SEAFISH
the authority on seafood

# The Seafish Guide To Greenhouse Gas Emissions in Seafood

This is one of a series of guides in which Seafish explores topical issues affecting the UK seafood industry. In this guide we define greenhouse gas (GHG) emissions and the different terminology used, the standards that are in place for seafood and aquatic food products and look at the tools available to measure and manage emission levels.

## A Definition

A greenhouse gas (GHG) is any gas, both natural and anthropogenic, that absorb and release infrared radiation in the atmosphere[5]. Many GHG's occur naturally in the atmosphere, such as carbon dioxide ($CO_2$), methane (which is around 25 times more potent than $CO_2$[5a]), nitrous oxide (300 times more potent[5a]), and water vapour, while others are man-made, such as the chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), as well as sulphur hexafluoride ($SF^6$).

Atmospheric concentrations of both the natural and man-made gases have been rising over the last few centuries. As the global population has increased and our reliance on fossil fuels (such as coal, oil and natural gas) has intensified, so emissions of these gases have risen. While gases such as carbon dioxide occur naturally in the atmosphere, our interference with the carbon cycle (through burning forest lands, or mining and burning coal), artificially moves carbon from solid state to its gaseous state, thereby increasing atmospheric concentrations[6].

## Other Associated Terminology

**Climate change**[5] refers to a significant variation in climate, persisting for decades or longer. Climate change may be due to natural processes (for example volcanoes) or to human-caused emissions of GHG's and other pollutants. However, in the United Nations Framework on Climate Change (UNFCCC), climate change means change which can be attributed to human activities. Climate Change Mitigation[5a] describes a human intervention to reduce the human impact on the climate system; it includes strategies to reduce GHG sources and emissions.

**The Global Warming Potential**[5a] is a measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to $CO_2$. $CO_2$ is the reference gas against which other GHG's are measured. Compared with $CO_2$, each GHG has a greater or lesser warming effect, but all are standardised into equivalent units of $CO_2$. As the reference gas, $CO_2$ has a Global Warming Potential of 1.

There are also other terms which are commonly used. The **greenhouse effect**[5] describes how GHG's effectively absorb infrared radiation (heat), emitted by the Earth`s surface. GHG's trap heat at the surface of the Earth and the lower atmosphere, and increase the temperature there. A **carbon footprint**[5] is the effect of human activities on the climate in terms of the net quantity of GHG's generated through production, the supply chain, individual lifestyle, etc. Carbon footprints are measured in terms of kilos or tonnes of $CO_2$. The term carbon footprint is commonly used as a way of describing GHG emissions applied to seafood and aquatic food products. Finally **food miles**[7] are a simple measure of the distance food travels, however this can ignore how food travels. Estimating transport GHG emissions should take into consideration both distance and the mode of transport.

**Life Cycle Assessment** (LCA)[3,7] is an approach that evaluates all stages of a product's life cycle and is the accepted analytical framework for assessing environmental impacts and GHG emissions. It is used to measure GHG emissions across all activities in the product life-cycle and can identify those activities which contribute most, often referred to as 'hot spots'.

*The main reference source for these definitions is the glossary produced by the British Council in partnership with the Meteorological Society and the Royal Geographical Society.*

## Key Facts

Government has committed to reduce the UK's greenhouse gas emissions by at least

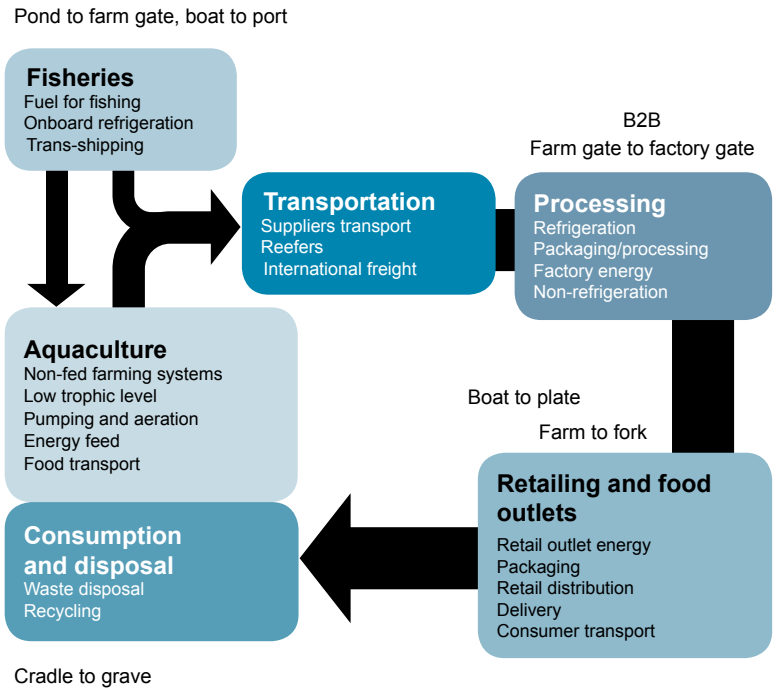
**↓80%**

(from the 1990 baseline) by 2050[4]

## Where GHG Emissions Are Generated In The Seafood Supply Chain

There is no comprehensive estimate of the volume of GHG emissions from activities associated with the fisheries and aquaculture sectors. The seafood industry is complex and GHG emissions can occur at every stage of supply.

### Where we can reduce emissions




Energy smart food system[3a]

The emission stages within the seafood supply chain differ most significantly between the fishing stage of capture fisheries and the production stage of aquaculture systems. There are also variations across different types of fishing methods; and within aquaculture systems in terms of post-harvest handling and processing. There are however a number of key emissions stages[8], with primary production (ie fishing or farming) typically the dominant contributor to GHG emissions associated with seafood products.

- For products originating in capture fisheries it is the fishing stage itself in terms of the direct fuel inputs which is typically the dominant contributor to GHG emissions. The direct fuel intensity and resulting emissions of various fisheries may differ by orders of magnitude, depending on the abundance of the targeted stocks, the fishing technology employed, the health of fish stocks and the distance to fishing grounds. In addition, refrigerants on the fishing vessel are also an important contributor to the total emissions. Whether products are fresh or frozen only affects the emissions if it requires a change in transport mode (eg from air to sea).
- For aquaculture, the main emissions come from the feed production stage and, therefore, differing feed formulations, levels of intensification and food conversion ratios can make a big difference.
- Seafood is one of the most traded food commodities globally and the UK imports the majority of the seafood it consumes, so transport plays an important role, especially when fresh products are transported over short or long distances by air, or frozen products are transported over long distances. It is important that both the distance and the mode of transport are considered.
- Processing and packaging generally make very small contributions to overall emissions (often under 10% of total) except in instances in which emission-intensive materials are used (eg metals), or where cooking is involved, etc.

## Assessing GHG Emissions In Seafood

Life Cycle Assessment (LCA)[3,7] quantifies resource use and environmental impacts of products and services related to raw material extraction, conversion and value-added processes, distribution, consumption and finally waste and disposal. The methodology therefore considers the flow of resources and the outputs and environmental impacts of these.

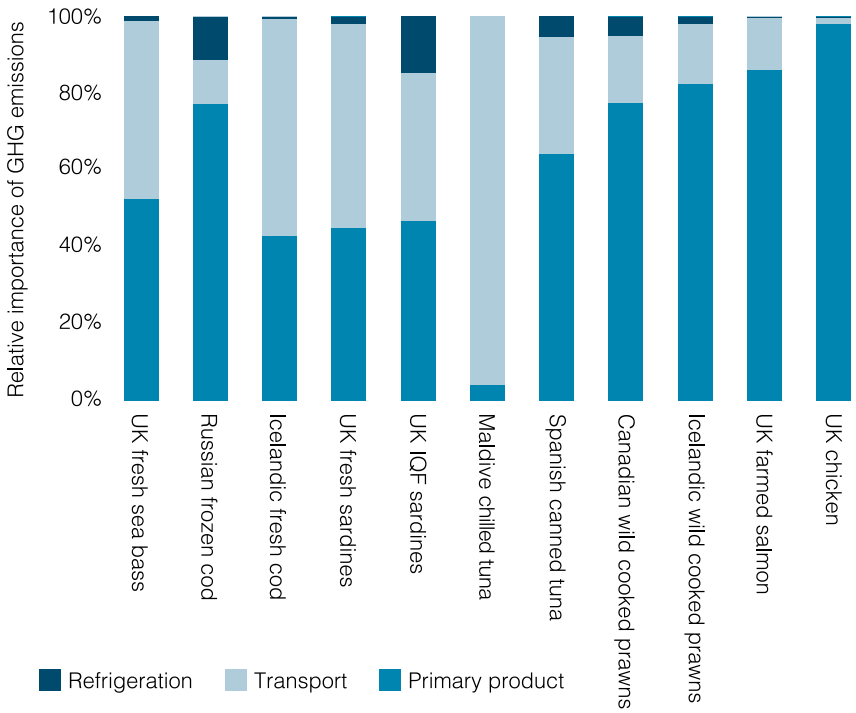
A growing number of seafood product LCAs have been completed but most have not considered impacts across the full lifecycle. To date these have mostly focussed on whitefish fisheries in the Northern hemisphere with less on pelagics and shellfish, and relatively few have looked at the larger fisheries, such as Alaskan pollock or Peruvian anchoveta. For aquaculture, the focus has been on salmonids and there has been little on other farmed sources such as carp and tilapia. In the UK Seafish[8] and researchers at Dalhousie University, Canada, in collaboration with selected UK seafood processors, looked into the GHG emissions of typical seafood product chains. Similarly, SINTEF and partners published a study[9] that analysed the carbon footprint of 20 Norwegian seafood products on the global seafood market. These have identified a number of significant drivers of energy use and related GHG emissions, with clear economic, social and environmental consequences.

This graph[8] below illustrates the relative importance of catching, transport and refrigeration to GHG emissions for 10 key UK seafood supply chains, compared with chicken.

## Key Facts

**GHG** is any gas that absorbs infrared radiation in the atmosphere

**$CO_2$** is the reference gas against which other greenhouse gases are measured, and is the one most commonly referred to



## Helping The Seafood Industry Reduce GHG Emissions

The UK Government commitment to reduce GHG emissions places the onus on businesses to understand the GHG emissions of their supply chains and take appropriate action. The purpose is to improve supply chain practices, make product declarations or simply to address misperceptions of industry practice.

There are challenges. A business can approach assessment from two different standpoints – they could undertake an assessment with the support of LCA professionals, but there is an explicit cost associated with this. Alternatively, they can perform assessments themselves, and there are tools and standards to help with this.

A wide range of initiatives, driven by organisations interested in understanding and mitigating GHG emissions in seafood, are underway.

- **Industry groups and networks to facilitate stakeholder dialogue**

  Seafish facilitates an industry group[10], that meets twice a year to advance work in GHG emissions. This group comprises some 10 organisations from the processing, retail, and NGO sectors drawn from a wider network of over 20 organisations with an interest in the issue. Seafish works internationally with others in this area, such as the FAO, SINTEF Fisheries and Aquaculture (Norway), SIK Swedish Institute for Food and Biotechnology (Sweden) and Dalhousie University (Canada).

- **Review of LCA studies in seafood**

  A growing number of seafood product life cycle assessments have been completed. Reviewing these assessments can provide useful insights where they are similar to UK industry product chains.

- **Standardising assessment of GHG emissions for seafood and aquatic food products**

  Using a common approach to assessing GHG emissions of seafood products reduces potential confusion and ambiguity when reporting to customers, the public and other stakeholders. There are three key standards published by National Standards Bodies and ISO (the International Organization for Standardization) to support the assessment of GHG emissions for seafood products (details on page 6).

- **Development of online tools to support seafood assessments**

  A web tool[14] for GHG assessment of wild-caught seafood products has been developed based on these standards. The tool allows users to explore the carbon implications of sourcing and supplying seafood to provide a better understanding of the major contributors to the 'carbon footprint' of seafood products and identify 'hot spots' which will be specific to specific businesses. The tool covers fuel and electricity consumption in fishing, processing and transport – from fishing / farming to final customer. In addition to energy commodities inputs and outputs such as packaging materials, fishing gear and refrigerants emissions are also covered. It also provides an optional screening of the potential importance of capital investments in the fishing vessel.

- **Seafish resources**

  For further details on Seafish-related activities see **www.seafish.org/responsible-sourcing/climate-impact/greenhouse-gas-emissions**

  For other Seafish guides see: **www.seafish.org/responsible-sourcing/further-information**

**Seafood Standards**

## ISO/TS 14067[11]

The ISO (Organization for Standardization) Technical Specification (ISO 14067) was published in June 2013. It details the principles, requirements and guidelines to help quantify and communicate information on the 'carbon footprint' of products (CFPs).

## BSI STANDARD[12]

The British Standards Institution (BSI) published the world's first standardised methodology for assessing GHG emissions in goods and services from life cycle emissions of seafood and other aquatic products. (Publicly Available Standard (PAS) 2050: Specification for the assessment of the life cycle greenhouse gas emissions of goods and services). This was launched in 2008 and subsequently revised in 2011 to support the provision of supplementary guidance for specific industry sectors. In 2012, Seafish alongside international stakeholders, sponsored the development of seafood specific guidance for use with PAS2050 in order to assess life cycle emissions of seafood and other aquatic products. (PAS2050-2 provides supplementary guidance for assessing GHG emissions in seafood and other aquatic foods). It provides a practical, pragmatic approach that can be used by organisations of all sizes and types, in any location, to assess the GHG emissions impact of both wild caught and farmed fish products with a focus on the cradle-to-gate stages of their life-cycle.

## NORWEGIAN STANDARDS[13]

Standards Norway (SN, 2013) has also produced standards for the carbon footprint of seafood products, NS 9418: 2013. These are only available in Norwegian.

## References

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3a. Diagram taken from presentation: Energy Smart Food Systems: Reducing our carbon footprint. What role for fisheries and aquaculture? Francis Chopin, FAO. Page 89.
4. www.gov.uk/government/policies/reducing-the-uk-s-greenhouse-gas-emissions-by-80-by-2050
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5a. www.epa.gov/climatechange/glossary.html#C
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12. www.bsigroup.com/PAS2050
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Also of relevance is the new BSI guidance notes for SMEs.
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14. www.seafish.org/responsible-sourcing/climate-impact/greenhouse-gas-emissions
15. www.eea.europa.eu/data-and-maps/daviz/total-final-energy-consumption-by-sector#tab-chart_4

## About Seafish

Seafish was founded in 1981 by an Act of Parliament and aims to support all sectors of the seafood industry for a sustainable, profitable future. It is the only pan-industry body offering services to all parts of the industry, from the start of the supply chain at catching and aquaculture; through processing, importers, exporters and distributors of seafood right through to restaurants and retailers.

## Contact Seafish at:

Seafish, Origin Way, Europarc, Grimsby DN37 9TZ
t: 01472 252300 I f: 01472 268792
e: seafish@seafish.co.uk I w: www.seafish.org