Aquaculture –
A case study of
hypothetical report preparer
Salmon Fresco
November 2022
Introduction and scope

This case study focuses on how a hypothetical report preparer in Chile, Salmon Fresco, applies the TNFD beta framework in the aquaculture sector. The case study demonstrates the process, data and enabling data tools used to implement the TNFD’s approach for nature-related risk and opportunity assessment (LEAP) (Box 1). It also demonstrates how implementing this approach can assist with government and market-driven certification requirements.

While aquaculture feed production is an important aspect of the aquaculture value chain – approximately 70% of all aquaculture is reliant on supplementary feeds – this case study limits the scope of its analysis to direct operations. It would have been difficult to include an assessment of the feed supply chain succinctly without significantly expanding the scope and complexity of the case study.

Data quality and availability

The available data specific to aquaculture in Chile is improving, with some types of data available at the site level and many datasets now differentiated by species and production region. Each region of Chile has complex environmental and industry variables. While data collection and availability, particularly from government sources, has improved non-domestic access, data availability remains difficult and continues to lag behind other major salmon-producing countries, particularly for site-specific information. This issue is not particular to Chile, but is more prevalent in the Global South, and needs to be addressed to enable greater data access more generally.

At the site level, many areas have active ongoing data collection and analysis of the data collected, but impacts on nature across the three southernmost regions of Chile are challenging to measure robustly. Data from sources such as the seafood industry media and the Global Salmon Initiative (GSI) are useful but need augmenting with other sources.

When assessing the carrying capacity of Chile’s fjords and channels where most salmon farming is located, and the corresponding impact on ecosystems of nutrient discharge from salmon sites cumulatively, some important data gaps exist. However, there is good research available on site-level impacts and sediment monitoring data is now readily available.

Case study company – Salmon Fresco

Salmon Fresco is a Chilean-based Atlantic salmon farm with nurseries and grow-out facilities exclusively located in Chile. All of Salmon Fresco’s grow-out sites are certified against the Aquaculture Stewardship Council (ASC) salmon standard, with the exception of three newly acquired sites. Certification under the ASC scheme is required by its Brazilian, Argentinian and American markets, which represent over 80% of company revenue.
Box 2: Context – salmon farming

The farmed salmon industry has grown significantly over the past 40 years and today approximately 60% of salmon produced worldwide is farmed. Chile is currently the world’s second largest farmed salmon producer. Farmed salmon is Chile’s second largest export product after copper. The industry is predominantly located in southern Chile.

Sea cages are the dominant production system for the grow-out stage of salmon farming and represent an effective production system, with lower investment and running costs than land-based systems. The development and improvement of the sea cage farming system has been one of the most important factors for the growth of the salmon farming industry.

However, in recent years, the placement of sea cages in the open marine environment has had impacts on local ecosystems and increased operating costs. Furthermore, certain natural conditions must be present to ensure optimal salmon farming production, including cold water temperatures, a sheltered coastline and optimal biological conditions. Salmon farming companies therefore need to be able to assess accurately and manage effectively their nature-related dependencies, impacts, risks and opportunities.

TNFD LEAP Locate Phase: Locate your interface with nature

L1: Business Footprint
Where are Salmon Fresco’s direct assets and operations and the related value chain (upstream and downstream) activities?

- Salmon Fresco produces farmed salmon at a combination of directly owned, leased and third-party operated sites.
- The spatial coordinates of Salmon Fresco’s farm site locations are documented during the land leasing process and initial site scoping process. Farm siting is an integral part of the company’s strategic process because the location, and associated coastal basin water quality, temperature and flushing rates, impacts fish health and growth, and the appropriate fish species. Given the importance of certification to the marketability of Salmon Fresco’s end products, the farm siting process also considers the appropriateness of each site for certification, with a focus on avoiding proximity to high value conservation areas and migration routes.
- Salmon Fresco already has data on the spatial locations of all the processing and nursery sites it owns through asset registry data, compliance reporting, environmental permits and land leasing agreements (Box 3). The locations of third party-owned and operated nurseries or by-product processing sites are not known, but as a result of applying the TNFD framework, Salmon Fresco asked its supply chain partners for this information, in order to have a complete view of all the sites in which production and by-product processing is taking place.

Enabling data tools:
- Geographic Information System (GIS) with organisation asset locations and access to relevant geo-spatial data, such as UNEP-WCMC’s Ocean+ Data Viewer, for site suitability mapping.
Box 3: Business footprint: using data collected for government or certification schemes

In Chile’s aquaculture industry, both government certification schemes and voluntary certification schemes require regular confirmation of locations of business operations. For certification schemes where compliance specifically focuses on traceability, location information must be readily available and accessible to users upstream in the value chain.

L2: Nature Interface

(a) Which biomes and ecosystems do Salmon Fresco’s activities interface with?
(b) What is the current integrity and importance of the ecosystems at each location?

Identify biomes of relevance for all locations

- Through mapping its location coordinates against available maps of biomes and ecosystems (for example, IUCN Red List of Ecosystems, ArcGIS view of WWF biomes), Salmon Fresco identifies the following relevant realms and biomes by asset type (Figure 1):
  - **Ocean realm**: Grow-out farms interface with the ocean as farms are physically located in marine ecosystems.
    - Marine shelf biome (M1) and Shoreline system biome (MT1): The majority of the farms are located in protected coastal regions meaning that the seashore and marine shelf are the main biomes that the business interfaces with.
  - **Freshwater realm**: Nurseries use freshwater.
    - Rivers and streams (F1): Water for the nurseries is sourced from and returned to local rivers, which are not known to be suffering from water stress or any significant water quality issues.
  - **Land realm**: Nurseries are land-based.
    - Temperate boreal forests and woodlands biome (T2): The nurseries are located in an area known to belong to the temperate boreal forests and woodlands biome.

Identify the current integrity and importance of ecosystems at each location

- Salmon Fresco uses available mapping tools (for example, ArcGIS, Plataforma de Observación del Sistema Océano Atmosfera (POSAR), HUB Ocean and UNEP-WCMC’s Ocean+) to determine if any of its operations overlap with areas of high biodiversity value, oceanic upwellings (high nutrient concentrations and therefore of high importance to marine ecosystems), important fisheries, mammal migration routes, deforestation or cultural heritage sites.

Figure 1: Biomes identified of relevance to Salmon Fresco, using TNFD’s fundamental concepts for understanding nature

<table>
<thead>
<tr>
<th>Realms</th>
<th>Biomes</th>
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</thead>
<tbody>
<tr>
<td>Land</td>
<td>Temperate boreal forests &amp; woodlands (T2)</td>
</tr>
<tr>
<td></td>
<td>Rivers and streams (F1)</td>
</tr>
<tr>
<td></td>
<td>Lakes (F2)</td>
</tr>
<tr>
<td></td>
<td>Artificial wetlands (F3)</td>
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<tr>
<td></td>
<td>Artificial Subterranean freshwaters (SF1)</td>
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<tr>
<td></td>
<td>Coastal rocks and lagoons (RM1)</td>
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<tr>
<td></td>
<td>Vegetated wetlands (TF1)</td>
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<td></td>
<td>Subterranean cave and rock systems (S1)</td>
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<td></td>
<td>Montane vegetation (MT2)</td>
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<td></td>
<td>Artificial shrublands (MT3)</td>
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<tr>
<td></td>
<td>Subterranean cave and rock systems (S1)</td>
</tr>
<tr>
<td></td>
<td>Coastal inlets and lagoons (FM1)</td>
</tr>
<tr>
<td></td>
<td>Subterranean tidal systems (MT1)</td>
</tr>
<tr>
<td></td>
<td>Montane vegetation (MT2)</td>
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<td></td>
<td>Artificial shrublands (MT3)</td>
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<td>Subterranean cave and rock systems (S1)</td>
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</table>
• Salmon Fresco found that in addition to the high conservation value of southern Chile as a whole, the sub-Antarctic Magellanic ecoregion is unique and presents remarkably high levels of endemic species, with 50% of the fish species being endemic to the biome. Endemic species tend to have specific adaptations to their environments and are important in maintaining biodiversity. If endemic species decline or disappear, the whole ecosystem would be adversely affected.
• Salmon Fresco's certified aquaculture sites are required to assess their current state for key indicators of ecosystem health against an identified and third-party audit or approved reference site. The third-party site must have comparable biological and chemical characteristics to the aquaculture site and be removed from the impact drivers of aquaculture activities.
• Salmon Fresco has identified reference sites with similar water quality profiles, flushing, benthic chemistry and biodiversity to its grow-out sites. These reference sites have been used in the certification process to prove the integrity of grow-out sites.
• Salmon Fresco's assessment determined that the siting of the aquaculture cage arrays does not result in the functional conversion of affected habitats, and the realisation of any or all of these potential impact drivers does not significantly impact the functioning of ecosystems or the provision of ecosystem services. Furthermore, the removal of farm infrastructure would quickly restore all baseline biophysical processes. Overall, the habitats in which Salmon Fresco's salmon farms are located are considered to be maintaining ecosystem functioning with minor or moderate impacts (no sustained changes in ecosystem condition – one of TNFD's acceptable ecosystem condition. Salmon Fresco has considered adding additional arrays does not result in the functional conversion of affected habitats, and the realisation of any or all of these potential impact drivers does not significantly impact the functioning of ecosystems or the provision of ecosystem services. Furthermore, the removal of farm infrastructure would quickly restore all baseline biophysical processes. Overall, the habitats in which Salmon Fresco's salmon farms are located are considered to be maintaining ecosystem functioning with minor or moderate impacts (no sustained changes in ecosystem condition – one of TNFD's acceptable ecosystem condition. Salmon Fresco has considered adding additional internal thresholds for monitoring purposes, but this has not yet been established.
• For the three newly acquired sites that are not yet certified, Salmon Fresco has yet to identify individual reference sites and is instead using existing reference sites with characteristics as similar as possible to the newly acquired sites.
• Ecosystem condition assessment trends, such as sediment chemistry below the grow-out sites and within the impact zone, water quality, as well as trends in relevant species indicators, such as change in the area of habitat (ha) for priority species as a proxy of changes to those species' population size, are considered over time. The certification scheme specifies the limitations for what is considered an acceptable ecosystem condition. Salmon Fresco has considered adding additional internal thresholds for monitoring purposes, but this has not yet been established.
• Given the higher degree of risk associated with the newly acquired sites, the company has decided to treat them as though they are at risk of being low integrity and include them as 'priority locations' in the analysis going forward.
• Salmon Fresco has identified that one of their certified sites has experienced worrying increases in water temperature over the last five years, indicating a change in the site’s steady condition assessment. The increase in water temperature at the site is aligned with water temperature increases at the reference site, but suggests that the basin as a whole is experiencing warming. This is likely due to climate change, which may make this basin unusable for Atlantic salmon culture. The warming is beyond what would be considered typical annual or inter-annual variation.

Box 4: Data needs to identify biome and ecosystem integrity and biodiversity importance for the aquaculture sector

- Spatial maps of areas of high biodiversity importance, habitat for high conservation value species, protected marine areas, protected terrestrial areas, deforestation and water temperature change over time.
- Historical and current information for common coastal indicators, such as water temperature. Many of these variables change regularly throughout the day, throughout the week and throughout the year and can be affected by longer term forces, such as climate change, habitat degradation and chronic pollution. Long term historic data for 10 years or more is therefore preferred.

Many of these types of data, including water temperature, biological oxygen demand, total ammonia nitrogen, total phosphorus and flow rates, are relevant beyond aquaculture production and can be used for other corporate, government, or NGO data collection and analysis.

Salmon Fresco is actively engaging with regional entities that have data coverage and/or data needs that overlap with its own data coverage and requirements to encourage collaborative sharing of information and insights. In this case, near the newly acquired sites, the government has been collecting detailed data regarding biological oxygen demand and temperature for the last 10 years. A local fishery has been supported by an academic institution to collect other key data, including species abundance information, for the last five years and other aquaculture companies in the area have been actively sampling benthic chemistry data points for the last 18 years.

Salmon Fresco regularly engages with the other aquaculture companies in the area to share key water quality, aquatic and coastal biodiversity observations and disease management information. This sharing of information is considered universally beneficial and provides Salmon Fresco with a greater understanding of the condition of ecosystems beyond its sites and their immediate surroundings.
Box 5: Nature interface: Using data collected for the government or certification schemes

Salmon Fresco's certification with the Aquaculture Stewardship Council requires that farms are not located in – or adjacent to – sites in High Conservation Value Areas (HCVA). Under the certification requirements, HCVA are defined through a multi-stakeholder process considering both social and environmental criteria, as described by the HCV Network. Disallowed areas include sites within or bordering marine protected areas, national parks, established migratory routes for marine mammals, the habitat of threatened or endangered species, the habitat needed for endangered and threatened species to recover and eelgrass beds. Salmon Fresco's certified sites have been assessed by a qualified third-party auditor and are regularly monitored through an internal audit system for ongoing compliance.

L3: Priority Location Identification

At which locations is Salmon Fresco's business interfacing with ecosystems assessed as being low integrity, high biodiversity importance and/or areas of water stress?

• Salmon Fresco compares the data on location in specific ecosystems and ecosystem integrity and biodiversity importance in those locations collected in LEAP components L1 and L2 to identify four priority locations.
• Data shows that one of its certified sites has experienced increased water temperatures beyond what would be considered typical annual variation.
• Salmon Fresco concludes that it has insufficient data on three of its newly acquired, non-certified sites, so it is unable to determine with confidence whether these are priority locations or not. Applying the precautionary principle, it decides to consider them priority locations.
• Each of the priority locations are grow-out salmon sites, all growing the Atlantic salmon species, *Salmo salar*. Sites all follow similar, centrally approved protocols for site activities and data collection. The central offices store and analyse all site-level data to identify issues and emerging patterns.

L4: Identification of Priority Nature-risk Locations by Sector, Business Unit or Value Chain

• Given that all owned and operated assets for Salmon Fresco were assessed in the Locate phase, the following steps are considered as an enterprise level evaluation and resulting mitigation measures and KPIs will cover all operations.

TNFD LEAP Evaluate Phase: Evaluate dependencies and impacts

E1: Identify Relevant Environmental Assets and Ecosystem Services

What are Salmon Fresco's business processes and activities at each priority location? What environmental assets and ecosystem services does Salmon Fresco have a dependency or impact on at each priority location?

Box 6: The TNFD's definitions of environmental assets, ecosystem assets and ecosystem services

**Environmental assets:** The naturally occurring living and non-living components of the Earth, together constituting the biophysical environment, which may provide benefits to humanity.

**Ecosystem assets:** A form of environmental assets that relate to diverse ecosystems. These are contiguous spaces of a specific ecosystem type, characterised by a distinct set of biotic and abiotic components and their interactions.

**Ecosystem services:** The contributions of ecosystems to the benefits that are used in economic and other human activity.

• To identify the relevant dependencies and impacts on nature at each of the four priority locations, Salmon Fresco creates a list of known and potential dependencies and impacts. This includes all topics outlined in the certification standard, key compliance topics, issues identified through its internal risk management system (including the nature-relevant results from its TCFD reports) and issues raised in its ongoing engagement processes with Indigenous Peoples and Local Communities (IPLCs), rights-holders, stakeholders, academia and government. Altogether, this creates a list of 35 nature-related dependencies and impacts.
Salmon Fresco identifies dependencies and impacts through a qualitative process informed through interviews with relevant internal and external stakeholders and rights-holders, including site managers, community representatives, local government officials and academics. Water quality was identified as both a dependency and an impact for Salmon Fresco grow-out sites. The company identified biological oxygen demand (BOD) as the metric representing water quality impact and water temperature as the metric representing dependency on water purification services.

- **Dependency:** Fish health is highly dependent on water temperature. Most fish species, and aquatic life in general, have a survivable temperature range and a narrower temperature range in which they thrive. Temperature also plays a role in determining other water quality measures like BOD, because as temperature increases, dissolved oxygen levels become progressively more limited. Fluctuations in temperature, gradual or acute, have a severe impact on aquaculture and the surrounding ecosystem. Given the impacts of climate change, the increasing water temperature trend observed at certain sites, and the impact water temperature could have on both the company and the ecosystem and local community, the increase in water temperatures is considered important in terms of likelihood, severity and scope and therefore an important dependency to consider in the risk and opportunity identification process.

- **Impact:** Aquaculture impacts aquatic BOD through added biological load and feed decomposition. While BOD at cage sites and reference sites is monitored in real time through automated systems, as part of the company’s standard operating procedures, changes in BOD occur regularly. Increases in BOD beyond what is tolerated by the ecosystem could have impacts on many species in the area, local community activities including a small fishery, and the growth and survival of Salmon Fresco’s fish. BOD is therefore an important Salmon Fresco impact to consider in the risk and opportunity identification process.

- **Impact:** Aquaculture can result in increased incidents of disease outbreak, such as sea lice, among the cultured fish population. Diseases impact not only the aquaculture fish, but also local wild populations of fish who come into contact with the grow-out sites or otherwise contract the disease. Risk of disease can increase based on water conditions and the act of other water basin users, including other farms. Given its certification and government licensing requirements, Salmon Fresco has a proactive and collaborative disease management plan in place. Given the potential impact of a disease outbreak on local fish populations Salmon Fresco consider this an important impact to consider in the risk and opportunity identification process.

- **Impact:** Salmon Fresco reviews all identified impacts and dependencies for relevance and revisits the process annually for relevance and completeness.

**Box 7: The TNFD’s definitions of dependencies and impacts**

**Dependencies:** Aspects of ecosystem services that an organisation or other actor relies on to function. Dependencies include ecosystems’ ability to regulate water flow, water quality and hazards like fires and floods; provide a suitable habitat for pollinators (which, in turn, provide a service directly to economies); and sequester carbon in the terrestrial, freshwater and ocean realms.

**Impacts:** Changes in the state of nature, which may result in changes to the capacity of nature to provide social and economic functions. Impacts can be positive or negative. They can be the result of an organisation’s or another party’s actions and can be direct, indirect or cumulative.

**Box 8: Government/certification compliments:**

- While only one of the high priority sites is certified, the three non-certified sites are managed using Salmon Fresco's corporate environmental management system, which is designed to meet the multi-site certification standard outlined by the certification organisation. Under this centrally managed system, all processes, including data collection and on-site monitoring, are standardised across sites.

- Salmon Fresco is therefore able to set a single set of activities across all sites and identify outliers in existing management data to pinpoint any additional criteria required to be considered for a single site. For example, in reviewing the centralised database, it became apparent that the certified site experiencing increased water temperatures was also experiencing increased incidents of marine mammal interactions, which can cause damage to pens and result in accidental fish escapes. Therefore, at that location, marine mammal interactions were identified as a key emerging concern, leading to the potential introduction of invasive species as an impact on nature, whereas this is less of an issue at the other sites.
Water temperature regulation is a dependency that was assessed as high priority under LEAP components E2 and E3.

In identifying related risks and opportunities, it was agreed that increases in water temperature are a nature-related physical risk arising from climate change. Salmon Fresco outlines each risk related to water temperature under the physical risk category. For example, acute changes in water temperature can lead to heat shock in fish, a die-off of an ecologically important species, or the migration of a species into or out of the area. Each of these risks will be assessed separately.

Chronic drivers of temperature changes are also identified through scenario analysis, including driving forces such as climate change and associated changes to the ecosystem condition, such as disease outbreaks and poor fish growth.

Salmon Fresco also identifies changing water temperature as a nature-related opportunity because it presents the possibility for growing novel strains of Atlantic salmon with higher temperature thresholds and disease resistance, or even the introduction of another species of cultured fish with a higher market value and fewer nature-related impacts, such as native or non-carnivorous species (both under the products and services category). The company can justify research into these novel strains and species knowing that its site’s baseline temperatures are likely to keep changing over time.

Where the cause of nature-related risks is not well understood, it is decided that a precautionary approach should be implemented, following TNFD guidance, and results should be monitored over time to adapt a risk mitigation approach.

For example, the site with increased interactions with particular species will need to add extra monitoring on cage site integrity to manage their site level risk. This species is known to break or become entangled in nets, causing harm to themselves or cause escape events impacting the local ecosystem by increasing competition, altering genetic composition, predation, habitat damage and spawning disruption.

Salmon Fresco may need to engage a wildlife specialist, collaborate with other companies operating in the same area and/or enter discussions with local authorities to understand the source issue. If, for instance, it is hypothesised that habitat destruction may be leading to a gradual emigration of the species into the farm site, or that the increase in site temperature has affected the mammals’ traditional food source, Salmon Fresco would consider mitigating these risks through off-site habitat restoration projects or on-site reinforcements. Over time, the company can monitor the number of mammal sightings and the severity of mammal interactions at its sites, share this information with other impacted companies in the area, and determine if its efforts have been successful.

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**Box 9: The TNFD’s definitions of nature-related risks and opportunities**

**Nature-related risks** are potential threats posed to an organisation linked to their and wider society’s dependencies on nature and nature impacts. These can derive from physical, transition and systemic risks.

**Nature-related physical risks** are a direct result of an organisation’s dependence on nature. Physical risks arise when natural systems are compromised, due to the impact of climatic events (e.g. extremes of weather such as a drought), geologic events (e.g. seismic events such as an earthquake) events or changes in ecosystem equilibria, such as soil quality or marine ecology, which affect the ecosystem services organisations depend on.

- **Acute risks** are short-term, event-based risks e.g. damage from zoonotic infectious diseases caused by ocean-use change
- **Chronic risks** are risks from long-term changes in environmental conditions e.g. reduced suitability of marine areas for aquaculture due to water temperature change

**Nature-related opportunities** are activities that create positive outcomes for organisations and nature by creating positive impact on nature or mitigating negative impacts on nature.

- For each of the dependencies and impacts with a medium or high rating, Salmon Fresco undertakes a qualitative risk and opportunity identification exercise.
- Salmon Fresco has collated the relevant risks and opportunities outlined in the TNFD’s Risk and Opportunity Register to identify nature-related risks corresponding to high priority dependencies and impacts. Where possible, the company creates more specific descriptions for the identified risks to reflect its business realities, using the categories defined in the TNFD guidance on the Assess phase of LEAP.

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**A1: Risk and Opportunity Identification**

What are the corresponding risks and opportunities for Salmon Fresco?
Box 10: Risk identification and assessment: Using definitions and criteria from government regulations and certification schemes

Government regulations and certification standards may provide thresholds for indicators that are used to identify specific risks. Certifications often include justifications for criteria in standards documents and these can be leveraged in the risk and opportunity identification and assessment process. For example, the rapid growth of the salmon farming industry in Chile has led to a significant increase of sea lice, which poses a significant risk to aquaculture businesses and can negatively impact wild salmon populations. The control of sea lice represents one of the major obstacles for sustainable aquaculture – direct and indirect costs associated with sea lice infestation in the 1990s were estimated to be $320 million per year by the Chilean Technological Institute of Salmon (INTESAL). It is important to be able to accurately identify and assess the risks sea lice pose to an aquaculture facility and its surrounding ecosystem. Salmon Fresco uses the ASC revised Salmon Standard that requires farms to establish a clear sea lice sampling protocol and monitor the sea lice species L. salmonis and also Caligus, where applicable. Salmon Fresco is also trialling a tool developed by INTESAL, the Norwegian National Veterinary Institute and the Canadian Department of Health Management to predict the abundance of sea lice to enable the company to identify and assess its sea lice risk.

A2 & A3: Existing Risk Mitigation and Risk and Opportunity Management; Additional Risk Mitigation and Risk and Opportunity Management

What existing risk mitigation and risk and opportunity management approaches are we already applying? What additional risk mitigation and risk and opportunity management actions should we consider?

- Salmon Fresco follows the TNFD’s principles for integrating nature-related risks and opportunities into existing risk and opportunity management approaches, as set out in the TNFD guidance for the Assess phase of the LEAP approach.
- For each identified risk, Salmon Fresco identified its existing risk management approaches. First, the multi-site certification programme Salmon Fresco has subscribed to and the frequency of its data collection covered all but a few risks. However, Salmon Fresco concludes that it should not rely solely on the use of certifications to help them manage risks and demonstrate risk mitigation. Instead, it decides to continue to develop internal assessment procedures and engage directly with suppliers to understand their own risks and opportunities to validate the conclusions drawn from certifications. Salmon Fresco decides to establish processes to understand if a supplier does reduce its impacts on nature or whether they really mitigate risks from degrading ecosystems.
- For priority location sites with additional issues which fall below average performance across Salmon Fresco - the certified site with water temperature increases and increased interactions with mammals – the company identifies that additional management measures may be needed.
- Salmon Fresco continues to engage with the wider industry community to stay up to date with the latest developments and sustainable practices for relevant nature-related risk and opportunity management. This includes engagement with stakeholders such as investors, customers and suppliers.
- Salmon Fresco also recognises that regulations and permitting processes will continue to impose management controls.

A4: Risk and Opportunity Measurement and Materiality Assessment

Which risks and opportunities are material and should be prioritised?

Process:

- Salmon Fresco assesses each identified risk and opportunity and decides whether each is material using TNFD guidance for the Assess phase of the LEAP approach, specifically for the A4 phase of LEAP. It draws on TNFD guidance on measurement and prioritisation of nature-related risks and opportunities, and metrics on exposure, magnitude and financial implications on the organisation.
- While some risks and opportunities are subject to a qualitative valuation, some can be assessed quantitatively or through a monetary lens, especially when the dependencies or impacts are directly linked to company assets and production capacity.
- Salmon Fresco opts to set a threshold for each type of assessment (a qualitative material threshold, a quantitative material threshold and a monetary material threshold, as relevant) and, where possible, links these thresholds back to either government compliance or certification requirement boundaries.
- Salmon Fresco subsequently qualitatively rates its exposure to nature-related risks and opportunities associated with the identified impacts and dependencies. The exposure of the organisation is driven by the priority locations (sites) identified in the Locate and Evaluate phases that are considered high-risk ecosystems, using the criteria established for sediment chemistry, water temperature or other variables that are beyond the threshold established by government/certification when considering the decision to follow a site. Given current measurements, it rates its risk and opportunity exposure as Medium.
- Financial impacts to the company incurred through disruption to the company’s operations and as a result of impacts to the condition of the ecosystem more broadly are both considered. For example, chronic temperature changes risk leading to a closing of the local small-scale fishery thereby impacting community socioeconomic wellbeing and reputational risks for the company.
Following the TNFD's assess guidance, Salmon Fresco has also identified magnitude metrics and used the TNFD's prioritisation criteria to prioritise and monitor these risks over time.

**Magnitude indicators/metrics:**
- Production loss due to extended periods of time with no permitted production (fallow periods).
- The value of the high-risk locations per year. The company has determined that the value of production from these sites represents 25% of its annual revenue.
  - KPIs: Change in annual revenue from high-risk sites
  - Rating: High

**Likelihood:** Based on historical data, reference sites and active monitoring, the company has determined that some low levels of extended fallowing are likely to be required across its operations.
  - KPIs: number of extended falls/years
  - Rating: High

This assessment results in a risk matrix (Figure 2).

**Figure 2: Nature-related risk matrix for Salmon Fresco**

![Risk Matrix](image)

**TNFD LEAP Prepare Phase: Prepare to respond and report**

**P1: Strategy and Resource Allocation**

What strategy and resource allocation decisions should be made as a result of this analysis?

- For each identified material nature-related opportunity and risk, Salmon Fresco assesses the positive impact pathways that can be implemented and managed.
- Resources for mitigation measures are allocated according to risk/opportunity severity, gaps in the current management system related to that risk/opportunity, and funding impact.
- For example, Salmon Fresco is considering funding conservation efforts and contributing in-kind expertise to restore habitat for the species with increased sightings at one of their farms. In taking this decision it considers the risk rating, the financial cost of its support, and the extent to which it believes its support will mitigate the risk.

**P2: Performance Management**

How will Salmon Fresco set targets and define and measure progress?

- Salmon Fresco has noted a tight correlation between its certification activities and its identified material risks and opportunities. Certification is a key criterion related to revenue, as the majority of its final customers (food retailers) require certification.
- Salmon Fresco notes the TNFD's recommendation to set science-based targets for impacts on nature aligned with guidance from the Science-based Targets Network (SBTN). It plans to set science-based targets for ocean impact once guidance for this realm becomes available from SBTN.
- Salmon Fresco has therefore selected the following KPIs to report against (not comprehensive):
  - % of output covered by farm certification
  - % of revenue from certified sites
  - % of revenue from high-risk sites
  - $ revenue from high, medium and low-risk sites
Box 11: Disclosing against TNFD recommendations

Salmon Fresco’s TNFD disclosure reports against each of the TNFD recommendations:

- **Governance:** Its governance section outlines its board and executive’s oversight of nature-related risks and opportunities alongside climate-related risks and opportunities, and its management’s role in assessing and managing nature-related risks and opportunities integrated with climate-related risks and opportunities, including involvement in strategy setting, risk management and performance monitoring.

- **Strategy:** In the strategy section, Salmon Fresco has described its interactions with low integrity/high importance ecosystems. It has listed its material risks and opportunities, classified them as short, medium or long term, and described how they have been integrated into the company’s strategy and financial planning. Salmon Fresco has not yet implemented a scenario analysis but plans to do so in the next three years.

- **Risk and impact management:** Under the risk and impact management section of the report, Salmon Fresco describes how the TNFD LEAP approach was used to identify and assess nature-related risks and opportunities, including stakeholder and rights-holder engagement, and describes all relevant risk management and mitigation measures, as well as how these process for identifying, assessing and managing nature-related risks are integrated into Salmon Fresco’s overall risk management.

- **Metrics and targets:** Lastly, under the metrics and targets section, the company discloses the metrics it used to assess material risks and opportunities, impacts on nature, and the metrics used in LEAP component P2. Targets have yet to be established but Salmon Fresco describes its intention and high-level approach to target setting, including a commitment to establish science-based targets for impacts on nature.
Box 12: Perspective of a report user

Finance4Life, a private equity investment fund managing funds provided by a range of global institutional investors including pension funds and sovereign wealth funds, wants to expand its investments into food production industries. It has focused on aquaculture as a high-growth industry with products sold globally. Finance4Life also wants to set a nature-related target and is conscious of its need to make investments in the aquaculture industry that align with its nature ambitions. In reviewing the salmon aquaculture sector, it has noted that certification provides initial assurances about the nature-risk mitigation of certain companies. Salmon Fresco’s TNFD disclosure helps to define its approach to nature-risk mitigation even further and informs Finance4Life about the extent of Salmon Fresco’s risk mitigation and activities that mitigate negative impacts.