PUBLICLY AVAILABLE SPECIFICATION

PAS 2050-2:2012

Assessment of life cycle greenhouse gas emissions

Supplementary requirements for the application of PAS 2050:2011 to seafood and other aquatic food products

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Foreword

This Publicly Available Specification (PAS) is published by BSI Standards Limited, under licence from The British Standards Institution, and is expected to come into effect in November 2012.

This PAS was prepared at the request of seafood industry representatives, sponsored by the Sea Fish Industry Authority (Seafish) in the UK by Jonna Meyhoff Fry as Technical Author. This was supported by a Steering Group and wider network of stakeholders drawn from the global seafood and aquatic food products industry. The members of this Steering Group are listed below and their valuable contribution is gratefully acknowledged here:

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Comments from other parties were also sought by BSI, at a meeting held in conjunction with the World Fisheries Congress Edinburgh in May 2012, where world fisheries experts contributed through a series of discussions around key topics and through the period of 'Expert Review and Public Comment' which took place during June 2012. The expert contributions from all the organizations and individuals contributing to the development of this PAS are also gratefully acknowledged.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Credit: ©FAO/Giuseppe Bizzarri

Introduction

As an industry, the provision of seafood and other aquatic food products compares well with other proteins with regard to its emissions of greenhouse gases. However, there is no room for complacency and there is growing industry recognition that there will always be room for improvement in this area, right across the supply chain.

In response to this, the British Standards Institution, with the support of seafood industry representatives and sponsorship from Seafish, has brought together an international group which includes representatives drawn from many areas of the world with strong fishing and aquaculture interests, to establish a common approach for the industry to assess its GHG emissions and enable informed action to reduce those emissions globally and locally.

This group has gathered and shared current knowledge on emissions from fisheries and aquaculture production units across the world and developed a common understanding of the aquatic food products industry, leading to a broad consensus on how greenhouse gases from seafood and other aquatic food products can best be assessed, using the methodology provided by PAS 2050:2011.

The relationship with PAS 2050:2011

This Publicly Available Specification (PAS), PAS 2050-2, contains requirements for the assessment of life cycle greenhouse gas (GHG) emissions specifically associated with seafood and other aquatic food products. The requirements are supplementary to those specified in PAS 2050:2011, which provides a generic method for assessing the life cycle GHG emissions of goods and services.

The purpose of this PAS is to provide supplementary requirements and additional guidance for the consistent application of PAS 2050:2011 to seafood and other aquatic food products, by providing:

- a fisheries and aquaculture focus for aspects of the PAS 2050:2011 assessment where options are permitted;
- rules or assessment requirements that are directly relevant to the main sources of emissions from capture fisheries and aquaculture; and
- clarity on how to apply specific elements of the PAS 2050:2011 assessment within the seafood sector.

In conjunction with PAS 2050:2011, this PAS provides a common and comprehensive method for the reliable, repeatable assessment of GHG emissions from the whole life cycle of seafood and other aquatic food products. The supplementary requirements provided in this PAS relate only to the cradle-to-gate stages of the life cycle, where in this case cradle-to-gate includes distribution until the product reaches the retailer, food service or similar gate. For feed production, retail, food service and all subsequent stages (e.g. retail, use and end-of-life) the requirements of PAS 2050:2011 apply.

PAS 2050:2011 sets out generic requirements for undertaking a GHG emissions assessment of all aspects of the life cycle of aquatic food products, whilst this PAS provides supplementary requirements and additional guidance on those elements that have been found to present particular challenges in an aquatic food products context, such as allocation, system boundaries and land use change. Although, hitherto, it has been possible for those experienced in the use of PAS 2050:2011 to achieve acceptable assessment outcomes using PAS 2050:2011 alone, for new or less experienced users the use of this PAS in conjunction with PAS 2050:2011, in an assessment of the GHG emissions from seafood or other aquatic food products, can be expected to ensure greater accuracy and uniformity of application.

Because of the global nature of trade in seafood and other aquatic food products, it is essential that the supplementary requirements provided in this PAS are applicable wherever an assessment of emissions from aquatic food products is to be made. The development of PAS 2050-2 has therefore been undertaken with participation by experts from different countries with experience in a range of seafood and other aquatic food production systems.

Relationship with other GHG assessment standards

PAS 2050 was introduced in 2008 (revised in 2011) with the aim of providing a consistent internationally applicable method for quantifying the GHG emissions of products and services. In 2011, another product life cycle assessment method was published by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) that in addition to providing a methodology to quantify the GHG inventories of products, also included requirements for public reporting. Both standards are broadly consistent in their quantification methods, but their differing objectives have resulted in some variation in approach.

The Product Life Cycle Accounting and Reporting Standard built on the initial PAS 2050 method in developing its own requirement. In turn, the PAS 2050 drew upon lessons learned during the Product Standard's development process in its 2011 revision. As a result of this cross collaboration, the key methodological rules underpinning quantification in both standards are consistent and in particular approaches to the following are in alignment:

- sector or product rules;
- inclusion of biogenic carbon;
- recycling;
- land-use-change; and
- delayed emissions.

While both PAS 2050:2011 and the Product Standard provide requirements for quantifying the GHG impact of a product over its lifetime, the Product Standard includes requirements for public reporting whilst the PAS 2050:2011 approach focuses on recording of information to support the assessment process. As a result, while harmonization on all aspects of the assessment was sought during the development of both standards, some differences do remain but these are of relatively minor significance.

Annex H provides a review of each aspect of the compared methodologies, identifying any differences between them, and the implication for the assessment outcome.

Importantly, both standards provide a consistent approach to promoting the use and development of sector specific rules – known as "product rules" in the Product Standard and "supplementary requirements" in PAS 2050:2011. This approach recognizes the importance that sector/product specific rules can have in aiding consistent application of the standards within sectors. As further supplementary requirements are developed, it is expected that those same criteria may be applied to either standard to bring further consistency in product carbon assessments internationally.

Other GHG assessment methods relevant to at least part of the range of aquatic food product covered by this PAS will be found under the International EPD System which provides a PCR Basic Module, referenced CPC Division 04 *Fish and other fishing products.*

Norway has published Product Category Rules (PCR) for preparing an Environmental Product Declaration (EPD) for wild caught fish, although this is believed to be under revision.

Note *The International Standards Organization (ISO) is also developing a standard for the carbon footprint of products (ISO 14067) with which collaboration is on-going.*

Credit: Seafish

1 Scope

This Publicly Available Specification (PAS) establishes supplementary requirements for use in conjunction with PAS 2050:2011 for the cradle-to-gate assessment of the GHG emissions from seafood and other aquatic food products derived from both wild capture and aquaculture production.

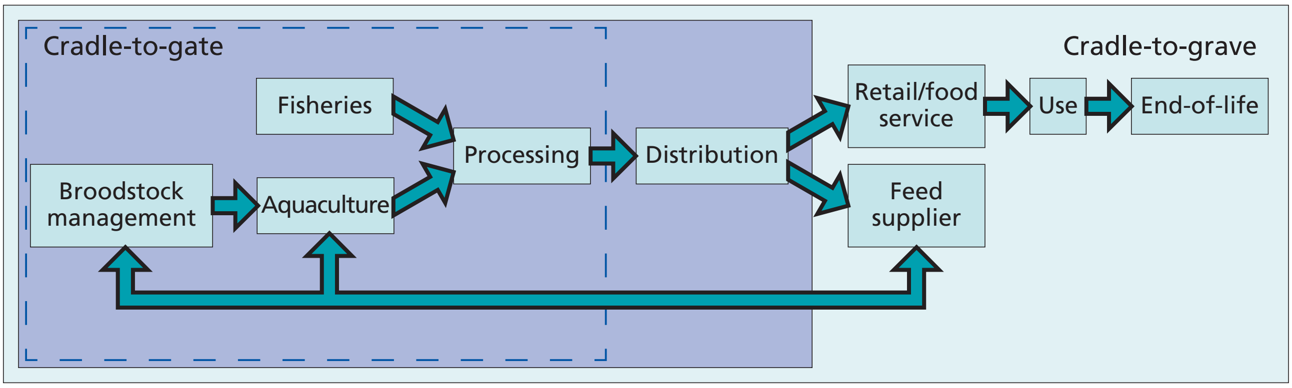
This PAS is appropriate for use by organizations operating in the seafood and other aquatic food product sectors that are intending to undertake a programme of GHG emission reduction of their product life cycle, or those needing to provide information on the GHG emissions from their products or processes to downstream business partners or other stakeholders (e.g. environmental regulators).

This PAS has been developed in accordance with the principles on supplementary requirements as set out in PAS 2050:2011 **4.3** and follows the structure and form of that PAS. Due to the specific circumstances of the seafood and other aquatic food products sectors, and the choices left open to practitioners in PAS 2050:2011, this PAS provides clarity on the issues associated with those choices and establishes supplementary requirements, in particular with regard to system boundary, allocation and land use change. It clearly identifies where PAS 2050:2011 requirements are to be applied without supplement, and provides sector-specific requirements and guidance, where permitted by PAS 2050:2011.

The scope of this PAS is limited to the cradle-to-gate stages of the life cycle, which for aquatic food products for human consumption is from fisheries or broodstock management to the incoming gate of the retail or food service and for animal consumption, is from fisheries or broodstock management to the incoming gate of the feed supplier. This is illustrated in Figure 1 below. Where an assessment of aquatic food products is to extend beyond distribution (i.e. to include retail/food service/feed supplier, use and end-of-life), the requirements of PAS 2050:2011 should be applied to the subsequent stages.

Credit: NOAA's Fisheries Collection Photographer: William L. High, NMFS

Figure 1 The scope of PAS 2050-2 in the context of PAS 2050:2011



Note 1 *This PAS provides supplementary requirements for the cradle-to-gate processes up until the aquatic food product reaches the retailer, food service, or equivalent. However, as illustrated by the dashed line, cradle-to-gate boundaries can vary according to the position of the "gate". Depending on the purpose, organizations conducting an assessment of aquatic food products may choose to position the "gate" elsewhere, or conduct a full cradle-to-grave assessment.*

Note 2 *Figure 1 is a simplified illustration of the life cycle of aquatic food products. The purpose of the figure is to illustrate the scope of this PAS, not to show all processes in the life cycle of aquatic food products or flows into and from the different processes.*

Note 3 *The simplified system representation of Figure 1 shows the feed supplier outside the cradle-to-gate boundary. However, given the potentially significant contribution of feed to the emissions of aquaculture products it is important to recognize that in its accounting for inputs of feed to the aquaculture processes an assessment needs to include the GHG emissions of the feed supplier. The figure illustrates that, in terms of aquatic food products for animal consumption, the scope of this PAS covers distribution until the receiving gate of the feed supplier or similar.*

As with PAS 2050:2011, this PAS addresses the single impact category of global warming. It does not assess other potential social, economic and environmental impacts arising from the provision of seafood and other aquatic food products, such as non-GHG emissions, acidification, eutrophication, toxicity, biodiversity, labour standards or other social, economic and environmental impacts that may be associated with the life cycle of such products. Thus, an assessment of the GHG emissions of seafood and other aquatic food products using this PAS in conjunction with PAS 2050:2011 does not provide an indicator of the overall environmental impact of these products, such as may result from other types of life cycle assessment.

In line with the principle adopted for PAS 2050:2011, this PAS does not specify requirements for communication of assessment outcomes of GHG emissions assessments of seafood and other aquatic food products. However, it is recognized that there may be situations where disclosure may be required or could be appropriate. Therefore, both directly and by reference to PAS 2050:2011, it does include requirements relating to what information on GHG emissions arising during the cradle-to-gate stages of seafood and other aquatic food products are to be conveyed when disclosed to a third party (e.g. a downstream business partner).

2 Normative references

The following document, in whole or in part, is normatively referenced in this document and is indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PAS 2050:2011 *Specifications for the assessment of life cycle greenhouse gas emissions from goods and services*

Credit: ©FAO/Rocco Rorandelli

3 Terms and definitions

For the purposes of this PAS, the terms and definitions given in PAS 2050:2011 and the following apply.

3.1 aquaculture

farming of aquatic organisms for food or feed, involving intervention in the rearing process to enhance production

3.2 aquatic food products

fish, molluscs, crustaceans, echinoderms and other forms of marine and freshwater life regarded as food for human consumption or feed for animal consumption

Note 1 *This term is used through the remainder of the document to denote both seafood and aquaculture products.*

Note 2 *See also Annex A.*

3.3 broodstock

sexually mature female and male specimens of aquatic organisms kept for the purpose of controlled reproduction in aquaculture, as well as younger specimens destined to be used for the same purpose

3.4 capture fisheries

all activities associated with the harvesting of wild aquatic organisms

3.5 (aquatic food product) cradle-to-gate assessment

assessment of GHG emissions arising from activities associated with an aquatic food product, from capture fisheries or broodstock management for aquaculture through to the point at which the aquatic food product reaches retail, food service or equivalent

3.6 distribution

movement of aquatic food products from processing to point of retail sale, including associated transport and warehousing

3.7 end of life

collection and treatment of waste products (including packaging) generated from the use phase, including, but not limited to, landfill, incineration, recycling and composting

3.8 processing

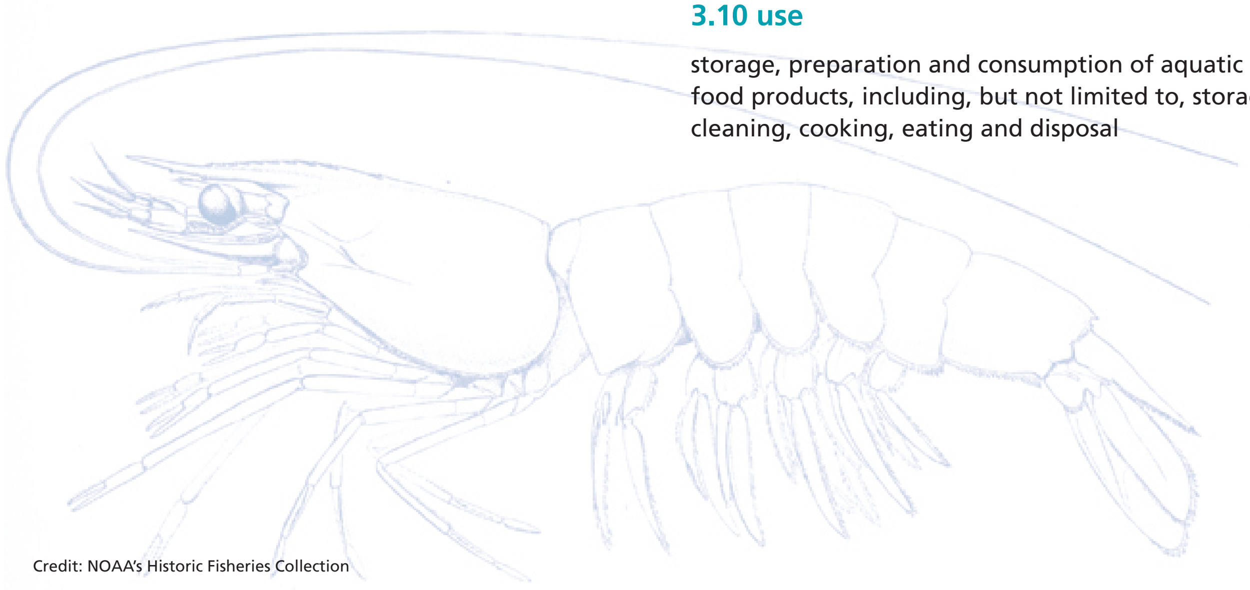
all activities relating to the receiving, preparation, preservation and packing of aquatic organisms as food products

3.9 seafood

aquatic food products from marine sources intended for human consumption

3.10 use

storage, preparation and consumption of aquatic food products, including, but not limited to, storage, cleaning, cooking, eating and disposal



Credit: NOAA's Historic Fisheries Collection

4 Principles and implementation

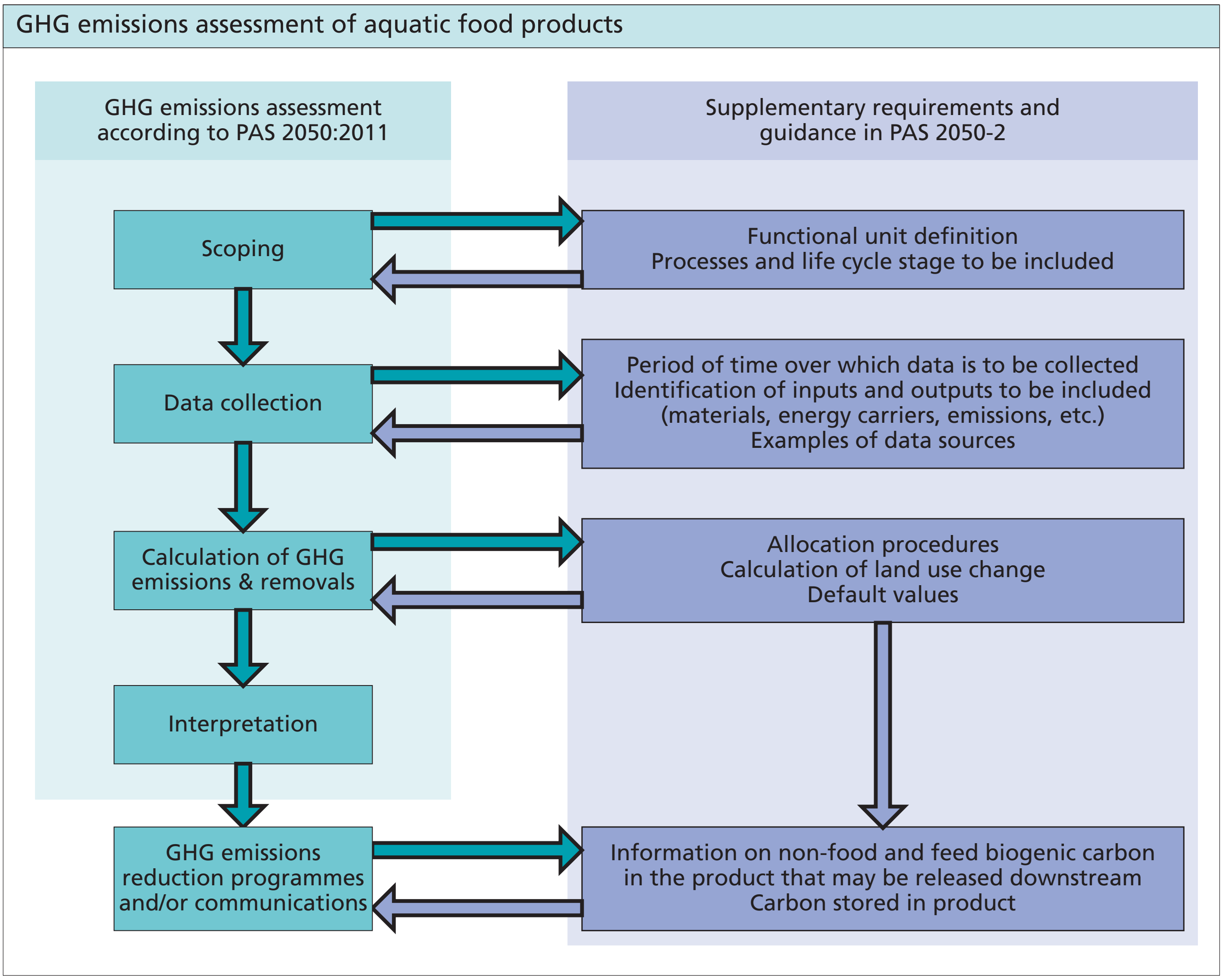
4.0 Overview

Provision for the development and use of supplementary requirements are included in PAS 2050:2011 because it is recognized that their use can enhance the application of PAS 2050:2011 for some product sectors or categories.

The primary objective of this PAS is to provide greater clarity as to how the inputs of goods, materials, energy carriers and land and related GHG emissions can best be attributed consistently to the aquatic food product that is being assessed (Figure 2). It does this by setting further requirements, as well as by providing additional guidance, including clarity on material inputs to be included and examples of calculations.

To facilitate a cradle-to-gate assessment of GHG emissions in accordance with PAS 2050:2011, this PAS also provides requirements on what needs to be reported when communicating the GHG emissions assessment to a third party, including reporting on biogenic carbon stored in aquatic food products (and its packaging) that is transferred to users and may be released downstream. The potential GHG emissions likely to arise from these products after the cradle-to-gate stages of production are to be assessed in accordance with the requirements of PAS 2050:2011.

Figure 2 Relationship between PAS 2050-2 and PAS 2050:2011



Notwithstanding its focus on the cradle-to-gate stages of the aquatic food product lifecycle, this PAS can be used in conjunction with PAS 2050:2011 for the proper undertaking of a GHG assessment (in accordance with PAS 2050:2011) for both of the situations described in 1 and 2, below:

1) A practitioner intends to undertake an assessment in response to or in anticipation of a request for GHG emissions information from the cradle-to-gate stages to support an assessment being performed further on in the supply chain, such as by a processor or retailer.
2) A practitioner intends to conduct a whole life cycle assessment up to and including the disposal stage.

However, in situation 1, where an assessment is being carried out to provide information to support assessments undertaken at subsequent stages of the supply chain, particular care will be required to ensure that the functional unit used in the cradle-to-gate assessment is known as part of the information provided, so as to facilitate its correct use in the subsequent assessment (see also **6.2.4**).

4.1 General requirements

Assessment of the GHG emissions and removals from aquatic food product systems, claimed to be in conformance with PAS 2050-2, shall be carried out using the principles and methods specified in PAS 2050:2011 supplemented by the provisions made in this PAS in respect of the cradle-to-gate stages of those products.

4.2 Supplementary requirements – implementing PAS 2050-2

Organizations claiming that an assessment of aquatic food products conforms to PAS 2050:2011 shall ensure that the cradle-to-gate stages of those products are assessed using the supplementary principles and methods specified in this PAS.

In accordance with PAS 2050:2011:

- the assessment of cradle-to-gate GHG emissions and removals arising from aquatic food products shall include the GHG emissions and removals (including all upstream emissions) arising up to and including distribution of the aquatic food product until the gate of retail, food service or equivalent;
- the assessment shall include the emissions from materials classified as waste from the cradle-to-gate stages; and
- in addition, actions taken during the cradle-to-gate stages that could result in emissions arising during and after transfer of the product to retail, food service or equivalent shall be recorded separately (**5.2.2**).

Note 1 *Cradle-to-gate boundaries can vary according to the position of the "gate" (see Figure 1). Although this PAS provides supplementary requirements for the cradle-to-gate processes up until the aquatic food product reaches retail, food service or equivalent, organizations conducting an assessment of aquatic food products may position the "gate" elsewhere.*

Note 2 *This does not preclude organizations undertaking a cradle-to-grave assessment for aquatic food products for which PAS 2050:2011 provides requirements for the other life cycle stages.*

Note 3 *Choices made at the aquaculture, capture and processing stages can affect emissions at subsequent stages of the product life cycle. This may involve the extent of processing the product has undergone and the packaging used, which will affect the level of processing required in subsequent life cycle stages as well as the type and quantity of product and packaging waste to management. Although this PAS only accounts for the cradle-to-gate stages of the product life cycle, information should be recorded separately that allows for subsequent emissions at use and disposal to be accounted for accurately. This enables the intended purpose to inform and drive choices towards reducing emissions across the product life cycle.*

Credit: ©FAO/Rosetta Messori

5 Emission and removals

5.1 Primary requirement

The requirements of PAS 2050:2011 Clause 5 shall be applied, supplemented by **5.2.1** to **5.2.4** of this PAS.

5.2 Supplementary requirements implementing PAS 2050-2

5.2.1 Scope of GHG emissions and removals

In relation to PAS 2050:2011 5.1, the cradle-to-gate assessment of aquatic food products shall account for both GHG emissions to, and removals from, the atmosphere arising from all processes, inputs and outputs in the cradle-to-gate life cycle stages. Both fossil and biogenic sources for the gases listed in Annex A of PAS 2050:2011 shall be included, with the exception of human food and animal feed products.

For food and feed, emissions and removals arising from biogenic sources that become part of the product may be excluded. This exclusion shall not apply to:

a) emissions and removals of biogenic carbon used in the aquaculture, fishing and processing of aquatic food products (e.g. in the combustion of biofuel for transport) where that biogenic carbon does not become part of the product;

b) non-CO_2 emissions (e.g. methane, nitrous oxide, etc.) arising from degradation of waste food and feed and treatment of waste water from processing of aquatic products; and

c) any biogenic component in material that is part of the final product but is not intended to be ingested (e.g. packaging).

Note 1 *The exclusion of emissions and removals arising from biogenic carbon for food and feed products avoids the need to calculate the biogenic CO_2 emissions arising from the decomposition of waste from the processing of aquatic food products. Non-CO_2 emissions do need to be accounted for.*

Note 2 *For most aquatic food and feed products, it is unlikely that they persist for more than the 100-year assessment period. However, where this does occur, the carbon storage implications need to be addressed (see **5.2.2**). This may be the case for shells, in some circumstances.*

Note 3 *An assessment of greenhouse gas emissions from aquatic food products undertaken in accordance with PAS 2050:2011 in combination with PAS2050-2:2012, will include all the gases identified as GHG under the Kyoto agreement (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride) and two groups of gases (hydrofluorocarbons and perfluorocarbons). Emissions of all of these will therefore need to be accounted for and recorded as CO_2 equivalents (CO_2 e).*

5.2.2 Carbon storage in aquatic food products

The requirements of PAS 2050:2011 5.5.1 and 5.5.2 shall be applied without supplement.

Note 1 *Carbon storage might arise where biogenic carbon forms a part of an aquatic food product not intended for ingestion (e.g. shells of clams, mussels, oysters, etc.).*

Note 2 *Storage of biogenic carbon in aquatic food products varies depending on the type of product and its disposal route (e.g. landfill, incineration).*

Note 3 *While aquaculture activities might result in additional carbon storage through the retention of biogenic carbon in aquatic organisms that have escaped or been discarded or lost to the surrounding natural environment, this potential source of storage is not included in the scope of this PAS.*

5.2.3 Inclusion and treatment of land use change

5.2.3.1 General

The requirements of PAS 2050:2011 5.6 shall be applied, supplemented by **5.2.3.2** of this PAS.

Note 1 *Land use change is especially relevant for feed ingredients production and land-based aquaculture.*

Note 2 *Some uses of land are not covered by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, because adequate methods are not available. This is, for example, the case for aquaculture ponds. Until a method is developed by IPCC, a temporary approach is provided in the following (see **5.2.3.1**).*

5.2.3.2 Limited traceability of products

The following hierarchy shall apply when determining the GHG emissions and removals arising from land use change occurring not more than 20 years prior to making the assessment:

a) where the country of production is known and the previous land use is known, the GHG emissions and removals arising from land use change shall be those resulting from the change in land use from the previous land use to the current land use in that country, where industrial land is used to represent the current land use of aquaculture.

The GHG implications from land use change consist of GHG emissions and removals from vegetation and soil carbon stocks changes. Vegetation and soil carbon stocks of the previous land use shall be assessed in accordance to the relevant sections of the IPCC Guidelines for National GHG Inventories. In accordance with PAS 2050:2011, the carbon stock change shall be linearly amortised during a period of 20 years;

b) where the country of production is known, but the former land use is not known, the GHG emissions arising from land use change shall be those resulting from the change in land use from the estimate of the weighted average of the land use in that country over the last 20 years to the current land use, where industrial land is used to represent the current land use of aquaculture.

The land use in the 20 years prior to the assessment shall be considered, using data from the United Nations Food and Agriculture Organization (FAO) (faostat.fao.org), starting with the most recent available year in this database. Estimating the land converted as a result of the new land use shall be calculated using the "maximum" approach. In this approach, the area of land converted is calculated by subtracting the amount of land used 20 years ago from the maximum amount of land used in the previous 20 years; and

c) where neither the country of production nor the former land use is known, the GHG emissions arising from land use change shall be those resulting from the change in land use from the estimate of the weighted average of the land use in the countries in which the aquatic food product has been produced over the last 20 years to the current land use in those countries, where industrial land is used to represent the current land use of aquaculture.

All GHG emissions from land use change shall be attributed to the production of aquatic food products.

Note 1 *Aquatic food products are generally labelled allowing for the identification of the producer and thereby the country of origin and the land area used.*

Note 2 *Countries in which an aquatic food product is produced can be determined from production statistics, and a cut-off threshold of not less than 90% of production by live weight may be applied.*

Note 3 *The capture of CO_2 in the previous land use plant coverage and delayed emissions from any harvested and consumed products, burning and decay of biomass is implicitly included in the land use change calculations and shall not be reported in another part of the GHG assessment, because this will result in double-counting.*

5.2.4 Unit of analysis

The requirements of PAS 2050:2011 5.9 shall be applied without supplement.

Note 1 *Aquatic food products include a great variety of product types each having their own specific features depending on product characteristics and on the market being supplied. Therefore, it is not feasible to establish specific requirements for reference flows or reference units, in a document intended to be applicable across all capture fisheries and aquaculture food products.*

However, some general guidance with regard to defining functional units and reference flows can be provided, as follows (see also Annex B):

- *be precise in the definition of physical and qualitative properties such as, weight, size, quality ranking, etc. This is especially important in case of assessments being used for comparison when exploring improvement options;*
- *consider the most appropriate units of analysis for the product. This will generally be the units usually applied in relation to the product type in question. Since the "gate" being considered in this specification is distribution until the retail, food service or equivalent gate, the appropriate functional unit the packaged unit as it arrives at the gate (if sold as a pre-packaged product); and*
- *be complete in the description of the functional unit. For instance, defining a functional unit as "one whole (gutted) sea bass as supplied to retail gate" means that the assessment would include the product, any packaging used and the proportion of product damaged through the supply chain.*

Note 2 *Although the unit of analysis is not specified by this PAS,* ***9.1*** *sets requirements for disclosing to third parties to ensure a common reporting unit.*

Credit: ©FAO/Giuseppe Bizzarri

6 System boundary

6.1 Primary requirement

The requirements of PAS 2050:2011 Clause 6 shall be applied supplemented by **6.2** of this PAS.

6.2 Supplementary requirements implementing PAS 2050-2

6.2.1 Establishing the system boundary

In relation to PAS 2050:2011 6.1, the setting of the system boundaries shall clearly define all of the material life cycle processes for the aquatic food product under study.

The cradle-to-gate assessment of aquatic food products shall include the following activities, where they occur:

Capture fisheries:

1) Fishing, including preparation and transport to and from fishing fields
2) Landing and auctioning
3) Processing and storing
4) Transport and distribution including packing

Aquaculture:

1) Capturing and/or cultivation of broodstock
2) Hatching and nurseries
3) Farming, harvesting & slaughtering
4) Processing and storing
5) Transport and distribution including packing

For each of these activities, there may be inputs of materials and energy and outputs of wastes and co-products, which shall all be considered for inclusion in the system boundaries (see Figure C1 for a more detailed depiction of system boundary).

The activities that are actually employed for each specific aquatic food product shall be identified and decision taken as to whether they constitute separated or integrated activities for different unit processes. For example, the hatchery/nursery for early stages of fish, oyster and seaweed production is usually a separate activity taking place at a different location (hatchery) to the grow-out unit. However in some other cases, like turbot or yellowtail kingfish, both stages are frequently integrated in the same facility. This can sometimes also occur with spat collection and mussel cultivation at sea and in these situations, the activities should be assessed as an integral part of the aquaculture process. In addition, fishing and processing on factory trawlers is often seen as one integral process. It is also possible that additional stages can be distinguished (for example, wholesale where the aquatic food product after processing is sold on the wholesale market).

6.2.2 Elements of the product system

The setting of the system boundaries shall include the identification of input and output flows for the different processes. In Table 1 and Table 2, examples of input and output flows that shall be taken into consideration for capture fisheries and aquaculture, respectively, are identified and explained in more detail. However, flows listed may be excluded under the materiality rules (PAS 2050:2011 6.3), provided the nature and extent of any such exclusion is unambiguously recorded.

The input categories identified in Table 3 shall be excluded from the GHG emissions assessment of an aquatic food product.

Figure 3 Typical system boundary for cradle-to-gate assessment of aquatic food products

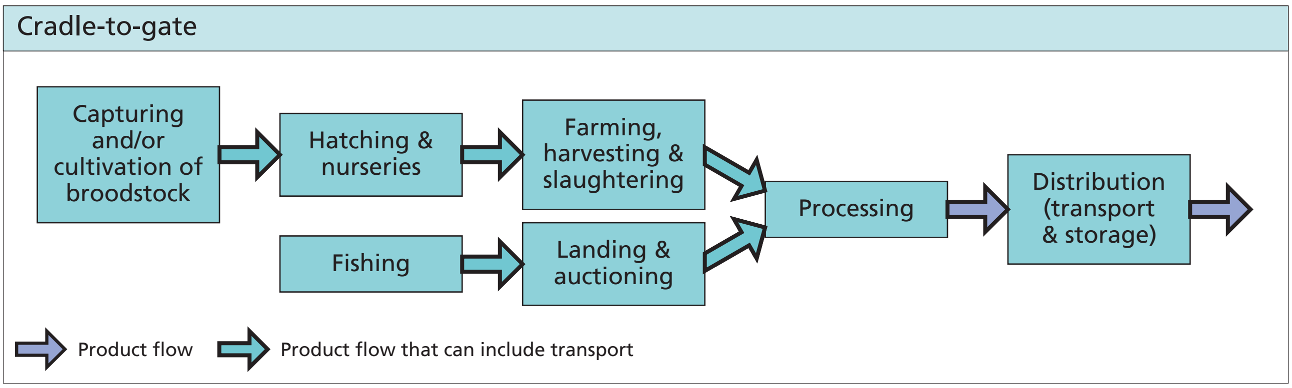


Table 1 List of example inputs and outputs for capture fisheries that shall be taken into consideration (provision 6.2)

Life cycle stage	Inputs (not exhaustive)	Outputs (not exhaustive)	Likely contribution
Fishing	• Consumables such as: – nets – rods, lines, hooks – ropes – etc. • Bait • Cooling materials: – ice – refrigerants • Fuels/energy: – marine special distillate – dieselw • Packaging: – fish crates – etc. • Materials used for maintenance: – lubricating oil – anti-fouling agents – cleaning agents	• Catch: – product – landed by-catch • Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – waste packaging – etc.	
Landing and auctioning	• Fuels/energy: – marine special distillate – diesel • Cooling materials: – ice – refrigerants • Packaging: – fish crates – etc.	• Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – waste product – waste packaging – etc.	
Processing	• Ingredients: – fish – other ingredients – additives – etc. • Materials used for processing: – wood – etc. • Cooling materials: – ice – refrigerants • Fuels/energy: – electricity – diesel – natural gas • Packaging: – fish crates – consumer packaging (primary & secondary) – etc. • Materials used for maintenance: – lubricating oil – cleaning agents	• Product • Co-products: – fish mince – offal – shells – etc. • Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – waste fish parts – waste packaging – etc. • Effluent: – wastewater treatment	

Life cycle stage	Inputs (not exhaustive)	Outputs (not exhaustive)	Likely contribution
Transport and distribution	• Product • Transport mode (road, rail, sea, air) • Transport details: – size/capacity of vehicle – ship type and size – domestic/short/long-haul air transport • Distance from a to b (km) • Empty return journey • Mass of product inc. packaging (tonne) • Cooling materials: – refrigerants	• Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – product loss – etc.	(orange)

■ Likely to be important ■ Likely to have a low importance ■ Likely to be insignificant

■ Shaded orange indicates care required. Importance could increase considerably in some circumstances

Table 2 List of example inputs and outputs for aquaculture that shall be taken into consideration (provision 6.2)

Life cycle stage	Inputs (not exhaustive)	Outputs (not exhaustive)	Likely contribution
Capturing and/or cultivation of broodstock	• Consumables such as: – nets – ropes – etc • Nutrients a.o.: – feed – antibiotics • Fuels/energy: – electricity – marine special distillate – diesel	• Intermediate product • Emissions: – emissions from fuel combustion • Waste: – waste equipment • etc.	(green)
Hatching and nurseries	• Consumables such as: – nets – ropes – etc • Nutrients a.o.: – feed – antibiotics • Fuels/energy: – electricity – marine special distillate – diesel	• Intermediate product • Emissions: – emissions from fuel combustion • Waste: – waste equipment • etc.	(green)

Life cycle stage	Inputs (not exhaustive)	Outputs (not exhaustive)	Likely contribution
Farming, harvesting & slaughtering	• Consumables such as: – nets – ropes – etc. • Nutrients a.o.: – feed – antibiotics • Cooling materials: – ice – refrigerants • Fuels/energy: – electricity – marine special distillate – diesel • Packaging: – fish crates – etc • Materials used for maintenance: – lubricating oil – anti-fouling agents – cleaning agents	• Product • Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – waste equipment – waste packaging – etc.	
Processing	• Ingredients: – fish – other ingredients – additives – etc. • Materials used for processing: – wood – etc. • Cooling materials: – ice – refrigerants • Fuels/energy: – electricity – diesel – natural gas • Packaging: – fish crates – consumer packaging (primary & secondary) – etc • Materials used for maintenance: – lubricating oil – cleaning agents	• Product • Co-products: – fish mince – offal – shells – etc • Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – waste fish parts – waste packaging – etc. • Effluent: – wastewater treatment	

Life cycle stage	Inputs (not exhaustive)	Outputs (not exhaustive)	Likely contribution
Transport and distribution	• Product • Transport mode (road, rail, sea, air) • Transport details: • Distance from a to b (km) • Empty return journey • Mass of product inc packaging (tonne) • Cooling materials: – refrigerants	• Emissions: – loss of refrigerants to atmosphere – emissions from fuel combustion • Waste: – product loss – etc	(orange)

■ Likely to be important ■ Likely to have a low importance ■ Likely to be insignificant
■ Shaded orange indicates care required. Importance could increase considerably in some circumstances

Table 3 List of inputs that shall be excluded from the analysis (capital goods and buildings)

Input category (e.g. product/material/ energy)	Subgroups (on data acquisition level)	Remarks with regard to contribution and future development	
Production and maintenance of capital goods used for capture fishery and aquaculture	• Buildings • Vessels • Tractors, fork-lift trucks • Machinery • Equipment • Etc. Except for consumables to maintain these goods as mentioned in Table 1	This category may have a significant contribution to the GHG emissions, especially for low carbon aquaculture products such as mussels. However, the inclusion of this category is hampered by the complexity of vessels and equipment and lack of data. In the next update of this PAS, inclusion will be reconsidered	(red)
Production and maintenance of vehicles and aircrafts used for transportation	• Vehicles • Aircraft Except for consumables to maintain these goods as mentioned in Table 1	These goods mostly have a low contribution to the GHG emissions of aquatic food products	(green)
Production and maintenance of harbours, buildings, roads, pavements and other floor covering		These goods mostly have a low contribution to the GHG emissions of aquatic food products	(green)

■ Likely to be important ■ Likely to have a low importance ■ Likely to be insignificant

7 Data

7.1 Primary requirement

The requirements of PAS 2050:2011 Clause 7 shall be applied supplemented by **7.2** and **7.3** of this PAS.

7.2 Period of data collection and variability in emissions in aquatic food products

In relation to PAS 2050:2011 7.6, data shall be collected over a period of time sufficient to provide an average assessment of the GHG emissions associated with the inputs and outputs of fisheries, aquaculture, and processing that will offset fluctuations due to seasonal differences.

This shall be undertaken as set out in a) and b) of this clause.

a) For capture fisheries, an assessment period of three years shall be used (to offset differences in yields related to fluctuations in stock availability and growing conditions over the period (e.g. from weather variation).

   Where data covering a three-year period are not available, i.e. due to starting up a new operation, the assessment may be conducted over a shorter period, but shall be no less than one year of stable operation.

b) For aquaculture, an assessment period of three years shall be used.

Note 1 *The fishing sector is a highly regulated sector and the energy efficiency, among others, is determined by the framework set by fisheries management systems (total available quotas and quota allocation policy, geographical aspects of where and when specific fisheries are open, technical regulations connected to gear adaptations and rules for minimum size, etc.).*

Note 2 *Capture fisheries may not operate for all 12 months of the year, or may not fish for the same species all 12 months of the year. The period of data collection shall still be three (calendar) years, which may therefore cover less than 36 months of operation.*

7.3 Data sampling – representative samples

In relation to PAS 2050:2011 7.7, if aquatic food products are sourced from a large number of origins (e.g. vessels, fish farms, wholesalers) a representative sample may be used that represents the group.

Determining the sample size is dependent on the objective, the acceptable uncertainty or error, the anticipated distribution in variation, and if sub-groups can be identified. Two ways of sampling can be distinguished: sampling without grouping; and sampling with grouping. For dairy farming, the sector defines a method for sampling that can also be applied for determining sample sizes for aquatic food products where a large group of vessels, fish farms or wholesalers supply products that are further traded or processed as a combined pool of products.

The following examples provide guidance on how to determine a representative sample.

Example 7.3.1: Sampling without grouping

Where there are a large number of origins and these are very similar in nature, data should be collected from a random sample of these origins. The minimum sample size can be determined via a statistical approach. One such approach is applied and explained in the "Guidelines for the Carbon Footprinting of Dairy Products in the UK, 2010" (Chapter 4 and Appendix 4). Table 4 below provides quick reference for values for total number of origins needed when a confidence interval of 0.95 is applied.

Table 4 Example data for random sampling – without grouping

Total number of origins	Random sample size	Percentage sampling rate
5	5	100%
10	9	90%
20	17	85%
30	23	77%
40	28	70%
50	33	66%
70	41	59%
100	49	49%
150	59	39%
200	65	33%
300	73	24%
400	78	20%
500	81	16%

Example 7.3.1: Sampling with grouping

a) Where there are a large number of origins and these display variation in GHG emissions that warrants sub-division, grouping may be undertaken as part of the data collection. This method requires the collection of preliminary data from all the origins in order to enable the grouping based on the relevant differences between the origins. The objective of the grouping is to divide the total set of origins into groups of origins that can be expected to have similar GHG emissions assessment outcomes. The grouping may take into account:

- the geographical location – e.g. distance to fishing grounds, climate conditions and the impact this may have on yields;
- the technology type, age, operational status/ operational management – e.g. type of farming method, types of fishing gear; and
- the size of the operation – e.g. economy of scale, small/medium/large farms, small/medium/ large vessels.

After grouping, random sampling can be applied to determine the minimum sample size for each group. Grouping reduces the standard deviation within each group, and thus reduces the total number of origins that must be sampled to achieve an acceptable margin of error.

Table 5 below provides values for a range of grouped origin number totals. The sampling size is determined by the square root of the number of such origins. For 10 origins and below it is not appropriate to apply the grouping method and the random sampling method is applied without grouping. For origins above 10 and below 100 a minimum of 10 origins should be sampled.

Table 5 Example data for random sampling (with grouping)

Total number of origins	Random sample size	Percentage sampling rate
5	5	100%
10	9	90%
20	10	50%
30	10	33%
40	10	25%
50	10	20%
70	10	14%
100	10	10%
150	12	8%
200	14	7%
300	17	6%
400	20	5%
500	22	4%


Credit: ©FAO/R. Grisolia

8 Allocation of emissions

8.1 General requirement

The requirements of PAS 2050:2011 Clause 8 shall be applied supplemented by **8.2** of this PAS.

8.2 Supplementary requirements implementing PAS 2050-2

8.2.1 describes the applied hierarchy of allocation within the GHG emissions assessment of aquatic food products. Annex E provides examples of specific allocation topics.

8.2.1 Allocation to co-products during capture fishing, aquaculture and processing

In relation to PAS 2050:2011 8.1.1, the approach towards allocation of emissions to co-products for the processes of fishing, aquaculture and processing shall be, in order of preference.

a) Avoidance by dividing the unit processes to be allocated or expanding the product system (PAS 2050:2011 8.1.1a) & b)).

b) Where neither of these approaches is practicable, the GHG emissions and removals arising from the process shall be allocated between the co-products in proportion to their mass.

Whatever the method of allocation, the underlying calculations, assumptions and applied data shall be recorded.

Note 1 *Allocation in aquatic food products systems is most likely, but not limited, to arise when dealing with: by-catch in capture fisheries; the use of co-product feed ingredients in aquaculture feeds; multiple outputs from fish farms; and the generation of by-products in processing.*

Note 2 *Discards, escapees and waste are not considered co-products and should not be allocated any GHG emissions.*

8.2.2 Allocation to co-products during transport

In relation to PAS 2050:2011 8.1.1, the approach towards allocation of emissions to co-products for the activity of transport shall be based on mass.

Note *Evidence shows that for transport of products, mass is generally determining the maximal load on the vehicle.*

8.2.3 Allocation to co-products during storage (wholesale stage)

In relation to PAS 2050:2011 8.1.1, the approach towards allocation of emissions to co-products for the process of storage shall be based on volume.

Note *Evidence shows that for cold storage of products, the size (volume) of the cold storage room is generally determining the maximum quantity of products that can be stored.*

Credit: ©FAO/K. Pratt

9 Calculation of the GHG emissions of products

The requirements of PAS 2050:2011 Clause 9 shall be applied supplemented by **9.1** of this PAS.

9.1 Recording and availability of cradle-to-gate GHG emissions assessment outcomes

The entity responsible for the undertaking of a cradle-to-gate GHG emissions assessment for an aquatic food product shall record the outcome and supporting information in a manner that cannot be misconstrued as a complete cradle-to-grave GHG emissions assessment.


Credit: ©FAO/P. Solbjerghaj

Where the results of a cradle-to-gate assessment are to be made known to other parties (e.g. to a subsequent stage of the supply chain), all relevant supporting information should also be made available. For aquatic food products, the following additional information shall be provided in conjunction with the assessment outcome.

a) Confirmation as to what constitutes the gate in the cradle-to-gate GHG emissions assessment (e.g. cradle to fish farm gate, cradle to landing, cradle to retailer or food service gate).

b) Determination and reporting of the GHG emissions and removals associated with one kg of product (including packaging) at the "gate". This may be in addition to other units of analysis defined.

c) Information required for calculation of the emissions and removals in subsequent life cycle stages.

d) Information as to any potential carbon storage in the product over the 100-year assessment period, including data sources from which the quantity of stored carbon was calculated.

Note 1 *Although this PAS includes requirements and guidance for cradle-to-gate GHG emissions assessment, covering all life cycle stages up until the product reaches the retail, food service or similar gate, a GHG emissions assessment conducted by an organization may consider fewer or more life cycle stages. For example, a fish farm requested to provide GHG emissions assessment information to a processor for use in their assessment, is likely to only provide information up until the product reaches the processor gate.*

Note 2 *Decisions and actions taken in the cradle-to-gate stage of the product life may attribute to emissions in the later life cycle stages. For example, this is the case for the packaging applied to the aquatic food product during processing, which will become waste further down the supply chain (i.e. at the point of sale or in the home in terms of aquatic food products for human consumption, and at the aquaculture farm in terms of aquatic food products for animal consumption).*

Note 3 *Generally it is unlikely that aquatic food and feed products will persist for more than the 100 years assessment period – with the possible exception of shells.*

10 Claims of conformity

The requirements of PAS 2050:2011 Clause 10 shall be applied without supplement.

Credit: ©FAO/M. Namundjebo

Annex A (informative) Classification of aquatic food products

A.1 The International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) (in use from 2000)

Code	Group of species
1	**Freshwater fishes**
11	Carps, barbels and other cyprinids
12	Tilapias and other cichlids
13	Miscellaneous freshwater fishes
2	**Diadromous fishes**
21	Sturgeons, paddlefishes
22	River eels
23	Salmons, trouts, smelts
24	Shads
25	Miscellaneous diadromous fishes
3	**Marine fishes**
31	Flounders, halibuts, soles
32	Cods, hakes, haddocks
33	Miscellaneous coastal fishes
34	Miscellaneous demersal fishes
35	Herrings, sardines, anchovies
36	Tunas, bonitos, billfishes
37	Miscellaneous pelagic fishes
38	Sharks, rays, chimaeras
39	Marine fishes not identified
4	**Crustaceans**
41	Freshwater crustaceans
42	Crabs, sea-spiders
43	Lobsters, spiny-rock lobsters
44	King crabs, squat-lobsters
45	Shrimps, prawns
46	Krill, planktonic crustaceans
47	Miscellaneous marine crustaceans
5	**Molluscs**
51	Freshwater molluscs
52	Abalones, winkles, conchs
53	Oysters
54	Mussels
55	Scallops, pectens
56	Clams, cockles, arkshells
57	Squids, cuttlefishes, octopuses
58	Miscellaneous marine molluscs

Code	Group of species
6	**Whales, seals and other aquatic mammals**
61	Blue whales, fin whales
62	Sperm whales, pilot whales
63	Eared seals, hair seals, walruses
64	Miscellaneous aquatic mammals
7	**Miscellaneous aquatic animals**
71	Frogs and other amphibians
72	Turtles
73	Crocodiles and alligators
74	Sea-squirts and other tunicates
75	Horseshoe crabs and other arachnoids
76	Sea-urchins and other echinoderms
77	Miscellaneous aquatic invertebrates
8	**Miscellaneous aquatic animal products**
81	Pearls, mother-of-pearl, shells
82	Corals
83	Sponges
9	**Aquatic plants**
91	Brown seaweeds
92	Red seaweeds
93	Green seaweeds
94	Miscellaneous aquatic plants

A.2 Some common aquatic food product forms

Breaded/battered
Dried
Fermented
Fresh or chilled – whole, gutted, headed and gutted
Fresh or chilled – fillets, steaks, loins
Frozen – whole, gutted, headed and gutted
Frozen – fillets, steaks, loins
Live
Pickled (treated with acid)
Readymeal
Salted or brined
Smoked – hot or cold smoked
Sterilized (cans/retort pouches)
Surimi

Credit: Seafish

A.3 Important aquatic food species by production volume

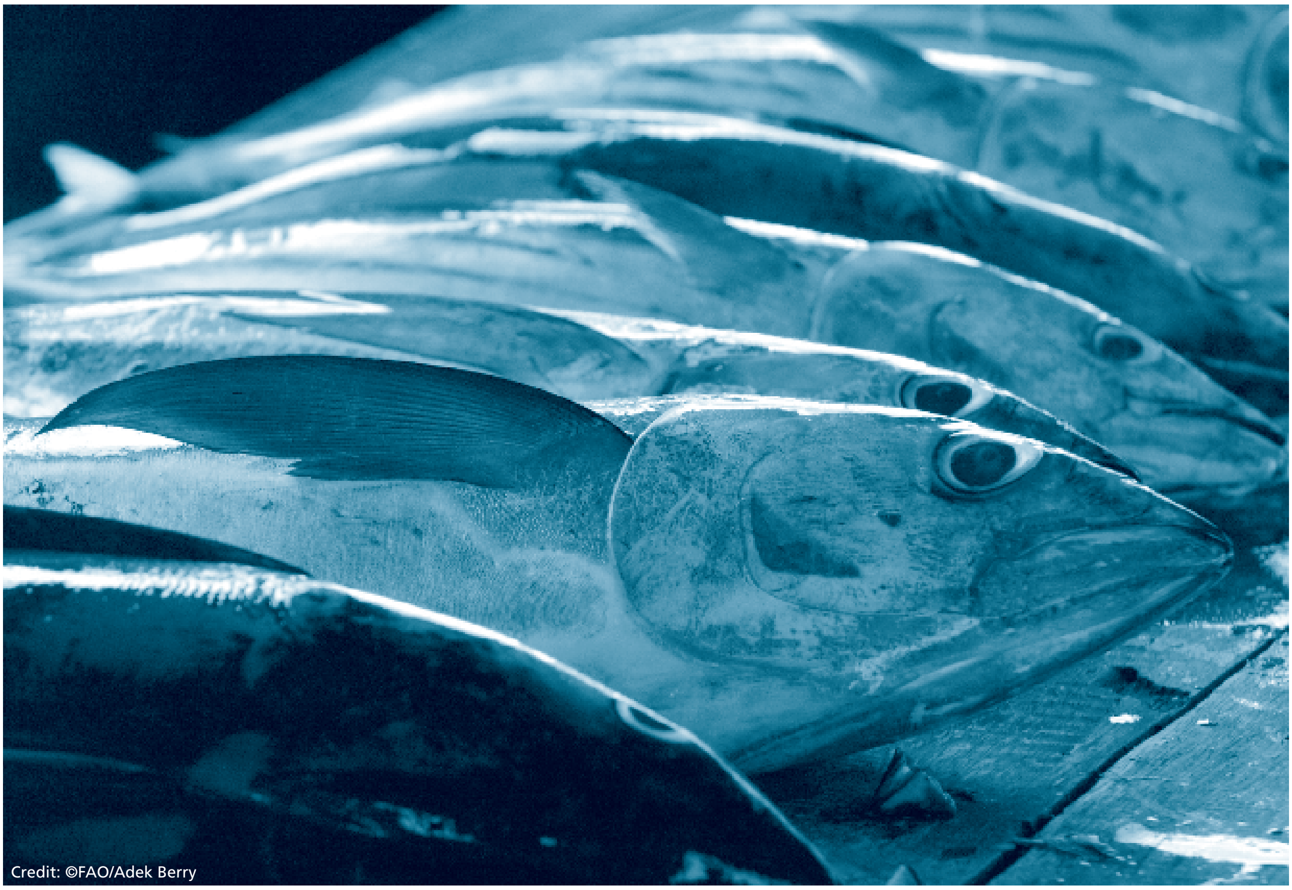
This section provides an alphabetical list of important aquatic food species. The list shows those species that account for 80% of global production volume in ISSCAAP groups 1-5, based on FAO 2009 statistics.

Table A3.1 FISH – Freshwater, diadromous and Marine (capture fisheries and aquaculture)

Alaska pollock(=Walleye poll.)	European anchovy	Jack and horse mackerels nei
Albacore	European pilchard(=Sardine)	Japanese amberjack
Anchoveta(=Peruvian anchovy)	European plaice	Japanese anchovy
Araucanian herring	European seabass	Japanese seabass
Argentine hake	European sprat	Kawakawa
Arrow-tooth flounder	Filefishes nei	Large yellow croaker
Atka mackerel	Flatfishes nei	Large yellow croaker
Atlantic bluefin tuna	Sandeels(=Sandlances) nei	Largehead hairtail
Atlantic cod	Sardinellas nei	Lefteye flounders nei
Atlantic cod	Scads nei	Lizardfishes nei
Atlantic herring	Sea catfishes nei	Mote sculpin
Atlantic horse mackerel	Seerfishes nei	Mullets nei
Atlantic mackerel	Short mackerel	Nile tilapia
Atlantic redfishes nei	Silver carp	Okhotsk atka mackerel
Atlantic salmon	Silver croaker	Pacific bluefin tuna
Bastard halibut	Silver pomfrets nei	Pacific cod
Bigeye scad	Silver seabream	Pacific halibut
Bigeye tuna	Skipjack tuna	Pacific sandlance
Bigeyes nei	Snappers nei	Pangas catfishes nei
Bighead carp	Snappers, jobfishes nei	Percoids nei
Blue whiting(=Poutassou)	Flathead grey mullet	Pink(=Humpback)salmon
Boarfish	Flathead sole	Ponyfishes(=Slipmouths) nei
Bombay-duck	Freshwater fishes nei	Porgies, seabreams nei
California pilchard	Freshwater fishes nei	Rainbow trout
Cape hakes	Frigate and bullet tunas	Red drum
Cape horse mackerel	Fusiliers nei	Rock sole
Capelin	Gilthead seabream	Roho labeo
Carangids nei	Goatfishes	Sockeye(=Red)salmon
Catla	Grass carp(=White amur)	So-iny (redlip) mullet
Chilean jack mackerel	Greenland halibut	Southern bluefin tuna
Chub mackerel	Groupers nei	Spinefeet(=Rabbitfishes) nei
Chum(=Keta=Dog)salmon	Groupers nei	Threadfin breams nei
Cobia	Groupers, seabasses nei	Threadfins, tasselfishes nei
Common carp	Grunts, sweetlips nei	Tilapias nei
Common sole	Gulf menhaden	Tonguefishes
Croakers, drums nei	Haddock	Whitemouth croaker
Crucian carp	Hairtails, scabbardfishes nei	Yellow croaker
Cyprinids nei	Indian halibut	Yellow striped flounder
Daggertooth pike conger	Indian mackerel	Yellowfin sole
Emperors(=Scavengers) nei	Indian mackerels nei	Yellowfin tuna

Table A3.2 SHELLFISH – Crustaceans and Molluscs (capture fisheries and aquaculture)

Akiami paste shrimp	Freshwater crustaceans nei	Octopuses, etc. nei
American cupped oyster	Freshwater molluscs nei	Opalescent inshore squid
American lobster	Gazami crab	Oriental river prawn
American sea scallop	Giant river prawn	Pacific cupped oyster
Antarctic krill	Giant tiger prawn	Patagonian scallop
Argentine shortfin squid	Giant tiger prawn	Penaeus shrimps nei
Atlantic surf clam	Japanese carpet shell	Queen crab
Banana prawn	Japanese flying squid	Red swamp crawfish
Blue swimming crab	Jumbo flying squid	Scallops nei
Cephalopods nei	Marine crabs nei	Sea mussels nei
Chinese mitten crab	Marine crustaceans nei	Siberian prawn
Common squids nei	Marine molluscs nei	Southern rough shrimp
Constricted tagelus	Marine molluscs nei	Squillids nei
Cupped oysters nei	Natantian decapods nei	Tanner crabs nei
Cuttlefish, bobtail squids nei	Northern prawn	Various squids nei
Fleshy prawn	Ocean quahog	Whiteleg shrimp


Credit: ©FAO/Adek Berry

Annex B (informative)
Functional unit for aquatic food products – Examples of functional units applied to aquatic food products

Example B1

The functional unit for a frozen cod fillet product is defined as "**500g of frozen cod fillets as delivered to distribution centres**".

Defining the functional unit was based on the assessment considering only cradle-to-gate GHG emissions and removals, with the gate including distribution to retail. In this case, the distribution covers until it arrives at the distribution centres of the specific retailers in question. The cod fillets are provided to retail frozen in packs of 500g.

Defining the functional unit "…as delivered to distribution centres" is important in that it includes the packaging applied for delivering the cod fillets to the distribution centres (i.e. it corresponds to 500g of frozen cod fillet and X g of packaging).

It also ensures that any product loss during the supply chain until it arrives at the distribution centres is taken into account. Therefore, the GHG emissions assessment must consider all the materials and energy required to produce and deliver 500g of frozen cod fillets to the distribution centres. Note that had the functional unit been defined as 500g of frozen cod fillets produced, the definition would not have accounted for product loss during distribution.

Example B2

The functional unit for a frozen cod fillet product is defined as "**1 kg of frozen cod fillets available for consumption**".

Defining the functional unit was based on the assessment considering the full life cycle cradle-to-grave GHG emissions and removals. The cod fillets are provided to retail frozen in packs of 1 kg.

Defining the functional unit "…available for consumption" is important in that the proportion of product loss during the supply chain (e.g. product damaged during distribution, unsold past the shelf life, etc.) is taken into account. Therefore the GHG emissions assessment must consider all the materials and energy required to produce and deliver 500g of frozen cod fillets to retail and ready for purchase by the consumer, as well as the downstream implications that occur as a result of their consumption (e.g. storage, preparation and cooking in the home, product wastage, disposal and waste treatment of any waste).

Example B3

The functional unit for cod is defined as "**1 tonne of gutted cod landed**".

Defining the functional unit was based on the assessment considering only cradle-to-gate GHG emissions and removals, with the gate being the landing of the fish at the harbour side. The gutted cod are landed in crates and covered with ice. Since the weight of cod per crate varies, the amount of studied product is set at a convenient one tonne.

Annex C (informative)
Process map for an aquatic food product – Example of the life cycle of an aquatic food product

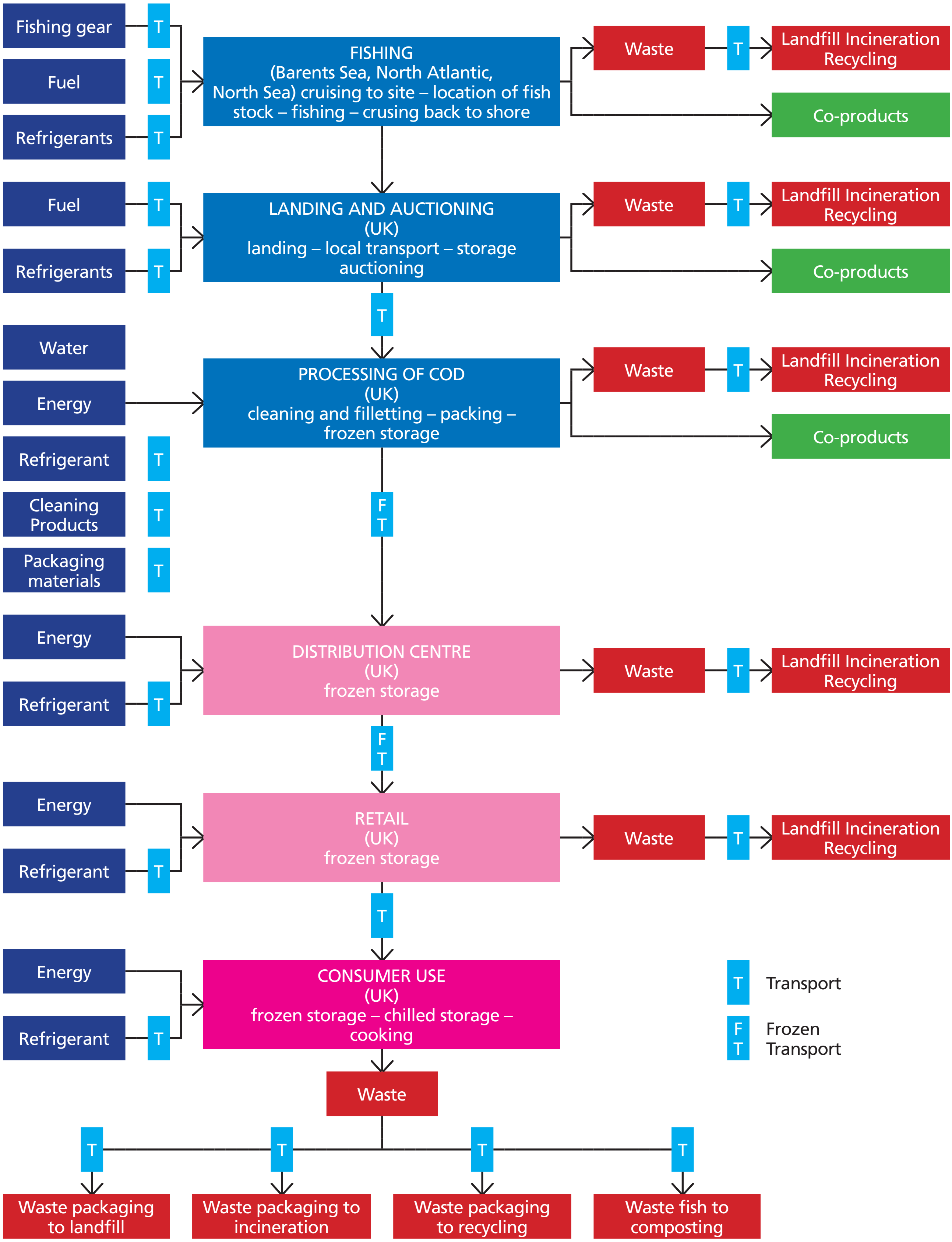
Having defined the functional unit, a producer of frozen cod fillets to the retail sector starts to map out the life cycle of the frozen cod fillet product being assessed.

The producer uses the process-mapping as an initial brainstorm exercise to identify all of the "flows" of materials and energy in and out of the product system as they are used to produce and distribute the frozen cod fillet product. Although the purpose is to calculate the GHG emissions from cradle-to-gate only, the producer still maps out the whole life cycle to make sure that important considerations "downstream" are not overlooked, such as the recyclability of the packaging that is used for the frozen cod fillets.

Having created the process map below, the producer uses it to consider the "flows" in more detail, determining which of them to be included as part of the "system boundaries" and which can be excluded due to falling below the materiality threshold or having been excluded either by PAS 2050:2011 or the supplementary requirements.


Credit: Seafish

Figure C1 An example process map for frozen cod fillets



Annex D (informative)
Data sampling – Example data sampling approach for sampling with grouping

7.3 outlines two potential sampling approaches, depending on the number of data sources and their variations: (1) random sampling without grouping; and (2) random sampling with grouping (stratified sampling). This Annex provides an example of sampling with grouping.

A fish processor produces a cod food product based on Atlantic cod from the Barents Sea. Over the three-year data collection period, the cod is sourced from nearly 1500 vessels of a variety of sizes and operating different fishing gear. Collecting data from each vessel would be prohibitively time consuming, and a sampling approach is required. Due to the variation between the vessels and their operations, and the impact this has on their GHG emissions, a sampling approach using grouping is being adopted.

The vessels can be categorized into five homogeneous sub-groups that reflect their size. These can then be further categorized into sub-groups according to the fishing gear used. Fuel consumption is the main contributor to the GHG emissions for fishing and since fuel consumption to a large extent is dependent on the vessel size (and therefore the distance it travels to the fishing stocks) and fishing gear used, these two parameters are used for grouping.

In order to determine the number of vessels to sample for each sub-group, the fish processor has to determine the proportion of the product supplied by the different groups as the sampling size is determined by this. For example, for the data collection period the vessels of the range 60 to 75m in length using Danish seine accounted for 23% of the supply of Atlantic cod for this particular product. The number of vessels to sample is therefore calculated as the square root of 1500 vessels multiplied by 23%, i.e. 9 sampling vessels.

Vessel size (length, m)	Fishing gear used	Number of vessels	Random sample size	Percentage sampling rate
60-75	Danish seine	345	19	6%
	Longline	30	10	33%
	Hook and line	30	10	33%
	Demersal trawl	75	10	13%
45-60	Danish seine	180	13	7%
	Longline	75	10	13%
	Hook and line	30	10	33%
	Demersal trawl	45	10	22%
36-45	Danish seine	165	13	8%
	Longline	90	10	11%
	Hook and line	60	10	17%
	Demersal trawl	30	10	33%
30-36	Danish seine	105	10	10%
	Longline	135	12	9%
	Hook and line	60	10	17%
	Demersal trawl	30	10	33%

Annex E (informative)
Allocation – Examples of the allocation of co-products

Example E1 Allocation of co-products during fishing

The majority of vessels catch several species at a time in the form of by-catch. This example considers a vessel landing three types of fish species.

Data for the fuel consumed and the catch landed is shown in the table below.

	Inputs	*Outputs*
Total fuel consumption	*60 litres*	
Total catch		*150 kg*
Catch of fish A		*80 kg*
Catch of fish B		*20 kg*
Catch of fish C		*50 kg*

Using mass allocation, the fuel consumed by the vessel is therefore allocated to the three products landed as follows:

Fish A: *60 litres x 80 kg / 150 kg = 32 litres*

Fish B: *60 litres x 20 kg / 150 kg = 8 litres*

Fish C *60 litres x 50 kg / 150 kg = 20 litres*


Credit: ©FAO/Rocco Rorandelli

Example E2 Allocation of co-products in processing

At the processing stage, there are generally always a number of co-products.

Considering demersal fish as an example, the co-products may be fish fillets as well as fish mince, offal, as well as some waste not being utilized. Fish mince may be used for producing fish cakes, fish fingers, etc. and offal may be used for animal feed and production of fish meal and oil.

Data for the electricity consumed and the products and waste produced in the process are shown in the table below.

	Inputs	*Outputs*
Electricity consumption	*10 kWh*	
Total processor input	*110 kg*	
Total co-product output		*100 kg*
Fillet		*50 kg*
Fish Mince		*20 kg*
Offal		*30 kg*
Waste		*10 kg*

The electricity consumed during processing is therefore allocated to the fillet product and co-products as follows:

Fillet: *10 kWh x 50 kg / 100 kg = 5 kWh*

Fish mince: *10 kWh x 20 kg / 100 kg = 2 kWh*

Offal: *10 kWh x 30 kg / 100 kg = 3 kWh*

The waste is not allocated any of the electricity consumption, as it does not have an economic value and, as such, is not considered a co-product.

Annex F (informative)
Calculation of GHG emissions from land use change (LUC) – Examples of the calculation of GHG emissions from land use change (LUC)

F1 Example of the calculation of GHG emissions from LUC when the country and previous land use are known

A food wholesaler imports farmed tiger prawns from Thailand. The farm the wholesaler purchases from was established in 2005 on land previously used as rice paddies. The farm yields 12 tonnes of tiger prawns per hectare per year.

Following **5.2.3.3** and the six steps outlined in the PAS Guide (page 35), the GHG emissions due to land use change for Thai tiger prawns are calculated as follows:

1) Are emissions from land use change relevant?

Yes. It is known that land use change has taken place in the past 20 years.

2) Place of origin?

Thailand.

3) Previous land use?

Rice paddies.

4) Emission factors:

Emission factor for rice paddy land converted to industrial land in Thailand = 0.86 t CO_2e/ha/year = 860 kg CO_2e/ha/year.

This has been calculated as follows:

LUC GHG emissions and removals from previous land use – LUC GHG emissions and removals from current land use

= carbon stock in biomass for annual cropland – carbon stock in biomass for industrial land

Where

Carbon stock in biomass for annual cropland = 4.7[1)] t C/ha = 0.86 t CO_2e/ha/yr

Carbon stock in biomass for industrial land = 0 t CO_2e/ha/yr

5) Percentage of the land area affected?

100%. The farm was established in 2005 on what was previously cropland (rice paddies).

6) Yield of tiger prawns?

The producer has informed that the yield is 12 000 kg/ha/year

7) GHG emissions due to LUC:

Land area affected / yield = 100% x 860 kg CO2e/ha/yr/12 000 kg/ha/yr

= **0.07 kg CO_2e/kg tiger prawn**

F2 Example of the calculation of GHG emissions from land use change (LUC) when the country is known but the previous land use is not known

A food wholesaler imports farmed tiger prawns from Thailand. The specific tiger prawn farm is not known and therefore neither the year in which the farm was established or its previous use.

Following **5.2.3.3** and the six steps outlined in the PAS Guide (page 35), the GHG emissions due to land use change for Thai tiger prawns are calculated as follows:

1) Are emissions from LUC relevant?

Yes. It cannot be proven that no LUC has taken place in this area in the past 20 years.

2) Place of origin?

Thailand.

3) Previous land use?

Unknown.

4) Emission factors:

Previous land use can be estimated from land characteristics data such as the Global Land Cover Characteristics Database (GLCCD) by the United States Geological Survey (USGS)[2)]. Combined with carbon stock information from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, this provides the following:

[1)] Table 5.9 from Volume 4 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[2)] http://earthtrends.wri.org/pdf_library/data_tables/for2_2003.pdf

	Area (ha)	% of usable land	Carbon stock (t C/ha)	GHG equivalents (t CO_2e/ha/yr)
Usable land				
Forest	203,354	40.3%	9.66	35.42
Grassland	367	0.1%	7.57	1.38
Cropland	301,135	59.6%	4.7	0.86
Barren land	322	0.1%	0.00	0.00
Unusable land				
Unusable land (snow, ice, water and wetlands)	8,487			
Industrial land	983			

Assuming a weighted average of all available land is converted to aquaculture, the following emission factor can be calculated:

(40.3% x 35.42) + (0.1% x 1.38) + (59.6% x 0.86) + (0.1% x 0)
= 14.79 t CO_2e/ha/yr = 14,788 kg CO_2e/ha/yr

5) Percentage of the land area affected?

No data is available for the change in land area under aquaculture in Thailand over the past 20 years. The closest proxy is the tonnage output from aquaculture in the FAO database. This shows that between 1990 and 2010 aquaculture production in Thailand rose from 291,719 tonnes to 1,286,122 tonnes. Taking a worst case approach, assuming that this is as a result of area expansion (as opposed to yield increase[3)]), 77% of the current aquaculture area has been created in the past 20 years.

6) Yield of tiger prawns?

An assumption is made that this is 12 000 kg/ha/year (equivalent to reported yields from other farms).

7) GHG emissions due to land use change:

77% x 14,788 kg CO_2e/ha/yr/12 000 kg/ha/yr
= 0.95 kg CO_2e/kg tiger prawn


Credit: Scottish Salmon Producers Organisation

[3)] In reality, any increase in production is likely to be a result of area expansion as well as yield increase. However, without any evidence of the contribution from both, a worst case approach has been taken here. If reliable information is available to support an allocation between the contribution from area expansion and yield increase, this may be used.

Annex G (informative)
Calculation of carbon storage in product – Example of the calculation of carbon stored for longer than the 100-year assessment period in an aquatic food production

A mussel farmer has been asked by a seafood processor to provide a GHG emissions and removals assessment for the mussels he is supplying. The processor has specified that the information should be reported per one tonne of mussels (including shells) as supplied to his facility.

As part of the information provided to the processor, the mussel farmer needs to include information about the carbon stored in the mussel shells as, depending on their treatment downstream, this may be stored within the shells for more than the 100-year assessment period specified by PAS 2050:2011.

The farmer knows that the shells account for 40% of the weight of the mussels, i.e. one tonne of mussels consists of 400 kg of shells.

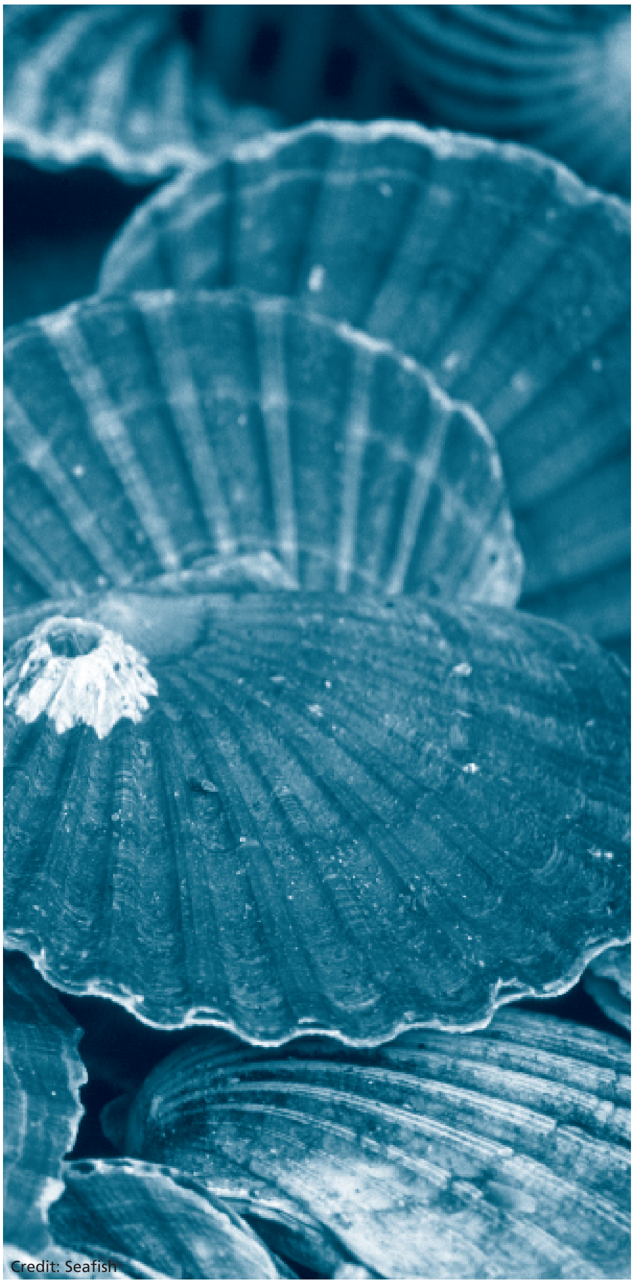
Since the mussel shell consists mainly of $CaCO_3$[4)], the carbon content of the shell can be calculated as

weight of one carbon atom / weight of one calcium carbonate molecule * 100%
= 12/100 * 100% = 12%

The carbon stored in shells, per tonne of mussels delivered to the processor is therefore:

40% * 1 tonne * 12% = 0.048 tonne

The farmer can therefore inform the food processor that the carbon content of the shells amount to 48 kg per tonne of mussels delivered. Subsequent processes downstream determine if the carbon is stored beyond the 100-year assessment period.


Credit: Seafish

4) Shells may also contain a certain level of impurities. For the purposes of this exercise, this is ignored and it is assumed the shell consist of $CaCO_3$ only.

Annex H (informative)
Commentary on the potential significance of different life cycle inputs and outputs

H.1 Introduction

Tables H1 and H2 provide a list of inputs and outputs for capture fisheries and aquaculture, respectively ranked by their potential significance to the GHG assessment outcome and providing commentary on that significance.

The following colour code applies to both tables:

- Red: Can be expected to be important
- Yellow: Can be expected to be of low importance
- Green: Can be expected to be insignificant
- Orange: Orange indicates care required. Significance variable could increase considerably in some circumstances.

Table H.1 Capture fisheries

The following life cycle inputs and outputs can always be expected to have a significant impact on the GHG assessment outcome		
Energy	• Marine special distillate • Diesel • Gas • Electricity	The emissions associated with the use of energy are likely to be of primary importance for the cradle-to-gate GHG emissions assessment
Co-products *(where present)*	• Landed by-catch • Fish mince • Offal • Shells • Etc.	Co-products can result from various processes. Where co-products are identified, a share of the impacts of all upstream processes should always be allocated to these co-products (see **8**)
The following life cycle inputs have the potential for significant impact on GHG assessment outcomes. They are however variable according to circumstances and could therefore have minimal influence on the assessment outcome. They should therefore always be taken into consideration.		
Materials used for cooling	• Ice • Refrigerants (both input of and loss to the atmosphere)	The emissions associated with refrigerants are in many instances likely to be of low importance for the cradle-to-gate assessment. However, where refrigerants are used for cooling on vessels, the impact from these could be of importance (especially if the vessel is of an older age)
Materials used for processing	• Wood • Additives • Other ingredients	Depending on the level of processing, the emissions associated with the production of materials for processing can range from low to high importance for the cradle-to-gate GHG emissions assessment
Transport	• Transport of materials and products within or between life cycle processes included in the cradle-to-gate assessment	The significance of transport is likely to vary depending on distances travelled, means of transport, load efficiency employed and type of refrigerant employed

The following life cycle inputs and outputs can be expected to have a low impact on the GHG assessment outcome		
Materials used for capture fishing operations	Consumables such as: • Nets • Rod, line, hooks • Ropes • Etc.	The quantities involved and the emissions associated with the production of consumables are likely to be of low importance for the cradle-to-gate GHG emissions assessment
Bait used for capture fisheries operations	• Bait	Not all capture fisheries employ bait. Where bait is employed, the emissions associated with the production of bait are likely to be of low importance for the cradle-to-gate GHG emissions assessment. An exception to this is crustacean trap fisheries, where the emissions associated with the production of bait are likely to be of importance
Packaging materials	• Industrial packaging used for transportation (fish crates, bulk tote bags, etc.) • Consumer packaging (primary & secondary packaging)	The impact of packaging is likely to be small in many instances, but could vary. Of the packaging used in the supply chain, the consumer packaging is likely to have the highest impact due to the product to packaging ratio
Waste to landfill	Different solid waste streams are produced depending on the exact process used	The significance of the waste is likely to vary depending on the type of waste and the treatment it has undergone
The following life cycle inputs can be expected to have an insignificant impact on the GHG assessment outcome		
Consumables used for maintenance of capital goods	• Non fuel oil use in transport equipment and machinery • Anti-fouling agents • Cleaning agents	Generally the consumption of consumables used for maintenance is likely to be minimal

Table H.2 Aquaculture

The following life cycle inputs and outputs can always be expected to have a significant impact on the GHG assessment outcome		
Energy	• Marine special distillate • Diesel • Gas • Wood • Electricity	The emissions associated with the use of energy are likely to be of high importance for the cradle-to-gate GHG emissions assessment. Especially for land-based aquaculture systems, energy consumption is high due to the need to maintain water quality and oxygen levels
Feed, fertilizers and medicine used for aquaculture operations	• Feed • Fertilizers • Medicines/vaccines	The emissions associated with feed for aquaculture production are likely to be of primary importance for the cradle-to-gate GHG emissions assessment
Co-products	• Fish mince • Offal • Shells • Etc.	Co-products can result from various processes. Where co-products are identified, a share of the impacts of all upstream processes should always be allocated to these co-products (see **8**)

The following life cycle inputs have the potential for significant impact on GHG assessment outcomes. They are however variable according to circumstances and could therefore have minimal influence on the assessment outcome. They should therefore always be taken into consideration		
Materials used for processing	• Wood • Additives	Depending on the level of processing, the emissions associated with the production of materials for processing can range from low to high importance for the cradle-to-gate GHG emissions assessment
Transport	• Transport of materials and products within or between life cycle processes included in the cradle-to-gate assessment	The significance of transport is likely to vary depending on distances travelled, means of transport, load efficiency employed and type of refrigerant employed
The following life cycle inputs and outputs can be expected to have a low impact on the GHG assessment outcome		
Materials used for aquaculture operations	Consumables such as: • Filters • Etc.	The emissions associated with the production of aquaculture equipment are often of low importance to the cradle-to-gate GHG emissions assessment
Materials used for cooling	• Ice • Refrigerants	Refrigerants are typically released in relatively small quantities and so have low significance
Packaging materials	• Industrial packaging used for transportation (fish boxes, bulk tote bags, etc.) • Consumer packaging (primary & secondary packaging)	The impact of packaging is likely to be small in many instances, but could vary. Of the packaging used in the supply chain, the consumer packaging is likely to have the highest impact due to the product to packaging ratio
Waste to landfill	Different solid waste streams are produced depending on the exact process used	The significance of the waste is likely to vary depending on the type of waste and the treatment it has undergone
The following life cycle inputs can be expected to have an insignificant impact on the GHG assessment outcome		
Consumables used for maintenance of capital goods	• Non fuel oil use in transport equipment and machinery • Anti-fouling agents • Cleaning agents	Generally the consumption of consumables used for maintenance is likely to be minimal

Annex I (informative)
PAS 2050:2011 and The Product Life Cycle Accounting and Reporting Standard – Compatibility assessment

Table I1 presents a comparison between the method provided by the Product Life Cycle Accounting and Reporting Standard and that of PAS 2050:2011 applied with the supplementary requirements provided by PAS 2050-2: 2012. Any potential areas of difference in outcome are identified.

The PAS 2050:2011 approach focuses almost entirely on assessment and does not include requirements for reporting. Because of this the method employed precludes free selection between options, providing a default assessment in all cases to ensure a credible outcome.

On the other hand, the Product Life Cycle Accounting and Reporting Standard which incorporates robust requirements for reporting is able to permit optional choice, relying on reporting of decisions taken, to deliver the necessary credibility.

It is this difference in approach that creates the possibility for difference in outcome between what are in all other respects two entirely compatible methodologies.

A GHG assessment undertaken using PAS 2050:2011 in combination with these sector specific supplementary requirements is likely to be compatible with the Product Life Cycle Accounting and Reporting Standard, provided the reporting requirements of that standard are also met.

Credit: Seafish

Table I.1 PAS 2050:2011 used with supplementary requirements for aquatic food products (PAS 2050-2) compared with WRI/WBSCD Product Life Cycle and Reporting Standard

Assessment element	Commentary	Anticipated effect on assessment outcome
Objectives	Same overall objective, to provide consistent method, e.g. to identify, understand and manage (e.g. reduce) emissions	No difference anticipated
	PAS 2050:2011 focuses on providing a "*consistent method for assessment*", while the Product Standard enables organizations to "*account for and publicly report GHG inventories of products*"	No difference anticipated
Principles	Essentially the same – both derived from common sources: ISO 14044 (PAS 2050) and the GHG Protocol Corporate Standard (Product Standard)	No difference anticipated
Product sector focus	PAS 2050 revision has introduced "supplementary requirements" (SRs) that include sector guidance/rules /PCRs. The Product Standard refers to "product rules" to enable comparisons. Both documents require sector approaches to be consistent with the overarching standard	Difference possible where different supplementary requirements or product rules are used. However it is expected that the same rules should be applicable to both methods
	PAS 2050:2011 sets out principles that SRs must comply with if they are to be used with the PAS. PAS 2050-2 has been developed accordingly and provides supplementary requirements to assist the application of the PAS 2050:2011 methodology to assessment of cradle-to-gate GHG emissions from aquatic food products The Product Standard provides guidance on the development of product rules	No difference anticipated – guidance and principles convey the same meaning
Biogenic carbon	Both require biogenic emissions and removals to be included in the assessment	No difference anticipated
	PAS 2050 excludes biogenic carbon for food and feed. This is on the grounds that they are short cycle products so the emissions & removals are likely to cancel each other out (and avoids the need to include CO_2 emissions from animal digestion). The Product Standard includes biogenic carbon in the inventory for all products and requires separate reporting for additional transparency	No difference anticipated – The exclusion of food and feed is optional in the PAS but if it is excluded the outcome of the assessment is likely to be the same
Aircraft emissions	Neither standard require the use of a multiplier or other correction to emissions from aircraft transport. The Product Standard allows the use of a multiplier in the inventory results, but if so the multiplier must also be disclosed in the inventory report. If a multiplier is used for PAS 2050:2011, it needs to be recorded separately from the main inventory result	Difference possible – the inclusion of a multiplier is optional in the Product Standard and if used it would result in a different result for air travel emissions. However the same difference could also occur between two Product Standard assessments

Assessment element	Commentary	Anticipated effect on assessment outcome
Time period for assessment	PAS 2050:2011 specifies 100-year assessment period, unless otherwise provided for in supplementary requirements. The Product Standard allows companies to specify the appropriate time-frame. But if known science, sector guidance, or product rules do not exist, the Product Standard suggests companies should assume a minimum time period of 100 years including the end-of-life stage	Difference possible – If a longer time period is used when using the Product Standard. However, both standards allow flexibility for certain products/sectors The same difference could also occur between two Product Standard assessments
Stored carbon	In both standards, carbon stored beyond the time period for assessment is treated as stored carbon. In the Product Standard, the amount of stored carbon is also reported separately for transparency	Difference possible – if time/assessment period is different (see above), otherwise none
Delayed emissions	For both standards weighting factors shall not be applied to the inventory results (but companies may include results with weighting factors separately)	No difference anticipated
Land use change	Direct land use change is included in both documents. The Product Standard includes land use change within the inventory results and requires separate reporting for transparency. For PAS 2050:2011 it is included within the assessment and the type and timing of land use change must be recorded	Difference possible – Differences could occur where different product rules/supplementary guidance are used. Use of the same SRs/product rules should bring consistency here
	PAS 2050:2011 no longer requires to the use of worst case scenario and allows for average statistical data when determining direst land use change impacts. The Product Standard provides guidance for estimating direct land use change using average statistical data but also allows for the worst case scenario to be assumed	No difference anticipated
	PAS 2050:2011 provides some default values for land converted to cropland but reverts to IPCC for other types of land use change. The Product Standard provides guidance on how to calculate land use change emissions, following IPCC, but does not include specific default values	No difference anticipated as they both follow IPCC
	Indirect land use change is not a requirement in the Product Standard, but can be reported separately from the inventory results. Indirect land use change is not included in PAS 2050:2011	No difference anticipated – neither method includes indirect land use change in the assessment results.
Soil carbon	In PAS 2050 soil carbon is excluded unless provided for in supplementary requirements. In the Product Standard including soil carbon is not a requirement, but it can be included in the inventory results if companies can reasonably measure it	Difference possible – the default is not to include it in both standards but both allow for soil carbon change in certain circumstances

Assessment element	Commentary	Anticipated effect on assessment outcome
Unit of analysis	Both documents specify the functional unit. The Product Standard includes requirements for cradle-to-gate inventories to use reference flow as the unit of analysis. PAS 2050:2011 does not address specifically but it can be assumed PAS 2050-2 includes requirement to use a specified functional unit for aquatic food products where the assessment outcome is to be communicated	No difference anticipated
System boundary	PAS 2050:2011 sets certain specific inclusions and exclusions for the system boundary as a default unless provided for in supplementary requirements (e.g. excludes capital goods) The Product Standard –requires all "attributable" processes to be included in the boundary. "Non-attributable" processes (i.e. not directly connected to the studied product like capital goods) are not required to be included (and if included must be disclosed). Inclusion or exclusion of either attributable or non-attributable processes can be disclosed and justified	Difference possible – these could occur where different product rules/ supplementary guidance are used Use of the same SRs/ product rules should bring consistency here
Materiality/ cut-off	Where a data gap exists, exclusions are allowed by the Product Standard on the basis of significance (a 1% insignificance threshold is given as a rule of thumb but not required). Justification and disclosure of exclusions from the assessment is required in the inventory report PAS 2050:2011 allows exclusions on the basis of materiality (<1%) but at least 95% of complete product life must be included. Revision has moved towards alignment with the Product Standard by removing requirements where a single source is >50% (the 95% rule applied to the remaining sources) and not requiring scale up to account for 100%	Difference possible – if an assessment under the Product Standard results in an insignificance threshold greater than 5 % of total GHG emissions excluded, this will cause different results than PAS 2050:2011. However, the use of supplementary requirements/product rules may bring consistency here
Data	Both standards have consistent data quality rules	No difference anticipated
	Both standards have the same primary data requirement for all processes owned and controlled by the organization	No difference anticipated
	PAS 2050:2011 has an additional requirement for organizations that own <10% of emissions to collect primary data from suppliers that contributes to >10%. GHG Protocol encourages primary data collection from suppliers	No difference anticipated
	PAS 2050-2 includes provision for taking a representative sample of data in supply chains involving a large number of suppliers this should not be incompatible with the Product Standard and may even assist in the provision of a quantitative statement of data uncertainty required by the Product Standard	
Non-CO_2 emissions from livestock	PAS 2050:2011 is more specific on how non-CO_2 emissions from livestock are addressed by including a clause which follows the highest tier approach in the IPCC or country (whichever yields the highest assessment). The Product Standard does not provide specific guidance on this but the general data collection rules are generally consistent with the IPCC approach	No difference anticipated

Assessment element	Commentary	Anticipated effect on assessment outcome
Electricity	PAS 2050:2011 is more specific on how specific data sources shall be addressed, e.g. for energy supply systems/stand-alone sources/electricity and heat from large energy transmission systems/renewable energy factors. The Product Standard does not provide specific guidance but the general data collection rules are generally consistent	No difference anticipated
Allocation	After avoiding allocation, the hierarchy within the Product Standard is physical allocation and then economic allocation. For PAS 2050:2011, the hierarchy is supplementary requirements (SRs) and then economic allocation as the default approach except in some cases where specific requirements are given (i.e. transport/energy recovery/energy production using CHP).	Difference still possible in situations where the Product Standard uses economic allocation but the change to physical allocation in PAS 2050-2 should bring increased consistency here
Waste	Neither method allows allocation of waste (e.g. co-product with no value)	No difference anticipated
	Re-use – PAS 2050:2011 includes specific requirements on re-use as defined by the EU Directive. The Product Standard does not provide this guidance but the general requirements of the standard are consistent	No difference anticipated
	Recycling – PAS 2050:2011 has moved into alignment with the Product Standard and both provide for use of: the "Closed Loop Approximation" (0-100) method and the Recycled Content or "cut off" (100-0) method	No difference anticipated
Claims of conformity	The Product Standard requires public reporting to claim conformance with the standard, and specifies each component that shall be reported. PAS 2050:2011 includes requirements for recording information (not reporting) and requires information to be documented and made available if requested (e.g. verification). It includes some set text if conformance is claimed with PAS 2050:2011	No impact on assessment outcome Assumption that an assessment to PAS 2050:2011 would also comply with the Product Standard provided the reporting rules, including those for uncertainty, are followed
Uncertainty	The Product Standard requires a qualitative statement of uncertainty be included in the inventory report. Uncertainty is only covered in PAS 2050:2011 as guidance.	No impact on assessment outcome See comment above

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