

The Norwegian Aquaculture Analysis 2020

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The EY logo consists of the letters 'EY' in a bold, white, sans-serif font. The 'E' and 'Y' are connected at the top. A yellow triangle is positioned above the 'Y', pointing downwards towards the letters.

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The Norwegian aquaculture and fishing industry – introduction

Dear distinguished reader,

We are once again honored to publish our annual analysis and report. This year is the fifth consecutive year we present an overview and our view on this prominent sector for the Norwegian economy.

It is motivating to see that the analysis has become an appreciated benchmark tool and trend guidance not only for the industry but also for the service providers and investors with interest in this sector.

We share insights on developments within operational and technical solutions. We also give you our forecast of key performance indicators for the sector together with the answer as to how last year's forecast performed against actuals.

In our fifth report, we have extended the scope to also include a chapter giving an introduction and update on the Norwegian fishing industry.

As always, the report focuses on a topic of special interest and relevance for the industry. In last year's edition, the focus was on the continuance of the challenge of balancing growth and sustainability within the Norwegian aquaculture industry, together with a status on land-based aquaculture.

Land-based aquaculture is relevant now more than ever. Therefore, we have focused on land-based aquaculture this year as well. We have also looked into the crystal ball together with external industry professionals. Based on this, we have provided our view on the potential state of the aquaculture sector in 2040, including opportunities, pitfalls and global widespread.

The extensive EY seafood company database (EY-SCD), with a broad volume of key financial figures, includes key data for 1,082 companies within the various segments of the aquaculture value chain – ranging from technical solutions to production and export of salmon and trout – substantiates both the quantitative and qualitative analysis presented.

Key financial data for 2,399 companies, within the fishing industry, is now also included in the EY seafood company database.

The EY organization, as a multidisciplinary provider of professional services to the industry, possesses in-depth insights into the characteristics of each value chain segment. The segments are seamlessly tailored with EY core professional services within Consulting, Strategy and Transactions, Tax and Legal Services, and Audit and Accounting. Specialized seafood sector teams are located in numerous seafood clusters and marketplaces around the world.

When analyzing the industry, we have identified the following key megatrends that will affect the global food industry and salmon, in particular:

- ▶ Growing world population
- ▶ Digitalization
- ▶ Growing middle-class together with urbanization
- ▶ Health-conscious consumers
- ▶ Resourceful planet focusing in sustainability and exploited resources

These trends will significantly impact the global potential and development on both the supply and demand side.

For the seafood industry, global trade and export to distant markets may face increasing challenges. Not only do we see protectionist discriminatory interventions, such as toll barriers and break up of Trade Agreements and Unions, there is also an all-time high number of armed conflicts together with a populism index (reference: Global Trade Alert) on levels in line with the late 1930s. Seen from a global perspective, this may, in the short term, impose obstacles for global export. Hence, it may lead to structural implications in the location of production – potentially making land-based aquaculture, close to consumers, the only secure supply option in certain situations, driving new projects. The logistical challenges brought on by COVID-19 have underlined the potential vulnerability of global trade.



Basing oneself on a larger global framework with implications more significant than those created locally is vital when analyzing trends. We observe an increasing consciousness and awareness, within the value chain and end-consumers, about sustainability and preventive health. This awareness affects the whole value chain and not just farming. The latter has been experiencing volume constraints due to biological challenges, regulations and a need for technical development. The growth of the industry is highly dependent on solving the existing challenges on present volumes, as well as growing its perspective on the global consumption potential.

As for a range of other industries, we see a noticeable shift in the attitude and investment that support sustainable value creation. Given the fact that salmon constitutes a marginal volume of the global seafood production with margins having attracted investment in R&D resulting in knowledge and insights learned,

the potential to transfer the value of know-how and applied technology to other species and agriculture sectors globally is considerable.

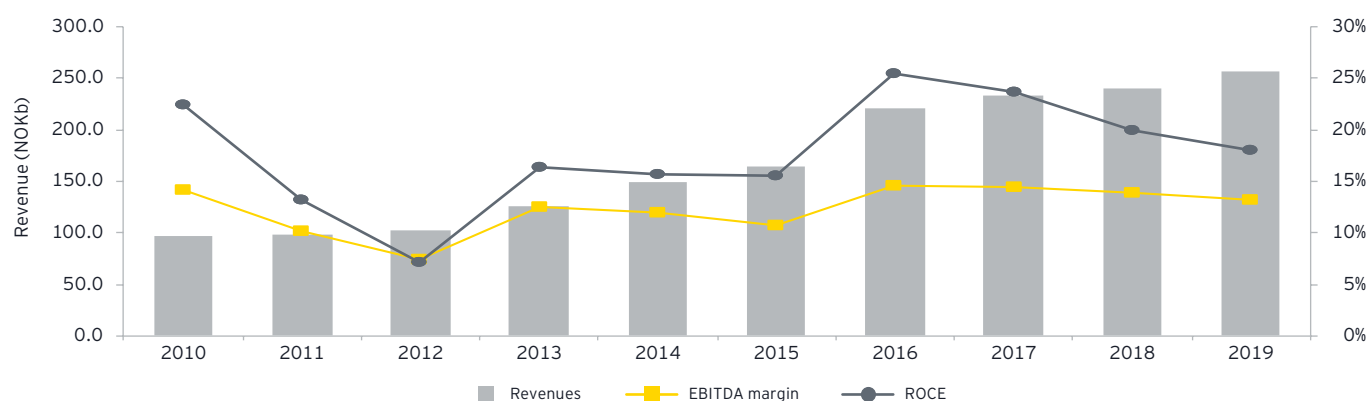
We sincerely hope you find this report useful and interesting. Please don't hesitate to contact us to discuss the aspects of this exciting industry.

Eirik Moe
Sector Leader, Aquaculture and Fisheries



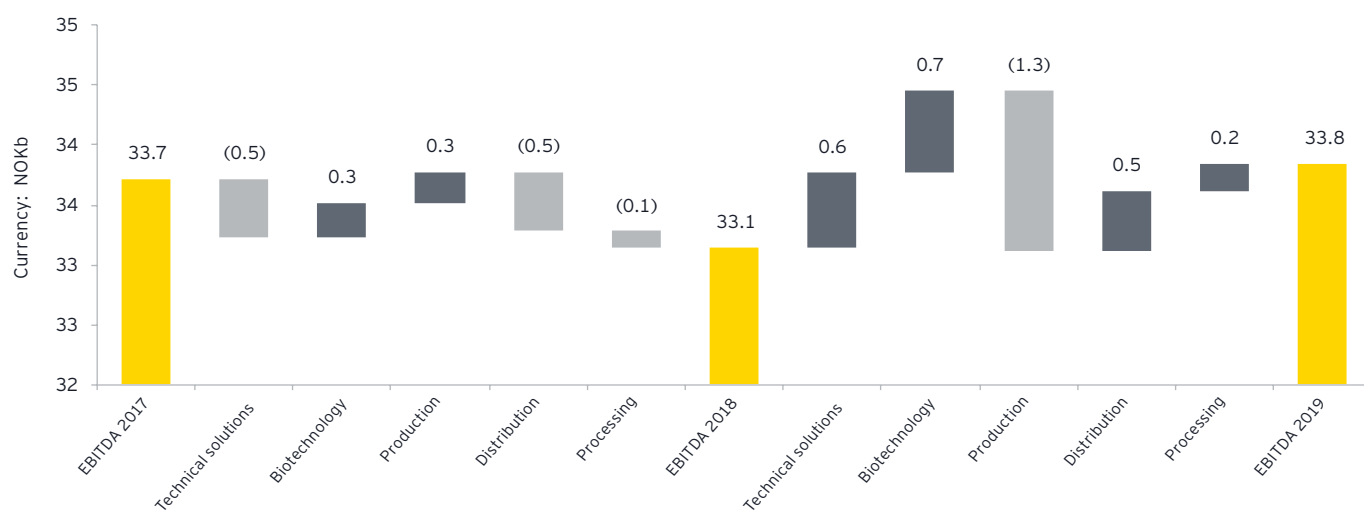
Key highlights

The Norwegian aquaculture industry 2010-19



- ▶ Once again, we observe revenue growth for the Norwegian aquaculture industry. Despite top-line growth, EBITDA margins have steadily decreased since 2016.
- ▶ For the first time since 2014-15, the production segment has a negative EBITDA development, as shown in the below chart. In fact, the production segment is the only segment in the analysis that has a negative EBITDA change from 2018 to 2019.
- ▶ Over the following pages, we will provide some comments on the key changes since last year's edition. In addition, a complete 10-year history and further description and analysis can be found in the appendix toward the end of this report.

EBITDA bridge 2017-19



Technical solutions

Transactions

- ▶ In 2019, 15 deals, involving companies from the segment, were announced. In nine of the transactions, companies from the segment were the target, with mostly strategic buyers.
- ▶ Thus, indicating a continuing trend of companies using Mergers and acquisitions (M&A) as a way of growing the top line through strengthening product offerings and market position.

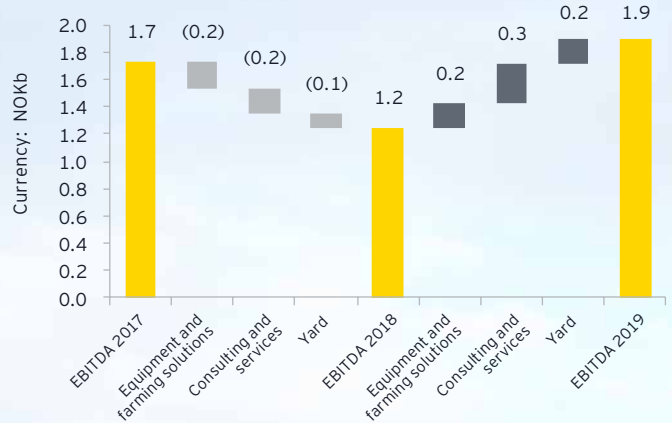
Export

- ▶ Our export number mapping shows that export from this segment increased from NOK 1.6b in 2018 to about NOK 2.0b in 2019 (up 25%), which is a positive trend. Since not all companies report export numbers, the total is likely to be somewhat understated.

Recovery in the Technical solutions segment

- ▶ In 2019, the technical solutions segment recovered from the low EBITDA levels witnessed in 2018. Companies reported high activity levels, coupled with improvements in project profitability through better planning and improved efficiency. That led to an increase in EBITDA by NOK0.6b, resulting in an EBITDA-margin of 7.1% (up from 5.4% in 2018).
- ▶ In this year’s analysis, we have introduced yards as a separate subsegment (previously, it was included as part of the equipment and farming solutions subsegment). Companies in the yard subsegment experienced high activity within newbuilds and reported record high revenue levels in 2019

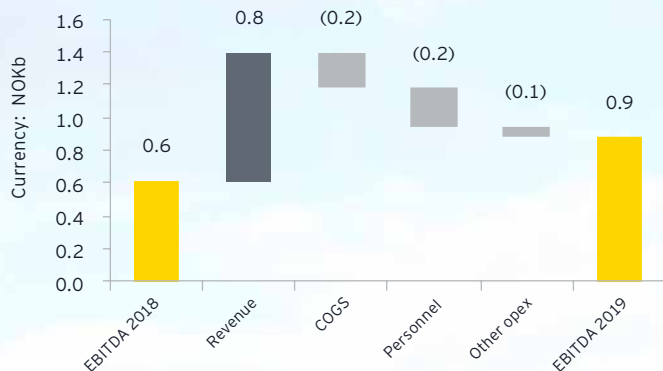
Segment EBITDA bridge



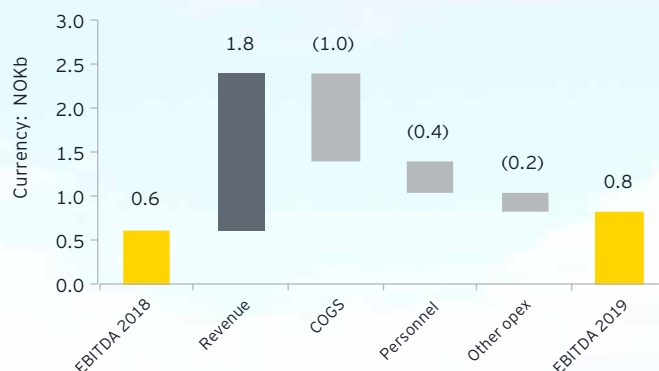
due to continued booming demand. This was especially the case for companies with high exposure to the well-boat market. Although the yard subsegment has historically struggled with low profitability levels, with EBITDA margins close to zero in 2018, the subsegment achieved a margin of 4.8% in 2019 – the highest margin in five years. One of the main contributors to this development was one company that improved EBITDA by NOK50m in 2019 (31% of the subsegment’s increase), recovering from last year’s losses caused by delays, and nearly doubling their newbuild activity in 2019.



Consulting and services EBITDA bridge



Equipment and farming solutions EBITDA bridge



▶ The consulting and services subsegment were the main contributor to the improved bottom line in the technical solutions segment in 2019. Companies continued to achieve high gross margin (72% in 2019), and by reducing personnel expenditures in % of revenue, this resulted in an increase in EBITDA margins from 9.9% in 2018 to 12.6% in 2019. More specifically, the service boat providers in the subsegment were able to increase profitability through cost-cuts, overall improvements and more efficient operations.

▶ The equipment and farming solutions subsegment saw double-digit revenue growth from 2018 to 2019 (12.7%). This massive growth was driven by a general growth seen throughout the subsegment for companies of all sizes. Looking at companies with more than NOK10m in revenue, we observe that more than 60% of them saw their revenue increase from 2018 to 2019.

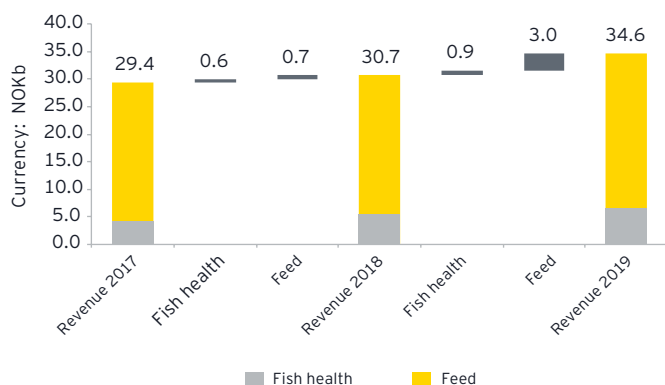
▶ This subsegment remains fragmented and highly competitive. While the revenue growth did raise EBITDA margins from the 10-year low of 2018, the 2019 EBITDA margin of 5.2% is still well below the 9.0% observed in 2016.



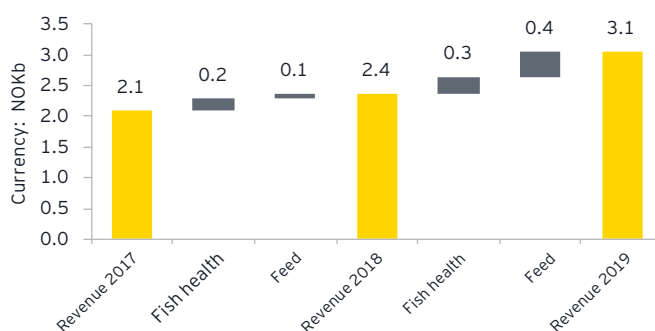


Biotechnology

Revenue bridge



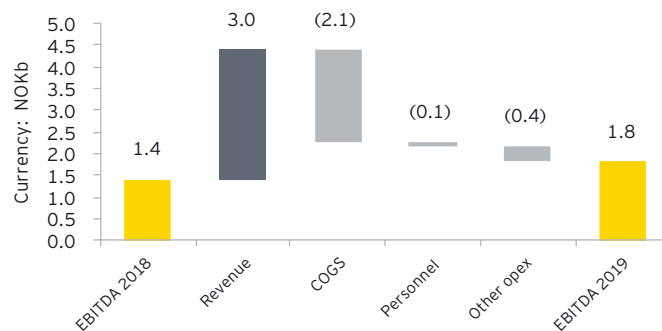
Segment EBITDA bridge



Increased feed volume drives the revenue growth

- ▶ The biotechnology segment experienced a significant increase in revenues of 12.8% from 2018 to 2019, with revenues totalling a record-high NOK34.6b in 2019. This is a massive growth compared to the last couple of years and the growth is primarily driven by the feed segment.
- ▶ One of the largest companies in the feed subsegment saw their revenues increase by 30% and contributed to approximately 50% of the subsegment’s revenue growth. The massive revenue growth in the subsegment was driven by higher sold volumes of feed, which coincides well with the observed growth in sold fish volume.
- ▶ The Norwegian feed segment produced more than 1,963 thousand tonnes of salmonid feed in 2019. Despite a significant volume increase of 7.0% from 2018 to 2019, margins were affected by harsh competition and high cost of raw material. However, the subsegment was able to increase their EBITDA margin to the highest seen in seven years at 6.3% – a development primarily driven by a higher gross margin.

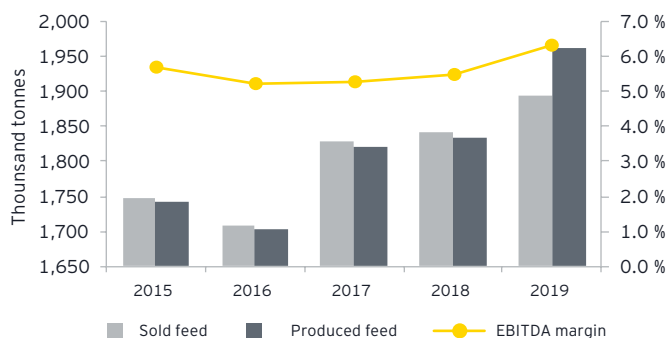
Feed EBITDA bridge



Continued increase in global demand for fish health related products and services

- ▶ Since 2014, margins in the fish health subsegment has doubled. Enhanced focus on biology and fish health in the sea farming industry has led to an extraordinary growth for the subsegment over the last years, with revenue growth of 18.0% from 2018 to 2019 (from NOK5.2b to NOK6.2b). EBITDA margins increased as well to 20.5% in 2019, which is the first time we observe margins above 20% for the subsegment. Continued high global demand coupled with the introduction of new pharmaceuticals and vaccines (e.g., a new sea lice pharmaceutical and a new PD-vaccine based on DNA gene technology), fuelled the 2019 revenue and EBITDA margin growth.

Feed EBITDA margin and volume development

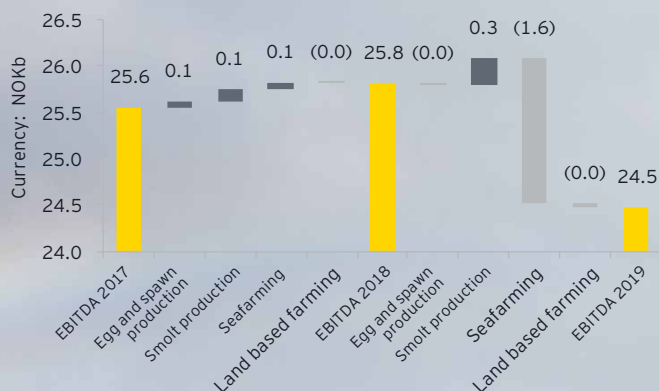


Source: Mowi Salmon Farming Industry handbook 2020, Directorate of Fisheries, The EY organization

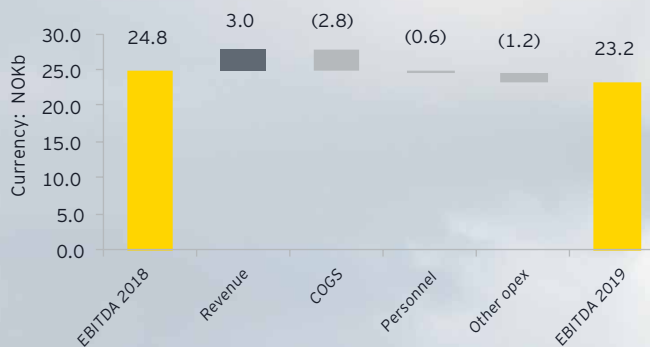


Production

Segment EBITDA bridge



Seafarming EBITDA bridge



Increased harvest volumes but production costs continue to rise

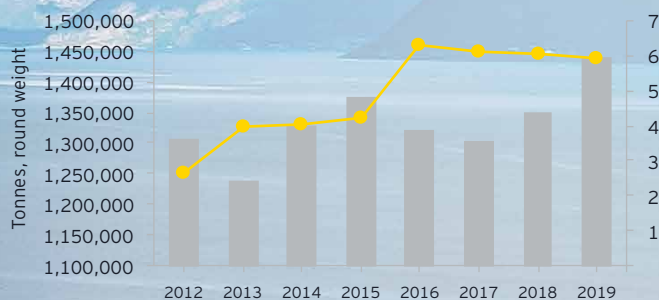
- ▶ The sea farming subsegment experienced record-high revenues in 2019. Although the price per kg (Fish Pool) decreased from 60.8 NOK/kg in 2018 to 59.2 NOK/kg, this was more than offset by the increased harvest volume. 2019 had an all-time high harvest volume of 1,440,000 tonnes, an increase of 90,000 tonnes compared to 2018. This is quite an achievement as volumes have shown stagnating tendencies for a long time. The volume growth is predominantly explained by the increase in the number of grow-out seawater licenses for salmon and trout in Norway over the last five years (from 973 in 2014 to 1,051 in 2019), and improved utilization of the maximum allowed biomass (MAB) in 2019 compared to the previous three years.
- ▶ Despite the high volume and relatively high prices, the sea farming subsegment saw a Y-o-Y EBITDA reduction for the first time since 2015, which takes us to the cost/kg development.
- ▶ Cost per kg (wfe) in the sea farming segment has continued the ongoing upward trend observed since 2012. There are

primarily two elements that have pushed cost/kg to new heights. COGS has continued its growth, a development seen in context with increasing feed prices. In addition, several of the sea farming companies also experienced algae bloom in Nordland and Troms during spring 2019, leading to a surge in production cost. Higher opex/kg is seen in context with the underlying biological issues that continue to challenge the subsegment.

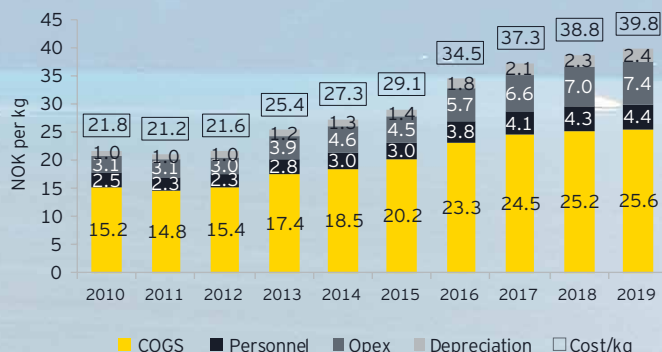
Transactions

- ▶ Over the last couple of years, there have been a limited number of transactions in the sea farming subsegment, with most M&A activity taking place in other parts of the aquaculture value chain.
- ▶ Norwegian transactions to note include Mowi acquiring K. Strømmen Lakseoppdrett, and NRS selling their farming operations in the South (Sør Farming) to Tombre Fiskeanlegg, Lingalaks and Eidesvik Laks. In addition, both Salmon Evolution and Andfjord Salmon were listed on Euronext Growth in 2020.

Price and volume development



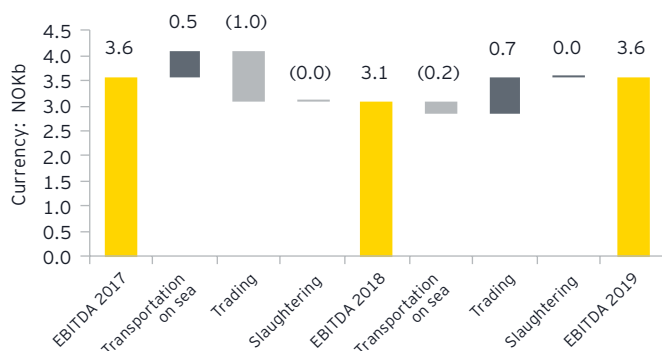
Cost per kg development (wfe)



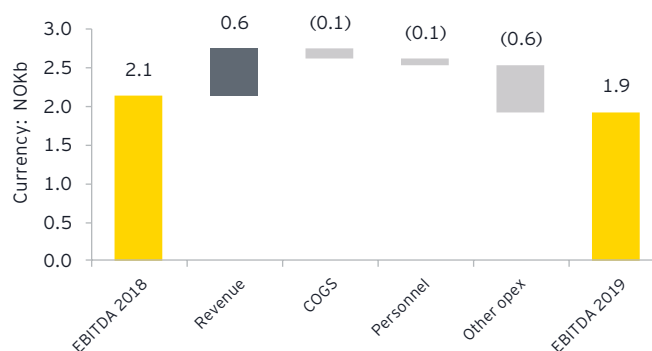


Distribution

Segment EBITDA bridge



Transportation on sea EBITDA bridge



Well-boats continue to reap super profit

- ▶ The distribution segment has recovered from last year's EBITDA decrease, and the 2019 EBITDA is in line with 2017. One of the surprises in this year's analysis is the transportation on sea subsegment, which shows a negative EBITDA effect for the year – this is the first observation with negative Y-o-Y EBITDA development in the 10-year period we have included in our database.
- ▶ Transportation on sea is a capital-intensive industry with historically exceptional EBITDA margins. In 2019, revenue was positively impacted by demand growth due to high production volumes and continued use of well-boats in various fish treatment operations, contributing to 12% revenue growth in the subsegment.
- ▶ Despite the revenue increase, the subsegment experienced a NOK 0.2b EBITDA reduction from 2018 to 2019, resulting in a substantial drop in EBITDA margin in 2019 compared to the previous year. This development is primarily explained by the following factors:
 - ▶ Y-o-Y EBITDA reduction: 2018 EBITDA was significantly impacted by vessel sale in several well-boat entities. The 2018 EBITDA margin for well-boat entities, adjusted for the effects of vessel sales, was approximately 41%, a level in line with the previous three years. In 2019, the well-boat companies continued to perform well, delivering a Y-o-Y revenue growth of 14% and an EBITDA margin of 41%.
 - ▶ EBITDA margin reduction: Feed freight and other service vessel entities within the subsegment delivered a high

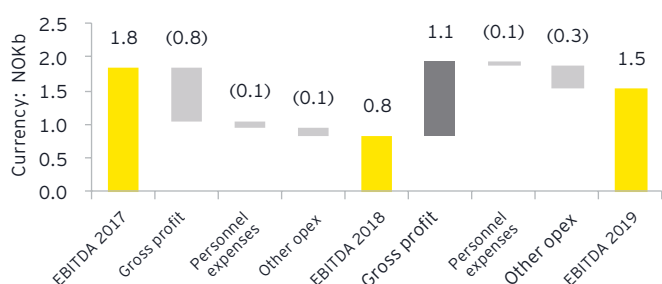
revenue growth from 2018 to 2019, while the EBITDA level was unchanged. Increased competition puts pressure on the margins, and particularly one feed freight company delivered a significant revenue growth in 2019, with very limited margin.

- ▶ The number of well-boats has increased significantly over the last couple of years, and the current shipyard backlog indicates continued fleet growth in the coming years. Reports indicate that there will be over 100 well-boats in the Norwegian market by 2022, up from 81 in 2019. Such fleet growth could potentially further increase competition and impact achieved margins.

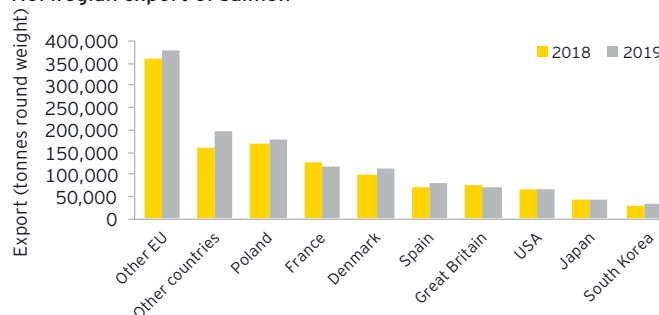
Salmon exports reached new heights

- ▶ The most significant contribution to the overall EBITDA change in the distribution segment came from the trading subsegment. In 2018, the EBITDA margin in this subsegment was at 1.0% – the second-lowest margin in 10 years. The 2018 EBITDA was heavily impacted by selected companies that experienced unfavorable fixed contracts. The 2019 EBITDA margin of 1.7% is more in line with the 10-year historical average we observe for the subsegment.
- ▶ Export of Norwegian salmonids reached new heights, totaling 1,357k tonnes in 2019, up from 1,263k tonnes in 2018. This, combined with high price achievement, resulted in growth in both revenue and EBITDA for the subsegment as compared to 2018.

Trading EBITDA bridge



Norwegian export of salmon





The state of aquaculture in 2040

What may the aquaculture sector look like 20 years ahead?

It has probably never been more challenging yet interesting to look into the aquaculture crystal ball ...

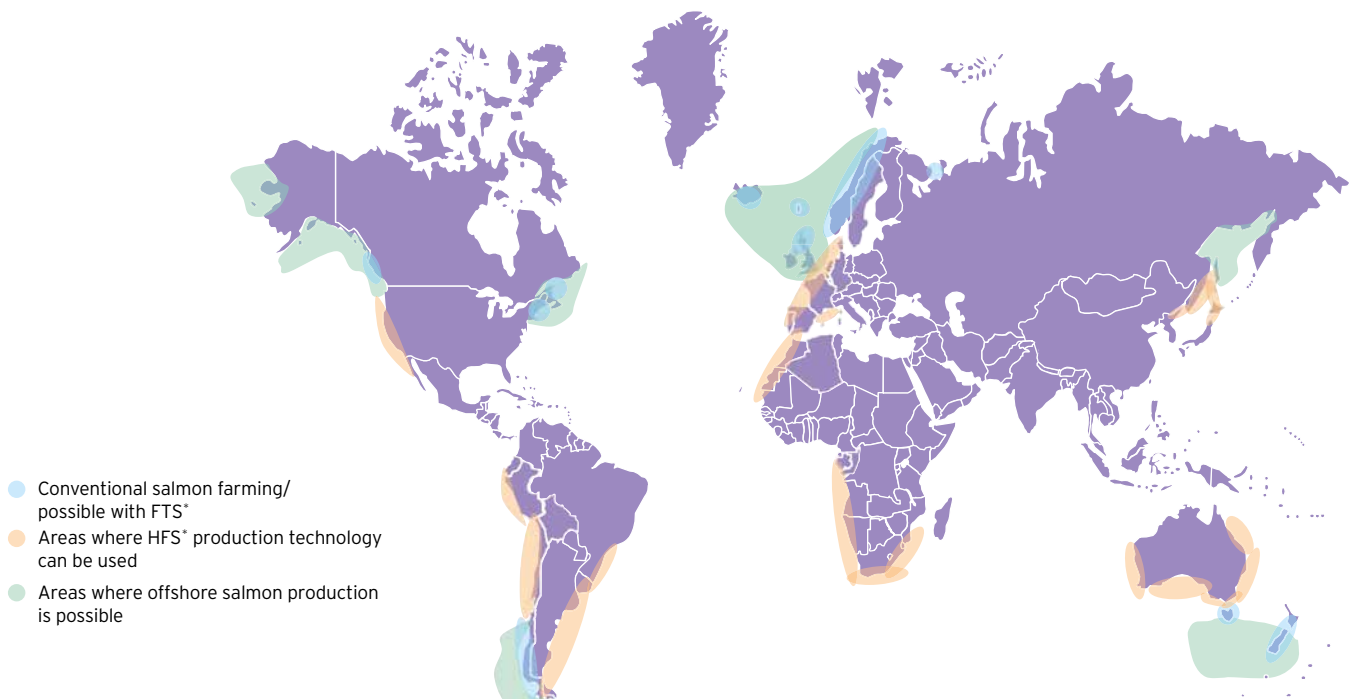
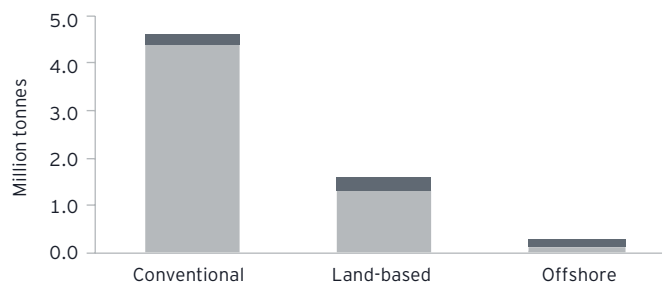
In 2000, the global production volume of Atlantic salmon totaled about 0.9 million tonnes, of which 0.44 million tonnes were produced in Norway. Conventional open sea net pens were the only production method, being characterized by a high degree of manual processes. For the Norwegian salmon farmers, the average salmon price was about NOK25, the production cost per kg reached a historically low level of NOK16.3 and the feed factor was 1.22¹. The primary consumption markets were Europe, Japan and the US. The average production loss due to mortality and escapes in Norway was 6.1%. Sea lice were primarily treated with chemical water treatments, cleaner fish and through adding toxin in the feed. Development licenses, traffic light system, digitalization, post-smolt and sustainability were not in the vocabulary yet.

The aquaculture sector has developed significantly in the past 20 years. We have witnessed increasing industrialization, globalization and consolidation in several parts of the value chain and technological improvements in many areas. But biological conditions, technology, solutions and regulations still differ considerably between the salmon producing countries. Sea lice, diseases, algae outbreaks and other biological challenges keep

the industry alert and on its toes, continuously working to find ways to increase production efficiency and volume output. The aquaculture industry currently finds itself juggling operational challenges with a wider set of opportunities than ever before.

EY teams have discussed potential aquaculture scenarios in 2040 with a range of industry professionals across the sector. Based on these conversations and the development trends we observe, we invite you into a potential state of the aquaculture sector in 20 years.

Estimated production volume in 2040



Flow-through system (FTS), hybrid flow-through system (HFS) and recirculating aquaculture system (RAS) are different production technologies used in land-based salmon farming. While facilities using FTS and HFS are dependent on being placed near the coastline, RAS is not.

1 "Fiskeoppdrett 2000", Statistisk Sentralbyrå, www.ssb.no/a/publikasjoner/pdf/nos_c711/nos_c711.pdf, accessed 26 November 2020.

In 2040, the annual global production volume may reach somewhere between 5.8 and 6.5 million tonnes, distributed between conventional farming (4.4-4.6 million tonnes, including closed/semi-closed), land-based (1.3-1.6 million tonnes) and offshore (0.1-0.3 million tonnes). Conventional farming will have

its prime presence in established regions, with a steady average Y-o-Y growth. Land-based facilities are widespread, but with the largest concentrations being located in North-America and Asia. Offshore production is primarily a niche segment in Norway and certain areas in Asia.

Growth enablers

- Sea-based**
- ▶ Post-smolt
 - ▶ Knowledge-based farming
 - ▶ Biological improvements
 - ▶ Regulations

- Land-based**
- ▶ Low carbon footprint
 - ▶ Time to market
 - ▶ Established technology
 - ▶ Access to capital

- Offshore**
- ▶ Opens up some additional sea areas
 - ▶ Biological improvements
 - ▶ New entrants



A range of opportunities ... and some potential pitfalls?

In 10 years, we expect a steady evolution. Will a 20-year perspective allow for disruption and revolution?

The aquaculture production scenario drawn up on the previous page is based on our dialogue with industry professionals and certain high-level assumptions regarding the development in key growth drivers and challenges. We have played around with various trends, possibilities, inhibitors and innovations – an exercise that provides increased awareness around the multiple and exciting potential roads, crossroads, turns and dead ends that may lie ahead. Below, we summarize some of the reflections regarding aquaculture toward 2040 that combine future thoughts from our external and internal industry professionals.

Supply and demand

When looking into the crystal ball, asking what the market equilibrium for salmon will look like in 2040, one has to filter out

short term events and occurrences creating temporary shifts in the demand or supply situation.

Keeping an eye on this sector for over 30 years has made us aware of how the supply is influenced by biological and aquacultural phenomena, such as diseases, lice, algae and sea temperature. “Livestock” in the sea will always be exposed to inherent biological risk factors. Governmental and political regulations governing production licenses and fish welfare will also be part of the supply-side restrictions. On the demand side, incidents, such as global political and trade agreement differences, will most likely continue to create periodic challenges for a sector very much based on export and global trade. Looking two to three decades ahead, the adaption of new production technology involving closed, semi-closed sea installations and land-based salmon farming will result in more production within trade barriers and in a more controlled



biological environment. This may filter shocks and interferences, which have affected both the supply and demand sides.

However, looking decades ahead, it will be the underlying primary forces of technology, demographics, globalization and environment that will evolve and impact both the supply and demand of salmon as well as other marine products. Megatrends, such as behavioral economy, work and life unbound together with health consciousness and economic growth for an increasing middle class and above, will, as we see, represent a solid and steady growing demand side. On the supply side, we do foresee growth in the annual global production, reaching somewhere between of 5.8-6.5 million tonnes in 2040. The market will find its balance given an annual average of 4-5% increase in demand for the coming two decades.

Technology and innovation

The increasing demand for salmon and continued industry growth potential drives the innovation agenda forward. The production technology platform continues to develop from the prospects we see today. Some solutions are scrapped along the way, but in 2040, we will see proven and established technology in all main areas – closed/semi-closed, offshore and land-based farming. Digitalization and AI positively impact fish welfare, production efficiency and traceability in unforeseen ways. Genetics and feed specialized for land-based farming will have emerged. Innovation within technical solutions is also fueled by new, large and capital strong market entrants from other borderline industries that see opportunities in aquaculture. Within 2040, we may very well witness technological disruptions that are unimaginable today.

Biology

Fish welfare is key. Biotechnological development has made the 2040 Atlantic salmon more robust through progress within breeding, genetics, vaccines and feed. The sea lice are still around, but the problem has been significantly reduced. Diseases that are known today are overall prevented and treated more effectively.

Sterile salmon reduces the impact on wild salmon. A transfer from experience-based to knowledge-based farming has contributed to this development through increased insights from comprehensive data sets, providing more detailed knowledge about the fish and other environmental conditions. Still, new biological challenges have arisen, some potentially due to global warming and increased algae blooms, coupled with yet unknown diseases. Closed or semi-closed farming pens – as a minimum in threshold fjords – have reduced some of the biological exposure.

Land-based farming facilities have faced their own biological battles toward 2040 but will have come a long way to overcome the most significant issues after twenty years of trial and error.

Feed

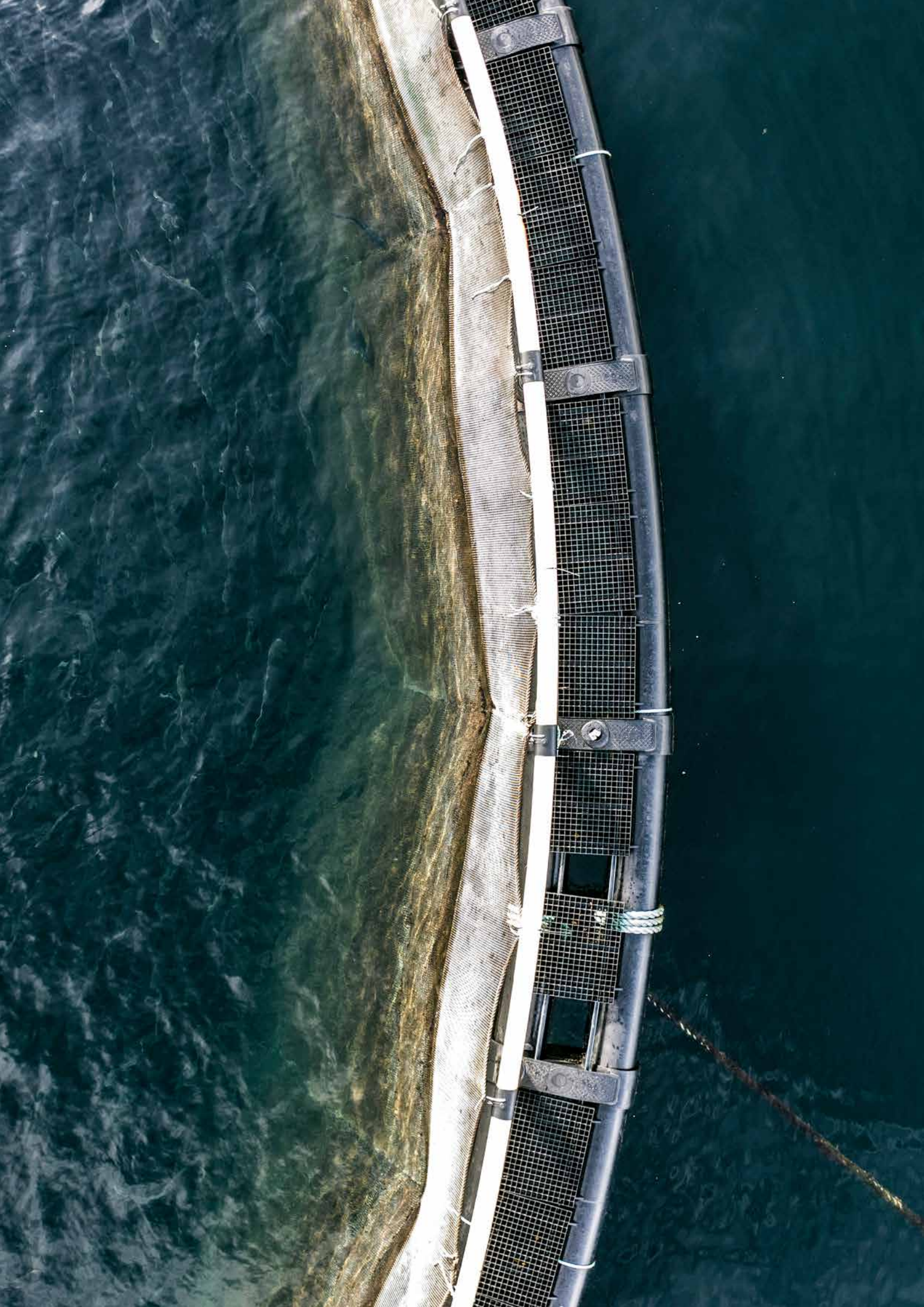
To reach an annual production of 5.8-6.5 million tonnes of Atlantic salmon in 2040, there is a need for novel feed ingredients with a high concentration of protein and omega-3, derived from, e.g., algae and insects. Thus, the trend of substituting marine raw materials with alternative sources of protein and fatty acids will accelerate toward 2040 – a shift that is inevitable as marine raw materials are scarce resources with increased competition from direct human consumption. The shift is also due to changes in consumer requirements. In 2040, small feed plants will be situated close to land-based sites. There will also be increased use of more locally sourced raw materials, reducing the environmental footprint even further.

Sustainability

Consumers', investors' and regulatory sustainability requirements will be relentless and non-negotiable. They will impact every segment in the value chain and across the globe. ESG reporting is extended and more frequent. Low or neutral carbon footprint will not be a market differentiator, but the norm. Digital traceability discloses all required information to the consumers in a second, favors local production, e.g., land-based in many areas, and challenges conventional farmers to re-think their distribution models. Improved freezing techniques may have paved the way for international transportation by sea unless sustainable aviation fuel has made a breakthrough. All the industry's vessels are electrified or on other sustainable power sources.

Regulatory environment

Toward 2040, the regulatory environment will play a significant role in making sure that the industry keeps the focus on reducing its environmental footprint while producing as efficiently as possible. Conventional farming will face increasing regulatory requirements and restrictions. Open net pens in threshold fjords are likely to be history. The traffic light system will be replaced by a more dynamic system based on real-time data from individual locations, combined with lower acceptable thresholds of sea lice levels, diseases and escapes. Regulation of land-based farming will have been further developed and adapted with zero tolerance for adverse environmental impacts. New incentive and subsidy programs will occasionally be put in place to incentivize investments in innovation. Norway is still the world's regulatory spearhead in salmon aquaculture, but other regions are closing in on the gap.



Will Norwegian aquaculture companies still lead the way?

Can the Norwegian industry capitalize on cluster advantages in the future?

The Norwegian salmon industry is world-leading in terms of technology, digitalization, research and regulations. The world's largest salmon farming companies are Norwegian, and the largest and most advanced players within technical solutions are based here. Norway has most likely also the best and most transparent biological data sets on mortality, diseases, medications and development.

Norway's position as the leading competency and innovation cluster for the salmon industry is a result of the historical development and, in particular, the early and robust foothold of the salmon farming industry along the coast. The fact that salmon has the highest EBIT per kg for all known farmed seafood species has paved the way for the increasing investments in technology, innovation and competence. Suppliers in all segments face their most demanding customers in Norway, keeping them on their toes.

Will Norwegian aquaculture be able to keep ahead of competition toward 2040? The answer is: It depends. The industry has an

excellent opportunity to remain the No.1 knowledge cluster, to let the development going forward be positively fueled by the innovation advantages a cluster normally provides. But it will not happen by itself. It will require continued investments in research and development (R&D), data collection and analysis, collaboration across and within the value chain segments and a regulatory environment that combines stringent requirements with a proactive will to focus on opportunities. No part of the industry must be tempted to rest on their laurels but continue the hard work. Many technical suppliers should also aim to increase their international sales and awareness while having a positive momentum.

We believe that new future competitors with capital, international presence and long industrial experience with one or more technologies with good growth prospects in aquaculture will enter this industry in the coming years. We also note that there are strong international companies with regards to turnkey land-based facilities and that Chinese yards gain a lot of insights and experiences by building offshore aqua installations for Norwegian salmon farming companies.



The positive megatrends supporting further profitable growth prospects in aquaculture will undoubtedly attract new competitors and Norwegian aquaculture companies will not be best in class in all areas. However, we believe that Norwegian aquaculture has a golden opportunity to continue to evolve

as the world's primary aqua cluster. The combination of international potential and a world-leading starting point makes this opportunity unique on a Norwegian scale. What are we waiting for?

Potential success factors

- ▶ We succeed with the institutionalization of the salmon industry competency and knowledge through big data sets and machine learning (all production technologies).
- ▶ Norwegian technical solution suppliers are at the forefront of delivering land-based facilities world-wide.
- ▶ We have educated marine biologists, economists and other professionals that lead the salmon farming companies toward AI and biology.
- ▶ Salmon farming companies establish industrial R&D projects with leading R&D institutions to solve biological issues.
- ▶ We develop new leading insights and experience on genetics.
- ▶ We export competency, services, technology and contribute to the establishment and development of aquaculture in new, as well as established regions.
- ▶ Large international players keep/establish their R&D and innovations centers in Norway.

Potential pitfalls

- ▶ Norwegian suppliers are too slow to increase their international exposure and network and are surpassed by new large capital-backed international players who seize a market opportunity.
- ▶ Land-based and offshore salmon farming gain foothold in other geographical regions, proactive companies and regions build knowledge, experience and solutions.
- ▶ The Norwegian industry does not build a sufficient pipeline of talents to transfer the industry to being AI and knowledge-based due to existing "super profits".
- ▶ The Norwegian industry players continue with experience-based salmon farming and have not succeeded in collaborating around establishing a large common data set that will serve as a basis for further development and insights.





Land-based salmon farming

What is the status of bringing the production of salmon onshore?

... it is more popular than ever!

The number of identified land-based projects has never been higher. Since we first started tracking these projects in our 2018 edition, several players have increased their planned land-based production volume and even more companies have expressed their intention of starting land-based production of Atlantic salmon around the world. Consequently, the identified volume has skyrocketed to more than 2.3 million tonnes – ~85% of the global production of Atlantic Salmon in 2019! However, only a limited number of these projects have received farming licenses, and even fewer have secured funding. Therefore, much of this volume will be realized far in the future or potentially never see the light of day.

A significant number of the new projects/facilities are located closer to the end consumers. The trend of locating land-based facilities closer to the anticipated end market is both expected and reasonable when considering that air freight is a large cost component, and a key polluting element, for the salmon farming industry. Globally, the focus on sustainability has never been higher, both on the consumer and supplier end, and there is no reason to expect a shift in this focus anytime soon.

Equity investors eager to invest ...

Since the 2019 edition, there have been several significant financial events relating to land-based farming projects. Most notably, equity investors have shown tremendous interest in certain projects.

To name a few, during one afternoon on 9 September 2020, Atlantic Sapphire completed a USD100m private placement, and the private placement was significantly oversubscribed. Salmon Evolution completed a NOK500m private placement in September 2020, and it was more than 9 times oversubscribed! In March 2020, 8F Asset Management (Pure Salmon) announced the completion of a massive USD359m fundraising to be used on their facilities in Japan (10k ton WFE), France (10k ton WFE) and the US (20k ton WFE). The high interest in investing in land-based farming shows the investors' belief in this up-and-coming salmon farming method being profitable in the future.

However, while there are some success stories in terms of funding, many projects struggle to secure enough equity financing to be eligible to even be considered for bank financing. It is easy to be impressed by the success stories, but considering that there are no large-scale land-based salmon farming up and running with multiple successful (large) harvests, many investors are probably indecisive and waiting for more large-scale proof of concepts. We observe that a growing number of the identified projects have limited to no resources employed in the company

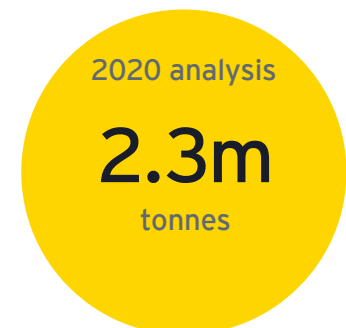
with actual experience from salmon farming. Although salmon farming on land is not 1:1 with salmon farming at sea, this is the closest one gets, and we note that relevant management experience appears to be a key investment criterion for most investors.

Identified planned land-based capacity

2019 analysis



2020 analysis



... while the lenders are still looking for boxes to be ticked

The largest bank in Norway, DNB, recently participated in a panel debate discussing land-based farming. They still expect that early-stage land-based facilities will primarily be financed with equity. For them to finance land-based farming projects, several necessary requirements must be fulfilled.

One company has apparently fulfilled all the necessary criteria, as Atlantic Sapphire announced that they secured a USD210m senior secured credit facility with DNB in April 2020. During the panel debate, DNB commented that they are cautious in financing land-based projects. However, they pointed out that Atlantic Sapphire has a proven track record from their production plant in Denmark, industrial experience and closeness to customers, which significantly reduces transportation cost – factors that seem to reduce the credit risk to an acceptable level.

2020 has been a year full of financial highlights for the land-based salmon farming companies. The table on next page shows selected financial events in 2020, which illustrates the financial market's willingness to invest in this segment. Several billions of NOK in new capital have been raised during 2020, allowing several companies to start construction work.

Several land-based farming companies have listed on Euronext Growth (previously, Merkur Market) and the Oslo Stock

Exchange during 2020. Some of these have seen negative price development since listing (as of December 2020), even though they have raised a significant amount of capital from willing investors.

As we see an incline in companies reaching their capital requirements, the next step will be to fulfill their construction plans. And while it may seem like the access to equity is better than ever, several companies still struggle to raise capital to start their construction phase. It is highly unlikely that all these planned projects will be realized, and several will undoubtedly end up as castles in the air – see table below.

Capex estimates are still uncertain ...

With funding secured several facilities are starting their construction phase. However, very little volume has yet to be produced. Consequently, as the projects are in the early stages, the capex estimates are still uncertain.

Various numbers on estimated capex/kg for the different facilities are presented in media and other presentations. However, it is not clear to what extent these capex KPIs are comparable across the various facilities. Differences in, e.g., the applied technology (such as recirculating aquaculture systems (RAS), flow-through system (FTS) and hybrid) and how large share of the value chain the facilities include may significantly impact the cost estimates.

We have researched some of the land-based farming projects where public information has been available, and estimates indicate a capex per kg ranging from NOK90 to NOK220 per kg. The large range must be seen in context with different

technologies applied, production capacity, the level of vertical integration and what the companies have chosen to include in their capex estimates (e.g., some include land and administration buildings and others do not). Generally, we observe that FTS and hybrid solutions are in the lower range of the range, while RAS is typically located in the higher spectrum of this range.

Prior to Atlantic Sapphire’s first commercial harvest in September 2020, they updated their capex estimates to NOK195 per kg (USD22), which was not the first time they increased their capex estimate over the years. This illustrates the uncertainties associated with the investment costs for the land-based facilities. It is fair to assume that we will see several adjustments in cost estimates for many of the identified projects as construction work begins and projects are getting closer to finalization.

Several projects are planned in Norway, which indicates that several companies find the need for industry expertise and infrastructure to outweigh the need for closeness to market. However, as air freight cost has rocketed following the shortage of passenger flights due to the COVID-19 pandemic, the cost of shipping to Asia and the United States has significantly increased. Whether or not this will go back to previous cost levels, not to mention when, will have a significant impact on the cost advantage of land-based facilities being located closer to the end market.

It remains to see if the market is willing to pay the premium needed to cover land-based production costs. Will the value of traceability, sustainability and less time to market offered by the land-based farmers turn the companies into profitable industry players?

Date	Company	Event
Dec 20	Nordic Aqua Partners A/S	Listed on Euronext Growth
Nov 20	Nordic Aqua Partners A/S	Completed NOKm 587 private placement
Sep 20	Salmon Evolution Holding AS	Listed on Euronext Growth
Sep 20	Atlantic Sapphire ASA	Completed USDm 100 private placement
Sep 20	Salmon Evolution Holding AS	Completed NOKm 500 private placement
Jun 20	Andfjord Salmon AS	Listed on Euronext Growth
Jun 20	Andfjord Salmon AS	Completed NOKm 150 private placement
May 20	Atlantic Sapphire ASA	Listed on Oslo Stock Exchange
Apr 20	Atlantic Sapphire ASA	Execution of USDm 210 senior secured credit facility with DNB
Apr 20	Nordic Aquafarms	Completed a NOKm 88 capital raise
Mar 20	8F Asset Management/Pure	Completed a USDm 359 fundraising

... as most construction processes have yet to see the light of day

However, most of these projects are still just that – planned projects. Very few have finalized their construction, and an even larger amount of these capex estimates are purely calculations as not even one shovel has been set into the ground. According to an IntraFish article¹, as little as 3 to 4 percent of the planned capacity has started the building process. This is a consequence of several factors, such as lack of necessary funding, required permits to operate, etc. Very few facilities have put out the first batches of smolt, and as such, we have yet to see significant volume from large-scale salmon farming on land.

The cost and production advantages are different for the various industry players. Factors, such as land, facilities, technology, licenses, employees, financing, smolt release and first harvest need to be in place in order to see if the project is feasible, not to mention profitable. The key for the up-and-coming land-based facilities will be to pull knowledge and experience together as we start seeing the results of more land-based facilities.

It remains to see if there will be a first-mover advantage or if the most successful companies are the ones that have a wait-and-see approach. In the end, the best performing and cost-efficient companies will be the ones to survive.

Who will succeed? Which locations will prove to be the most profitable? How will profitability develop compared to conventional farming at sea? When will the conventional salmon farmers add land-based farming to their portfolios? We are excited to see what the future of land-based salmon farming will look like. Based on the current escalating project traction, step-by-step positive technological developments and underlying strong demand trends for protein sources, we keep a firm belief that land-based farming will develop into a substantial supply supplement for salmon in the coming 10 to 20 years. The pace of the development will be impacted by the number of success vs. failure stories in the near future, moving from early-phase to established technology, the actual capex/kg and cost/kg performance of realized projects and the availability of necessary competence and financing.

Identified planned capacity*

Million tonnes	Identified
Norway-Denmark	0.9
US-Canada	0.6
Other	0.8
Total	2.3

* Not an exhaustive list, only identified projects included. The table illustrates the companies' announced expected production capacity and volume.



1 "Analyst on land-based salmon production: 'Too early to call it a paradigm shift'", IntraFish, www.intrafish.com/salmon/analysts-on-land-based-salmon-production-too-early-to-call-it-a-paradigm-shift/2-1-889433, accessed 30 October 2020.



The Norwegian fishing industry

The rich history of Norwegian fisheries

The history of Norwegian fisheries goes back to the Stone Age when the first settlers came to Norway. They quickly learned that the coastal waters were rich in resources, including a variety of fish species, and fisheries became an important resource base for settlers along the coastline. The 11th century marked the beginning of the Norwegian export history when dried cod and herring became Norway's first export products of volume and economic significance¹. The fish was traded in exchange for products, including grain, flour, spices, fishing gear and fabrics. However, the major breakthrough of the Norwegian stockfish export came when the Hanseatic League settled in Bergen in the 12th century. This resulted in the tremendous growth of the fishing industry, and several trade centers emerged along the coast, including Bergen and Trondheim.

In the centuries that followed, fisheries, fish processing and export became major industries along the coast and of great economic importance. Still today, fisheries are important for the livelihoods and culture of many coastal communities and is one of Norway's largest export industries. In 2019, the industry exported 1.5 million tonnes of seafood at a value of NOK30.8b².

Resource management

The Norwegian fisheries have evolved from being virtually free and open to becoming a highly regulated and access-restricted industry. The regulatory framework of the authorities' resource management of the Norwegian fisheries is laid down in the Marine Resource Act (havressursloven) and the Participation Act (deltakerloven). The Marine Resource Act regulates the management of the wild living marine resources, and the Participation act regulates who can participate in the fishery of marine animals³.

The ultimate responsibility for the Norwegian fishing industry lies with The Ministry of Trade, Industry and Fisheries. The Directorate of Fisheries serves as the Ministry's advisory and executive body to manage and administrate fisheries and aquaculture and is also responsible for control activities³.

Resource management through regulations is necessary for securing sustainable management of the marine living resources

and ensuring an economically sustainable industry supporting the existence of the coastal communities.

Sustainable fishing is the overall consideration and fundamental principle. Without resource management, the industry would suffer under the "tragedy of the commons", a situation where all players act independently according to their own self-interest (e.g., overfishing), eventually resulting in disaster (e.g., collapse of fish stocks). Norwegian fisheries management is well recognized internationally, and many argue that Norway is the world leading country in this field. Many countries want to learn these best practices and Norway exports this knowledge to a large extent, e.g., Norway has supported Namibia in developing a well-regulated system for fisheries management.

The regulations of who can fish, when, how and volume are called the quota system³. The most important fisheries are restricted and require a permit to participate. As a consequence, owning a quota today entails an exclusive right with a high value.

Approximately 90% of the fish stocks the Norwegian fisheries harvest from are shared with other nations and includes fish that migrate from one coastal state to another⁴. Effective resource management of these fish stocks is important and requires close international cooperation between concerned countries. Every year, total fishing quotas (total allowable catches) for each of the shared species are determined based on advice and recommendations from the International Council for the Exploration of the Sea (ICES) that consists of scientists from member countries⁴. Allocation of the total quotas between the concerned countries are then negotiated and determined. When the Norwegian quotas are set, the quotas are allocated between vessel groups and then distributed to individual vessels⁵. The Directorate of Fisheries splits the fishing fleet into the following vessel groups⁵:

- ▶ Demersal fisheries (including cod, saithe and haddock) and pelagic fisheries (including herring, mackerel and capelin)
- ▶ Coastal vessels and ocean-going vessels
- ▶ Fishing gear used for fishing
- ▶ Vessel size in terms of length

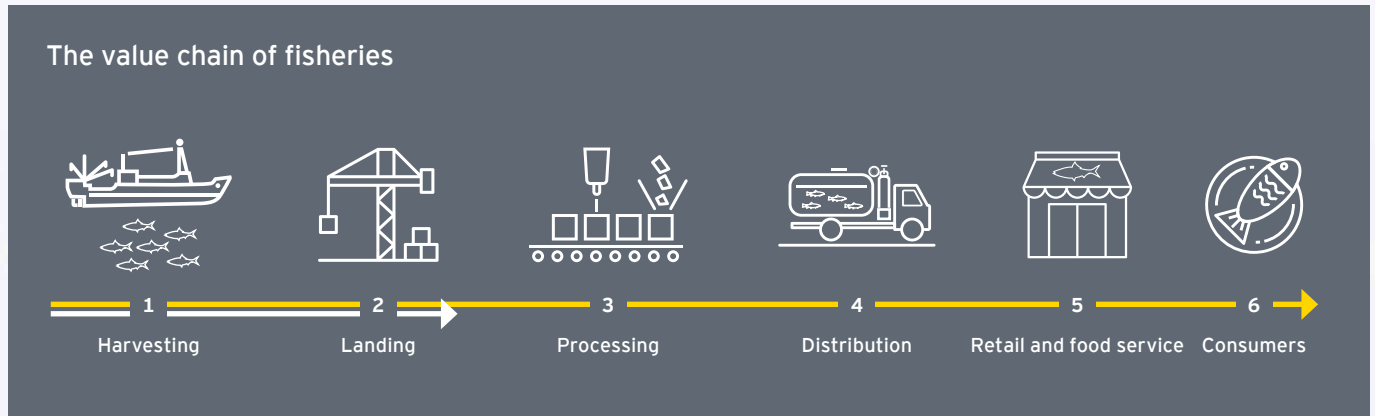
1 "Norsk fiskerihistorie", Store norske leksikon, , accessed 23 November 2020.

2 "Nøkkeltall", Norwegian Seafood Council, www.nokkeltall.seafood.no/, accessed 23 November 2020.

3 "Riksrevisjonens undersøkelse av kvotesystemet i kyst- og havfiske", Riksrevisjonen, <https://www.riksrevisjonen.no/rapporter-mappe/no-2019-2020/undersokelse-av-kvotesystemet-i-kyst-og-havfisket/>, accessed 16 November 2020.

4 "Fishery and Aquaculture Country Profiles; The Kingdom of Norway", FAO, www.fao.org/fishery/facp/nor/en, accessed 24 November 2020.

5 "Lønnsomhetsundersøkelse for fiskeflåten 2018", The Directorate of Fisheries, <https://www.fiskeridir.no/Yrkesfiske/Tall-og-analyse/Statistiske-publikasjoner/Loennsomhetsundersokelse-for-fiskefartoy>, accessed 16 November 2020.



Participation in commercial fishing requires a permit from the Directorate of Fisheries, which is given to the vessel owner for a specific vessel. There are several requirements that must be met in order to obtain a permit, including:

- ▶ The vessel owner is an active fisherman (their ownership of the vessel exceeds 50%) and registered as a Norwegian citizen.
- ▶ Foreign citizenships can be granted permits if the vessel's length is less than 15 meters and the owner resides in Norway.
- ▶ Foreign ownership of fishing vessels cannot exceed 40% and is independent of where the owner resides.
- ▶ At least half of a vessel's crew must reside in a coastal municipality or in a neighboring domestic municipality to a coastal municipality.

The starting point of the fisheries value chain is harvesting wild seafood, i.e., fish, shrimps and crabs. The wild-caught seafood is then "landed" when it is unloaded from the fishing vessel to the port. Upon landing, all data from the catch is collected and administered by the Directorate of Fisheries. The seafood is then processed, sold and distributed to end-markets and consumers.

First-hand sales of seafood are regulated through the Raw Fish Act (Råfiskloven). The act states that all first-hand sales of wild-caught Norwegian seafood must be conducted through one of the six appointed sales organizations. The sales organizations

are owned by the fishermen and operate as marketplaces for the landed seafood and safeguard the income of the fishermen. One of the sales organizations, Norges Sildeslagslag, has the right to first-hand sales of all pelagic species. The other five have the exclusive rights of first-hand sales of all other wild-caught seafood, each organization covering their separate coastal region¹.

The structure of Norwegian fishing fleet

The adjacent chart shows that the number of registered vessels has decreased dramatically over the past decades. In 1985, the fleet comprised 24,000 registered vessels, in contrast to the 6,000 vessels in 2018. Simultaneously, revenue per vessel has increased by more than seven times since 1985². This development is a result of the restructuring of the fishing fleet, which was partly set in motion by overcapacity in the fleet. To reduce the overcapacity and increase the profitability of the fleet, the authorities introduced regulations and measures to reduce the number of vessels. The results of the reduction in number of vessels are increased productivity per vessel, reduced costs and consequently increased profitability. Additionally, the average size and capacity of the vessels have increased³.

The fleet is fragmented and consists of many small vessels. In 2018, more than 80% of the total fleet was less than 11 meters long. Although they represent the majority of the fishing fleet, they accounted for only 12% of the total first-hand value of

1 "The Norwegian Fishermen's Sales Organization", Norges Råfisklag, www.rafisklaget.no/portal/page/portal/NR/Omoss/Norwegian_fishermens_sales_organization, accessed 23 November 2020

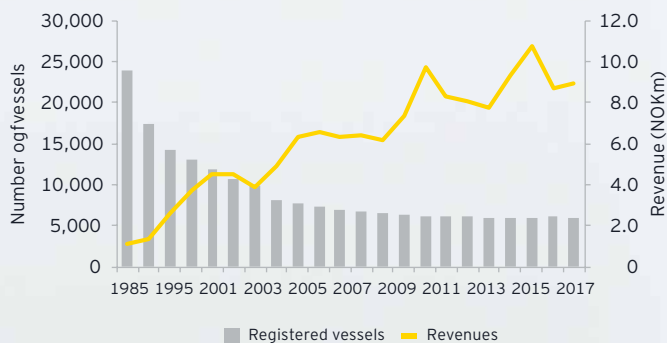
2 "Lønnsomhetsundersøkelse for fiskeflåten 2018", The Directorate of Fisheries, <https://www.fiskeridir.no/Yrkesfiske/Tall-og-analyse/Statistiske-publikasjoner/Loenksomhetsundersokelse-for-fiskefartoy>, accessed 16 November 2020

3 "Riksrevisjonens undersøkelse av kvotesystemet i kyst- og havfiske", Riksrevisjonen, www.riksrevisjonen.no/rapporter-mappe/no-2019-2020/undersokelse-av-kvotesystemet-i-kyst-og-havfiske/, accessed 16 November 2020

landings. Most of these smaller vessels are part of the coastal fleet and targets demersal species. The larger vessels account for most of both harvest volume and value. In 2018, only 4% of the fleet consisted of vessels of 28 meters or above in overall length but accounted for 70% of total first-hand value².

A natural consequence of the reduction in the number of fishing vessels is a decrease in the number of fishermen. In 1985, more than 22,000 fishermen were registered as full-time employed fishers, while in 2019, the number had dropped to 9,400¹.

Number of registered fishing vessels and revenue per vessel



Source: Økonomiske og biologiske nøkkeltall frå dei norske fiskeria 2019, April 2020, Directorate of Fisheries, 2020

¹ Økonomiske og biologiske nøkkeltall frå dei norske fiskeria 2019", The Directorate of Fisheries, <https://www.fiskeridir.no/Yrkesfiske/Tall-og-analyse/Statistiske-publikasjoner/Noekkel-tall-for-de-norske-fiskeriene>, accessed 16 November 2020

The Norwegian fishing fleet

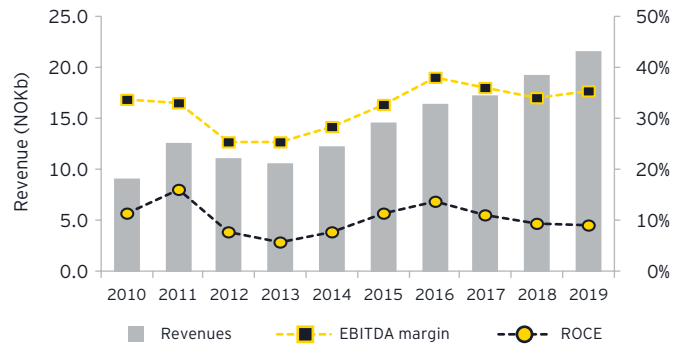
The Norwegian fishing fleet has experienced substantial growth in revenues and EBITDA margin from 2010 to 2019. In the same time period, we also observe a significant growth in the fleet's first-hand sales value by 58%. The positive development is primarily driven by increased prices as the catching volume is reduced by 14% over the past decade¹.

Additionally, the most important fish stocks have become in better conditions and the number of registered vessels has reduced². As mentioned earlier, reduced numbers of vessels combined with stable catching volumes, have reduced the fleets costs and increased its productivity.

The largest and most important fish species, in terms of total first-hand value, are Atlantic cod and other codfish families.

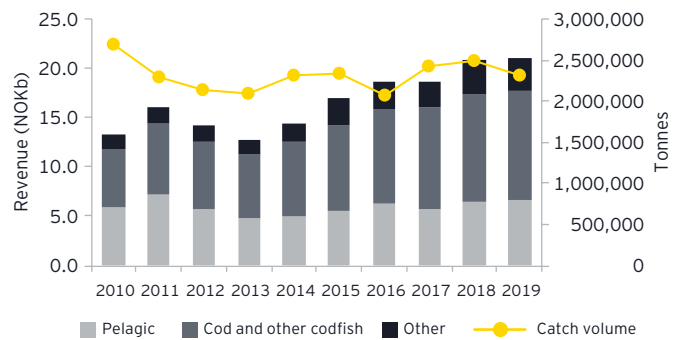
Atlantic cod is by far the largest species within the Norwegian fisheries, and the first-hand value has increased by approximately 140% from 2010 to 2019, driven by a strong increase in prices. However, in terms of volume, pelagic species are the largest fish species group and accounted for 56% of total catch volume in 2019. Over the past decade, the volume and first-hand value of pelagic species have, on average, remained relatively stable. Thus, the price increase on cod and other codfish is the main driver behind the revenue and EBITDA margin growth in the period².

Key financials for the Norwegian fishing fleet*



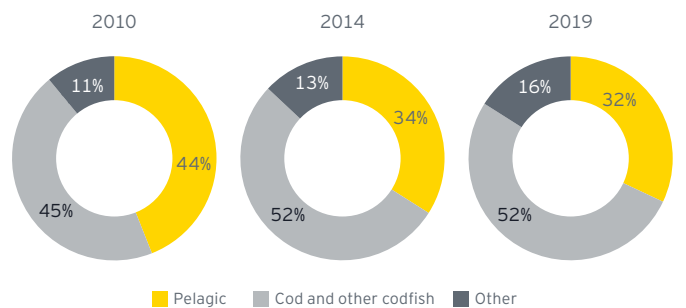
* The historical values are underestimated compared with actual totals because the analysis does not include mergers, companies that are liquidated or declared bankrupt etc. during the historical time period.

First-hand value and volume of wild-caught seafood (WFE)



Source: Directorate of Fisheries

First-hand value



1 "Økonomiske og biologiske nøkkeltall frå dei norske fiskeria 2019", The Directorate of Fisheries, <https://www.fiskeridir.no/Yrkesfiske/Tall-og-analyse/Statistiske-publikasjoner/Noekkeltall-for-de-norske-fiskeriene>, accessed 16 November 2020
 2 "Lønnsomhetsundersøkelse for fiskeflåten 2018", The Directorate of Fisheries, <https://www.fiskeridir.no/Yrkesfiske/Tall-og-analyse/Statistiske-publikasjoner/Loennsomhetsundersokelse-for-fiskeflaetoey>, accessed 16 November 2020

Fish landing and processing

Landing sites and processing facilities are most often strongly related as the fish processing companies often receive the fish directly upon landing. However, this is not always the case. An increasing share of the fish is transported from the landing sites to processing facilities in either Norway or abroad¹.

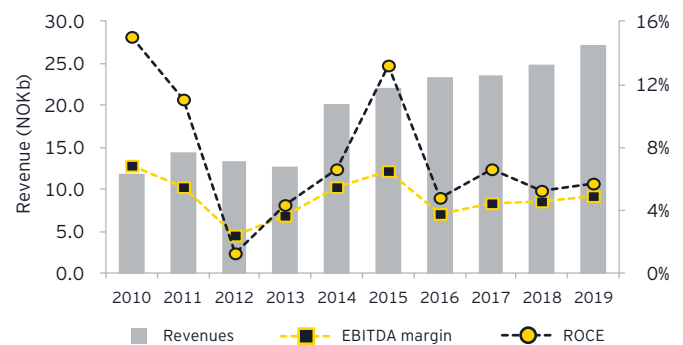
The landing structure is changing. From 2003 to 2017, the number of landing sites has decreased from 382 to 3042. It has become fewer small sites and an increased number of larger sites, and the larger sites are receiving a higher share of the volume landed. Smaller coastal vessels are dependent on reasonable proximity between the fishing grounds and the landings sites. If this disappears, fishermen can be forced to move or sell their vessels².

The fish processing industry is a low margin industry, and the EBITDA margin has a 10-year average of 4.8%. The industry has experienced strong revenue growth of 128% from 2010 to 2019, mainly driven by favorable currency exchange rates for exports and increased prices. Despite the strong revenue growth, margins have remained low and relatively stable throughout the historical period. This is mainly due to increased raw material costs, which is reflected in the increased prices and revenues of the fishing fleet.

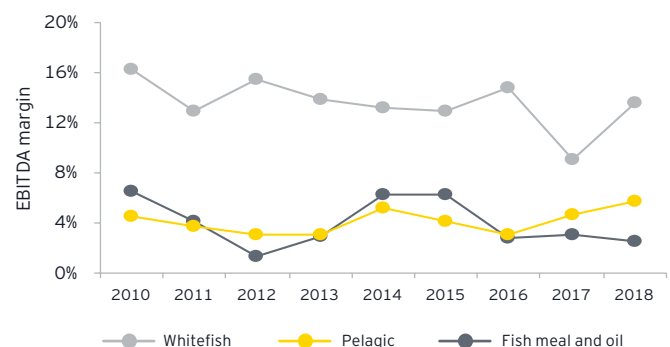
The landing location of the fish fleet's seafood has a large impact on the fish processing industry. The number of processing facilities for wild-caught seafood has decreased from approximately 500 to 300 from 1995 to 2017². Important drivers for this development are that many smaller facilities disappear, existing facilities become larger, new large vessels often process the fish onboard, and a decreasing share of the wild-caught fish is processed domestically. Low industry profitability is an important reason for the reduction in domestic processing¹. However, the fishing industry is working on turning this trend, which is increasingly possible with the development in automatization of the processing activities.

In the lower right chart, we observe that the fish processing facilities producing fish meal and oil have a substantial higher EBITDA margin than the facilities processing whitefish and pelagic fish species (includes facilities that combine processing of wild-caught and farmed fish)³. However, in terms of revenue, the fish meal and oil segment is a smaller part of the processing industry.

Key financials for the processing industry of wild-caught seafood



Revenue and EBITDA margin for the processing industry of pelagic and whitefish species for human consumption and fish meal and oil



Stable access to raw materials is crucial for the processing industry. Large seasonal fluctuations of the fisheries make it difficult to maintain operation all year round. Thus, many of the facilities combine processing of wild and farmed fish. Competition of raw materials is tough and is intensified by the decline in domestic processing, expanded capacity at the landing sites as the vessels and landings become larger, an increasing share of the fish is sold through closed channels, and increased integration between the fishing fleet and the processing industry.

1 "Riksrevisjonens undersøkelse av kvotesystemet i kyst- og havfiske", Riksrevisjonen, www.riksrevisjonen.no/rapporter-mappe/no-2019-2020/undersokelse-av-kvotesystemet-i-kyst-og-havfiske/, accessed 16 November 2020.

2 "Driftsundersøkelse i fiskeindustrien", Nofima, nofima.no/prosjekt/driftsundersokelsen-i-fiskeindustrien/, accessed 16 November 2020.

3 "Driftsundersøkelse i fiskeindustrien", Nofima, nofima.no/publikasjon/1734807/, accessed 16 November 2020.

Export of wild-caught seafood

The fishing industry is one of Norway’s largest export industries, and most of the catch volume is exported to all the corners of the world. Over the past 10 years, export value has grown substantially, with a notable acceleration from 2013, reaching an all-time high value of NOK30.8b in 2019. As the export volume has decreased by 21% from 2010 to 2019, the value growth has been primarily driven by increased prices and favorable currency exchange rates.

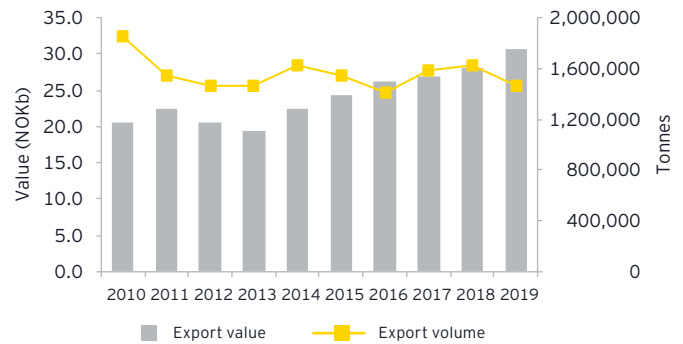
Cod accounted for 32% of the total export value in 2019 and is, in terms of revenue, the largest species in the export of wild-caught seafood. Portugal, Denmark, China and the UK are the largest export markets for cod¹. Portugal consumes the cod mainly as clipfish, the UK prefers Norwegian cod in their fish and chips, and a large share of the cod that is shipped to China is processed in China and reexported to Europe and the US.

Wild + farmed = the Norwegian seafood industry

The Norwegian seafood industry consists of the fishing industry and the aquaculture industry. Most of the seafood is exported, and over the past decade, the aquaculture industry’s share of total seafood export value has increased substantially. Simultaneously, the volume distribution between the two industries has been relatively stable, with fisheries having a 10-year average of 60%. However, this is changing as the production volume of the aquaculture industry rises. In 2019, farmed seafood accounted for 45% of the total export volume.

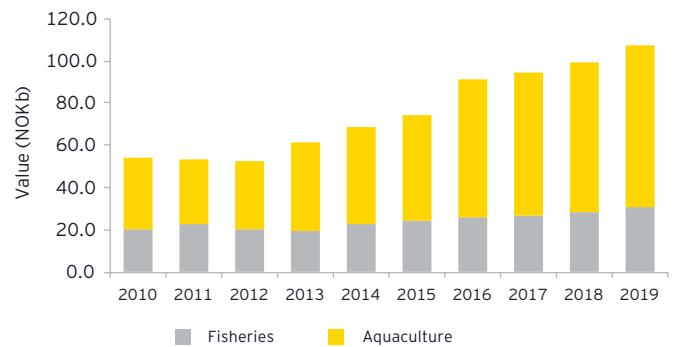
While the fishing industry has existed since the first settlers came to the Norwegian coastline, the adventure of the aquaculture industry only started 50 years ago. During the pioneering phase of the aquaculture industry, the competence from the fishing industry was crucial. Also, wild-caught fish was, and still is, an important feed ingredient in diets for farmed fish. Today, these coastal industries operate side-by-side in the same waters, and they will continue to be large and important industries in Norway.

Export of wild-caught seafood



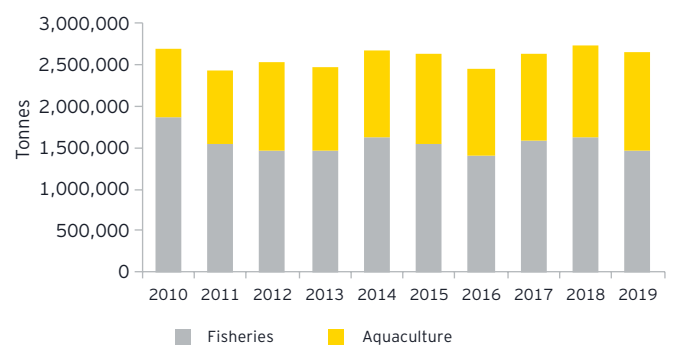
Source: Norwegian Seafood Council

Export value of Norwegian seafood



Source: Norwegian Seafood Council

Export value of Norwegian seafood



Source: Norwegian Seafood Council

The coexistence of the industries is key in ensuring sustainable management of the valuable marine resources and the future for these ocean treasures.





Short-term forecast

First, the verdict on last year's forecast ...

Methodology

Revenue has been estimated for 2020 and 2021 based on a quantitative forecasting model. Several approaches have been incorporated into the model, varying between the different subsegments.

Among the approaches used are:

- ▶ An analysis of the historical correlation between key variables (such as salmon price and volume) and revenue
- ▶ Guidance from public companies
- ▶ Analyst reports for certain subsegments
- ▶ Discussions with industry experts
- ▶ Introduction

A forecast has been presented in most editions of this analysis. The goal is to forecast the development of the companies included in our database.

We note that in terms of revenue contribution, the subsegments of sea farming and trading are, by far, the largest. Their revenue is, to a large extent, the product of volume and price. With this in mind, our primary focus in our forecast section will be on the main factors impacting these two subsegments.

There is currency exposure in both revenue and cost for the farming companies. Most sales are in euros, and a large part of the fish feed costs are in currencies other than NOK. In theory, the forecasted NOK price of salmon should, therefore, take currency effects into account. Although input factors for feed are purchased primarily in US dollars, the raw materials originate from a broad range of currencies and are, as such, more diversified than the trading currencies may imply.

How did we do?

Salmon price

The 2019 forecast was finalized in the fall of 2019. At this time, we had some intel in terms of salmon prices thus far in 2019, and our forecast of salmon prices was not for a full year.

Despite having multiple sources of prices for year to go 2019, we missed with our forecasted price primarily due to record high prices in December.

While the average salmon price is a key input factor in our forecast, the degree to which the sea farming and trading subsegments actually achieve the spot price is also of importance. For instance, an average spot market salmon price of NOK60 does not mean that the average salmon price of the sea farming subsegment constitutes 100% of this. This will be impacted by long-term contract coverage and related contract prices. Historically, we have observed that the combined sea farming subsegment in our database has achieved between 80% and 90% of the average annual spot price.

In the 2019 forecast, we estimated the achieved spot price for the sea farming subsegment to be 90%, spot-on with the actuals. For the sea farming subsegment, we estimated the EBITDA margin to be 33%, which turned out to be too optimistic compared to the actual 2019 margin of approximately 30%. We had been optimistic and estimated a minor decrease in cost/kg, while actual numbers showed yet another year with increased costs.

Fish volume

According to the Directorate of Fisheries, the sales volume of slaughtered fish increased by 6.7% (salmon and trout (WFE)). In our forecast, we had estimated the growth to be a little lower at 5.0%. We based our estimates on our professional judgment combined with observed growth and guidance data from some of the publicly traded sea farming companies, as well as estimates from various analyst reports.

The verdict

Looking at our total forecast for the value chain, we had estimated a top-line growth of 1%, with the actuals ending up at 7%. This was primarily driven by both a higher volume and price than we had in our forecast. The trading segment achieved 104% of the Fish Pool 2019 price. Achieving over 100% must be seen in context with volume being sold at times with higher prices and potentially favorable fixed-price contracts. In terms of EBITDA for the whole database, we had forecasted close to 13.8% vs. the actual 13.2% – being negatively impacted by higher cost/kg in the sea farming segment than expected.

... and what would a 2020 forecast be without a discussion on COVID-19

When writing a forecast in 2020, it is impossible not to go into the COVID-19 pandemic we are currently facing. The outbreak of COVID-19 has had a significant impact on businesses in a wide range of industries.

While the aquaculture industry is not immune to negative COVID-19 effects, there are still noticeable interesting impacts throughout 2020 that actually may speak in favor of an even more promising future for the Norwegian aquaculture industry.

The lower demand in HORECA has mostly been absorbed by retail

As a consequence of what can be described as a “world shutdown” in March 2020, the premium-paying HORECA market for Norwegian seafood collapsed. Prior to COVID-19, food service accounted for approximately 45% of the global salmon market¹. With the sudden drop in demand, the export of Norwegian salmon and trout declined in the following months compared to 2019 (see illustration in the chart).

Nevertheless, a pandemic does not stop people from consuming food. As a result, an increasing portion of seafood is now being consumed at home rather than in restaurants. Consequently, seafood sales in retail and home delivery services have boomed

post-COVID-19. The Norwegian aquaculture industry is known for being highly adaptable, and the industry has, to a large degree, managed successfully to move HORECA volume over to retail throughout the pandemic. The drop in the demand in August (see graph) was due to the holiday season in Europe and reduced restaurant consumption, as well as reduced traction from the weak NOK². Despite demand challenges, the total export volume of Norwegian salmon and trout, so far this year (Jan- Nov), is up by 1% compared to 2019.

Turning volume from HORECA to larger customers with higher purchasing power, including retail and large processing companies, has put pressure on the prices. Looking at the graphics, one can clearly see that salmon prices have dropped during the pandemic. On the other hand, the weak NOK has been favorable for the export value.

Surge in consumer demand for pre-packet products and transportation challenges

The combination of increased home consumption, the shutdown of restaurants and fresh food counters, and an urge to buy non-perishable food, has boosted demand for pre-packed and frozen products – although the effect on frozen products seems to have been short term. In turn, this has increased the need for processing activity, both internationally and domestically,

1 “Hvordan har det egentlig gått for havbruksnæringen”, kyst.no, <https://www.kyst.no/article/hvordan-har-det-egentlig-gaatt-for-havbruksnaeringen/>, accessed 8 October 2020

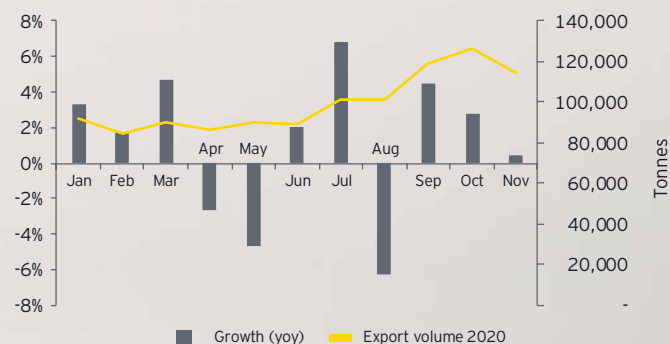
2 “Kraftig nedgang for sjømateksporten i august”, Norwegian Seafood Council, <https://seafood.no/aktuelt/nyheter/kraftig-nedgang-for-sjomateksporten-i-august/>, accessed 8 October 2020

and export to the major processing countries has risen. The increased availability of pre-packaged products and expanded product range has contributed to boosting home consumption growth even further¹.

The logistics of Norwegian seafood has worked surprisingly well throughout the pandemic. Although air freight has been hit hard, truck transport within Europe has been less effected¹.

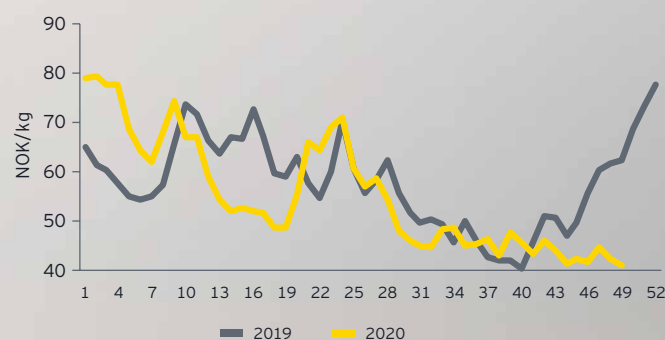
The significantly reduced airfreight capacity to overseas markets has naturally put certain restrictions on the export volume to these markets, which in turn has increased transportation costs and sales price. As a direct consequence of high transportation costs to overseas markets, there has been a surge in the export of fillet products³. With higher sales prices, a potentially negative effect is that consumers seek to find substitutes.

Norwegian export of salmon and trout 2020



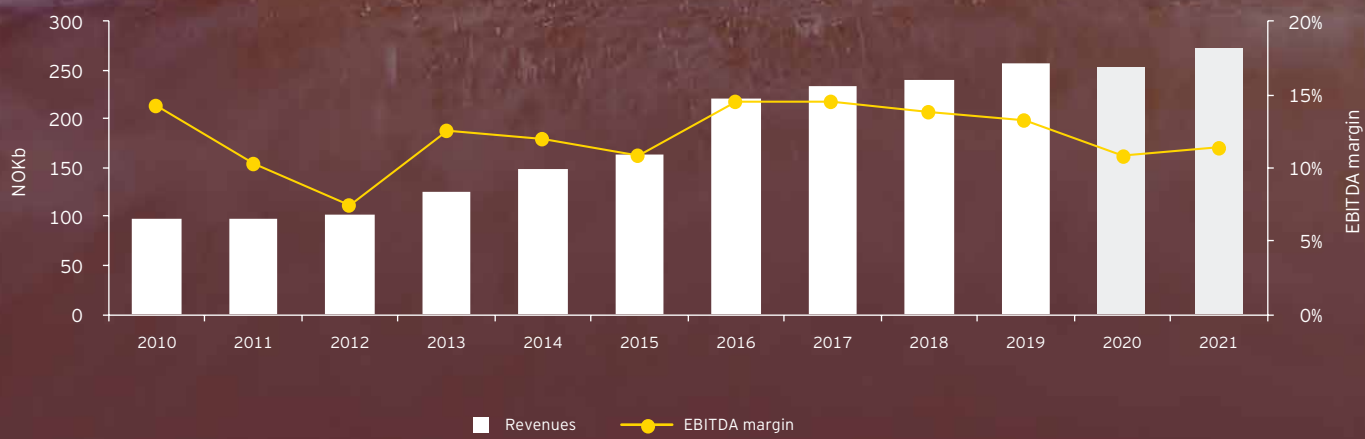
Source: Norwegian Seafood Council

Norwegian salmon price NOK/kg*



* Weighted average of weekly reported sales prices of fresh Atlantic Superior Salmon. Source: NASDAQ Salmon Index

1 Aandahl, P. T., Interview with Seafood Analyst Paul T. Aandahl from the Norwegian Seafood Council, October 2020



A promising future still

The Norwegian aquaculture industry has suffered in the stock market

All in all, the Norwegian aquaculture industry has fared quite well so far in this pandemic when considering its operations, particularly compared to how hard certain other industries have suffered. However, the stock market has not been merciful to the listed aquaculture entities. YTD (mid-Dec), the Oslo Seafood index was down approximately 14%, which is significantly worse than the Oslo Stock Exchange benchmark index, which was up approximately 1% at the same time.

It is worth noting that compared to many other industries, aquaculture has managed the crisis with limited support from the Norwegian government. Nonetheless, there is some uncertainty related to seafood demand in the near future, hereunder, in relation to how consumers purchasing power and behavior will change when governments start reducing compensation schemes¹. In addition, there are declining GDP in many countries, and the threat of new waves of outbreaks is still very much real.

Volume and price

It is unlikely that we will see a repetition of the high year-on-year volume growth observed from 2018 to 2019. However, 2019 was after all an all-time high for sold volume of Norwegian salmon and trout. Keeping this in mind, our estimated 1.5% growth from 2019 to 2020 is impressive from a historical perspective as this will implicate another record high volume for 2020.

Throughout 2020, it has become apparent that 2020 will not be a record year in terms of salmon price. As illustrated earlier, salmon prices have taken several hits in 2020 despite starting the year at a much higher price level than in 2019. We estimate the 2020 salmon price to end up somewhere around NOK55/kg.

We expect margins to further deteriorate in 2020. Lower prices combined with high cost/kg will most likely push the margins to the lowest level observed since 2015.

What positive effects might come out of this major crisis?

First and foremost, global seafood consumption is expected to continue its growth in the long term. People are now spending more time at home, and seafood has become a more relevant dish to serve at home¹.

There have been reports of an increase in new seafood consumers, especially younger ones, in several markets. This may be due to the increased availability of pre-packed products, an expanded product range and better shelf placement in retail stores. Experts predict that this broader base of home consumers will remain even when the HORECA market reopens. Increased retail penetration is likely to have a positive long-term effect on seafood demand¹. Amplified focus on health is also positively affecting seafood demand and could potentially increase consumers' willingness to pay.

The rise of seafood sales in retail stores, online channels and home delivery services provides opportunities for increased focus on marketing and branding activities. There is massive room for improvement in this aspect for the Norwegian seafood players. The industry may take this opportunity to work on differentiation and adding more value to their products.

Consumer awareness is on the rise. Transparency, traceability, quality and social responsibility are areas that a growing number of consumers emphasize. These are trends that the Norwegian seafood industry is positioned to take advantage of if it plays its cards right going forward. It is becoming more and more apparent that in order to win over future consumers, companies will have to prove that they can deliver on these metrics.

A promising future for Norwegian seafood

The COVID-19 chapter has yet to be closed, and we do not know how it will affect us in the foreseeable future. Businesses must adapt, be resilient and be at the forefront of shaping our new future. This will define who emerges as tomorrow's winners. The Norwegian aquaculture industry has so far managed well, and the future seems promising. Will the Norwegian aquaculture industry come out of this crisis as one of the winners?

¹ Aandahl, P. T., Interview with Seafood Analyst Paul T. Aandahl from the Norwegian Seafood Council, October 2020.



Production tax from January 2021

A production tax levied on all production of salmon, trout and rainbow trout has been implemented with effect from January 2021 with NOK 0.4 per kilo.

With few exemptions, production tax is imposed on all entities granted a license to produce fish in accordance with the Aquaculture Act. Accordingly, all entities granted a license to produce salmon, trout or rainbow trout will be liable to report and pay the production tax on an annual basis. The only proposed exemption are fish produced under a slaughtering pen license (NOR: slaktermerdtillatelse) and fish park license (NOR: fiskeparktillatelse). The current hearing proposal only intends to levy the tax on fish produced in the sea, while land-produced fish will not be taxed. If the production in general is moved on-shore in the future, the authorities will consider to also tax the land-based production to avoid distortion of competition between sea and land-based production.

All fish produced within the Norwegian territorial borders, i.e., within 12 nautical miles of the mainland, will be taxed. The production tax will be levied on all produced fish, meaning the amount of gutted and bled out fish with the head on, measured in kilos and with no differentiation between quality. If data is only available for, i.e., round fish, the product weight will be determined based on a fixed conversion rate. Fish that are sorted out due to i.e. disease are not included.

Each taxable entity will be liable to calculate and report the amount of produced fish to the tax authorities on a self-declaration basis. However, the tax authorities are planning to automatically obtain the necessary data from the Directorate of Fisheries and expect this to be operational within the 2021 filing date which will be due on the 18.

January 2022. If so, the data will be imported automatically based on numbers reported to the Directorate of Fisheries, allowing for a simplified reporting procedure to the tax authorities as the data will already be available before filing.

The first deadline will be on 18 January 2022, covering the period from 1 January to 31 December 2021. The reporting will be on an annual basis, but shorter reporting terms are being considered. Production tax will be imposed when the fish is slaughtered, regardless of where the fish is slaughtered.

Because the production tax is imposed as an excise duty, all taxable entities will be liable to register for excise duties at the tax authorities (NOR: særavgiftspliktig). This triggers an obligation to self-declare and report the production tax in accordance with the excise duty act.

Appendix



The aquaculture value chain

Technical solutions

Biotechnology

Production

Distribution

Processing

The value chain

When discussing the aquaculture industry, we primarily talk about the end product – salmon and trout. However, there are many other stages and actors in the industry. The aquaculture value chain includes broodstock (egg and spawn), smolt, edible fish, fish processing (based on farmed fish), export and trade and suppliers of goods and services.

For analytical purposes, the value chain and the value creation can be presented in different ways.

In particular, there are three groups of suppliers – namely technical solutions suppliers, biotechnology suppliers and distributors – which can be challenging to present in a common value chain. These three can also be perceived as diverted or parallel activities.

It is apparent that technical solutions suppliers are needed at every stage of the value chain (as we can see in the illustration on the right side). Hence, presenting them as just one segment can be misleading.

The above-mentioned challenge is almost the same as that for the biotechnology suppliers, who deliver a wide range of products, including feed, vaccines, medicines and cleaner fish.

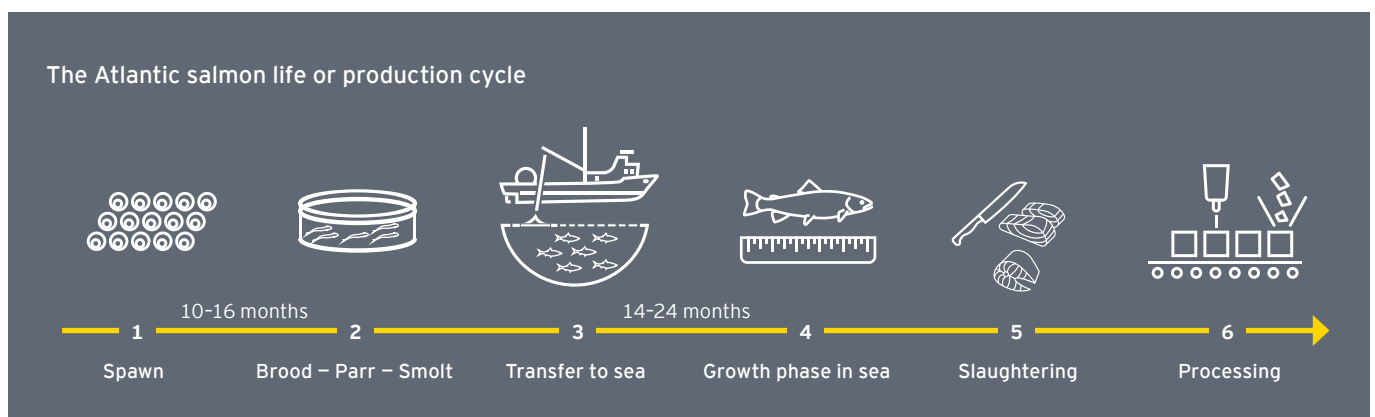
The common denominator for these products is the biological or pharmaceutical raw materials. The biotechnology manufacturers supply both egg and spawn producers, smolt producers and sea farmers.

The distribution phase is also complex. Sea transportation is needed to transport smolt from freshwater to net pens in seawater and transporting harvestable fish to processing plants. In addition, we have traders and exporters who purchase fish from sea farmers and provide it to the end-consumers, either slaughtered or processed.

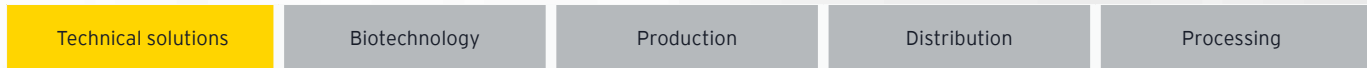
The primary value-creating activity in the industry is production. The production cycle is about three years. During the first year, eggs are fertilized, and the fish are grown to 100-250 grams in controlled freshwater environments.

Subsequently, the fish are transported into seawater cages where they are grown to about 4-5 kilos. This growing process takes 14-24 months, depending on the seawater temperature.

Despite the methodological challenges, we have decided to present technical solutions, biotechnology and distribution together with production and processing in one single value chain. This is to make the analysis easier to follow and interpret.



Technical solutions



About the segment

The technical solutions segment includes companies with approximately 50% or more of its business linked to the aquaculture industry, but which are not directly linked to any of the other segments. Hence, there is a large variety of products and services provided by the companies in this segment.

The largest companies within this segment are producers of technical solutions and services specifically developed for the aquaculture industry, e.g., barges, well-boats, feeding systems, cages, mooring systems, sea lice treatments and software.

We have divided the segment into three subsegments:

1. Consulting and services
2. Equipment and farming solutions
3. Yards

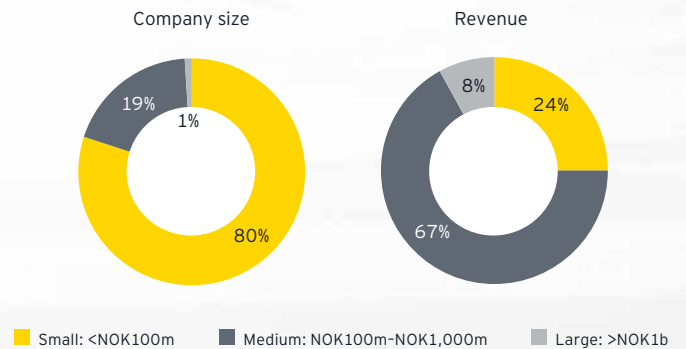
Segment highlights

While the segment has experienced continuous revenue growth, margins have been under pressure since 2016, among others due to increased competition among the companies. However, in 2019 we observe a positive trend with margin increase in all of the subsegments. Increased focus on farmer’s environmental footprint and sustainability, as well as digitalization, has a positive spillover effect on this segment as it incentivizes farmers to invest in new technology. Despite the M&A activity being high the last couple of years, the segment remains rather fragmented and is predominantly made up of small-sized companies (of which 80% had revenues below NOK50m in 2019).

Key financials



Segment composition (2019)



We continue to observe more interest from industrial players. In 2019, 15 deals involving companies from the segment were announced. In nine of the transactions, companies from the segment were the target, with mostly strategic players on the buy-side. This indicates a continuing trend of companies using M&A as a way of growing the top line through strengthening product offerings and market position.

Consulting and services

Equipment and farming solutions

Yards

Consulting and services

The companies in this subsegment offer competency on various specializations across the whole value chain (asset-light) and ongoing maintenance and services on production facilities with vessels and machinery.

Over the last five years, the five top players share of the subsegment's revenue has increased from approximately 35%-40%.

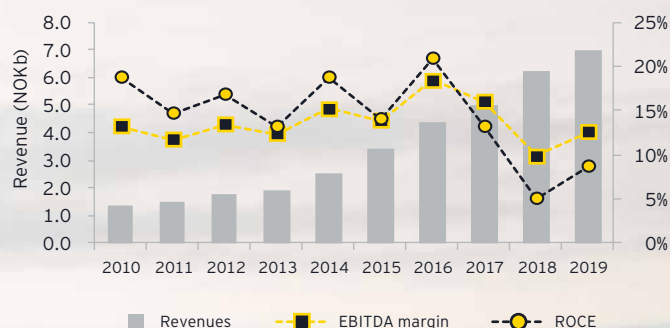
The revenue has more than quadrupled in the period 2010 to 2019. While we observe a positive margin trend in the period 2010 to 2016, the margin dropped the two following years to a low-point in 2018. While the gross margin was relatively stable, the reduced EBITDA margin was driven by increased personnel and other operating expenses. In 2019, the margins recovered. The companies continued to achieve high gross margin, while managing to reduce personnel and other operating expenses in % of revenue.

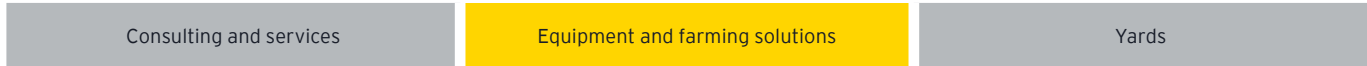
Part of this subsegment is capital-intensive and CAPEX has increased significantly during the last five years. The increase has primarily been driven by vessel purchases for some of the service providers. This, in turn, reduced the ROCE in the 2016-2018 period, but is expected to increase as the new additions start to generate more returns.

Top five companies (2019 revenues)

1. SINTEF Ocean AS
2. Gildeskål Forskningsstasjon AS
3. Aqs AS
4. Frøy Akvaservice AS
5. Akvaplan Niva AS

Key financials





Equipment and farming solutions

The companies in this subsegment offer a variety of equipment and solutions – from the largest players, such as AKVA Group offering nearly all kinds of equipment, to smaller and more niche players providing more specialized equipment.

From the peak in 2016, the EBITDA margins plummeted the two following years to an all-time low in 2018. The reduction was driven by a reduction in gross margin and an increase in personnel expenses. The reason for this development is somewhat complex, where we see a change in product mix and increased competition as the main explanatory factors. However, in 2019, the margins recouped as the subsegment saw a double-digit revenue growth from 2018 (12%). This growth was driven by a general growth seen throughout the subsegment for companies of all sizes. However, the subsegment remains fragmented and highly competitive, and the 2019 EBITDA margin of 5.2% is still below the 9.0% as observed in 2016.

We have observed a double-digit growth in capital employed every year since 2013. Since 2016, the growth in EBIT has not been high enough to keep ROCE at pre-2016 levels, resulting in a decline in ROCE. This indicates that the effect of the investments made in the period has yet to materialize.

Capitalized R&D spending has increased over the last couple of years, and we observe increased investments toward software solutions and further development of RAS technology. This is closely correlated with the farmers' agenda to secure cost-efficiency, animal welfare and decrease environmental footprint.

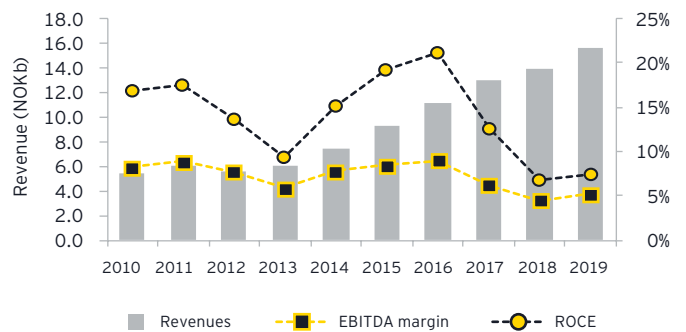
We observe trends where companies in the subsegment join forces either through M&A or joint ventures. In most cases, the companies continue as separate entities yet have the advantage of knowledge-sharing opportunities and the ability to strengthen market position through these collaborations.

Top five companies (2019 revenues)

1. Optimar AS
2. AKVA Group ASA
3. Steinsvik AS*
4. Egersund Net AS
5. Aqualine AS*

* Please note that Steinsvik and Aqualine had not filed their 2019 accounts as of the time of completion of this report. For comparability, we have included them with numbers for 2019 equal to 2018.

Key financials



Consulting and services

Equipment and farming solutions

Yards

Yards

Yards included in this subsegment primarily constructs, or retrofits, well-boats and feed freight vessels. Yards were previously included as part of the equipment and farming solutions subsegment.

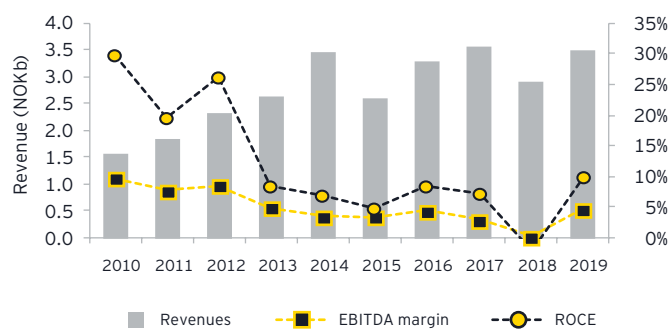
The yards can only build a limited number of vessels at a time, and the construction period may be longer than a year. An effect of this is fluctuating revenues, easily observed in the chart. The well-boat industry is blossoming, resulting in a significant number of well-boats being ordered – with several yards reporting high order backlogs. The high level of newbuilds is driven by increased demand for well-boat services, but also through the replacement of older well-boats due to new technologies and the ever-increasing focus on environmental impact and sustainability.

Companies in the yard subsegment experienced high activity within newbuilds and reported high revenue levels in 2019 due to continued booming demand. This was especially the case for companies with high exposure toward the well-boat market. Following the low profitability level in 2018, the subsegment was able to achieve a margin of 4.8% in 2019 – a higher margin than all previous five years. One of the main contributors was one of the largest companies, which improved EBITDA by NOK50m in 2019 (31% of the subsegment’s increase), recovering from last year’s losses caused by delays, and nearly doubling their newbuild activity in 2019

Top five companies (2019 revenues)

1. Fitjar Mekaniske Verksted AS
2. Aas Mek Verksted AS
3. Myklebust Verft AS
4. Sletta Verft AS
5. Vaagland Båtbyggeri AS

Key financials



Biotechnology

Technical solutions | **Biotechnology** | Production | Distribution | Processing

About the segment

Biotechnology refers to the application of biological technologies in product research and development. Modern biotechnology has been used in aquaculture with regards to cases, such as reproduction control, disease control, environmental management, feed production and biodiversity conservation.

We have divided the segment into two subsegments:

1. Fish health
2. Feed

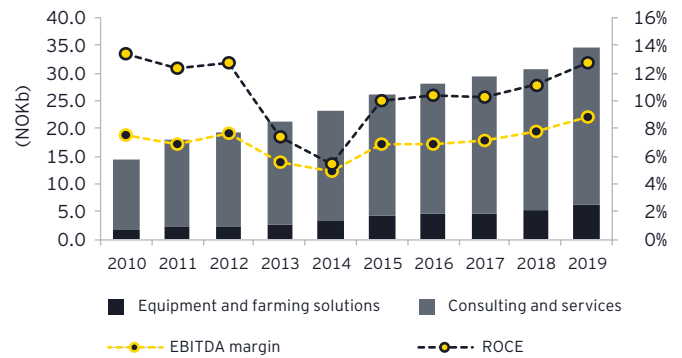
Segment highlights

Biotechnology not only enhances production to meet demand but also ensures sustainability and response to environmental threats. The use of technology makes it possible to maintain healthy fish stocks at low prices by contributing to nutritious feed and effective disease prevention.

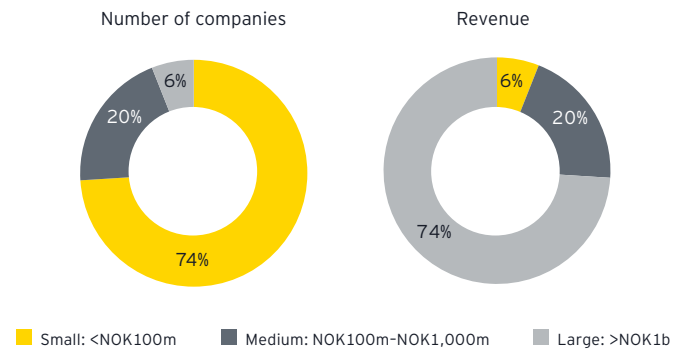
The biotechnology segment has seen substantial growth in the past decade with a compound annual revenue growth rate of 10.1% from 2010 to 2019. The growth has been positively influenced by high salmon prices and stagnating volume due to biological issues, resulting in an increased demand for healthy and efficient fish feed, fish medicines, vaccines, etc.

While the revenue growth rate subsided, and the EBITDA margin remained fairly unchanged in the period 2015 to 2018, the segment experienced double-digit revenue growth from 2018 to 2019. At the same time, the segment experienced a record-high EBITDA margin in 2019 (8.8%). The significant revenue growth and positive margin development were observed in both the high-volume/low-margin feed subsegment, as well as in the high-margin fish-health subsegment.

Key financials



Segment composition (2019)



Fish health

Feed

Fish health

The financial results in the fish farming industry depend on healthy and high-quality fish. Entities within the fish health subsegment provide products, services and research and development projects, which are crucial for maintaining and improving the fish health for the global aquaculture industry. Contrary to the feed subsegment, where only a limited share of the produced volume in Norway is exported, companies in the fish health segment have a higher degree of export.

Finding the solution to biological challenges

Biological issues remain a significant challenge for the Norwegian salmon farmers. Sea lice still represent the biggest threat to Norwegian fish health, but there are also other significant risks, such as pancreas disease (PD), infectious salmon anemia (ISA) and heath and skeletal muscle inflammation (HSMI).

Solving the sea lice issue demands a combined effort from the entire aquaculture industry, including research into pharmaceuticals and vaccines, breeding technologies and genetics, functional feeds, mechanical and biological methods for lice removals, etc. Several companies within the fish health subsegment have provided medicinal treatments for combatting sea lice, and they are continuously developing new and improved pharmaceuticals.

Entities within the fish health subsegment invest heavily in research for finding new, sustainable and efficient solutions for battling sea lice and the other aquaculture related biological issues.

There is among other ongoing research for developing a viable commercial protective sea lice vaccine. If successful, this will be an international break-through in vaccinology that will help the industry reduce the need for chemical treatments.

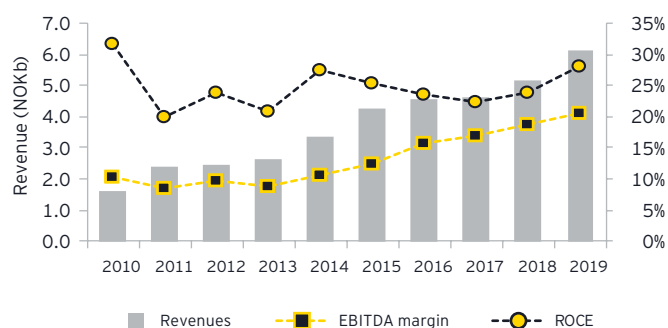
Continued revenue and margin growth

The focus on fish health and biology in the aquaculture industry has been the driver behind the revenue and margin growth in the fish health subsegment over the last decade, and 2019 was no exception (18% year-on-year growth compared to 2018). Continued high global demand coupled with the introduction of new pharmaceuticals and vaccines (e.g., a new sea lice pharmaceutical and a new PD-vaccine based on DNA gene technology) fueled the 2019 revenue and EBITDA margin growth.

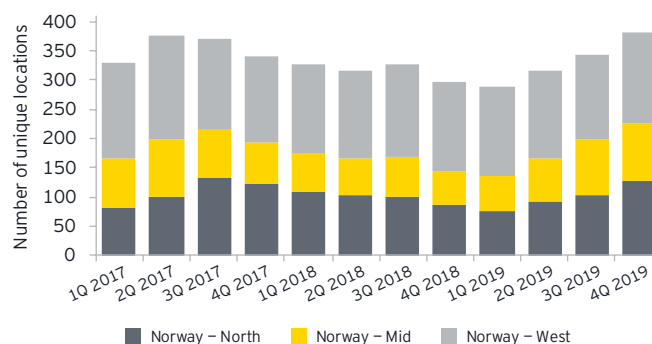
Top five companies (2019 revenues)

1. PHARMAQ AS
2. Stim. AS
3. Nofima AS
4. Veterinærmedisinsk Oppdragscenter AS
5. MSD Animal Health Norge AS

Key financials

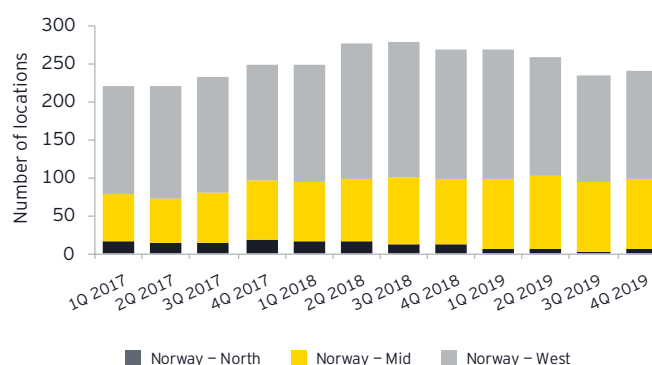


Number of unique locations reporting sea lice above limit – rolling last four quarters per region



Source: Barentswatch.no and EY analysis

Locations with ISA or PD per region – rolling last four quarters



Source: Barentswatch.no and EY analysis

Fish health

Feed

Feed

The feed subsegment includes feed producers and companies producing and supplying input factors to feed production. Feed represents about half of the total production cost for salmonids and makes out approximately 95% of the carbon footprint in traditional salmon farming. Also, the correct ingredients are vital for both the health and quality of farmed fish. Thus, feed is a key focus area in the industry from an economic, environmental and biological perspective. While the feed producers included in the feed subsegment produce feed and products to other species as well, salmonid feed makes up a significant amount of the total.

Shortage of conventional marine materials (mainly fish meal and fish oil) has resulted in a shift toward vegetable materials. While fishmeal and fish oil made up more than 80% of salmon feed in the '90s, today, conventional marine materials only constitute between 25-30% of the average Norwegian fish feed. Consequently, the long-chain omega-3 fatty acid content in the farmed salmon has declined. However, the feed procurers are investing heavily in finding alternative sources of omega-3, including the use of byproducts from conventional fisheries, krill, algae, etc.

Consolidated feed production

The salmonid feed industry is largely consolidated and consists of a few large producers controlling the majority of the salmon feed output. Over the last five years, the top four companies have accounted for between 80-90% of the feed subsegment revenues.

Continued revenue growth and margin improvement

The subsegment had a steady, but diminishing, revenue growth from 2010 to 2018, and the EBITDA margin was virtually unchanged in the period 2015 to 2018. This is largely explained by increased competition in the feed subsegment following Mowi's entrance to the market in 2014.

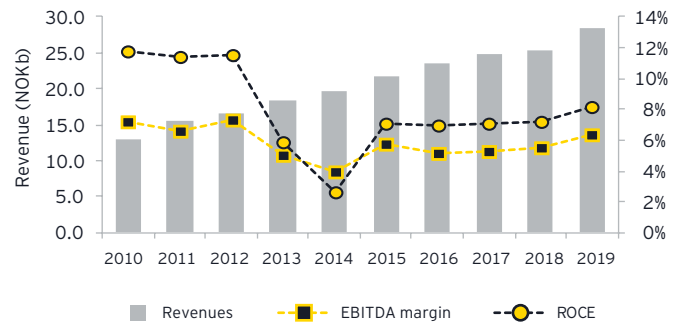
In 2019, the subsegment experienced a double-digit revenue growth (not seen since 2015), and the EBITDA margin increased to 6.3%. The massive revenue growth in the subsegment was driven by higher sold volumes of feed as a consequence of the observed growth in biomass and harvest volume.

While virtually all of the companies in the subsegment experienced revenue growth, the revenue growth was primarily driven by one of the largest feed producers (making out approximately 50% of the subsegment revenue growth).

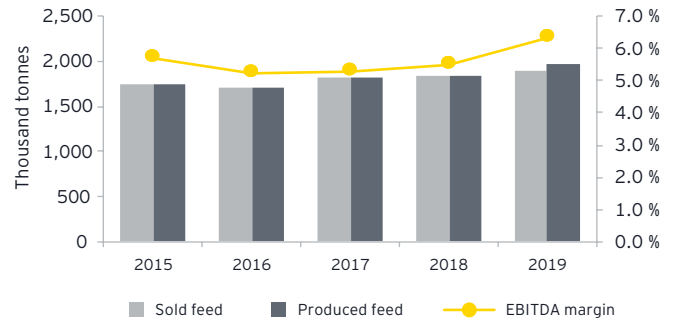
Top five companies (2019 revenues)

1. Skretting AS
2. EWOS AS
3. BioMar AS
4. Mowi Feed AS
5. Aker BioMarine Antarctic AS

Key financials



Feed EBITDA margin and volume development



Source: Mowi Salmon Farming Industry handbook 2020, Directorate of Fisheries, The EY organization





Production



About the segment

The production segment consists of the fish' life cycle from the breeding and fertilization of eggs, through nurturing of fry to smoltification, to finally putting it to sea for growing to harvest size.

In this year's analysis, we introduce land-based farming as a separate subsegment. As of today, the production volume in this subsegment is very limited. But given the current number of identified land-based projects, this subsegment may potentially be an important complementary production method in Norway. However, if and how many of these projects will materialize remains to be seen.

To reflect the various stages of the production cycle, we divide this segment into four subsegments:

1. Egg and spawn production
2. Smolt production
3. Sea farming
4. Land based farming

As quality in the first stages of the cycle is crucial to successful sea farming, there has been a large degree of vertical integration in this segment. The sea farming companies expand into upstream activities to facilitate access and high quality, both in the broodstock or eggs and in the handling and vaccination of fry during the freshwater stage.

The segment in total consists of about 260 companies.*However, a relatively small number of companies account for the majority of the value creation. In 2019, the 10 largest companies had a market share of about 54% in terms of revenue.

Segment highlights

The production segment has experienced substantial growth from 2010 to 2019, with a notable acceleration from 2016, driven by a significant increase in prices and favorable currency exchange rates for exports.

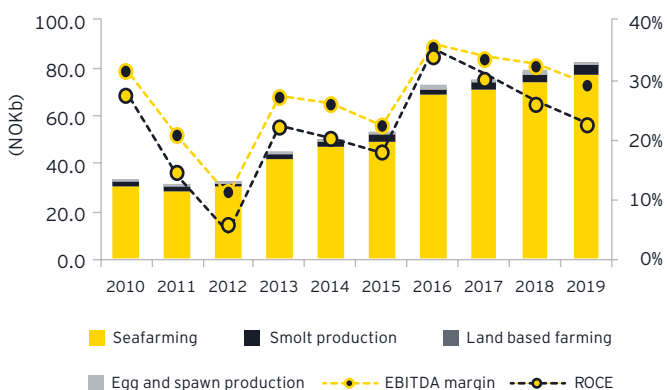
As a result of the increased profitability and increasing demand for various supporting services, the sector has become a major contributor to value and job creation along the Norwegian coast.

There is a continuous concern about the sector's challenges related to sea lice and other environmental issues. These challenges materialize in higher cost and are the main reason for the decline in the EBITDA margins since 2016.

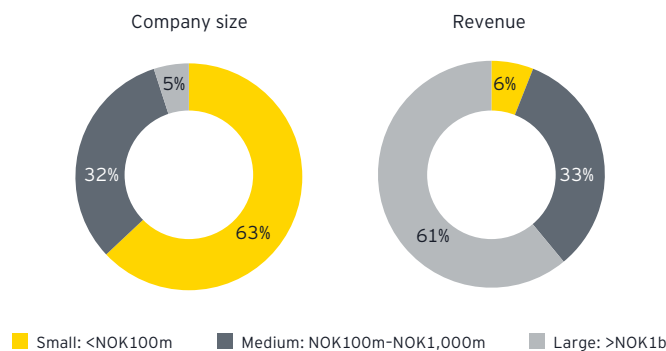
These challenges have plateaued the growth in production volumes in the past few years, paradoxically driving up prices and profits in the short term. In the long term, however, there is a need for sustainable growth in volume. Biological challenges and diseases are two of the major concerns the industry faces going forward.

As an attempt to tackle the industry's challenges today, there has been a significant increase in R&D over the last years. Most of the new innovations are focused on making aquaculture more sustainable, decreasing biological challenges while at the same time increasing volumes in the long run.

Key financials



Segment composition (2019)*



* Note that many of the legal entities in this report are, in reality, part of the same group.



Egg and spawn production

The companies in this subsegment are specialized in spawning and egg production. Their primary product is fertilized fry. In addition, these companies often sell other products, such as fry, smolt and broodstock, as a result of the breeding business.

Many of these companies also cross over into smolt production and even sea farming on a smaller scale. Some of the companies operate on a stand-alone basis, while others are owned fully or partially by sea farmers or other industry players.

Research and development

As the industry faces increasing production challenges related to sea lice and diseases, this subsegment puts a lot of effort into R&D. These companies work extensively to develop knowledge in areas, such as breeding, spawn production and disease control. They aim to strengthen the breeding material and utilize genetic technology to improve resistance to diseases and enhance growth rates.

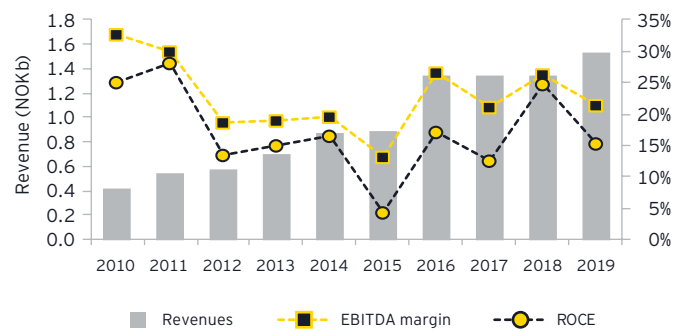
Revenue and margin development

The egg and spawn producers have experienced strong revenue growth over the last 10 years. A sharp increase in the sale of mature salmon grown on the egg producers' own licenses drove much of the revenue growth in 2016. After the spike in 2016, revenues have plateaued but with substantial growth in 2019. The revenue growth, as well as the EBITDA margin development in 2019, is among other impacted some substantial extraordinary sales with close to zero margin in some of the entities in the subsegment, as well as some mergers (between companies included in the subsegment and companies previously not included in the subsegment).

Top five companies (2019 revenues)

1. AquaGen AS
2. Benchmark Genetics Norway AS
3. Nordnorsk Stamfisk AS
4. Osland Stamfisk AS
5. Svanøy Havbruk AS

Key financials



Egg and spawn production

Smolt production

Sea farming

Land-based

Smolt production

Smoltification is the biological process that makes young fish ready for the transition from freshwater to seawater, and fish that has undergone this process is called a smolt. This is the middle stage of the production cycle and is operated by the smolt producers. In specialized fish farms where conditions are optimized, the smoltification process is 10-16 months.

Stable growth

In the last decade, the smolt-producing companies have experienced continuous revenue growth and fairly stable EBITDA margins. The up-tick in revenue growth and EBITDA margin observed in 2019 is primarily driven by improved gross margin, explained by several companies as an effect of improved biological performance.

Vertical integration

All the top five companies by revenue in this subsegment are fully or partially owned by sea farming companies. Being present in the entire value chain enables sea farming companies to control more of their production cycle. The high degree of cross-ownership and intergroup trade, along with other long-term business relations, is believed to contribute to the stable revenue growth and EBITDA margin observed in this subsegment. However, this is difficult to verify without direct insight into bilateral purchases and contracts.

Larger post-smolt

Over the last years, the production of larger smolt (500 grams) has been introduced to the market. The larger smolt is typically referred to as post-smolt. Today, several smolt producers are looking into producing even larger smolt of up to 1 kg. Using larger post-smolt reduces time in the sea, minimizing the time the fish is exposed to uncontrollable risk factors, such as sea lice and diseases. However, increasing smolt size requires extensive investments in R&D and new facilities.

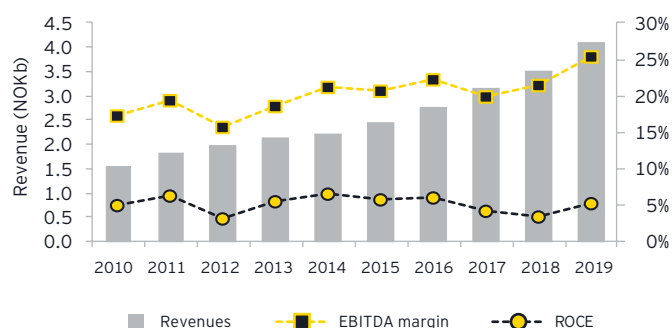
RAS technology

As RAS technology is becoming developed, we see an increase in land-based smolt facilities based on this technology. RAS is a way of recirculating water in the fish tanks, enabling companies to produce large quanta of fish with relatively low water consumption. Most of the existing smolt facilities in Norway are based on traditional FTS. However, most new smolt facilities are built using RAS technology.

Top five companies (2019 revenues)

1. SalMar Settefisk AS
2. Helgeland Smolt AS
3. Nordlaks Smolt AS
4. AS Sævareid Fiskeanlegg
5. Sisomar AS

Key financials





Sea farming

The final step in the production process is the sea farming, which is by far, the largest subsegment in the aquaculture industry. This is where the fish are put into seawater and grown until harvest size (about 4-5kg). This process takes about 14-24 months, depending on smolt size and other growth factors.

High stable salmon prices since 2016

Over the last years, the sea farming segment has experienced record-high profitability as a consequence of all-time-high salmon prices. This has resulted in EBITDA margins above 30% since the salmon price increase in 2016.

While demand has increased in recent years, sea farmers have struggled to increase supply correspondingly due to production constraints, sea lice and diseases. Consequently, the average salmon price for farmed Atlantic salmon more than doubled from 2012 to 2016 (to above NOK 60/kg) and has remained fairly stable at this level from 2016 to 2019. The weakening of NOK vs. EUR in the period has also positively affected the price.

Volume growth in 2019 after several years with stagnating production volumes

In 2019, the segment observed a notable increase in harvest volume for the first time in several years, with approximately 7% volume growth compared to 2018 volumes. In comparison, the compound annual volume growth rate from 2014 to 2018 was merely 0.4%. The volume growth is predominantly explained by the increase in the number of grow-out seawater licenses for salmon and trout in Norway over the last five years (from 973 in 2014 to 1,051 in 2019), and improved utilization of the maximum allowed biomass (MAB) in 2019 compared to the previous three years. The volume growth, together with an average price per kg marginally below the 2018 level, resulted in revenue growth in line with the 2018 levels.

Continued growth in cost per kg

Over the last years, disease, sea lice, extreme weather and other operational challenges have led to a significant increase in cost per kg, and cost per kg fish grew by more than 50% in the 2013-2018 period. The negative trend continued in 2019, with both a reduction in gross margin (i.e., increase in production cost per kg) and an increase in operating expenses in percentage of revenue. This, coupled with a slight reduction in revenue per kg, resulted in a continued deterioration of the EBITDA margin compared to the all-time high level observed in 2016. In fact, 2019 was the first year with a reduction in EBITDA level compared to the previous year (NOK 1.6b), since 2014/2015.

To a large extent, increasing costs can be explained by costs related to feed and health issues, primarily sea lice. Increased use of lice treatments, cleaner fish, specialized feed, service boats and investments in R&D drives operating costs. Delayed growth, starvation and forced early harvest curtail harvest volumes and represents less visible costs that are also present due to sea lice. These sea lice-related costs are the main drivers for the increase in OPEX we see over the past years

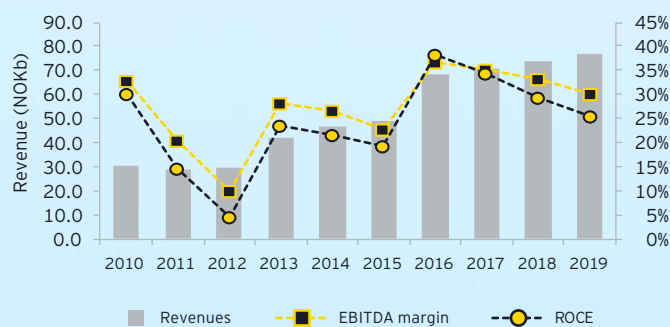
High investment levels

Over the last couple of years, there has been a significant increase in capital expenditure and R&D investments, with an increase in CAPM of 61% from 2015 to 2019. R&D investments are especially related to alternative sea farming solutions, like closed and semi-closed facilities at sea and offshore farming solutions, potentially increasing supply in the long run.

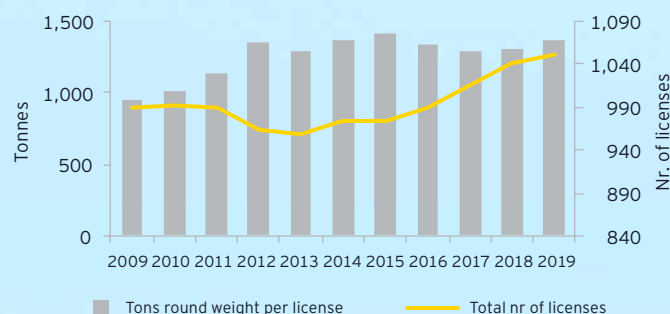
Top five companies (2019 revenues)

1. Mowi ASA
2. SalMar Farming AS
3. Lerøy Midt AS
4. Cermaq Norway AS
5. Nova Sea AS

Key financials



Development in number of licenses and harvest volume per license



Source: Directorate of Fisheries

Egg and spawn production

Smolt production

Sea farming

Land-based

Land-based farming

The stagnating volumes in the sea farming segment (traditional net pen production), combined with increased demand over the last years, have been driving forces behind the emergence of land-based farming. As presented earlier in this year's analysis, there has been tremendous growth in planned land-based production projects (although how many will materialize are yet to be seen), and several of these projects are planned in Norway. Land based production can potentially be an important complementary production method for supplying the market with the much sought after product.

There is a large number of land-based farming projects in Norway. Even though there are still quite some time until several of these will start with full-scale production, we have included them as a separate part of the production value chain in this year's analysis.

However, since only Nordic Aquafarms AS has salmon production in Norway as of today, we have presented the top 5 companies based on planned capacity in Norway instead of basing the list on revenue.

Several of the Norwegian projects are based on flow-through technology rather than RAS. This is possible through a combination of sea temperatures and being able to locate the facilities close to the ocean.

Top five companies (based on planned capacity)

1. Andfjord Salmon AS (70 000 tonnes)
2. Salmon Evolution (51 500 tonnes)
3. Helgeland Miljøfisk AS (50 000 tonnes)
4. Ecofisk AS (40 000 tonnes)
5. Salfjord AS (40 000 tonnes)





Distribution

Technical solutions

Biotechnology

Production

Distribution

Processing

About the segment

The distribution segment includes companies offering services within three subsegments:

1. Trading
2. Slaughtering
3. Transportation on sea

Total revenue and the margin development for the distribution segment is heavily influenced by the fact that the trading subsegment makes up almost 95% of revenues.

Trading is driven by the volume and price of fish sold. While part of the jump in revenue from 2015 to 2016 can be explained by volume and price, MOWI also split their trading business into a separate legal entity this year.

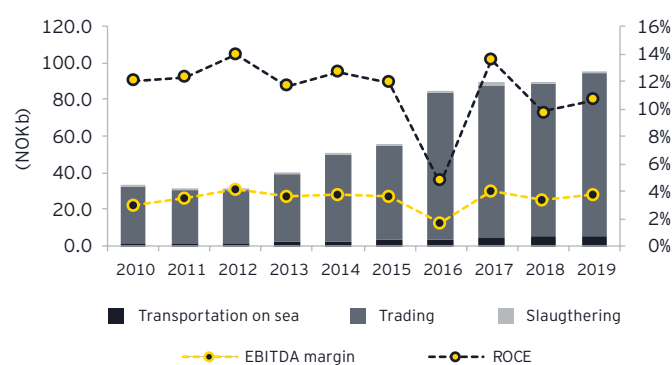
Since 2016, there has been a relatively modest change in both volume and price, resulting in limited revenue changes for the traders.

Export of Norwegian salmonids has steadily increased, reaching new heights every year. The total export value of Norwegian Salmonids was NOK76.2b in 2019, an increase of NOK5.5b from 2018¹. In the last couple of years, a weak NOK as compared to EUR has also been favorable for the exporters.

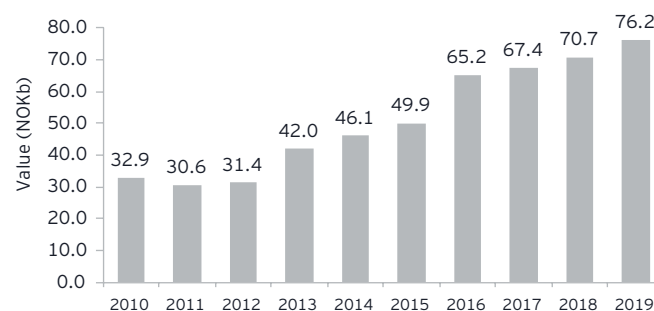
The overall export development is not surprising, as there is continued high demand for Norwegian salmon. Thus, an increase in salmon supply through more farmed fish will be welcomed in the market.

Transportation on sea yet again experienced a double-digit revenue growth in 2019. Well-boat entities continue to perform well with EBITDA margins above 40%, reaping the benefit of increased harvest volumes, as well as the continued biological challenges in the sea farming subsegment. Other entities within this subsegment such as feed freight and other service vessels also delivered high revenue growth in 2019, but the EBITDA margin has declined due to increased competition.

Key financials

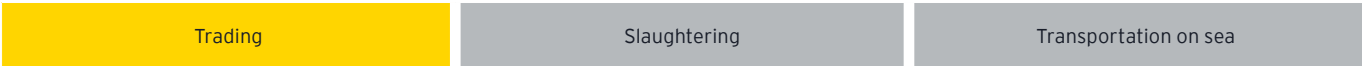


Norwegian salmon and trout exports



Source: Norwegian Seafood Council

1 "Nøkkeltall", Norwegian Seafood Council, <https://nokkeltall.seafood.no/>, accessed 8 October 2020



Trading companies

Norwegian-registered trading companies for farmed salmon and trout include both independent trading companies and trading companies owned by salmon producers who have organized this activity in separate companies. Salmon producers that include trading as an integrated part of their production companies are not included in the analysis, with the exception of Norway Royal Salmon ASA.

Volume growth

Revenue in the trading segment is closely linked to the volume of fish sold and price achievement. Hence, the increase in harvest volume and relatively stable prices explains the increase in revenue from 2018 to 2019. Please note that the large increase in revenue from 2015 to 2016 was driven by both a surge in salmon price and the fact that Mowi separated their trading business into a separate company (previously being integrated with the production company).

The trading subsegment is a low-margin business. The companies typically sell fish both in the spot market and on fixed-price contracts. Historically, we have observed companies experiencing both favorable and unfavorable fixed contracts, impacting the achieved margins.

Norwegian exports

The vast majority of Norwegian produced salmonids are being exported, and Europe is by far the most export market. Approximately 70% of the 2019 export volume went to Europe, compared to 73% in 2018. Increased farmed volume lead to record-high export of Norwegian salmonids in 2019. According to the Directorate of Fisheries, the value of exported salmonids in 2019 was NOK76.1b, an increase of NOK5.4b compared to 2018¹. Since most of the volume is sold in EUR, the weakening of NOK vs. EUR in 2019 relative to 2018 also positively impacted the export value.

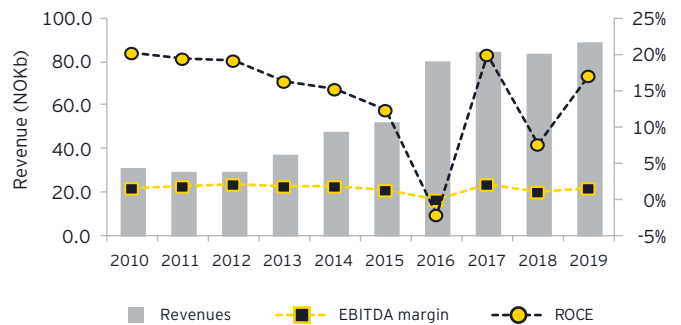
Strong export values despite COVID-19

Despite the COVID-19 pandemic, the export of salmonids has remained strong in 2020. According to statistics from the Norwegian Seafood Council¹, the year-to-date export volume as of the end of October 2020 was 2% above the same period in 2019, while the export value was virtually unchanged (a reduction of 0.4% compared to 2019). Please refer to the forecast section presented earlier in this report for further information concerning the 2020 development and the impact of COVID-19.

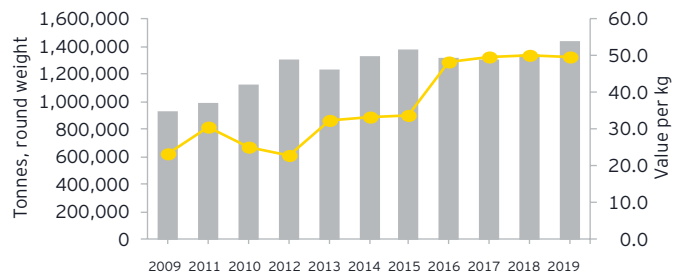
Top five companies (2019 revenues)

1. Lerøy Seafood AS
2. Mowi Markets Norway AS
3. SalMar AS
4. Ocean Quality AS
5. Seaborn AS

Key financials

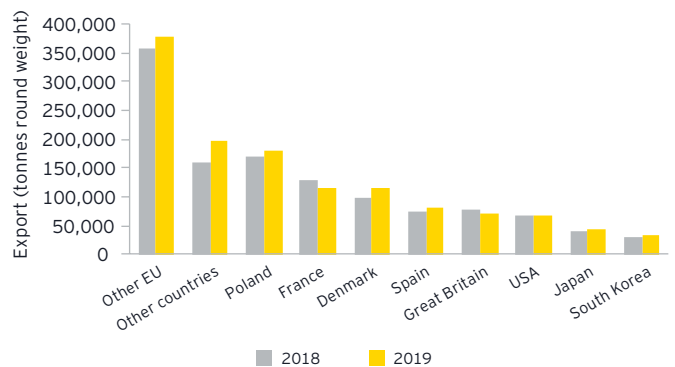


Sold volumes of slaughtered fish (round weight)



Source: Directorate of Fisheries

Export markets for salmon: share of volume (2019)



Source: Directorate of Fisheries

1 "Nøkkeltall fra norsk havbruksnæring 2019", Directorate of Fisheries, 09.07.20

Trading

Slaughtering

Transportation on sea

Slaughtering companies

Companies in this subsegment offer slaughtering services. Similar to trading, slaughtering is offered by both independent suppliers and salmon producers as an integrated part of their value chain. This analysis includes only slaughtering businesses organized in separate legal entities and it will, therefore, underestimate the total size of the subsegment.

Continued revenue growth but diminishing margins

Larger harvest volume will naturally give the slaughtering subsegment more work, and as such, an increase in revenue is expected when harvested volumes increase. Since 2016, EBITDA margins have shown a downward trend primarily driven by lower gross margins. However, as the subsegment is relatively small, the financial performance of a few companies can have a high impact on the total subsegment performance. This is evident when analyzing 2019. One of the larger entities account for 86% of the year-on-year revenue growth for the subsegment but was not able to make this growth profitable and reported an EBITDA level more or less in line with 2018. Adjusting for this entity, the rest of the subsegment performed in line with previous years with a slight revenue increase and an EBITDA margin of approximately 11%.

The future of slaughtering

A vital trend in determining the future of this subsegment is the entrance of slaughtering vessels. In 2018, Hav Line introduced a vessel with slaughtering facilities onboard. The vessel's capacity is up to 100 tonnes salmon per hour (160,000 tonnes per year), with a workforce of 45 per shift. By slaughtering the fish as they are harvested, both costs related to transportation and slaughtering are reduced.

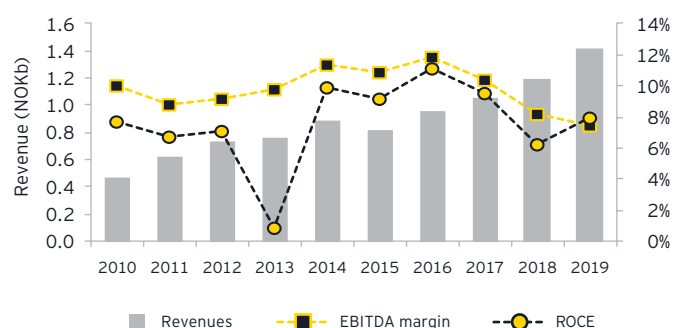
This vessel brought on some political turmoil and led to the introduction of a regulatory requirement to sort farmed fish in Norway before export. This puts significant operational restrictions on Hav Line and similar vessels going forward, if upheld. While protecting workplaces along the Norwegian coastline, this amendment will make it very challenging to take full advantage of the combined transport and processing characteristics of such vessels.

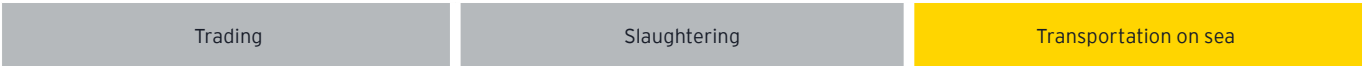
The company filed a lawsuit against the Norwegian state, where the court in June 2020 delivered its verdict mainly in favor of the company. The final conclusion in the case, however, is yet to be seen as the Norwegian state appealed the ruling.

Top five companies (2019 revenues)

1. Pure Norwegian Seafood AS
2. Slakteriet AS
3. Viking Fjord AS
4. Martin E Birknes Etft AS
5. Salten N950 AS

Key financials





Transportation on sea

The subsegment consists of well-boat companies transporting smolt to sea farms and live salmon and trout from farming cages to harvesting and processing plants. The segment also includes companies that focus on freight of feed. Most of these companies also offer sea lice and amoebic gill disease (AGD) treatment onboard well-boats, as well as services, such as sorting and counting of fish.

As entry barriers are high in terms of required capital expenditure, the segment remains dominated by a few players. The five largest companies make up approximately 53% of the revenue and 62% of the EBITDA in the subsegment in 2019.

Continued revenue growth, but margins are trending down

Transportation on sea has experienced tremendous growth over the last decade, predominantly driven by well-boat companies. Well-boat entities make out approximately 75% of the revenue and 90% of the EBITDA in the subsegment. These companies have thrived on the biological issues in the production segment, as a large share of the revenue growth has come on the back of increased treatment of AGD, sea lice and such. This has also contributed to high EBITDA margins in this subsegment. In the period 2015 to 2019, the EBITDA margin for the well-boat companies has been in the range of 41% to 43%.

The observed margin decline from 2018 to 2019 is explained by the other entities within this subsegment such as feed freight and other service vessels. While these companies delivered high revenue growth in 2019, increased competition has put pressure on the margins.

Investment patterns

High margins fuel the willingness to invest. Several of the larger players are announcing that they are continuing the already ongoing expansion of the well-boat fleet. For instance, Sølvrans has announced that they plan to build 20 new vessels over the next five years. Based on numbers received from Kystrederiene, we observe a median age of 8 years for the active well-boat fleet.

Whether the new vessels are going to replace existing vessels or increase the active Norwegian fleet could have different effects on the margins for this subsegment. If the newbuilds replace existing vessels, which could mean that the replaced vessels are either sold or moved to other markets (Chile, Scotland, Canada, etc.), the supply dynamics will not change much. Thus, we would not expect this to lead to reduced margins. If the newbuilds

come in addition to the existing fleet, this could lead to increased competition, impacting margins negatively.

The market demands well-boat capacity with more flexibility. A regulatory requirement has been put in place that states that closed systems (onboard the well-boats) are mandatory for transportation through and in between areas with disease-free status for ISA (Infectious salmon anemia).

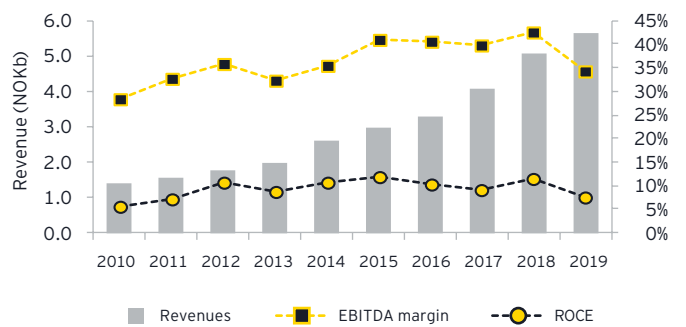
Innovation versus regulation

A key operation for the transportation subsegment is to transport farmed salmon and trout from fish cages to processing plants. The entry of vessels combining processing and transport, such as the Hav Line vessel, commented upon in the slaughtering segment, may impact the demand for traditional well-boats offering purely transport solutions.

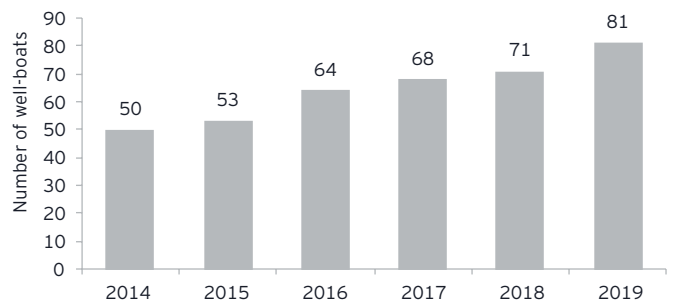
Top five companies (2019 revenues)

1. Rostein AS
2. Sølvrans Rederi AS
3. Eidsvaag AS
4. Norsk Fisketransport AS
5. Frøy Rederi AS

Key financials



Number of well-boats*



* Numbers received from Kystrederiene, based on year built





Processing

Technical solutions | Biotechnology | Production | Distribution | **Processing**

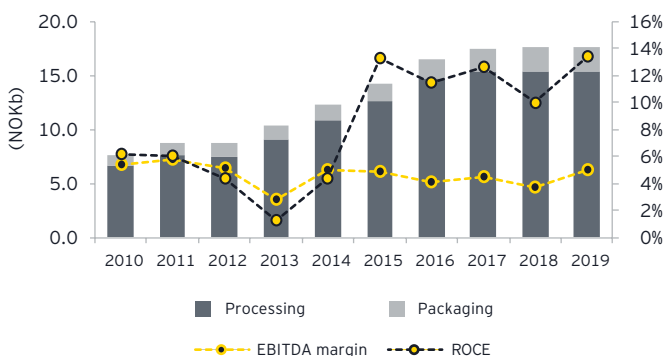
About the segment

The processing segment includes companies offering services primarily related to secondary processing and companies producing different types of packaging.

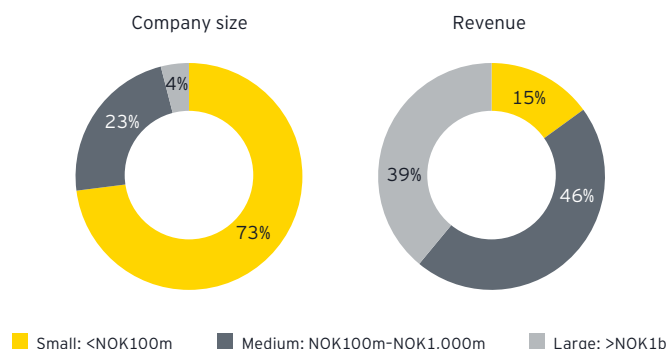
We have divided the segment into two subsegments:

1. Processing
2. Packaging

Key financials



Segment composition (2019)



Processing | Packaging

Processing

For the purpose of this report, we distinguish between primary and secondary processing. Primary processing is defined as slaughtering and gutting, while secondary processing is filleting, fillet trimming, portioning, smoking and the like. In this section, we will take a closer look at secondary processing, as primary processing is mainly covered under the presentation of the slaughtering subsegment. Secondary processing leads to products normally referred to as value-added products (VAP).

Processing is offered both by individual entities and salmon producers as a part of their value chain. However, this analysis includes only separate legal Norwegian entities and the analysis, therefore, underestimates the total size of the subsegment. Another factor is that the majority (approximately 80%) of Norwegian salmon is exported for further processing.

Stable revenue and margin levels

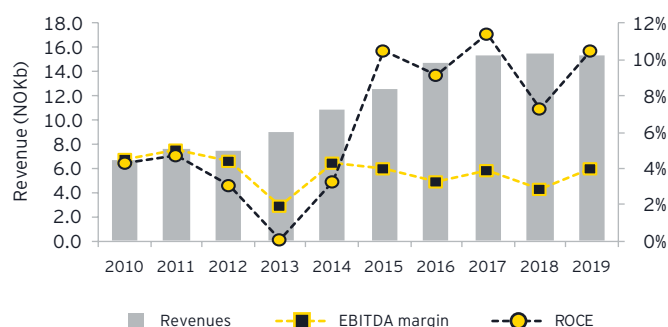
While margin levels have been fairly stable the last decade, the subsegment has experienced high revenue growth until 2016, when the revenue plateaued. In 2019, we in fact, observe a slight decrease in revenue compared to 2018. This is explained by a company, which until 2018, also carried out trading as part of their business. As the company did not perform any trading

activity in 2019, this had a material impact on the subsegment revenue compared to 2019 but had limited impact on the EBITDA margin.

Top five companies (2019 revenues)

1. Sekkingstad AS
2. Hofseth Aalesund AS
3. Hofseth AS
4. North Sea Seafood AS
5. Sjømathuset AS

Key financials



Processing

High cost segment

As evident by the EBITDA margin, secondary processing is still demanding and costly in Norway, both due to the labor-intense production, but also the cost of raw material influenced by high salmon prices.

There have been discussions about whether more secondary processing, i.e., VAP, should be performed in Norway as opposed to abroad. This is a topic with a wide range of opinions. High labor costs, low unemployment in Norway (e.g., potential import of workers will be needed), and environmental impact are some of the focus points in this discussion. Today, Poland and Denmark are two of the main countries that receive round weight fish and process these to filet and such before redistribution.

It's worth mentioning that in 2020, the export share of processed salmon increased compared to 2019. As of the end of September 2020, processed volume accounted for approximately 20 percent of the exported volume, compared to

Packaging

17 percent in 2019. The COVID-19 pandemic might be the reason for the observed increase, e.g., shift from HORECA to retailers, transportation issues (easier and cheaper to transport fillets) etc.

Similar to other segments, the processing subsegment is to an increasing extent impacted by innovation in terms of fish processing. As with the slaughtering subsegment, the processing subsegment will be affected by solutions, such as the Norwegian Gannet vessel from Hav Line. Currently, the vessel has dispensation to operate from the Norwegian regulatory authorities, although with some limitations compared to their intended use. Thus, the total impact of such vessels on the processing subsegment has yet to materialize.

Processing

Packaging

The packaging subsegment consists of small to medium-sized companies producing and providing all sorts of packaging and wrappings for fish and feed. While the companies generally produce for the aquaculture industry, a vast share also delivers products to other industries. In addition, there are several companies that deliver products to the aquaculture industry but where the share of revenues from aquaculture industry may not be high enough to be included in this analysis. Due to this, revenue for this subsegment may be somewhat misrepresented.

The packaging subsegment products are vital in keeping fish and fish products fresh during transportation and storage. Such products enable longer shelf longevity for the final fish products. Increased focus on sustainability and the focus of coming up with new, improved and innovative solutions, will impact the subsegment going forward.

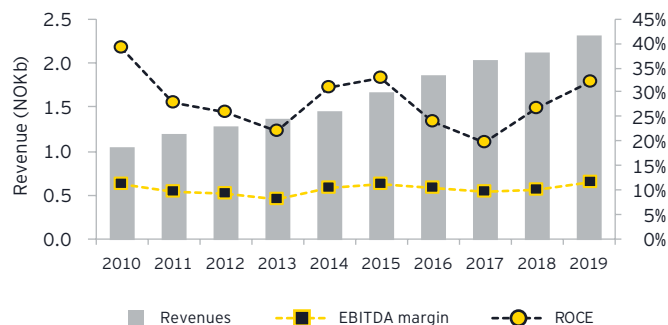
The subsegment has experienced steady growth, with a revenue CAGR of 8.6% over the last five years. Margins have remained relatively stable at around 10% for the whole historical period.

Packaging

Top five companies (2019 revenues)

1. Vartdal Plastindustri AS
2. Bewisybra Norway AS
3. Nordic Emballasje AS
4. Acon AS
5. A/S Nesseplast

Key financials







Methodology and definitions

Inclusion criteria

A company is defined as a Norwegian aquaculture company if both of the following criteria are met:

- ▶ At least 50% of its turnover is generated in the aquaculture industry.
- ▶ It is a Norwegian-registered legal entity.

Value chain segments

- ▶ Technical solutions
- ▶ Biotechnology
- ▶ Production
- ▶ Distribution
- ▶ Processing

Each of these categories are further broken down into subsegments to capture the huge diversity within the industry.

Company size definition

- ▶ Large company: revenue above NOK1b
- ▶ Medium-size company: revenue between NOK100m and NOK1b
- ▶ Small company: revenue below NOK100m

Methodology

In order to analyze financial activity across the value chain, we have gathered information from standalone financial statements of individual legal companies. Accounting information is publicly available from the Brønnøysund Register Centre. The number of companies included in the analysis will vary slightly depending on the availability of financial information. For companies operating with divergent financial periods, adjustments have been made to present the data on a calendar-year basis.

Many of the identified companies offer products and services in more than one segment of the value chain. However, in this analysis, each company is linked to only one segment of the value chain based on its main activity. This simplification could result in subsegments being over- or understated compared to the actual total. For larger industrial conglomerates with multiple subsidiaries, each entity is allocated to its respective best-fit segment.

The methodology does not capture or eliminate intercompany transactions or revenues in holding companies registered abroad.

Please note that the analysis is limited to the domestic aquaculture industry. Thus, foreign units owned by Norwegian companies are not reflected in the analysis. This may give a somewhat misrepresentative picture, particularly for the companies noted on the Oslo Stock Exchange, as many of them have a substantial part of their business outside Norway.

Calculations

EBIT = earnings before interest and taxes

EBITDA = earnings before interest, taxes, depreciation and amortization

Capital employed = total assets - (financial long-term and short term investments + cash) - (trade creditors + tax payable + public duties payable)

Return on capital employed (ROCE) = $\frac{\text{EBIT}}{\text{capital employed}}$

CAGR = compound annual growth rate

WFE = whole fish equivalent

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