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Traffic Light Risk Analysis

The aqua feed, salmon and shrimp value chains

eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

PROJECT

We have chosen to focus on environmental, social, and governance criteria in the traffic light analysis

- The traffic light analysis is a high-level analysis of risks related to sustainability in the aqua feed, farmed shrimp and salmon value chains
- For the salmon analysis, we have focused on the salmon farming countries (Norway, Chile, Canada, USA, The Faroes, Australia and the UK)
- The shrimp and feed analyses are primarily based on the largest players globally
- We assume the higher the severity and frequency/likelihood of a given criterion (risk), the more likely it is to negatively impact profitability
- As our main competence is in salmon, the shrimp analysis has a higher degree of uncertainty to it
- The sustainability criteria are divided into three main categories: environment, social & governance. See all criteria below.

This document has been peer reviewed for accuracy and quality of content by at least three independent experts from credible organisations including research universities, WWF and business.

Although the utmost care has been taken to identify and correct all typographical errors, some may still exist and if found write to info@projectxglobal.com. UK spelling is used in most cases.

Sources: criteria adapted from WWF's risk assessment tool

The traffic light methodology has three main steps: ranking of frequency/likelihood, severity and a final score

1

Ranking of frequency/likelihood

Rank the frequency/likelihood of a given risk from 1 to 4 using these criteria:
4 = Very Likely - Almost certain to occur within a 10-year period
3 = Likely - Probably will occur during a 10-year period
2 = Unlikely - Probably will NOT occur during a 10-year period
1 = Very Unlikely - Almost certain NOT to occur during a 10-year period

2

Ranking of severity

Rank the severity of a given risk from 1 to 4 using these criteria:
4 = Very High – Would cause severe harm to the environment, stakeholders or value chain
3 = High – Would cause significant problems for the environment, stakeholders or value chain
2 = Medium – Would cause relatively minor problems for the environment, stakeholders or value chain
1 = Low – Would probably not affect environment, stakeholders or value chain

3

Final score

Determine whether each risk category is high, medium, or low according to the following thresholds:
6-8 High Risk (red) – The industry should have a detailed mitigation action plan
4-5 Medium Risk (yellow) – the industry should have a clearly defined mitigation action
1-3 Low Risk (green) – No mitigation action required

Sources: WWF

Environmental impacts, specifically waste, GHG, water and energy usage, are significant in the whole feed chain

Aqua feed

Category	Criteria	Agricultural	Marine ingredients	Production	Marketing & distribution
Resource use	Water & energy	Use of energy and freshwater is significant in the whole feed value chain. The water used per kilo of feed sold is a key KPI for the feed producing companies, and is around 0.5 litres/kg. Both direct and indirect energy consumption is monitored, and energy per tonne feed is around 1 GJ/t. Feed production requires energy for grinding and mixing raw materials and extruding the feed mix, but the most energy intense production steps are the cooking and drying stages.			
Climate	GHG	GHG-emissions are released throughout the whole value chain. The amount of emissions released are highly dependent on energy source, and as with energy use, the main contributor to the value chain footprint is the production of feed ingredients.			
	Deforestation	To grow soybeans, vast expanses of land are needed, and some places production of feed ingredients are overtaking huge areas of land. It is important to challenge the use of land to produce feed ingredients for food production in the ocean. There are many environmental standards* for sustainable soy production, but no real agreement and a lack of widespread industry support.			
Circular-ity	Waste	Waste is generated throughout the value chain and recycling initiatives are being made to increase the value and usage of both direct production waste and waste from materials used in production and distribution, such as plastic.			
	By-products		Fishmeal and oil origin from small pelagic fisheries and by-products in fish processing for human consumption. At the same time, an estimated 20 million tonnes of bycatch is discarded globally every year, which could potentially be used in fish feed.		
Fisheries	Sourcing		In 2017, only 14% of fish caught for all uses were MSC-certified. On the other hand, 45% of fishmeal and oil produced globally was certified to IFFO. As fish oil and fishmeal is a scarce resource, feed producers have reduced their inclusion in feed, ranging from 23-30%.		

Length indicates focus area in the value chain

*Notes: *For example ProTerra, The Roundtable on Responsible Soy, ADM's responsible soy standard, Cargill's Triple-S, Cefetera's CRS 3.1*

Sources: FAO (2018), Greenpeace (2009), WWF (2012), MSC (2017), Cargill (2017), Skretting (2017), Biomar (2017), Marine Harvest (2017), Nutreco and Skretting Sustainability Report (2016)

Deforestation, unutilised by-products and waste represent the highest risks in the aqua feed value chain

Deforestation

Soy can replace fishmeal in feed. The frequency of unsustainable soy used in feed is decreasing with ProTerra certification. Marine Harvest claims that 100% of their soy is certified, Cargill Aqua Nutrition (74%), Biomar (78%) and Skretting (33%). Deforestation is severe as it threatens biodiversity, affects people, climate, water reserves and soil quality.

F/L: 3, S: 4

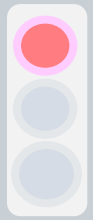
Fisheries sourcing

The big four feed producers* are reporting 80-90% of their marine ingredients to be MSC-certified. Still, the lack of available certified fisheries represents a challenge, especially if aquaculture production is to grow. Only ~14% of fish caught for all uses were MSC-certified in 2017. Unregulated fishing and bycatch represent negative externalities.

F/L: 3, S: 4

By-products

Feed producers are generally good at utilising by-products, but more could be done to incentivise fisheries to bring discards back to shore. The main challenge is that most fish farmers are not willing to pay the extra premium for such feed.



F/L: 3, S: 3

Aqua feed

Agricultural ingredients

Marine ingredients

Production

Marketing & distribution

Water and energy

Feed production is energy and water-intensive, but producers are turning towards more sustainable energy sources. Managing the amount of water used per tonne of feed reduces use of water and saves energy, and various water reduction projects have been implemented in the feed industry.

F/L: 2, S: 4

GHG

Raw material production typically represents 80-90% of the finished feed carbon footprint, whilst transport and processing cover the rest. For the feed producing companies, logistics is a focus area as it improves operations and efficiency with larger and fewer vessels and more optimised routes.

F/L: 2, S: 4

Waste

Recycling of waste, both biological and from production, is a focus area. With today's technology, the options are limited due to biosecurity concerns. The use of plastic in inbound and outbound packaging represents a large improvement area as issues concerning micro plastics have been set on the agenda.

F/L: 4, S: 3

*Notes: *Skretting, Biomar, Cargill Aqua Nutrition, Marine Harvest Feed*

Sources: FAO (2018), Greenpeace (2009), WWF (2012), MSC (2017), Cargill (2017), Skretting (2017), Biomar (2017), Marine Harvest (2017)

F/L = frequency / likelihood, S = severity of risk

Most environmental impacts and risks for farmed salmon are generated in the upstream value chain

Farmed salmon

Category	Criteria	Roe/ Brood-stock	Smolt	On-growing	Transportation	Harvesting & packaging	Export & Distribution	Processing	Retail/ HoReCa	End consumer
Resource use	Water & energy	Use of energy and freshwater is significant in the whole value chain, with the greatest use intensity occurring in farming and fish processing. Freshwater is a scarce resource, and salmon require less water than other protein sources. The replacement of flow-through systems with RAS* in smolt-production will decrease water use, but increase energy use.								
	FCR			Feed is expensive and represents about 45% of production costs. FCR measures productivity of protein production. Farmed salmon has an FCR of 1.3:1, and is the most efficient farmed animal (compared to chicken, cattle and pork).						
Climate	GHG	GHG-emissions are released throughout the whole value chain. Still, farmed salmon has a lower carbon footprint (2.9 kg) than pork (5.9 kg) and beef (30 kg), but not chicken (2.7 kg). The reason for this is that fishmeal and oil production have higher GHG-emissions due to the fuel used in fishing and energy used in processing. If fishmeal and oil are further reduced, the GHG-emission will be lower than chicken in proportion to the lower FCR. Air freight emissions remain unknown and unquantified.								
Local impact	Bio-diversity			Impact on biodiversity from nutrients, lice and chemicals used for treating lice, represent a big challenge. Too much lice can lead to loss of wild salmon returning to rivers, and antibiotics usage in Chilean salmon farming is a significant threat to marine organisms and human health.						
	Escapes			Escaped salmon impact wild stocks, e.g. competition and genetic introgression. Overall, there has been a positive trend in Norway, North America, Chile and UK with reduced escapes up until 2016. Recent escapees in the US of 150,000 and 21,000 in Scotland have halted this progress.						
Circularity	Waste	Waste, which otherwise could have been treated as a resource, also occurs in fish farming. Nutrients from feed and faeces causing benthic impacts, could be collected and used as nutrients for algae. Currently, a majority of salmon by-products are processed as silage, when it could have been made into higher-value products for human nutrition. It is not known how much plastic from packaging, on the downstream side, is wasted in this sector, but we believe it is notable.								
Welfare	Mortality/ stress			High mortality lowers the feed conversion ratio and causes loss of food and loss of potential income. In 2016, mortalities were 14-23% in Scotland, 19% in Norway, and 5-10% in the Faroes, mostly due to mechanical lice treatment, which stress the fish, and AGD disease.**						

*Notes: *RAS – Recirculating Aquaculture Systems, **AGD - Amoebic Gill Disease*

Length indicates focus area in the value chain

Sources: Fishfarming expert, IntraFish, Fisheries and Oceans Canada. WWF, Global salmon initiative (2017), Marine Harvest annual report (2016), PwC Seafood Barometer (2017)

The environmental impacts on biodiversity, and from salmon mortality and stress, are major red lights

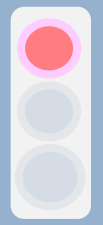
FCR

There is little likelihood of worsening FCR as farmers have an incentive to keep it low. However, recent high mortality rates have impacted FCR. The severity of increased FCRs is high as it will lead to less food for people and lower profitability.

F/L: 1, S: 4

Biodiversity

The likelihood and severity of impact on biodiversity is high, especially from salmon lice and their impact on wild salmon. Lice chemicals, although the usage has been reduced, can impact species like shrimp. Nutrient releases impact the sea bed.



F/L: 4, S: 4

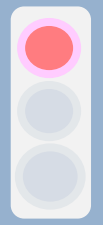
Escapes

The likelihood of escapes has decreased significantly, but new technology and delousing methods have recently led to more escapes. The severity is debated, but it is believed that farmed salmon compete and mate with wild salmon.

F/L: 2 , S: 3

Mortality / stress

Mortality is a significant problem stemming from rough handling, mechanical lice treatments and diseases. With the recent trend of changing from medicinal to mechanical treatments of lice, mortality has increased as it is stressful for the fish.



F/L: 4 , S: 4

Farmed salmon

Water & energy

Freshwater is a scarce resource and therefore the severity of its usage is high. Freshwater is used in treating for lice, in processing and in flow-through hatcheries. The trend of building recirculation hatcheries (RAS) decreases this dependency. Consequently, energy usage will increase.

F/L: 1, S: 4

GHG

As with freshwater usage, GHG-emissions are lower compared with other types of husbandry. The main concern is emissions from air-freight as salmon is a global commodity transported far away from its origin. At the same time, there is a trend of adopting renewable energy in production.

F/L: 2, S: 4

Waste

The likelihood and frequency of wasting valuable resources, like nutrients and by-products, in the salmon value chain is quite significant. However, the severity is not that high. There is a lack of incentives to collect sludge and increase utilisation of by-products, mostly because it is risky and costly.

F/L: 4, S: 2

Sources: PwC Seafood Barometer (2017)

F/L = frequency / likelihood, S = severity of risk

Impact on biodiversity, shrimp mortality, water and energy usage, and GHG emissions, are major red flags

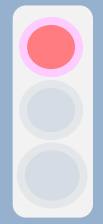
FCR

As with salmon farmers, shrimp farmers have an incentive to keep FCR low. Average FCRs in modern shrimp farming vary from 1.6 to 2.0, which is higher than farmed salmon but lower than pork and cattle. On older farms with suboptimal conditions the ratio may be much higher. High mortality rates due to diseases like EMS have impacted FCR.

F/L: 2, S: 4

Biodiversity

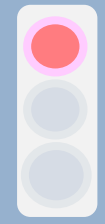
The likelihood and severity of impact on biodiversity is enormous. Organic waste, chemicals, salt and antibiotics from farms can pollute groundwater, coastal estuaries or agricultural land. Wild shrimp stocks can be depleted if they are captured for farming. Ecologically sensitive habitat can be cleared for farming, and mangroves destroyed.



F/L: 4, S: 4

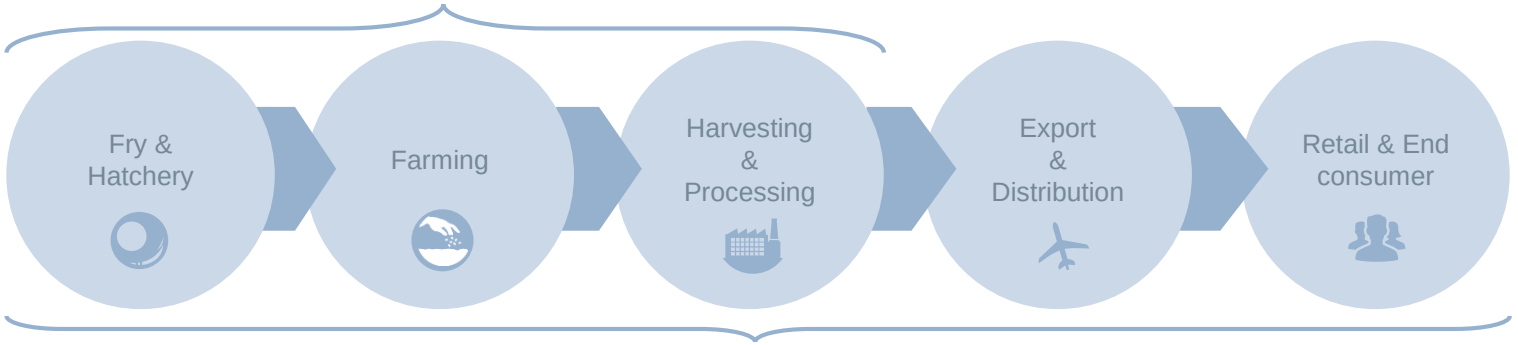
Mortality / stress

Mortality is a larger problem in shrimp than salmon farming. EMS has devastated shrimp stocks in Southeast Asia and Central America, and mortality is as high as 40-50%. It doesn't just lead to loss of profits, but also trade bans. Peru has banned shrimp imports from Asia, Mexico and the US until they are rid of the disease.



F/L: 4 , S: 4

Farmed shrimp



Water & energy

Marine shrimp farming is dependent on freshwater for hatcheries, and ponds can also pollute nearby freshwater. It is not known how much freshwater is used, but semi and super-intensive systems could be converted into RAS, thus saving a lot of water.

F/L: 3, S: 4

GHG

According to a 7-year study completed by CIFOR in Southeast Asia and Central America, shrimp farming has a massive carbon footprint. For every kg of shrimp produced in ponds cleared for production, 1603 kg of emissions are released into the atmosphere. Mangroves store a lot more carbon than terrestrial tropical forests.

F/L: 4, S: 4

Waste

Pond waste can have a positive impact on mangroves if managed correctly. Growth, survival and quality of pond water is impacted by pond waste. Vietnam produces about 200k tonnes of biowaste annually from shells and heads. While heads are used for chitin recovery, minerals, carotenoprotein and lipids are thrown away.

F/L: 4, S: 2

Sources: Groupe Techna 2017, WWF 2017, Skretting Sustainability Report 2017, IntraFish 2017, Aquaculture farming technology, Center for International Forestry Research (2017), BioAqua, Trang si trung and pham thi dan phuong 2012

F/L = frequency / likelihood, S = severity of risk

There is significant room for improvement related to social and governance issues for farmed shrimp

	Category	Criteria	Fish feed	Globally farmed shrimp	Globally farmed salmon
Social	Work place	HSE & diversity	Have received a very good score on transparency regarding women's role in management, but less for monitoring. HSE* is also very well implemented.	HSE-focus varies greatly. Thai Union has a vision of becoming the most trusted seafood company in the world, and they have goals on improving HSE.	Fish farmers aim to achieve zero workplace injuries and promote diversity in management. Still, highly criticised for lack of women in management.
Social	Social impact	Local community	Feed companies have implemented various programs, such as development programs for small scale producers in developing countries.	Many large shrimp farmers in developing countries place effort in various social programs to alleviate poverty. Still, stakeholder analysis is lacking.	Most farmers care about local communities, provide jobs, and donations to organisations. Still, existence of disputes with natives and lack of stakeholder analyses.
Social	Food quality	Healthy & safe	Seafood Intelligence is criticising the lack of disclosure related to cleaning fish oils from contaminants and communication regarding GMOs.	Due to lack of transparency there are serious concerns related to the safety of farmed shrimp, such as levels of antibiotics and contaminants.	There have been concerns, but numerous studies show that farmed salmon is healthy to eat. The main issue is antibiotics in Chilean salmon.
Social	Human rights	Slavery & trafficking	As the global feed companies are moving into new species, such as shrimp, they have been forced to include new KPIs on slavery and trafficking.	Thailand's slavery and trafficking scandal has forced producers to improve their sourcing and third-party audits of fisheries providing fish for fishmeal in feed.	Salmon producers Norway, Canada, Australia, The UK and USA generally score high in rankings on human rights and low corruption. Chile scores lower.
Governance	Supply chain manage-ment	Compliance	Seafood Intelligence has given Ewos, Skretting and Marine Harvest an excellent score for their evidence of a policy to ensure regulatory compliance	Large shrimp companies focus on compliance through certifications such as Naturland, GAP, ASC and BAP, but sourcing scandals still occur.	Integrated farmers have good control of their own supply chain, and big buyers like Walmart and Tesco push for certifications like BAP, GAP and ASC.
Governance	Supply chain manage-ment	Transpa-rency	Seafood Intelligence has given Ewos, Skretting and Marine Harvest an excellent score for their evidence of a traceability system and their transparency.	Global shrimp production is fragmented and not transparent. The recently launched Sustainable Shrimp Partnership initiative is tackling this issue.	ASC requires supply-chain transparency, among other things, and many of the leading salmon farmers** have certified sites. And more will follow.
Governance	Regu-lations	National Regulations	Feed companies have led the way in governance in the seafood sector, incentivizing suppliers and customers to become more sustainable.	The top producing regions, Asia and South America, have various performance in governance depending on which country they operate in.	Most salmon farming nations have enforced strict regulatory frameworks due to serious disease outbreaks and pressure from NGOs.

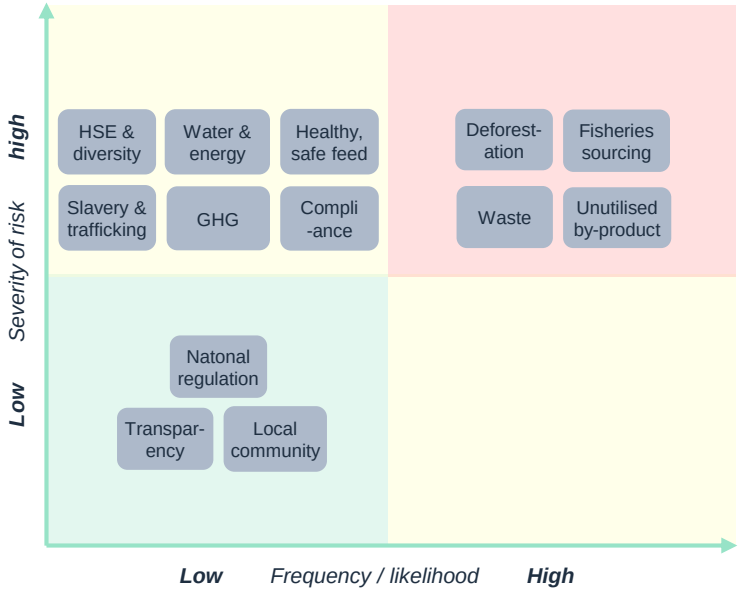
*Notes: *Health Safety and the Environment **Marine Harvest, Salmar, Cermaq, Tassal, Huon, Petuna, AquaChile, Bakkafrost, Nova Austral, Australis, Nova Sea, Lerøy, Multiexport, Exportadora Los Fiordos, etc.*
Sources: PwC Seafood Barometer (2017), Seafood Intelligence (2017), IntraFIsh 2018, The Fish Site (2018), Nifes 2017, Skretting Sustainability report (2016), US News ranking of best countries, ASC

There is significant room for improvement related to social and governance issues for farmed shrimp

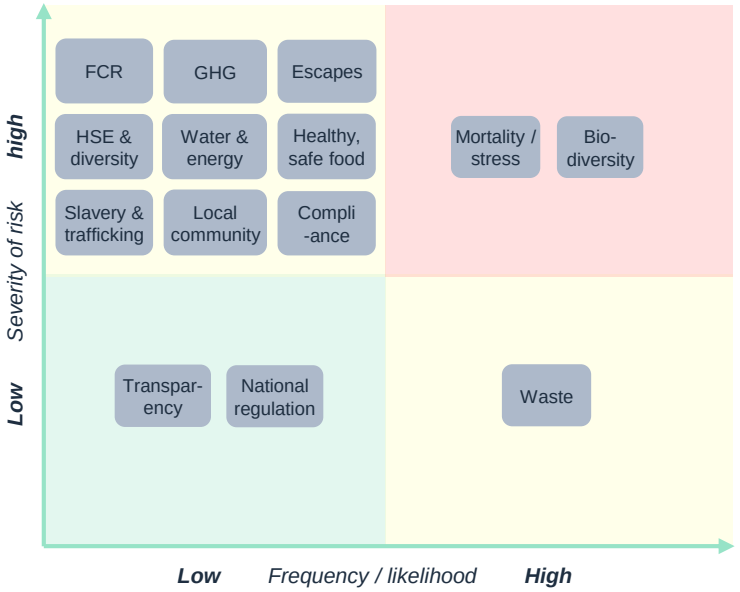
	Category	Criteria	Fish feed	Globally farmed shrimp	Globally farmed salmon
Social	Work place	HSE & diversity	Frequency / Likelihood: 1 Severity of risk: 4	Frequency / Likelihood: 3 Severity of risk: 4	Frequency / Likelihood: 2 Severity of risk: 4
Social	Social impact	Local community	Frequency / Likelihood: 1 Severity of risk: 3	Frequency / Likelihood: 2 Severity of risk: 3	Frequency / Likelihood: 2 Severity of risk: 3
Social	Food quality	Healthy & safe	Frequency / Likelihood: 1 Severity of risk: 4	Frequency / Likelihood: 4 Severity of risk: 4	Frequency / Likelihood: 2 Severity of risk: 4
Social	Human rights	Slavery & trafficking	Frequency / Likelihood: 1 Severity of risk: 4	Frequency / Likelihood: 3 Severity of risk: 4	Frequency / Likelihood: 1 Severity of risk: 4
Governance	Supply chain manage-ment	Compliance	Frequency / Likelihood: 2 Severity of risk: 3	Frequency / Likelihood: 3 Severity of risk: 3	Frequency / Likelihood: 1 Severity of risk: 3
Governance	Supply chain manage-ment	Transpa -rency	Frequency / Likelihood: 2 Severity of risk: 2	Frequency / Likelihood: 4 Severity of risk: 2	Frequency / Likelihood: 2 Severity of risk: 2
Governance	Regu-lations	National Regulations	Frequency / Likelihood: 2 Severity of risk: 2	Frequency / Likelihood: 3 Severity of risk: 2	Frequency / Likelihood: 2 Severity of risk: 2

Sources: PwC Seafood Barometer (2017), Seafood Intelligence (2017), IntraFIsh 2018, The Fish Site (2018), Nifes 2017, Skretting Sustainability report (2016), US News ranking of best countries, ASC

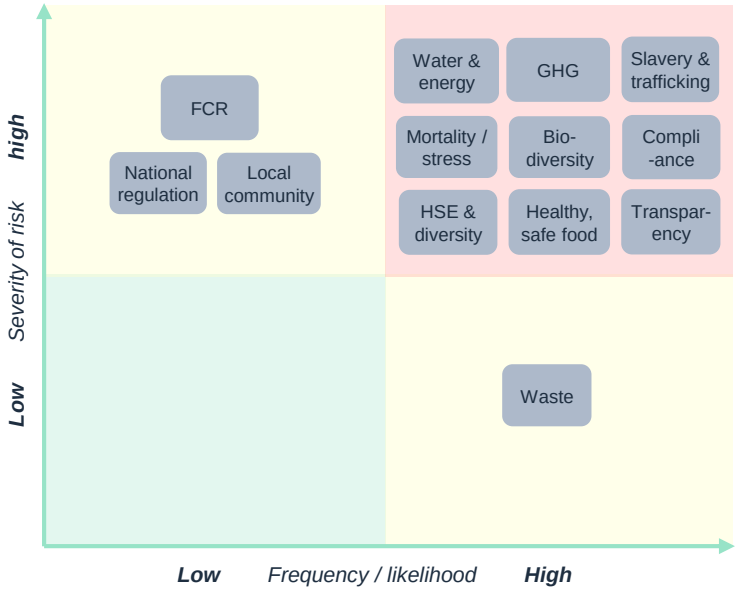
There are many risks to mitigate and overcome, especially in the farmed shrimp industry



The aqua feed industry should continue mitigating risks from deforestation, fishmeal and oil sourcing, better re-use of waste generated, and increase usage of discards from fisheries in feed.



The global salmon farming sector's most significant risks are fish mortality and stress, and negative impact on biodiversity.



The global shrimp sector has many severe risks which should be monitored by the players in the downstream value chain.

Sources: PwC Analysis, Photos: Skretting