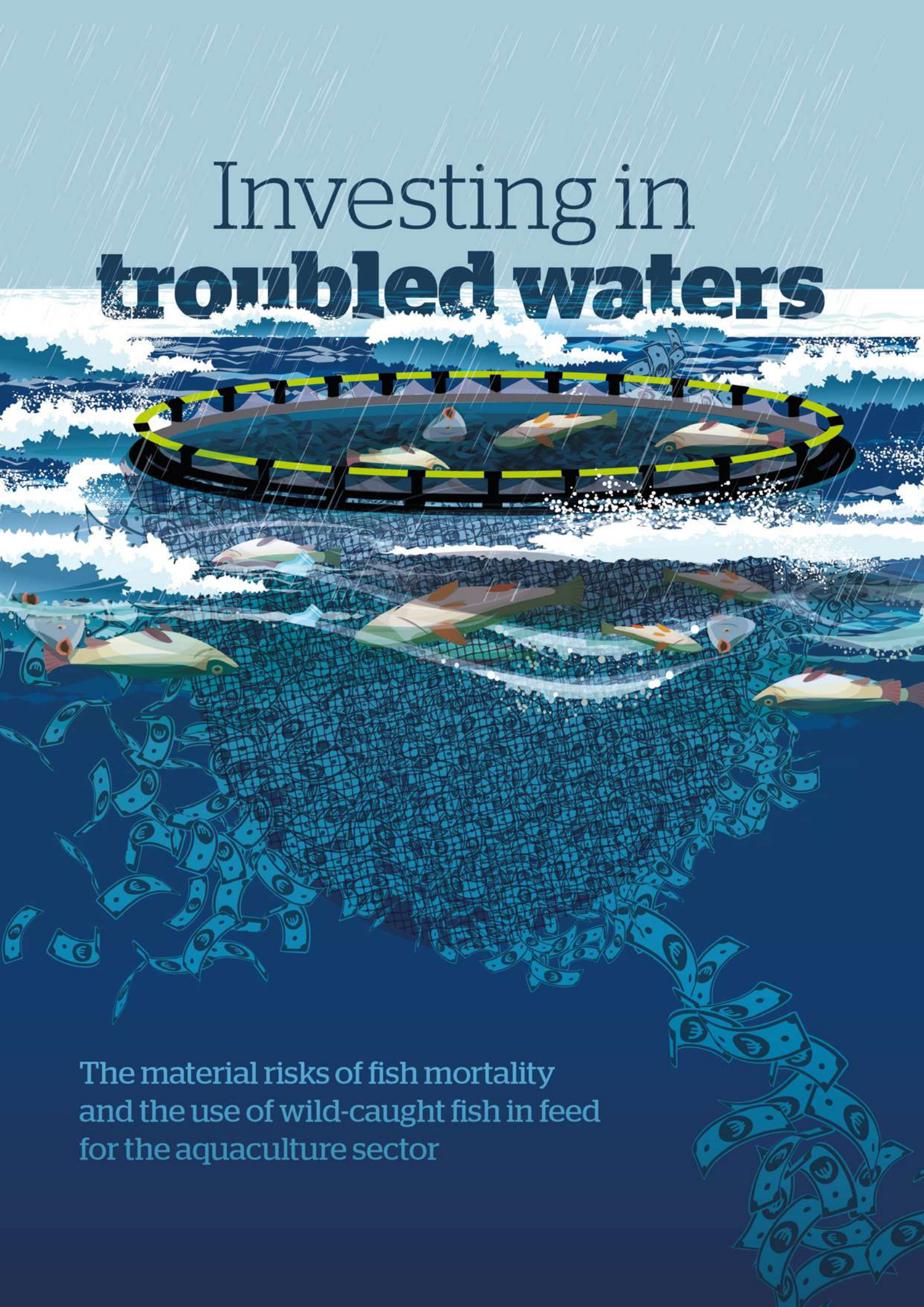
Investing in **troubled waters**



The material risks of fish mortality and the use of wild-caught fish in feed for the aquaculture sector

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A dead salmon floating in a sea cage
Credit: Compassion in World Farming

Executive summary

Soaring consumer demand for seafood,[1] coupled with the depletion of wild-fish stocks from overfishing, is often perceived as creating opportunities for the aquaculture sector, making it an attractive target for investment. The value of the global aquaculture market is projected to reach US$376 billion by 2025.[2]

Between now and 2030, it is forecast that investment in aquaculture could range anywhere from $150 billion to $300 billion, according to a study by Encourage Capital and The Nature Conservancy.[3] DNB, Nordea Bank and Rabobank are the top three lenders to aquaculture companies, with a total loan exposure of around €8 billion.

However, analysis shows the aquaculture industry is exposed to numerous risks relating to the use of wild-caught fish in feed and the high level of mortalities in aquaculture, which stem from poor fish welfare.[4] Together, these issues present significant environmental, social and animal-welfare concerns. Investors should be at the forefront of addressing these risks with companies; such environmental, social and corporate governance (ESG) issues are likely to affect returns on investments.

Our research shows that, overall, very few investors are taking these material issues of fish mortality and wild-caught fish in aquaculture into account in their engagement with investees in the aquaculture supply chain. We sent a questionnaire to 23 investors and financial institutions, and the responses show they could be doing much more to require companies to rapidly address these two critical material challenges. The risks can be mitigated by investment in better farming practices that place fish welfare front and centre, and by eliminating the use of wild-caught fish for feed in aquaculture supply chains.

Key findings

1. High mortality rates are a financial risk

- **None** of the investors or financial institutions **require** investees to **report on fish mortalities** in their supply chain.
- **None** have robust policies in place that ensure investees **are working to reduce farmed-fish mortality rates**, either directly or in their supply chain.

Farm profitability and fish welfare are inextricably linked. A 2018 study by a Norwegian seafood analyst showed that good fish-welfare standards provide more stable earnings and lower costs, and reduce the risk of reputational damage.[5] Good fish health and welfare not only reduces risk for the company and its investors but also affects the valuation of a company. It has been shown that good vs poor fish health can make a difference of 20% of the market value of a company. For example, SalMar has low production costs and stability of biology compared to other salmon farmers, and, as a result, is valued highly on the stock exchange.[6]

Analysis by Just Economics, commissioned by the Changing Markets Foundation and published in 2021, calculated the unaccounted economic, environmental and social costs of salmon farming. The report shows that fish mortalities cost $15.5 billion over seven years to the four main salmon-producing countries (Canada, Chile, Norway and Scotland) – a third of the overall cost. Overall, it is estimated that salmon aquaculture has produced private and external costs of $47 billion since 2013, with around 60% falling to producers and 40% to wider society.[7]

Mortality rates on salmon farms are high; in Norway in 2019, they stood at 15%.[8] Compassion in World Farming has estimated that mortality rates on Scottish salmon farms are even higher: In the years between 2012 and 2017, an average of 24.2% of fish reared on Scottish salmon farms died prematurely every year.[9] This far outweighs mortalities found in other forms of intensive farming.

It is possible to achieve high welfare and low mortality rates on farms. In OneKind's 2018 report on the welfare status of salmon farms in Scotland, Wester Ross Fisheries stood out from the others in terms of good animal welfare. Across the company's three sites, there were no incidents of escapes, low sea-lice levels, and monthly mortality rates did not exceed 10%. Of the larger companies, Cooke Aquaculture stood out as having, on average, sites that were better for fish welfare.[10] There are opportunities for companies that prioritise higher-welfare seafood; in Europe, consumers are willing to pay 14% more for salmon produced with higher welfare standards.[11]

Since fish-welfare standards and mortality rates are directly linked to the financial performance of aquaculture companies, investors should be much more attuned to poor farming practices that threaten to reduce profits and undermine the long-term financial viability of the industry.

2. Reliance on wild-caught fish threatens diminishing returns

- **No** investors or financial institutions have criteria in place that require a **reduction or phase-out of the use of wild-caught fish as feed** in investees' products or practices.
- **65%** (15 out of 23) of investors and financial institutions **fail** to put in place criteria to ensure **no illegal, unreported and unregulated fishing, or other compliance failures, occur** in their portfolio of investments and lending to the aquaculture sector.

The aquaculture sector's continued dependence on wild-caught fish for use in aquafeed represents a systemic and economic threat for companies. Feed is the single largest input cost for fish farmers – 50–70% of business expenditure – and higher prices will put more pressure on fish farmers' margins.[12] Aquaculture is the biggest driver of demand for fishmeal and fish oil (FMFO). With soaring growth of the aquaculture industry, and fed aquaculture outpacing growth of non-fed aquaculture,[13] demand for FMFO is likely to outstrip supply. Over the period 2010–30, the World Bank projects that fishmeal prices will rise by 90%, and fish oil prices by 70%, due to limits on the supply of wild-caught fish.[14] Unless the sector's dependence on wild-caught fish can be abated, this represents a resource risk, which limits the further growth and profitability of the industry.

3. Green bonds can be used for greenwashing

- **Mowi** has issued a **green bond** for nothing more than conducting **business as usual** – this should be challenged by investors.

Mowi, Grieg Seafood and SalMar are the only three companies to have issued a green bond in the aquaculture sector, bringing the current total amount invested into the sector in green bonds to €689 million.[A] All three bonds were oversubscribed – demand for Mowi's €200 million issuance was over €700 million[15] – which reveals the appetite for issuance of debt to scale sustainable practices in seafood.

Mowi's green-bond framework states that a key use of the €200 million proceeds will go towards developing environmentally sustainable aquaculture, which encompasses both sustainable feed and fish welfare.[16] However, the framework relies heavily on certification schemes for both sustainable feed and fish welfare – Aquaculture Stewardship Council (ASC), Marine Stewardship Council (MSC) and MarinTrust – rather than focusing on a measurable reduction in farmed-fish mortalities or the elimination of wild-caught fish in feed.[17] It appears that Mowi has issued a green bond for nothing more than conducting business as usual – on the other hand, Grieg Seafood has recognised the need to develop novel feed ingredients.

4. Unsustainable aquaculture is hindering the Sustainable Development Goals

- Unsustainable aquaculture is **threatening food security** (SDG 2) and **adding pressure to wild-fish stocks** (SDG 14).
- Investors that have committed to **supporting the SDGs** need to act to **align their aquaculture investments** with these commitments.

Despite the aquaculture sector's aspirations to improve global food security and relieve pressure on wild-fish stocks, it is failing to deliver on this promise. Marketing images might tout farmed fish as a sustainable food with the ability to meet the world's protein needs – but, in reality, industrial aquaculture removes high-quality protein and micronutrients from the food chain in one part of the world and transfers the nutrients to different – often more affluent – markets.[18]

A 2021 report by Greenpeace Africa and Changing Markets showed how, each year, over half a million tonnes of fish are extracted from the ocean around the coast of West Africa to produce FMFO. This quantity of fish could feed over 33 million people in the food-insecure region, but is instead used to feed farmed fish and animals, mostly in Europe and Asia. Not only are the fish species the FMFO industry uses in West Africa already overexploited,

A Mowi green bond: €200 million EUR (https://mowi.com/investors/share-and-bond/bonds/); Grieg Seafood green bond: €142 million EUR (https://salmonbusiness.com/grieg-seafood-to-expand-green-bond-by-e47-million/); SalmMar green bond: €347 million EUR (https://www.seafoodsource.com/news/business-finance/salmar-far-exceeds-green-bond-fundraising-goal-of-nok-2-5-billion).

Close-up of "trash fish" being offloaded at FMFO Company at Ullal, Karnataka, India.

according to the Food and Agriculture Organization, but industrial extraction from West African fisheries also undermines food security in the region and deprives people of their livelihoods.[19]

Rather than providing a solution to food-security issues, the aquaculture sector is significantly undermining the achievement of Sustainable Development Goal (SDG) 2 (to end hunger and achieve food security) and SDG 14 (to conserve and sustainably use the oceans). Since many investors have committed to supporting the SDGs, they need to recognise that investment in unsustainable aquaculture is at odds with this commitment.

Recommendations for investors

The combination of high mortalities on farms, resulting from poor fish husbandry, and growing ecological impacts from the use of wild-caught fish in feed – juxtaposed with consumer demand for ethical, environmentally friendly and high-welfare products – are creating financial and reputational risks to the aquaculture industry.

Investors in the aquaculture supply chain should develop robust policies and engagement practices that require investee companies to:

1. **Publicly disclose full aquaculture supply chains and report on key indicators.**

2. **Reduce mortality rates on fish farms.** This should include the requirement for monthly reporting on mortality and escape rates from all aquaculture suppliers, and early engagement if these numbers seem to be increasing.

3. **Adopt good fish-welfare standards.** We recommend using Compassion in World Farming's species-specific toolkit to set fish-welfare standards and reporting indicators: https://www.compassioninfoodbusiness.com/resources/fish/

4. **Eliminate the use of wild-caught fish in feed for aquaculture by 2025.** This should include the requirement for companies to publicly report – or require public reporting – from their suppliers on the composition and origin of feed, and investment in sustainable alternatives.

List of abbreviations

AM	Asset Management
ASC	Aquaculture Stewardship Council
EIF	European Investment Fund
ESG	Environmental, social and corporate governance
FAIRR	Farm Animal Investment Risk & Return
FAO	Food and Agriculture Organization
FIP	Fisheries Improvement Programme
FMFO	Fishmeal and fish oil
IUU	Illegal, unreported and unregulated
MSC	Marine Stewardship Council
NBIM	Norges Bank Investment Management
NNIP	NN Investment Partners
RAS	Recirculating aquaculture systems
SASB	Sustainability Accounting Standards Board
SDG	Sustainable Development Goal

A trout fish farm in the Mediterranean
Credit: Shutterstock

1. Introduction

In investor circles, soaring consumer demand for seafood,[20] coupled with the depletion of wild-fish stocks from overfishing, is often perceived as creating opportunities for the aquaculture sector, making it an attractive target for investment. The value of the global aquaculture market is projected to reach US$376 billion by 2025, witnessing a compound annual growth rate of 4.7% from 2018–25.[21]

The Sustainability Accounting Standards Board (SASB) – which identifies sustainability issues, relevant to each industry, that are likely to impact corporate ability to create value over the long-term – has outlined animal welfare and feed sourcing as factors likely to impact the operations and financial performance of the meat, poultry and dairy industry – which includes aquaculture.

The SASB highlights the increasing public and regulatory scrutiny of the treatment of animals, and demonstrates how consumer pressure has already shifted industry practice in this area. Furthermore, it outlines that companies prepared to anticipate and adapt to these trends may be able to increase their market share. In terms of feed sourcing, the SASB highlights how companies that work with suppliers to actively manage resource-scarcity risks will be better protected from price volatility and supply disruptions, and may improve their brand reputation. Conversely, failure to effectively manage feed-sourcing risks can lead to higher costs of capital, reduced margins and constrained revenue growth.[22]

In 2020, the Royal Bank of Canada Global Asset Management Responsible Investment Survey showed that 75% of investors across Europe, the US, Canada and Asia integrate environmental, social and corporate governance (ESG) principles into their decision-making, and 67% of those surveyed agreed that integrating ESG factors into their investments can help mitigate risk.[23]

GlobeScan's 2020 Healthy and Sustainable Living Study, conducted across 27 markets, shows that consumers placed '*the depletion of natural resources*' as one of the top-four very serious problems facing the world.[24] Yet, as identified by Share Action, not one of the world's largest asset managers has published a specific policy on biodiversity risks and impacts, and 86% of asset managers make no reference to biodiversity, natural capital or ecosystem protection in their policies. In the context of biodiversity-related engagement, very few asset managers can point to engagement on themes related to overfishing and ocean health. Share Action concluded that asset managers' understanding of biodiversity-related risks remains critically underdeveloped.[25]

In this report, we highlight how the combination of high mortalities on farms, resulting from poor fish husbandry, and growing ecological impacts from the use of wild-caught fish in feed – juxtaposed with consumer demand for ethical, environmentally friendly and high-welfare products – are creating economic and reputational risks to the aquaculture industry. These issues also present missed opportunities for companies unwilling to adapt to growing consumer demand for higher sustainability, thus failing to seize the market opportunity to offer higher-welfare fish. This report also evaluates the investment community's exposure to these risks by examining the policies and practices of 23 of the biggest investors in, and lenders to, the aquaculture sector.

The coastline and fish farms from above. Credit: Selene Magnolia / We Animals Media

BOX 1. Investment in the aquaculture sector: Salmon farming dominates equity holdings, but aother forms of aquaculture are of increasing interest to investors

The salmon industry is a multi-billion-dollar industry with privileged access to financial markets – including loans, credit facilities and private equity – and salmon stocks account for approximately 92% of the value of all aquaculture equities. There is a big contrast between the salmon industry and other forms of aquaculture, which are overall less financially sophisticated – although better-financed companies farming shrimp, tilapia and pangasius are emerging.[26] Most aquaculture companies remain in private hands, and the majority of investor activity is focused on lending rather than equity holdings.

Figure 1: Collective market capitalisation of the 46 publicly-listed companies in aquaculture as of 31 October 2019.

Source: Spheric Research and Undercurrent News (2019) *Aquaculture frontiers: financing aquaculture's potential.*

DNB, Nordea Bank and Rabobank are the top three lenders to aquaculture companies, with a total loan exposure of around €8 billion, according to a 2019 report on aquaculture financing. Their specialism in aquaculture lending has led to their expansion in lending to companies outside their national borders; for example, DNB and Rabobank both lend to the Chilean salmon industry, while DNB lends to 17 of the 20 largest global salmon companies. Rabobank, however, lends to all areas of aquaculture and companies farming species *besides* salmon.[27]

According to Rabobank, the aquaculture companies that are leading the way on sustainability also have the best financial results.[28] Banks that lend to the aquaculture sector are already incorporating ESG criteria into their loan covenants and evaluations – but these criteria do not go far enough.

There is a high level of interest in aquaculture from impact investors, venture capitalists and philanthropists seeking to improve food security, make seafood affordable and improve the environmental footprint of the industry.[29] Between now and 2030, it is projected that investment in aquaculture alone could range anywhere from $150–$300 billion, according to a study by Encourage Capital and The Nature Conservancy.[30] This means that impact investors have an opportunity to steer the future of the industry by directing investments toward the most sustainable forms of aquaculture.

Venture capital for aquaculture was slow to get moving, but Aqua-Spark was a frontrunner in financing for early-stage companies in sustainable aquaculture. Now, venture-capital deals are happening in larger numbers in the aquaculture sector, with many investors choosing to put their money behind farming species that have a lower barrier to entry, such as oyster, seaweed and kelp.[31]

Alongside a renewed policy impetus for aquaculture, the European Commission is channelling significant investment into the sector, through a partnership with the European Investment Fund (EIF) to launch the BluInvest initiative, the first equity-funding programme for the EU blue economy. It aims to promote investment in innovative solutions in the EU aquaculture sector for start-ups, early-stage businesses, and small- and medium-sized enterprises. According to the EIF, over €300 million is expected to flow into the blue economy during the course of 2021.[32]

A salmon with missing eye and mouth damage
Credit: Compassion in World Farming

2. Risks

2.1. Risks and impacts of poor fish welfare

There are growing concerns about the impact of fish farming on fish welfare, with high mortality rates reflecting inadequate fish husbandry. On fish farms, high stocking densities are the norm, and fish are kept in barren environments that offer very little environmental complexity. Keeping fish in this way can lead to high stress, aggression and injury, and increases the risk of disease transmission.[33] Fish are often exposed to extremely stressful handling procedures, which have led to poor welfare and mass deaths; for example, mechanical treatments to remove sea lice from salmon.[34] Major contributing factors to mortality rates on salmon farms are lice, disease and their treatments, plus toxic algal blooms and warming seas. Salmon are also lost through escapes - but, in general, many deaths are unexplained.[35] The issue of high mortality rates for farmed fish is not limited to farmed salmon; disease is the main cause of death for farmed sea bass and sea bream in the Mediterranean, where, in the ongrowing phase, the mortality rate is 15–20%.[36]

FIsh in a net
Crefit: iStock

BOX 2. Salmon aquaculture and its high mortality rates

Salmon aquaculture is the fastest-growing food-production sector in the world, and continued growth in demand is forecast. It is often presented as sustainable and offering high returns. The business is worth $20 billion annually, with 96% of production concentrated in just four countries: Canada, Chile, Norway and Scotland. Half of production is controlled by ten companies. These top-ten producers had combined total revenues of $12 billion in 2018; yet, between them, over half a million tonnes of salmon – worth $3.7 billion – died or escaped between 2010 and 2019.[37] Mowi's fish-mortality rates accounted for almost half of this loss.

Company	Volume of losses (tonnes)	Cost (MUSD)
Seafood Mowi	252521	$1,719
Leroy Seafood	66975	$456
Grieg Seafood	64992	$442
Australis	34042	$231
Blumar	32236	$219
Norway Royal Salmon	28342	$193
Bakkadrost	21058	$143
Salmar	15929	$108
Camanchaca	11550	$78
Seafood Invermar	9256	$63
Total	**536901**	**$3.656**

Table 1. Estimated mortalities and associated losses by producer (2010–19)

Source: Just Economics (2021) Dead loss: The high cost of poor farming practices and mortalities on salmon farms.

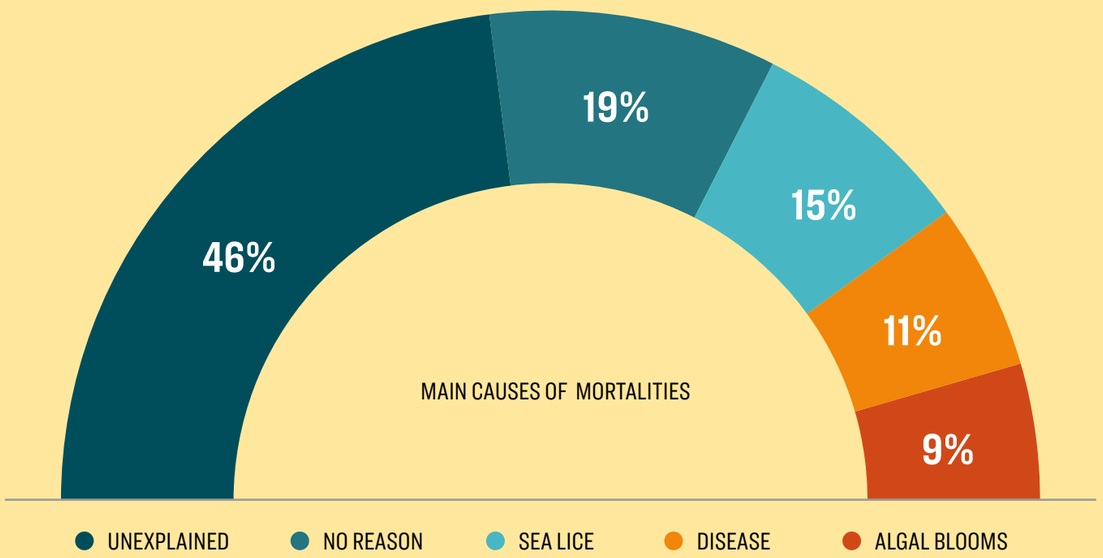


Figure 2: Main causes of mortalities on salmon farms

Source: Planet Tracker Salmon Dashboard Database, drawn from data from annual reports of global top-ten salmon producers.

It is important to note there is very little data on mortalities from the aquaculture industry as a whole. Where data is available, it is reported inconsistently, and the number of total mortalities is likely to be significantly underestimated. Data on mortalities in salmon farming are only consistently available in Norway and Scotland, where producers report them to the government, while data are largely absent in other producing countries and for other species. For this reason, this section on mortalities will primarily focus on salmon farming.

It is possible to achieve high welfare and low mortality rates on farms. In OneKind's 2018 report on the welfare status of salmon farms in Scotland, Wester Ross Fisheries stood out from the others, in terms of good animal welfare. Across the company's three sites, there were no incidents of escapes, low sea-lice levels, and monthly mortality rates did not exceed 10%. Of the larger companies, Cooke Aquaculture stood out as having, on average, sites that were better for fish welfare.[38]

There is a hidden layer of fish mortality in the aquaculture industry - that found in wild-caught fish ground down into fishmeal and fish oil (FMFO), which is used in feed. Based on Food and Agriculture Organization (FAO) fisheries-capture tonnages, together with estimated mean weights for fish species, it is estimated that 0.5–1 trillion fish[39] are caught each year and reduced to ingredients to feed farmed animals - mainly fish, but also pigs and chickens.[40] In Scotland in 2019, the farmed salmon that died before being harvested led to a waste of around 25,000 tonnes of wild fish in the form of feed - enough to feed 2 million people their weekly portion of oily fish for a year.[41]

The mortalities of cleaner fish (wrasse and lumpsuckers) used to eat sea lice from salmon (as an alternative to mechanical and chemical treatment) are often forgotten when discussing mortalities on salmon farms. There are significant welfare issues in the use of cleaner fish, and questions have been raised over their efficacy at reducing lice on farmed salmon.[42] Figures from Norway estimate that 20–60% of cleaner fish die before the end of a production cycle,[43] and approximately 50 million die per year in the Norwegian salmon industry.[44] Aside from the impact on their welfare, cleaner fish are an ongoing cost for the salmon industry, as they are killed at the end of each growing cycle.

A salmon with fin damage + sea lice attached to their head
Credit: Compassion in World Farming

2.1.1. Financial risk

The factors leading to fish mortality are often directly related to poor fish-husbandry practices. Over time, financial shortcuts in fish husbandry lead to disease, lice, stress – and, ultimately higher mortality rates, which result in heavy financial losses. Analysis in a Just Economics report published in February 2021 shows that poor husbandry, parasites and pollution have caused hundreds of millions of fish deaths, at a cumulative cost of $15.5 billion to the four salmon-producing countries ($768 million in Canada, $4.9 billion in Chile, $8.9 billion in Norway and $922 million in Scotland). Furthermore, the top-ten farmed-salmon producers have seen over half a million tonnes of salmon deaths on their farms since 2010 – worth a total of $3.7 billion.

In 2019, mortalities on salmon farms in Norway stood at 15%.[45] Compassion in World Farming has calculated that mortality rates on Scottish salmon farms are even higher; from 2012–17, an average of 24.2% of fish reared on Scottish salmon farms died prematurely every year.[46] This is much higher than mortalities found in other forms of industrial farming; for example, mortality rates on egg-laying-hen farms are 5–6%.[47]

A 2018 study by a Norwegian seafood analyst showed that good fish-welfare standards provide more stable earnings, lower costs and reduce the risk of reputational damage.[48] Indeed, reducing mortalities on salmon farms in Norway to 5.5% (comparable to mortality rates on egg-laying-hen farms) would represent an annual saving of $892 million, based on 2019 volumes and prices.[49]

Fish mortalities are an indication and a cost of poor farming practices. It is in farms' long-term interests to keep densities at the optimum level for fish health and welfare, and to adopt the highest farming standards. Good fish health and welfare not only reduces risk for the company and its investors but also affects the valuation of a company; it has been shown that good vs poor fish health can make a difference of 20% of the market value of a company.[50]

BOX 3. Missed opportunities

There are big opportunities for companies that invest in better alternatives, including higher-welfare seafood and higher environmental standards. In Europe, consumers are willing to pay 14% more for salmon produced with higher welfare standards.[51]

There is evidence to suggest that ESG-focused aquaculture companies are gaining success in winning over consumers, especially when accompanied by certification and ratings; for example, those awarded by Monterey Bay Aquarium's Seafood Watch. According to Spheric Research and Undercurrent News's Aquaculture Frontiers report, Regal Springs – which adopts high ESG standards at its tilapia farms in Central America and Indonesia – commands a healthy price premium versus Chinese tilapia, and has gained several lucrative contracts in North America, including with wholesaler Costco and meal-kit supplier HelloFresh.[52]

Salmon farmers who are able to ensure their farming cycles are consistently antibiotic-free can also command a significant price premium.[53] It is reported that antibiotic-free salmon can fetch premiums of as much as 30% over non-antibiotic-free salmon in international markets.[54]

Good fish health also affects the value of a company. There is a big variation in the stock exchange's value of a company, some of which is linked to stability in earnings and production costs. For example, according to a former Norwegian analyst, SalMar has low production costs and stability of biology compared to other salmon farmers – and, as a result, is valued highly on the stock exchange.[55] In 2021, Nordic Credit Rating gave an A- rating for SalMar, which '*reflects the company's strong profitability compared to its peer group*'. The company reported an annual survival rate of 95.3% in 2019 – significantly above the industry average of 83.8% recorded in the same year. Nordic Credit Rating also noted that SalMar's ESG performance supported the company's competitive position: '*the company recognises the industry's effect on the environment and understands the importance of fish welfare*'.[56]

2.1.2. Environmental risk

Aquaculture is coming up against environmental pressures linked to its commercial success, and this is a major source of risk. Aquaculture farms are an interconnected part of the ecosystem in which they exist; but they also create pollution impacts from uneaten feed and faeces, which are directly discharged into the environment. The use of antibiotics and fungicides may also pollute downstream ecosystems and affect surrounding life. The resulting pollution and change to ecosystems can directly impact on the future viability of the farm. It is estimated that, between 2013 and 2019, the cumulative local pollution costs for salmon farming across the four main producing countries was over $4 billion.[57]

Greece is the EU's largest producer of farmed sea bass and sea bream: 120,500 tonnes – worth €506 million – in 2019. Sea-bass and bream production is also concentrated along coastal areas of Italy. In both countries, the release of waste from the fish farms is leading to environmental deterioration of coastal areas, where farms are located.[58] Coastal-shrimp farms in Asia and Latin America often impact on sensitive and vulnerable ecosystems, such as mangrove forests, estuaries and coastal reefs. For example, experts estimate half of all the mangrove forests destroyed between 1980 and 2005 were a result of shrimp farming and the growing aquaculture sector.[59]

In 2016, a red algal bloom spread along the Patagonian coastline, killing over 20 million salmon, writing off 15% of the country's salmon production and resulting in an economic loss of $800 million. Chilean authorities investigated the country's salmon-farming industry for creating conditions that may have exacerbated the algal bloom, through dumping rotten salmon into the open ocean and covering the seafloor with salmon faeces and salmon food.[60]

Research generally finds that salmon farms are a contributing factor in the decline of wild Atlantic salmon stocks, as disease, pollution and escaped fish have negative impacts on fish in the wild. The estimated value destroyed by salmon farming through loss of wild stocks is $308 million.[B]

Atlantic salmon can only be farmed under certain conditions and, as available locations become exploited, there are fewer viable sites for new farms. This creates pressure to locate farms in less-suitable environments and increase stocking densities, which further exacerbates environmental pressures. Warming seas, as a result of climate change, are also highly relevant to investors in salmon. If salmon farms experience prolonged higher water temperatures as a result of climate change, this may increase the frequency and severity of algal blooms, disease and parasites, impacting on fish health and mortalities. For this reason, Planet Tracker estimates that growth forecasts to 2025 for coastal farmed salmon may be overestimated by 6–8%.[61]

In terms of climate change, aquaculture is often positioned as a low-carbon alternative to land-based farming. While farmgate emissions are indeed low relative to agriculture, these figures underestimate the true carbon cost; they do not account for the full carbon cost through the supply chain, which includes substantial CO2 emissions for aquafeed and airfreight.[62] Analysis by Just Economics reveals that the minimum social cost of carbon from salmon farming in the four producing countries was almost $8.3 billion between 2013 and 2019.[63] The Rainforest Foundation Norway has also reported that the Norwegian salmon industry is linked to illegal deforestation in Brazil, through its soy suppliers for feed.[64]

2.1.3. Social and reputational risk

The impact of intensive farming practices on fish welfare is an important social issue for investors to consider. Fish welfare is important because fish are sentient animals, capable of feeling pain and emotions, and therefore

B Economic analysis of the loss of salmon stocks attributable to salmon farms is focused on Canada, Norway and Scotland, where the contingent valuation studies have been carried out. See: Just Economics (2021) *Dead loss: The high cost of poor farming practices and mortalities on salmon farms* (p.32). [ONLINE] Available at: http://changingmarkets.org/wp-content/uploads/2021/02/Dead_Loss_FINAL.pdf

capable of suffering. International legislation also acknowledges fish as sentient beings. Intensive fish farming, with its high stocking densities, barren environments and stressful handling procedures, leads to high levels of stress and injury of fish and increase their risk of disease and premature death.

Poor fish welfare is a reputational risk for the industry. Consumers are increasingly questioning the welfare of the fish they eat and the impact industrial aquaculture and overfishing has on the environment and marine life. The Business Benchmark on Farm Animal Welfare 2019 shows companies reporting an increase in consumer interest in the welfare of animals farmed for food, which illustrates how essential it is that companies are seen to have high animal-welfare standards across all species.[65] More specifically to fish welfare, a 2018 survey of over 9,000 adults across 9 European markets showed 4 in 5 (79%) people believed the welfare of fish should be protected to the same extent as the welfare of other animals we eat.[66]

A salmon with a large exposed wound
Credit: Compassion in World Farming

2.2. Risks of reliance on wild-caught fish for feed

Aquaculture provides over half of global fish consumption ,and is expected to grow further to reach 60% of total global fish consumption by 2030.[C] Choices about the species cultivated are highly relevant to the sector's future viability; in recent decades, resource-intensive fed aquaculture has far outpaced non-fed aquaculture, making up nearly 70% of all aquaculture production in 2018[67] and driving demand for feed ingredients. Almost one-fifth of the world's total catch of wild marine fish is processed into FMFO,[68] of which the vast majority is used in aquafeed – 69% of the world's fishmeal and 75% of fish-oil production goes to feed farmed fish.[69]

The aquaculture sector's continued dependence on wild-caught fish for aquafeed represents a systemic threat for companies. The industry's future growth relies on the continued extraction of marine resources that should be either left in the ocean or prioritised for direct human consumption. FMFO and aquafeed companies are particularly vulnerable, but seafood processors and retailers are also exposed to the risks, through a disruption of supply arising from localised collapses in fish stocks, rising costs and reputational damage.

C FAO projections show that combined world-capture fisheries and aquaculture production will reach 200 MT (LWE) by 2030, up from just under 100 MT in 1990. Capture production will remain roughly stable (with a slight downward trend) up to 2030, with aquaculture production accounting for most of the growth. See: FAO (2018) *The state of world fisheries and aquaculture 2018*. [ONLINE] Available at: http://www.fao.org/3/i9540en/I9540EN.pdf

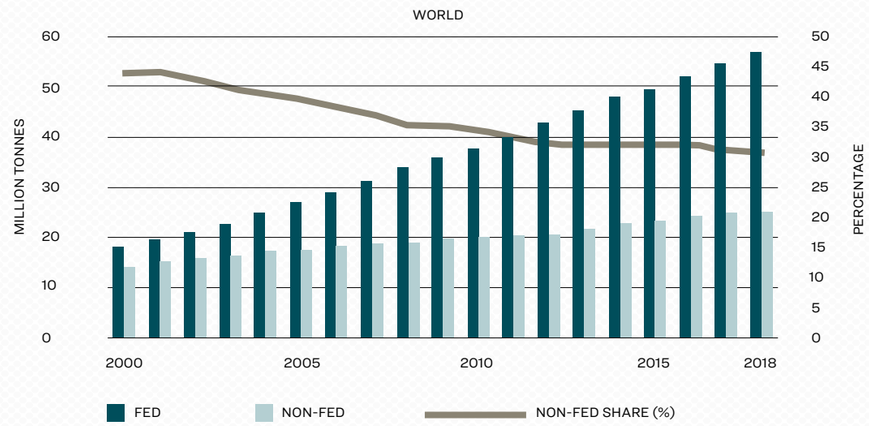


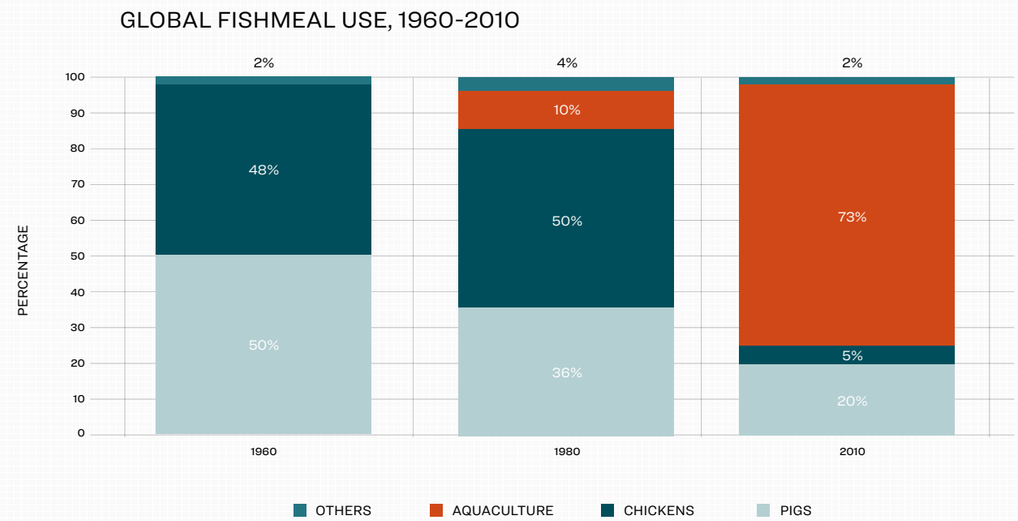
Figure 3: Fed and non-fed aquaculture production, 2000-2018
Source: FAO (2020) The state of world fisheries and aquaculture: Sustainability in action (p.28)

Figure 4: Global fishmeal use, 1960-2010
Source: Shepherd, J. 2012. "Aquaculture: Are the Criticisms Justified? Feeding Fish to Fish." World Agriculture 3 (2): 11–18.

2.2.1. Financial risk

Feed remains the biggest cost in aquaculture production – 50–70% of business expenditure – and higher prices will put more pressure on fish farmers' margins.[70] Aquaculture is the biggest driver of demand for FMFO. The strong demand for FMFO for aquaculture, and the finite supply of wild-capture fisheries to supply the ingredients for feed, has led to higher FMFO prices; for example, fishmeal prices quadrupled between 2000 and 2015.[71] Over the period 2010–30, the World Bank projects fishmeal and fish-oil prices will rise by 90% and 70% respectively due to limits on the supply of wild-caught fish.[72]

Increased costs are also of concern to fish-feed manufacturers, who acknowledge the risk that volatility (in terms of both price and availability) presents to their business. For example, Cargill states: '*Fishmeal has long been the most important ingredient in commercial feed formulations, but fluctuations in price and availability makes it important for Cargill Aqua Nutrition to adapt a flexible and more rational use of marine proteins*'.[73]



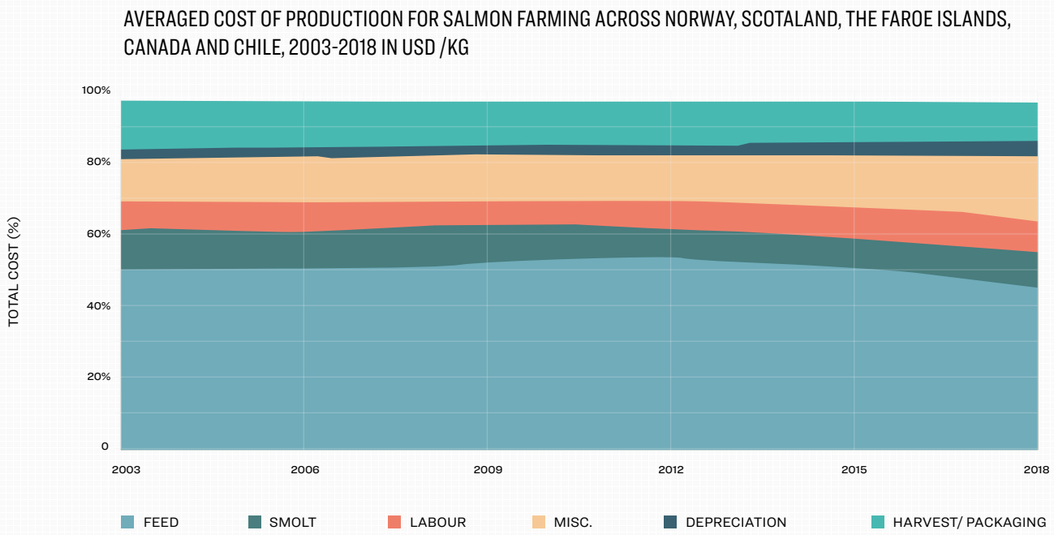


Figure 5: Averaged cost of production for salmon farming across Norway, Scotland, the Faroe Islands, Canada and Chile, 2003-2018 in USD/kg
Source: Planet Tracker (2020) Bonds for Ponds: Green bonds can assist aquafeed's transition.

Workers feed fish inside a fish farm, Greece
Credit: Selene Magnolia / We Animals Media

2.2.2. Environmental risk

If business as usual continues, rising demand for FMFO could outstrip supply by up to 16 million tonnes a year by 2025.[74] Unsustainable levels of fishing will further deplete pelagic fish stocks, the FMFO industry uses. Ultimately, dependence on FMFO limits further growth and profitability of the aquaculture industry in its current form. In June 2019, Farm Animal Investment Risk & Return (FAIRR) – an investor network representing companies with $38 trillion of assets under management[75] – examined a variety of ESG risks that could have a significant impact on aquaculture companies' future growth and financial performance. Noting that the industry is '*heavily dependent on wild stocks of certain fish for future growth*', FAIRR warned that '*demand is set to outstrip supply*', and that '*aquaculture is not a full solution to depleting fish stocks until this dependence is severely reduced*'.[76]

Alongside pressure on supply, the growing demand for FMFO creates incentives for low standards and poor fisheries practices, and encourages illegal, unreported and unregulated (IUU) fishing. This presents a potentially serious compliance issue affecting the whole aquaculture supply chain. Changing Markets investigations have revealed that FMFO production, driven by demand from the global aquaculture sector, is visibly accelerating the decline of fish stocks in The Gambia, India and Vietnam. In particular, findings showed that FMFO production in India and Vietnam is driving IUU fishing, resulting in the localised decline or collapse of target fish stocks.[77] In Peru – the world's largest FMFO producer – our investigation revealed corrupt practices such as underreporting fish catches, overfishing juvenile fish and diverting thousands of tonnes of anchovy destined for human consumption to FMFO production instead, plus several illegal FMFO factories with no installation or operating permits.[78]

Given the rapid growth of the aquaculture sector and the unstable supply and rising prices of FMFO, aquaculture and aquafeed companies that remain reliant on FMFO will eventually lose out to companies that invest in the development of, and make the switch to, sustainable alternatives.

2.2.3. Social and reputational risk

Consumers are concerned about the sustainability of the fish and seafood they eat. In 2020, 6 out of 10 seafood consumers made changes to the way they choose and buy seafood to protect fish in the oceans, and two-thirds of seafood consumers said buying fish from sustainable sources was vital, according to a survey conducted by GlobeScan for the Marine Stewardship Council, which involved more than 20,000 people across 23 key countries.[79] For this reason, the association of aquaculture production with the exploitation of marine resources for FMFO creates a reputational risk for consumer-facing companies – especially retailers, but also producers that increasingly try to promote their own brand (see Box 5).

Using wild-caught fish for aquafeed impacts on global food security. This is a vital social issue for investors, in light of efforts to meet SDG2 – to end hunger and improve nutrition. Aquaculture has been marketed as supplying '*sustainable protein*' with the ability to help meet goals of '*a world without hunger and malnutrition*'.[80] However, experts estimate that 90% of the fish diverted for FMFO could instead be used to feed humans.[81]

Not only is the FMFO industry diverting wild-caught fish from direct human consumption but this is also happening in countries and regions with a high incidence of food insecurity. A report by Greenpeace Africa and the Changing Markets Foundation reveals the extent of diversion of pelagic fish from the oceans around the coast of West Africa to feed farmed fish and animals, and the resulting food-security implications for the population in the region.[82] In Senegal, people rely on the same small pelagic fish for 70% of their essential animal protein intake; in The Gambia, it accounts for over half. In Mauritania – the country with the largest number of FMFO factories – 1 in 5 children are chronically malnourished[83] and over 600,000 people were forecast to be in crisis or worse, in terms of food security, during the lean season in 2020.[84] The FMFO and aquaculture industries are therefore contributing to depriving these populations of essential nutrients and intensifying malnutrition in the region.

Sainsbury's salmon. Mowi supplies salmon to Sainsbury's.

Mowi Loch Erisort fish farm, Isle of Lewis, Scotland

Credit: Christian David Cooksey / Shutterstock.com

BOX 4. Case study: Mowi ASA

Mowi is one of the world's largest seafood producers, by both volume and revenue, with a turnover of €3.8 billion in 2020.[85] The company is headquartered in Bergen, Norway; operates in 25 countries worldwide; and claims to fulfil one-fifth of the global demand for farmed salmon. The company has salmon farms in Chile, Canada, the Faroes, Ireland, Norway and Scotland. As a vertically integrated company, it is also a major producer of aquafeed, with feed-production sites in Norway and Scotland that, as of 2020, have the capacity to produce 600,000 tonnes of feed.

Mowi is listed on the Oslo Stock Exchange, and its shares also trade on the US OTC market. Mowi currently has a secured five-year €1,406 million multi-currency revolving credit facility with DNB, Nordea, Rabobank, ABN Amro, Danske Bank and SEB which has a final maturity in June 2022.

The top 10 shareholders in Mowi, as of 31 March 2021, are:[86]

1. Geveran Trading Company – 14.27%
2. Folketrygdfondet – 8.97%
3. BlackRock – 3.94%
4. Vanguard Group – 2.59%
5. UBS – 2.48%
6. CPP Investment Board – 2.43%
7. Svenska Handelsbanken – 2.29%
8. Storebrand Kapitalforvaltning – 1.79%
9. DNB – 1.57%
10. Kommunal Landspensjonskasse – 1.49%

Mowi presents itself as leader in sustainability

Mowi claims to be a leader in sustainability, viewing itself as '*leader of the Blue Revolution*'. Its CEO states the company is: '*very proud of producing food that is healthy for people and good for local communities and the planet*', and a '*front runner on environmental stewardship and innovation*'. The World Benchmarking Alliance ranks Mowi as the second-most-sustainable seafood company.[87] Mowi also ranks top of the Coller FAIRR Protein Index, in which it rates as a low risk for investors.[88] This year, Mowi launched its new branded salmon products in the UK market, with package labels claiming the company is '*pioneering responsible farming*'.[89]

Reality check 1: High fish mortalities

Over the last decade, Mowi had the highest amount of fish mortalities out of the top salmon producers. Since 2010, 50 million salmon (a quarter of a million tonnes) have died or escaped from Mowi farms – worth $1.7 billion. This is almost as many mortalities as the next nine largest producers put together.[90]

Recent incidents of mortalities and escapes include:

In 2018, 680,000 fish escaped from Mowi's Chilean Punta Redonda farm, resulting in Mowi being fined $7 million,[91] after the country's Superintendency of the Environment ruled the escape occurred because Mowi had not maintained appropriate security conditions or equipment of optimal quality.[92]

- In 2019, Mowi reported the deaths of around 700,000 salmon (2,600 tonnes) on its Scottish farms in just a three-month period. Diseases and sea-lice infestations were among the top reasons cited for the large number of deaths.[93]
- Also in 2019, 10 of Mowi's farming licences in Canada were suspended after 2.6 million salmon – approximately 5,000 tonnes, and 50% of all salmon on the farms – died at Mowi's farms in Newfoundland, significantly reducing harvest volumes and knocking €5 million off their Q3 results.[94]
- Between January and September 2020, Mowi reported over 1.1 million salmon mortalities to the Scottish government fish inspectorate. This is the second-highest figure of all large salmon-farming companies operating in Scotland.[95]
- In May 2020, 1.5 million juvenile fish died at Mowi's new recirculating aquaculture systems (RAS) hatchery in northern Norway.[96]

In its 2020 annual report, Mowi states that 12,200 tonnes of salmon died on its farms in '*incident-based*' mortalities, which represented 21.5% of total mortalities. Using this percentage, it can be calculated that total mortalities of salmon ('*incident*' and '*non-incident*' based) on Mowi farms equals 56,744 tonnes. When added to the 2020 production statistics (440,000 tonnes), it can be calculated that Mowi's mortality rate for the year was 11.42%.[97] Using the same calculation, the 2019 overall mortality rate on Mowi farms was 12.26%.[98]

Mowi was ranked the worst for animal welfare out of the four large salmon-farming companies present in Scotland in a 2018 report by OneKind. And the aforementioned information shows the company is not doing much to improve; poor welfare and high mortality seem to be a consistent theme on Mowi farms.

Reality check 2: Reliance on unsustainable FMFO

Mowi does not have any concrete targets for reducing its reliance on, or phasing out, the use of wild-caught fish in feed. The company's policy on sustainable feed does not mention exploring potential alternatives to FMFO;[99] nor does Mowi's *Salmon farming industry handbook* make any such mention in its chapter on research and development focus.[100]

In 2019, Mowi used 11% fish oil and 13% fishmeal in its salmon feed.[101] According to Mowi's *Annual report 2020*, the company sourced 78,333 tonnes of fishmeal and 62,436 tonnes of fish oil for use in its aquafeed.[102] In absolute terms, this is a significant increase from their 2019 report, in which they report sourcing 52,391 tonnes of fishmeal and 44,490 tonnes of fish oil.

Mowi confirms that feed is the company's biggest production cost when rearing salmon, and that raw materials account for 85% of the cost of producing feed. Prices for fish oil are volatile, but the average price of fish oil was about $1,827 per tonne in 2019.[103] Using these figures, the amount Mowi spent on fish oil in 2020 was approximately $114 million.

In the company's Q4 2020 trading update, Mowi announced losses in 3 out of 6 production regions, and operational earnings before interest and taxes were down 70% compared to Q4 2019. Aside from the impact of Covid-19, it is reported that the company '*continues to experience cost pressure in its farming operations from more challenging biology, stricter regulations and a general cost increase from input factors*'.[104] Mowi has embarked on measures to reduce its cost base, aiming to lay off 10% of its staff by 2024, but the company does not appear to be addressing the financial costs and risks associated with FMFO in feed.[105]

Mowi states the species used in FMFO production are '*from reduction fisheries and trimmings not used for human consumption*'.[106] In 2020, Mowi sourced 18,617 tonnes of fish oil from Peruvian waters, equivalent to nearly 30% of its total fish-oil requirements.[107] The Peruvian FMFO industry portrays itself as a model of sustainability, with more MarinTrust-certified fishmeal plants than anywhere else in the world. However, in reality, it is plagued by corruption and scandals – from the underreporting of fish catches and the overfishing of juvenile fish to the diversion of thousands of tonnes of anchovy, destined for human consumption, to produce fishmeal instead.[108] In addition to sustainability concerns, Peru is facing a food-security and malnutrition crisis, which is especially impacting small children. According to the UN World Food Programme, chronic child malnutrition continues to affect 13.1% of children under five, with significant differences according to area of residence. This affects areas near the coast, where most FMFO production is concentrated – such as the Ancash region, where 16.1% of children under five (above the national average) were reported to suffer from anaemia in 2017.[109]

Furthermore, the company's 2020 annual report states that 5,100 tonnes of fish oil were sourced from Mauritania; in 2019, this was 10,759 tonnes. The FAO considers sardinella – as well as other important pelagic species – to be overfished throughout the entire West African region.[110] In 2019, the FAO advised that a 50% reduction in fishing effort is required for all sardinella species, and has repeatedly called – along with local community organisations – for '*strong and urgent action*'.[111] People in West Africa rely on the same small pelagic fish for their essential protein intake. A 2021 report by Changing Markets and Greenpeace Africa highlighted how the extraction of fish from the West Africa region, for the FMFO industry and for aquafeed, is diverting essential nutrients for human consumption and contributing to the intensification of malnutrition in a region grappling with food insecurity. The report also highlighted the reputational risk to retailers linked in a supply chain to Mowi; for example, Aldi, Auchan, Edeka, E.Leclerc, Groupe Casino, Kaufland, Lidl, Rewe and Sainsbury's.[112]

Green-bond greenwash?

Mowi, Grieg Seafood and SalMar have all issued green bonds in the aquaculture sector, bringing the current total amount invested into the sector in green bonds to €689 million.113 All three bonds were oversubscribed – demand for Mowi's €200 million issuance was over €700 million[114] – which reveals the appetite for debt issued to scale sustainable practices in seafood. Additionally, Chilean salmon companies Agrosuper, Blumar and Ventisqueros have sustainability-linked loans totalling $520 million.[115] We are in a boom era of borrowing linked to sustainability criteria – 2020 saw 60% growth in green-bond issuances since 2015, the highest year since annual issuance of green debt instruments.[116] Yet, if a business backslides on its commitments, bondholders have little power and no legal recourse to hold them to account.[117] Although raising capital via green bonds offers companies long-term operational, reputational and financial benefits,[118] and green bonds can play an important role in financing assets needed to scale sustainability solutions, there is no common or robust green-bond standard within the EU. However, the European Commission is developing an EU Green Bond Standard to try to address this.[119]

In January 2020, Mowi was the first company to issue a green bond in the aquaculture sector, pledging €200 million to finance various 'green' projects. In its green-bond framework, Mowi listed the development of environmentally sustainable aquaculture as a key use of the proceeds, which encompasses both sustainable feed and fish welfare.[120] However, Mowi's framework relies heavily on certification schemes for both sustainable feed and fish welfare (ASC, MSC and MarinTrust) – rather than, for example, focusing on a measurable reduction in farmed-fish mortalities, or the elimination of wild-caught fish in feed.[121]

The reliance on certification schemes is problematic because many are not fit for purpose on the issues they claim to address. For example, when Compassion in World Farming evaluated the five main certification schemes for aquaculture, none of them had good fish-welfare standards. The ASC does not require farmers to enforce a maximum stocking density (apart from pangasius), does not set a limit on the time fish can be starved, does not require environment enrichment for farmed fish and does not require humane slaughter.[122]

MarinTrust – which aquafeed companies, retailers and other sustainability schemes rely on as a guarantor of the FMFO sector's sustainability – is fatally flawed, principally because reduction fisheries are inherently unsustainable, but also due to numerous conflicts of interests and weak standards that lack accountability. MarinTrust is closely linked to IFFO–The Marine Ingredients Association, the trade body that represents FMFO producers, promoting FMFO in new markets and for new uses while using its influence and lobbying power to defend the industry.[123] Additionally, while MarinTrust claims to offer a '*robust, credible and accessible tool that ensures traceability and eliminates IUU fishing*',[124] our Peru investigation revealed that MarinTrust has certified as sustainable Peruvian companies that have historically underreported fishing catches, participated in highly unsustainable fishing practices (including overfishing juveniles) and been involved in a national corruption scandal, in which government officials inflated the anchovy biomass – and therefore the fishing quotas – by several million tonnes to benefit the fishing and FMFO sectors.[125]

It appears as though Mowi has issued a green bond for nothing more than conducting business as usual.

Mackerel - meant for human consumption, but this catch, damaged by bottom trawlers, is sent to fishmeal plants

3. Investor responses

The Changing Markets Foundation wanted to better understand the policies and practices investors have in place to mitigate the vulnerability to risks that fish mortalities in aquaculture, and the use of wild-caught fish in aquafeed, pose to companies in global aquaculture supply chains. To do this, in September 2020, we (together with Coalition for Fair Fisheries Arrangements, Compassion in World Farming, Feedback, Future in our Hands and Western Sahara Resource Watch) sent a questionnaire to 23 of the biggest investors in aquaculture.

The questionnaire consisted of eight questions. These related to transparency about investors' investment portfolios; requirements for investees to disclose their supply chain, policies and practices on fish welfare – including metrics used to integrate risks and impacts, and reporting on fish mortalities; and criteria to reduce or phase out the use of wild-caught fish as feed in aquaculture, and to avoid the use of IUU fishing, in investees' supply chains. (See Annex for a copy of the questionnaire.)

Of the 23 investors contacted, 12 responded. To assess investors' policies and practices, points were allocated for each question answered. One point was awarded for questions that demonstrated the investor was aware of the issue and taking measures to address it, half a point was awarded for a partial response (for example, an investor acknowledged the issue but has not taken sufficient measures to address it) and zero points were awarded if there was no response or if a company was ignoring the issue. The maximum number of points that could be awarded was eight.

11 investors did not respond to the questionnaire and, as a result, were given zero points. The lack of response suggests these investors do not view the growing concerns and financial risks regarding fish welfare and the use of wild-caught fish in aquaculture as important, and are not working with investees to identify and mitigate these risks in aquaculture supply chains.

There are large discrepancies in how investors address the topics of transparency, fish welfare and the use of wild-caught fish as feed in aquaculture. Below is a summary of the key issues emerging from the responses.

WHERE DO INVESTORS STAND ON ADDRESSING FISH WELFARE AND PHASE-OUT WILD-CAUGHT FISH IN FEED?

- 1 — ACKNOWLEDGES THE ISSUE AND TAKES SOME MEASURES TO ADDRESS IT
- 0.5 — ACKNOWLEDGES THE ISSUE BUT DOES NOT TAKE SUFFICIENT MEASURES TO ADDRESS IT
- 0 — NO, OR IGNORES THE ISSUE

- FRONT RUNNERS
- COULD DO BETTER
- TRAILING BEHIND
- RED ZONE

	TOTAL SCORE (OUT OF 8)	HEAD QUARTERS	ASSETS UNDER MANAGEMENT (€ BILLION)	DID THE INVESTOR RESPOND?	TRANSPARENCY		FISH WELFARE				USE OF WILD-CAUGHT FISH IN FEED	
					Q1 Do you publicly disclose which companies in the aquaculture sector (including aquaculture and/or aquafeed companies) your organisation invests in?	Q2 Do you have any requirements for your investees to publicly disclose their full supply chain?	Q3 How do you integrate risks and impacts associated with fish welfare (including, but not limited to, the use of wild-caught fish in feed) into your investment decisions? (please identify any metrics used). Do you actively engage with your investees on these issues?	Q4 Do you require your aquaculture/aquafeed investees to report on fish mortalities in their supply chain? If so, please specify what information you require (e.g. cause of mortality, number of deaths, whether investees are also required to report on wild fish mortality)	Q5 Do you have any policies in place to ensure reduction of fish mortality rates in your investees' supply chains?	Q6 Do your policies cover any other aspects of fish welfare, such as: 6.1 Stocking densities 6.2 Humane slaughter 6.3 Steps taken to reduce antibiotic and chemical use 6.4 Other (please explain)	Q7 Do you have any criteria to require a reduction or a phase-out of the use of wild-caught fish as feed in your investees' products/practices? If so, please specify what these are and provide the links if the relevant documents are publicly available.	Q8 Do you have any criteria in place to ensure that no IUU (illegal, unreported and unregulated) fishing or other compliance failures occur in your investees' supply chain? If so, please identify the policy documents where this is reflected. Are these documents publicly available?
NO FRONT RUNNERS												
DNB (DNB AM & DNB LIV)	5		€62	✓	0.5	0.5	1	0.5	0.5	0.5	0.5	1
Rabobank	4.5		€610	✓	0.5	0	1	0.5	0.5	0.5	0.5	1
NN investment partners	4.5		€293	✓	1	0	1	0.5	0.5	0.5	0.5	0.5
Triodos Investment Management	4.5		€5.4	✓	1	0.5	0.5	0.5	0.5	1	0	0.5
NORGES BANK INVESTMENT MANAGEMENT	3		€927	✓	1	0.5	0.5	0	0	0	0	1
Nordea	2.5		€266	✓	1	0	1	0.5	0	0	0	0
storebrand	2.5		€88	✓	0	0.5	0.5	0.5	0	0	0	1
Handelsbanken	2.5		€83	✓	0	0	0.5	0.5	0.5	0	0	1
Allianz Global Investors	1.5		€598	✓	1	0	0.5	0	0	0	0	0
Folketrygdfondet	1.5		€29	✓	1	0	0.5	0	0	0	0	0
Fidelity INTERNATIONAL	1		€599	✓	0	0.5	0.5	0	0	0	0	0
DNB BANK	1		?	✓	0	0	0	0	0	0	0	1

WHERE DO INVESTORS STAND ON ADDRESSING FISH WELFARE AND PHASE-OUT WILD-CAUGHT FISH IN FEED?

- 1 — ACKNOWLEDGES THE ISSUE AND TAKES SOME MEASURES TO ADDRESS IT
- 0.5 — ACKNOWLEDGES THE ISSUE BUT DOES NOT TAKE SUFFICIENT MEASURES TO ADDRESS IT
- 0 — NO, OR IGNORES THE ISSUE

- FRONT RUNNERS
- COULD DO BETTER
- TRAILING BEHIND
- RED ZONE

	TOTAL SCORE (OUT OF 8)	HEAD QUARTERS	ASSETS UNDER MANAGEMENT (€ BILLION)	DID THE INVESTOR RESPOND?	TRANSPARENCY		FISH WELFARE				USE OF WILD-CAUGHT FISH IN FEED	
					Q1 Do you publicly disclose which companies in the aquaculture sector (including aquaculture and/or aquafeed companies) your organisation invests in?	Q2 Do you have any requirements for your investees to publicly disclose their full supply chain?	Q3 How do you integrate risks and impacts associated with fish welfare (including, but not limited to, the use of wild-caught fish in feed) into your investment decisions? (please identify any metrics used). Do you actively engage with your investees on these issues?	Q4 Do you require your aquaculture/aquafeed investees to report on fish mortalities in their supply chain? If so, please specify what information you require (e.g. cause of mortality, number of deaths, whether investees are also required to report on wild fish mortality)	Q5 Do you have any policies in place to ensure reduction of fish mortality rates in your investees' supply chains?	Q6 Do your policies cover any other aspects of fish welfare, such as: 6.1 Stocking densities 6.2 Humane slaughter 6.3 Steps taken to reduce antibiotic and chemical use 6.4 Other (please explain)	Q7 Do you have any criteria to require a reduction or a phase-out of the use of wild-caught fish as feed in your investees' products/practices? If so, please specify what these are and provide the links if the relevant documents are publicly available.	Q8 Do you have any criteria in place to ensure that no IUU (illegal, unreported and unregulated) fishing or other compliance failures occur in your investees' supply chain? If so, please identify the policy documents where this is reflected. Are these documents publicly available?
Alfred Berg 1863	0		€13	×								
apg	0		€583	×								
BlackRock	0		€7,500	×								
CPP INVESTMENT BOARD	0		€334	×								
Dimensional	0		€537	×								
Janus Henderson GROUP PLC	0		€342	×								
KLP	0		€60	×								
联想控股 LEGEND HOLDINGS 制造卓越企业	0		€13	×								
Nykredit	0		€44	×								
ODIN	0		€8	×								
Vanguard	0		€6,000	×								

3.1. Transparency

- Only **26%** (6 out of 23) of investors and financial institutions **publicly disclose which aquaculture companies they invest in.**
- **None** have requirements for their investees to **publicly disclose their full supply chain**.

Many investors provide a certain level of transparency about their investment portfolio but only very few – such as DNB Asset Management (AM), Norges Bank Investment Management (NBIM) and Triodos IM – disclose their investees at company level. None of the investors require investees to publicly disclose their full supply chain. However, DNB AM and NBIM have transparency policies in place that clearly stand out compared to other investors. NBIM's policy on ocean sustainability requires companies to be transparent about the source of their ocean-based resources – for example, the volumes, capture locations and species of wild-caught fish – which necessitates, in many cases, transparency about the supply chain.[126] DNB AM's policy document for sustainable oceans includes an expectation that companies address oceans and sustainability in their governance structure and strategy, and report on relevant metrics and targets, including exercising due diligence in their supply chain. In particular, the policy spells out the need for investee companies to assess the short- and long-term impact of activities on ocean health; to incorporate such impacts into their strategy and policies; and to be transparent about their ocean-related activities, impacts and dependencies, in line with relevant reporting frameworks.[127]

3.2. Fish welfare

- **None** of the investors or financial institutions **require** investees to **report on fish mortalities** in their supply chain.
- **None** have robust policies in place that ensure investees **are working to reduce farmed-fish mortality rates**, either directly or in their supply chain.

On fish welfare, there was a wide range of responses from investors. At one end of the spectrum, several investors rely solely on data from national authorities; while at the other end, there are investors with comprehensive fish-welfare policies.

None of the investors require investees in the aquaculture supply chain to report on farmed-fish mortalities, although many stated they '*encourage*' companies to do so. Triodos IM went furthest in answering this question – the company said reporting on fish mortalities forms part of its sustainability assessment, yearly update and risk assessment – however, no further information was provided about the specific details required from companies, nor how often the companies are asked to report on fish-mortality rates. Storebrand also said mortality reporting forms an important part of its engagement with companies, but no further information was provided.

No investors had robust policies in place to indicate they were working with investees to reduce mortality rates, either directly or through the supply chain. Several investors referred to national regulations, such as in Norway, that require regular reporting of mortalities on fish farms. Both Folketrygdfondet and Nordea rely heavily on Norwegian regulations on the operation of aquaculture-production sites, and DNB Bank similarly said it operates on aquaculture production within OECD countries (where it believes fish mortality and fish welfare are relatively well regulated by the authorities).

However, several investors, despite lacking specific policies in relation to fish welfare, have practices that include fish welfare and fish-mortality rates as the basis for investment decisions. Fidelity International said that, if a company is facing a serious environmental problem (such as high fish-mortality rates), they ask that company to review its processes and remediate the issue to ensure the risk is not an ongoing threat to the environment or to the long-term sustainability of the company, its suppliers or its customers. Meanwhile, NN Investment Partners (NNIP) uses value-chain analysts to take a closer look at risks and impacts associated with animal welfare. NNIP uses data and information gathered from its membership and participation in various initiatives, such as Sustainalytics (a well-known ESG data provider) and FAIRR (an initiative to drive change in the animal-agriculture sector). NNIP also said it has continuing open dialogue with the organisation World Animal Protection. Although the investor has no obligation for investees to report fish mortality, NNIP's *Stewardship policy* requires investees to address material issues – and, in this context, NNIP strongly encourages investees to report and provide context on fish-mortality rates, and to set preventative measures. Folketrygdfondet does not have specific policies on fish welfare, either, but the investor provided a case study detailing how it applies a financial approach to ESG investing; for example, challenging investees with questions on fish welfare, and requiring operational and strategic measures to address challenges related to sea lice.[128]

Nordea stands out for ddeveloping metrics and practices that integrate risks and impacts associated with fish welfare. Meetings with investee companies' management are held four to six times a year, and the metrics are used as a basis for investment decisions. The metrics include a company's ability to farm fish, from smolt to full size, within acceptable levels of mortality – although Nordea did not provide further detail on what is considered '*an acceptable level of mortality*'. Nordea is aware of risks related to mechanical treatment options against sea lice, and makes '*favourable investment decisions*' for companies that limit exposure to sea lice through post-smolt facilities. However, Nordea did not provide further detail for us to be able to evaluate how robust these measures are.

DNB AM expects – but does not require – mortality reporting from a full value-chain perspective, which notably includes mortalities of cleaner fish. Nordea also spelled out a specific stance against the use of cleaner fish to combat sea lice because of the 100% mortality rate of cleaner fish when used for that purpose.

Compared to other investors featured in this report, Rabobank has a strong animal-welfare policy, which requires all clients to be transparent and account for any animal-welfare incidents.[129] The company's animal-welfare policy requires all investees that work with animals to be aware of the potential to cause adverse welfare issues, and to take measures to minimise animals' negative experiences – such as discomfort, pain, injury, distress or fear – and ensure animals have the freedom to express normal behaviour. This includes a policy on slaughter, which requires that animals be handled and slaughtered in the least distressing, most pain-free manner possible. The policy also refers to the World Organisation for Animal Health guidelines, which clearly state humane methods of slaughter for fish.[130] However, although the policy is robust, no information was provided about its implementation, and it is not clear how Rabobank controls the application of requirements with investees.

Triodos IM requires companies to have a policy on animal welfare and animal-welfare standards for the animal products they buy or produce, addressing aspects such as housing, transport and slaughter methods, and requiring no use of preventative antibiotics. Furthermore, Triodos IM not only considers whether the company has a good animal-welfare policy but also places importance on how investees apply the animal-welfare standards in practice.

Both Rabobank and DNB AM rely on aquaculture producers to gain certification under a recognised scheme, such as the ASC, as a way to limit fish moralities and increase fish welfare. However, as we explain in Box 5, these certification schemes fail to address several key issues, and investors should stop relying on them.

3.3. Use of wild-caught fish as feed

- **No** investors or financial institutions have criteria in place that require a **reduction or phase-out of the use of wild-caught fish as feed** in investees' products or practices.
- **65%** (15 out of 23) of investors and financial institutions **fail** to put in place criteria to ensure **no IUU fishing or other compliance failures occur** in their portfolio of investments and lending to the aquaculture sector.

Sea bass are dropped into tanks filled with ice meant to kill the fish instantly with temperature shock Credit: Selene Magnolia / We Animals Media

While a handful of investors identified the risks of using wild-caught fish as feed in aquaculture, most are in denial about the growing evidence that the majority of aquafeed includes problematic marine ingredients, which are a material risk for aquaculture and aquafeed producers and other companies involved in the supply chain, such as retailers.

DNB AM strongly encourages the development of novel and more sustainable feed ingredients. It also requires its investee companies involved in wild-caught fisheries to incorporate estimates for developing the stock of relevant fish species in their strategies and planning, and to achieve sufficient traceability within the supply chain that illegally caught fish cannot be sold.

Rabobank also encourages aquaculture clients to reduce unsustainable ingredients – both marine and terrestrial – in feed, and states this includes finding alternatives for 'unsustainable' FMFO. However, Rabobank displays a concerning overreliance on certification schemes, such as MarinTrust and MSC, as a means of indicating whether its investees are sourcing 'sustainable' FMFO (see Box 5). Rabobank advises clients to trace the wild catch they source to specific vessels, to avoid sourcing endangered or threatened species and becoming implicated in adverse human rights and labour issues.

Responses from Allianz, DNB Bank, Fidelity International and NBIM all lacked sufficient concern about the use of wild fish as ingredients in feed. These investors appear to ignore the material risks posed by wild-caught fish for feed, and display an absence of understanding of the important connection between wild-caught fish and fed aquaculture.

The majority of investors fail to put in place criteria to ensure no IUU fishing, or other compliance failures, occur in their portfolio of investments or lending to the aquaculture sector. However, there were notable exceptions, including DNB AM, DNB Bank, NBIM, Rabobank and Storebrand. NBIM's policy on ocean sustainability requires companies buying or selling wild-caught fish to monitor that these activities do not involve stocks that are overfished, stocks exploited beyond the maximum sustainable yield and IUU fishing.[131] According to NBIM's response, ESG risks in the portfolio are monitored on an ongoing basis. Moreover, an Independent Council on Ethics assesses whether companies in the portfolio are responsible for, or contribute to, severe environmental damage, and may recommend exclusions from the portfolio.

BOX 5. Why certification is not enough

Requiring certification under a relevant scheme – for example, ASC, MSC or MarinTrust – as a way for investors and financial institutions to ensure investees' good practice on fish welfare, or to ensure the sustainability of ingredients in feed, is deeply misguided, and is not a sufficient proxy for investors' own policies and due diligence on these material issues. Investors' responses to our questionnaire indicated a concerning overreliance on certification schemes.

Reliance on certification does not necessarily help reduce fish mortalities and ensure good fish-welfare practices. Compassion in World Farming evaluated the main certification schemes for aquaculture – ASC, BAP, GlobalG.A.P and FOS – and found none of them had good fish-welfare standards. The ASC, for example, does not require farmers to enforce a maximum stocking density (apart from pangasius), does not set a limit on the time fish can be starved, does not require environment enrichment for farmed fish and does not require humane slaughter.[132]

When it comes to the use of wild-caught fish in feed, NGOs have repeatedly raised concerns about MarinTrust's (formerly IFFO RS) certification of sustainable feed ingredients. Other certification schemes – for example, ASC and Global G.A.P – rely on MarinTrust certification to ensure a 'sustainable' supply of fish for FMFO.[133] Investigations have uncovered FMFO and aquafeed plants with links to highly unsustainable fishing practices that are certified by MarinTrust, and Changing Markets investigations in Peru revealed MarinTrust was MarinTrust was also certifying companies engaged in illegal and corrupt practices. corrupt practices.[134] The effectiveness of certification schemes has been called into question; our analysis indi-

Trash fish unloading at Phuoc Tinh port, Vietnam

cates they are simply not enough to guard companies against the reputational risk of destructive fishing and farming practices in the aquaculture supply chain. Investors should instead develop their own robust policy, which seeks to manage the material ESG risks associated with wild-caught fish as aquafeed – and, ultimately, seeks to rapidly phase out the use of wild-caught fish as feed from investees' products and practices.

Spotlight on MarinTrust's Mauritanian Small Pelagic Fisheries Improvement Programme (FIP)

Sardinella and bonga-shad fish stocks of West Africa are both currently overexploited.[135] This means that, even at current levels of extraction, the fish stocks are not sustainable. Despite this, certification bodies and FMFO/aquafeed companies have increasingly turned their attention to West African pelagic fish, with a view to certifying the stocks as 'sustainable' for use in FMFO. The Mauritanian Small Pelagic FIP was initiated in August 2017; the fishery under assessment consists of artisanal and coastal purse seine and pelagic trawl vessels, targeting round sardinella, flat sardinella and bonga in Mauritania.[136]

The Mauritanian Small Pelagic FIP has chosen to pursue IFFO RS 2.0 certification (now known as MarinTrust), as opposed to MSC certification, on the basis that this standard is more '*flexible*'.[137] This raises considerable concerns about the robustness of the project – particularly considering aforementioned conflicts of interest that arise from close links between MarinTrust, IFFO (the FMFO industry body) and FMFO companies.

Many of the FIP's objectives relate to improving the data available for stock assessment, and improving information on the ecosystem and endangered species. However, local activists have reported that some of the landing data used in the FIP is based on unreliable reports by fishing vessels' logbook estimates, without proper verification by authorities.[138] Additionally, the Mauritanian Small Pelagic FIP does not cover any human rights or food-security issues – which, considering that these stocks provide a vital source of protein for coastal communities in West Africa, is a considerable oversight, with potentially hugely damaging consequences.

The existence of an FIP is enough for some companies to justify sourcing from Mauritania. For example, Mowi states in its 2019 annual report that '*96% of [its] marine raw materials were either MSC, IFFO RS certified or part of fisheries improvement projects aimed at achieving the IFFO RS certification*'. In 2019, Mowi sourced 10,759 tonnes of round and flat sardinella from Mauritania.[139]

According to the FisheriesProgress website, the current status of the Mauritanian Small Pelagic FIP is the same as when it began in August 2017, with 100% of the action plan currently incomplete.[140]

Trash fish unloading at Phuoc Tinh port, Vietnam

After crowding sea bass into smaller nets inside their cage, workers fish them with a crane. Credit: Selene Magnolia / We Animals Media

4. Conclusions

Investors have a financial interest in ensuring the companies in which they invest are managing material factors and risks. Our analysis shows that, overall, very few investors are taking the material issues of fish mortality and wild-caught fish in aquaculture into account in their engagement with investees in the aquaculture supply chain. Investors and financial institutions could be doing much more to require companies to rapidly address these two critical challenges. The risks can be mitigated by investment in better farming practices – ones that place fish welfare front and centre – and by eliminating the use of wild-caught fish for feed in aquaculture supply chains.

DNB Bank, Folketrygdfondet and Nordea rely heavily on national regulations that require aquaculture producers to report fish mortalities each month. Our research indicates that mortalities are currently reported for salmon farming in Norway and Scotland, but there are huge data gaps in other regions and for other species. It would seem sensible for investors and financial institutions to put in place a policy for all investees that reflects (or goes beyond) national legal requirements to report key fish-welfare indicators – including mortalities – at aquaculture-production sites. All investors should have robust policies and practices in place to ensure investees are working to measurably reduce mortality rates on farms, either directly or in their supply chains. Overall, investors and lenders need to give much higher priority to the issue of fish mortalities in aquaculture.

Rabobank's animal-welfare policy is strong, compared to the policies of other investors. We would encourage all investors to produce a similarly strong policy to increase fish welfare in aquaculture and clearly state humane methods of slaughter for fish. However, it is not clear how Rabobank implements its policy with investees. Once policies are developed, investors need to make sure the requirements are enforced in practice.

As this report demonstrates, relying solely on certification is not good enough. Certification does not ensure investees' good practice on fish welfare, nor guarantee the sustainability of ingredients in feed, and it is not a reliable proxy for investors' own good policies and practices to mitigate such risks. Investors and financial institutions should instead develop their own robust policies to manage the material ESG risks associated with poor fish welfare, high mortality rates and wild-caught fish in feed, and ensure their investees implement due diligence in their supply chains.

It is no longer acceptable for investors to display a lack of understanding about the connection between wild-caught fish and aquaculture, nor to ignore the material risk posed by wild-caught fish in feed. Although DNB

AM has a sustainable-oceans policy – which is commendable – and both DNB AM and Rabobank encourage the development of sustainable alternatives to FMFO, all investors should aim to rapidly phase out the use of wild-caught fish in feed from investees' products and practices. Investors' policies and practices should not only involve companies active in wild-caught fisheries but also companies further down the supply chain; for example, feed producers and fish farmers, and also retailers, which are susceptible to reputational damage from selling seafood products linked to unsustainable practices.

The EU Taxonomy Regulation, which determines what can be defined as sustainable activity for investment purposes in the EU, currently does not include aquaculture or other livestock farming. This exclusion reflects the fact that the sustainability of industrial animal production is contentious.[141] Unfortunately, delays in agreeing the taxonomy have forced the EU to abandon an attempt to use it as the basis for EU green bonds. Around €250 billion will be issued by the EU in the form of sustainable bonds over the next few years, as part of an €800 billion recovery and resilience fund.[142] Given the potential for green bonds to be used as greenwash by aquaculture companies with unsustainable practices, the European Commission should develop robust standards for green bonds, which should include high fish-welfare standards and the reduction of reliance on FMFO in feed.

BOX 6. Land-based recirculating aquaculture systems (RAS)

RAS are land-based, closed rearing systems which can be used for multiple fish species. They have been touted as a potential solution to sustainability problems in salmon production, especially to prevent escapes and interbreeding with wild salmon. The technology has generated excitement amongst both producers and investors, and has recently received considerable attention in the EU's strategic guidelines for a more sustainable and competitive EU aquaculture 2021–2030.[143] Lerøy Seafood recently announced plans to invest in a new RAS facility in Western Norway;[144] Lighthouse Finance is financing RAS projects for established and early-stage seafood companies throughout North America, Europe and Asia, including a 10,000 MT RAS salmon farm in Vietnam;[145] and SalmonBusiness reports that over half a million tonnes of salmon from land-based farms will be on the market within a decade.[146]

Land-based aquaculture represents attractive opportunities for private capital in aquaculture because the projects are capital-intensive. Atlantic Sapphire, the world's largest onshore aquaculture company, recently raised $121 million to finance its expansion – despite several incidents of fish loss, including 200,000 salmon dying prematurely in March 2021.[147]

Atlantic Sapphire Miami grow-out
Credit: Atlantic Sapphire / SalmonBusiness.com

However, high capital expenditure and teething problems with the technology means land-based salmon farms are unlikely to meet the market demand for salmon in the near future.[148] The technology offers poor return on investment, compared to sea-cage farming of salmon, because the high prevalence of early maturation in RAS means male salmon do not reach harvest weight, resulting in financial loss.[149] Furthermore, RAS is highly problematic from a fish-welfare perspective. High stocking densities are needed to offset the cost of technology and improve margins. Mowi reports stocking densities of 50kg per cubic metre for adult salmon at its land-based RAS facility in Canada, which is several times higher than independently recommended stocking densities of 10–15kg per cubic metre for salmon.[150]

While rearing fish in a closed system may prevent escapes, marine pollution and genetic contamination of wild salmon, and may reduce the need for antibiotics, if the system is compromised due to poor water quality or disease, mass mortalities will occur. RAS systems also have high water usage and high greenhouse-gas production compared to sea cages.[151] Neither do land-based aquaculture systems address the risks associated with the use of wild-caught fish for feed.

4.1. Recommendations

Investors in the aquaculture supply chain should develop their own robust policies and engagement practices, which require investee companies to:

1. **Publicly disclose full aquaculture supply chains and report on key indicators.**

2. **Reduce mortality rates on fish farms.** This should include the requirement for monthly reporting on mortality and escape rates from all aquaculture companies, and early engagement if these numbers seem to be increasing.

3. **Adopt good fish-welfare standards.** We recommend using Compassion in World Farming's species-specific toolkit to set fish-welfare standards and reporting indicators: https://www.compassioninfoodbusiness.com/resources/fish/

4. **Eliminate the use of wild-caught fish in feed for aquaculture by 2025.** This should include the requirement for companies to publicly report – or require public reporting – from their suppliers on the composition and origin of feed, and investment in sustainable alternatives.

Further to this, investors should consider divesting from companies with high mortality rates; that is, farms with monthly mortality rates above 10% for more than three months in a year. Investors also have an opportunity to steer the future of the industry by directing investments towards the most sustainable forms of aquaculture, and into research and development of sustainable feed alternatives that can be used at scale.

Dead fish removed from fish farm
Credit: Selene Magnolia / We Animals Media

Shoals of sardines
Credit: iStock

5. Annex: Copy of letter and questionnaire sent to investors in September 2020

Dear [NAME]

We represent a consortium of non-profit organisations working on environmental and social problems related to industrial aquaculture. We are writing with regard to the steps [INVESTOR] is taking to mitigate vulnerability to risks that fish mortalities in aquaculture and the use of wild-caught fish in feed (primarily in the form of fishmeal and fish oil - FMFO) pose to firms operating within global aquaculture supply chains.

We intend to publish an evaluation of the investment community's exposure to these risks in an upcoming report; to this end, we are inviting you and a number of other investors in the aquaculture sector to complete the questionnaire below, to ensure that we are able to present a fair assessment of your policies and practices on these critical issues.

Both of these issues - the high level of mortality in aquaculture and significant reliance on wild-caught fish - represent economic loss, an inadmissible waste of natural resources and a serious animal-welfare issue, with the unnecessary loss of fish life. For example, in 2019 the Scottish salmon industry reported 5.8 million fish deaths; equivalent to roughly 14% of production.[D] Recent research by Feedback estimated that the amount of wild-caught fish used to feed the farmed Scottish salmon that died before being harvested in 2019 was around 25,000 tonnes - enough to provide a weekly portion of oily fish to 2 million people.[E] For more information on environmental and social problems around the use of wild-caught fish for aquaculture see our investor briefing.[F]
We would appreciate it if you could return your completed questionnaire by [DATE]. We will be collating responses and publishing them in a report. Responses may be directed via [NAME + EMAIL].
If you have any questions or would like to organise a meeting or a call with our team, please do not hesitate to get in touch.

We look forward to hearing from you.

D Feedback (2020) *Off the Menu: The Scottish salmon industry's failure to deliver sustainable nutrition* [ONLINE] Available at: https://feedbackglobal.org/wp-content/uploads/2020/06/Feedback_Off-the-Menu_June-2020_LoRes.pdf

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F Changing Markets Foundation (2019) *Fishing for Catastrophe: The risks to aquaculture and retailers from the production of fishmeal and fish oil to feed farmed seafood* [ONLINE] Available at: http://changingmarkets.org/wp-content/uploads/2020/02/Fishing_for_Catastrophe_Investor_Briefing.pdfb

Questionnaire:

Transparency

1. Do you publicly disclose which companies in the aquaculture sector (including aquaculture and/or aquafeed companies) your organisation invests in? Please provide relevant links.

2. Do you have any requirements for your investees to publicly disclose their full supply chain?

Fish welfare[G]

3. How do you integrate risks and impacts associated with fish welfare (including, but not limited to, the use of wild-caught fish in feed) into your investment decisions? (please identify any metrics used). Do you actively engage with your investees on these issues?

4. Do you require your aquaculture/aquafeed investees to report on fish mortalities in their supply chain? If so, please specify what information you require (e.g., cause of mortality, number of deaths, whether investees are also required to report on wild fish mortality).

5. Do you have any policies in place to ensure reduction of fish mortality rates[H] in your investees' supply chains?

6. Do your policies cover any other aspects of fish welfare, such as:
   - 6.1. Stocking densities
   - 6.2. Humane slaughter
   - 6.3. Steps taken to reduce antibiotic and chemical use
   - 6.4. Other (please explain):

Please explain and provide links to relevant documents.

Use of wild-caught fish as feed in aquaculture

7. Do you have any criteria to require a reduction or a phase-out of the use of wild-caught fish as feed in your investees' products/practices? If so, please specify what these are and provide the links if the relevant documents are publicly available.

8. Do you have any criteria in place to ensure that no IUU (illegal, unreported and unregulated) fishing or other compliance failures occur in your investees' supply chain? If so, please identify the policy documents where this is reflected. Are these documents publicly available?

G This includes but is not limited to protection from threats like parasites (e.g. sea lice), disease, stress, and environmental factors (algal blooms, pollution, water temperature, oxygen) that are not ultimately lethal but negatively affect production quality, efficiency, and cost.

H On farms: rate of individuals lost during growout period from initial stocking to harvest due to mortality or escapes (including so-called 'cleaner' fish); in the wild: fish used as feed, whether whole or as fishmeal and fish oil (FMFO).

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Investing in troubled waters

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