VALUMICS
Food Systems Dynamics

H2020 VALUMICS Project

Novel Solutions for Food Chain Climate Impact Reduction

Research Findings Brief

August 2021

Life Cycle Assessment was used to estimate the change in environmetnal impact and eco-efficiency of novel technologies targeting hotspots in animal-based food chains. This research evaluated the role of (1) novel feed ingredients (production stage), (2) sustainable aviation fuel (international logistics stage), and (3) wasted food reduction (consumption and end of life stage) on the impact of butter, beef steak and salmon fillets produced in Europe.

Context: what did we set out to achieve?

Impact hotspots

The farm, airfreighting fresh products and wasted food are the most important impact hotspots for fresh animal-based food products.

It is well recognized that the production stage of animal-based foods makes a major contribution to impact. A new finding from our research showed, depending on where the food was sold (the end market), that transport could become a dominant hotspot, and that wasted food can be an important hotspot (Figure 1 illustrates this for Norwegian salmon fillets sold domestically and to Denmark and China).

A number of solutions have been suggested to reduce the climate impact of these hotspots. Our research identified three important solutions, one for each hotspot:

- Farm production stage – novel feed ingredients (black soldier fly, which can be used with both cattle and salmon). Common to all markets.
- Airfreight in the logistics stage – sustainable aviation fuel. Only relevant to international markets.
- Wasted food at the consumer stage – waste prevention programmes. Common to all markets. This research focused on climate impact only.

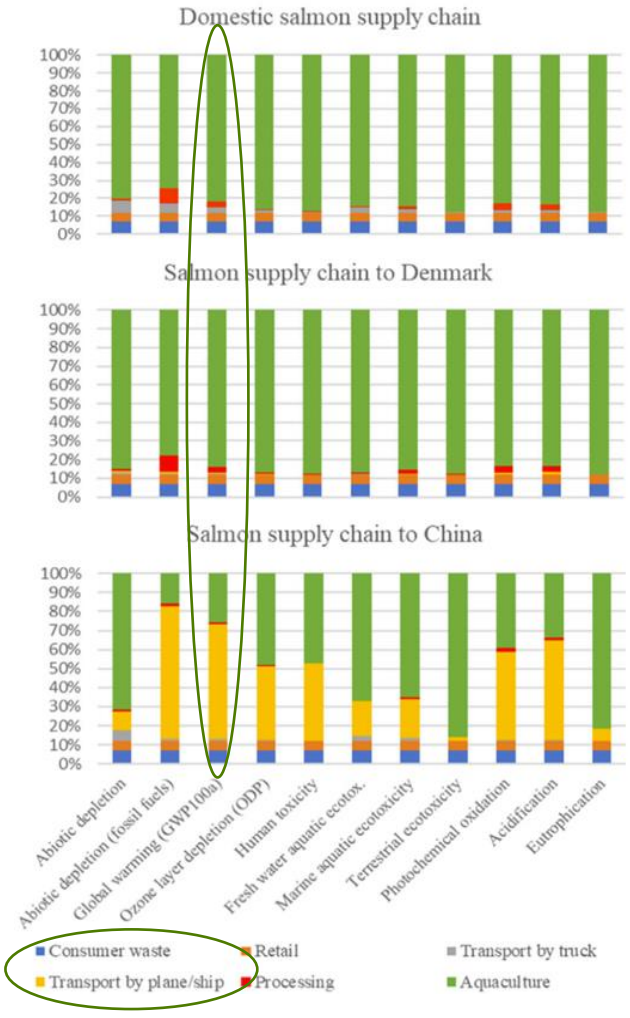

Figure 1. Relative contribution of hotspots for 11 different environmental impacts by market for Norwegian Salmon

What impact reduction was possible?

Novel feed for cattle and salmon

Impact of novel feed

In a whole system context, novel feed could offer a small but consistent climate impact reduction.

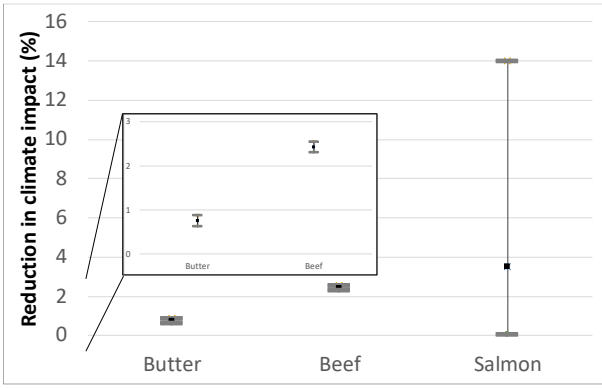

Figure 2. Climate impact reduction due to novel feed

See Figure 2.

- A greater range on impact reduction was possible for salmon than cattle because feed is a larger hotspot for salmon.
- For cattle the effect is small but certain. For salmon the effect is large but uncertain.
- In most cases, a climate impact reduction of 1% to 2% might be expected.

Sustainable Aviation Fuel

Impact of sustainable aviation fuel

Sustainable aviation fuel offers great potential to allow fresh food to be supplied with lower impact to international markets.

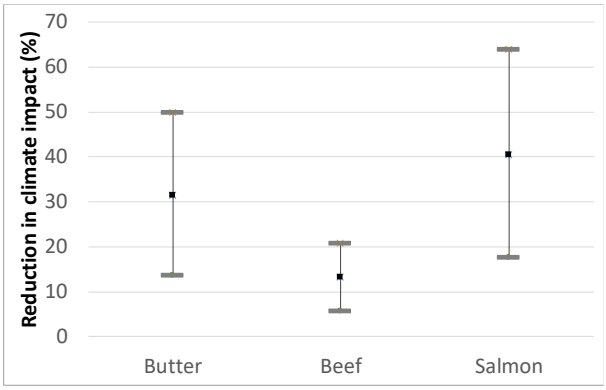

Figure 3. Climate impact reduction due to using sustainable aviation fuel.

See Figure 3.

- Only relevant for international markets
- Offered the greatest potential for impact reduction of all the interventions evaluated.
- Climate impact reduction of at least 10%, and up to 40% or more might be expected to supply animal-based products to international markets.

Food waste reduction programme

Importance of food waste

Food waste reduction should be a priority in all markets for high impact foods.

Figure 4. Climate impact reduction due to wasted food reduction in the end market.

See Figure 4.

- The impact of food waste reduction depends on the baseline wastage in each market.
- Food waste reduction should focus on high impact products (e.g., beef) and in markets with high waste rates (e.g., USA).
- Climate impact reduction of at around 2% (in low waste markets) up to around 15% (in high waste markets) is possible.

Implications

There are technical solutions, currently available that can address hotspots in animal-based food supply chains. The simplest way of reducing the impact of these food types is to produce and eat less of them. This work looked at the eco-efficiency of animal-based food products, with a particular focus on climate impact. Given current market trends, there are options that could be factored into planning and policy to reduce the climate impact of animal-based food products, particularly those supplied as fresh food to international markets.

Available technologies can reduce climate impact

Novel, but currently available technologies could drive at least 15% reduction in climate impact for animal-based foods. Much greater reduction is possible.

Our research has shown that:

- Novel feed for cattle and salmon can reduce the production (farm) stage impact. Feed is a larger hotspot for salmon, so the benefit is greater for salmon than for cattle, but there is large uncertainty that needs to be better understood.
  - 2% – 4% reduction in climate impact is likely using novel feed.
- Sustainable aviation fuel could be used for airfreighting fresh food products to reduce the climate impact when selling internationally.
  - 20% reduction in climate impact is likely using sustainable aviation fuel.
- Wasted food reduction should always be encouraged, but particularly in markets associated with high rates of waste.
  - 10% reduction in climate impact is likely through wasted food reduction in markets with moderate (ca. 7%) to high (ca. 13%) wasted food.
- Combined there is potential to drive significant reduction in climate impact of animal-based foods using novel technologies.
  - Butter: 15% – 52% reduction is possible.
  - Beef: 21% – 41% reduction is possible.
  - Salmon 32 – 82% reduction is possible.
    (The greater range reflects uncertainty around novel feeds.).

Key sources for further information

To discuss the research presented in this brief, please email *Nick.Holden@ucd.ie*

Deliverable report citations:

Chen, W., Holden N.M., Mehta, S., Thakur, M., Ólafsdóttir, G., Gudbrandsdottir (2020). **Report on LCA and Social-LCA of the selected food products.** The VALUMICS project funded by EU Horizon 2020 G.A. No 727243. Deliverable: D4.4, University College Dublin, Ireland, 66 pages. doi.org/10.5281/zenodo.5151582

Published scientific papers and articles:

Chen, W., Jafarzadeh, S., Thakur, M., Olafsdottir, G., Mehta, S., Bogason, S., Holden, N.M. (2021). **Environmental impacts of animal-based food supply chains with market characteristics.** *Science of the Total Environment*, 782, 147077. https://doi.org/10.1016/j.scitotenv.2021.147077

H2020 VALUMICS – Understanding Food Value Chains and Network Dynamics

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