmental impacts are caused.
- LCA is standardized by ISO in their 14 000 family on environmental management.
- The Product Environmental Footprint (PEF) method is EU's rewriting of the LCA method (in my words). This method is also «standardized» by the PEF guide.
- The Environmental Products Declaration (EPD) system(s) produce Product Category Rules (PCR) to be used together with the ISO 14 000 standards.

What is LCA (II)

- LCA is holistic by taking a complete life cycle, or a complete production system, into account, and by including a complementary set of environmental impacts
- LCA can discover how a change in the production system may cause a shift in location or type of environmental impacts. Or even better, explain and quantify the net reduction of environmental impacts, caused by a change in the system.
- LCA include not only the direct impacts from handling of your product, but also impacts caused by everything that underpins the value chain of your product: Energy production, raw material extraction, infrastructure etc.

What is LCA? (IV)

- Initially a tool for environmental management. For decision makers.
- Potentially good tool to form the basis for ecolablieng, but this is only one of several potential efficient ways of using LCA.
- The methodology grew out from logistic optimization methods developed during 1st world war. Basically identical to that of input-output economy methodology.

LCA/PEF vs Risiko

«Frem til i dag» har miljøstyring i stor grad vært preget av en risikobasert tilnærming.

- Fokus på å unngå uønskede hendelser innenfor planlagt og lovlig drift.

Nå også fokus på å redusere miljøpåvirkning fra planlagt drift.

- Redusere energibruk og direkte klimagassutslipp
- Velge innsatsfaktorer med lavere miljøfortavtrykk
- Lage produkter som er mer miljøvennlig ei distribusjon, bruk og avhending

The iterative phases of an LCA

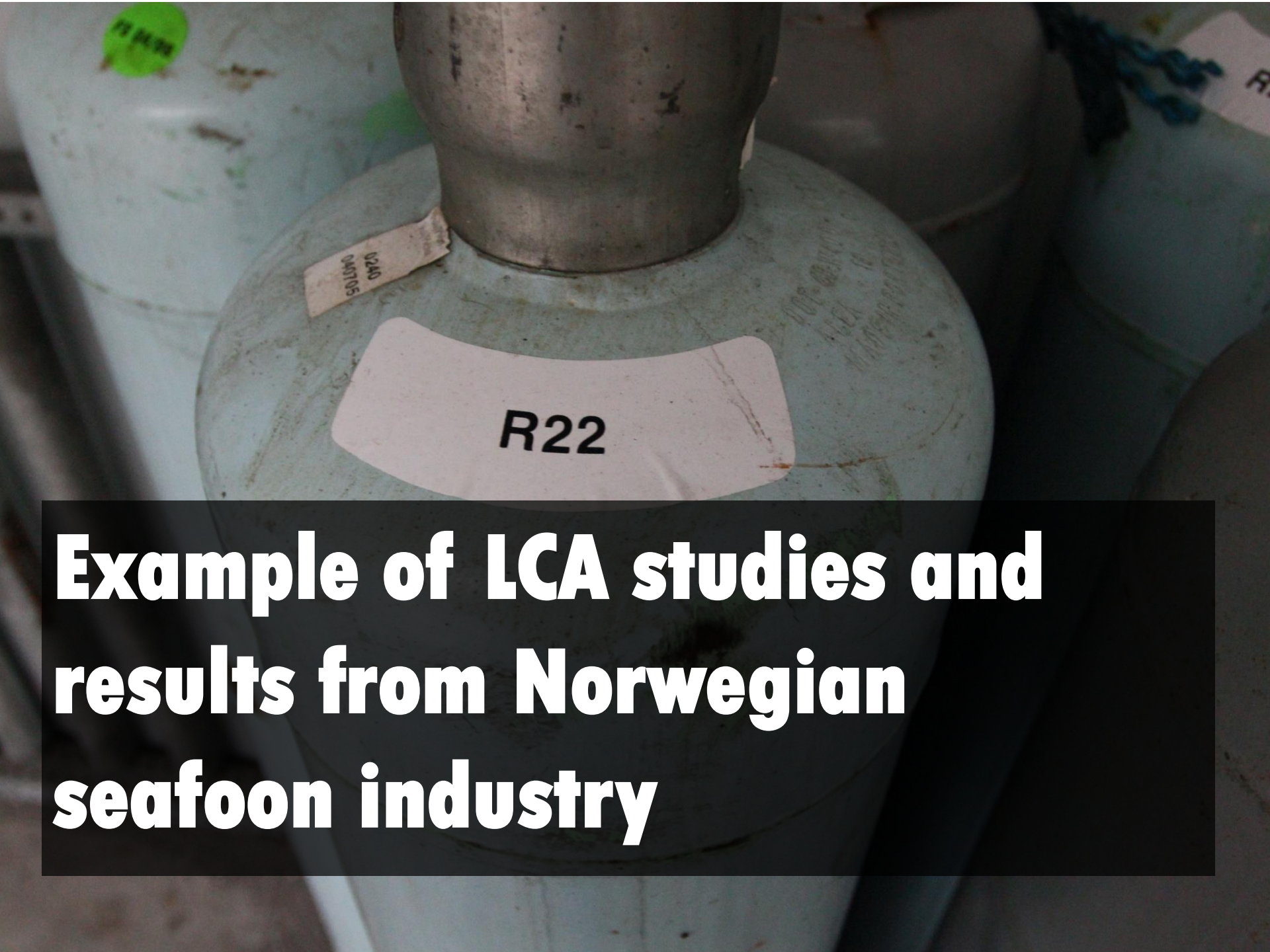
- Goal and scope: Exactly what is the assessment for, what is the intended use and audience
- Inventory: Gather the data that is needed to fulfill your stated goal and scope
- Impact assessment: Model your system with the data that you have gathered, perform calculations and quantify potential environmental impacts
- Interpretation: The knowledge about the environmental properties of your product or your organization is continuously generated. The final results are only part of it and can even be misleading without sufficient understanding of the method, data and assumptions behind them

LCA: Practical challenges

- The perfect LCA should cover every type of environmental impacts that a product causes through its life cycle. To do this one would have to set a perfect mass and energy balance for each and every step of its life cycle and everything that underpin these steps. Transport, infrastructure....
- A mass and energy balance means quantifying, for each and ever
 - what goes inn to every process
 - and life cycle stage and what comes out, emissions, byproducts, waste, heat.....

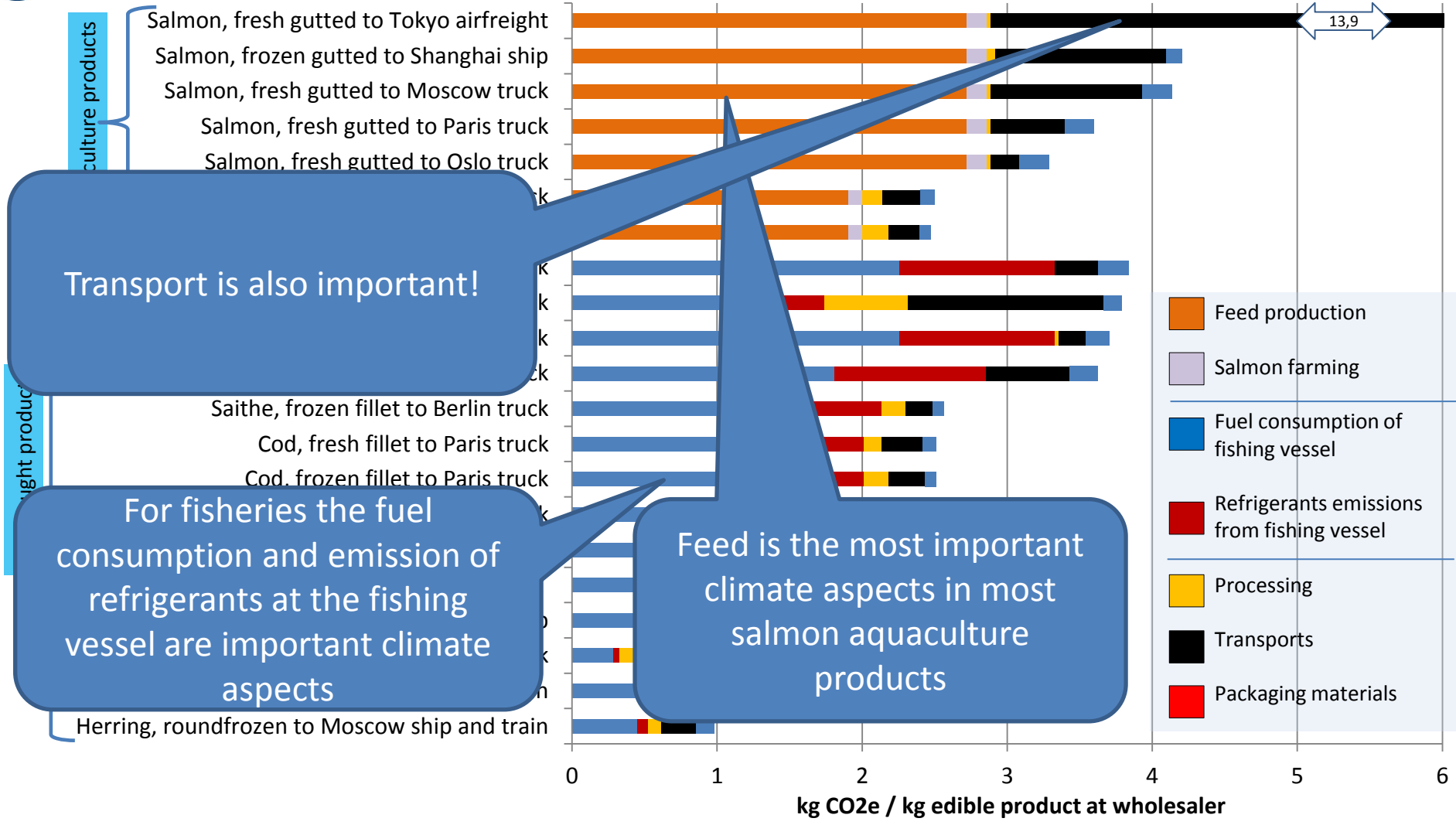
Goals of the PEFCR Development

- (Chapter 1.1): PEFCRs shall be developed according to the PEF Guide . PEFCRs shall aim to focus PEF studies on those aspects and parameters that are most relevant in determining the environmental performance of a given product. A PEFCR shall further specify requirements made in the general PEF Guide and shall add new requirements where the PEF Guide provides several choices or where the PEF Guide was not covering sufficiently the particularity of life cycle of a specific product category.
- This is ok, but somewhere they also added the goal of benchmarking



R22

Example of LCA studies and results from Norwegian seafoam industry



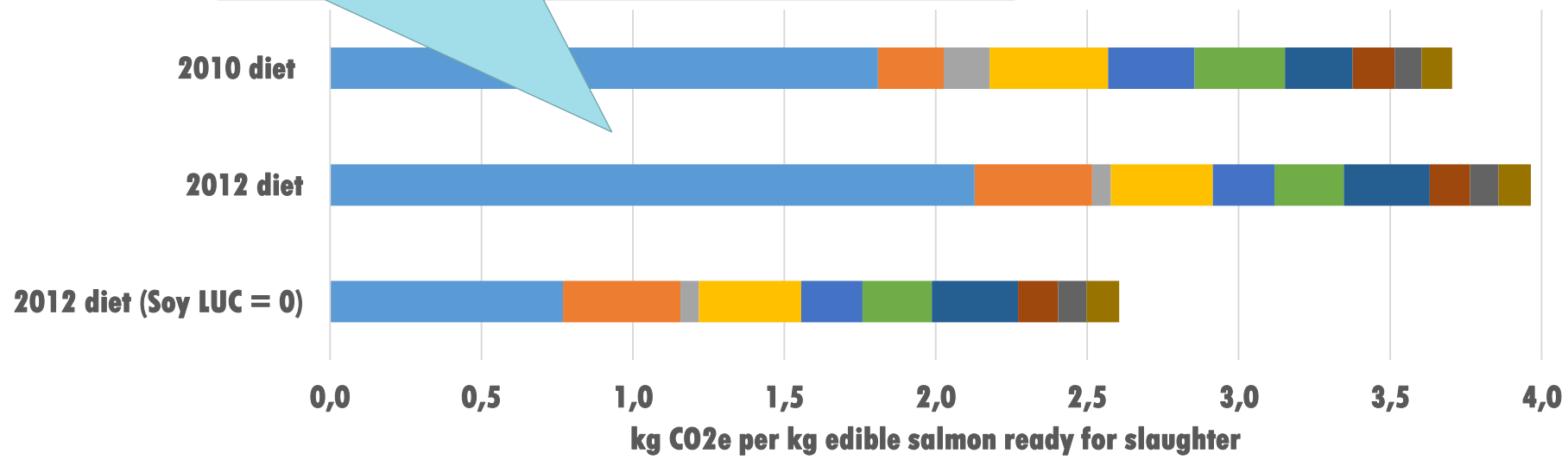
Transport is also important!

For fisheries the fuel consumption and emission of refrigerants at the fishing vessel are important climate aspects

Feed is the most important climate aspects in most salmon aquaculture products

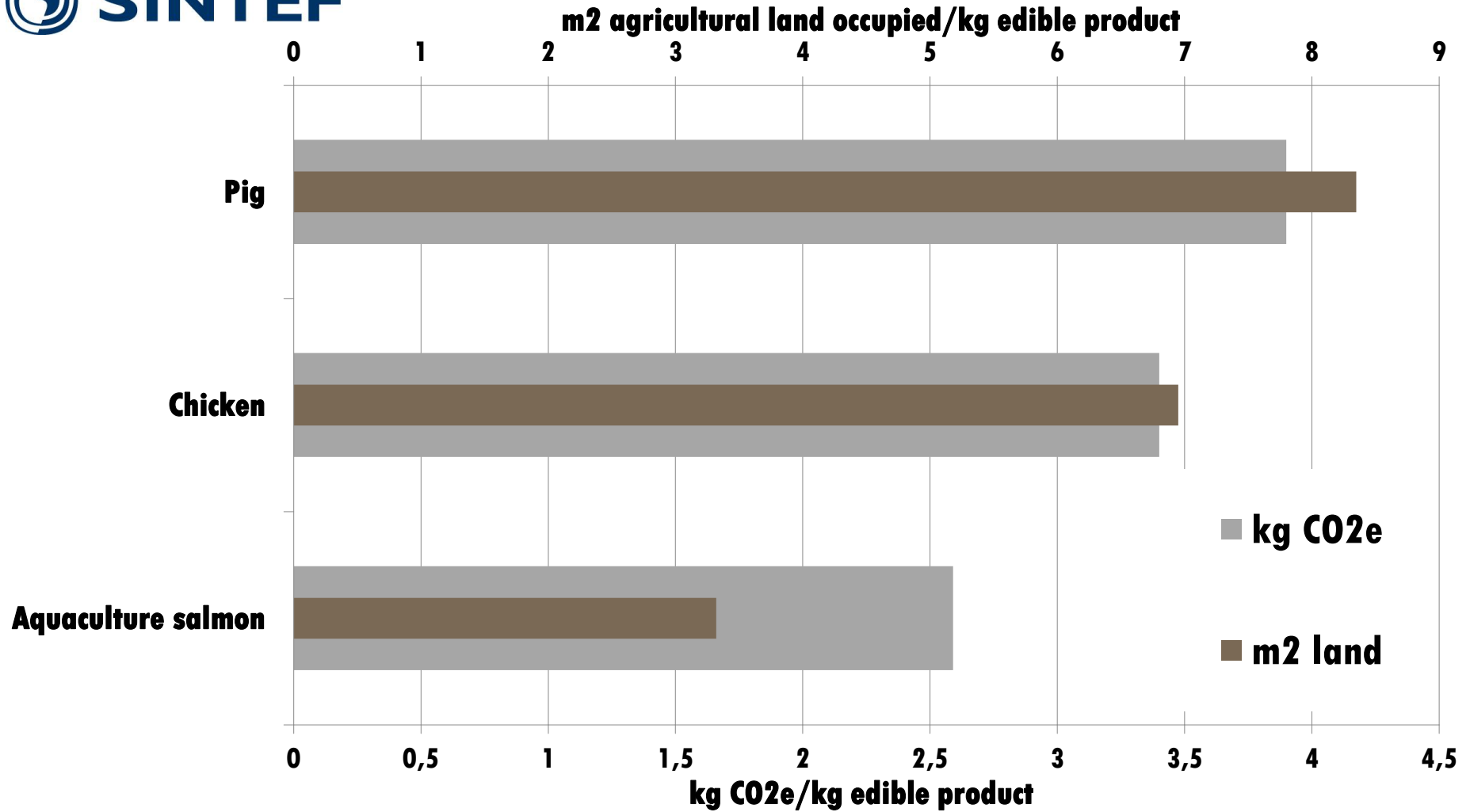
Accumulated sum of GHG emissions caused by producing, processing and transport 1 kg edible product of different Norwegian seafood products to different markets. From the report "Carbon footprint and energy use of Norwegian seafood products" by SINTEF and SIK. Full report here:

The FCR improved, but content of Soy Protein Concentrate increased. Due to land use changes and associated climate impacts this made the carbon footprint increase



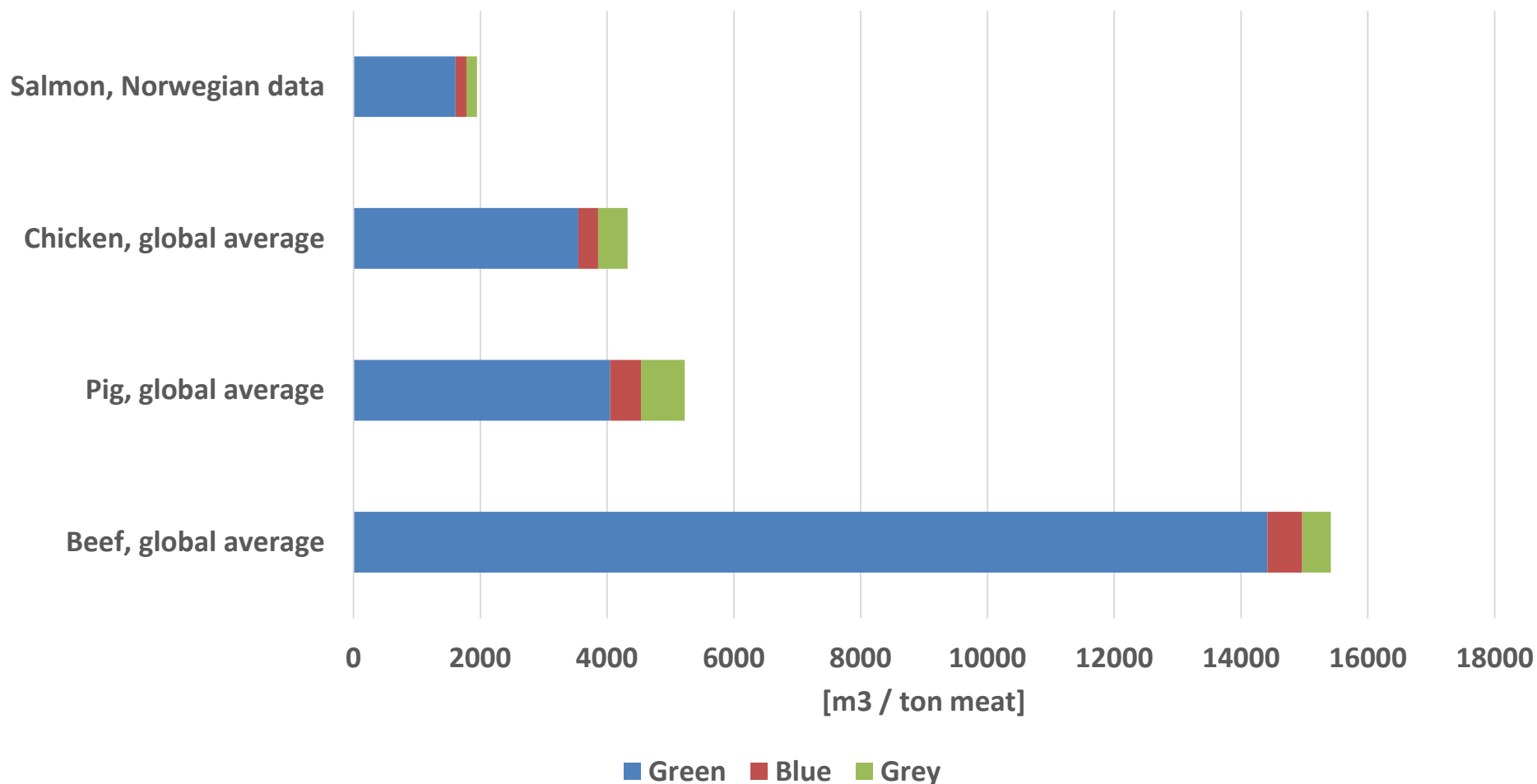
- Vegetable protein
- Vegetable oil
- Vegetable starch/carbohydrates
- Marine protein
- Marine oil
- Reduction to marine oil/meal
- Micro ingredients
- Pellets production
- Smolt production
- Salmon farming

Accumulated sum of GHG emissions per kilo of edible salmon at the stage where it is ready for slaughter. Average data for the Norwegian aquaculture industry. FCR for 2010 1,3. FCR for 2012 1,2. The case «2012 diet (Soy LUC=0) refers to a case where climate changes from land use change caused by growing of soy beans is not included.



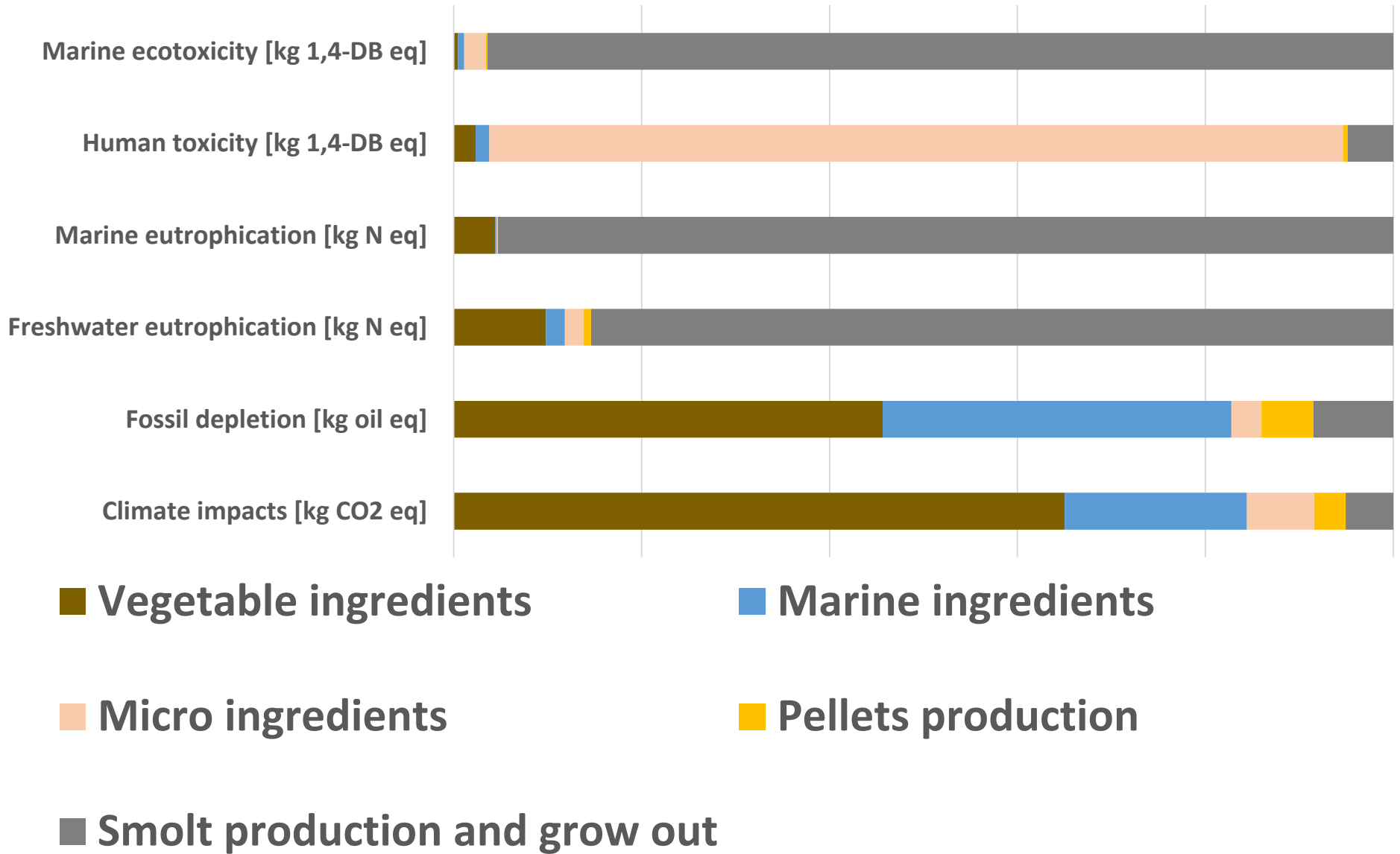
Comparison of occupation of agricultural land (top axis) and greenhouse gas (GHG) emissions (bottom axis) from production of 1 kilo edible Norwegian aquaculture salmon and Swedish chicken and pig. From project with SIK: "Carbon footprint and area use of farmed Norwegian salmon". Full report: www.sintef.no/miljoregnskap-sjomat

Comparison of water footprints



Results from using the method promoted by the Water Footprint Network and demonstrated by Mekonnen et al. in their assessments of the water footprint of crops and animal products. www.waterfootprint.org. **Data:** Mekonnen, M.M. and A.Y. Hoekstra, *The green, blue and grey water footprint of crops and derived crop products*. Hydrol. Earth Syst. Sci., 2011. **15**(5): p. 1577-1600. **Results for beef, chicken and pig:** Mekonnen, M. and A. Hoekstra, *A Global Assessment of the Water Footprint of Farm Animal Products*. Ecosystems, 2012. **15**(3): p. 401-415.

Holistic view of 2012 salmon production





**What can you use LCA
for?**

LCA in R&D

- LCA provides an established and trusted method to explore the potential environmental effects of a new product, technology, strategy etc.
- The holistic approach avoids sub optimization as it will help you discover
 - how environmental impacts might have changed location rather than been reduced
 - or how one environmental impacts has been traded off for another
 - **Clearly show how your solution has a net positive environmental effect**



Market requirements

Retailers and governments require that their suppliers can document the environmental properties of their products with LCA

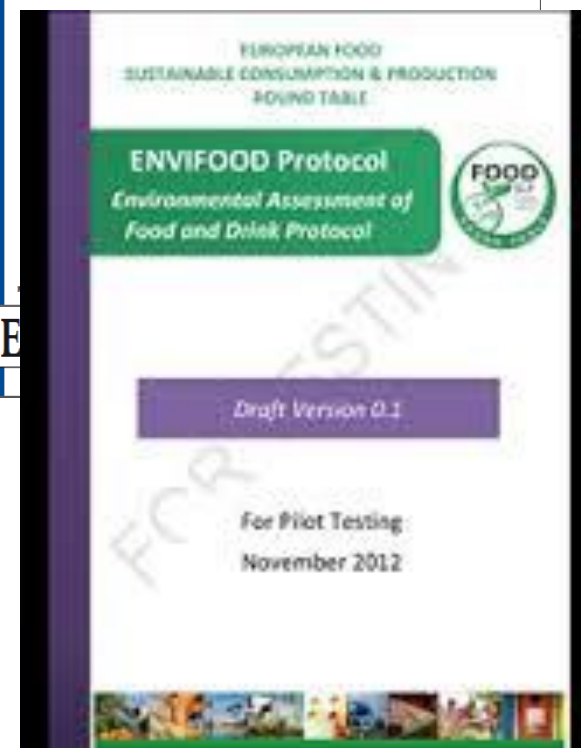
- The European Commission and their Single market for green products
- Retailer consortiums



PEFCR bakgrunn for utvikling og oppgaver

Single market for green products

- The EC will require that all products on the European market is followed by documentation of their environmental properties.
- This documentation should be based on LCA and the Environmental Footprint Method
- In this very moment the rules for seafood products – for what the assessment should include - is developed. The Norwegian Seafood Federation is leading this task.
- **Every stakeholder in the global seafood industry should pay attention to this development and consider to become a part of it – to make sure the rules are set fair, reasonable and responsible.**



Hva skal TS gjøre?

Foreslå et sett med regler for hvordan et miljøfotavtrykk av sjømatprodukter skal gjennomføres og hvordan det kan brukes (kommuniseres). Dette regelverket skal utvikles i henhold til EU kommisjonens retningslinjer for utviklingen av en PEFCR, dette er et omfattende regelverk som blant annet inkluderer:

- A. Gjennomføre analyser av utvalgte produkter for å danne grunnlaget for reglene. Screening analyser. Analysene skal favne alle produkter som regelverket har som ambisjon å gjelde for.
- B. Kommisjonen vil at analysene gjennomføres på en slik måte og med et slikt omfang at de gir en referanseverdi (benchmark) for de produktene som regelverket skal gjelde for. De vil ut far dette definere «prestasjonsklasser» (performance classes) for produktene.
- C. Regelverket skal teste ut underveis ved at et utvalg næringsaktører tar i bruk det da gjeldene utkast til regelforslag og gjennomfører analyser av sine produkt. Supporting studies.
- D. Ulike måter å kommunisere resultatet av regnskapene skal testes ut. Ulike kommunikasjonskanaler (App? Annonser? Produktmerke? Sertifikat?) og formidling av resultatet (fargeskala? Tall? Smilefjes?)

Hva skal TS ta stilling til i sitt forslag til regelverk?

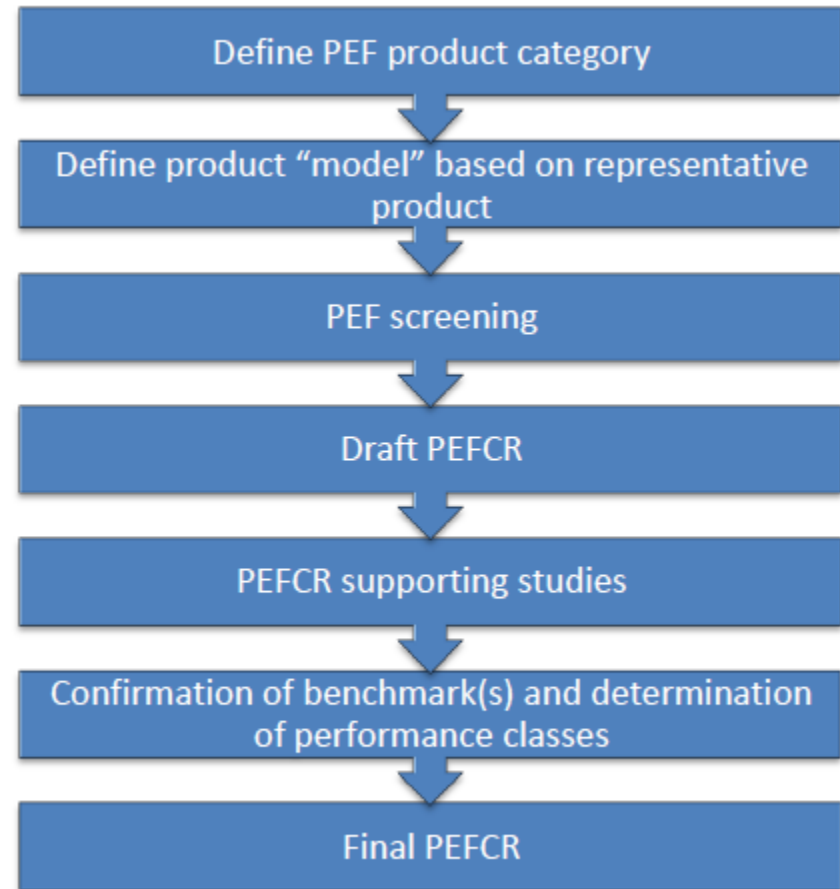
- Nøyaktig hvilke produkter skal regelverket gjelde for?
 - Hvilke produkter kan vi inkludere mht.: Representativiteten i TS? Kommisjonens krav? Tilgjengelig kunnskap og data?
- Hva skal regnskapet inkludere?
 - Hvilke steg i livsløpet til sjømatprodukter? Hvilke prosesser?
 - For hvilken enhet skal regnskapet gjøres opp? (funksjonell enhet)
 - Hvilke miljøpåvirkninger skal regnskapet gjøres opp for? Klima? Forsuring? Finnes det etablerte metoder som godt nok inkludere de viktigste miljøpåvirkningene fra fiskeri og havbruk?
- Hvilke krav skal stille til datakvalitet/datapresisjon? Hva må produsenten samle inn av spesifikke data for akkurat sitt produkt og hva kan produsenten hente fra databaser?
- Metodiske valg
 - Hvordan fordeles miljøpåvirkning mellom produkter fra prosesser med mer enn en produkt (Allokering)?
 - Hvordan skal avfallshåndtering og eventuell resirkulering inkluderes?

Hva ligger det i dette for deg?

- Kort sikt:
 - Bruke «screening analyser» og «supporting studies» til å belyse ditt produkt
 - Bakgrunn for miljørapportering
 - Bli bedre kjent med hvordan du kan bruke LCA tankegang i ditt styringssystem
- Langsiktig:
 - Sikre tiltrodd arena for å kommunisere ditt produkts miljøfortrinn
 - Sikre rettferdig, rimelig og robust regelverk (som du uansett må forholde deg til?)

Obligatory activities for our TS

- We are now defining the product category that our PEFCR will cover and the model to be used for screening, supporting and benchmarking studies
- Decisions in on step must be evaluated with respect to the requirements further down the road.
- A wide scope means several/more complex models and screening and supporting studies.



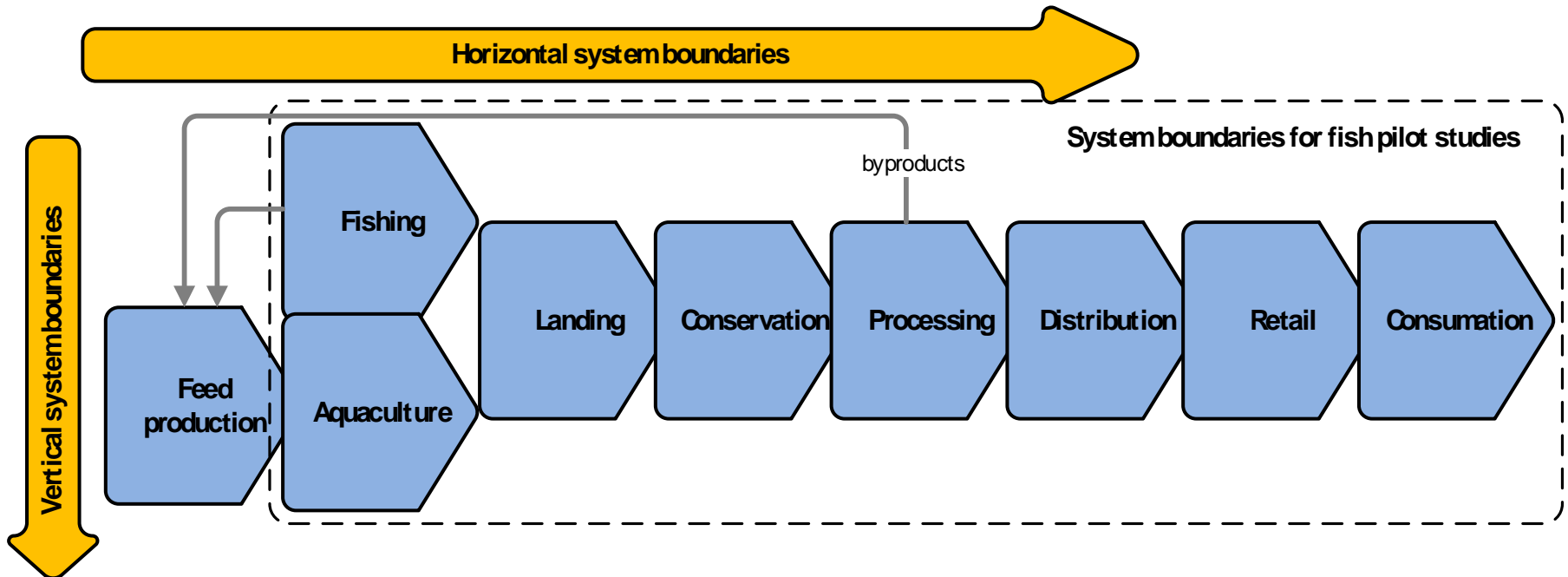
Scope of PEFCR and screenings

- (Chapter 2.3) Pilot testers are advised to define an as broad as possible scope for the PEFCR, including all products that are capable of fulfilling the same function. A too narrow (small) product category definition would result in a very large number of PEFCRs, diminishing the usefulness of the developed PEFCRs. In its extreme, it could lead to meaningless PEFCRs.
- (Chapter 3.4) The objective of the screening is to pre-identify the following key information:
 - Most relevant life cycle stages;
 - Most relevant processes;
 - Preliminary indication about the most relevant life cycle impact categories
 - Data quality needs;
 - Preliminary indication about the definition of the benchmark for the product category/sub-categories in scope.
- In order to use the screening step to identify the hotspots, the “model” of the representative product shall cover all potential technologies/materials that fulfil the scope in order to perform relevant sensitivity analysis. Lack of available data and low market shares shall not be used as an argument for exclusions.

Scope of PEFCR

- Seafood products, including both fish and mollusks, for human consumption
- Crustaceans are not included
 - No European production of significance
- For products where seafood is only part of a manufactured product, the seafood PEFCR can be used to cover the fish or mollusk part of the product, but the other ingredients and the preparation of manufactured products will **not** be covered by this PEFCR.

Scope PEFCR: System boundaries



Functional unit of the PEFCR (I)

- Functional unit for the Seafood PEFCR and its screening and supporting studies will be **“1 kg of edible seafood plus necessary packaging”**
 - “edible” ensuring comparability with other food products and relevant for what most consumers and professional buyers actually consider when purchasing food.
 - For fish edible is defined as meat, liver and roe
 - For mollusks edible is everything except the shell and parts that are considered unsafe to consume
 - For most commercial fish species it already exists established average factors for calculation of weight from:
 - live/round -> gutted -> head off and gutted -> fillet/Back loin etc.

Scope of PEFCR: NACE/CPA classification system.

Included (I):

- 03.0 Fish and other fishing products
 - 03.00 Fish and other fishing products
 - 03.00.1 Fish, live
 - 03.00.12 Live fish, marine, not farmed
 - 03.00.13 Live fish, freshwater, not farmed
 - 03.00.14 Live fish, marine, farmed
 - 03.00.15 Live fish, freshwater, farmed
 - 03.00.2 Fish, fresh or chilled
 - 03.00.21 Fresh or chilled fish, marine, not farmed
 - 03.00.22 Fresh or chilled fish, freshwater, not farmed
 - 03.00.23 Fresh or chilled fish, marine, farmed
 - 03.00.24 Fresh or chilled fish, freshwater, farmed
 - 03.00.4 Molluscs and other aquatic invertebrates, live, fresh or chilled

Scope of PEFCR: NACE/CPA classification system.

Included (II):

- 10.20.1 Fish, fresh, chilled or frozen
 - 10.20.11 Fish fillets and other fish meat (whether or not minced), fresh or chilled
 - 10.20.12 Fish livers and roes, fresh or chilled
 - 10.20.13 Fish, frozen
 - 10.20.14 Fish fillets, frozen
 - 10.20.15 Fish meat, (whether or not minced), frozen
 - 10.20.16 Fish livers and roes, frozen
- 10.20.2 Fish, otherwise prepared or preserved
 - 10.20.21 Fish fillets, dried, salted or in brine, but not smoked
 - 10.20.22 Fish livers and roes dried, smoked, salted or in brine
 - 10.20.23 Fish, dried, whether or not salted, or in brine
 - 10.20.24 Fish, including fillets, smoked
 - 10.20.25 Fish, otherwise prepared or preserved, except prepared fish dishes
 - 10.20.26 Caviar and caviar substitutes

Scope of PEFCR: NACE/CPA classification system. Not included:

- 03.00.3 Crustaceans, not frozen
 - 03.00.31 Crustaceans, not frozen, not farmed
 - 03.00.32 Crustaceans, not frozen, farmed
- 03.00.5 Pearls, unworked
- 03.00.6 Other aquatic plants, animals and their products
- 03.00.7 Support services to fishing and aquaculture
- 03.00.11 Live ornamental fish
- 10.8 Other food products
 - 10.85.1 Prepared meals and dishes,
 - 10.85.12 Prepared meals and dishes based on fish, crustaceans and molluscs

Functional unit of the PEFCR (II)

- What: Seafood products for human consumption
- How much: 1 kg edible product.
- How good: The product should be appropriate for human consumption
- How long: Durability is set in compliance with quality and safety regulations

Representative product

What is a representative product?

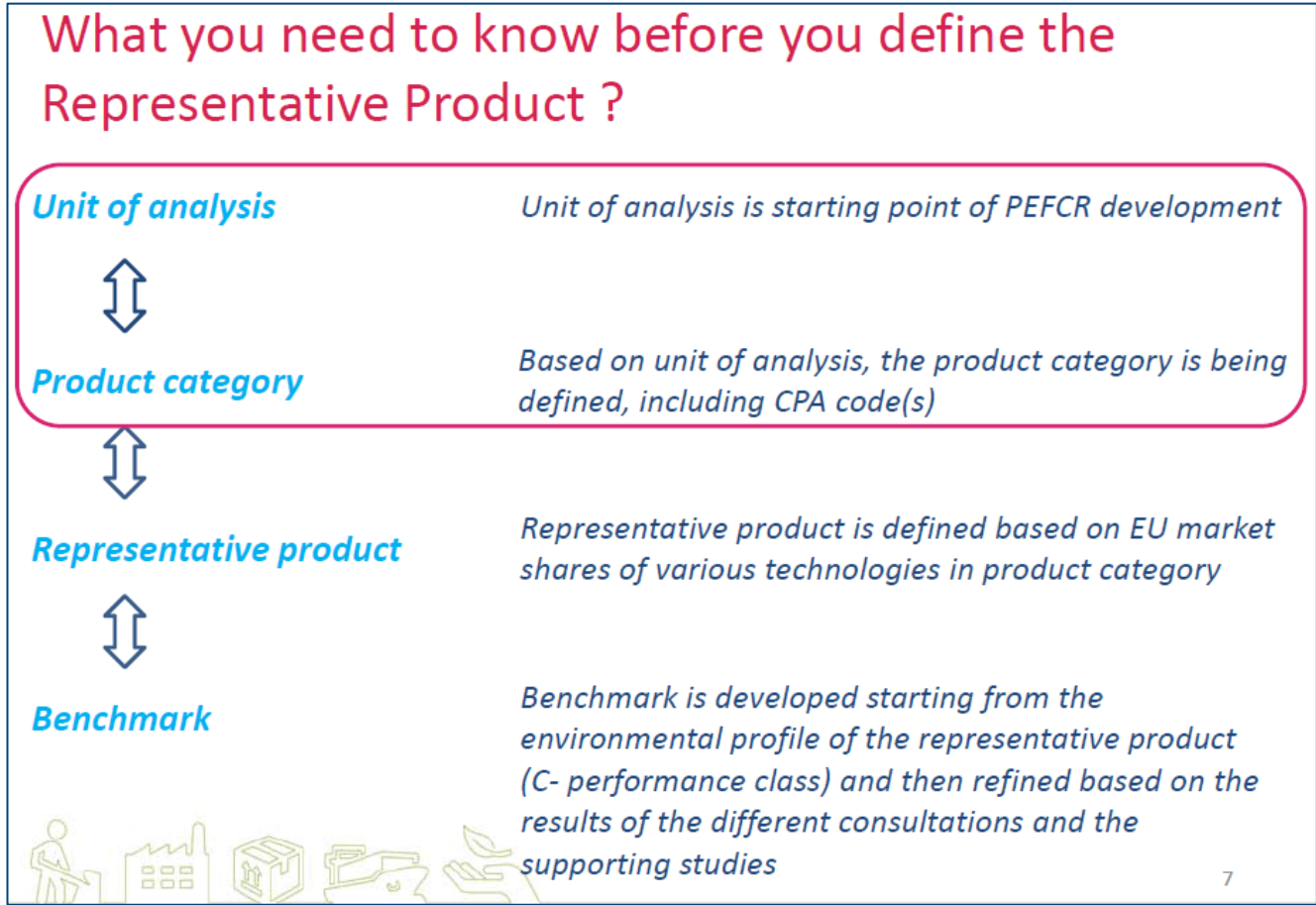
- The representative product represents all products covered by the PEFCR.
- The representative product may or may not be a real product that one can buy on the EU market.
- When the market is made up of different technologies, the “representative product” may be a virtual (non-existing) product with the average EU sales-weighted characteristics of all technologies around.

Representative product

Why define a Representative Product?

- The representative product is the basis of the PEF screening which provides insight into the relevant life cycle stages, processes and impact categories of the product category (including the identification of processes for which primary data are requested).
- The representative product will contribute to the definition of the environmental performance benchmark for the product category (meaning that products within the same product category that serve the same function shall be comparable to each other).

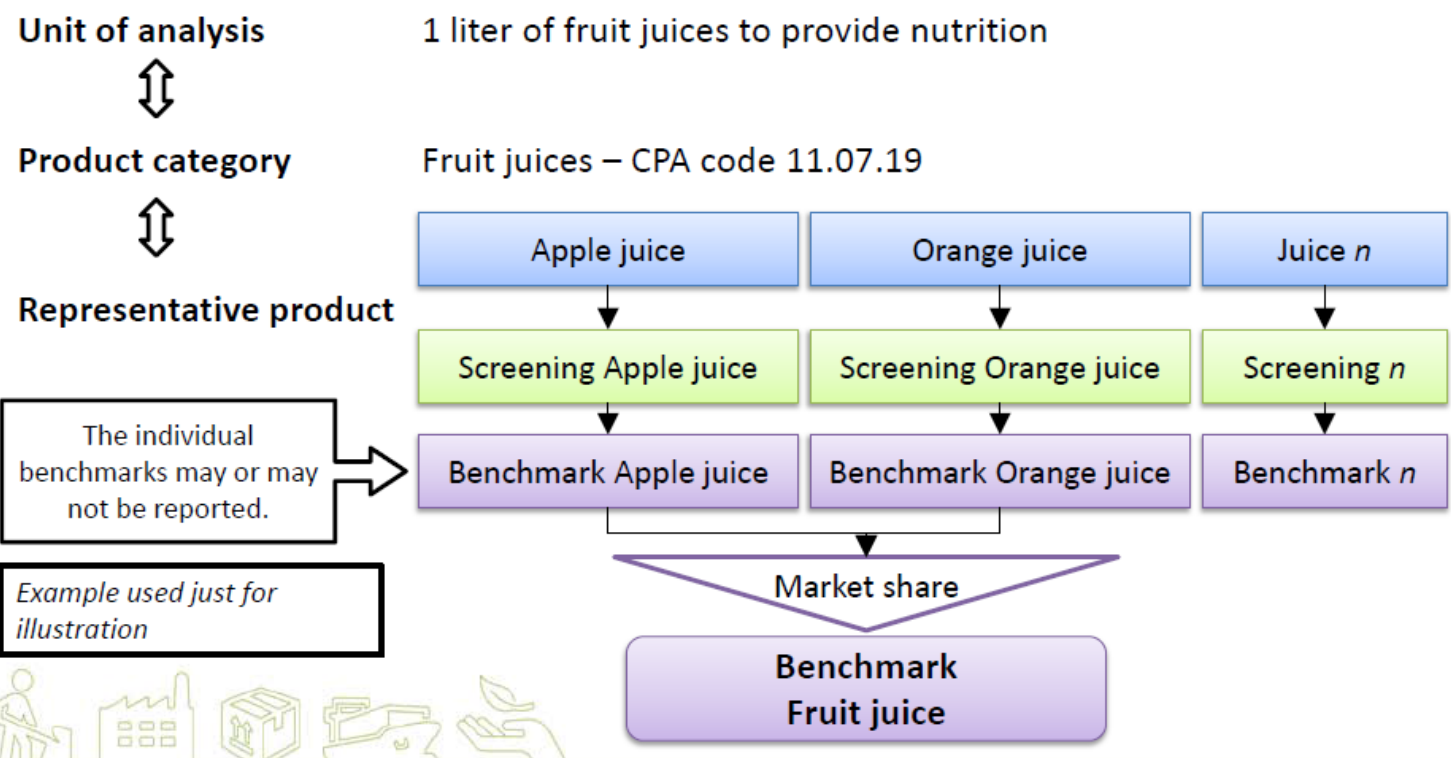
Representative product



Representative product

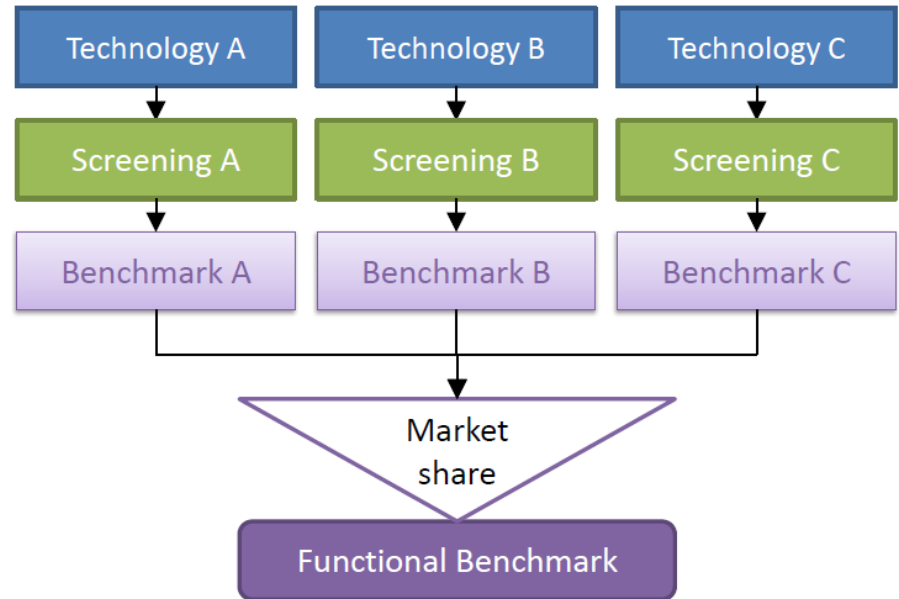
Option 3 - examples

Multiple technologies but single application – Fruit juices



Representative Product: Seafood

- The representative product will be 1 kg of edible seafood.
- Seafood products all deliver same function, a meal, but can be produced and distributed with numerous different methods and technologies
- Multiple technologies but single application



Representative Product

- The environmental impacts caused by a seafood product are connected to how the seafood is produced rather than what species it is produced from
 - One exception from this is the impact on wild stocks, where one would say that what species the seafood is made from is the only thing that matters. Stock impacts will be addressed in the screenings of the wild caught seafood products.
- A selection of production systems were selected for the screening studies, this selection was based on the goal of covering systems that:
 - Produce important volumes of the seafood consumed on the EU market (screenings cover around 92% of European seafood consumption)
 - Are different in how and why they cause environmental impacts (all important production methods are covered).

Representative Product: Screenings suggested

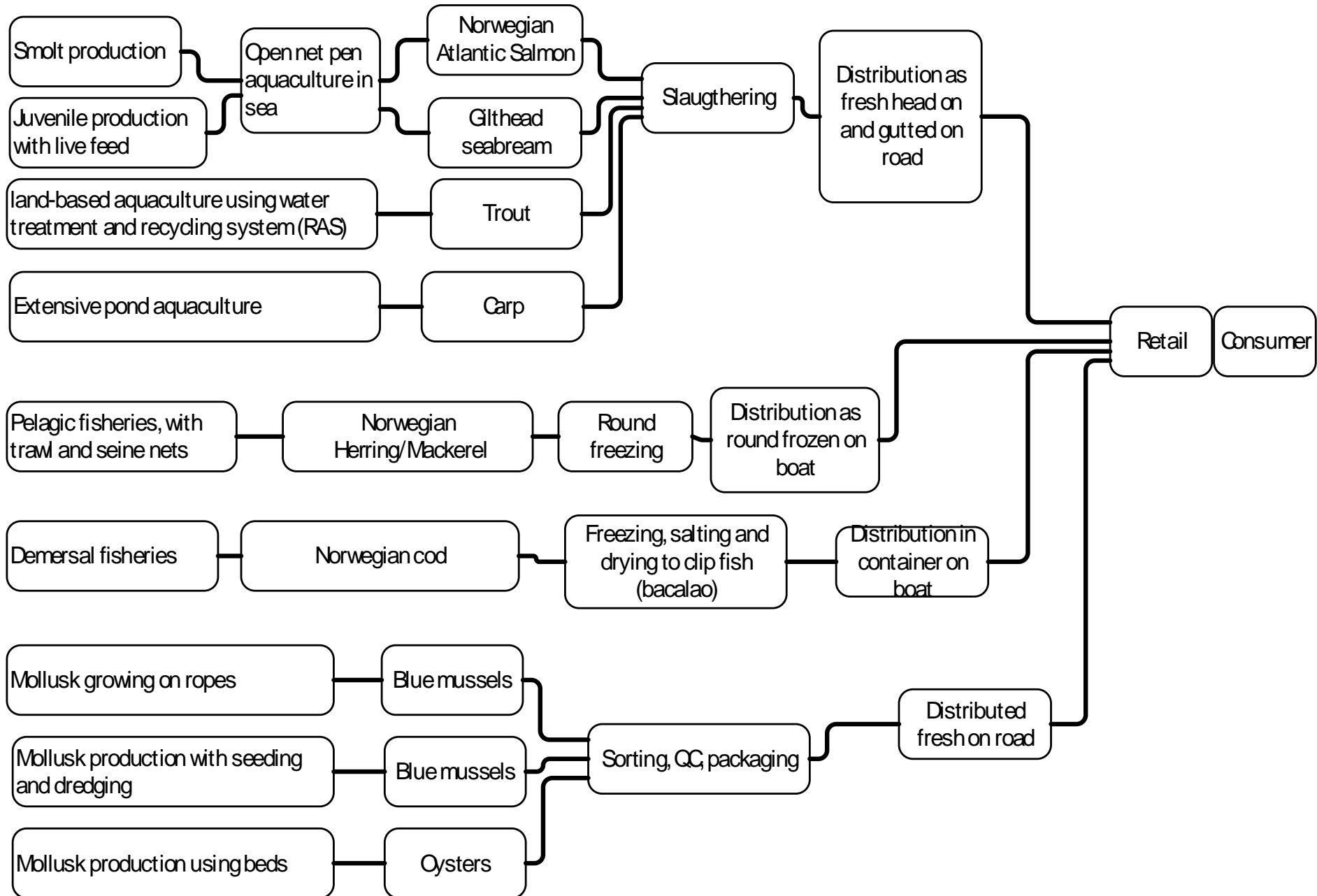
Production technology	Case	Comments
Pelagic fisheries with trawl and seine nets	Norwegian herring	Pelagic species constitute 15% of EU seafood consumption, Herring alone 5%. Tuna that is also fished with similar methods 11%.
Demersal fisheries	Norwegian cod	Ground fish constitute 23% of EU seafood consumption, cod alone 8%. Other marine fish 9%, Cephalopods 5%.
Net pen (cage) aquaculture in saltwater	Norwegian Atlantic salmon	Salmonids from aquaculture constitute 9% of the EU seafood consumption, salmon alone 7%. Fresh water fish from aquaculture constitute 5%. Salt water aquaculture close to 1,5%.
Water recycling system (RAS)	Danish trout	
Extensive pond aquaculture	Hungarian carp	
Aquaculture based on juveniles that uses live feed	Gilthead seabream	
Mollusk production by growing on e.g., ropes	Blue mussels	bivalves and aquatic invertebrates constitute 11%, mussels alone 5% and scallops 2%
Mollusk production using seeding and dredging	Blue mussels	
Mollusk production using beds	Oysters	

Scope of PEFCR and screenings

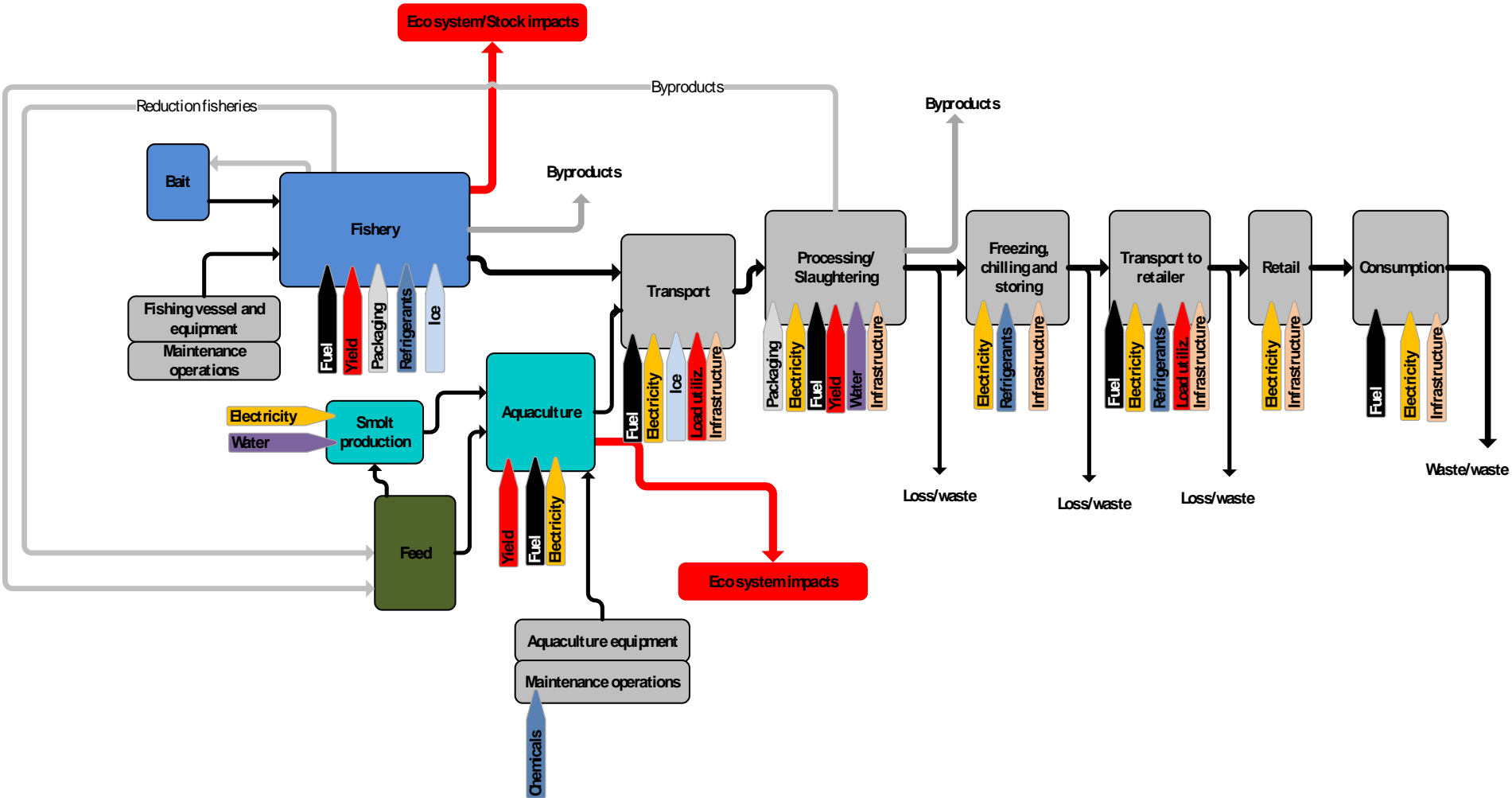
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The screening model

- Functional unit: Same as for the PEFCR: 1 kg edible seafood pluss necessary packaging
- System boundaries:
 - Wild caught products from fishing to consumer
 - Aquaculture products: From smolt/juvenile production to consumer
- Allocation: For process with multiple products mass allocation will be used.
- Data: ??



Screening modell



Bill Of Materials

- The representative product exists of fish or molluscs and conservatives, such as salt, and packaging materials.
- Fish can be divided into different body segments, the following list providing non-exclusive examples, as there are numerous different ways to separate a fish:
 - Head; Guts; Body - Fillets, Back loin, Belly loin; Tail; Fins; Offal - e.g. Stomach, Liver; Eggs or Roe;
- For molluscs, the body and the shell are the 2 main materials.
- Packaging materials are used in different parts of the process: two main types will be bulk packaging, used in the value chain from fishing to repacking, and retail/consumer packaging. Materials commonly used:
 - Plastics: Extruded polystyrene (EPS), polypropylene boxes and polyethylene film
 - Wood: Boxes and pallets
 - Paper and cardboard. Often cardboard with a plastic or wax film

Thank you !



Questions?

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