

**Voluntary Report** – Voluntary - Public Distribution

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**Report Name:** Salmon Overview

**Country:** Chile

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**Report Highlights:**

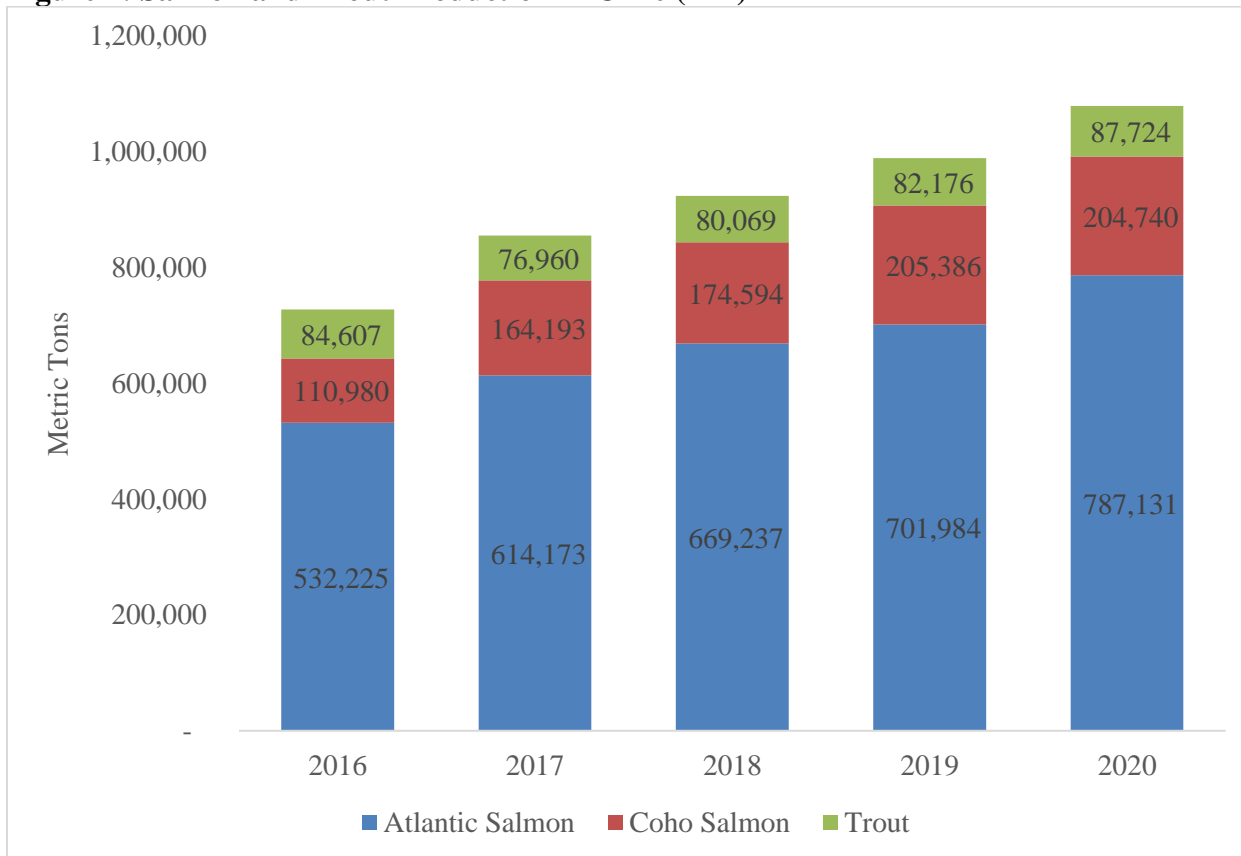
Salmon is Chile's largest food and agricultural export and the second largest total export sector after copper. In 2021, exports totaled 615 thousand metric tons worth \$4.8 billion. Production is growing rapidly; Chilean salmon production grew an average of 10.4 percent between 2016 and 2020 and totaled 1.1 million metric tons (MMT) in 2020. Salmon has a feed conversion rate of 1.2 – 1.5 kilograms of feed per kilogram of salmon, which results in a feed demand of approximately 1.32 – 1.65 million metric tons per year. More than 50 percent of salmon production cost is feed; thus, the salmon industry is constantly investing in research and technology to optimize feed and increase productivity. The current trend in salmon feed is to replace animal-based proteins with vegetable-based protein.

### 1. Salmon production and exports Chile

According to data from the Chilean Salmon Producers Association (SalmonChile), the salmon industry employs 71,000 people, of which 30,000 are employed in production companies and 41,000 in companies that provide inputs or services to the industry. Out of these, 7,000 are working in small and medium enterprises. The Chilean salmon production industry is composed of 17 companies. Salmon production takes place in the *Los Lagos*, *Aysén* and *Magallanes* regions in the southern part of Chile, where the water quality and climatic conditions are ideal for salmon development.

Chile is the second largest farmed salmon producer after Norway, supplying around 25 percent of the salmon in the world. In 2020, Chilean salmon and trout production totaled 1,079,595 metric tons (MT). Of the total production, 787,131 MT was Atlantic salmon (72.9 percent), 204,740 MT was Coho salmon (19.0 percent), and 87,724 MT was trout (8.1 percent). Between 2016 and 2020, salmon and trout production grew at 10.4 percent annual average rate (See Figure 1). [Note: Chilean data include farmed trout with farmed salmon.]

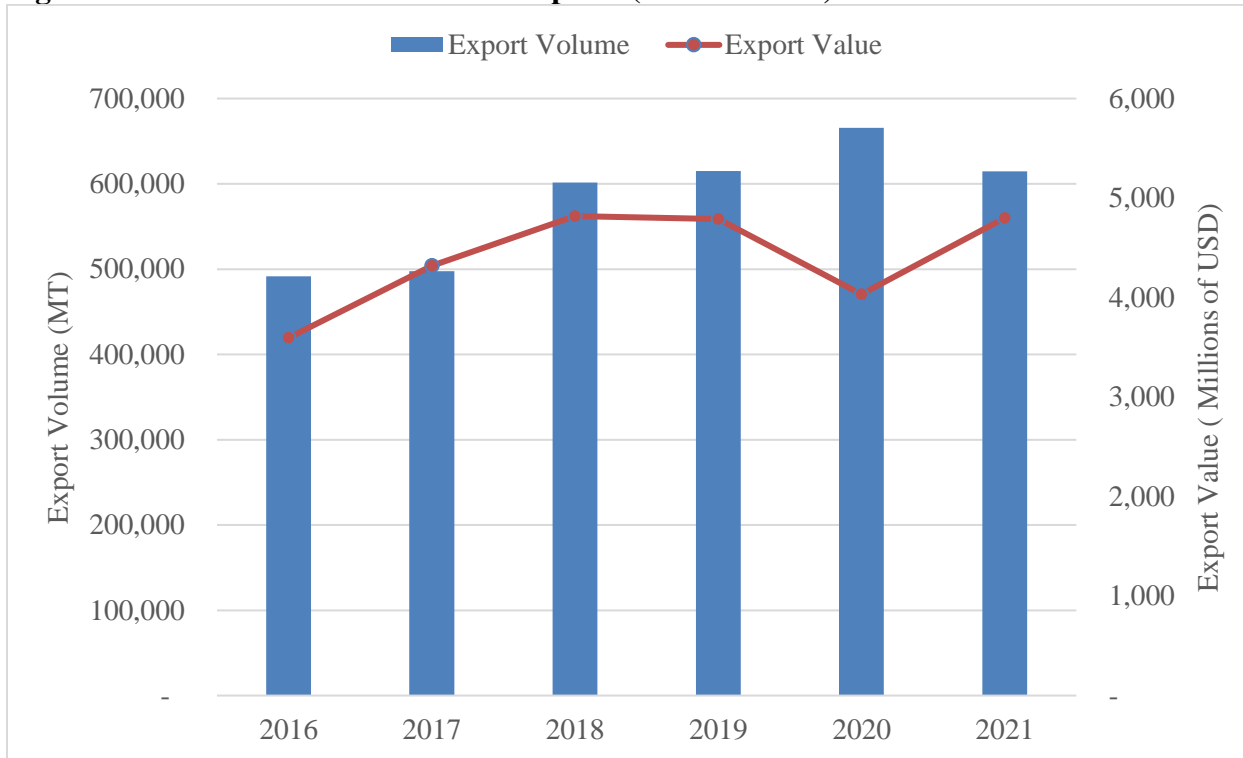
**Figure 1: Salmon and Trout Production in Chile (MT)**



Source: Sernapesca

Chilean salmon is exported to more than 104 different markets. In 2021, Chile exported \$4.8 billion, or 614,675 MT, of salmon and related products to the world. Between 2016 and 2021 export volume grew at an average of 5.0 percent per year (see Figure 2).

**Figure 2: Chilean Salmon and Trout Exports (MT and USD)**

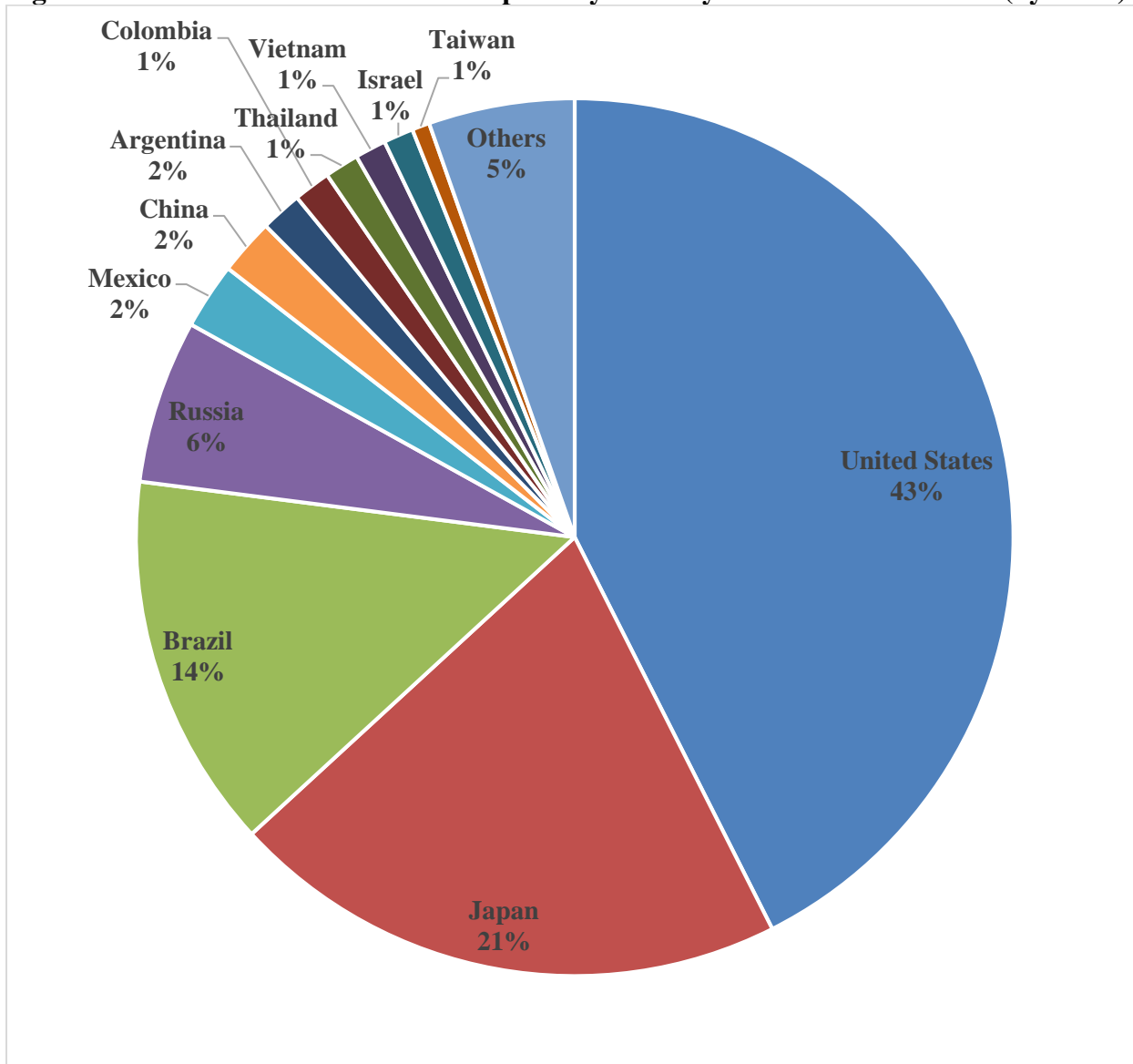


Source: Trade Data Monitor, LLC.

In 2020, export volume increased by 8.2 percent, but export value decreased by 15.8 percent. The cause of the decline in value was the impact of the Covid-19 pandemic on the hotel, restaurant, and institutional (HRI) channel. With limited HRI demand, prices were depressed. In contrast, in 2021 there was a decline in export volume due to lower production during 2020 but an increase in export value due to the reopening of the HRI channel in 2021.

The main market for Chilean salmon products is the United States, which consumed 43 percent of 2021 exports. The key product exported to the United States was frozen Atlantic salmon fillets. Japan is the second largest destination with 21 percent of 2021 Chilean salmon exports. Japan consumed mainly coho salmon. The third largest export market is Brazil which generally consumes whole frozen salmon and represented 14 percent of Chilean exports in 2021 (see Figure 3).

**Figure 3: Chilean Salmon and Trout Exports by Country of Destination in 2021 (by value)**



Source: Trade Data Monitor, LLC.

Chilean domestic seafood consumption went from 14.8 kg per capita in 2019 to 15.9 kg per capita in 2020. This increase in per capita consumption was due to an increase in the consumption of salmon and mussels. The development of online delivery services during the Covid-19 pandemic helped increase domestic consumption of seafood products. Sushi and Peruvian food, both large users of salmon and other seafood products, have gained popularity in recent years.

The salmon sector projects a three percent growth in production since only the region around *Punta Arenas*, in *Magallanes* Region, has the capacity to grow. Salmon production in Chile operates under a system of government-granted concessions. The concession system allows for salmon producers to farm salmon in specific areas of the ocean or adjacent bays according to preestablished conditions. Conditions include maximum animal density, mortality rate thresholds, and distance from other production centers, all of which are determined using food safety and sanitation criteria. SERNAPESCA is the Chilean agency in charge of monitoring the compliance with seafood regulations, and ensures that production follows strict environmental protocols, including the established criteria for each concession.

According to data from the Chilean Undersecretary for Fishery and Aquaculture (Subpesca), there are 1,357 concessions for salmon production. However, according to the Chile industry association, only around 300 of those concessions are operational. Non-operational salmon concessions are: 1) in places where production is not possible because they are geographically inaccessible; 2) too close to other concession to comply with environmental or density regulations; or, 3) located in or near marine protected areas. For the past year, the Chilean government has taken steps to relocate existing concessions to increase productive capacity; however, the process is slow and requires extensive technical and scientific justification. Notably, some new salmon concessions are in the *Magallanes* region, which is home to many marine protected areas, making salmon production impossible. As a result of the constraints on expanding concessions, much of the industry's growth has come from increased productivity and efficiency.

In recent years, the Chilean salmon industry faced broad criticism from both international and Chilean environmental groups due to the overuse of antibiotics and antiparasitics, escape of farmed fish into the environment, and pollution of the ocean and seabed. Though the criticism was not entirely unbased, the industry has taken overt steps to address these problems. Contacts note that the Chilean industry is improving in terms of sustainability and environmental impact using research and technology to enhance production practices. Moreover, the industry is working to improve its relationship with the community and local partners.

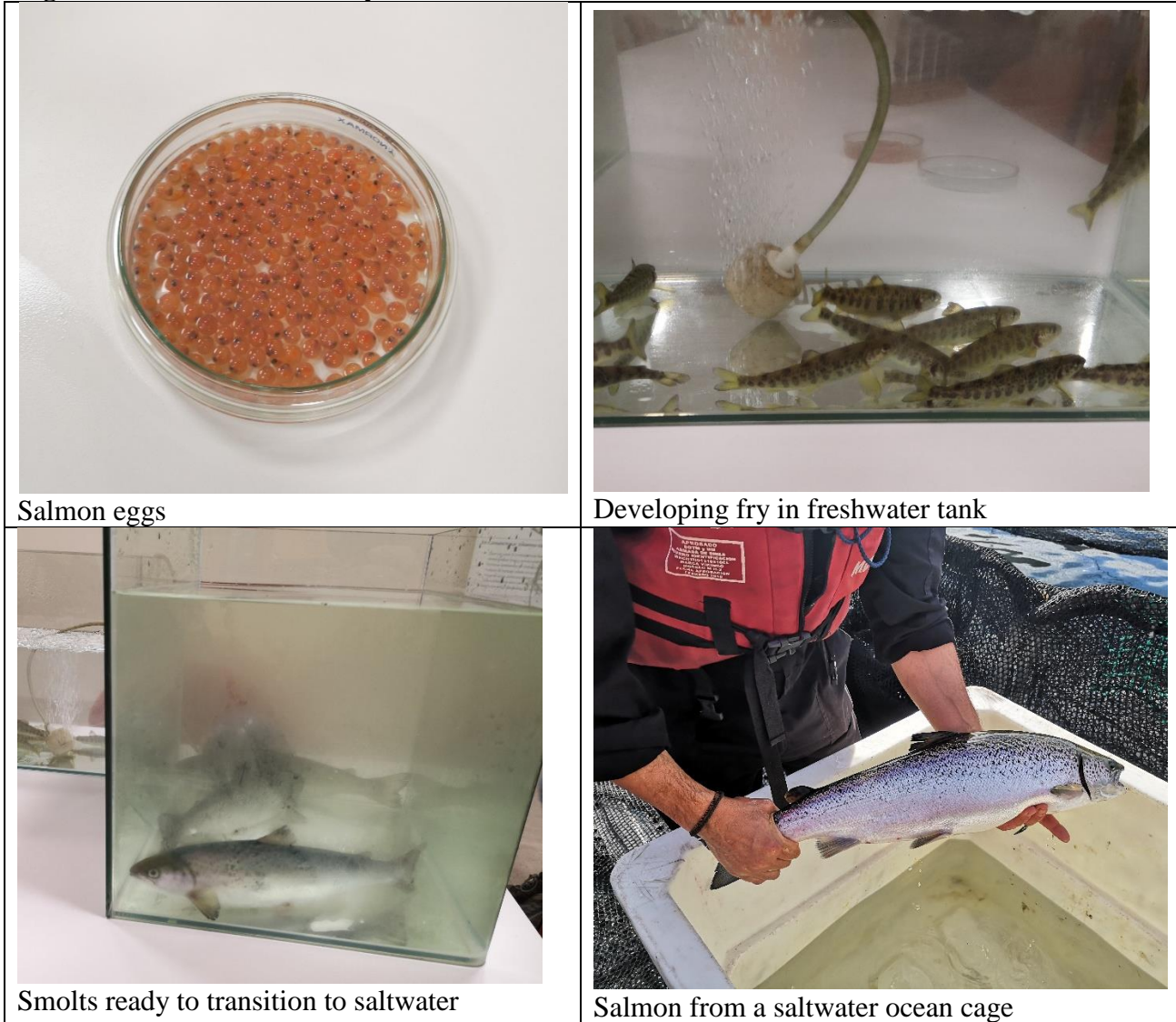
Chilean salmon producers do use antibiotics to fight diseases, including Salmonid Rickettsial Septicemia (SRS). The disease is caused by a bacterium, *Piscirickettsia salmonis*, and can produce important economic losses to salmon producers during the saltwater growth cycle. The disease symptoms in salmon are anemia, weight loss, respiratory problems, damage to the liver, and lesions on the skin. Treated fish are withheld from harvest for a period to ensure the animals fully eliminate the drug from their system. According to Salmon Chile, there are no traces of antibiotics found in any of the Chilean products by the time they reach their markets.

Another disease that affects salmon production in Chile is the parasite *Caligus rogercresseyi*, which causes stress and weight loss to the salmon during the saltwater growth cycle. There are various treatments to fight this parasite, some of which include adjusting the fish densities in the ocean cages, applying mechanical wash to the salmon, using antiparasitic products in the feed (lufenuron), or other veterinary products such as pyrethroids.

## 2. Salmon Growth Cycle

Salmon has a two-year growth cycle in both freshwater and saltwater. The freshwater cycle lasts 12 months, and the saltwater cycle ranges from 12-15 months. In the initial part of the process, salmon eggs are farmed in freshwater tanks, in controlled conditions, until they develop and are ready to move to saltwater (see Figure 4).

**Figure 4: Salmon Growth Cycle**



Salmon eggs

Developing fry in freshwater tank

Smolts ready to transition to saltwater

Salmon from a saltwater ocean cage

Source: FAS Staff

Fry, or young fish, ready to transition from freshwater tanks into saltwater are called smolts. In the *Los Lagos*, *Aysén* and *Magallanes* regions, the smolts are transported to cages in the adjacent bays and coastlines. They are fed in the cages until they reach a weight of approximately five kilograms. Once they reach this stage of development the fish are harvested and processed for human consumption. The salmon industry processes specific cuts for different markets and clients. For instance, the U.S. market demands frozen Atlantic salmon fillets, the Brazilian market prefers the whole fish or chilled fillets, and the Japanese market demands frozen Coho salmon.

One of the main reasons that salmon production takes place in the southern part of Chile is because of the quality and temperature of the seawater, which is ideal for salmon farming. Salmon production companies usually have their production systems vertically integrated, owning facilities and infrastructure for the freshwater and saltwater cycles, as well as for processing the salmon for exports. Access to freshwater is increasingly limited, thus companies invest in associated efficiencies. For example, one company located near the *Petrohué* river in the *Los Lagos* region owns a nearby hatchery. The river provides freshwater for the hatchery, which uses a closed production system to reutilize water in the production process hundreds of times. The water treatment involves the use of bacteria, mechanical procedures, oxygenation, and UV rays. Out of the total salmon farmers, 30 percent have similar closed water systems to save freshwater.

### **3. Salmon Feed**

Salmon has a high conversion ratio from feed to animal protein, when compared to other species like poultry or pork, which makes it very efficient. Chicken requires approximately 2.0 kg of feed to produce one kilogram of chicken; swine require 4.0 kg of feed per kilogram of pork, and cattle need nearly 6.0 kg of feed per kilogram of beef. Salmon feed conversion ratios range from 1.2-1.5 kg of feed per kilogram of salmon. To cover the 1.1 million metric tons (MMT) of salmon production, the industry demands around 1.32 – 1.65 MMT of feed per year. The edible portion of salmon is around 68 percent of the animal, making it a very efficient source of protein for consumers.

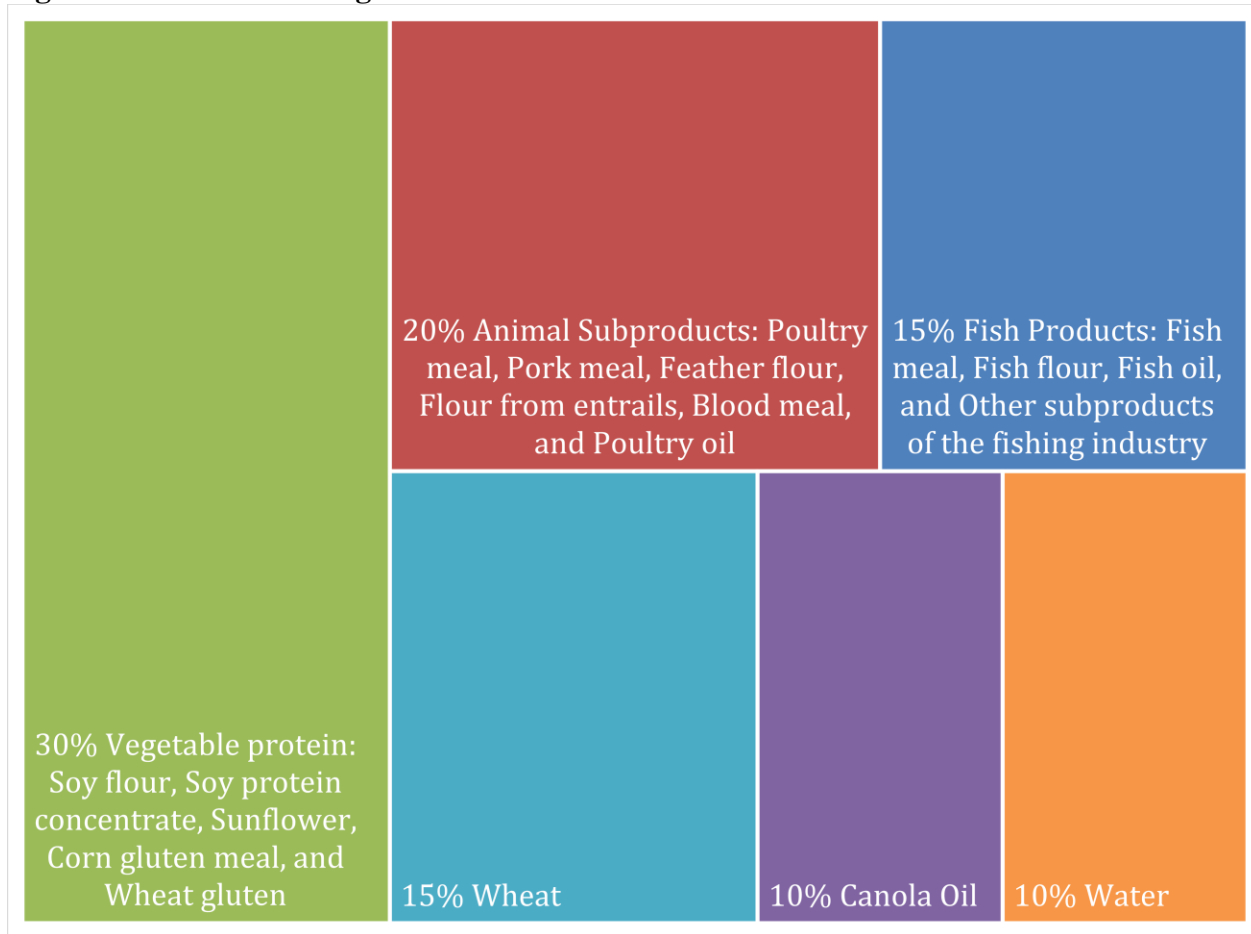
Feed costs represent 50-54 percent of the production cost of the salmon. Since, feed represents such a large part of the production cost, there is a lot of research and effort invested in optimizing salmon diets to maximize productivity. Companies employ veterinarians to optimize salmon diets for each stage of the growth cycle, from a nutritional and commercial point of view. During the freshwater growth stage, it is easier to monitor and control all the variables that could affect salmon development, such as water temperature, light, feeding frequencies, feeding quantities, pollution, and density in the fish tanks. Conversely, in the saltwater cycle, controlling these variables becomes difficult, since the fish cages are in the ocean and are subject to any natural occurrences and other external factors that could impact salmon development.

Currently, there are four major companies selling feed to salmon producers: *Skreeting*, *Biomar*, *Cargill* and *Salmofood*. These feed companies import inputs from different markets and offer products for each stage of development and for the specific needs of each production system. Feed companies have research centers to test different products, diets, feeding frequencies, production cycles, and other factors to maximize productivity. Feed formulation varies greatly for smolts and adults as most growth occurs in the post-smolt stage, while the salmon are in the ocean. Feed for salmon in the saltwater stage of growth is very high in protein.

In general terms, salmon feed contains vegetable protein, animal subproducts, fish products, grain, oil, and water. In the 1990s the share of fish meal in feed rations was higher, but with the increasing cost of fish products, it has largely been replaced with vegetable products. The current trend is to have more vegetable inputs and ingredients that have high levels of protein and reduce production costs. Thus, the goal of the feed industry is to try to produce feed using vegetable products and provide the same nutritional content that animal-based feed would provide.

The type of vegetable products that the feed industry employs is important to deliver the proper nutritional content that the salmon requires for development. In general, the feed industry uses high protein vegetable products and protein concentrates such as sunflower and canola oil. Soy is an alternative to these products, but it must be used in moderation. According to sources, soy may cause stomach irritation in salmon since around 50 percent of its fatty acids are omega 6. The feed industry usually seeks products that are rich in omega 3 fatty acids, because omega 6 may cause bloating and irritation to the stomach of the salmon (see Figure 5).

**Figure 5: Salmon Feed Ingredients**



Source: FAS Santiago

Salmon feed companies purchase inputs in the local market, directly from producers or traders, but also import many of the ingredients directly. Fish products used in feed come mainly from Chile and Peru. Corn gluten meal and canola oil are sourced from the United States and Canada. Wheat or salmon feed must have a high gluten content; thus, the industry uses hard wheat, purchased from local producers.



#### **4. Current trends**

According to the salmon industry, salmon is a sustainable and efficient source of protein. They anticipate that production will continue to grow as demand currently outstrips supply. Despite that salmon production grew an average of 10.4 percent during the past five years, growth is still limited by the regulatory and sanitary constraints: environmental footprint, concession system, and limitations in the maximum farming densities.

Chile remains a relevant exporter and global supplier of salmon, exporting to more than 104 markets, dominated by the United States, Japan, and Brazil. Salmon production remains also a crucial activity for the *Los Lagos*, *Aysén* and *Magallanes* regions in Chile, generating more than 71,000 jobs.

Current salmon feed demand is between 1.32 – 1.65 MMT per year, to cover for the 1.1 MMT of salmon production. FAS Santiago expects demand for feed to grow at around 3-4 percent per year for the coming years. Since feed represents half of the production cost, salmon producers and feed manufacturers are constantly seeking more efficient and cheaper sources of inputs, including high protein vegetable concentrates.

#### **Attachments:**

No Attachments.