

Seafood for Human and Planetary Health

Seafood brings benefits to both human health and environmental sustainability. It will have an increasingly important role to play for future food sustainability and for our ability to stay within planetary boundaries. High variability between different seafood systems environmental performance needs careful consideration for the industry's sustained growth.

Overview

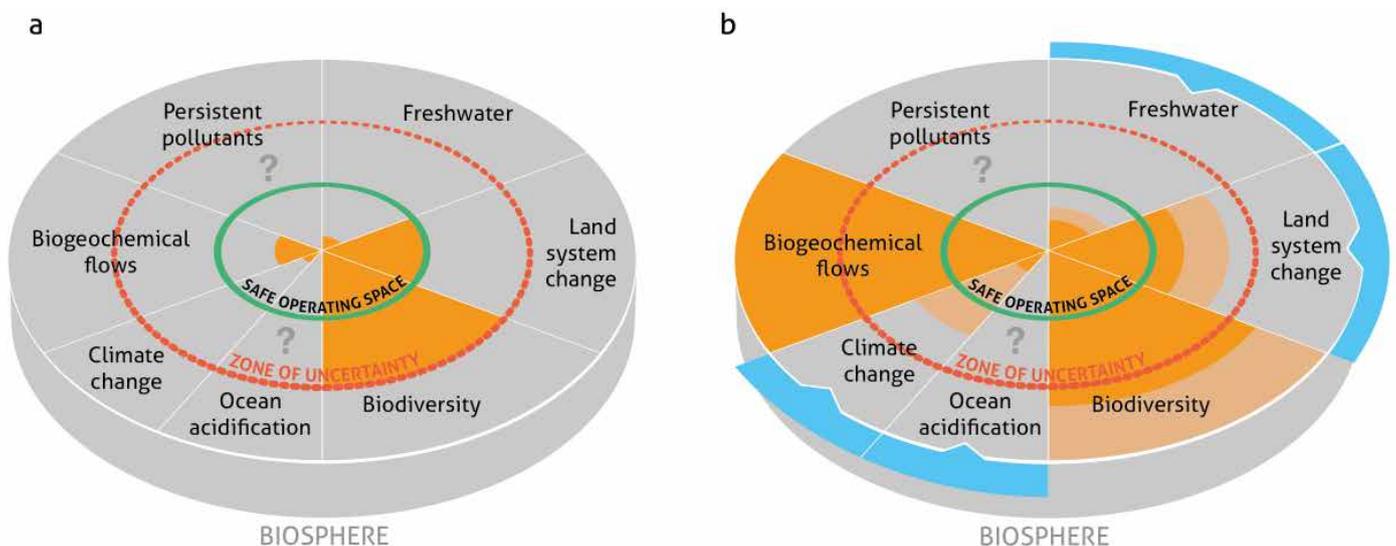
How to sustainably feed more than nine billion people by 2050 is one of the greatest challenges facing humanity. Reducing environmental impacts from food systems will be key for staying within planetary boundaries, while failure to do so will jeopardise the functioning of our life support system. Capture fisheries and aquaculture already play a central role for sustainably transforming the global food portfolio and improving human health, but their future contribution will in large depend on how the seafood industry develops as environmental performance can differ fundamentally between production systems.

The food challenge

Humanity is approaching several "planetary boundaries" indicating the urgent need to change our interactions with the environment¹. The food system is a major

driver of global environmental change, especially impacting four important planetary boundaries that have already been crossed – climate change (agriculture contributes more than 24% of global greenhouse gas emissions), biodiversity, land system change and altered phosphorous and nitrogen cycles^{1,2}. Future food systems need to produce enough volumes and contain adequate nutrients to support healthy populations, but simultaneously limit negative environmental impacts.

Peoples' food choices therefore matter and the consensus is that diets based on plant foods and low meat inclusion generate less emissions of greenhouse gases, use less water, and reduce human health problems³. Seafood has in this discussion been lifted as particularly beneficial as it contributes positively to human health and can cause less environmental degradation compared to many land based animal



Food production has grown relative to the biosphere pushing Earth to transgress several planetary boundaries (dark orange shows agriculture's contribution to overall transgression (light orange)). Approaching planetary boundaries results in different constraints for increasing seafood production, e.g. from changed climate, ocean acidification, freshwater scarcity and limited available land. Data from 1961 (a) to today (b) (on health from 1990 to today). Adapted from Gordon et al. in review [4].

systems. Seafood is however a non-homogenous food category and different production systems will relate differently to the planetary boundaries.

A planetary boundary perspective

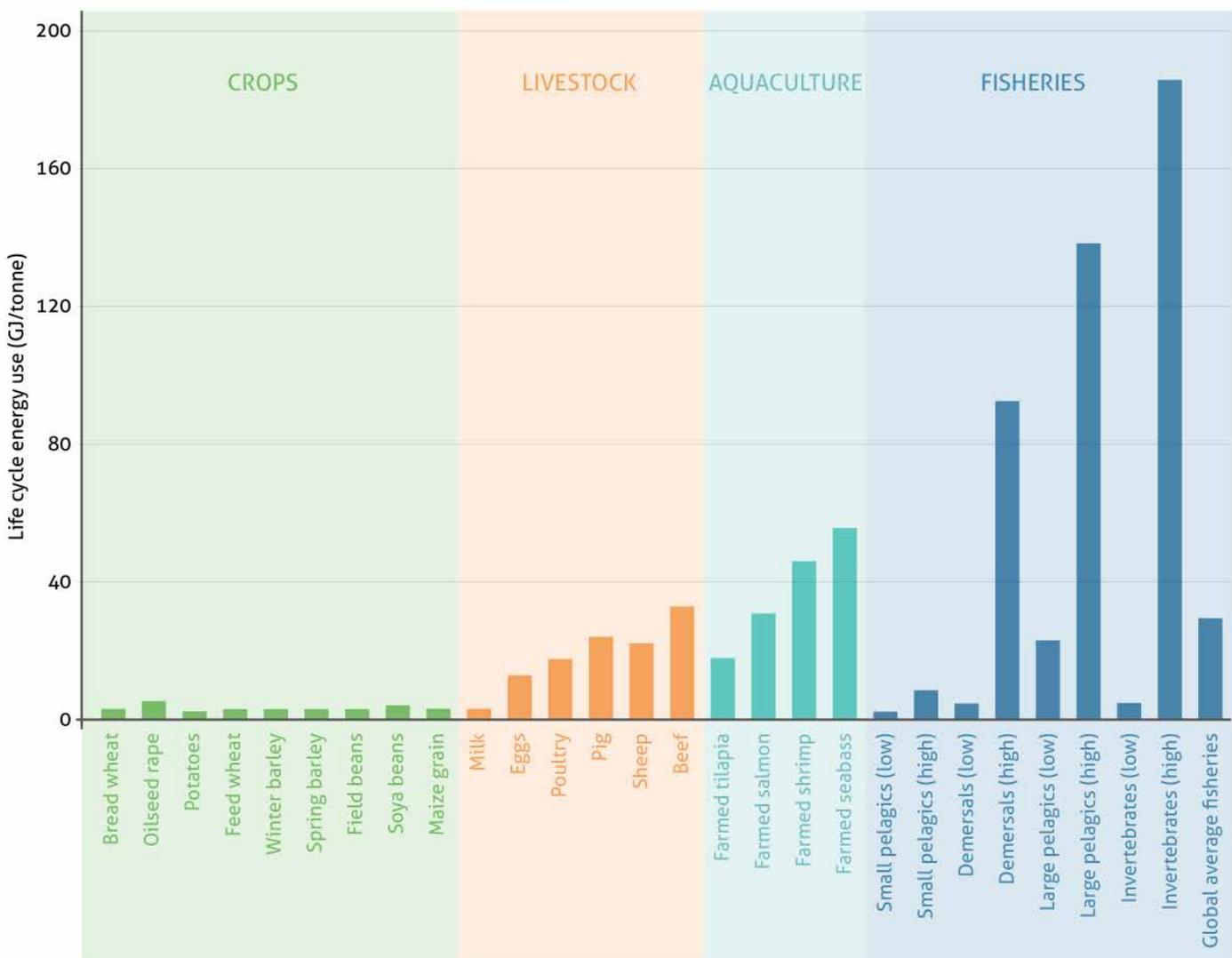
Seafood constitute an increasingly important part of our food supply contributing with 167 million tonnes in 2014 (approx. 20% of global farmed edible animal volumes)⁵. However, our seafood supply has changed dramatically over the last few decades due to increased aquaculture production. This has resulted in new challenges but also new opportunities. Seafood's pressure on the planetary boundaries is relatively small compared to agriculture crop farming. However, its contribution is still important and needs to be considered for attaining a future sustainable food portfolio. Simultaneously, reaching certain planetary boundaries will also limit seafood's future production potential for both capture fisheries and the aquaculture sector⁶.

Capture fisheries – a unique food resource

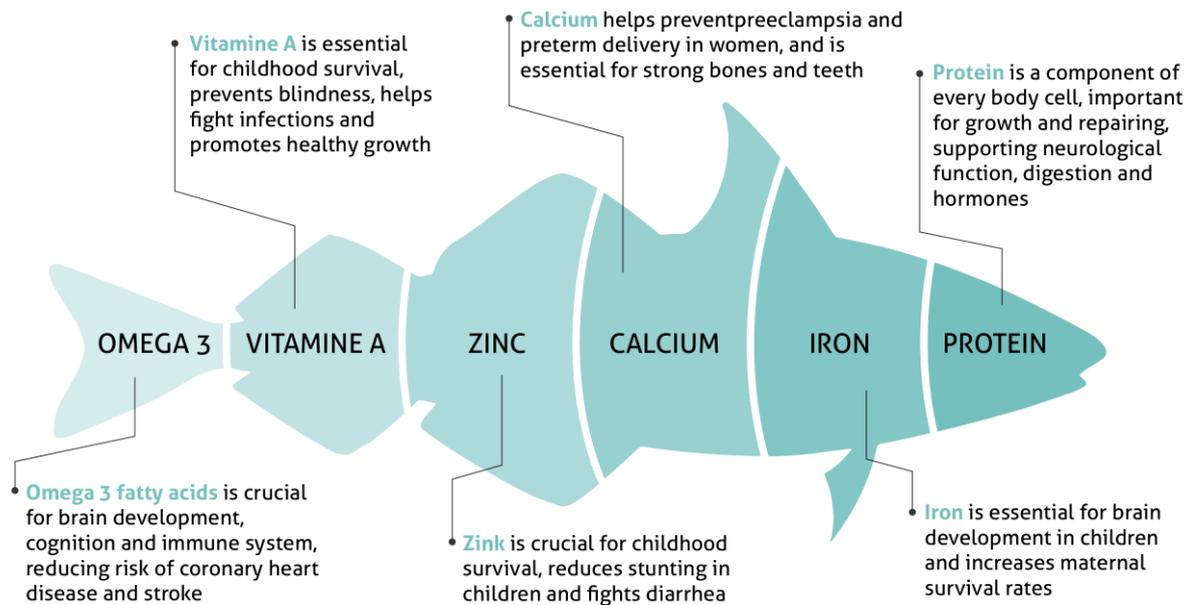
Capture fisheries provide half of global seafood. This production is truly unique since it is the only large-scale

food production system still based on harvests of a wild resource while contributing significantly to food security, especially in many poor countries. This has important implications for utilisation of resources and environmental impacts. Fisheries are fundamentally different compared to animal farming but they have their own set of challenges, of which most being specific to the aquatic realm (e.g. overfishing, impacts on aquatic biodiversity, etc.). While many wild fish stocks are fully or over-exploited, it has been argued that global landings potentially could increase by up to 20% if stocks were properly managed⁷.

Capture fisheries require relatively few inputs of natural resources, i.e. no land, pesticides, fertilizers, nor irrigation, so it makes an important contribution to our food portfolio. A failure in fisheries stock management would for example result in increased freshwater consumption when compensating this through terrestrial protein production. Consumption of captured marine species should therefore be seen as a huge freshwater saving (sustaining global fish stocks equals a global water savings of about 5%)⁸.



Cradle-to-producer gate life cycle energy use (GJ/tonne) in selected crop (green), livestock (orange), aquaculture (light blue) and fisheries (dark blue) production systems. Note: Methane emission not included which significantly increases greenhouse gas emission from domestic livestock such as cattle and sheep [2].



Fish provides important health benefits and remains an essential source of protein and micronutrients [12]. Prevalence of high quality and easily accessible Omega-3 fatty acids (DHA and EPA) has been identified as one of the main health advantages with seafood consumption.

Capture fisheries can however contribute significantly to greenhouse gas emissions, especially fishing for large demersal and pelagic fish species and invertebrates². Depending on the fishery and gear type, energy use for boat and gear provision, maintenance, bait, ice, and on-board refrigeration may also be non-trivial.

Aquaculture – a diverse sector

The future seafood demand will be met by an expanding aquaculture industry. Over 600 different species are farmed today but only about 44 species make up 90% of total global production⁶. The aquaculture sector is highly diverse with respect to species, production technologies, input regimes, product forms and characteristic modes of distribution, all influencing environmental performance.

Feed production represents a large part of the environmental impacts of fed aquaculture and can contribute to over 90% of energy use. However, there is a wide range in energy intensity both within and between different feed resources⁹. Agricultural inputs tend to have lower energy demands than marine- or livestock-derived inputs but instead increasing freshwater demand¹⁰. Nonetheless, it has been shown that farmed fish can perform better than e.g. livestock in terms of environmental impacts¹¹.

Seafood as game changer?

Studies on future diets enabling humanity to stay within planetary boundaries reached consensus about the importance of shifting towards more vegetarian diets. Seafood clearly impacts positively on human health and food security, and especially aquaculture

has a potential to become a major “game changer” that enables meeting future food demand sustainably. However, aquaculture offers products with highly mixed impacts on environment and resources. For aquaculture to significantly contribute to the global food portfolio, innovations within the feed sector and increased focus on low impact species are needed.



Unloading of fish used as feed in fish farms in China. Photo: M Troell/Azote

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