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Arctic Char- A Sustainable Land-based Alternative

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As this opportunity is a significant milestone in my career, I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on the improvement to attain my desired career objectives.

Zahirul Islam

Table of Contents

Abbreviations

Acronym	Explanation
GDP	*Gross domestic product*
EU	*European Union*
CMS	*Cardiac myopathy syndrome*
PD	*Pancreas disease*
ISA	*Infectious salmon anaemia*
FTS	*Flow-through systems*
RAS	*Recirculating aquaculture systems*
R&D	*Research and development*
SIVA	*Selskapet for industrivekst*
INN	*Inland Norway University of Applied Sciences*
NMBU	*Norwegian University of Life Sciences*
TAM	*Total addressable market*
SWOT	*Strengths, Weaknesses, Opportunities and Threats*
NOK	*Norwegian kroner*
VCA	*Value chain analysis*
USP	*Unique selling propositions*
NTNU	*The Norwegian University of Science and Technology*
COGS	*Cost of Goods Sold*

List of Tables

List of Figures

Abstract

Aquaculture is one of the booming industries all over the world, especially in Norway. But sea-based aquaculture has had been damaging effects to biodiversity, various emissions/discharges, and other related problems. Norwegian authority, research personnel and aquaculture Industries are trying to find a sustainable alternative to sea-based aquaculture. Land-based aquaculture is less harmful for the nature, and it is also more beneficial for the farmers due to less vulnerability to infectious diseases and sea-lice. Arctic char which can be farmed on land-based facilities, can be an excellent alternative for this purpose. Klosser Innovasjon, together with the Norwegian government, is running project Arctic Red to solve this problem by creating an increased value creation of sustainable aquaculture production, R&D, technological improvements along with proper market creation. Market segmentation for Arctic char was performed to identify the beachhead market. Value proposition, value chain analysis, SWOT analysis, end-user profiling, TAM analysis, market survey, and pricing frameworks was done by interview and observation to find the most profitable Business model for the Arctic char farmers.

1. Introduction

Aquaculture, a relatively new field by the middle of the twenty-first century, has rapidly surpassed the ocean fishing industry in number and scale. About 600 aquatic species are being produced in tanks and other artificial settings, with some species being more desirable places than others. Experts expect that the significance of fish farming will increase as its advantages over livestock farming become more widely recognized (Berveridge et al., 2013).

Norway began exploring the potential of aquaculture in the late 1950s, and since then, the country's output has gradually increased each year. With an increase from 491 329 tons in 2000 to 1,326,216 tons in 2016, the most significant increase happened between 2000 and 2016. This progress has been aid governments and private sector's attention to sustainable development (FHL, 2020). Fish farms in way must adhere to strict regulations to guarantee that they meet severe environmental, quality, and food safety standards. In the ocean, fish are raised in enormous circular cages containing only 2.5% fish and 97.5% water. These government rules are supplemented by independent third-party certification schemes like GLOBALG.A.P. ("Aquaculture in Norway," 2020).

Recent research on the global salmon aquaculture sector revealed that pollution, parasites, and excessive fish mortality cost marine ecosystems billions of Kroner annually. Numerous obstacles have been to efficiently treat and preventing sea lice in recent years (Veterinærinstituttets, 2019). When it is harvested and produced in a facility on land, it will not have too many adverse consequences. Consequently, the local ecosystem is significantly less affected.

Due to the country's abundant water supply, Norway's potential for freshwater aquaculture is high. Approximately 16,000 square kilometers are occupied by Norway's rivers. The proportion of farmland exceeds 5 percent of the total area. There are 440 thousand lakes larger than 60 square meters and rivers longer than 1 cubic meter per second, with a total length of 250,000 kilometers. Arctic char and brown trout (Salmo trutta) are produced on land for the majority of Norway's freshwater aquaculture business (Olk, 2021). The Arctic char shares many traits with salmon and trout, including high levels of omega-3 fatty acids, and is closely related to both. Arctic char has not been farmed as extensively as salmon because to a lack of infrastructure to increase production; hence, the existing supply is quite restricted. But Klosser innovasjon has pioneered a sustainable approach to farming Arctic char at its innovative

breeding farm located a short drive from Rena, a small town in Inland County, Norway. By taking advantage of Norwegian natural resources in combination with the county´s clean fresh water, Klosser Innovasjon has been able to grow as an environmentally friendly and sustainable aquaculture breeding company for Arctic Char.

The primary target of the literature is to find an alternative of sea-based farming and analyse the market of the new alternative farmed fish. If we properly perform the market segmentation on the Arctic char, it is possible to focus on and go after the specific customer segment. By doing so, the small stakeholders such as small-scale Arctic char farmers can fully concentrate on the specific customer/ consumer segment with their limited resources and earn a good revenue by following proper business model to thrive on.

1.1 Aquaculture Industry

Finding sufficient to meet the nutritional needs of a growing global population has been humanity's greatest challenge. It is a bit silly to say, "If you don't have food, nothing else matters." However, in many parts of the world, adequate food sources are currently in short supply (Gjedrem, Robinson, & Rye, 2012). In contrast, the expansion of the world's population is extremely astonishing. The world's population is projected to reach 8 billion in 2022, up from 2.5 billion in 1950. According to UN estimates, this number could reach 9 billion by mid-century (Berveridge et al., 2013). This illustrates that there is already a severe food shortage, and that the situation is anticipated to worsen over the next few years. Attempting to increase food supply in order to satisfy expected future demand is a massive undertaking (Gjedrem et al., 2012). Fish is readily available, inexpensive, and nutritious. There will always be a substantial demand for fish around the globe (Berveridge et al., 2013). Fish breeding and aquaculture have emerged as the only feasible options in recent years as the catch of wild fish has remained largely stable (Berveridge et al., 2013).

Aquaculture, or the cultivation of seafood, is a growing industry. Many studies show a correlation between the consumption of fish, crustaceans, and shellfish and farming. In either freshwater or saltwater, aquaculture businesses produce aquatic plants and animals for human consumption (" Aquaculture Stewardship Council," 2022). Aquaculture occurs in a wide range of ecosystems, including tanks on land, rivers, lakes, and even coastal ocean waters ("What Is Aquaculture and Why Do We Need It?," 2022). Aquaculture has certainly existed for

thousands of years, however its roots are unknown (Rocha, Cabral, Marques, & Gonçalves, 2022).

Aquaculture for human consumption exceeded capture fisheries for the first time in 2014. In 2018, the global value of aquaculture seafood production was expected to be $250.1 billion, with fish accounting for around 82.1 million tons of that total (Bianchi et al., 2014) (FAO, 2021). Even if the growth rate decreased to 4.5% between 2016 and 2018, the average yearly growth in global aquaculture production of aquatic animals from 2001 to 2018 was 5.3%. Despite the well-established fact that Asia produces the most in both volume and value, goods grown in the Americas and Europe continue to attract higher market prices per unit of volume (Rocha et al., 2022). The contribution of the different types of aquaculture environment for each continent total production is represented in Figure 1 .

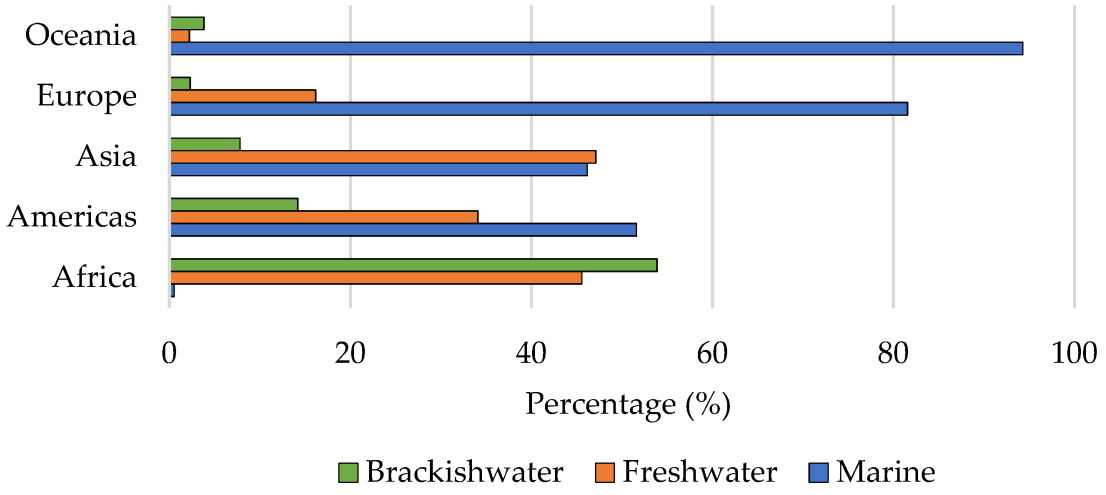


Figure 1: Seafood production of brackish, fresh and marine aquaculture: percentage of total production in 2018 by aquatic system in each continent. (FAO, 2021)

Aquaculture in Europe produced over 3,1 million tons in 2018, representing more than 4% of worldwide production. In 2018, marine species accounted for around 83.5% of the continent's total production, making marine and coastal environments the primary locations for the majority of European aquaculture. High-yielding European nations, such as Norway and the United Kingdom of Great Britain, concentrate on producing marine species such as seabass and seabream, in addition to cold-water salmonids (Figure 2). Norway is the leading producer in Europe and eighth in the world, generating more than fifty percent of all aquaculture products in Europe in 2018 (about 1.4 million tons of live weight) ((FEAP), 2020) (FAO,

2021). Its major manufacturing method is Atlantic salmon farming, which has been significantly improved to maximize productivity while adapting to quite severe conditions (Bjelland et al., 2015).

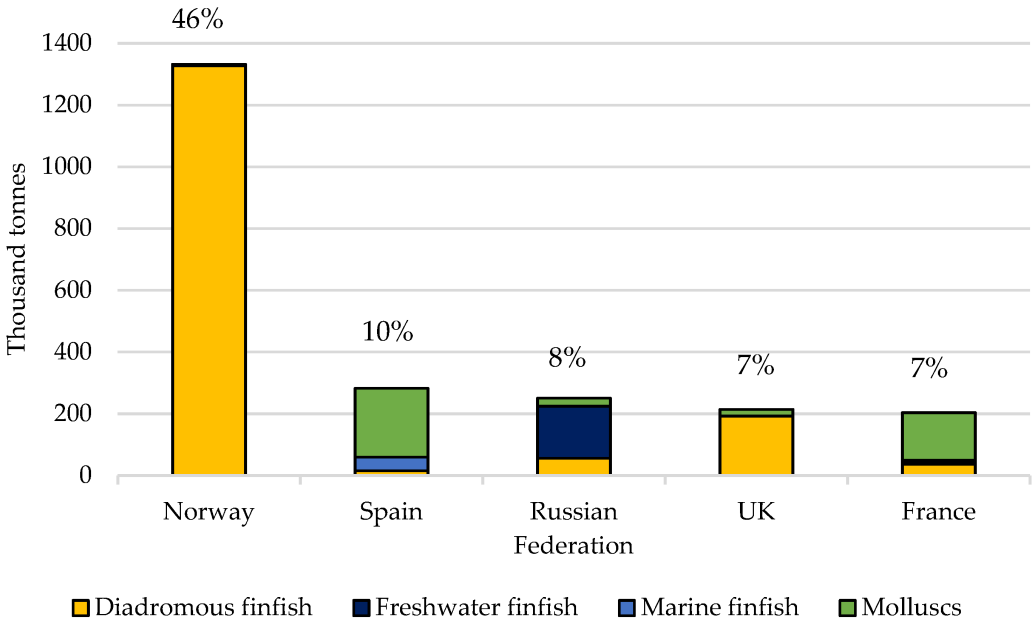


Figure 2: Aquaculture fish output in Europe's major producing nations, in terms of volume: % of total European production in 2018. The values above each column show each country's proportional contribution to the total European aquaculture production in 2018 (FAO, 2021).

1.2 Norwegian Aquaculture Industry

With approximately 83,000 kilometres of coastline that includes fjords and islands, Norway is one of the top producers of marine fisheries and aquaculture in the world. The fishing industry has historically played a significant social and economic role, acting as the basis for settlement and employment throughout the whole Norwegian coastline. The expansive coastal regions of Norway are among the most prolific in the world, making them suitable for the establishment of aquaculture. In 2010, fishing and fish farming employed 12,900 full-time equivalents and contributed 0.7% of the nation's gross domestic product. Norway is the world's second-largest exporter of fish and fish products by value. Among its largest export destinations are the European Union (EU), the Russian Federation, Japan, China, Ukraine, and the United States. In 2012, Norway's second-largest export was seafood, accounting for 8.9 billion USD, or 6% of total exports. Herring, cod, capelin, mackerel, saithe, blue whiting, and haddock are the most frequently caught fish species (FAO, 2021).

The Atlantic salmon is the major species cultivated in Norway, accounting for 94.4% of total aquaculture production (Table 1). In 2019, Norway produced 1.367082 million metric tons of Atlantic salmon, making it the largest producer in the world. The remaining species are dominated by large trout, which account for 5.41 percent of total production. In 2019, halibut is the third most valuable aquaculture commodity, contributing for 0.1% of total production. Arctic char and Atlantic cod are two further farmed species (*European Aquaculture Production Report 2014-2019*, 2020).

Table 1 Aquaculture production in Norway (European Aquaculture Production Report 2014-2019, 2020)

Production (tons) Year Species	2014	2015	2016	2017	2018	2019
NORWAY	1312996	1333994	1267751	1306603	1353730	1447291
Atlantic salmon	1236554	1252932	1185266	1243106	1284770	1367082
Large Trout	74769	79557	80694	61418	66337	78320
Halibut	1257	1243	1461	1623	1843	1524
Arctic Char	285	257	330	339	285	365
Cod	131	5	0	117	495	0

Since the 1970s, when the first Norwegian salmon were raised in floating sea cages, the aquaculture business in Norway has expanded at an exponential rate. In 2017, Norway generated more than 52 percent of the world's total Atlantic salmon supply. The majority of Norway's coastline is currently used for fish farming, which produces approximately 1.2 million tonnes of fish annually, of which 95% is exported (Dyrevernalliansen, 2019). Cage aquaculture is the practice of cultivating fish in net cages that permit free water flow in reservoirs, rivers, lakes, and oceans (Ignatius, 2016).

Breeding has increased features such as growth, color, and product quality through multiple generations. On a land-based, freshwater farm, salmon production begins in holding tanks. Similar to how wild salmon are fertilized in rivers, the roe is fertilized with fresh water. The process concludes when the roe develops into alevins, which consume their yolk sacs for sustenance during their first few weeks of life. Once the yolk sacs have been depleted, the alevins must start feeding. At this point, they are referred to as fry since they have been weaned onto a pelletized diet. The juveniles are then transferred from the hatching tank to a larger rearing tank. The parr are ready to be released into the ocean when they weigh between 100 and 300 grams, depending on their location. Since hatching, young salmon have undergone smoltification, which transforms them from parr to smolt and prepares them for life in sea

water. Using well boats, the smolts are transported to marine farms where they are held in sea cages (Leroy, 2017).

1.3 Challenges in Norwegian Aquaculture: Problems for the Sea-based Farming and Solution

The aquaculture industry in Norway occurs in a shared natural environment, which affects all stakeholders. The government, scientific communities, and businesses are collaborating to maintain the sustainability of Norwegian aquaculture. This may include various sorts of emissions or discharges, damage to biodiversity, consumption of non-renewable resources such as oil or renewable resources such as the primary ingredients in animal feed, or any combination of these (FHL, 2020).

Sea lice

Lepeophtheirus salmonis, a parasite that occurs naturally in salmon and sea trout, is the leading cause of the parasite problem in Norwegian aquaculture. Whelan investigated the renowned effects of sea lice infections (2010). These effects include epithelium loss, hemorrhage, increased mucus production, changed mucus biochemistry, tissue necrosis, and reduced physical and microbiological protective function (Bergheim, 2012). There are a lot of protesting because farmed salmon transfer the lice to wild broodfish and the smolts that are swanning by while migrating out.

Disease

In addition to sea lice, viral diseases pose a major threat to sea aquaculture. Among the most challenging to treat are cardiac myopathy syndrome (CMS), pancreas disease (PD), and infectious salmon anemia (ISA). During stressful tasks such as treating fish for sea lice, sorting, transporting, and another fish handling, the degree of stress might reach a point where it induces heartbreak (Veterinærinstituttets, 2019). Consequently, diseased fish may be extremely sensitive, resulting in a higher mortality rate (Solheim & Trovatn).

Escape

When farmed salmon escape aquaculture facilities at sea, that impact wild salmon negatively. Once sexually mature, salmon travel upstream to spawn. It has the ability to alter the genetic structure of both wild and farmed salmon if it is successful. This is a harmful unintended

consequence for Norwegian society that is frequently extremely harmful (Solheim & Trovatn, 2019a).

Emissions

Significant organic and nutrient emissions are produced by sea-based salmon farming. Depending on variables such as river flow, geography, and biodiversity, these emissions have various impacts on the surrounding regions and water. The majority of biological material emissions will accumulate on the adjacent seabed, wreaking havoc on the environment of the bottom of the sea. In addition, as bacteria decompose the organic material, H2S and methane gas may be produced, as well as an oxygen deficiency in the surrounding water (Hansen et al., 2017).

In the future decades, the Norwegian government intends to significantly enhance the value generated by aquaculture production. To achieve these goals, growth must be consistent, environmentally responsible, and predictable. Using current production technologies, the type and scale of aquaculture output are determined by nature. To fully realize the growth potential of the Norwegian aquaculture industry, research and development are as important as technological advancements. The administration of the industry will protect the environment in order to facilitate the long-term expansion of the sector. It must be assessed how much environmental harm society can endure if a predictable growth regime is granted to the industry (Skjoldager et al., 2021).

Civil organizations, the media, and social media may increase political pressure to restrict the amount of environmental harm tolerable from sea-based salmon farming. In addition, a greater emphasis on fish welfare and a corresponding decline in support for existing operational procedures in sea-based aquaculture is possible. If land-based salmon farming replaces aquaculture, this number could climb much further. This could influence the political opposition and the administration, resulting in stricter maritime sector regulation.

An increased emphasis on fish health and welfare may lead to stricter regulations for aquaculture operations in marine environments and a reduction in the use of non-medical sea lice treatments. In addition, a drop in acceptance for escape can result in an increase in the quantity of farm equipment needed. This could increase the compliance costs for conventional farms in terms of operating and capital spending. In November 2019, a government-formed commission produced an official Norwegian Report on the aquaculture company's taxes. The

committee recommends a profit-based, accruing resource tax of 40.0% in addition to the ordinary Norwegian tax rate of 22.0%. In practice, this translates into a tax rate of 62% for the Norwegian aquaculture industry located on the sea. The proposed resource tax does not apply to agriculture conducted on land (Solheim & Trovatn, 2019a).

1.4 Land-based aquaculture systems

Several of the challenges identified by sea-based agriculture can be overcome or alleviated by land-based production. Land-based aquaculture would no longer utilize common coastal resources and would not impede the migratory and fishing paths of wild salmon. It will help boost the health of wild fish by minimizing the invasion of sea lice. If land-based farming were employed to supplement aquatic output, this would not be the case. Land-based farming, on the other hand, may reduce fish welfare since land-based tanks contain fish at a higher density (25,0 kg/m3) than tanks used for sea-based farming. Due to an exception law for farming on land, this is legal (Holm et al., 2015).

Aquaculture on land benefits both fish and the environment. Fish from conventional offshore farms are susceptible to infectious illnesses and sea lice infection. Modern land-based aquaculture systems allow landlocked areas to generate local fish products (Benjaminsen, 2021). There are two fundamental land-based production techniques. These flow-through systems (FTS) and recirculating aquaculture systems (RAS) recycle water differently.

1.4.1 Flow through systems

The basis of FTS is pumping water from an intake to the fish tanks, where it is used once and then disposed (Holm et al., 2015). In addition, conventional FTS does not recycle water. Traditional FTS do not in any way treat the intake or effluent water (Figure 3). These characteristics give the appearance that the complexity of such systems is low (Bjørndal, 2018).

Modern facilities incorporate water reuse technologies as well as systems for treating wastewater and intake water as a result of technological breakthroughs over the past few decades (Bjørndal, 2018). FTS may also incorporate temperature-controlling systems that maintain constant, optimal water temperatures for fish growth (Eielsen & Magar, 2019). Due to technology advancements, the complexity of current FTSs has increased, resulting in a combination of RAS and traditional FTSs.

FTS, on the other hand, is viewed as posing significantly less risk than RAS because it utilises proven, very reliable technology. This is owing to FTS's better access to water quality-related operating parameters that have been confirmed (Bjørndal, 2018).

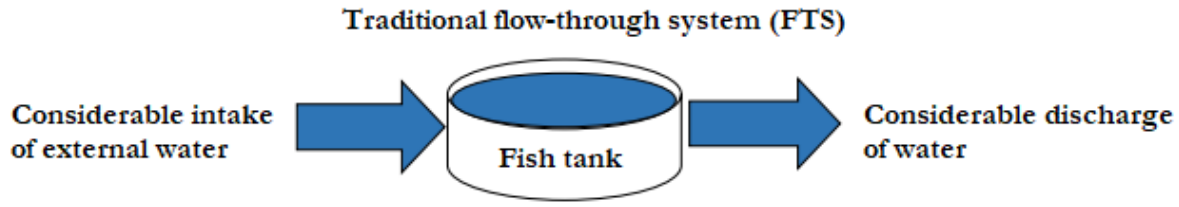


Figure 3: Overview of Land Based Traditional Flow-through System (FTS) (Terjesen, SFI, & Seniorforsker, 2017)

The reuse method employed by FTS oxygenates and removes CO2 from the water, resulting in a water recycling rate of 30 to 70%. Reusing 30 to 70 percent of the water results in substantial energy savings for modern facilities, as less water must be pushed, and less temperature change is necessary. In addition, FTS facilities are less advanced than equivalent RAS facilities due to the absence of a biological filter in the water treatment system (Solheim & Trovatn, 2019a).

1.4.2 Recirculating aquaculture systems

RAS has achieved significant technological advancements over the past two decades. The water at RAS facilities gives oxygen to the fish, removes waste and disease-causing organisms, and is then filtered, oxygenated, and reintroduced to the fish (Figure 4). Mechanical particle removal and biological filters containing bacteria are used in the water treatment process to remove, convert, and eliminate undesirable substances. In addition, carbon dioxide is reduced, oxygen is added, the water is disinfected, and the salinity and pH levels are regulated. Depending on the level of the treatment, this comprehensive water treatment results in water recycling of 95 to 99 percent (Holm et al., 2015).

While some RAS facilities employ a mixture of freshwater and seawater with salinities between 2.0 and 3.0%, the great majority grow fish in brackish water with salinities between 12 and 14% (Bjørndal, 2018). In addition, the water temperature is changed to give the fish with the optimal habitat for growth. This method requires far less external water than conventional FTS and permits greater control over the production environment and the

production itself. Because the system recycles 95-99% of the water, it is more complex and operational risk is increased (Holm et al., 2015).

With the assistance of RAS technology, which enables effective waste capture and repurposing while minimizing environmental impact, it is possible to enhance biosecurity to prevent fish escapement, reduce pathogen entry or release to the surrounding environment, and tightly control the rearing environment for improved fish performance and welfare. In terms of choosing a site based on market accessibility, it also provides greater flexibility. Growing fish close to where it will be sold increases sales, reduces transportation costs, has a reduced carbon impact, improves product freshness and traceability, and contributes to the local economies of the regions where it is done (Steve Summerfelt, 2022)

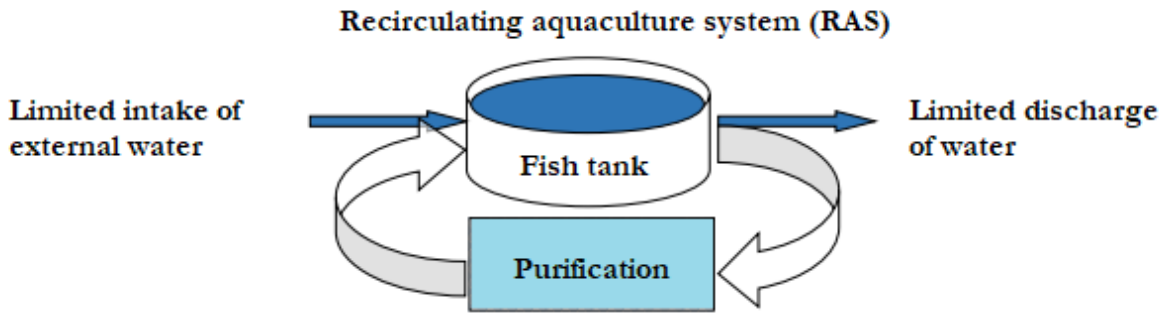


Figure 4: Overview of Land-based Recirculating Aquaculture System (RAS) (Terjesen et al., 2017)

1.5 Land-based Aquaculture in Inland County

The 1960s and 1970s marked the commencement of land-based salmon aquaculture. Modern land-based aquaculture technologies enable landlocked counties such as Inland to provide residents with fish products produced locally. Finding a way to make this production method commercially feasible has always been the greatest obstacle. Particularly, recirculating aquaculture systems (RAS) have enabled enterprises to be lucrative in ways that were previously impossible. This is owing to the recent emergence of new technology. These cutting-edge technological developments have cleared the path for large-scale commercial production of fish on land, encompassing the complete fish life cycle from egg spawning to fish death, fish fry to harvestable salmon. As a result, there has been a rise in investors' and the industry's interest in land-based initiatives in Norway (Fondevik, 2020).

Even if it is summer near Lake Mjosa, a snowstorm may always occur on the top of the Rondane mountains. Due to the great changes in altitude, the climate of the interior differs considerably. The geology and soils of the county exhibit a great lot of variation. In the inland regions, agriculture and forestry exhibit a great deal of diversity as a direct result of the diverse environmental conditions that exist there (Kleve-Ruud, 2021). The Norwegian government has constantly advocated for the encouragement of land-based fish farming, and the country's authorities have made regulatory steps to facilitate the growth of the industry. In contrast, the county boasts an abundance of high-quality drinking water due to the presence of various rivers and lakes, including the begna, etna, filsa, leira, and otta (Fondevik, 2020). People in Inland County who have access to land for land-based farming may consider producing freshwater fish as a side business they can operate in combination with their farm or as a distinct business. These species include of brown trout, rainbow trout, perch, whitefish, Arctic char, among others.

1.6 Arctic char

The arctic char is a stenothermic fish with an arctic and Antarctic distribution (Salvelinus alpinus). The life cycle of this species is diversified due to anadromous, riverine, and lake dwelling. It exists in a variety of variants that vary in morphological characteristics like as body size, head form, and mouth placement. Variation can also be observed in the ecological niches of various morphs, such as the ecology of feeding.

Since the 1970s, Arctic char aquaculture has gained popularity. Aquaculture of Arctic char was encouraged in the 1980s and 1990s, and it has potential. In the northern temperate zone, small-scale agriculture has a long history. However, until the late 1990s, Arctic char aquaculture was less successful due to the adoption of the same techniques as for Atlantic salmon and rainbow trout (Oncorhynchus mykiss) (Jobling, Tveiten, & Hatlen, 1998). Nevertheless, despite the faults of early Arctic char aquaculture, the Nordic nations believe it has immense potential (Paisley et al., 2010). This is owing to the Arctic char's many positive cultural characteristics, such as its capacity to grow quickly in freezing temperatures (Sæther, Siikavuopio, Thorarensen, & Brännäs, 2013), which make the species excellent for fish farming in high latitudes and elevations. Arctic char can be cultivated in intensive systems because they are tolerant of high population densities (Sæther et al., 2013). Arctic char has a high fillet yield and is available for sale in some markets. Arctic char can adapt to a variety of

culture regimes, which is advantageous for aquaculture because to the species' intrinsic plasticity.

However, Arctic char aquaculture is a small and sluggishly expanding economic sector. Obtaining viable eggs and juveniles in terms of egg quality, fertilization rates, and survival after initial feeding is one of the most pressing challenges. Additionally, marketing, early development, uneven growth, and flesh pigmentation have been obstacles. Some of these difficulties were worsened by the Arctic char's lack of recognition as a stenothermic cold-water mammal (Olk, 2021). However, the adaptability of the species has drawbacks because growth rates, size, and maturity age vary among individuals (Sæther et al., 2013). Due to the ever-changing combinations of risks that fish in captivity experience, identifying what constitutes an ideal rearing environment can be challenging. Important aspects of water quality include dissolved oxygen, metabolic waste products like ammonia and carbon dioxide, pH, and toxicants including heavy metals and organic contaminants. Depending on life stage, the temperature, dissolved gas concentrations, and ionic concentrations of Arctic char also vary. Additionally, relationships between environmental factors that induce physiological or behavioral reactions must be considered (Olk, 2021). Therefore, the environment offered to farmed fish will always be a compromise between what is optimal for the fish and what is feasible for the producer, the site, and the place itself (Sæther et al., 2013).

Despite the abundance of freshwater in Inland County, Norway, both freshwater fish farming and Arctic char farming have remained minor industry (Olk, 2021). There were no breeding programs or commercial producers of arctic char roe or fry in Norway. Today's char farmers are small producers who manage the complete production cycle, from roe to marketable product, which requires significant time, resources, and expertise. A lack of fish intended to meet the needs and standards of farming and the market is one of the key problems stopping the sector from expanding. Since Sweden and Iceland have maintained char breeding programs for many years with great success, Norway should do the same for the magnificent Norwegian char. This would allow Norwegian farmers to compete with Swedish and Icelandic char producers on a more level playing field. In this instance, reproduction is essential for narrowing the gap (Johansen, 2022). Norway's rigorous environmental regulations governing freshwater aquaculture are a contributing factor (Olk, 2021).

1.7 Klosser Innovation

Klosser Innovasjon is a leading provider of innovation and development environments in Norway. They operate throughout the Hedmark region to encourage knowledge-based business growth and development based on sustainability. Klosser Innovasjon has branches in Hamar, Kongsvinger, Tynset, Elverum, Brumunddal, and Grue. Klosser Innovasjon is a key driver in the Inland for enhanced innovation, value creation, and growth. It provides assistance to the Inland business community in the areas of innovation, business development, and research projects. Klosser Innovasjon has become a driving factor in the development of new companies based on the natural resources in the Inland County.

The business divisions of Klosser Innovasjon include incubator, an innovation centre, clusters and networks, and regional business development. They specialize in four key areas: Bioeconomy, Industry, One Health, and Digital services. They have an extensive network of national and international R&D establishments which aid them to collaborate throughout the world. The innovation centre assists firms and founders throughout the whole innovation process, from conception to implementation. Klosser Innovasjon provides advisory services to all sorts of growing businesses. The Incubation Program, a national growth program for creative growing enterprises, is their most significant scheme.

Klosser Innovasjon intends to conduct development initiatives in collaboration with businesses, academic institutions, and the government. Klosser Innovasjon is in charge of several significant regional development initiatives throughout the region of Hedmark.

Klosser Innovasjon has established a national leadership in bioeconomy as well as green economy and is a bioeconomy centre with a specialization on the innovation centre Biosmia, the clusters NCE Heidner Biocluster and Greenheart Industry, and the business incubator offer.

Currently, their major owners are Innlandet county municipality with 34.4%, SIVA with 30.4%, Hamar municipality with 9.6%, and Kongsvinger municipality with 5.9%. Additionally, there are a handful of minor stockholders with ownership of less than 5 percent. This type of strong relationship with public sector stakeholders is Klosser Innovasjon's greatest strength.

Klosser innovasjon envisions inland char farming as a new industry for the Inlandet. They have launched a significant investment in char farming through BioSmia through two projects:

1. Arctic Red - a national Arctic char breeding effort at a separate fish farm on Rena. Arctic Red's Project Manager is Karina Hauge Johansen.
2. A mobilization project in which new char farmers are recruited and deployed.

The main goal of this project is to be able to distribute eye roe to new fish farmers by 2020, using a char strain that is better adapted for land-based fish farming and has a larger profit margin. Arctic Red also conducts research to provide genetic tools for use in breeding efforts. Inland Norway University of Applied Sciences (INN), Norwegian University of Life Sciences (NMBU), Norwegian Char Forum, and Aninova were among the key partners in that project.

1.8 Project Arctic Red

Arctic Red is the name of Norway's new breeding initiative for arctic char (Salvelinus alpinus). In 2014, Klosser Innovasjon AS (formerly Hedmark Kunnkappark) initiated the breeding program as a project with assistance from project partners and a part of financing from the Regional Research Fund Inland. From 2014 to 2017, Norwegian Ryeforum, Nord University, Aninova, Hongset Char (char breeder), Tydal Char, and the Evenstad Department of Innlandet University College participated in the project. (Char breeder). Since 2018, the effort has been supported by Klosser Innovasjon, Hedmark County Municipality, and a new research grant from the Regional Research Fund Inland. This includes the mobilization efforts conducted on land. The plan now also involves NMBU as a collaborator for genetic research (Johansen, 2022).

Arctic Red's expertise was originally described in the breeding environment at Hamar's business cluster NCE Heidner Biocluster. Aquagen's salmon breeding program was enabled in effect by the environment around the cluster, which is primarily located in Hamar. Arctic Red was founded with the intention of setting the foundation for a breeding program that will ultimately be able to give roe for sale to char farmers in Norway. This was done in response to the breeding environment and the lack of systematic char breeding. The new line will be adapted to meet market demands and bred to generate an aquaculture-friendly fish. The breeding program will result in more development and investment for the char business, which has lacked a solid push for quite some time. The char farming sector in Norway is now very

limited, but there is significant growing potential on domestic and international markets with a variety of specialized products. With greater production, it may be conceivable in the future to sell more generics (Johansen, 2022).

The new char line will be founded on broodstock from the best Norwegian populations, which will be crossed to eliminate any inbreeding in the first generation. After that, comprehensive individual marking and reconstruction of the family tree will guarantee breeding success and prevent inbreeding. In the winter of 2015, the first island roe from broodstock populations is produced. This fish reaches sexual maturity after three years, may be ironed, and sells roe (Johansen, 2022).

1.9 Aim of the study

As I am writing a business model for Arctic char farmers, the aim of this study is to answer the following questions:

- What is the different market for Arctic Char fish?
- What could be the beach head market for Arctic char?
- What is the value chain for farmed Arctic char fish?
- What could be the most profitable business model for small scale farm of Arctic Char?
- How would the breeding program be able to affect the future business model?

2. Material and Methods

In conducting research and gathering data, both primary and secondary sources were utilized.

2.1 Database search

Books, reports, case studies, review articles, and research papers are examples of secondary sources. The statistical data and statistics were compiled using numerous web-based data sources. In addition to searches for roe, smolt, arctic char, arctic red, etc., the terms "aquaculture industry," "Norwegian aquaculture industry," "sea-based aquaculture," and "land-based aquaculture" were also utilized. The relevant articles, eBooks, journals, theses, and books were discovered using the Hgskolen I Innlandet database's Oria search engine. Other search engines such as Google, Google Scholar, Science Direct, Springer Link, ACADEMIA, ResearchGate, and NCBI were employed throughout the investigation.

2.2 Interview

Four interview sessions were performed with Arctic char fish end user who love to try different kinds of fish available in the market. Also, some informal questionary was performed with some fish selling associated people. The interviews were carried out in person, in addition to being performed over the phone and over e-mail. The information that was gathered from the secondary sources as well as the interviews was helpful in obtaining the results and formulating the conclusion.

2.3 Observation on Site

Klosser Innovasjons Arctic Char breeding project named “Arctic Red” is situated at Løpet Settefiskanlegg, a fish facility at Rena. The fish facility” has been visited to acquire knowledge about the Arctic Red project. Also visit various fish shop, supermarkets, restaurants in Oslo and Hamar to know the price, their preference, and how they sell the fish.

2.4 Flowchart and Diagram Software

This research makes use of the free web-based diagramming and flowcharting application known as diagram.net. It is a technology that is fully accessible and is the most popular tool

that is utilized for browser-based end-users. The primary objective of diagram.net is to shake up the market with a novel approach to conducting business by means of the distribution of free, high-quality diagramming software that is accessible to all users. Also use the Microsoft PowerPoint to make high-definition graph figure with the help of Microsoft Excel.

2.4 Tools Used for Market Analysis

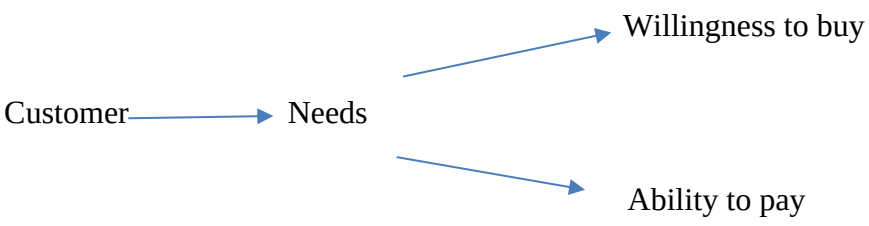
Below mention methods were used to analyse the farmed Arctic Char market.

2.4.1 Market Segmentation

The basic objective of market segmentation is to acquire customers. The fundamental assumption of market segmentation is to identify unique market categories based on the needs, willingness, and ability to pay of users. We must identify the distinguishing qualities between market segments. The criteria used for segmentation must be measurable and connected to consumer demands and product behaviour.

Market segmentation is the process of splitting a huge population of prospective customers into a number of distinct segments. Customers are categorized into groups based on whether they meet predetermined criteria or possess other characteristics that compel them to require the same things. Each market segment consists of customers who respond similarly to marketing strategies. They have same desires, needs, and interests (Aulet, 2013).

The majority of companies lack the marketing resources necessary to reach a wide audience. They must target the specific market segment with the highest demand for their items. Consequently, the company is able to concentrate on providing value to a certain consumer segment in order to create a market that would eventually be profitable enough to generate sufficient revenue. Through market segmentation, the market is divided into distinct but related segments.



2.4.2 Beachhead Market selection

A beachhead method is one in which promoters seek out a specific, well-defined customer profile or market segment that will most likely be the first to purchase the new product or service. It creates a structure for customer involvement, marketing and sales emphasis, and resource management. It is a military word that refers to planning and focusing all of your resources on capturing a small border area that will serve as a stronghold area from which to move into enemy territory as you approach it (Kavanagh, 2011a).

2.4.3 End User Profiling

End user profiling is the process of learning about and creating a profile of the system's end user based on their age, gender, socioeconomic status, expertise, skill set, frequency of use, a nd interests, as well as any other relevant information (Trulock, 2022).

2.4.4 Competitive Analysis and Market Situation

Our company competes with competitors for the same clients. We both provide similar products or services. We are uncertain as to why you succeed on some orders but not others. A competitive study can give us with the road map necessary to enhance your market share and gain a better grasp of the upcoming trends that will impact our market (Fairlie, 2022).

2.4.5 Total Addressable Market (TAM) Analysis

Total addressable market (TAM) refers to the highest number of potential customers that a specific product or service could attract. Or, to put it another way, how large would the market be for a certain product or service if everyone who could possibly benefit from it purchased it or began using it?(Editor, 2022b).

2.4.6 Value Proposition

The term "value proposition" refers to a promise to give a value. It is the primary reason why a potential customer would consider these things. In its simplest form, a value proposition is a simple explanation of how a product helps clients improve their current conditions or solve their current problems. Explains to the ideal customer why they should acquire this product as opposed to a comparable one from a competitor (Chai, 2022).

2.4.7 Value Chain Analysis

A value chain is a concept that describes the whole series of activities that a company undertakes when generating a product or service. These operations commence with the receipt

of raw materials and continue through the delivery of the finished product to the market, encompassing all intermediate phases (Chai, 2022).

2.4.8 Market Survey

Market survey refers to the process of conducting survey research and market analysis for a certain product or service. This method also analyses client preferences. An investigation into the diverse capacities of clients, including investment qualities and buying options. Market surveys are utilized to collect direct input from the target audience in order to gain a deeper understanding of their characteristics, expectations, and requirements (Editor, 2022a).

2.4.9 Unique Selling Proposition and Product Positioning

The proposition, also known as the unique selling proposition (USP), is the distinguishing characteristic or advantage of a product that sets it apart from other organizations. A buyer will acquire this item despite the fact that it is more expensive than other products in its category (Editor, 2022c).

Product positioning is a marketing strategy that focuses the benefits of our product to a certain client demographic that represents our target market. Through market research and focus groups, marketers can choose which demographic to target based on the product's reception (Shopify, 2022).

2.4.10 Distribution

Distribution is the process of transmitting a product throughout the market so that a large number of individuals can purchase it. Distribution is crucial to the success or failure of a business. Simply put, this indicates that the company has a greater probability than its competitors of selling more of its items due to the superior quality of its distribution system (Editor, 2022c).

2.4.11 Business Model Canvas

The business model canvas is a useful tool for gaining a well-organized understanding of a business's model. This canvas can be used to get insight about the clients we serve, the value propositions we give via numerous channels, and the revenue sources of our organization. The business model canvas might be utilized to comprehend either our own organization model or that of a competitor. The Business Model Canvas was established by Alexander Osterwalder of Strategyzer (Author, 2022).

2.4.12 SWOT Analysis

A SWOT analysis is a straightforward yet effective method for developing a business plan, whether we are starting a new company or managing an existing one.

The abbreviation SWOT represents Strengths, Weaknesses, Opportunities, and Threats.

Both the company's internal strengths and weaknesses are under its control and subject to modification. Examples include team members, intellectual property and patents, and location. Threats and opportunities are external events that occur in the market outside of the organization. Benefits from opportunities and safeguards against threats but is unable to alter them. Examples include competition, the cost of raw materials, and consumer purchasing habits (Parsons, 2021).

3. Results and Discussion

Following the results collected throughout the course of the study, several types of literature searches were performed, and experts from the relevant fields were consulted.

3.1 Arctic Char Market segmentation

Market segmentation is the process of dividing a large customer base into smaller consumer groups that include both current and potential customers. Market segmentation is a customer-focused strategy applicable to virtually every market. To divide or segment markets, researchers typically look for similar characteristics such as shared interests, shared hobbies, comparable lifestyles, or even identical demographic profiles. Due to the fact that distinct customers are frequently targeted through differing offerings, prices, promotions, distributions, and other marketing variable combinations, market segmentation indicates that distinct categories demand distinct marketing campaigns (Camilleri, 2018). For instance, if we plan to sell farmed Arctic Char on the market, we must concentrate on certain categories that let us to determine what our target population enjoyed.

Now we will look at the scenario here. Who has the need for the Arctic Char? The customers who will eat Arctic char as an alternative to Salmon. After that, we will have to find out whether the customers have the ability to buy and willingness to pay for the product. The customers will be willing to pay if they find the product useful for fulfilling their needs. For example, we can say that this Arctic char will be tastier, have a mild flavour with more nutrients than salmon. This kind of value proposition will uplift the chance of more sales of the product.

For Arctic char farmed fish, here I tried to find different market segment through various database and market research.

Arctic Char Market breakdown by application

- Food Industry
- Hospitality industry
- Supplements Industry
- Export Industry

Arctic Char Market breakdown by End product type

- Fresh Round and Fillet
- Frozen Round and Fillet
- Processed (marinated, smoked, graved, raked…)

Arctic Char Market breakdown by Distribution channel

- Retail Stores
- Hypermarket/Supermarket
- Online Sales Channels
- Broker
- Framed Store

Arctic Char Market breakdown by region (only focuses on Norwegian fish market)

- Eastern Norway
- Northern Norway
- Southern Norway
- Trøndelag

3.1.2 Market Segmentation Wire Frame Matrix

The marketer must choose which consumer niche to target after discovering and studying the various client segments. Different consumers will have different necessities. For instance, some users may place a higher value on a unique, high-quality product, whilst others may be more concerned with price. However, not every company has the means to deliver satisfactory service to every consumer. Attempting to satisfy every consumer may not be a wise decision. The primary objective of segmentation is to identify segments with high yield. These consumer niches may be the most lucrative or provide room for expansion (Camilleri, 2017). After Basic segmentation of Arctic char market, we can move forward and try to make a market segmentation wire frame matrix based on the applications segment in the front (Table 2). First, we try to identify the end user for different segment, their task in the market and what problem we are solving for them. Then we focus of their urgent of the product and how they will get the fish from the farmers. That can be direct sales from the farm, supermarkets, hypermarkets, fish shop hotel, restaurants, canteens or through export to foreign countries. Then we focus on the competition of these segment and the willingness of the customers to

change a new product. Finally, we focus on the concentration of the consumers and how frequent they are going to buy farmed Arctic Char fish.

Table 2: Market Segmentation Wire Frame Matrix for Arctic char based on the applications

Market Segment Name	*Food Industry*	*Hospitality Industry*	*Supplements Industry*	*Exports Industry*
End User	*Regular people who buy fish from supermarket or online shop*	*Customer of restaurants, hotels etc.*	*Patients with certain condition like heart disease, stroke, depression etc.*	*People in foreign countries*
Task	*Protein source sustainable alternative to salmon fish*	*Protein source, sustainable alternative to salmon fish*	*decreasing inflammation, lowering blood pressure, and improving the function of the cells that line the arteries*	*Protein source for growing food demand worldwide*
Benefit	*High quality easy digestible proteins*	*High quality easy digestible proteins*	Omega- 3 fatty acids, *B vitamins, Vitamin D source*	*Earning foreign currency*
Urgency of Need	*High*	*Medium*	*Medium*	*High*
Lead Customers	*Direct sales, Supermarkets, hypermarkets, fish shops etc.*	*Hotel, restaurants, canteens etc.*	*Supplements industry, oil industry etc.*	*Worldwide fish industries*

Willingness to Change	*Medium*	*Medium*	*Medium*	*Low*
Frequency of Buying	*Medium*	*Medium*	*Low*	*High*
Concentration of Buyers	*Price, taste, type etc.*	*Price, size, colour, taste*	*Nutrients value*	*Price, supply frequency*
Competition	*High*	*High*	*High*	*High*
Other components needed for a full solution	*No*	*No*	*Yes*	*No*

3.2 Beachhead Market for Arctic Char

The aim of the beachhead strategy is to provide concentrate so that the business and its resources may speed the process of acquiring markets, customers, and revenue. Clearly defined, verifiable objectives with specific dates must be established for the beachhead (Kavanagh, 2011b).

- Establish and demonstrate the company's economic viability (customers are willing to acquire the product and/or service, and it is lucrative)
- commercially prove the product or service
- improve the product or service and
- prove/refine the business model

Criteria to Consider when Selecting Beachhead

- ✓ Is the target customer financially secure?
- ✓ Is it possible for our sales team to reach the target consumer with relative ease?
- ✓ Does the customer have a compelling reason to purchase?
- ✓ Are we currently capable of delivering a comprehensive product with the aid of partners?
- ✓ Is there an established competitor that could limit our progress?
- ✓ Can we use our success in this area to gain entry to others?
- ✓ Does the market match the founding team's values, goals, and objectives?(Aulet, 2013).

3.2.2 Beachhead Market Selection Matrix

We must construct a worksheet for beachhead market selection for Arctic Char based on the beachhead market selection criteria (Table 3). Here, I discuss the application section of market segmentation, which can comprise all potential sorts of Arctic Char consumers. The selection matrix takes into account the food sector, hospitality industry, supplement industry, and export industry segments. Economic attraction, the strength of the value proposition, the ability to provide a complete product, competition and strategic superiority of the product, personal alignment, and overall rating, ranking based on value, etc. are taken into account when selecting the beachhead market for Arctic Char. According to market research, the food and export industries are the most economically attractive and capable of providing a good value proposition to customers, followed by the hospitality and supplement industries. Except for the supplement sector, it is possible to give clients with complete products. For the food business and export sector, strategic value and personal alignment are likewise very high, as is the level of competitiveness. The food sector and export industry are ranked highest overall, however the export industry's market needs improvement.

Char is a relatively unknown edible fish in many regions, and chefs are the most knowledgeable about it. The hospitality industry market is easy to pitch the goods to, yet they operate relatively independently, necessitating extensive individual promotion. If we are able to produce and ship large quantities every week throughout the entire year, the export market may become less difficult. This is the greatest issue facing the char industry; production is difficult to distribute equally throughout the year. But if we integrate our product into the salmon supply chain, the fish will reach consumers more quickly. However, if we are unable

to produce these quantities, you will require smaller delivery agreements that can accommodate seasonal fluctuations, as the fish is more difficult to locate. So, we can see that food industry segment of the market for Arctic char is more convenient to be Beachhead for us than others and we can also give complete products as well.

Table 3: Beachhead Market Selection Worksheet for Arctic Char. Rating is Very High (best), High, Medium, Low(worst). Rating for Ranking is 1 (most attractive) to 4 (least attractive) –Key Factors is Most Important Contributor to the ranking

Criteria	*Food Industry*	*Hospitality Industry*	*Supplements Industry*	*Export Industry*
Economically Attractive	*Very High*	*Medium*	*Low*	*Very high*
Strong Value Proposition	*Very high*	*High*	*Medium*	*Very High*
Complete Product	*Yes*	*Yes*	*No*	*Yes*
Competition	*Very High*	*High*	*High*	*Very High*
Strategic Value	*Very High*	*High*	*Low*	*Very High*
Personal Alignment	*Very high*	*Medium*	*Low*	*Very High*
Overall Rating	*Very high*	*High*	*Medium*	*Very High*
Ranking	*1*	*2*	*3*	*1*

Key deciding factor	*Whole product*	*Less competition*	*Product Characteristics*	*High demand*

3.3 End User Profile for Beachhead Market

To achieve success, we must customize our activities to the needs of the individuals we serve, rather than forcing the products or services we intend to market. Each customer consists of an end user and a unit of decision-making. Almost certainly, the end user is an important member of the decision-making group, although they may not be the most significant member (Aulet, 2013).

End User

Typically, the individual who uses our products is a member of the household or business that buys products. According to Beachhead, the ultimate consumers of farmed Arctic Char are the food sector and fish eaters.

Persona

The Persona best depicts the target market's key customer. We are developing a Persona for a single prospective client whose end-user profile most closely matches our own. The process of creating a Persona for our beachhead market makes our target customer tangible, letting the founding team and all workers to focus on the same objective: ensuring the success and satisfaction of our target consumer (Aulet, 2013).

Decision-Making Unit: These factors determine whether a buyer will purchase our product: consisting of:

- Champion: An advocate for the customer's decision to acquire the product, typically the end user.

- Primary Economic Buyer: The buyer who possesses the financial resources necessary to execute the deal. In certain instances, the consumer is at fault.

- Influencers, Veto Power, Purchasing Department, and so on: Those who directly or indirectly impact the Primary Economic Buyer's decision.

The food industry is the beachhead market for the Arctic char market category. Typically, the final consumer is an individual who enjoys trying new fishes and purchases it from a nearby store (Table 4). I tried to create an end user persona using end user profiling matrix.

Table 4: End user of persona of farmed Arctic Char fish food industry segment.

Manager of a fish shop	
Name	*Valentinas Ivanauskas*
Title	*Manager, Fisketorget:The Oslo Fish Market, Oslo, Norway*
Gender	*Male*
Age	*45*
Income	*Around 4,50,000 NOK per year*
Location	*Oslo, Norway*
Aspirations	*Being involved in discovering new concepts/findings.*
Fears	*World food crisis growing every year.*
Motivators	*Fellow employees*
Hobbies	*Travelling around the world, try new dishes/foods*
Values	*Creating value for people around the world whom dying with hunger*
Proxy Product	*Atlantic Salmon*
Watering Hole	*People he knows or find through online forums, direct contacts, online research, YouTube, farmers advertisements, Comparative specifications, videos etc.*
Day in Life	*A normal day includes waking up early in the morning, eat breakfast and then go to the shop, planning sales, talk to other employees, listen*

	to feedback from customers and do inventory for next days. After work go to the gym, watching YouTube for some time and then sleep.
Priorities	*Product Quality* *Product Taste* *Product colour* *Product Price*

3.4 Competitions and Market Situation Today for Farmed Arctic Char

In recent years, the food sector has anticipated the rise of the arctic char market due to the rising demand for protein-rich foods. Increased awareness of the significance of preserving the marine environment and reducing pollution is expected to be a major factor in the rise of the Arctic market. It is anticipated that development, research, and breeding activities will provide farmers opportunities to enter the fish farming and fish processing industries. As previously noted, salmon and arctic char share a number of traits, including red flesh and comparable flavor. In contrast, Arctic char is less fatty and has a softer flavor. According to the Monterey Bay Aquarium, this species is also a sustainable "Best Choice" for consumption (Char, 2014). Although Arctic char reaches sexual maturity roughly 20 months after hatching, its growth rate is comparable to that of salmon. Because it is smaller than other salmonids (about 1.5 kg w/r), its fillet size is likewise smaller. Arctic char production is cost-effective, despite its small scale, due in large part to the use of sustainable aquaculture techniques, which will be crucial for expanding the market (Towers, 2016). The high price of farmed salmon and increasing demand have been the key drivers of income development for aquaculture businesses, which has had a ripple effect on other aquaculture-related industry. Table 5 displays the global report on Arctic char production from 2014 to 2020 *((FEAP), 2020)*.

Table 5 Arctic char worldwide production report 2014-2020 (((FEAP), 2020)

Production (tons) Year SPECIES	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***
Arctic Char	*5491*	*6020*	*6441*	*6354*	*6810*	*6915*
ICELAND	*3411*	*3937*	*4200*	*4454*	*4914*	*4914*
SWEDEN	*1644*	*1675*	*1760*	*1310*	*1310*	*1310*
NORWAY	*285*	*257*	*330*	*339*	*285*	*365*
AUSTRIA	*151*	*151*	*151*	*151*	*151*	*151*
ITALY				*100*	*150*	*175*

3.4.1 Norwegian Arctic Char Markets and Farmers/Producers

There appears to be a lack of knowledge regarding the marketing of Arctic Char. The majority of current Arctic Char markets are in Norway's foodservice and retail industries, where fresh, frozen, dressed, and smoked char is marketed. Although it is theoretically possible to distinguish char from salmon and trout in the marketplace and get a greater price for the species, continuous efforts to do so have mainly been unsuccessful. Currently, prices are higher due to low volumes. The market price of Char is especially sensitive to volume. Currently, dressed char costs roughly 90 NOK per kilogram. There have been reports of fillets selling for as much as 200-300 NOK per kilogram. If char aquaculture production expands without further market development efforts, prices may fall.

Given that less than 7,000 tonnes of char are generated on a global scale, one may anticipate customers to line up outside the doors of producers to get it. However, no single manufacturer has been able to regularly deliver supplies 52 weeks per year, which has hindered the marketing of Arctic char. Instead, a few of small farmers, the majority of whom also raise trout, began to "sell" char at somewhat higher prices than trout. Using this strategy, Arctic char has not been positioned on the market as effectively as salmon and trout. According to a

char producer quoted in Seafood Leader Magazine, differentiating char from salmon in the buyer's view is "the key to selling the fish."

The modest freshwater aquaculture industry in Norway mostly raises brown trout (Salmo trutta) and Arctic char in lakes and on land-based cages. The production of Arctic char is restricted to 38 completely recognized license holders. There are 13 commercial licenses, 4 research organizations, and 53 single licenses, 17 of which are active (Aalvik, 1999). There are some prominent fish farm producers across Norway who are currently farming, and processing Arctic char include: In no order of rank

Hongset Røye

Telemarkrøye AS

Sigerfjord Fisk AS

Blåfjell Drift AS

Sæterstad Gård AS

Norwegian Fish Farms AS

Finnmarksrøya AS

3.5 Total Addressable Market (TAM) Size for the Framed Arctic Char Fish Market

Total Addressable Market (TAM), also known as Total Accessible Market, is the full income opportunity available to a product or service if it achieves 100 percent market share. It aids in determining how much time and money a person or corporation should devote to a new business line (Team, 2022).

The entire amount of arctic char fish sold in Norway in 2020 was roughly 501 metric tons round weight, with a total value of approximately 32 million NOK. In addition, the entire sale value of juveniles in 2020 is precisely 7 million NOK. Therefore, the present total addressable market equals the value of the arctic char market, which is 39 million Norwegian Krone (statista.com, 2022).

Arctic char has a market that is comparable to that of the more visible and well-known Atlantic salmon and trout, whose value for eating in 2020 will be roughly 65 billion NOK; accordingly, the species struggles to increase market share. The creation of specialty markets could be advantageous for Arctic char farmers (statista.com, 2022).

3.6 Value Proposition of Arctic Char

A value proposition is a simple statement that addresses the question, "Why should someone conduct business with us?" The value proposition describes the primary factor that makes a product or service the perfect option for a given consumer segment. Therefore, it must always be prominently stated on a business's website and other client touchpoints. Additionally, customers must be able to comprehend the value offer without further explanation. The value proposition, in my perspective, describes how my product will satisfy the needs of purchasers. In a nutshell, a value proposition is a precise description of how this product solves problems or improves situations for users. Delivers specific benefits and explains to the ideal customer why they should purchase a product rather than one of its competitors.

The value proposition of Artic Char is to produce environmentally sustainable alternative to salmon fish as well as ingredients (vitamin D, Omega-3 fatty acid, vitamin E) for protein-rich nutraceutical supplement. Artic char can be a very good alternative to Salmon fish due to its protein rich flesh and its oil can be proved useful in making the ingredients for the supplements for pregnant women, older people as well as child and adults too.

“Sustainable, environmentally safe, mild flavour with delicate taste, alternative protein-rich fish with lots of health benefits to an affordable price”.

3.7 Arctic char Value chain

Value chain analysis (VCA) is a technique whereby a company identifies the primary and secondary activities that provide value to its final product, and then analyses these activities to reduce costs or enhance distinction. The value chain describes the internal processes a company employs to transform inputs into outputs.

The purpose of value chain analysis is to determine which operations are most beneficial to the company (i.e., the source of cost or competitive advantage) and which can be enhanced to provide the business with a competitive advantage. In other words, the study investigates an

organization's internal operations to determine its competitive strengths and weaknesses. A firm with a competitive advantage based on differentiation will strive to do its tasks more effectively than its competitors. If the company competes on pricing, it will attempt to perform internal operations at a lower cost than rivals. When a corporation is able to create items for less than the going rate or to provide superior goods, it generates profits (Jurevicius, 2022).

The value chain of Arctic char starts when the breeding company producing eggs or fry which integrated horizontally with academic research partner, feed suppliers, suppliers of fish tanks, pumps and other equipment, veterinarian regulatory agencies, microbiology lab, quality control of fertilisation and survival, electrician, water quality control etc. Then the fish farmers producing roe to adult fish in 2-4 four years where water control, feed suppliers, research on market, culture method, Harvesting, security, disease monitoring, growth monitoring integrated to add value to the fish. After that fish has been slaughtered, gutting, filleting, Smoking, preserving, quality management are done by the processors and either sell it directly

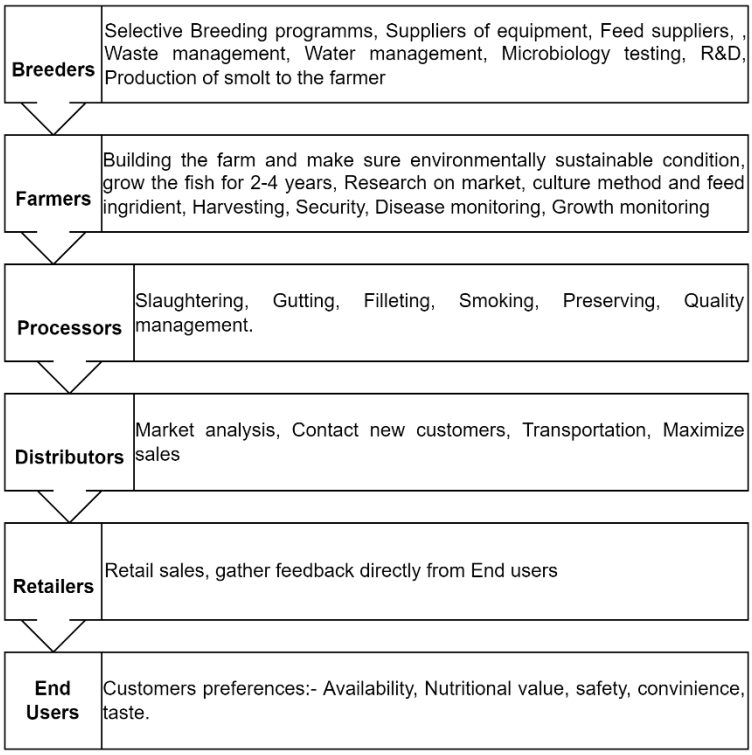


Figure 5 Value chain analysis of Arctic Charr from roe to customers (designed with software from diagrams.net).

to the consumer or sell it through distributors. The distributors do market analysis, manage transportation, try to get new customers, and maximize the sales number. For the beachhead consumer market, distributors sell the fish to the retail shop like supermarket, fish outlet etc.

The consumer buy fish from the retailers based on their preferences like availability, nutritional value, safety, convenience, taste etc and give feedback to them (Figure 5).

3.8 Findings from Farmed Arctic Char Market Survey

Few people with extensive knowledge of farmed Arctic Char were interviewed. The majority of them are from the fish industry or a related industry that is aware of the issue that our product, farmed Arctic Char, is designed to address. In addition, several observations and queries conducted in numerous fish markets in Oslo and Hamar were utilized to build a summary of the market survey report for farmed Arctic char.

Available products- There are both fresh and frozen char fillets as well as whole fish.

Brand- Arctic Char from dependable farmers

Availability- Not available all year around

Key Customers- Direct sales to end users, retail chains, seafood wholesalers, food service distributors, and food service outlets are among the most important clientele.

End Users- People between the ages of 30 and 50 who want to try anything other than salmon

Price- Price varies between 85 and 300 NOK per kilogram

Competitors- Atlantic Salmon and Trout

Demand- Relatively high in the market area where it is renowned for its superiority and originality

Barriers- Uncertain marketing channels, a lack of pricing regulation, insufficient marketing, and weekday-only delivery in Oslo are all obstacles.

Opportunities for the Future: Effective marketing, branding, and storytelling

3.9 Selling propositions of Farmed Arctic Char

A unique selling proposition, or USP, is a representation of the qualities that define a product and, ultimately, make it advantageous for a potential client or target market. Essentially, it responds to the questions... How are we superior to the competition? Alternatively, why should the client choose us above the competition (Jefferson, December 4, 2019) ? A unique selling proposition (USP) may be an authentic differentiator or specialization, or it may be a proven truth. The development of a distinctive selling offer is becoming increasingly adaptable and versatile. A corporation may have dozens of USPs, particularly if it serves several customer personas and provides a wide range of products and services. The objective of a USP is, once again, to target a certain market segment or need and fulfill a promise. A unique selling proposition is what differentiates us and our product or service from the competition and effectively conveys the benefits to the customer (USP) (Hirschberg, 2022). As a relatively new fish in the market, the unique selling proposition of farmed Arctic Char should be something its competitor like salmon can't offer. The selling point can offer by Arctic Char farmer should include following.

- Sustainable famed fish
- Mild flavour with better test
- Affordable price
- Red meat color
- High nutritious value
- Farm consistency

3.9.1 Head-to-Head Positioning Canvas Between Arctic Char and Atlantic Salmon

Arctic Char has a distinct light, sweet flavour and firm red flesh that is similar to salmon, though milder. It is nutrient-rich and an excellent source of heart-healthy Omega-3 fatty acids. Arctic char has a higher protein content than salmon. It is also a good source of vitamin D and B12 (Figure 6).

If people are put off by farmed fish, they should be aware that Arctic Char is considerably more environmentally safe than salmon. Arctic Char receives the "Best Choice" eco-rating from the Monterey Bay Aquarium Seafood Watch, but salmon only receives the "Good Alternative" or "No, Thanks" grades (Blog, 2022). Individuals who aspire to make a difference

in the world can benefit from this environmentally beneficial long-term solution. Arctic char requires one-tenth the amount of land and generates one-hundredth the amount of garbage as farmed salmon. Finally, salmon are raised in hatcheries, which may be detrimental to the ecosystem, while arctic char inhabit cold, clean water. Because it requires less food and generates less waste, arctic char has a smaller impact on the environment than salmon. Because it is less sensitive to disease than salmon, fewer antibiotics and other chemicals are required (Facts, 2022).

Salmon is typically more flavorful than arctic char. If you like milder seafood, Arctic char is an excellent option. Furthermore, because salmon has more fat than arctic char, it has a stronger flavor and cooks up juicier. Char is typically more expensive than salmon due to its rarity. Char should be more expensive than salmon because it is not produced as intensively. The rising demand for the distinct flavor and texture of char has led to a price increase. In contrast to other upscale fish, however, it is not unduly pricey (Garce, 2022). Finally arctic char has the better color than salmon, but it stays shorter time.

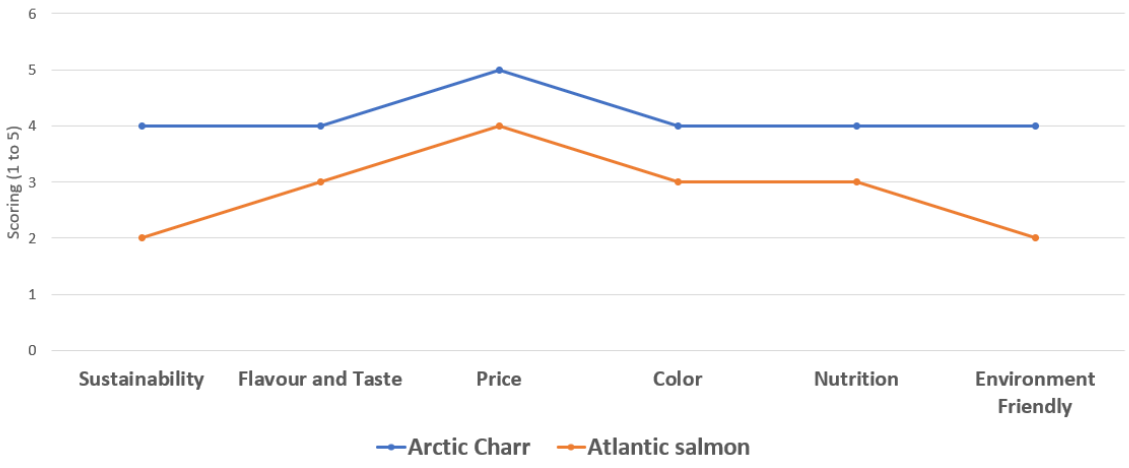


Figure 6: Head-to-Head Positioning canvas: Arctic Char vs Atlantic Salmon

3.10 Pricing Framework of Farmed Arctic Char

Currently, Arctic char is more expensive than salmon and trout. On the massive market, farmed Arctic char has been selling for no less than 90 NOK per kilogram; however, this price is frequently for little fish (i.e., less than 0.9 kg). Various fish markets in Oslo often charge 25-35 NOK/kg more for Arctic char than for Atlantic salmon. According to study, a fish weighing more than 1.36 kilograms might get a price of 100 Norwegian Krone per kilogram. In recent years, Arctic char prices have been consistent with recent market data from a variety of sources.

Arctic Char are exceptional fillet fish with a very high standard price. In Oslo and Hamar, Arctic Char fillet costs between 260 and 290 NOK per kilogram. In contrary, the price of farmed Arctic char in Norway ranges from 300 to 500 NOK per kilogram (2022).

In contrast to the trout industry, which has shifted to the manufacture of 227–284-gram boneless fillets, char is typically still provided dressed/gutted, head-on (DHON). Due to the presence of microscopic pin bones, Arctic char cannot be filleted in the same manner as trout and salmon. Wild-caught char is typically frozen, but farm-raised food is virtually always advertised as fresh. While most markets prefer fish weighing between 0.91 kg and 1.81 kg, the foodservice industry (hotels, restaurants, and institutions) is experiencing an increase in demand (and price increases) for fish weighing between 1.81 kg and 2.72 kg. The majority of individuals believe that farm-raised char is superior to wild-caught char.

Because domestic production of farm-raised arctic char will remain significantly below mass market tonnage for the foreseeable future, it is anticipated that char prices will remain stable for some time. Therefore, it is reasonable to assume that the processed char value of one to two kilograms of gutted fish would be around 100 to 110 NOK.

3.11 Farmed Arctic Char Distribution

Norwegian Arctic char fish farmers are able to consistently supply fresh, high-quality products, they will be able to effectively compete with Norway's lower-priced trout products. Once the fish reach market size, farmers are required to sell them to a processor, however in rare situations they may shift the fish to their own processing facility. As seen in the accompanying image, there are a variety of ways to transport a product from the processing plant to the market (Figure 7).

Frequently, brokers are employed to assist with large-scale sales. In exchange for a commission on sales ranging from 3 to 5 percent, brokers find customers and coordinate shipments. Brokers are often compensated after the cargo's processor has been paid. Multiple processors have agreements with multiple brokers to reduce the risk of selling to only a few large clients. Typically, each broker is granted an area in which to sell the product.

Generally, distributors mark up a product by 5-20% and manage a product line (exclusively seafood or a variety of foods). When a processor deals directly with a distributor, the product price is often higher, but the processor must have sufficient inventory to match the distributor's volume requirements.

Occasionally, processors collaborate with retail or culinary companies. This is frequently possible in specific circumstances, including accounts with exceptionally high-volume requirements, accounts with exceptionally low or irregular volume requirements, or niche markets for speciality commodities. The processor must maintain a huge operation 52 weeks per year to ensure product availability and consistency for high-volume customers. Smaller market competitors frequently manage specialized and low-volume customers. The accompanying diagram demonstrates common pathways for fish dispersion.

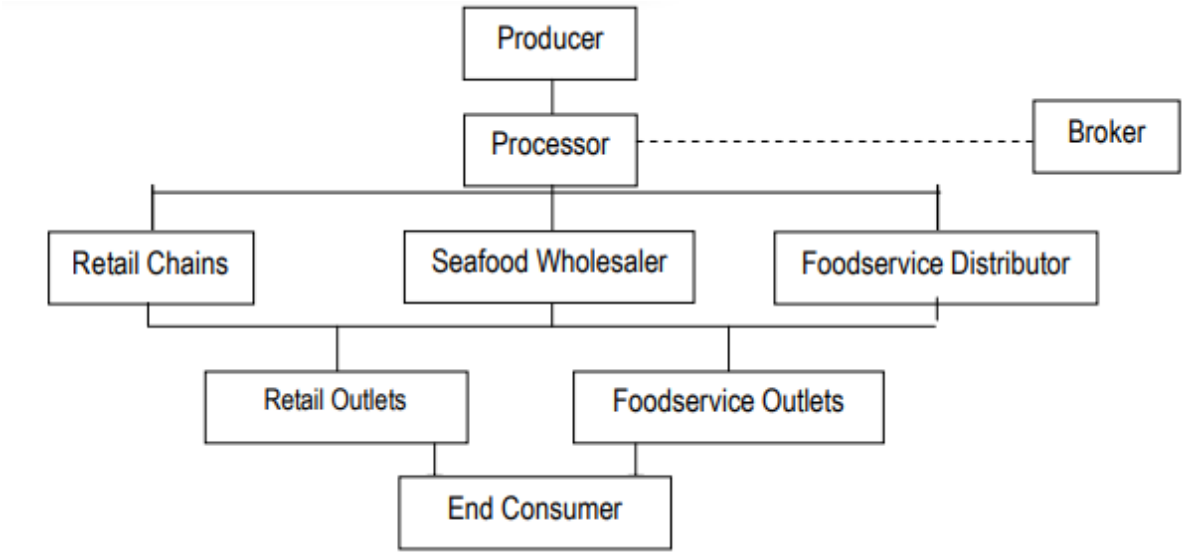


Figure 7: Norwegian Farmed Arctic Char Distribution Channel (designed with software from diagrams.net).

3.12 Most Profitable Business Model for Farmed Arctic Cahrr

There are two marketing option for Arctic char farming in a land-based facility.

- Selling to high volume buyers (wholesalers)
- Niche markets

To establish profitability, a niche market is the most cost-effective strategy for a small-scale aquaculture business. A high-value fish with an acceptable premium price is required for a small fish farm with an annual yield of no more than 30 tons. Despite the fact that salmon and trout farms have a variety of competitive advantages in terms of sustainability, these niches can supply significantly less expensive fish, which could pose a threat to Arctic char farms.

To assess how a company alters its business model, it is essential to comprehend how it performs, provides value to customers, and maintains profitability. Combining value creation and delivery, value proposition, and value capture led to the creation of a sustainable business model. Determining how to capitalize on new opportunities, markets, and revenue streams is necessary for creating and delivering value. Value capture involves considering how to earn revenue, while value proposition focuses on the product that generates economic return.

Following is the Business Model Canvas prepared for Arctic char farming based on the nine building blocks canvas model of Osterwalder and Pigneur:

Key Partners

- ✓ Breeders
- ✓ Investors
- ✓ Processors
- ✓ Distributors

(Retail outlets, Foodservice outlets)

Key Activities

- ✓ Product making/ growing
- ✓ Sales & Marketing
- ✓ Partnership & Collaboration

Key Resources

- ✓ Fish material/Roe
- ✓ Infrastructure
- ✓ R&D
- ✓ Highly skilled employees

Value Propositions

People

- ✓ High Value Product
- ✓ Delicate Texture
- ✓ Mild Flavor
- ✓ Contain PUFA, Vitamin and Omega 3

Planet

- ✓ Sustainable Land-based farming
- ✓ Environmentally safe
- ✓ Efficient Use of Resource (water)
- ✓ Effective Use of Land

Customer Relationships

- ✓ Direct meeting With respective sales outlet
- ✓ Personal assistance with dedication

Channels

- ✓ Farmers to end user (direct sales)
- ✓ Farmers to processors to distributors to retail outlets to end users
- ✓ Online sales

Customer Segments

- ✓ Norwegian consumer market
- ✓ People of 30-50 years
- ✓ Lovers of traditional Norwegian food
- ✓ People who love to eat fish

Cost Structure

- ✓ Structure cost
- ✓ Feed cost
- ✓ Operating cost
- ✓ Marketing cost

Revenue Streams

- ✓ Product sale (85-300 NOK/kg)

3.12.1 Choice of Appropriate Technology

There are currently two approaches for land-based farming, and the geology determines which method to employ. Recirculating aquaculture systems (RAS) can be installed anywhere, unlike conventional flow-through systems (FTS), which must be placed near a shoreline. To save money and decrease water consumption, RAS technology can be implemented near to the market. RAS, on the other hand, necessitate a greater capital expenditure and land area than FTS, as well as a much higher operational complexity. Our research indicates that RAS is gradually replacing FTS as the primary land-based farming method on a global basis. Land-based salmon farming, and RAS technology in particular, is not without its difficulties. An important concern is the effective management of microbial conditions and water chemistry. Due to the difficulty of maintaining biological conditions in land-based facilities and the susceptibility of very young fish to poor water quality, recent examples from major land-based facilities demonstrate that the sector may suffer massive mortalities and fish may be tainted with an earthy flavor (Howell, 2021).

3.12.2 Selling in Premium Prices

Aquaculture on land benefits both the habitat and the fish. Our comparison of models for Arctic char farming on land and salmon production in the water indicates that the capital expenses per unit of annual production for land-based RAS farms are significantly higher than for sea-based salmon farms. Similarly, production expenses for salmon fish farming have increased significantly; in 2005, they were 20.14 NOK/kg, whereas in 2019, they were 30.76 NOK/kg (Aalvik, 1999). Increasing feed prices and costs connected with environmental and health concerns have mostly contributed to growing production costs. Due to rising input costs and a krona depreciation, higher feed costs were the result of higher feed prices (Howell, 2021).

Due to the transition to larger smolts and higher investments in RAS facilities, smolt costs have increased marginally over time. Real earnings have also barely increased. As air freight expenses are added to rising production costs, the cost differential between land-based and net pens is narrowing, making it more likely that land-based farms will be able to compete with the costs of open sea cage farming in the future (Aalvik, 1999). If this is achieved in conjunction with high expenses, land-based may reach its commercial potential.

3.12.3 Aquatic Expertise

Land-based Arctic char farming need more than just money and technology to be successful. Over the past two decades, Norway's expertise in state-of-the-art RAS facilities has been in high demand internationally, especially in relation to the farming of several species. Land-based systems, notably RAS, require extensive and in-depth knowledge of aquaculture farming and fish biology to understand the complexity and integrate technology to aid biology. Therefore, aquaculture experience is one of the most crucial criteria for ensuring the maximum biological performance and profitable management of a land-based Arctic char farm (Howell, 2021).

3.12.4 Building the sustainability credentials of land-based farming

One of its most compelling themes has been the improvement of land-based farming's sustainability. The primary contrast used to sell land-based farming as a more "sustainable" Arctic char product than salmon produced in conventional open sea cage farms on the other side of the globe has been the elimination of airfreight and the convenience of the farm to the market. In contrast, a Sintef, NTNU, and SNF study comparing land-based farming and net

pen production in Norway found that land-based farming will have a carbon footprint that is 28% more than net pen output.

Due to the lack of actual data and the fact that land-based production is still in its infancy, this number is extremely reliant on FCR ratios, the electricity mix, and the combination of all of these factors. According to this study, there is some uncertainty regarding the environmental advantages of land-based production vs traditional open pen production on a worldwide scale, and land-based agriculture must make greater efforts to establish its sustainability credentials. However, ocean aquaculture is not at a standstill. To enable long-distance sea transportation routes, salmon farmers are launching new pilot projects from land to sea using low-carbon fuels and cutting-edge freezing technology. If efficiently implemented, these enhancements will minimize the carbon footprint of sea cage farming, increasing the burden on land-based agriculture to show its sustainability (Howell, 2021).

3.13 Farmed Arctic Char SWOT Analysis

Based on the research, SWOT analysis was performed to analyse different internal and external factors of Farmed Arctic Char fish. Not just early but SWOT is the first step in business planning to identify potential market opportunities.

Table 6: SWOT analysis of farmed Arctic char

Strength	**Weakness**
✓ Perfect fit for land-based agriculture consequently increases its sustainability ✓ A source of vitamin D, vitamin E, and omega-3 fatty acid ✓ Meat with improved color and quality ✓ Market's highest wholesale pricing	✓ Farmers have limited access to commercial producers of roe and fry. ✓ Lack of breeding program and beginning of broodstock development - Early sexual maturity ✓ Slow growth ✓ Very few details regarding industry niche and client needs

✓ More disease and stress resistant than salmon ✓ Outstanding fillet yield and delicate texture ✓ Tolerate of cold water ✓ Can be stored at a higher density	✓ Unfamiliar to the majority of customer segments ✓ May generate a significant amount of visceral fat ✓ Expensive production ✓ Not aggressive feeder ✓ Facilities consume more energy
Opportunity ✓ Appropriate option for lovers of grilled fish -Can be used for sushi and sashimi ✓ Can be sold at a premium price when processed ✓ Suitable substitute to Atlantic Salmon owing to flavor variance. ✓ Ideal for lovers of traditional Norwegian cuisine. ✓ Strong initiative on the part of the Norwegian government to promote land-based agriculture.	**Threat** ✓ Zoonotic disease transmission ✓ Competition from salmon and rainbow trout farming ✓ Strong environmental legislation. ✓ Lack of investor enthusiasm for financing

3.13.1 Internal Factors

Strengths and weaknesses of the company designed are included in the internal factors. A company has full control over internal factors so it can make strategic plans to exploit strengths and address weaknesses.

Strengths

When analyzing the suggested Arctic Char farming capabilities and resources, the highest price, the highest quality red meat, disease resistance, stress resistance, cold water tolerance,

outstanding fillet yield, good flesh flavor, and delicate texture perform very well as farm strengths. The aforementioned elements combine to create a strong brand and a distinctive product. The fundamental advantage of Arctic Char farming is that it can provide a sustainable alternative to ocean-based salmon breeding. There are significant distinctions between growing in an aquaculture facility and farming on land. Many of these are the result of land-based operations' improved production environment control and separation from the surrounding environment. On its intake water, a land-based plant can use water treatment procedures. This eliminates any harmful pathogens or sea lice before the water enters the facility. Significantly more advantageous than sea-based aquaculture is the ability to raise Arctic char without worrying about sea lice or other diseases. In the absence of sea lice treatments, fish health, biological development, and mortality may all considerably improve. Large direct expenses, including the cost of treatment, the quantity of sea lice found, monitoring, and preventative actions, are also excluded. In addition to these benefits, disease prevention renders medication and the chemicals employed in treatments outdated. A more consistent production environment in aquaculture facilities benefits the health of fish. A more steady oxygen supply has beneficial effects. In addition, land-based facilities may maintain an optimal water temperature between 12 and 14 degrees Celsius during the whole production cycle (Solheim & Trovatn, 2019b). This provides greater growing conditions compared to farming on the ocean floor.

Compared to conventional farming, increased control over the production environment may result in improved product quality. Additionally, it permits increased product customization in response to market need. When the temperature during the growth cycle remains steady, the fish grows more steadily. In addition, by using different tanks at different phases of their lives, fish can be exposed to the optimal flow conditions throughout the duration of their lives. Both of these characteristics of land-based aquaculture have the potential to improve the quality of fish meat in comparison to fish grown in water. Additionally, the fish can be cultivated to achieve the color chosen by the consumer. This could increase the price of land-caught Arctic char. In addition, buyers may value the fact that land-based farming allows for total traceability of persons. A highly regulated production environment may limit fish loss throughout the manufacturing process. The correct and consistent water temperature may aid in preventing smolt mortality. In addition, eliminating the need for wellboat transfer could reduce loss. As noted previously, the absence of lice treatments dramatically reduces loss. Due to the

decreased amount of fish wasted during processing, the sector may reap substantial economic and fish welfare benefits (Fiskehelserapporten, 2019).

Additionally, farming on land offers safer working conditions than aquaculture. Moreover, given a comparable output volume, land-based agriculture may require less labor due to increased automation and complexity of production operations. Due of the stable water temperatures, land-based facilities are able to produce more consistently than those located at sea. The advantages of land-based aquaculture, such as superior product quality, more sustainable production, and improved fish health, may result in a price premium on the market. While industry sources said a 5-15% price rise was likely, the researcher utilized a 30% price premium. The true price achievement has not yet been evaluated, although it may be advantageous for Arctic char raised on land over salmon raised on the ocean floor (Solheim & Trovatn, 2019b).

Weaknesses

Numerous issues prohibit the farm from operating at full capacity. To be competitive, farmers must overcome their vulnerabilities. There is little availability of commercial roe and fry to farmers. Due to a lack of breeding and broodstock growth, the maturation period of this fish is longer than that of other breeds, which might be disadvantageous to fish farmers. Arctic char has the lower value chain than salmon due of consumers' unfamiliarity with it. Customers and market segments are poorly studied. Sometimes, Arctic char is an oily fish that can produce significant amounts of visceral fat and cholesterol.

Land-based facilities consume more energy than their aquatic counterparts. Ventilation, air pumping to vent CO2, water pressurization to add oxygen, water pumping, water treatment, temperature adjustments, and ventilation are the energy-intensive processes. Sludge and other production-related pollutants, in addition to smolt and the processing facility, necessitate energy (Solheim & Trovatn, 2019b).

Despite all the advantages of land-based agriculture, production costs per kilogram are considerable, according to the data. Due to high production costs per kilogram and total capital requirements, this agricultural method appears to be very price sensitive. Breeding, fertilization, and hatching require skilled labor and optimal conditions, which increases the cost of farming. Initial investment and recurring expenses increase the farm's selling price.

High pricing may discourage purchasers from purchasing high-quality goods (Solheim & Trovatn, 2019b).

There may be disease in land-based institutions. In addition to intake water, roe, smolt, and fish are significant sources of infection. When externally produced roe enters the facility, it may be contaminated. Infected water may potentially pass through the water filtration system due to technical issues. Under these conditions, improved manufacturing environment and water recycling can be detrimental (Fiskehelserapporten, 2019).

Land-based facilities may be more hazardous than offshore ones. This could be due to the fact that these facilities are young, and the technology is uncertain. This includes the possibility that the facility will not meet its volume, quality, or cost per kilogram of biomass objectives (Bjørndal, 2018). Fish health and welfare concerns may potentially influence the variables listed above. Comprehensive planning and risk management are required to achieve production and facility utilization objectives (Bjørndal, 2018). According to Bjrndal (2018), it is difficult to achieve the 1.5 to 5.0 kg growth rate. This has reduced anticipated harvest weights to 4.0 kg (Solheim & Trovatn, 2019b). Technological risk encompasses facility-based concerns. H2S, which is produced by the decomposition of organic matter, is capable of causing widespread mortality. Avoid biological buildup and excessive eating. Biological RAS filters are sensitive to H2S. Several active RAS facilities have had this issue, which may have contributed to an increase in mortality. Prevention includes the use of RAS-specific feed (Fiskehelserapporten, 2019).

Design can sometimes be dangerous. CO2 concerns exist at RAS facilities utilizing seawater (Fiskehelserapporten, 2019). The piping, pumping, and water treatment systems must be built to ensure a constant water flow and to prevent stagnant water. The structure is dependent on a steady water supply (Solheim & Trovatn, 2019b).

3.13.2 External Factors

External factors include opportunities and threats that are outside a business. A farm may be able to influence such factors, but it cannot have full control over them.

Opportunities

This section includes all external factors that contribute to a firm's strategic advantage. The Arctic char industry benefits from the initiative and influence of the Norwegian government. Consider the impacts of the Arctic char farm on the environment and true sustainable

development. In Norway, the regulatory trend has been to permit biological variables to limit the expansion of aquaculture productivity. On the other hand, recognizing biological and environmental consequences is a question of expert judgment and political choice. In recent years, the sea-based salmon farming industry has experienced an increase in expenses due to the need to comply with existing regulations. This trend is mostly attributable to severe biological difficulties, which have had a substantial impact on both operating and capital expenses. Due to a greater emphasis on fish welfare and environmental impact, future acceptability of sea-based salmon farming conditions may decline, while acceptance of land-based Arctic Char farming may increase (Solheim & Trovatn, 2019b). Arctic char is suitable choice for the lovers of grilled fish, can be used for sushi and sashimi, can be sold at a premium price when processed, suitable substitute of Atlantic Salmon due to variation in taste, suitable for traditional Norwegian food lovers make it mor competitive in the fish market.

Threats

External factors that are averse to the business's future are among the dangers. Atlantic salmon dominates the Norwegian fish market and is widely available in shops, restaurants, and homes. Innovative products, such as vertical Arctic Char, face a substantial obstacle in competing for the ever-present market. For Arctic Char farming operations, higher selling prices are both a challenge and a vulnerability. There is no proof that people would pay more for Char fish, therefore this could pose a threat to the company. The operational assumptions developed during the facility's design are necessary for the economic success of land-based agriculture. Specifically, achieving the desired fish density, EFCR, and growth function is crucial. If it turns out that the assumptions made about these features cannot be met, facilities may lose their economic appeal. This could have a negative impact on the expansion of the land-based char farming industry. A situation such as this could result in a significant drop in investment in land-based agriculture technology and the cessation of commercial-scale operations. Research and development may now take center stage in order to demonstrate the viability of the technology, which looks necessary prior to the emergence of new commercial ventures. Strict government measure and lack of investors also pose a threat to Arctic char farming.

3.14 Suggestions for further research

When data collected that has been verified becomes available, it is recommended that more researchers do a similar study. This could provide a more accurate depiction of the market trend for Arctic Char farming on land. Also recommended are further studies on the fish pricing structure and a study of the product's COGS. Comparing alternative agricultural technologies with land-based agriculture could assist the sector in identifying the most attractive unconventional development prospect. Lastly, I recommend conducting additional research on the large-scale Arctic Char farming industry in Inland County in order to gain access to the Atlantic salmon farming supply chain.

4. Conclusion

Land-based Arctic Char farming is a brand-new industry that has recently received considerable attention. It appears that the production costs of land-based Arctic char operations are quite variable. A proper evaluation is lacking because to the lack of high-quality performance data from commercial char systems. The majority of current land-based businesses fall below the minimum production barrier and exhibit variable stock performance (e.g., survival, growth, feed conversion) between lots, which is required to generate a stable financial return. Lack of a substantial national/regional genetic selection program to improve the quality and characteristics of Arctic char stocks available to farmers exacerbates a portion of the problem. Freshwater aquaculture is not prioritized by the current regulatory and legislative framework for fish farming. The public attitude is frequently impacted by media coverage of concerns associated with Arctic Char farming. Three pillars support "sustainable development": economic growth, environmental protection, and social well-being. Positive and negative social elements of freshwater aquaculture have received little attention. As a result of the consolidation of farmed fish customers, significant clients are requesting (year-round) greater and more constant volume from suppliers (retail & food service).

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