RESEARCH NOTE

DOES FARMED FISH HAVE A PLACE IN SUSTAINABLE, HEALTHY DIETS?

Delivering a sustainable future is fraught with knotty problems. Thanks to the work of the prestigious EAT Lancet Commission, we now know that sustainable, healthy diets need to be mostly plant-based and include little red meat. They should also feature a moderate amount of fish and seafood.

In 2019, the EAT Lancet Commission, a panel of 37 of the world's leading scientists on sustainability, diets and health, set out the findings of its research in the form of a definitive sustainable healthy diet, i.e. one that can be produced within planetary boundaries and which supports good health over the long term.[1]

While the commission concluded that the level of animal protein in global diets needs to be reduced substantially – for example, red meat consumption needs to be halved – our current average seafood consumption is optimal, at two servings, or around 200 grams per week, although there are substantial regional variations. For example, seafood plays a particularly vital dietary role in East Asia and the Pacific.[2]

The challenge, therefore, is to ensure that all types of fisheries are managed sustainably, to provide sufficient seafood for an optimal diet for everyone. With the global population predicted to reach 10 billion by 2050, pressure on fisheries will intensify.[3]

However, more than one-third of global marine fish stocks are already fished beyond sustainable limits and a further 60% are being exploited to their natural limit.[4] Freshwater fisheries – in rivers, lakes and ponds – provide crucial protein for hundreds of millions of vulnerable people but are also under increasing threat from overfishing, pollution and urban expansion.[5]

The EAT Lancet Commission concluded that future supply growth should come from aquaculture.[6] However, as this paper explains, producing farmed fish sustainably is challenging.

In fact, aquaculture is the fastest-growing food-production sector, accounting for more than half of all fish consumed by humans.[7] That figure is expected to increase to nearly 90% by 2030.[8] The sector has highly ambitious targets for the growth of salmon aquaculture, in particular. The Norwegian government, for example, is aiming for a fivefold increase in the volume of salmon production between 2014 and 2050.[9]

OUR APPROACH TO SUPPORTING A SUSTAINABLE SEAFOOD SECTOR

To facilitate investment in the aquaculture sector and in the suppliers to the sector that provide solutions to reducing some of its environmental impacts, BNP Paribas Asset Management offers various options, including the Blue Economy ETF (exchange-traded fund) and the actively managed Ecosystem Restoration Fund.

At the same time, we believe in the need to engage with the companies in these funds because aquaculture can have a number of adverse environmental and social impacts that must be minimised.

The environmental footprint of seafood depends on the species farmed, what they eat, and where aquaculture takes place. Key environmental impacts include:

[1] Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, *Lancet* 2019; 393: 447–92, 16 January 2019. http://dx.doi.org/10.1016/S0140-6736(18)31788-4
[2] ibid
[3] The State of World Fisheries and Aquaculture 2020 (fao.org)
[4] ibid
[5] WWF Position on Healthy and Sustainable Diets, September 2020
[6] Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems, *Lancet* 2019; 393: 447–92, 16 January 2019. Page 476, Panel 6.
[7] The State of World Fisheries and Aquaculture 2020 (fao.org)
[8] ibíd.
[9] https://www.fairr.org/engagements/sustainable-aquaculture-engagement/

- **Pressure on wild fish stocks**: Farmed fish, particularly carnivorous species like salmon, are fed 'FMFO' (fishmeal and fish oil) made from fish caught in wild marine fisheries. This adds to the pressure on wild fish stocks.
- **Deforestation and habitat loss**: Vegetable products are another key ingredient in salmon feed. They include soy, the production of which has contributed to substantial clearance of the Amazon and of critically important savannah ecosystems in several South American countries, including from illegally cleared land.[10]
- **Greenhouse gas (GHG) emissions**: While the carbon footprint of farmed salmon (can fish have a footprint?) is considerably lower than that of beef, it is higher than that of chicken and pork, as shown in Exhibit 1. Scope 1 and 2 GHG emissions (those emanating directly from a company's activities or from the energy sources its uses) pale in comparison to Scope 3 emissions (stemming from a company's suppliers' or customers' use or transportation of its products) when it comes to the production and transport of fish feed. In addition, the 2021 Intergovernmental Panel on Climate Change (IPCC) report states that aquaculture is among the fastest-rising contributors of nitrous oxide (N_2O) emissions.[11] While N_2O is a short-lived gas and stays in the atmosphere for far less time than CO_2, it is 273 times more potent in terms of its global warming potential.[12]

Exhibit 1
Greenhouse gas emissions per kilogram*

Source: POORE & NEMECEK (2018). Reducing food's environmental impacts through producers and consumers. Science, vol. 360, Issue 6392, pg. 987-992. Reducing food's environmental impacts through producers and consumers | ScienceCarbon
*The unit of measurement is 'Greenhouse gas emissions per kilogram of food product including emissions from methane (kg CO2 equivalents per kg product)'

- **Parasites and diseases among wild fish**: Farmed fish are stocked at high densities and farms are often sited close to one another. As a result, diseases and parasites can easily spread among them. Outbreaks can wipe out whole farms. Moreover, parasites like sea lice spread to wild stocks, threatening their health and survival. Treatments for these diseases are often stressful to the fish and result in mortality.
- **Contribution to antimicrobial resistance (AMR) due to use of antibiotics:** Fish farmers use antibiotics and other medicines to treat their stocks but, as in humans, this contributes to AMR in wild and farmed fish. The aquaculture industry is a significant consumer of antibiotics. The Asia-Pacific region accounts for 93.8% of consumption worldwide.[13] Antibiotics are most often used for catfish, followed by tilapia, shrimp, trout and salmon.[14]
- **Pollution due to use of chemicals, waste**: Farms release their waste, which includes chemicals and other pollutants, into surrounding waters. They also produce a great deal of plastic and equipment waste. Recent studies have found microplastics in fish feed.[15] They accumulate in the fish and therefore pose health risks to those who eat them.[16]
- **Loss of natural habitats such as mangrove forests:** Aquaculture is practised in ponds, lakes, rivers or along coastlines. Clearance of other habitats, including particularly sensitive habitats like mangroves, has a significant impact and is a cause of concern.[17] It can drive climate change, threaten wildlife and pollute drinking water. In addition, it destroys important natural coastal defences that protect areas immediately inland from floods and storms, and harms neighbouring fisheries on which local communities rely for food and jobs.[18]
- **Impacts on naturally occurring species**: Just as Japanese Knotweed has become the scourge of gardeners outside Japan, and non-native goats and rats pose a huge threat to the unique fauna of the Galapagos Islands, many types of fish have been introduced into ecosystems far from their origins. The introduction of non-native species affects local species. Specific consensus figures are hard

[10] Soy | Industries | WWF (worldwildlife.org)
[11] Global Carbon and Other Biogeochemical Cycles and Feedbacks - AR6 WGI Report. IPCC (2021) https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_05.pdf
[12] ibíd.
[13] Coller FAIRR Protein Producer Index 2021, Chapter 3
[14] ibíd.
[15] https://www.sciencedirect.com/science/article/abs/pii/S0044848620340229?via%3Dihub
[16] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6132564/
[17] https://planet-tracker.org/lack-of-transparency-threatens-farmed-shrimp-investments-says-new-planet-tracker-report/
[18] https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Rapport/Getting%20the%20shrimp%20s%20share.pdf

to pin down, but more than five million fish are thought to have escaped following the 20 biggest breaches of the past 20 years. Small escapes – those involving fewer than 100 000 fish – are far more frequent.[19]

Competition for feed resources and availability of land for freshwater farming are also critical constraints to the sector's growth. Not only does the current feed mix impose significant environmental impacts, feed accounts for 40% of production costs in the salmon-farming industry. Ensuring a sustainable supply of feed is therefore critical to its ability to grow.[20]

However, it is estimated that if current approaches to feed formulation continue, the growth of the sector will be curtailed because production in finfish aquaculture will be unable to exceed 14.4 million tonnes globally compared to the seven million tonnes currently produced.[21]

Climate change will also affect fisheries and aquaculture.[22] Productivity is predicted to increase at high latitudes and decrease at low and mid latitudes. In May this year, New Zealand's biggest king salmon farmer shut some of its farms after warming seas prompted a die-off of 42% of its fish.[23]

An alternative, innovative feed source – insect protein

One type of alternative protein being explored to create fish feeds is insect-based protein. The EU approved the use of insect protein in aquaculture in 2017. Two pioneering insect farming companies in this emerging sector, in which BNPP AM has an interest, are Ÿnsect and Protix.

Protix was founded in 2009 in the Netherlands. It creates a range of products from the Black Soldier fly, including ProteinX used in aquaculture, from hatchery to grower diets for several fish, including salmon.

Ÿnsect is a French firm founded in 2011 by scientists and environmental activists. It aims to farm insects and transform them into high-performance natural protein solutions for pets, fish, plants and humans. The company has raised c. USD 425 million from leading global investors and received **B Corp certification** in 2021.

ENGAGING WITH SALMON FARMERS

Among the many ways in which BNPP AM is working to combat climate change and reduce companies' impacts on biodiversity is to engage with companies in the food sector to urge them play a central role in the transition to sustainable healthy diets.

This is the backdrop for our recent collaborative engagement with three Norwegian fish farming companies facilitated by FAIRR – the Farm Animal Investment Risk & Return initiative – an investor network focused on environmental, social & governance (ESG) risks and opportunities in the food sector. BNPP AM joined FAIRR in 2021.

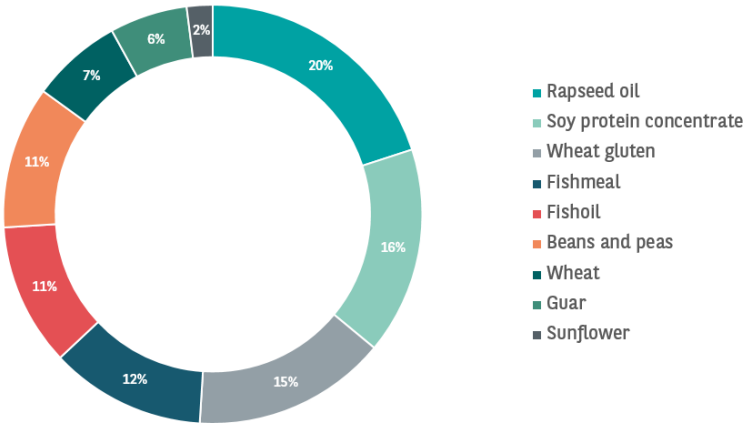
In the listed aquaculture sector, salmon is one of the two most extensively farmed species, in addition to shrimp. Norway produces just over half of all salmon farmed in the world.[24] We therefore focused our engagement on three pure-play Norwegian salmon-farming companies: Mowi ASA, Lerøy Seafood ASA and Grieg Seafood ASA – all of them constituents of the Blue Economy ETF.

We engaged alongside other investors in a process facilitated by FAIRR. In the first quarter of 2022, we signed joint investor letters to Grieg Seafood ASA, Lerøy Seafood ASA and Mowi ASA. Although all three companies were given a relatively good rating by FAIRR in its 2021 Protein Producer Index, they could all improve their sustainability performance, specifically in relation to the feed mix they use.

Salmon are predominantly fed on a mixture of FMFO derived from wild catch, and vegetable ingredients such as soy, wheat or pea protein (see Exhibit 2). The industry is exploring new, alternative sources of feed to lessen its environmental impacts. For example, researchers are looking at the feasibility of making feed with currently unused waste from fish processing plants, such as the heads and tails, or with protein derived from farmed insects. However, FAIRR's analysis shows that while there has been extensive research to identify sustainable and alternative feed sources, the current approaches lack scalability and are not orientated to quickly achieving sufficient impact.

[19] ibid
[20] Managing Biodiversity & Climate Risks in Aquafeed - FAIRR
[21] The-Future-of-Food-from-the-Sea.pdf (oceanpanel.org)
[22] Eat Lancet Commission report, see footnote 1
[23] Major New Zealand salmon producer shuts farms as warming waters cause mass die-offs | New Zealand | The Guardian
[24] Leading salmon producers worldwide 2018 | Statista

Exhibit 2
Feed source by type



Source: Grieg Seafood Integrated Annual Report 2021

The objective of our engagement was therefore to accelerate these companies' efforts to reduce their GHG emissions – their carbon 'fin-print', if you will – and to protect biodiversity, by reducing their dependency on feed sources such as soy, and FMFO derived from wild fish stocks.

More specifically, we sought to secure commitments to establish a comprehensive research-led, science-based strategy to underpin the development and greater use of alternatives to marine and soy feed ingredients.

A sustainable feed strategy needs to be based on reliable, comparable data on the emissions associated with different types of feed, and their wider environmental impacts. This is proving to be a challenge that each company is tackling in different ways, which is what our engagement was designed to explore and accelerate.

Using green bonds to finance sustainable solutions

Aquaculture companies are starting to turn to green bonds to raise capital to finance investment in research and scaling up the production of novel, more sustainable feeds. Planet Tracker – a non-profit financial think-tank aligning capital markets with planetary boundaries – outlined in a 2020 report that Mowi ASA and Grieg Seafood ASA issued the first green bonds in the sector, with sustainable feed listed as a key use of proceeds in their respective frameworks. It found that 'both bonds were significantly oversubscribed, with demand for Mowi's €200 million issuance exceeding €700 million, indicating good appetite for debt issued to embed and scale effective sustainable practices, not only offering access to long-term sustainability, but also operational, reputational and financial benefits.'

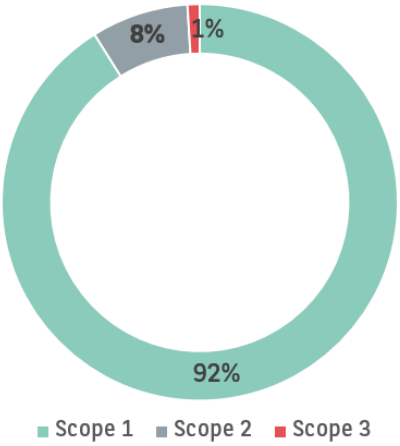
DEEP DIVE: ENGAGEMENT WITH GRIEG SEAFOOD ASA

In early June 2022, we joined an investor call with Grieg Seafood ASA, the smallest of these three Norwegian fish farming companies. Grieg is one of the world's leading salmon farming companies, set to harvest 90 000 tonnes of fish in 2022 increasing to 130 000 tonnes in 2025. It farms in Norway and Canada.

The purpose of the call was for Grieg to update investors on the progress it has made since Phase 1 of FAIRR's engagement in 2020, see what the company is doing in relation to its feed strategy and ask them to make further improvements.

In its 2021 annual report, Grieg published its Scope 1, 2 and 3 emissions, including those related to feed. As illustrated by Exhibit 3, its Scope 3 emissions are by far the largest, accounting for 91% of the total, of which CO2e related to feed were 282 456 tonnes out of total scope 3 emissions of 370 421 tonnes, or 76%. This was a 2% increase over the previous year.

Exhibit 3
Grieg's greenhouse gas emissions by scope, 2021



Source: Grieg Seafood Integrated Annual Report 2021

When asked why emissions had increased, the company explained that this was due to production increasing by 6%, thus implying a relative decrease in such emissions as a result of the introduction of new feeding technologies. We then asked the company to explain how it plans to reduce emissions and its wider environmental impact.

The company explained that is working through the Global Salmon Initiative (GSI) – a leadership forum of 13 salmon farming CEOs from around the world that represent around 40% of the global sector – to develop a new industry standard for emissions from feed. The intention is to harness the collective weight of salmon producers' voices, encourage suppliers to provide greater traceability and impact data, and set standards for how the ESG impacts of fish feed are reported.

Grieg is also working with WWF-US to develop a methodology to assess holistically the ESG credentials of all novel feeds and to try to develop feeding systems that fit within a sustainable food system. The scope includes topics not previously explored in-depth in relation to all ingredients. These include land use and biodiversity, carbon footprint and climate risk, circularity, pollution, soil health, fresh water consumption, human rights, governance risk and scalability.

The goals of the project are to increase feed transparency and traceability, to be able to benchmark feed ingredients based on their material ESG characteristics and to have the ability to reduce risk and drive change throughout its supply chains. The assessment will also inform which novel ingredients the company explores further to introduce into its feed mix.

To finance several of its environmental initiatives, including investments in sustainable feed sources, Grieg noted that it took the innovative step of issuing its first green bond in June 2020 to raise NOK 1 billion and then added an additional NOK 500 million to the issue in November 2020.

The bond proceeds will finance or refinance assets and projects in four categories set out in the green bond framework:

1. Environmentally sustainable aquaculture
2. Pollution prevention and control
3. Water and wastewater management, and
4. Waste management.

Fully 75% of the proceeds are intended to be used for the first category, with a quarter of the funds allocated to sustainable feed and the remainder to sustainable fish farming.

Overall, we were pleased with how open the company was to our approach. We concluded that it is committed to addressing the environmental issues associated with fish feed, being proactive and making good progress in understanding both the impacts of, and reporting on, the biodiversity and climate impacts of its feed mix.

In this, as with many other biodiversity and climate-related issues across many sectors, the challenge is the lack of comprehensive, comparable data, and the ability to trace feed to its source. In turn, this is hindering accurate corporate reporting and the company's ability to implement effective sustainability strategies.

In follow-up correspondence, in line with the objectives set out by FAIRR for the engagement, we asked the company to further improve its disclosure, specifically by publishing a sustainable feed policy and the methodology involved, as well as a worked example of how it generates particular feed ratios, including assumptions on mortality, escapes, and consumption data. Its progress will be reflected in the next iteration of the Coller FAIRR Producer Protein Index.

An emerging alternative solution: Land-based aquaculture

By 2030, the annual investment needed to begin to restore oceans, soil and urban areas is estimated to be USD 22 trillion.[1] BNP Paribas Asset Management's Ecosystem Restoration Fund, launched in 2021, invests in quoted companies that aim to address these global crises.

Alongside investing in companies that provide solutions to terrestrial and urban ecosystem challenges, the fund invests in those that relate to aquatic ecosystems: Water pollution control, water treatment and sustainable packaging, efficient irrigation systems and flood control solutions, and aquaculture.

A new form of aquaculture under development is 'land-based' aquaculture. Pioneering companies in this segment include AquaBounty and Atlantic Sapphire. Here, fish are raised in pens on land, which avoids polluting surrounding waters, lice infestation and contamination of wild fish stocks.

However, farms that raise carnivorous fish face a number of similar challenges to sea-based systems, including the sourcing impacts of fish feed and welfare-related issues due to high stocking densities. Species better suited to this new form of production are therefore herbivorous fish and bivalves.

Rachel Crossley

Rachel is the Head of Stewardship Europe within the Global Sustainability Centre, having joined BNPP AM in 2021. She leads stewardship activities in the region to deliver BNPP AM's Stewardship Policy. This includes direct corporate engagement and engagement through collaborative investor initiatives, as well as proxy voting. Her role also encompasses working with policymakers on key issues relating to sustainable finance and investment, and representing BNPP AM in key investor networks including IIGCC, FAIRR, and the Access to Nutrition Initiative.

Rachel has more than 25 years of wide-ranging experience at the intersection of sustainability, international development and responsible investment. She joined BNPP AM having spent the previous 11 years as a consultant in responsible investment and sustainable business.

Prior to that, she co-led the development of responsible investment capabilities at two firms in London, Insight Investment and ISIS Asset Management. For the first 10 years of her career, she worked on natural resource management and agriculture projects at the World Bank in Washington DC and then at a start-up environmental finance company in New York. She has also held numerous roles as a board trustee and committee member of charities including The Climate Group and Oxfam's Enterprise Development Programme.

She holds a BA (Dual Hons) in economics and geography from the University of Sheffield (1988) and an MSc in rural resources and environmental policy from the University of London (1990).

Rachel is based in London.

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BNP Paribas Asset Management is the source for all data in this document unless otherwise specified

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