



Conditions for sustainable growth - an unpredictable future

PwC Seafood Barometer 2023



Preface

Dear reader,

At PwC, we use our knowledge to shed light on key industry topics. By engaging in, and raising important questions, we seek to create discussions that can contribute to increased value creation from the seafood industry. This aligns with our PwC purpose - to build trust in society and solve important problems.

Today's society is experiencing challenging times. Pandemic, war, nature catastrophes, shortage of raw materials, energy crisis, and rising inflation. With such a troubled macro picture, this creates great uncertainty for business in general - also for the Norwegian seafood industry. Ongoing political processes is an additional factor that creates further uncertainty in aquaculture and fisheries. The result is greater unpredictability - a potentially toxic cocktail when operating in an industry that is dependent on significant investments in order to maintain its leading position, and a big challenge if we are to fulfil our growth ambitions.

As Norwegians, we have always been proud of the way we show trust in one another, also between the industry and the government. A high degree of perceived political risk and unclear processes when implementing significant changes to the business conditions of the industry may impair the most valuable asset we have - our trust capital.

The foundation of our barometer has always been the scenarios for future growth. There is now too much uncertainty associated with the future growth expectations. Therefore, we have changed our approach and instead chosen a different angle to assess what is needed to achieve the growth visions for the future.

As in previous editions, our insight is shared through PwC's Point of View. However, the most important insights come from industry representatives. This year's survey was live during unprecedented events such as the announcement of a ground-rent taxation of aquaculture. This gave us a unique insight in the minds of the industry, and the marked change from before and after the announcement.

A shift towards a more sustainable future requires a significant amount of capital. The industry's ability to invest is reduced due to unpredictable conditions - uncertainty related to political processes, increased taxation, ever changing climate, and increased requirements from stakeholders. These are all elements that may contribute to a perfect storm for the industry.

I hope you enjoy the read, and gain valuable insight into how these effects impact the industry. Please contact me if you would like to discuss the content.



Best regards,
Hanne Sælemyr Johansen
Partner
PwC

Executive summary



Reaching the five million vision in 2050 will require stable conditions, trust and a substantial amount of capital - is this possible?

All-time low belief in the growth vision for 2050

Neither the industry nor we believe that the five million tonnes vision is within reach given today's regulatory framework. Reaching five million tonnes by 2050 seems unrealistic unless the industry adapts new production technology that lifts existing biological constraints. Although the development and implementation of new technology require modernization of the licensing scheme, the most critical components for future growth are capital and trust.

We are not convinced of the claimed investment neutrality of the new tax reform proposed. If the new tax reform is not adjusted, we are concerned that it may imply a significant and long-lasting reduction in investment levels due to both lack of both capital and trust.

Norway's position as the world's largest salmon farmer has seemingly never been more at risk. The rise of land-based technology, combined with an eventual significant tax disadvantage of conventional technology implies that the vision of five million tonnes is probably more unrealistic than ever.

The announcement of the new ground-rent tax proposal was considered a shock to the industry and its stakeholders

We are concerned of the current attitude towards transparent and thorough processes when conducting significant changes to the framework conditions. Substantial regulatory shocks may impair trust and Norway's overall attractiveness as a safe haven for industry investments at the expense of society. The process behind the tax proposal fails in many aspects and may have unintended consequences for the industry and Norway going forward.

In our opinion a comprehensive tax reform for a single industry should not be introduced without assessing the total tax burden. Focusing on the proposal alone, it is apparent that it contains several inherent characteristics that contribute to an effective tax rate that is not sustainable. The total tax burden proposed will dramatically weaken the industry's self-financing ability, and as a result we expect to see a broad restructuring of the industry. We will also express our concerns related to reduced ripple effects and diluted local affiliation in the long run.

Growth ambitions and sustainability requirements create a need for a substantial amount of capital

The aquaculture industry is getting more capital intensive, both due to development

of new technology and regulatory requirements. Reaching the five million vision requires hundreds of billions in new growth capital, in addition to capital needed to maintain current production level. The question is - will these funds be available?

This year's barometer has given us a unique insight into the seafood industry and how the industry responds to changes in the regulatory framework. The basis for the report is a survey which has been active since August 2022 up to up to the publication of this report. Early on, we were made aware that the seafood industry is experiencing more uncertainty. Monitoring the responses throughout the period after the ground-rent announcement, it is evident how vulnerable the trust capital is from sudden and unexpected changes. A high number of our respondents report that they are experiencing increased political uncertainty. This applies to both aquaculture and fisheries.

Unpredictable is the key word that sums up the atmosphere amongst leaders in the industry. Considering how much capital is needed to be able to grow - and not least what is needed in order to invest in new sustainable technology and solutions - the conditions are definitely not optimal for a nation and an industry with a bold growth ambition.

Ongoing regulatory decisions will shape the future of the Norwegian fishing fleet - the industry calls for long-term, predictable conditions

There is positivity to be found, despite the lack of predictability and confidence in policy makers

Unpredictability is a key word for the fishing sector. Important questions regarding the future regulatory conditions for the fishing fleet remain unanswered. As a consequence, further development in the sector is to a large extent put on hold. Moreover, uncertainty associated with the introduction of ground rent tax in aquaculture has spread to the fishing sector. Our respondents describe a complete lack of stability and predictability in political and regulatory conditions. In addition, the fishing sector has low confidence in policy makers. This complicates decision-making, particularly with regards to long-term investments, such as renewal of the fleet.

Nonetheless, there is positivity to be found. Many respondents report willingness to make significant investments in the next five years, and the majority of the sector believes that the profitability potential has not been fully exploited. According to the industry, increased quotas is the most important factor for growth, but this is unlikely in the coming years due to the current state of our fish stocks. The industry then mentions factors such as market access, increased degree of processing, utilisation of

residual raw material, and product development. In essence, we must maximize the value of each and every kilogram of raw material.

Sustainable fisheries management is a key success factor, for Norway and globally

Sustainability will be an increasingly important premise for both market access and price in the future. It is therefore regrettable that six fisheries in which Norway participate have lost their MSC-certified status since 2019. The MSC-label is the most widely recognised certification of sustainable fisheries. The share of MSC-certified landings in Norway was 90 per cent in 2019. This number is estimated to be only 40 per cent by 2024. Norway should strive to be a leader in sustainable fisheries management, but requirements from authorities, players such as MSC, and consumers will only become stricter in the future.

Sustainable fisheries management is also crucial on the global scale, as overfishing is a prevailing issue. Putting an end to overfishing is a must, for fisheries to be part of the solution to the global food crisis. A holistic approach to fisheries management and long-term international collaboration is necessary. Successful management strategies, policies and regulations must be replicated across regions and countries.



Sustainability is viewed as a top three driver for seafood demand, but the industry is flying blind with regards to the EU Taxonomy

Sustainability is a top driver for growth in demand and the industry's have increased their maturity on sustainability

An increasing share of respondents have stated that sustainability is an integrated part of their business strategy. This coincides well with the industry's increased belief that sustainability is one of the top three drivers for demand for seafood. The industry's self-evaluation of maturity on sustainability further strengthens how important this has become for the industry.

The level of maturity can be related to several factors, market orientation is of course extremely important. Another reason is the amount of reporting requirements from stakeholders. The EU's Green Deal has set ambitious climate targets and a clear course for the transition to a climate-neutral Europe in 2050. This will also set guidelines for Norway, this includes among other things incorporation of the EU taxonomy. However, the industry is to a large degree uncertain as to how the taxonomy will affect their operations in a five-years perspective.

The amount of companies that evaluates their own level of sustainability at the higher levels of maturity are increasing. Companies in the mid-section of the maturity ladder seems to

migrate towards higher degree of sustainability whilst the at the lower end of the scale the numbers are more stable. This results in a gap-increase between companies and the level of self-evaluated maturity on sustainability.



Foto: Petter Lund Wåge

Key findings from the survey

Aquaculture

- Only one of four still believe that 5 million tonnes of Norwegian produced seafood is achievable by 2050
- 68 per cent of respondents believe that the large number of planned projects for land based production of salmon are empty promises
- Taxation, sustainability and the Traffic Light System are ranked as the top three regulatory changes that will impact the industry to a high degree in the next five years
- The industry points at fish welfare as the most important indicator to incorporate in the Traffic Light System
- Prior to the announcement of ground rent taxation 88 per cent of respondents experienced political risk. After the news this increased to 96 per cent


Fisheries

- 75 per cent of respondents in the sector experience increased political risk
- 4 in 5 respondents in the fishing sector believe that Norwegian policies are reducing our competitiveness as a seafood nation

- The sector expects to have to adopt to regulatory changes in the next five years (Some extent: 58 per cent large extent: 26 per cent, very large extent: 5 per cent)
- 58 per cent believe that the profitability potential has only been exploited “to some extent”
- Only 37 per cent believe that the sector has, “to a large extent”, become more market oriented in the past five years.

Sustainability

- 42 per cent compared with 29 per cent in 2017 identify sustainable production as one of the top three drivers for increased seafood demand
- The gap between companies self-evaluated maturity level on sustainability are increasing.
- Only 22 per cent in aquaculture and 45 per cent in fisheries have an idea about the consequences of the EU taxonomy



“Today’s politicians do not have the prerequisites to manage that vision. I have no faith that future politicians will do any better either. By 2050, we will have lost our identity as a seafood nation”

Industry representative, PwC’s seafood survey

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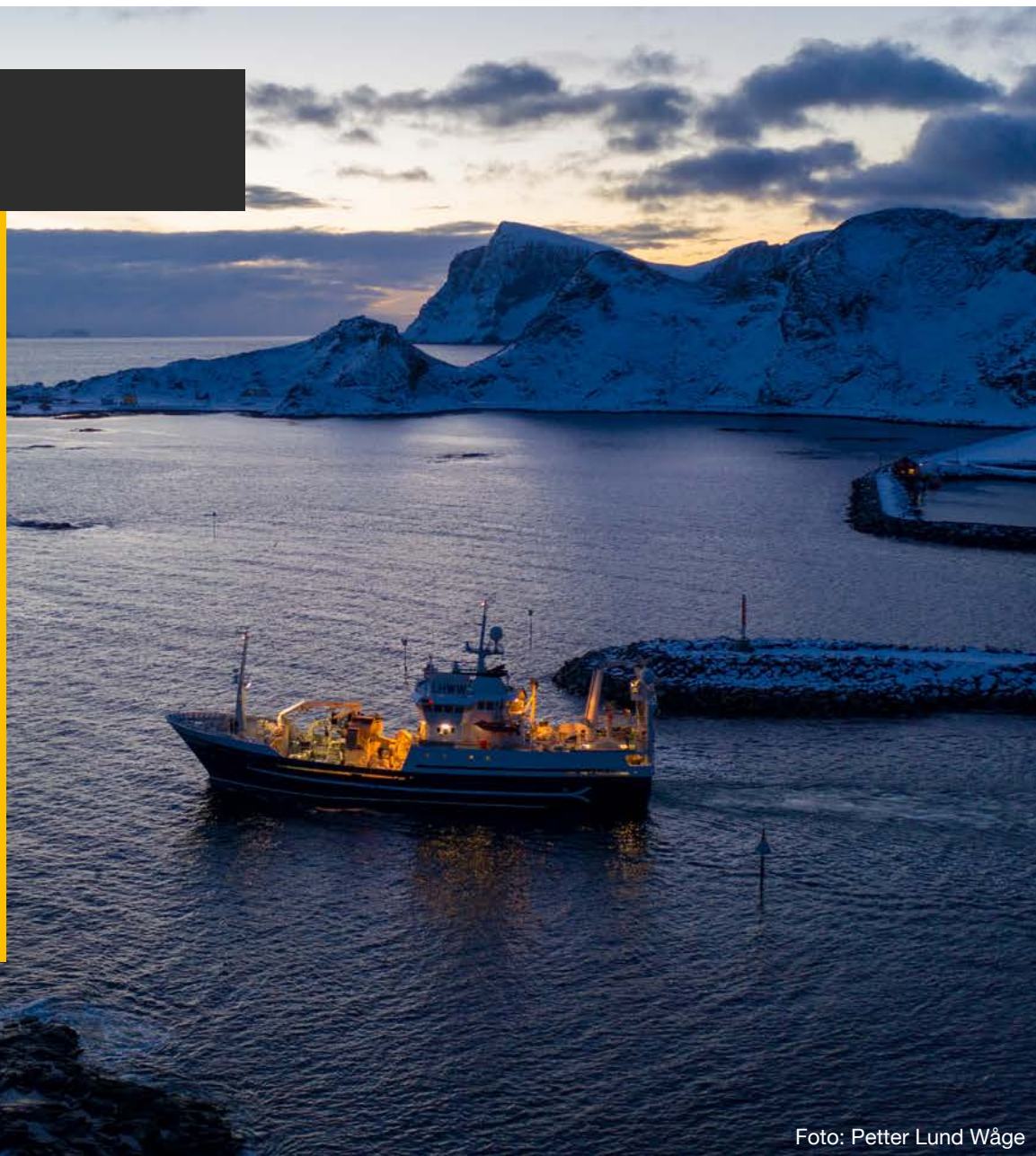


Foto: Petter Lund Wåge

Aquaculture

Status in the industry

01

Norway is still the world's largest producer of Atlantic salmon and rainbow trout, although our total share is decreasing

Production has never been higher

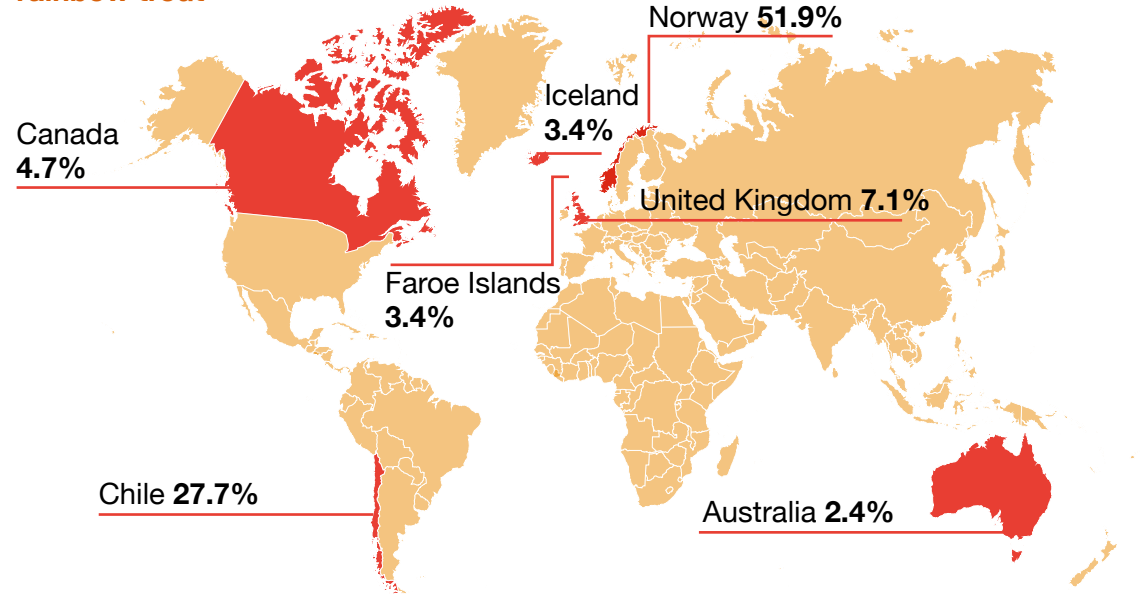
In 2020, the total global production of Atlantic salmon was 2.7 million tonnes. As the largest producer of Atlantic salmon and rainbow trout, Norway accounts for approximately half of the world's total production, as seen in the illustration to the right.

Although Norway remains the largest producer, its share of total global production has decreased by approximately ten percent in the last decade.

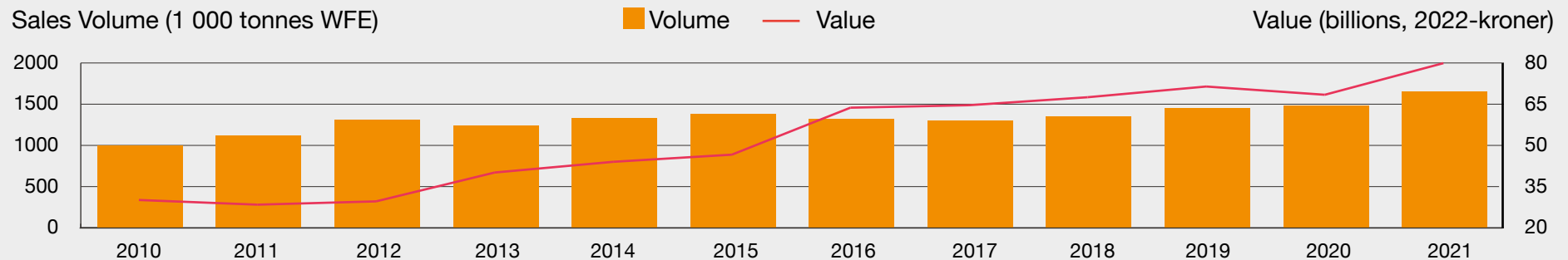
Both sales volume and value has increased significantly since 2010

From 2010 to 2021, the sales volume of salmon, rainbow trout, and trout increased by two-thirds, but the growth has not been linear. There was negative volume growth from 2016 to 2018, primarily due to problems with high mortality caused by diseases and lice.

Percentage distribution of the largest producers of Atlantic salmon and rainbow trout



Sales volume and value from 2010 to 2021

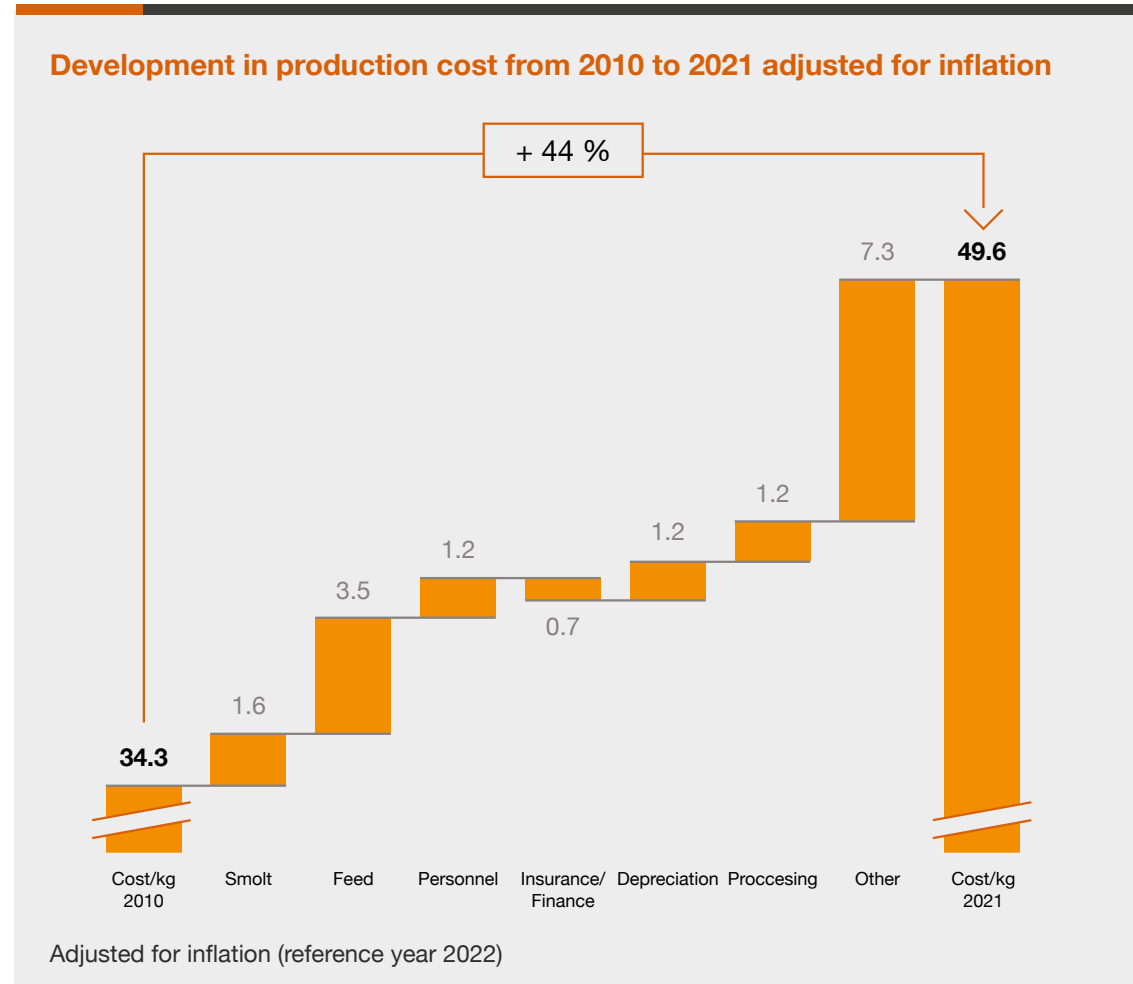


Source: Food and Agriculture Organization

The costs have increased significantly over the last decade in the aquaculture industry, despite a relative flat inflation rate up until 2021

Cost development over the last decade is threatening value creation

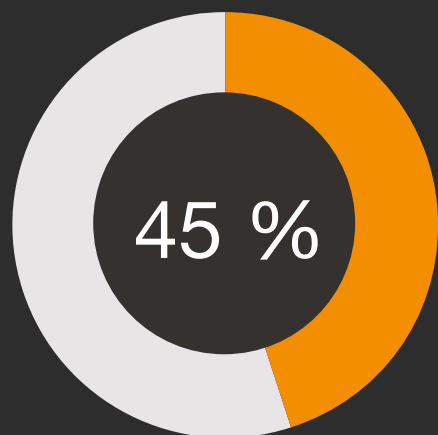
Since 2010, average production costs relating to salmon farming have increased by 44% (adjusted for inflation), rising from NOK 34 per kg HOG in 2010 to NOK 50 per kg HOG in 2021. In particular, costs relating to the treatment of lice and various diseases have increased during this period. These are included in the bar “other” in the figure below. The allowance for average lice in a pen before delousing activities are required has tightened in the last 11 years, resulting in more frequent delousing operations for farmers. This requires more personnel and specialised equipment, consequently driving up the costs related to delousing. Further, there has also been a notable increase in the cost of feed. This is driven by a combination of an increase in raw materials going into the feed as well as research and development into new feed formulas changing the composition of feed.



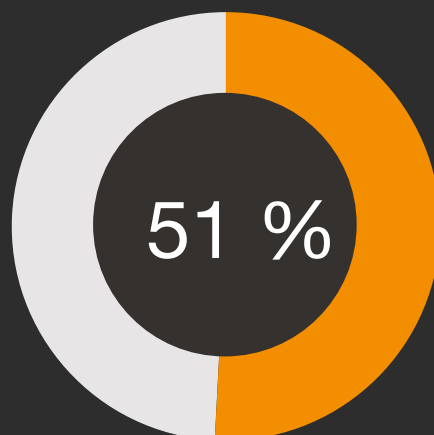
New set of factors will be the main driver of cost going forward according to our respondents

We asked the industry how various factors will affect the cost level of production over the next five years. Our respondents believe that feed, energy and carbon taxation will be the most critical factors driving the cost level from now on. Traditionally, sea lice have been viewed as one of the main contributors to increased costs. However, our responders believe this will contribute less in the future.

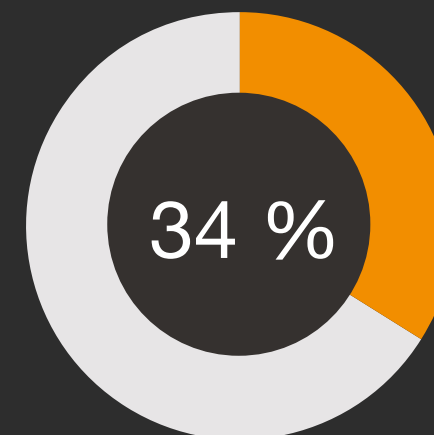
The most critical factors driving costs the next five years



Feed Cost



Energy Cost



Carbon taxation

of respondents believe that feed- and energy costs in addition to carbon taxation will be the most important cost factors the next five years

PwC's seafood Barometer 2023

According to the industry, conventional technology will be the main production method for many years to come, however other technologies do have a future

From conventional technology to other production technologies

In the future, Norwegian salmon production will most likely be more diversified with the use of different production methods and technologies.

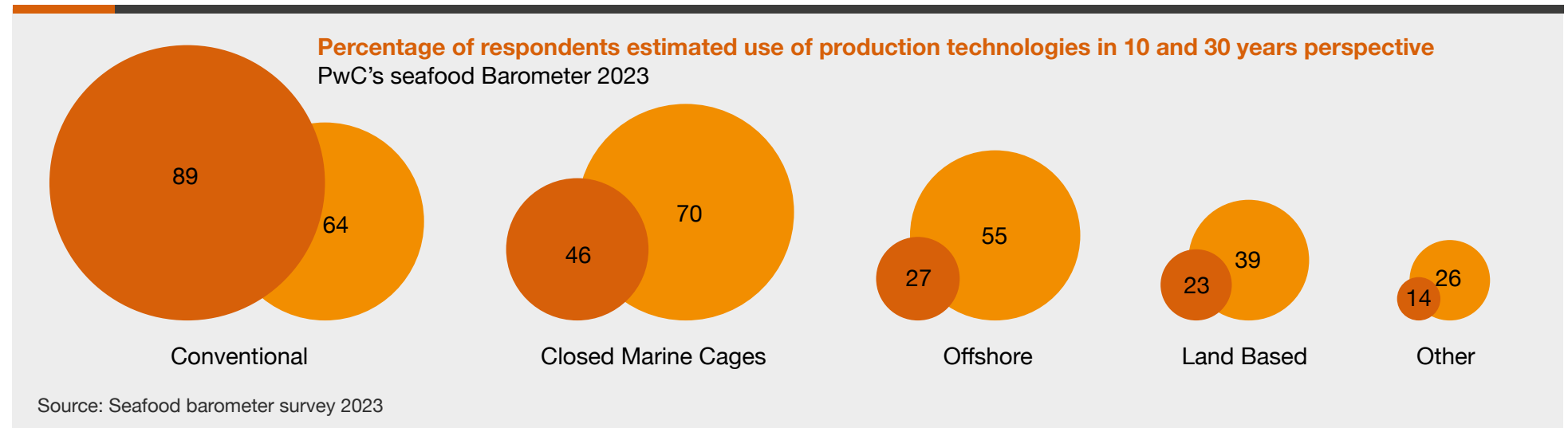
Today almost all Norwegian salmon is produced using conventional technology. According to the industry, this is not set to change over the next decade as nine out of ten believe conventional technology will still mainly be used. But looking further ahead, it is clear that there is a stronger belief that other technologies will play a larger role in the aquaculture production.

Looking further ahead - the industry believes that an increased focus on technologies such as closed marine cages, and offshore and land-based

production will create a shift away from conventional technology.

As new technology proves viable, it is reasonable to expect investment costs to fall. Lower costs will, in turn, make the technology more accessible.

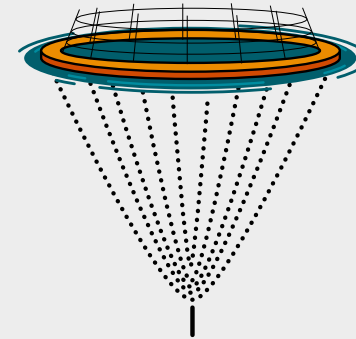
With today's regulations, the industry needs to seek other growth opportunities than conventional methods. In addition to developing new production technologies, a new regulatory framework must be implemented. The industry needs to diversify production and wants to avoid the potential negative consequences of excessive expansion with conventional technology.



There are several production technologies for producing salmon in the grow out phase, but conventional technology still accounts for the majority of the production

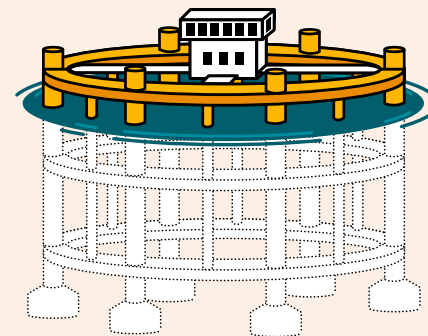
Conventional technology

Conventional technology allows for the natural flow of water through the cage. This is the most common production method for Atlantic salmon in Norway. It's the cheapest and most convenient method for producing salmon. This production method provides the most natural conditions. A disadvantage of the method is that it is open to exchange of potential viruses, bacteria, and parasites to the surrounding environment. Today nearly all production volume in the grow out phase is produced in open-net pens.



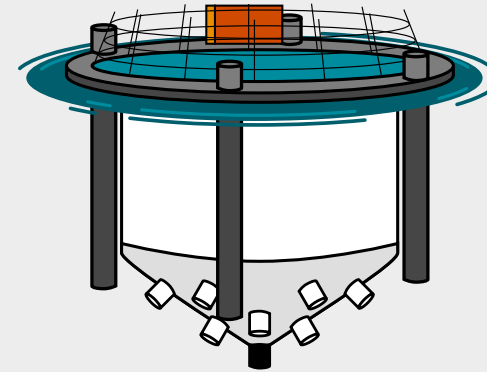
Offshore farms

A production unit for offshore farming is typically much larger than a conventional pen. This production technology is developed to be used at exposed (high wind, big waves, strong currents) locations in the open sea. Farming on exposed locations requires technical solutions of high standards combined with good operational routines to ensure safety and reliability in production. This technology is still at early stages but several pilot facilities has completed full production cycles. Advantages for offshore production can for example be more stable currents, deeper waters, longer distance to other facilities, greater distance to salmon rivers etc.



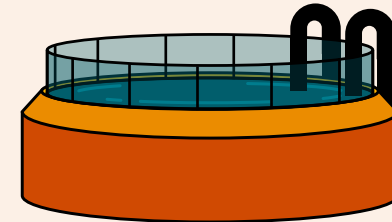
Closed production facilities in sea

Closed cages have walls that separates the fish in the cage from the outside environment. Production in closed facilities can be divided into two different categories: closed and semi-closed. The closed production facility has no emissions into the sea, while semi-closed can still emit waste substances, although sludge (i.e. feed waste and faeces) and other waste can be collected. The advantages of this method are that seawater can be pumped in from water depths where there are no salmon lice and there is more a stable temperature.



Land-based - Recirculating Aquaculture Systems (RAS) & Flow Through Systems (FTS)

There are now a number of projects both in Norway and internationally where companies produce fully grown salmon on land. There are two important technologies to be mentioned here, RAS and FTS. In RAS technology most the water is filtered and reused in the production. One of the benefits of RAS is the reduction in use of freshwater. In FTS the seawater is continuously pumped into the production facility. There are still major financial and biological risks associated with farming fully grown salmon on land. However, there are now some facilities showing promising results using RAS and FTS technology.



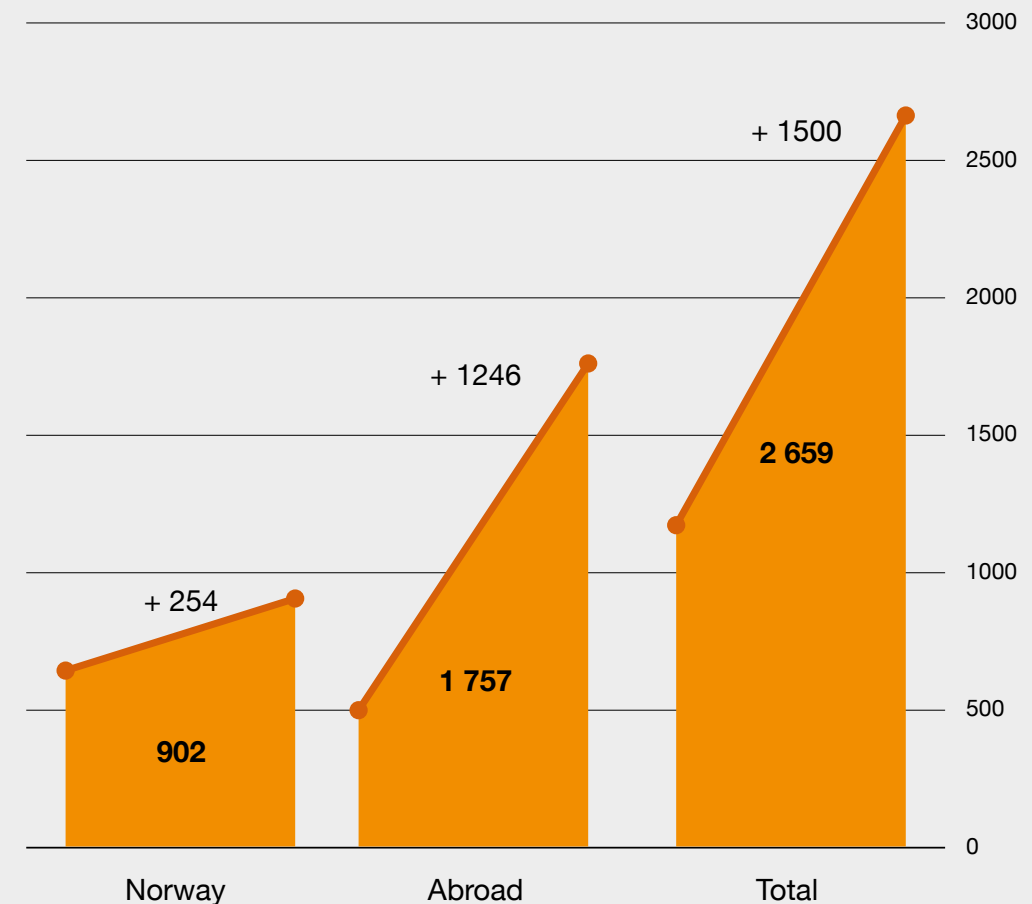
Land-based salmon farming - extensive future investment plans

International land-based-salmon production to outgrow Norway's production in sea

Since our analysis of planned land-based-salmon production projects in 2021, more than 48 new projects outside of Norway have been presented. This brings the planned production capacity abroad to nearly 1.8 million tonnes as of 2023. This is an increase of approximately 1.2 million tonnes compared to the 2021 issue of PwCs Seafood Barometer, and represents a volume exceeding the combined production volume using conventional technology in Norway (2022). In comparison, the planned land-based production in Norway has only risen from 0.6 million tonnes in 2021 to 0.9 million tonnes as of January 2023. Additionally, the conventional production in Norway remained the same in the period. In other words, there is a potential threat to Norway's leading position as a salmon and trout producer in the world should all foreign projects reach their planned capacity.

A big advantage for projects abroad is their close to market location. This permits for a significantly reduced dependency on transportation as the production is considerably closer to consumers. This allows for reduced transportation costs, which in turn leads to increased margins and contributes to a lower carbon footprint for the salmon produced abroad. Further, salary levels abroad are typically lower than Norwegian salary levels, allowing for a reduced salary cost compared to Norwegian competitors.

Total planned land-based salmon production 2021 vs 2023 (in tonnes)



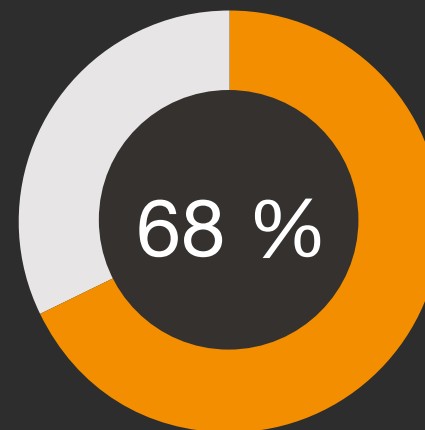
Foreign capital flood in land-based farming

With high salmon prices and limited supply, salmon farmers have experienced unusually high margins in the past years, tempting new investors to seize investment opportunities in land-based farming projects. The big change from our previous Barometer, is the composition of investors. Our analysis indicated that a larger number of the investors involved in the new projects were foreign investors, without any clear connection to Norway or the Norwegian seafood industry. Further, the leading Norwegian fish farming companies appeared hesitant to invest in big volumes on land. As far as we know, smaller salmon farmers' involvement in projects abroad remains limited, leaving room for new foreign players to explore possibilities on land.

We have asked what the industry thinks of the large number of planned investments in land-based production. 68% of our respondents believe that land-based salmon farming is “a bucket of empty promises”. The scepticism is understandable and the experienced farmer knows that the journey from investment plans to fresh salmon is long and difficult. Further, for these plans to actually materialise, it will require multiple hundred billion NOK in investments. Given the current macroeconomic picture in the world, these companies might experience that money is kept tighter in investor pockets, as investors seek investments associated with lower risk. However, we are confident that some of these projects will see the light of day within the next couple of years.

As we wait for the first land-based producers to harvest substantial volumes, we wonder if the industry's lack of faith in the upcoming competition from land are well based judgments, or if the industry is failing to realise the potential competition building in the horizon.

Is investing in land-based farming of salmon just hopes and dreams?



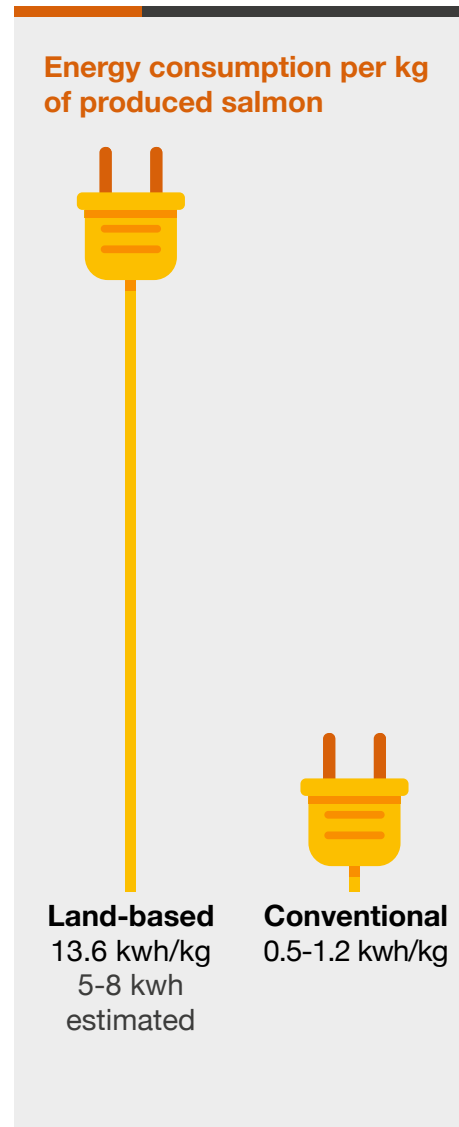
of respondents believe that the large number of planned projects are empty promises

PwC's seafood Barometer 2023

Land-based-salmon production no walk in the park - costs building up

Rising costs

Land-based-salmon producers are faced with challenges both financially and environmentally. Since the pandemic and Russia's invasion of Ukraine, most countries have experienced a substantial rise in inflation led by rising fuel and energy prices. This in turn has led to higher interest rates and a more pessimistic outlook. One of the largest cost drivers in land-based-salmon farming is the cost of energy, something that our PwC analysis has shown is needed in large quantities. The available energy consumption figures from operating land-based farmers with RAS-technology, indicate an average energy consumption of around 13.6 kwh per kg, whilst estimates for projects currently being developed quote future consumption levels in the interval 5-8 kwh per kg. With the current energy prices, the financial hit on land-based farmers dependent on energy is obvious. Similar energy figures for production in conventional ocean pens is in the interval 0.5-1.2 kwh* per kg, meaning the energy cost in land-based farming is between 11-28 times higher than in conventional farming, depending on technology. Neither FTS or RAS can compete with the levels of conventional production as of now.



Biological challenges also in land-based farming

A common view is that land-based farming is the solution when it comes to environmental and fish welfare concerns, as there is a lower impact on the wild salmon stock and their surroundings. The main reason for this is that land-based farming provides the ultimate solution to the biggest problems haunting conventional ocean pen farming - lice as well as lower risk of escape. However, the picture is not only positive, as land-based farming is still considered a relatively new and unproven technology.

The biological uncertainty related to producing salmon on land has been made evident by multiple events with a sudden loss of large volumes of biomass experienced by operating producers. Land-based farmers are solely dependent on all systems related to water quality and filtration systems functioning at all times, which can be crucial as even a small malfunction in important sensors could result in a nonoptimal quality of water and loss of biomass. If something fails, the result could be loss of the entire biomass.

Further, land-based farmers are still faced with substantial costs related to disease treatments, as diseases still exist when the fish are farmed on land. There are also substantial costs related to clearing land and building the actual production facility, making expected fixed cost levels significantly higher compared to conventional farming. Where conventional farming borrows the sea area, which can be returned after use, land-based farming represents a permanent intervention to the landscape, that is not easily reversible at a later stage.

Will land-based-salmon be sold at a premium?

The viability and profitability of land-based farming largely depend on land-based farmers being able to position their salmon as a premium product, i.e. locally farmed or as more environmentally friendly. This positioning could make it possible to achieve a price premium. When coupled with the current price level of salmon price, land-based projects have a potential to make profits. However, should the salmon price fall to the levels seen in the early 2000s, land-based facilities will have significantly higher fixed costs compared to conventional technology.

PwC point of view:

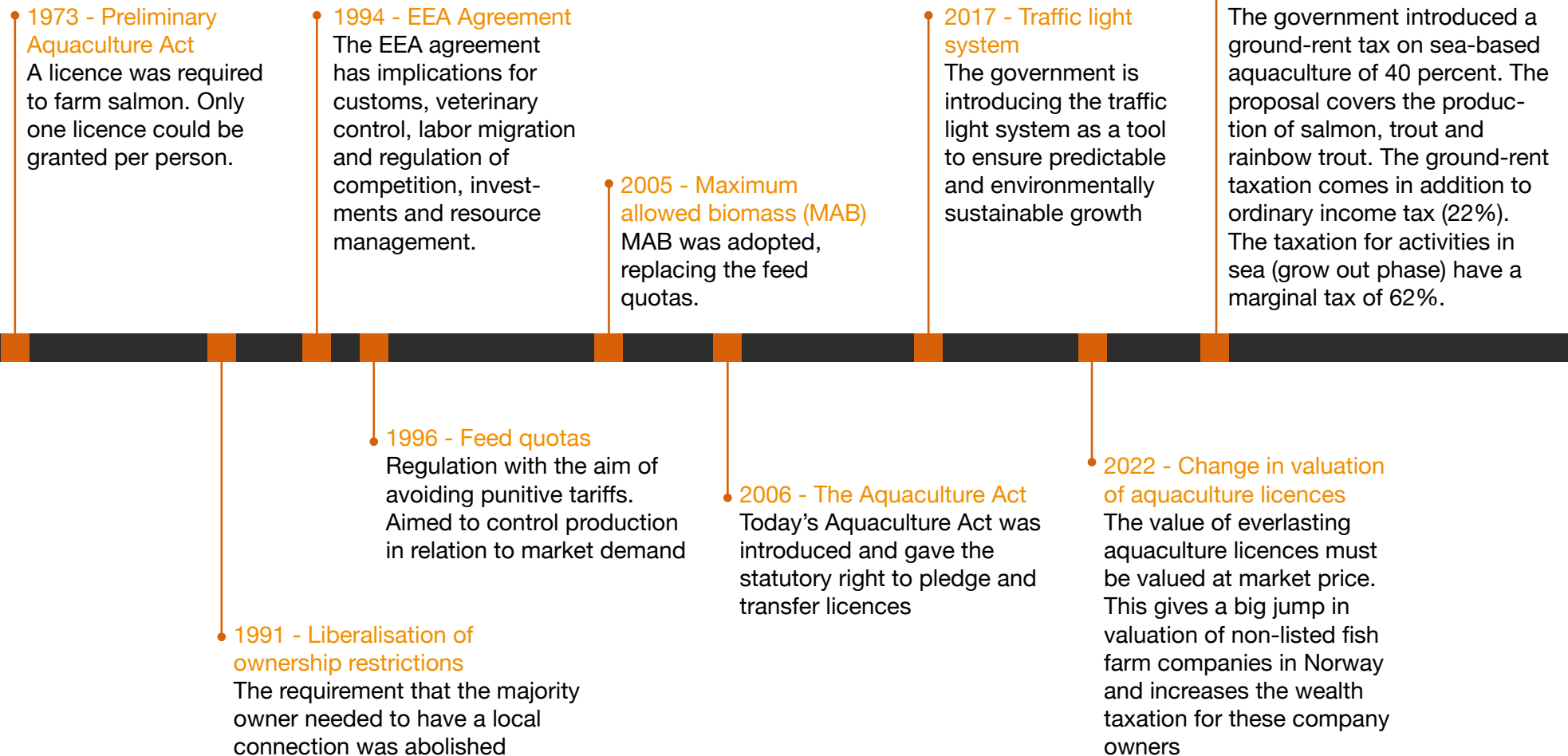
Limited ability to achieve growth in conventional open pens will force farmers to start using other production methods moving forward. The respondents in our survey also support this opinion. Planned production capacity on land is now larger than the entire Norwegian production in sea, and we ask ourselves two questions. Firstly, will land-based farming technology prove to be successful? Secondly, if so will it enable foreign producers to overtake Norway as a leading producer of salmon, benefiting from nearness to the market, cheaper wages, and the possibility of marketing a local product? For Norwegian production, we argue that using such an electricity demanding production method in a market where electricity is increasingly scarce is not a truly viable alternative. Instead, the government should continue to support the industry in solving sustainable growth, as conventional open pen production is more efficient and has proven to be Norway's competitive advantage.

Aquaculture

Regulatory framework

02

Regulatory timeline - key events from 1973 to today with ground rent taxation as the latest regulatory change



Too many changes and destabilisation of the industry?

Regulations are starting to have a negative impact on the industry

Regulation of salmon farming has continuously evolved, and in the past few years new regulations have been introduced to ensure sustainable growth for the industry.

Farmers have historically been innovative and adaptable, and the industry has welcomed many of the regulations introduced. However, recent development with an increasing number of new regulations as well as existing regulations becoming stricter, is starting to have a negative impact on the industry.

Through our survey, representatives from the industry have given us direct insight into how they are experiencing the continuous introduction of new and tougher requirements related to lice, taxation, outcome in the traffic light system, and more.

The industry is experiencing an increase in political risk

88% of our respondents state that they are experiencing an increased level of political risk. We predicted this would be the response from some respondents, but we were surprised to find that 9 out of 10 have experienced increased political risk. Unpredictable is a repeated keyword when respondents can write freely, as can also be seen by the quotes.

When the industry is experiencing a high level of political risk, this will have a notable impact on the way investments are made, or in many cases not made, as well as how the industry is hesitant to investing in growth. For example; in the last auction round held in the traffic light system, the achieved price per MAB tonne was significantly lower than in the previous auction round in 2020. The bidders were also fewer and the interest to bid was less, as farmers held back due to uncertainties and a more pessimistic outlook on the future.



“There is no predictable stability in the political framework conditions at the moment”

Industry representative, PwC’s seafood survey



Alarming many are experiencing an increase in political risk - poor political process to blame?

Ground rent taxation is causing an increase in perceived political risk

One of the main reasons behind increased political risks is the higher degree of uncertainty in the regulatory landscape.

On 28 September 2022, the Norwegian government announced a plan to introduce an additional ground-rent tax on the aquaculture industry. For industry participants and investors, this was experienced as an overnight shock, increasing the taxation with an effective rate of 40 per cent.

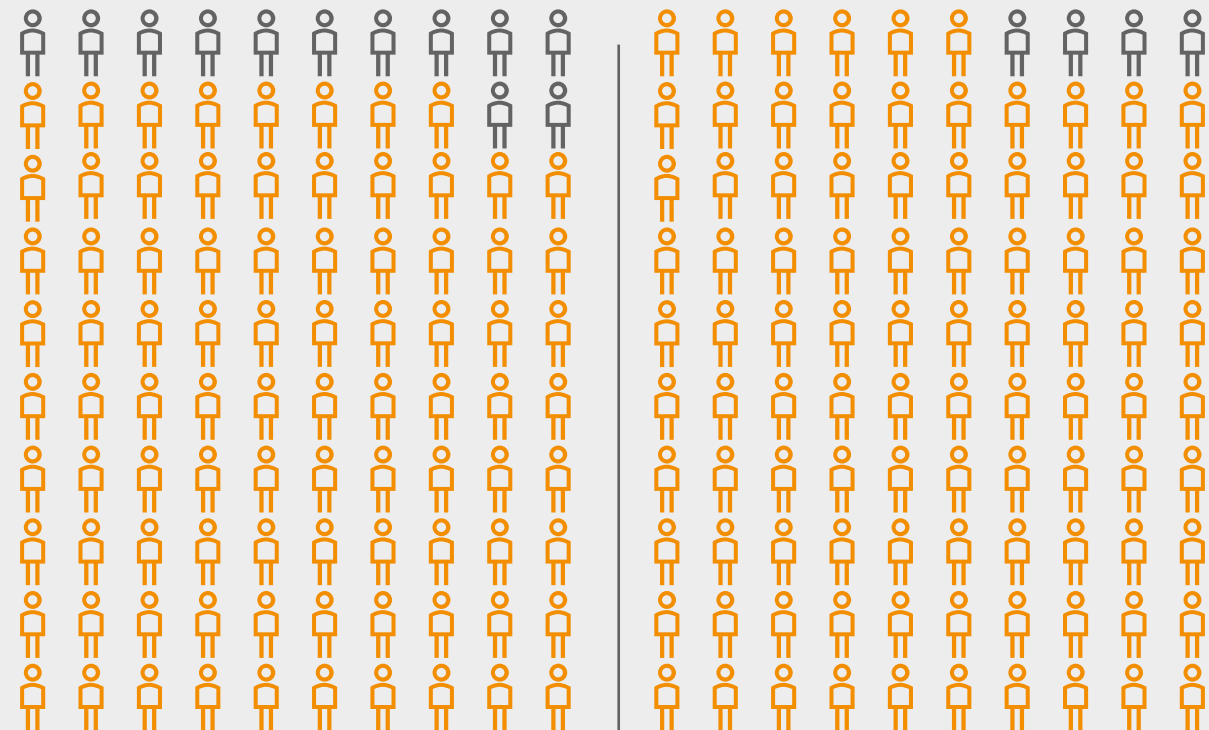
Furthermore, this damaged the industry's trust in the government. Our survey highlights that the news of a new taxation significantly increased the perception of political risk in the industry to a whopping 96%.

“Very unpredictable, difficult to make big investment with decisions that are irreversible”

Industry representative, PwC's seafood survey

Do you experience increased political risk in the aquaculture industry?

PwC's seafood Barometer 2023: Percentage of yes



Before: **88 %**

Ground rent taxation
announcement
28 September 2022

After: **96 %**

Combined with an uncertain macroeconomic picture, increased political risk and regulatory framework may be a toxic cocktail that significantly lower the industry's capital capabilities

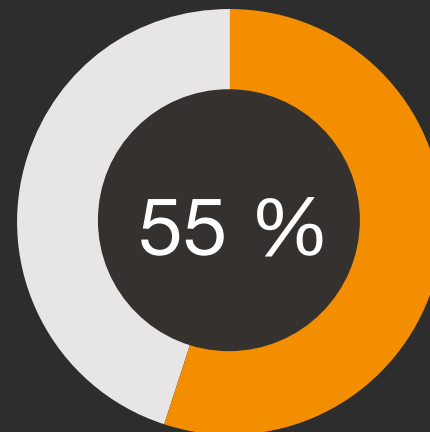
The industry is expecting significant changes due to regulatory factors

The results from our survey are clear: almost all our respondents replied that they experience increased political risk in the industry. We believe this is closely linked with recent regulatory changes, as more than half of our respondents said that their companies will have to drastically change in the next five years due to regulatory changes. Taxation, sustainability, and the Traffic Light System are ranked as the major drivers.

The next sections will introduce and discuss the licensing regime, the Traffic Light System, and the increased taxation of farmed salmon and trout in Norway. It is evident that the Traffic Light System and the increased taxation of the industry have had negative impacts on many companies.

A combination of decreased production capacity, decreased liquidity and profitability can lead to a slowing of development and investments. This is quite grave in a time when capital and willingness are needed to invest in more sustainable solutions and where transitional risk is another factor to consider.

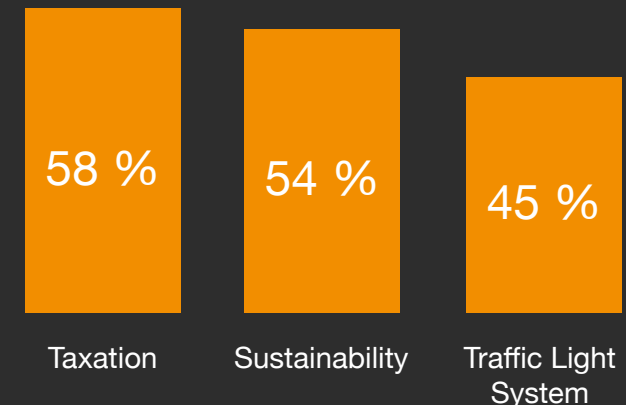
Regulatory changes affecting the industry



Respond that their company must change, to a large or very large degree, due to regulatory changes in aquaculture the next 5 years.

PwC's seafood Barometer 2023

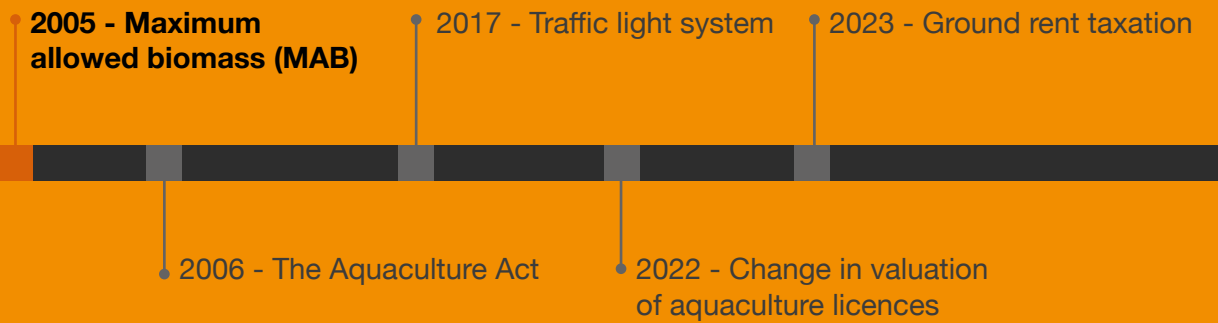
Top three major regulatory changes in aquaculture the next 5 years



Percentage of respondents in aquaculture rank taxation, sustainability, and the Traffic Light System as the top three major regulatory changes that will impact their companies, to a high or very high degree, the next 5 years.

PwC's seafood Barometer 2023

Production Licensing Scheme



The licence regime has undergone many changes since its inception

Norwegian aquaculture regulations - from one-man show to big business

A brief historical outline of the licencing regime and growth regulations of aquaculture in Norway has been detailed in our very first seafood barometer (2017). Just to recap, the licence regime has gone through many changes since its birth.

In the 60s, no licence was required. From 1973, one licence per operator was allowed - the goal being local ownership and jobs in rural areas, already under threat of depopulation. The pioneers, however, were allowed to keep their farms and were given licences accordingly.

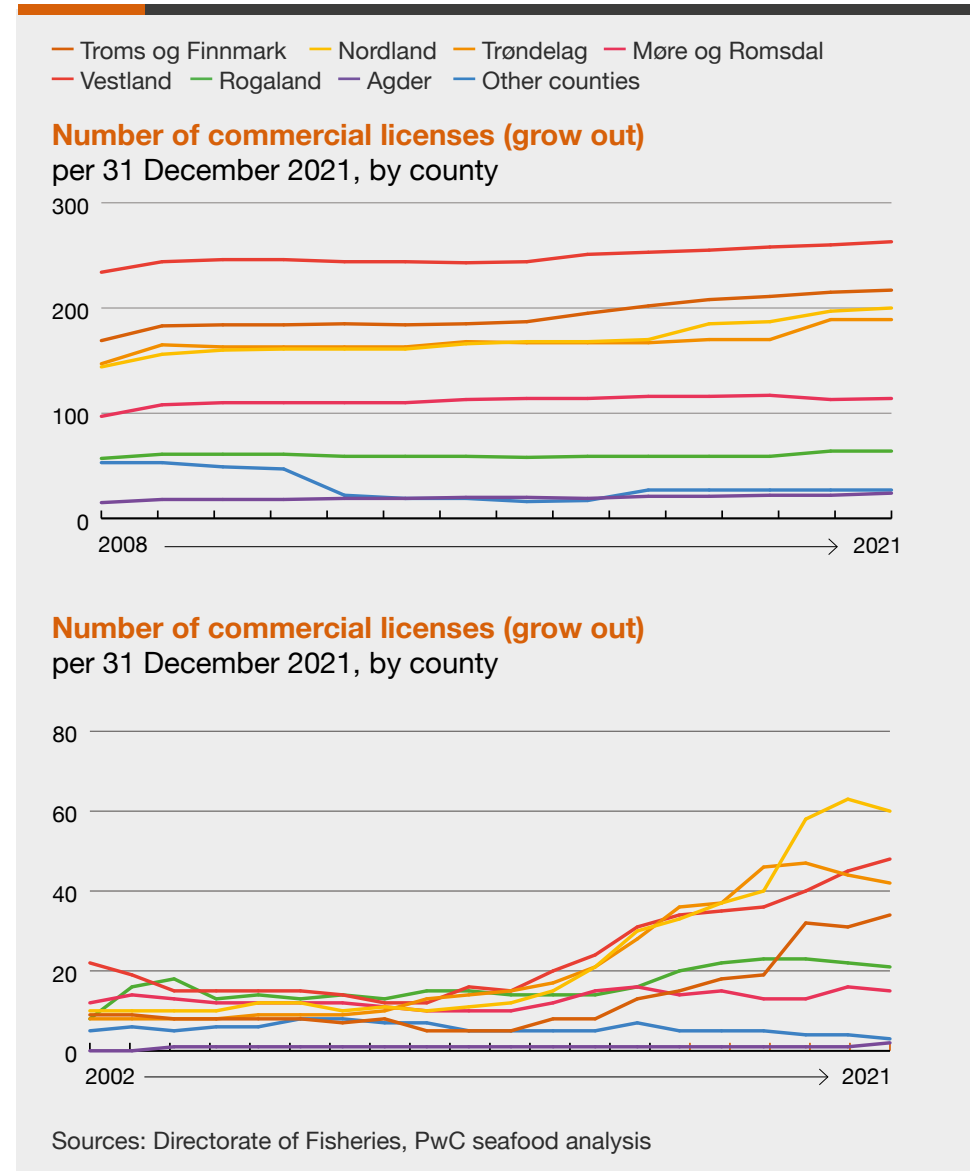
Through the 70s and 80s, a high number of licences – close to 1,000 - were granted. Most of the licences we have today were issued in the 80s, a decade in which the first and second Aquaculture Acts were passed.

Rapid growth also led to a multitude of crises such as: diseases, overproduction, falling prices, the collapse of FOS (a national sales organization based on cooperative ideology), and anti-dumping measures from the US and EU.

The idea of one licence per fish farmer was in reality removed in 1991, kick-starting consolidation in the industry. The following year the FOS collapsed, which led to a wave of bankruptcies among fish farmers. While some survived, it opened the door for a new generation of fish farmers with an intention to grow aquaculture in an industrial way.

In the 90s, about ten companies controlled a quarter of total production and sales, whilst in 2020, this number has rose to about two-thirds.

Sources: PwC Seafood Barometer 2017, Norwegian Directorate of Fisheries



2023 - a year of big changes, from a new licencing regime to an updated Aquaculture Act

Today's licencing regime is currently being reviewed by a committee

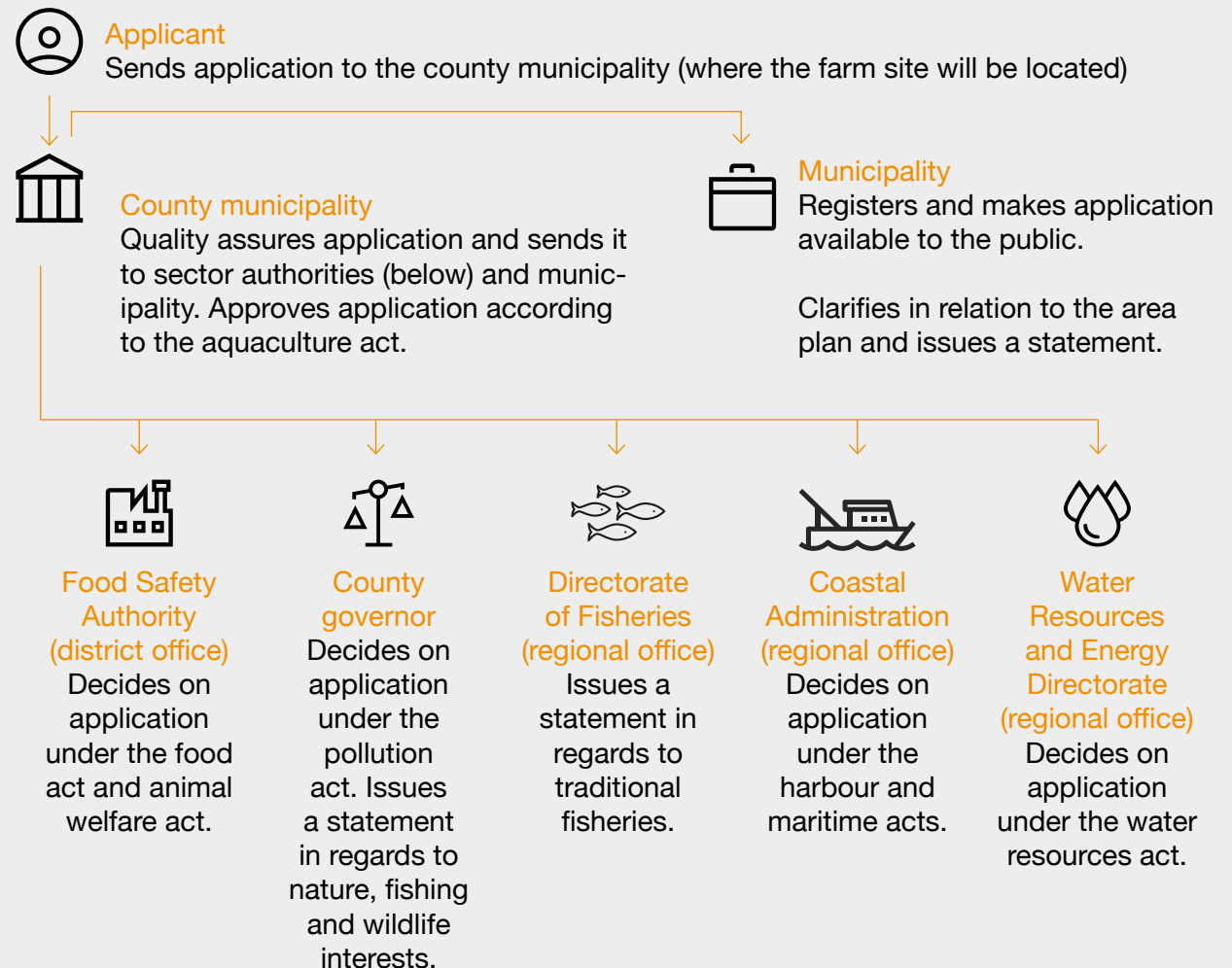
Many acts regulate Norwegian aquaculture, yet the Aquaculture Act is of very central importance. The purpose of the Act is to contribute to the aquaculture industry's profitability and competitiveness within the framework of sustainable development, and to create value along the coast.

The Norwegian Ministry of Trade, Industry, and Fisheries discussed the current regulations and licencing regime in their aquaculture strategy of 2021. The growth, changing needs of the industry, biological challenges, and increasing complexity and fragmentation of the system, call for an update. A committee is therefore reviewing, among other things, whether MAB is the most suitable instrument for limiting capacity and if changes should be made to the Aquaculture Act. They are also assessing a scheme for time limited licences. The goal is to have an efficient, coordinated and knowledge-oriented administration of aquaculture.

New licencing opportunities in the making

The government has proposed a new type of license and environmental technology permits. The minimum requirements are strict, demanding zero discharge of salmon lice and eggs, and at least 60% collection of sludge.

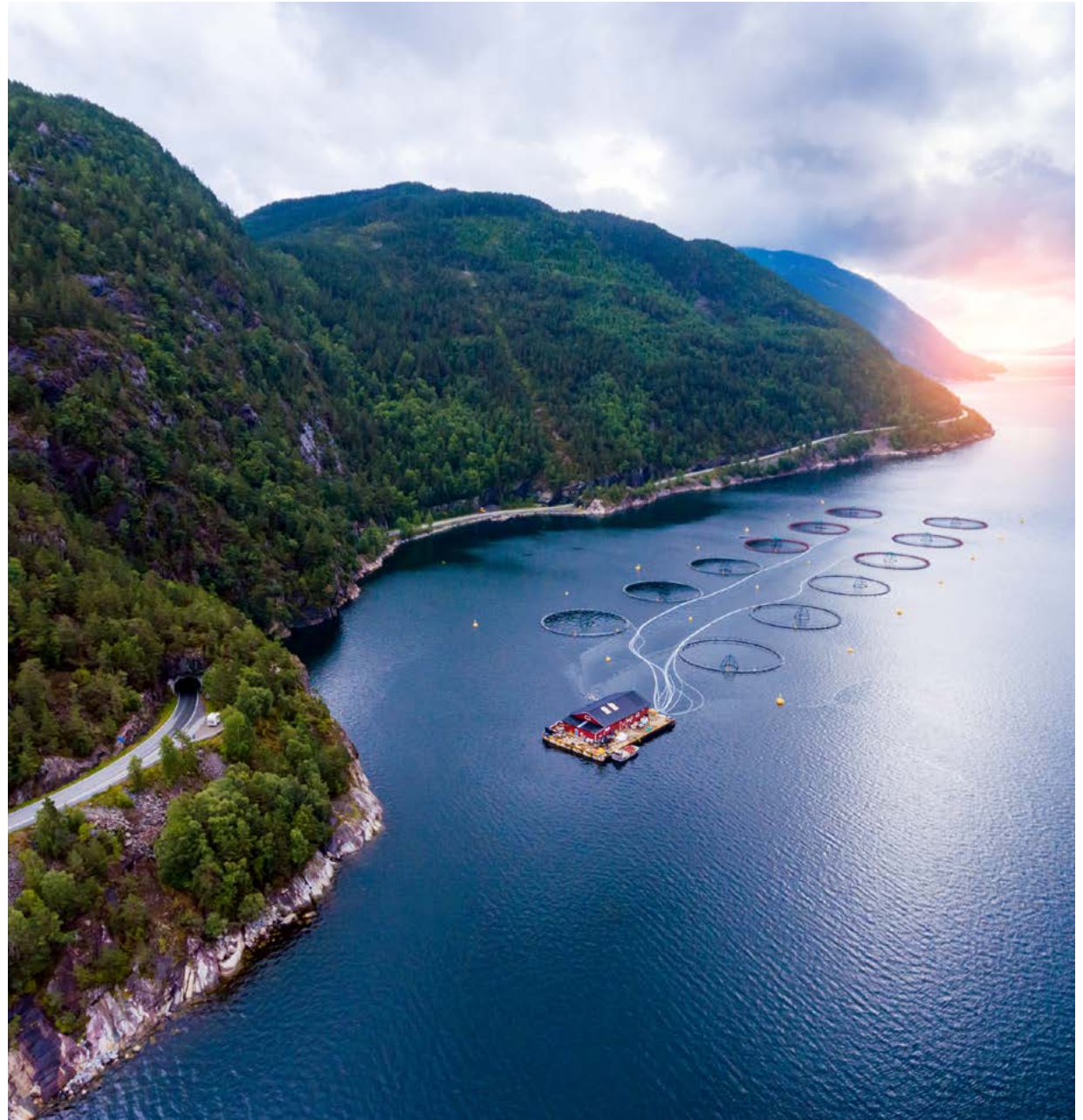
The different authorities responsible for regulating aquaculture



They are expected to come into effect during 2023.

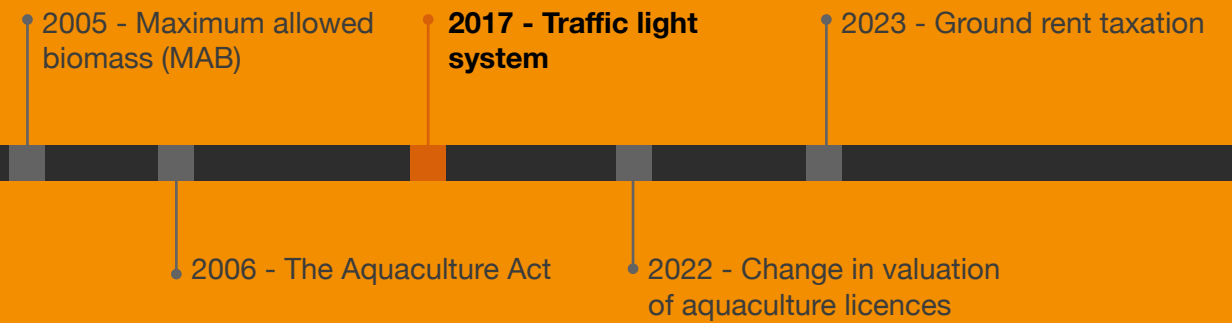
As of December 2022, the government paused all new applications for land-based aquaculture for a minimum of six months. It is set to last until a new regulation for aquaculture on land has come into force. The reasoning is that current applications are challenging the distinction between aquaculture on land and at sea, especially due to recent technology developments.

The government also announced that it will assess the impacts of aquaculture in three possible offshore areas, potentially opening up for more offshore farming.



Sources: Norwegian Environment Agency, The Norwegian Ministry of Trade, Industry and Fisheries, Lovdata, Ilaks, NRK

Traffic Light System



The traffic light system, and growth, reached a peak in 2020, however, negative outlook on the future has dampened growth in the latest auction



Recap - what is the Traffic Light System (TLS) and why do we need it?

The Traffic Light System (TLS) came into effect in October 2017, and aims to regulate sustainable growth based on environmental impact. The current and only indicator is the level of salmon lice that affects wild salmon. The system was introduced because there was a need for predictability and transparency in how the government allocated growth. Demand for salmon was high, but volume growth had stagnated in Norway. On top of that, the government introduced an ambitious vision of a five-fold increase of salmon farming by 2050. The time was ripe for a new system to manage sustainable growth.

Developments since implementation

The first round of traffic light growth was issued in 2018. Two production zones were coloured red, three zones were yellow, and the remaining eight were green. Green areas were allowed to grow by a maximum of 6% in MAB.

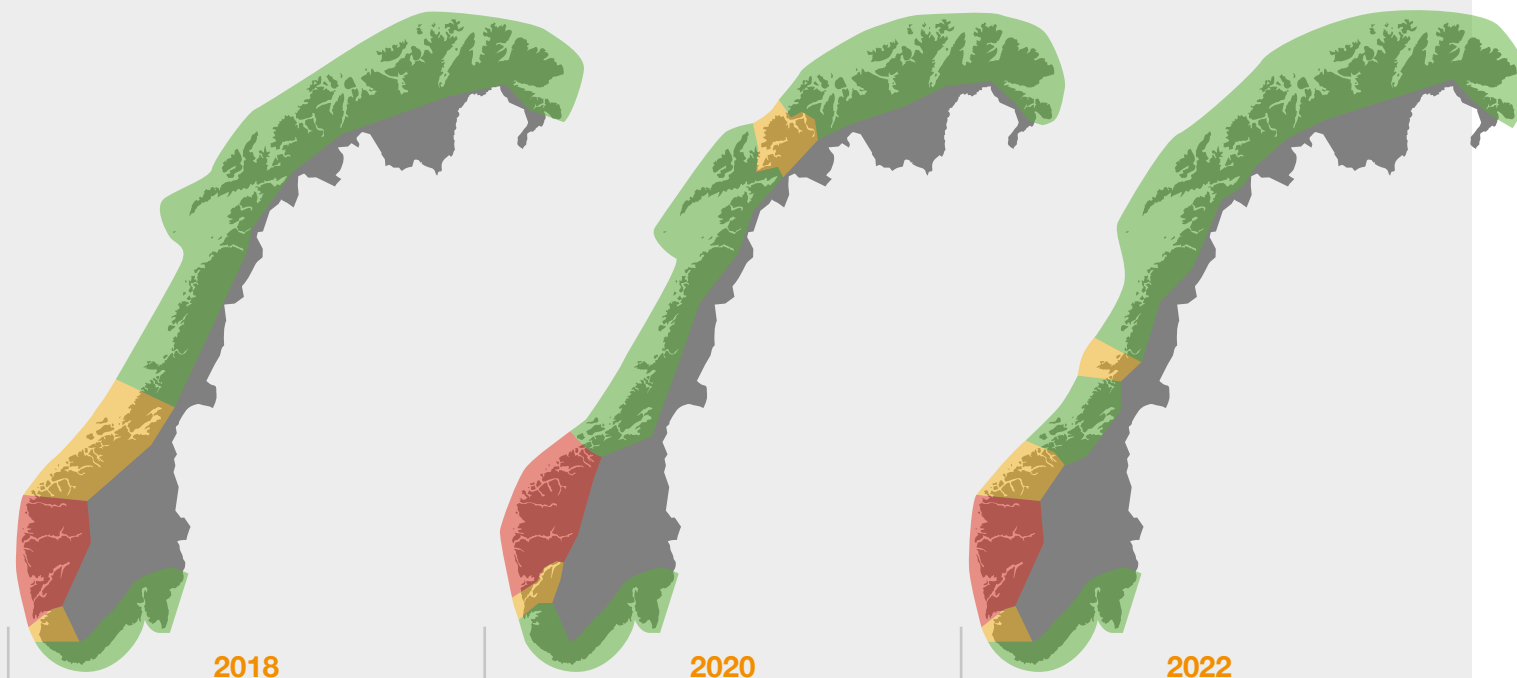
1% growth could be purchased at a set price of NOK 120,000, and the remaining 5% could be purchased at auction - an open auction, and a closed auction, where the average auction price ended at NOK 221,720 per tonne (adjusted for inflation). In this round, red zones were exempt from reducing production. The figure on the right shows the colouration and status for each round of adjustments.

Although there was more room for growth in 2020, due to less yellow zones, the net growth in MAB amounted to about the same level as for 2018 due to a 6% reduction in red zones. The average auction price reached an all time high of NOK 240,525 per tonne.

In 2022, net growth halved since the last TLS round, driven by reduction in red zones and a pessimism on future outlook due to the taxation schemes imposed on the industry. This development is reflected in the average auction price of NOK 154,158 per tonne.

Sources: PwC Seafood Barometer 2017, Norwegian Directorate of Fisheries, PwC seafood analysis

Developments of traffic light growth: 2018, 2020 and 2022



	2018	2020	2022
Volume offered for sale in auction	15,359 t	27,189 t	32,887 t
Volume bought at auction*	15,308 t	27,189 t	24,644 t
Avg. auction price **	221,720 NOK/t	240,525 NOK/t	154,158 NOK/t
Net growth***	23,772 t	23,786 t	13,078 t

*Growth from TLS (auctions), excluding exception growth

** Price (NOK) per tonne, adjusted for inflation (reference year 2022)

*** Net growth is actual growth in MAB including exception growth, fixed price growth, and adjusted for red zone reduction in MAB

Traffic light growth has been an important source of income for the public sector

Billions in funds to the public sector

In 2015, the Norwegian Parliament decided to establish an aquaculture fund, which distributes funds from purchased MAB growth in aquaculture to municipalities, counties and the national government. It came into effect in 2017, and has distributed funds from licences and MAB purchased by the industry, for instance through traffic light auctions.

Initially, the distribution was set to be 10% to counties, 70% to municipalities and 20% to the state. However, the proposed national budget for 2021 suggested that the distribution key be changed to 25/75 in favour of the state. As a more stable and predictable income, the counties and municipalities would receive a production tax from the industry, amounting to about NOK 500 million per year from 2022. Still, to the municipalities' great dismay, the income they had become dependent on would be greatly reduced. Later, due to opposition, the key was changed to 40/60 in favour of the state (from 2022).

Since 2017, the aquaculture fund has provided around NOK 8.4 billion to the municipalities and around NOK 1.2 billion to the counties.

A majority of the income stems from revenue earned in traffic light growth auctions.

As farmers were less willing to pay for traffic light growth in 2022, resulting in about NOK 3 billion less to the aquaculture fund than in the previous action round, the state decided to provide an additional NOK 800 million to the municipal sector as a compensation and to soften further opposition on the distribution of funds, as well as the newly proposed ground rent taxation scheme.

Winners and losers

Farmers in production areas 3 to 5, who have had to reduce their production, rather than be able to purchase growth, are the losers in the traffic light system.

If we look at the auction winners the numbers speak for themselves. The table below shows the top 10 winners of all three rounds of auctions, accumulated from 2018 to 2022 (excludes growth purchased at a fixed price). Salmar is the top buyer, having purchased more than ten thousand tonnes. Note that the majority represent mid to large-sized farming companies located in Middle or North Norway.

Top 10 winners of capacity in TLS auctions 2018-2022

Company	MAB	Remuneration (NOKb)
Salmar farming AS	10,189	2.1
Eidsfjord sjøfarm AS	6,978	1.2
Cermaq norway AS	5,004	1.1
Mowi ASA	4,690	0.8
Bjørøya AS	3,800	0.6
Bjørøya AS	2,522	0.6
Salaks AS	2,358	0.3
Frøy kapital AS	2,265	0.4
Lofoten sjøprodukter AS	2,110	0.3
Midt-norsk havbruk AS	2,026	0.4

Sources: PwC seafood analysis, Norwegian Directorate of Fisheries, Troms and Finnmark counties

Despite being a source for production growth, the TLS is considered a political risk by the industry

What do the industry say about the Traffic Light System?

Through our seafood survey, we have asked the industry to rank positive and negative consequences of the TLS. The three highest-ranked positive consequences represent increased cooperation with others, increased transparency in the industry and better control with lice levels. 31% respond that the TLS has had no positive consequences at all, however the responses vary significantly based on geographical location. Whilst 41% of responders from the Western Norway respond that there are no positive consequences with the TLS system, the figures from North Norway is 19%. The most negative responders are located in red zone areas where the MAB has been reduced.

Similarly, the response related to negative consequences varies with geographical location. 68% of responders from Western Norway list decreased production as a negative consequence, whilst the same figure for Middle Norway and North Norway is 50% and 33%. Increased mortality and

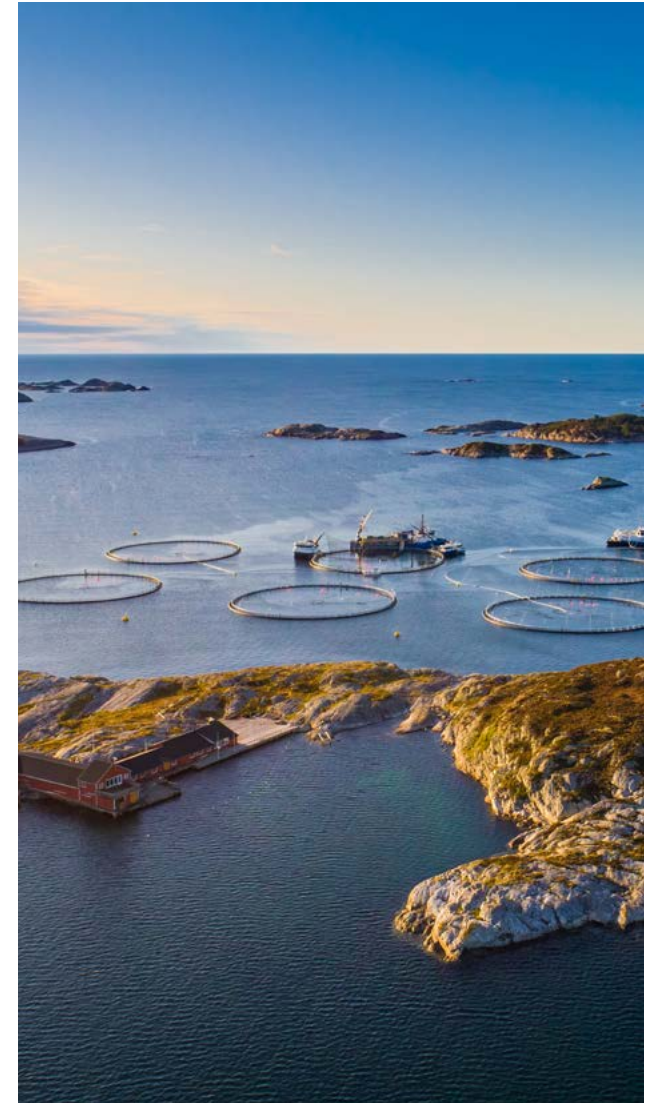
welfare issues is listed by 48% of responders from North Norway compared to 32% from Western Norway. Higher production costs and increased political risk are more evenly viewed

as negative consequences by responders from around the country.

Farmers lost against the state

An indication of increased political risk is the lawsuit against the national government, led by 25 salmon farming companies in production area 3/4 (red zone). They sued the government back in 2021 because they believed the knowledge basis backing the 6% reduction to be inadequate.








The farmers pointed to three factors that they were particularly unhappy with; firstly that the industry was given all the blame for the amount of lice in rivers and on wild salmon, although other external factors such as water temperatures and currents could contribute. Further, assumptions about the number of wild salmon migrating in and out of rivers were not in line with measurements carried out by the industry itself, and lastly that the industry were not given insight into the proceedings behind the traffic-light decisions. Once a decision is made in the traffic light system, there is no possibility of appealing the outcome. Still, the 25 companies lost in court and were not permitted to present their case in front of the supreme court.







Sources: E24, Bergens Tidende, The Research Council of Norway, PwC's Seafood Survey 2022








Besides decreased production growth, our respondents indicates fish welfare and mortality stick out like a sore thumb due to the traffic light system







Top positive consequences of TLS








-  Increased interaction with others
-  Better control at the lice level
-  Growth in production
-  Increased R&D activity
-  Do not know
-  No positive consequences
-  Increased transparency in the industry

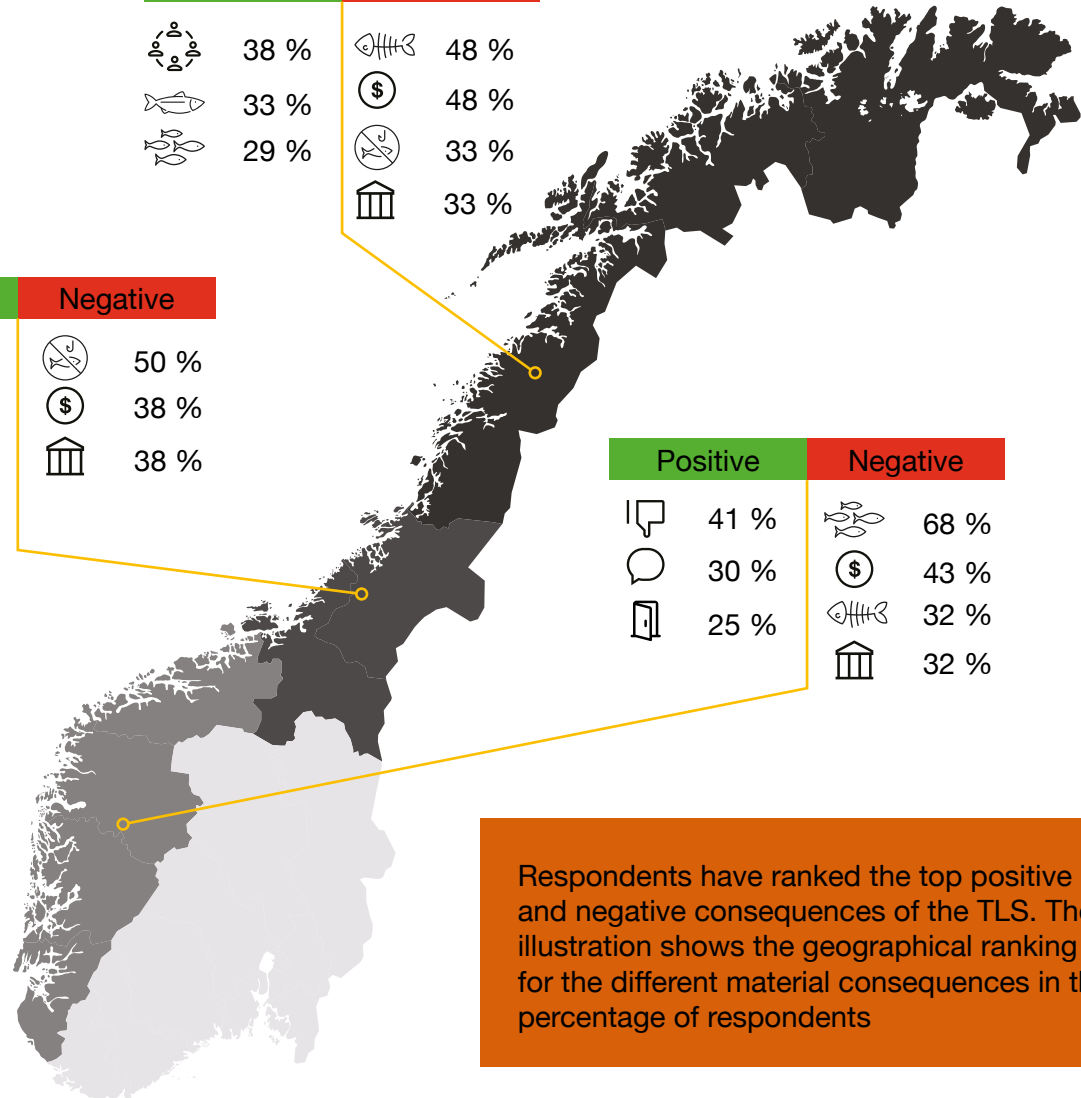
Top negative consequences of TLS

-  Increased mortality and welfare problems
-  Higher production cost
-  Cutback in production
-  Increased political risk

Positive		Negative	
	38 %		48 %
	33 %		48 %
	29 %		33 %
			33 %

Positive		Negative	
	50 %		50 %
	38 %		38 %
	38 %		38 %

Positive		Negative	
	41 %		68 %
	30 %		43 %
	25 %		32 %
			32 %



Respondents have ranked the top positive and negative consequences of the TLS. The illustration shows the geographical ranking for the different material consequences in the percentage of respondents

Are changes to the traffic light system needed?

External scientific review of the TLS

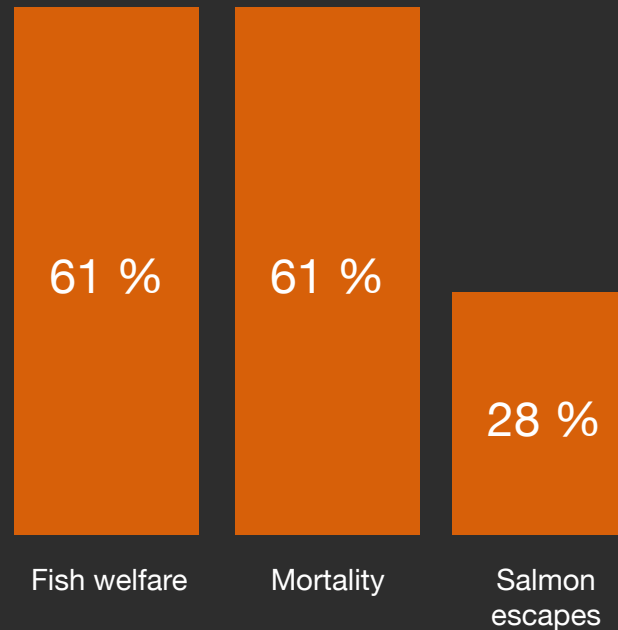
An external report and review of the scientific basis of TLS came out in 2021. It was published by the Research Council of Norway, at the request of the Ministry of Trade, Industry and Fisheries and was conducted by a committee comprised of eight European scientists. In the report, the committee honours the system's advanced attempt to regulate fish farming, but also gives fifteen recommendations on how to improve the system. According to the report, some areas that could be improved are how uncertainty is managed, is the way uncertainty is managed, how the system and its results are communicated, its transparency, and how data and stock assessments are included and reviewed in the TLS.

Future outlook

In the future, new indicators will likely be introduced to the system. As for now, there are still improvements to be done in the way the TLS is managed and enforced.

According to our survey, the industry believes that fish welfare and mortality are the two most relevant indicators to be included in the system other than salmon lice.

Top three new indicators to be included in the TLS



Percentage of respondents rank fish welfare, mortality and escapes as the most important indicators to include next in the Traffic Light System.

PwC's seafood Barometer 2023

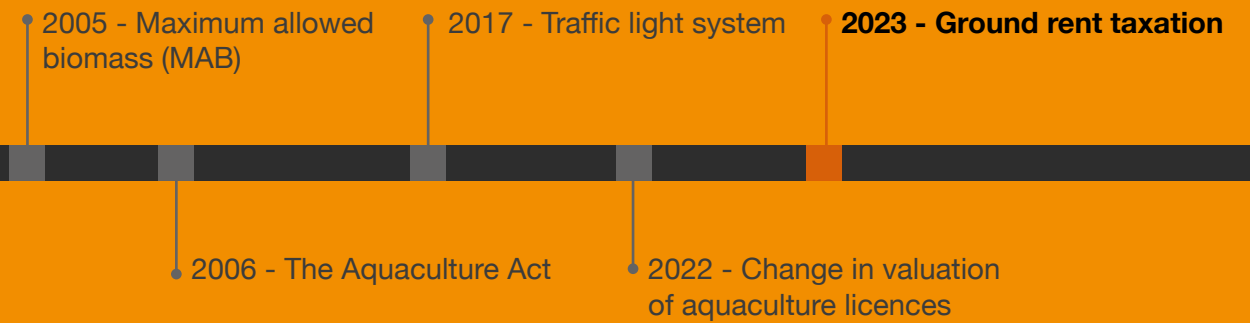
PwC point of view:

The purpose of the TLS is to manage sustainable growth for the farming of Atlantic salmon. It is natural to debate if the level of sea lice should be the only measurable indicator for sustainable growth and if collective punishment for all industry participants in one particular region is the most effective incentive mechanism to achieve this.

The way sustainable growth is regulated today is, in our opinion, neither optimal with regard to fish welfare nor with respect to predictable growth conditions. Furthermore, together with the sea lice regulations, it is contributing to higher mortality rates than necessary.

We believe that basing industry growth on one measurable indicator appears too narrow and that the government should emphasize the entirety of sustainable growth in their assessments. Additionally, we think the system should be reevaluated to examine if there are more effective and righteous incentive mechanisms than collective punishment.

Ground Rent Taxation



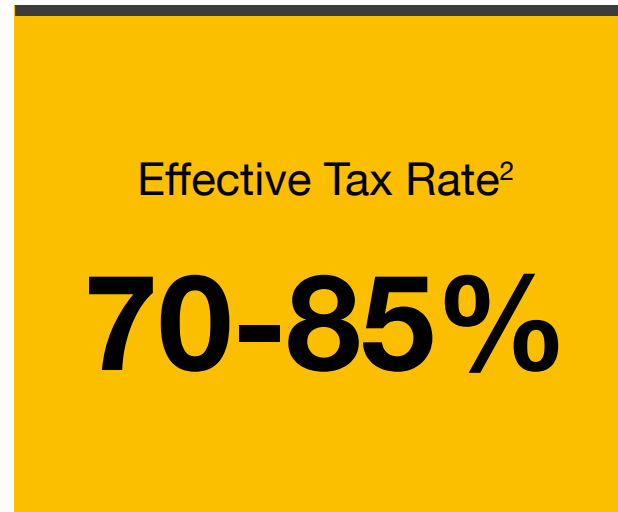
The considerable effective tax rate implies a substantially weakened ability for the industry to accumulate capital for future growth

Introduction to the suggested new tax regime

In late September 2022, the Norwegian government proposed to extend the existing special taxation system of salmon and trout aquaculture (henceforth aquaculture) with a cash-flow-based ground rent tax. The rate of the new tax is 40 per cent and implies that all commercial aquaculture activities conducted in Norwegian waters will be subject to a marginal tax rate of 62 per cent, including the corporate income tax of 22 per cent.

The proposal allows for a basic deduction of four or five thousand tonnes (to be decided) at corporate group level, intending only to target the largest players with the ground rent tax. The product of the fixed number of tonnes and a four-year industry average profitability per tonne defines the deduction's value. The proposal outlines a value between 54 and 67.5 million kroner based on the average profitability during 2016-2020 (13.5 kroner per kilogram).

Moreover, the government also introduced an explicit resource tax of 56 øre per kilogram of produced fish (HOG) and raised the existing



production from 40.5 to 56 øre per kilogram. Implicitly, all aquaculture activities are subject to a gross fee per kilogram produced fish of 1.12 øre. However, large farming groups can offset the fee with the calculated ground rent tax during profitable years, making the net effects of the gross taxes zero. On the other hand, smaller firms exempt from the ground rent tax cannot offset the fees and are subject to a 255 per cent increase in the fixed-tax level¹, i.e., the smallest firms will also experience a considerable tax increase.

Fixed assets in place are deductible in the special tax through the depreciation of their remaining tax values, and new investments are fully deductible at the time of investment. However, investments in license capacity and financing costs are non-deductible.

To include a full technical assessment of the proposal is beyond the scope of this report. That said, several critical aspects of the proposal increase the effective tax rate significantly above the marginal rate of 62 per cent. Our analysis shows that the effective tax rate will be more than 70 per cent for large firms, with an extra 5-15 percentage points if the owners are subject to wealth taxes financed by dividends. Similar effects are also documented in multiple consultation responses, e.g., the responses by Lerøy Seafood Group and Kverva.

Capital and capital needs

The considerable effective tax rate implies a substantially weakened ability for the industry to accumulate capital for future growth. Over the past decade, the invested capital per kg of sold fish has continuously increased. It is

1 In addition to the total increase in the gross tax, the production fee is no longer deductible in the corporate income tax: $(1.12/(0.405*(1-0.22)))-1 = 255\%$

2 Assuming no norm-price deviations

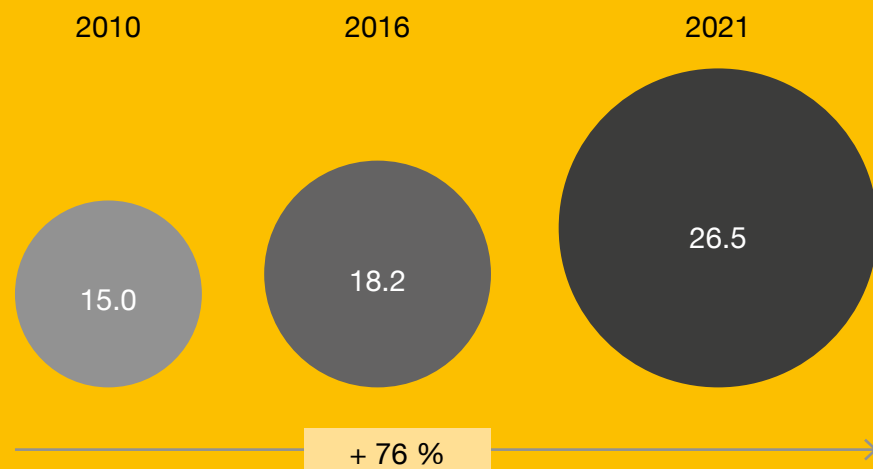
3 Invested capital as defined in the national accounts by Statistics Norway. Note that licenses and biomass are excluded from the capital base.

reasonable to expect the trend to continue in the coming decades as the industry must solve underlying biological challenges and develop even more sustainable farming methods to reach its full volume potential.

In line with prominent corporate finance theories, a private entity will prefer retained earnings to finance new investments due to the inherent pricing effects of asymmetric information in financing processes.



Average invested capital per kilogram of sold fish³



3 Invested capital as defined in the national accounts by Statistics Norway. Note that licenses and biomass are excluded from the capital base.

As the industry's investment capacity are being reduced, this may in turn distort parts of the local ripple effects the industry generates today

Thus, raising other types of capital is generally considered costly. Consequently, when companies are incapable of self-financing growth, the choice is to refrain from such opportunities or seek more expensive capital externally.

The latter will be the only real alternative for companies with strong growth ambitions. Given the sizable need for capital to reach the vision of five million tonnes in 2050, a large part of the need must be satisfied by foreign investors.

The new tax regime may threaten local ownership and affiliation

Since its inception in the 60s and 70s, the aquaculture industry has been closely intertwined with the local communities. A solid local affiliation has been the backbone of developing the industry we know today. However, an intended feature of ground rent taxes is that they secure the public's share of the profit regardless of the underlying ownership in the industry. We see this in the petroleum industry, where foreign players make up the lion's share of the operators on the Norwegian continental shelf. However, as foreign ownership increases, it is reasonable to expect the local affiliation to weaken and potentially compromising long traditions and possibly distort parts of the local

ripple effects the industry generates today.

The new tax regime is based on questionable assumptions and has weak empirical backing

The tax proposal seeks to continue the sensible principles for long-term management of the Norwegian natural resources known from hydropower and petroleum. In the latter, particular care has been given to ensure that all rents benefit current and future generations equally. However, an essential prerequisite for introducing a ground rent tax is that there exists a ground rent.

Rent capture in terms of special taxes is only legitimate when the existence of rent is proven beyond doubt. According to the Ministry of Finance, a significant ground rent has been documented in the aquaculture industry. This claim is based, among other things, on an analysis by Statistics Norway (SSB), which concludes that the aquaculture industry has realized an average rent of nearly sixteen billion kroner annually during 2013-2021.

However, SSB applies a broad definition of the term ground rent and measures general economic profits in vertically integrated corporate groups. As a result, the estimates do not isolate the contribution from the natural

resources and potential regulatory rents. Hence, the profits measured may equally be driven by excessive risk-taking or skill.

Furthermore, it is worth noting that Statistics Norway does not include market remuneration for capital invested in licenses and biomass, nor do they account for the significant depreciation of the Norwegian krone we have seen in the last decade.

The calculations also do not consider marketing efforts over many decades to create demand and build the product value of salmon. The majority of these investments represent non-capitalized efforts.

The above, combined with a notably low required rate of return on invested capital, inflates the profit estimates and introduces considerable uncertainty to the underlying justification of the taxation proposal.

The trust capital has been Norway's most valuable asset - is the Norwegian government putting that on stake?

The proposal caught the markets by surprise

The idea of introducing ground rent taxation on aquaculture in Norway is not novel. The industry has been mentioned as a potential candidate for special taxes on multiple occasions, e.g., NOU 2014: 13. In 2019, the government appointed a commission to investigate the existence of rents in aquaculture and whether it is taxable. The commission suggested introducing a periodised ground rent tax. However, the proposal met political opposition and resulted in a settlement with a production fee as a compensation for the use of public sea areas.

Three years later, the sitting government turned around and chose to go forward with an explicit ground rent tax combined with the production fee. The news sent shock waves through the financial markets. The combined market value of the four largest aquaculture firms on the Oslo Stock Exchange (OSE) fell by NOK 52 billion during the announcement day.

The green paper from 2019 forms the basis of the present proposal. However, the proposal deviates from the recommendations in several respects, e.g., the basic deduction and the cash-flow arrangement. In addition, the 2019 green paper states explicitly that they do not

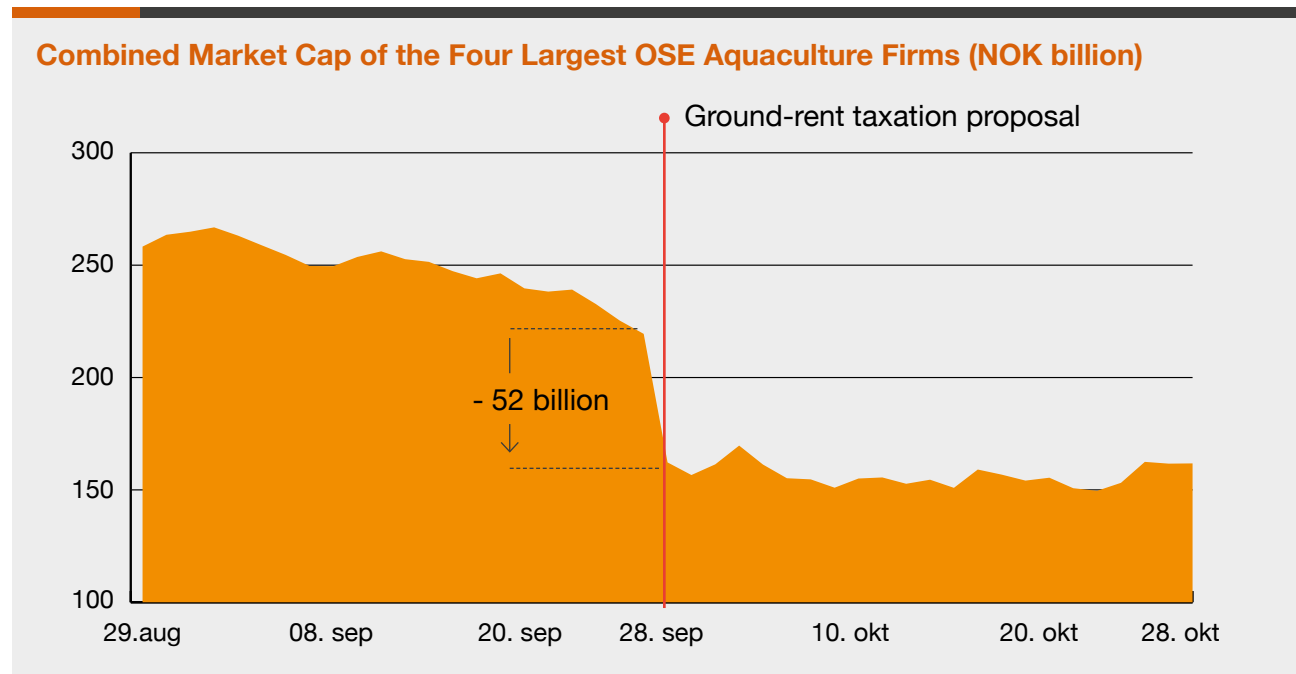
consider the entirety of the tax system in its recommendations.

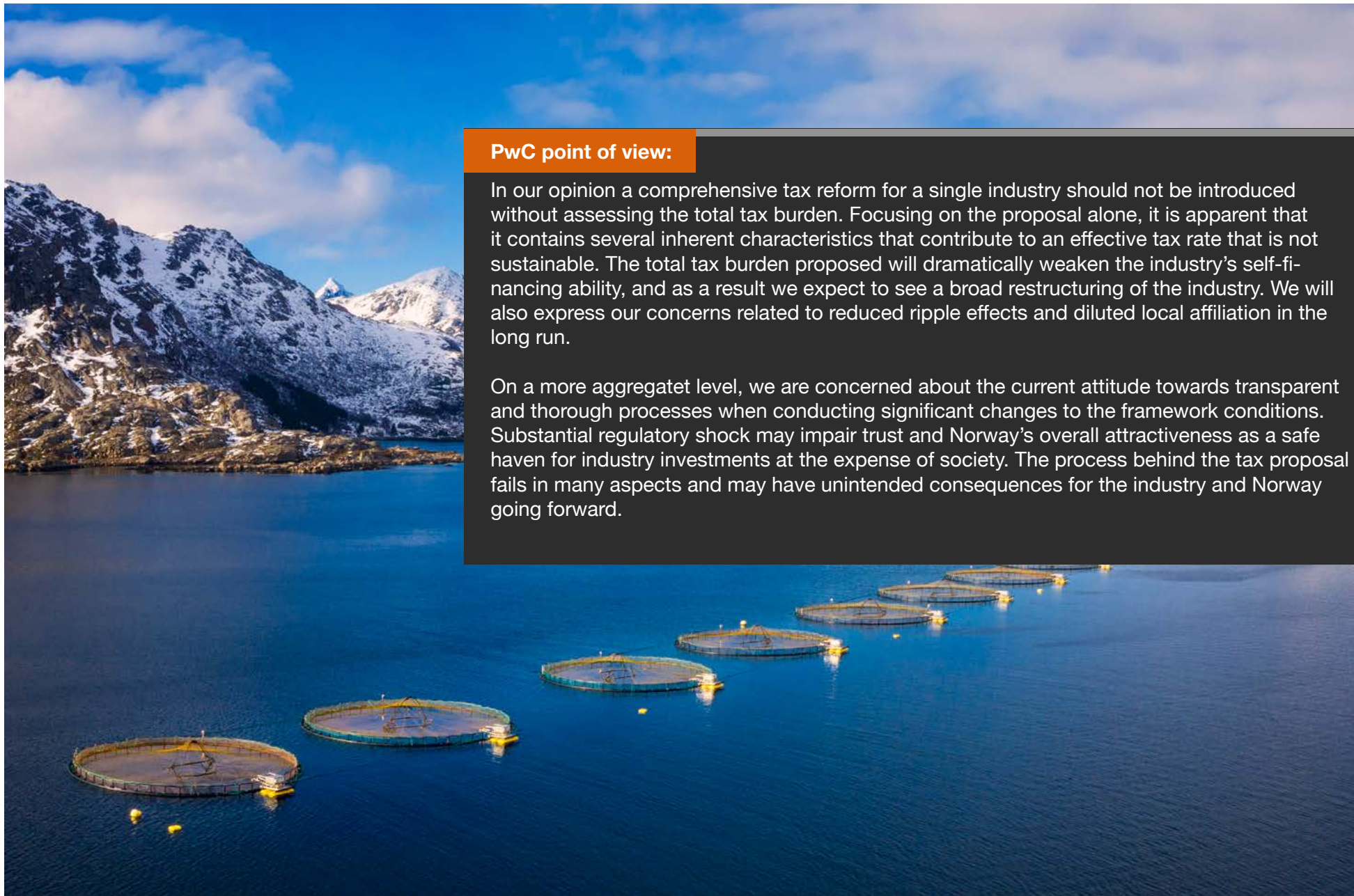
As a result, the present proposal in its final form is not investigated and evaluated by a professional commission despite common belief.

In Norway, we have a proud tradition that all major regulatory changes follow strict guidelines for thorough and transparent processes.

Predictability, responsibility and a long-term perspective have served as a basis for all large changes in the legislative landscape.

Unfortunately, we have seen several signs recently that the time of thorough and open processes seems to belong to the past. It is thought-provoking that Norway's second-largest export industry does not know the details of its tax system until six months into the year.





PwC point of view:

In our opinion a comprehensive tax reform for a single industry should not be introduced without assessing the total tax burden. Focusing on the proposal alone, it is apparent that it contains several inherent characteristics that contribute to an effective tax rate that is not sustainable. The total tax burden proposed will dramatically weaken the industry’s self-financing ability, and as a result we expect to see a broad restructuring of the industry. We will also express our concerns related to reduced ripple effects and diluted local affiliation in the long run.

On a more aggregated level, we are concerned about the current attitude towards transparent and thorough processes when conducting significant changes to the framework conditions. Substantial regulatory shock may impair trust and Norway’s overall attractiveness as a safe haven for industry investments at the expense of society. The process behind the tax proposal fails in many aspects and may have unintended consequences for the industry and Norway going forward.

Aquaculture

Future outlook

03

The industry has all-time low faith in reaching the five-million-tonne vision by 2050

Only one in four believe that the Norwegian production of salmon and trout will reach five million tonnes by 2050, down by four percentage points since our last survey.



Will norwegian production of salmon and rainbow trout be 5 million tonnes or more within 2050?

PwC's seafood Barometer 2023

“Today’s politicians do not have the prerequisites to manage that vision. I have no faith that future politicians will do any better either. By 2050, we will have lost our identity as a seafood nation”

Industry representative, PwC’s seafood survey

The declining belief is justified. Reaching five million tonnes requires a considerable change of pace in the coming three decades.

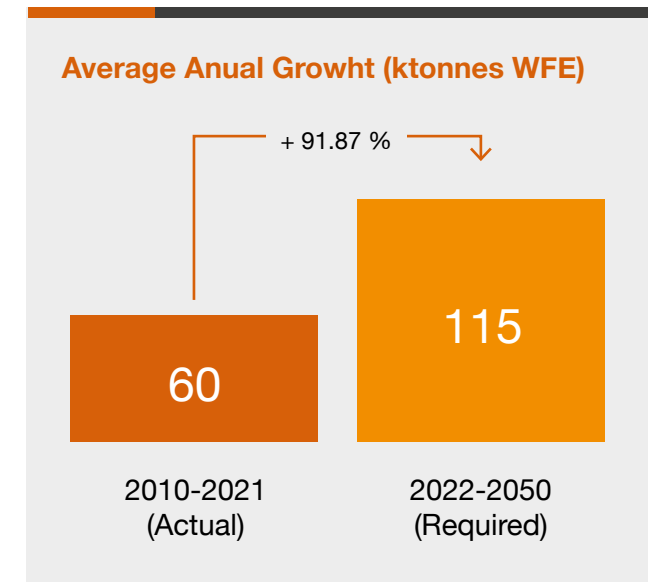
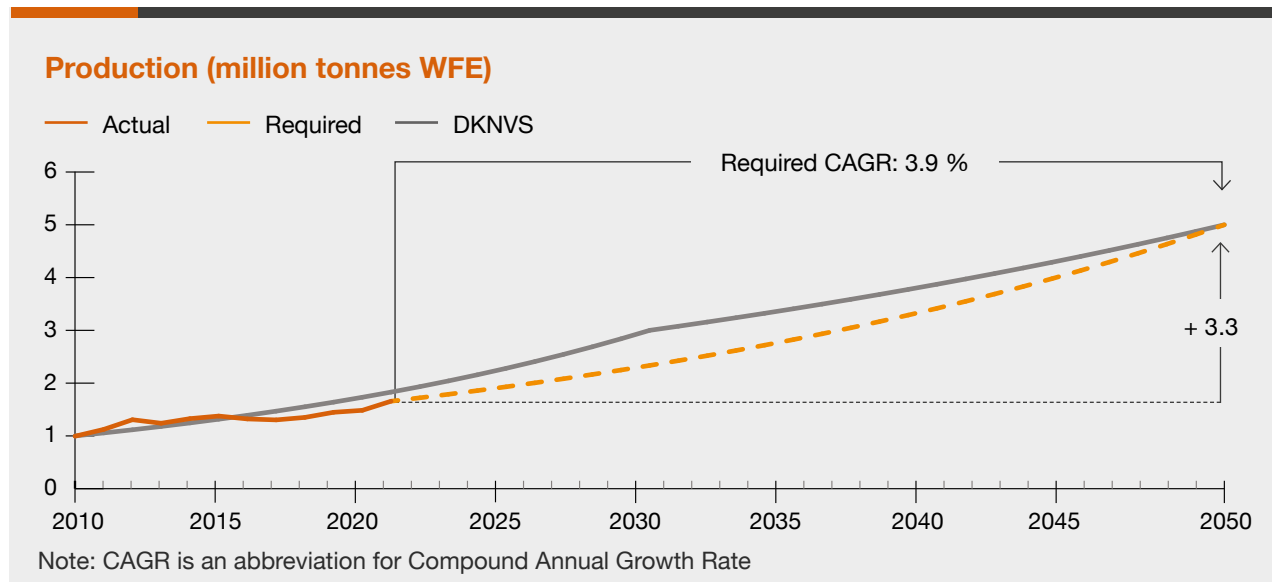
The vision of five million tonnes was put forward by DKNVS¹ and NTVA² (henceforth DKNVS) in the report “Value Creation Based on Productive Oceans in 2050” (our translation) in 2012. The authors based their analysis on a total production of one million tonnes in 2010 and estimated a tripling of the total volumes by 2030 to three million tonnes (5.65% annual growth) and a fivefold increase to five million tonnes by 2050 (2.59% annual growth during 2030-2050).

The figure below depicts the implicit growth curve from the DKNVS report and compares

their expectations with the realized production by Norwegian aquaculture firms (“Actual”). The actual volume output showed an average annual growth of nearly 4.8 per cent during 2010-2021, and the realized production was about 172 thousand tonnes short of the expected volume by DKNVS in 2021.

For production to reach five million by 2050, the industry must realize an average annual growth of approximately 3.9 per cent (“Required”) from 2022 onwards. This growth rate implies a total increase in yearly volumes of 3.3 million tonnes by 2050.

At first glance, we are somewhat on track with the five million-tonnes vision. However, the story is considerably less convincing if we look beyond the growth rates and focus on the required growth in tonnes. The realized growth of 4.8 per cent during 2010-2021 translates to 60 thousand tonnes annually, whereas the required growth from 2022-2050 implies an average yearly increase of 115 thousand tonnes, i.e., the annual growth in tonnes must be 92 per cent higher the next thirty years compared to the preceding decade.



1 DKNVS is short for “The Royal Norwegian Society of Science and Letters” (Det kongelige Norske Videnskabers Selskab - in Norwegian)

2 NTVA is short for “The Norwegian Academy of Technological Sciences” (Norges Tekniske Vitenskapsakademi - in Norwegian)

Growth in line with TLS will not achieve the vision alone

A sustainable increase in production of 115 thousand tonnes annually implies a significant change of pace for both industry and the authorities. In previous barometers, we analyzed the potential volume contribution from various production technologies leading up to 2050 to assess the realism of the vision. However, in this year's edition, we find ourselves having to refrain from doing similar exercises due to the considerable uncertainty associated with the ongoing industry-specific tax reform. Consequently, we assume a different approach this year and focus on prerequisites for realizing the vision in terms of technology and the regulatory framework as is.

Conventional technology is strictly regulated

As we know from above, most Norwegian farmed salmon is produced in conventional flow-through cages with associated advantages and disadvantages. Due to the free flow and the entailed externalities, production is carefully regulated through the licensing scheme coupled with the traffic light system (TLS). The latter is currently the only means of real growth available for conventional technology.

The TLS cannot facilitate enough growth even in an all-green-scenario

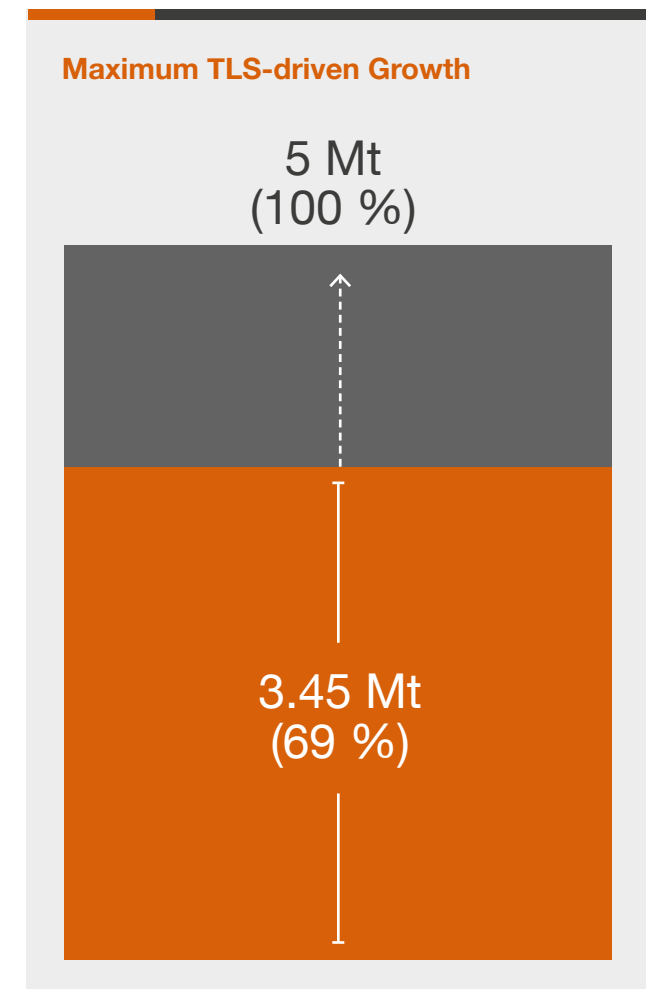
The TLS regulates growth by adjusting the licence capacity of each license in a given

area. As stated above, production areas with low lice-induced mortality in wild salmon are offered to grow at six per cent every other year. The question is whether the offered growth is sufficient to facilitate the vision.

To address this question, we compute the maximum theoretically possible growth from the system based on the current production capacity in each of the thirteen areas. The combined MAB for all commercial grow-out licenses is 898 thousand tonnes as of 31. December 2022. We assume that all areas obtain the right to increase production by six per cent every other year until 2050 (14 periods). Implicitly, the total MAB reaches 2 million tonnes in the last period. To convert the MAB to production volumes, we assume that each tonne of capacity yields 1.7 tonnes of fish WFE (1.5 HOG), in line with the industry average during 2018-2021 in Norway. As a result, we derive a total production of 3.45 million tonnes in 2050 or 69 per cent of the five million production target.

The growth mechanism inherent in the TLS model is clearly insufficient to reach the vision of five million tonnes on a stand-alone basis. Hence, the TLS must be coupled with considerable productivity improvements over the same period to reach the target. Specifically, the output per tonne of license capacity must increase by almost 45 per cent to 2.46 tonnes

WFE (2.19 HOG) while simultaneously realizing the 6 per cent capacity growth in all areas to reach five million tonnes in production by 2050.



Conventional technology may have limited growth potential unless the industry solves current biological challenges.

The industry is continuously seeking to increase license utilization through long-term strategic actions. In newer times, there has been a notable trend towards investing substantially in facilities on land to produce larger smolt, known as post-smolt. Larger smolt comes with the benefit of being more robust to parasites and viruses combined with a higher growth rate per unit of time, which, together with the high initial weight, allows for a shorter production time at sea. Although the preliminary results of the post-smolt strategy are promising, the full potential of the productivity improvement is yet to be proven.

Conventional technology may imply a unsustainable fish density

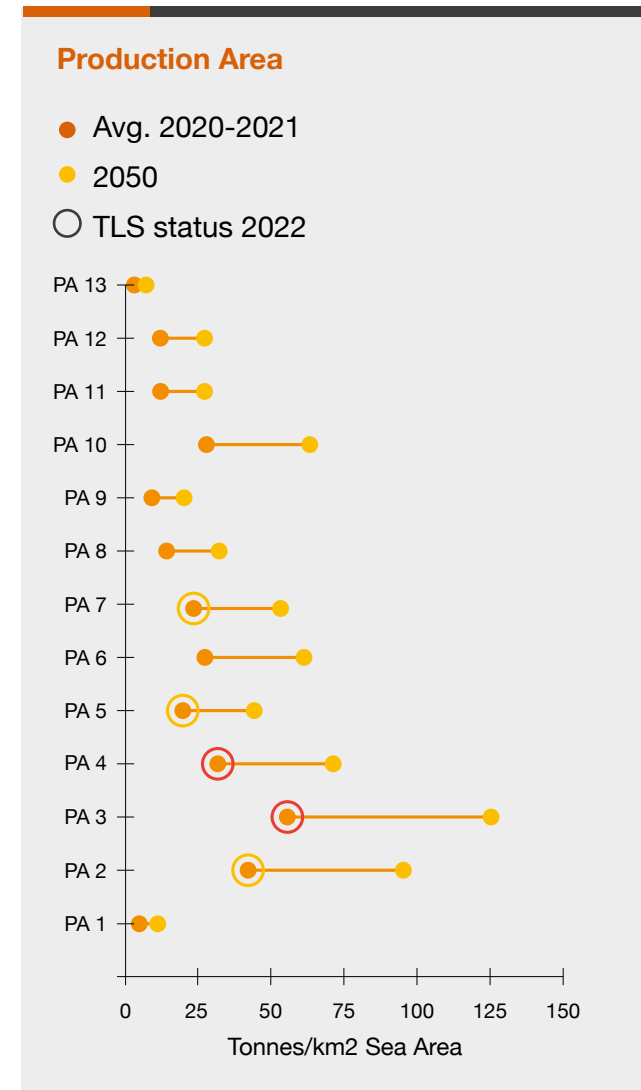
There are no reasons to believe that the TLS will provide the necessary growth to achieve the five-million-tonne vision in its present form. Could a potential solution be to increase the systems' growth rate? Suppose we continue our assumptions from above that one tonne of license capacity yields 1.7 tonnes of fish. In that case, we will need a total MAB of 2.9 million tonnes in 2050 to reach a production volume of five million tonnes. Assuming all areas are allowed to grow every two years until 2050, the implied growth rate must increase by 2.8 percentage points from 6 to 8.8 per cent.

Initially, increasing the growth rate seems like a trivial solution. However, it goes against the basic premise of the

TLS, namely that the amount of biomass in an area is the driving force for the general level of lice, which in turn gives an increased probability of lice-induced mortality in wild salmon. Furthermore, a high proportion of biomass will naturally also make the consequences of any disease outbreaks significantly greater, even though diseases are not formally included in TLS at the time of writing.

As part of the preparatory work for determining the colors of the production areas in the TLS, the Institute of Marine Research analyzes the production intensity in each of the thirteen areas. The measure of intensity is formally defined as the total production volume throughout the year relative to the available sea area within the baseline in each production area, stated in tonnes per square kilometre.

We conduct a similar analysis to study the implied intensity of the maximum-growth scenario from above using the average production during 2020-2021 as a starting point. We assume that the output per tonne of license capacity is constant within each



production area throughout the analysis period.

The results of the analysis are plotted in the figure on the previous page. As the figure shows, all areas except 1 and 13, which initially have little biomass regardless of sea area¹, will achieve a production intensity similar to or higher than the areas that received yellow or red status in 2022.

As a result, it is reasonable to expect that the production conditions will be challenging for several areas and will probably not be compatible with the desire for sustainable growth and value creation.

¹ Production area 1 and 13 accounted for around 1.1 and 0.7 per cent of the total biomass in Norway, respectively



Foto: Petter Lund Wåge

New production technology can boost production growth but requires an adaptive licensing scheme and a considerable risk appetite

For the industry to be able to grow significantly with conventional technology, the major biological challenges must be solved. The industry is well underway and invests billions annually to overcome the tribulations. However, the investments are long-term and will require both risk capital, cleverness and patience in the years to come to materialize in considerable volume growth at terms with nature.

Closed cages are one option to support further growth

An appealing solution to overcome the demanding growth prospects of conventional technology is to develop and implement new production technologies. An apparent alternative is to use closed or semi-closed pens, which goes a long way towards neutralizing the effect of the negative externalities. Specifically, the two-way transmission of diseases and parasites is avoided by establishing a physical barrier between the fish inside and outside the cage. Hence, the technology allows for a very high area-specific production intensity and still remain within nature's long-term carrying capacity.

Although there are multiple favourable aspects of closed cages, the advantages are coupled with significant disadvantages concerning investment costs and high energy consumption compared to conventional technology.

There are several facilities utilizing closed and semi-closed solutions in Norway at present, but further expansion of the technology requires, among other things, a modernization of the licensing scheme, where the licenses need to be linked to the underlying production technology to achieve a sufficient remuneration adjustment to reflect the capital intensity and risks associated with the technology. Looking beyond the license issues, a shift towards a more widespread use of closed cages will accelerate further the industry's average investment costs per kilogram of fish.

Drawing on sixty years of oil experience may lead to substantial volume growth from offshore farming

Another potential candidate to facilitate the required production growth are ocean-based farming solutions. Driven by the development-licensing scheme, several industry players have started to develop aquaculture rigs capable of farming fish in the open ocean.

Exploiting vast areas offshore allows for large distances between sites, thus reducing the horizontal transmission pressure and lowering the risk of parasites and viruses. In addition, more stable water currents combined with greater depths help dilute and disperse waste products more efficiently. Moreover, the

production facilities are situated far away from the fragile salmon rivers, hence reducing the probability of negatively affecting wild-living salmon.

Despite the clear benefits of offshore-based farming methods, the technology is still in development, and the capital requirements are enormous compared to conventional technology. Hence, introducing offshore farming at a large scale will require extensive investments at considerable risk.

Similar to the closed-cage solutions, a renewal of the licensing scheme and long-term regulatory stability is crucial for further development and implementation of the technology.



SalMar ASA, Ocean Farm 1

The future aquaculture industry will have a wide range of production technologies - at sea and on land

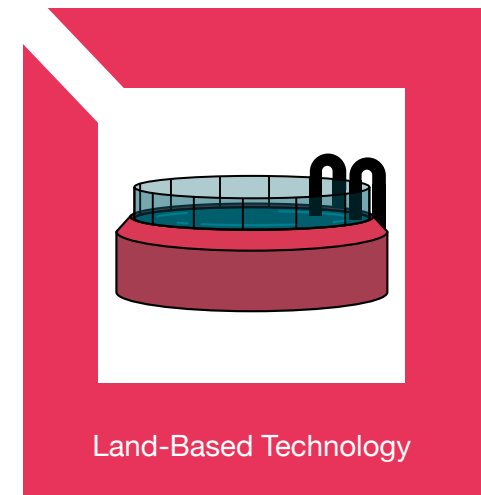
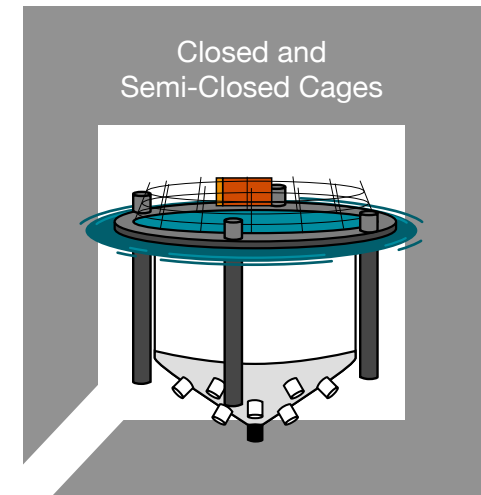
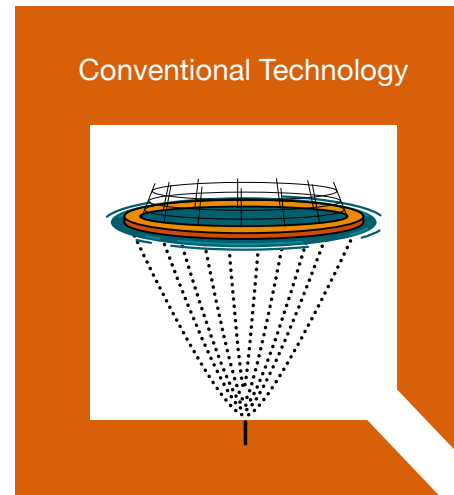
Projects driven by the development-licensing scheme may not materialize with the new tax regime

Since its introduction in 2015, the temporary development-licensing scheme has been the most important stimulant for developing new production technologies in the industry. The arrangement was open for applications from late 2015 to late 2017. At the time of writing, the Directorate of Fisheries has issued nearly 89 thousand tonnes in development-license capacity, and two projects are still pending decision (about 16.4 thousand tonnes). Roughly 46 and 38 per cent of the granted capacity is offshore and closed-cage based, respectively.

An essential component of the scheme is the inherent conversion option from a development license to a regular commercial license upon project completion. This convertible right was pivotal for reducing risk and was an important value driver in the initial investment analysis of the projects during the application preparations. Unfortunately, the convertible right has suffered a sharp decline in value due to the recent tax reform. Upon conversion, the licenses become part of the ground-rent tax regime and are subject to a threefold tax increase from 22 to 62 per cent. This tax increase is a devastating exogenous shock with the potential to prevent the realization of the planned projects due to lacking profitability and elevated investment risk.

Land-based farming is showing promising results and may threaten Norway's leading role in salmon farming

A growth opportunity for the industry that is neither driven by the development-license scheme nor will be heavily taxed for the time being is land-based farming methods. As we know from above, fruitful development is now underway to commercialize land-based solutions, and there are plans for around 950 thousand tonnes on land in Norway. A decisive selling point for land plants is savings related to avoided lice-mitigation



expenditures and the ability to collect and utilize waste products to produce, e.g., biogas and fertilizers. The advantages, however, come with considerable energy and capital costs compared to conventional technology.

Although the avoided lice-mitigation costs are compelling, the most prominent advantage of land-based production methods is the ability to conduct the farming in, or closer to, the end markets. Consequently, one ensures a secure supply of fresh products, reduces transportation expenses and minimizes transportation-related greenhouse gas emissions.

Currently, land-based projects are still experimental, but some preliminary results are promising. That said, if one succeeds in developing commercially viable land-based solutions, it may be bad news for Norway as the world's largest salmon producer. We see few convincing arguments for continuing to build land sites in Norway as soon as the technology is proven. Unfortunately, the significant tax burden on conventional technology constitutes a notable cost disadvantage and makes it easier for land-based methods to compete on costs. As a result, Norway's long-lasting position as the world's leading salmon-producing nation is more at risk than ever.

The future will exist of a wide range of production technologies and require sizable investments

There are strong reasons to believe that the farming industry of tomorrow will be more heterogeneous regarding production technology. This view is also the consensus among our survey respondents. Thus, there might be a way to reach the vision after all. However, there is no doubt that any industry expansion towards the vision will require enormous commitment and vast amounts of capital.



Lack of capital and trust may halt the industry's growth pace. The vision of producing five million tonnes by 2050 is probably more unrealistic than ever

We can illustrate the magnitude of the capital requirements through a highly simplified example. As mentioned above, the total production in Norway must increase by about 3.3 million tonnes to reach five million. Let the invested capital and working capital requirements in kroner per kilogram of fish be 26.5 and 40, respectively¹. Using these assumptions, we derive a total capital requirement of about 220 billion kroner for equipment and biomass alone². In addition to this estimate, the growth will require billions in remuneration for new license capacity and considerable maintenance investments. Furthermore, introducing new production technology will, of course, increase the capital requirements. Hence, the total capital intensity implied in the vision will be substantially higher in reality.

To finance the incremental growth will not be as simple as it has been

All things considered, there exist technological solutions that can enable a significant increase in production in Norway. However, the big question as we advance will be how

to finance the growth. As mentioned, most investment projects are financed by a mix of retained earnings and debt. Unfortunately, the tax reform will seriously weaken the industry's ability to accumulate the former and pay the latter, which implies a dramatically depreciated self-financing ability. As a result, the industry will experience an increased dependency on the capital markets for further growth. Given the sizable capital requirements, it is reasonable to expect a large share of the necessary equity to be sourced from the global markets. In the long run, the increased dependency on foreign investors may challenge the local affiliation, which has been the backbone of the industry since its inception in the 60s.

Lack of trust can be a significant obstacle for investments in years to come

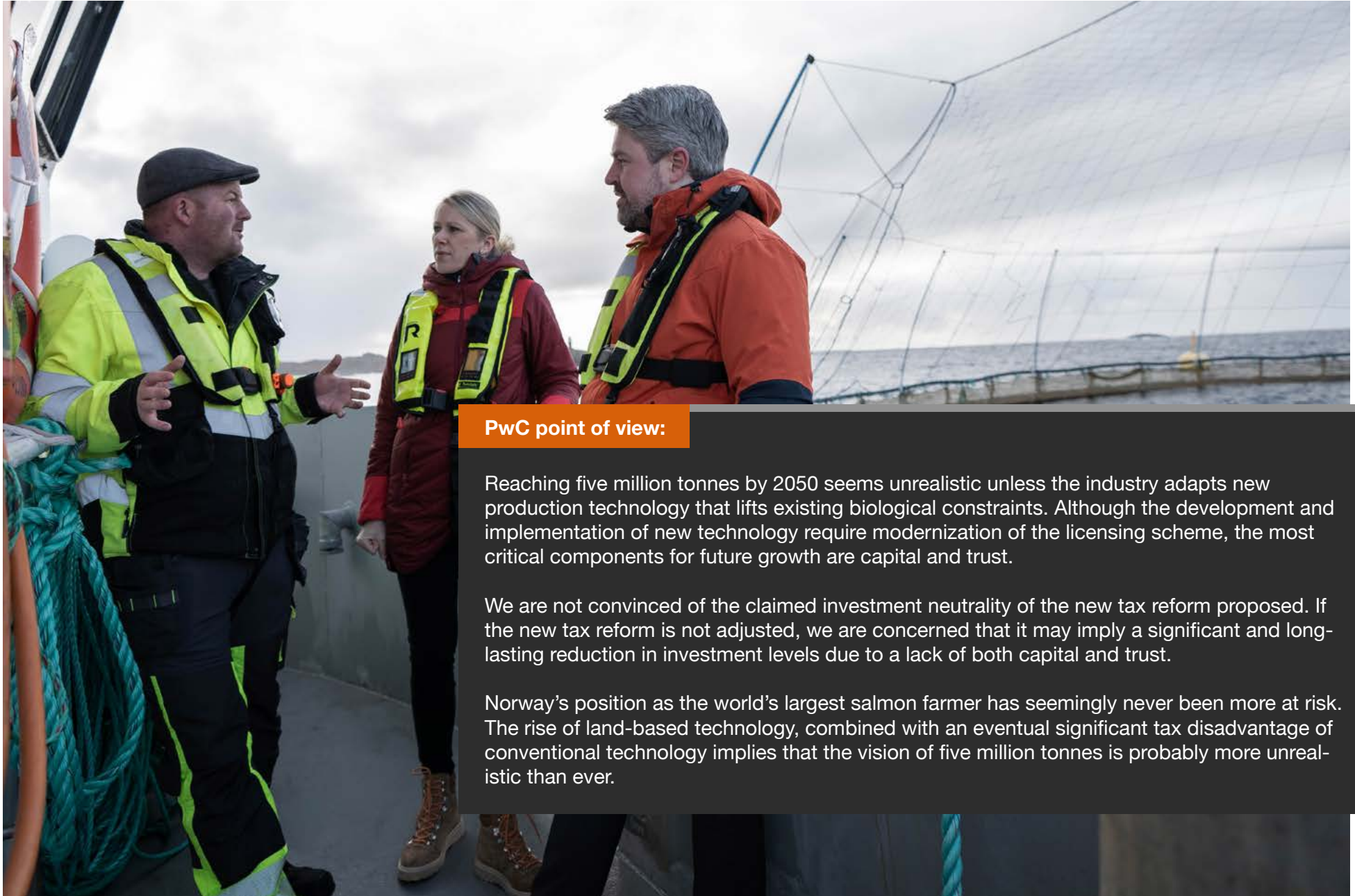
That said, raising capital in the global markets may be considerably more expensive going forward, which can introduce a bottleneck for further growth. Unfortunately, we have witnessed several recent cases of foreign

investors refraining from investing in the industry. The reason is the deterrent effect of unpredictable changes to fundamental policies. As a result, investors will require a substantial premium to compensate for the increased political risk, lowering the total investment level.

At the time of writing, investments worth more than 40 billion kroner in the aquaculture industry have been cancelled or postponed due to a breach of trust and a lack of capital in the future. We have observed a common belief among politicians that investments will resume as soon as the industry learns the details of the new tax system. Unfortunately, trust takes years to build and a second to ruin. Therefore, we expect a notable and long-lasting decline in investment activities irrespective of the details of the tax system.

1 Note that both the working capital requirements and the investment costs are based on conventional technology

2 220 billions (= (26.5 + 40) * 3.3)



PwC point of view:

Reaching five million tonnes by 2050 seems unrealistic unless the industry adapts new production technology that lifts existing biological constraints. Although the development and implementation of new technology require modernization of the licensing scheme, the most critical components for future growth are capital and trust.

We are not convinced of the claimed investment neutrality of the new tax reform proposed. If the new tax reform is not adjusted, we are concerned that it may imply a significant and long-lasting reduction in investment levels due to a lack of both capital and trust.

Norway's position as the world's largest salmon farmer has seemingly never been more at risk. The rise of land-based technology, combined with an eventual significant tax disadvantage of conventional technology implies that the vision of five million tonnes is probably more unrealistic than ever.

Fisheries

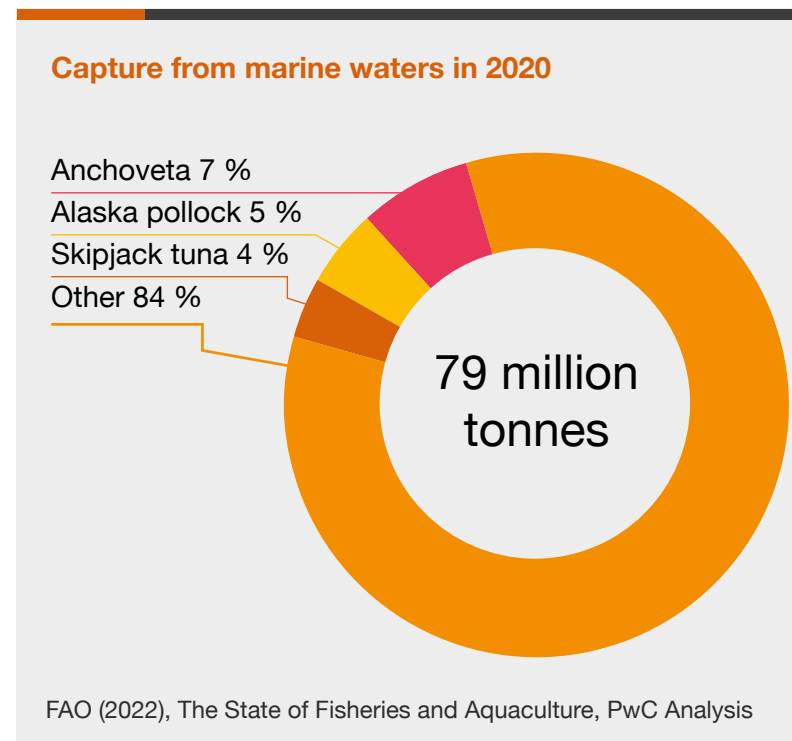
Status in the industry

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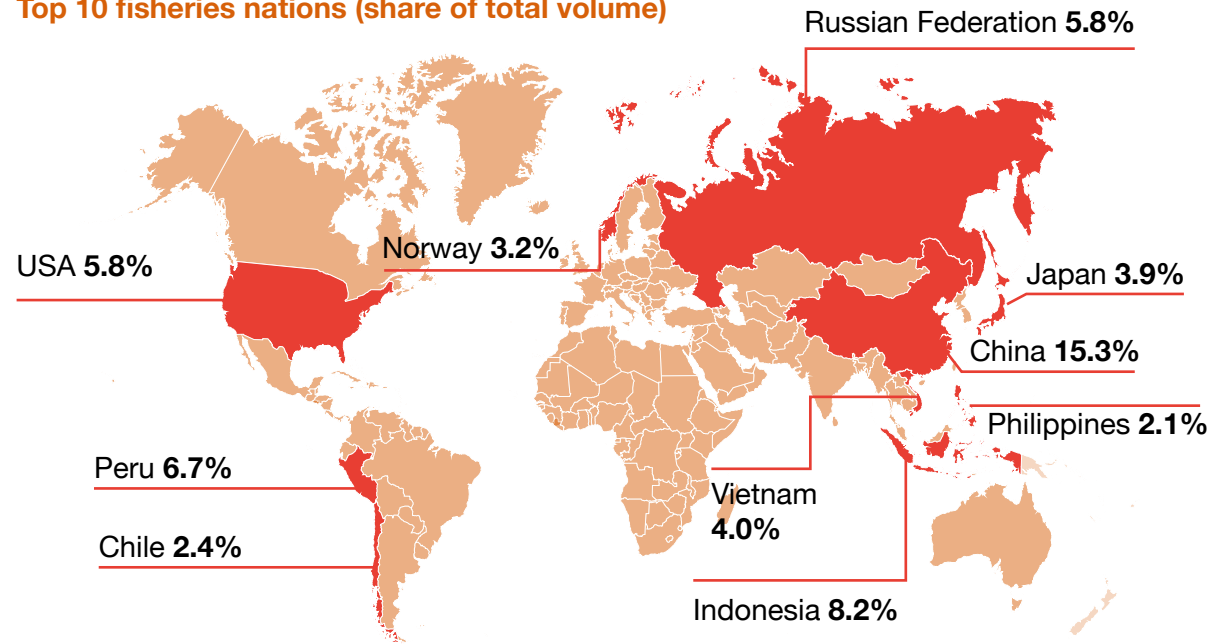
Global catch volumes have seen a moderate decline in recent years

Relatively stable catch since the 1980's

According to the Food and Agriculture Organisation (FAO), the global harvest from marine fisheries was close to 79 million tonnes in 2020. This has remained relatively stable since the late 1980s, but in the past years we have seen a slight decline. This is primarily caused by fluctuating catches in pelagic species (particularly anchoveta), reduction in China's catches, as well as impacts of the Covid-19 pandemic.



Top 10 fisheries nations (share of total volume)



The figure shows the average share of the global fisheries production for the top 10 producing countries in the period 2017-2020

Norway is the 8th largest contributor to global fisheries

Norway reported a catch volume of 2.45 million tonnes in 2020, corresponding to approximately 3% of the world total.

The Norwegian fishing fleet operates primarily in the Northeast Atlantic region (FAO27). The most important fisheries are groundfish and pelagic fisheries, in which cod and mackerel respectively are the two most important species measured in both volume and value. In addition to cod, haddock and saithe are important groundfish, while herring and capelin are other important pelagic species.

Well managed fisheries are crucial for sustainable growth, when an increasing share of fish stocks are being overharvested

The world's fish stocks are constantly being overharvested

In 2019, FAO reported that more than 35% of marine fish stocks were fished beyond biologically sustainable levels, and the trend is significantly increasing over time. The United Nations Sustainable Development Goals (SDGs) set a clear target to end the overfishing of marine fisheries by 2020 (SDG Target 14.4). However, global fisheries are diverging away from this target, and the situation is particularly urgent in regions with less developed fisheries management.

Fisheries are an important part of the solution to securing global food security and economic growth. To ensure a long-term supply of food from the sea, we depend on rebuilding ecosystems and fish stocks through effective management. A key success factor is to replicate successful policies and regulations across regions and countries.

Effective management must be scientifically grounded

The International Council for Exploration of the Sea (ICES) is an intergovernmental marine science organisation providing impartial evidence on the state and sustainable use of marine ecosystems. ICES provides scientific advice on the annual quotas based on the current condition of fish stocks. In addition, Marine Stewardship Council (MSC) has become the world's most widely used framework providing voluntary third-party assurance and certification of sustainable fishing practices, thus setting the standard for sustainable fisheries. Countries such as Norway and Iceland, work closely with both ICES and MSC to ensure sustainable management of marine resources.

FAO (2022), The State of Fisheries and Aquaculture, Marine stewardship council (2022), PwC Analysis



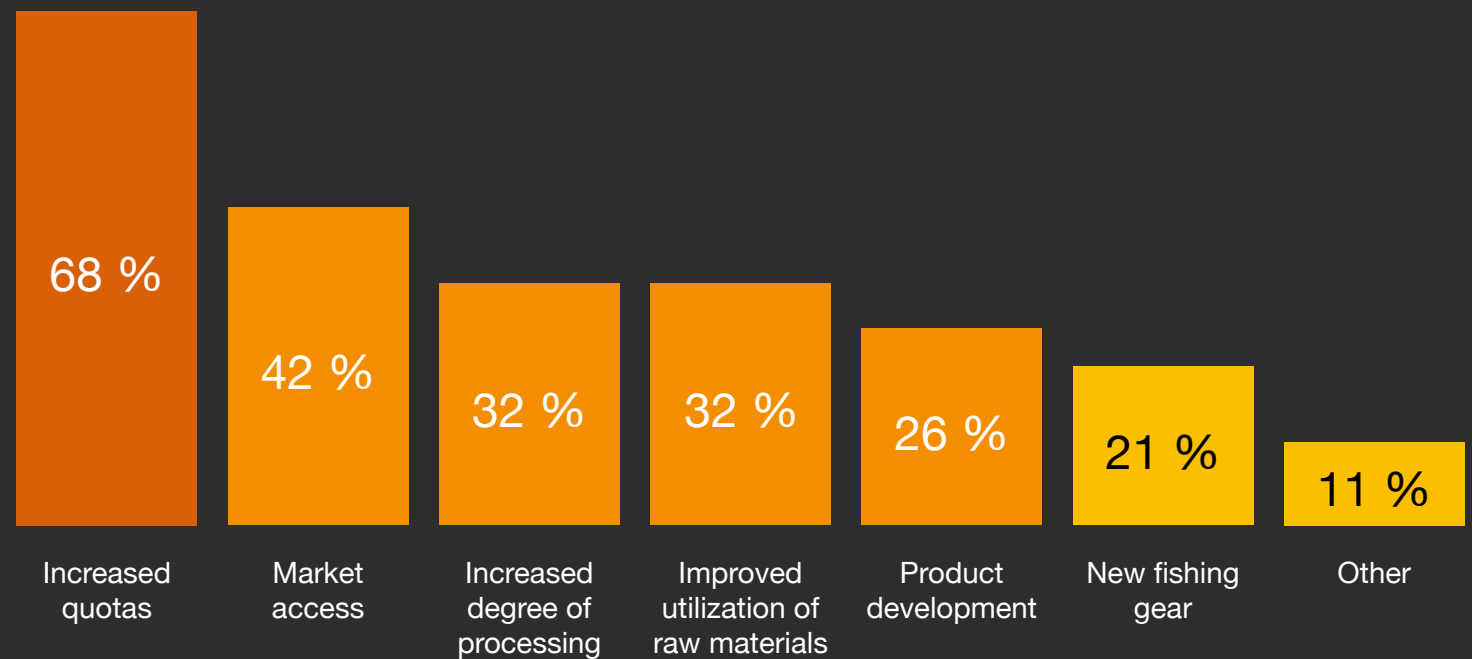
Foto: Petter Lund Wåge

The industry ranks increased quotas and strengthened market access as the most important elements for growth

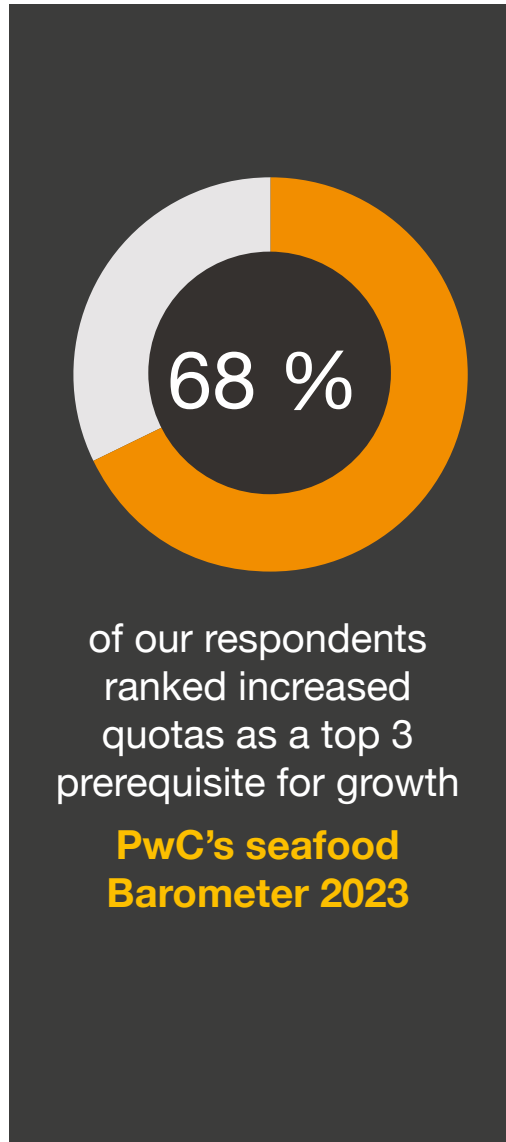
In the following, we will take a closer look at areas related to quotas and market access, and present key findings from our Seafood Barometer 2023. The findings presented are based on our survey responses from fisheries, unless otherwise is stated.

What is most important in order to achieve increased production growth in the next five years?

PwC's seafood Barometer 2023



Increased quotas is considered the most important element for growth, but highly unlikely in the coming years



Is the cod party over?

In line with the advice from ICES, the Joint Norwegian-Russian Fisheries Commission agreed on an additional 20% cut to the total allowable catch (TAC) of northeast Atlantic cod in the Barents Sea for 2023. This brings the TAC to the lowest level in the last decade, at 566,784 metric tonnes.

According to the harvest control rule, which balances long-term stock management with fishermen's need for predictable regulatory conditions, 20% is the maximum possible reduction in the TAC from one year to the next.

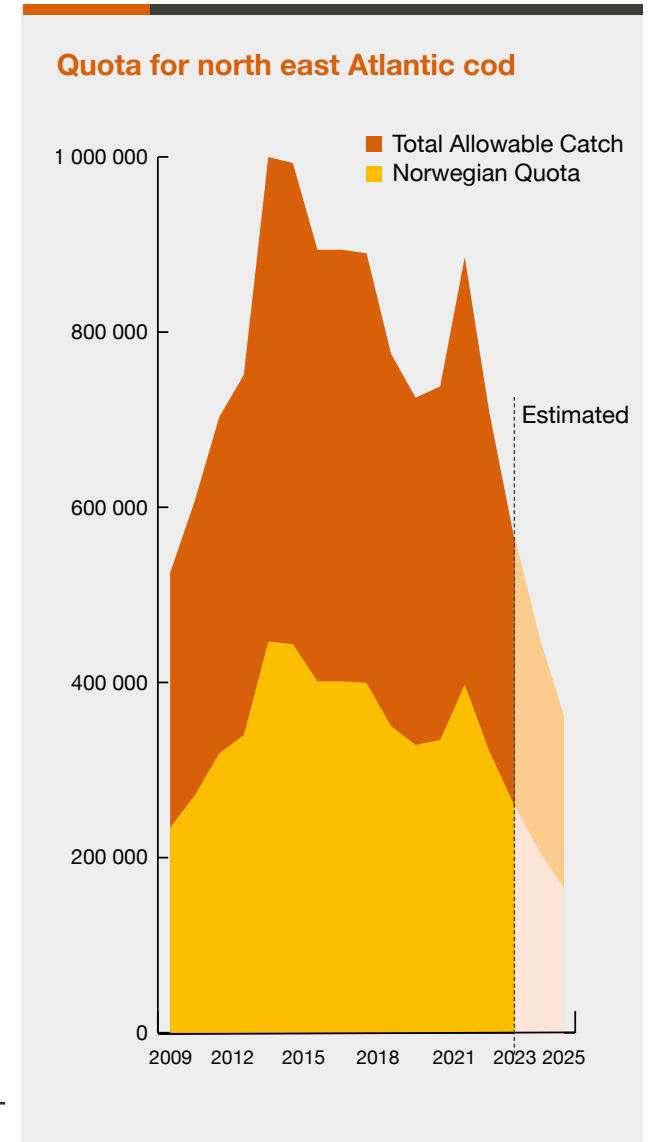
Considering the state of the stock and the current recruitment from spawning, the sector is in anticipation of further reductions of substantial size in the coming years.

If the current trend of 20% annual reductions continue, we will see a TAC under 370,000 tonnes in 2025. According to Nordea¹, growth in demand is slowing, suggesting that reduced volume might not be fully compensated for by increased price. In addition, they expect that the NOK will appreciate going forward, reducing the favourable currency effects for exporters.

In a case of declining quotas, slowing demand growth and adverse macroeconomic conditions, the industry faces a challenging task in sustaining the export value in the coming years.

Ministry of Trade, Industry and Fisheries (2023), Enighet om norsk-russisk fiskeriavtale for 2023, PwC Seafood Barometer 2019, ¹Finn Arne Egeness, Nordea at Ombordfryst 2023

1 Finn Arne Egeness, Nordea at Ombordfryst 2023



Political instability complicates the situation further

A successful collaboration hanging in the balance?

Norway and Russia have collaborated in the Barents Sea for more than 50 years. Joint fisheries management strategies and cooperation on resource control are considered to have had a positive impact on the stock situation in the Barents Sea. In an international context, the collaboration is described as highly successful.

The Russian invasion of Ukraine has challenged the relationship between the two nations. In 2022, Russian scientists were excluded from ICES, putting the annual negotiations at risk. Despite the uncertainty this caused, Norway and Russia were able to reach a fisheries agreement for 2023. However, questions have been raised as to whether Norway should impose further sanctions on Russia.

Further sanctions can cost dearly

Exclusion of Russia from Norwegian harbours and fishing areas has been heavily debated. So far, the Norwegian authorities have been cautious to impose restrictions on Russian fishing vessels activity in Norwegian waters and ports. There is fear that if the collaboration falls apart, it can cause a collapse of the cod stock in the Barents Sea. It is known that the cod stays in the eastern part of the Barents

Sea while growing up, and migrates west to the areas outside Lofoten, Vesterålen and Senja to spawn. As such, there is a better age composition in the cod stocks in the western parts of the Barents Sea. If Russian fishing vessels are to fish their quota exclusively in Russian waters, it could pose a significant threat to recruitment to the cod stock.

Post-Brexit difficulties

Several fish stocks in the North Sea roam between fishing areas in Norway, EU and the United Kingdom. Norway and EU has had a bilateral fisheries agreement since 1978, but after Brexit, the UK is no longer governed by the EU Common Fisheries Policy, presenting the need to renegotiate and establish fisheries agreements between Norway and the UK. In 2020, Norway and UK reached an agreement on fisheries cooperation.

Important issues remain unresolved

Norway and UK has agreed a bilateral fisheries agreement for 2023, including mutual access to each other's waters and exchange of fishing quotas. However, the agreement does not address the important question of zonal access regarding mackerel fisheries. Failure to reach agreement on this issue has "forced" the Norwegian fleet to fish its entire quota early in the season, before it roams into UK waters.

Harvesting the mackerel before it has time to grow large can have detrimental consequences for the stock.

In terms of export value, mackerel is the second most important specie for the Norwegian fishing sector, underpinning the importance and urgency of reaching an agreement on mutual zonal access. Moreover, it is a key factor for continued sustainable management of the mackerel stock in the North Sea.



Foto: Petter Lund Wåge

Ministry of Trade, Industry and Fisheries (2023) Fiskerisamarbeidet med Russland, Fiskerisamarbeidet med EU og Storbritannia, PwC Analysis

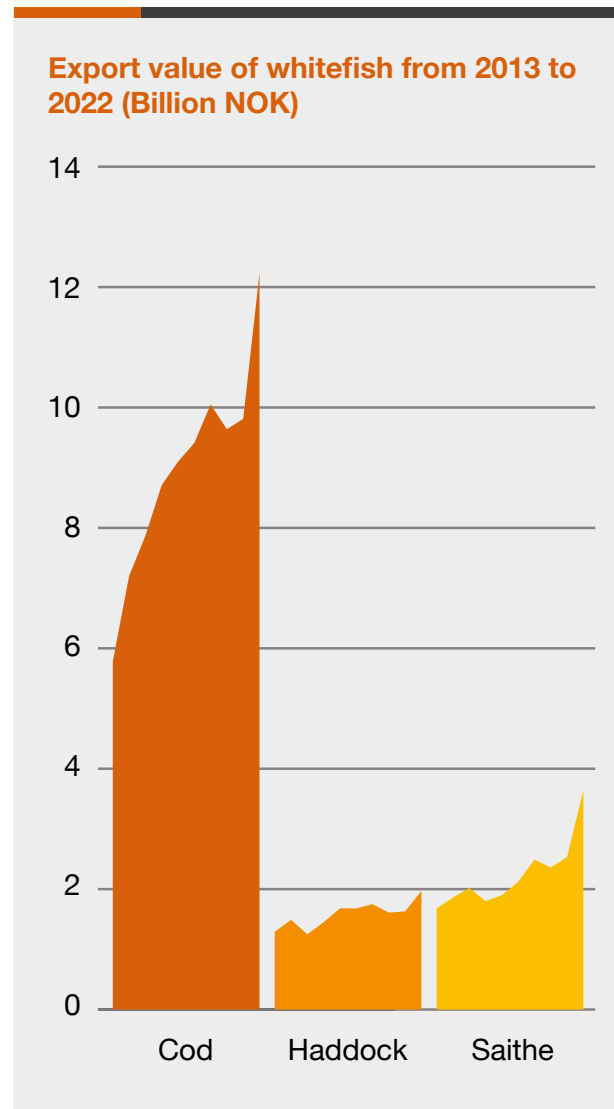
Value growth in recent years is largely driven by inflation and favourable currency effects, rather than increased value creation from the raw material

Cod is still king

In 2022, Norway exported whitefish valued at a total of NOK18.5 billion - an increase of more than 30% compared to 2021, and more than doubled since 2013. We saw value growth in all whitefish species, including cod, saithe, haddock and other. In total, the export volume remains stable compared to 2021.

Cod accounts for approximately two-thirds (NOK12.2 billion) of the total whitefish export. As such, the increased price of cod is a key driver of export value growth. The price increase was first and foremost a result of a 20% cut in cod quotas in 2022, compared to the year before. In combination with sustained global demand, this drove prices to unprecedented levels. In total, we saw a 40% increase in the price of whole frozen cod in 2022. Moreover, the price increase reflects high inflation rates and favourable currency effects, as the NOK depreciated against USD and EUR towards the end of 2022.

Haddock saw a slight volume reduction, but a 21% increase in value compared to 2021. The total value was just short of NOK 2 billion, a new record. In contrast to cod and haddock saithe increased in volume, presumably as a more reasonably priced substitute for cod. 14% volume growth and 44% value growth from 2021 to 2022 resulted in NOK 3.6 billion in export, concluding a solid year for saithe.

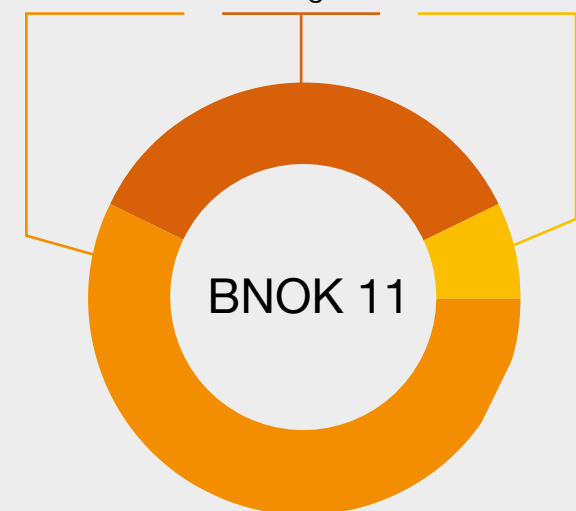


Close, but no cigar for the pelagic sector

The pelagic sector was 20 million NOK short of setting a new export record in 2022. Mackerel and herring accounted for almost 92% of the total export value. However, higher prices for both mackerel and herring do not fully compensate for more than 11% reduction in export volume in the sector.

Pelagic export value 2023

Mackerel 6.3 Herring 3.9 Other 0.8



With decreasing quotas, it will be all the more important to maximise the value of the landed volume

Market access, product development and improved utilization of raw materials are all core elements of market orientation.

Given the lack of volume growth going forward, it is crucial to maximise the value of the landed volume. Market orientation will be a key factor in achieving this, as the industry itself points out.

Old news, but what's new?

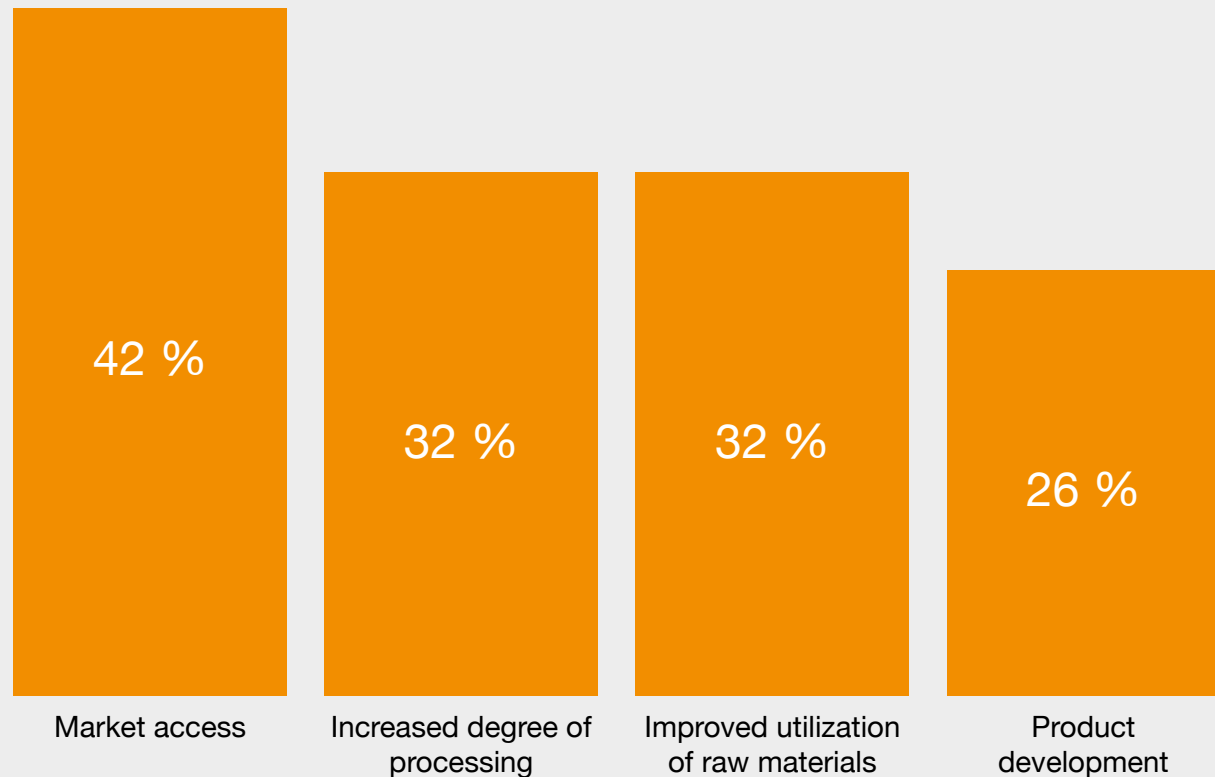
Market orientation as a success factor is nothing new. PwC, has shed light on this topic in previous seafood barometers, but how has this developed over time?

In our seafood barometer from 2019, 83% said that the Norwegian seafood industry must, to a large or very large extent, become more market oriented.

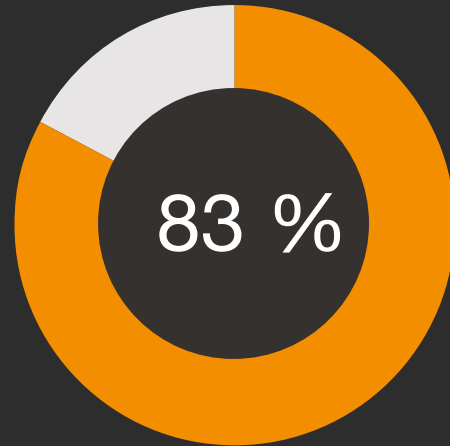
In our survey this year, only 37% of respondents from fisheries say that the industry has succeeded in this. While the development is positive., we emphasise the importance of continuously taking steps to create more value for consumers, strengthening the position of Norwegian seafood further.

Market orientation will be a key success factor

PwC's seafood Barometer 2023

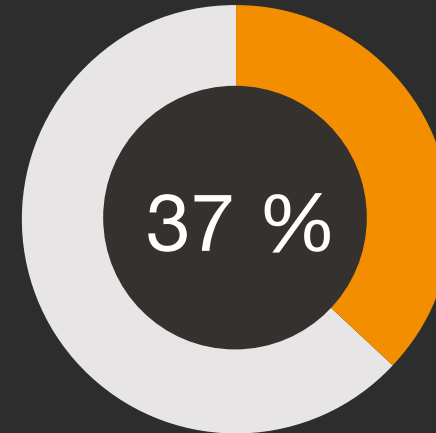


Should the seafood industry become more market orientated? (2019)



of the respondents thought the seafood industry should become more market orientated to a large or very large extent.

Has the seafood industry succeeded in becoming more market orientated? (2023)



of the respondents think the seafood industry have succeeded become more market orientated to a large or very large extent.

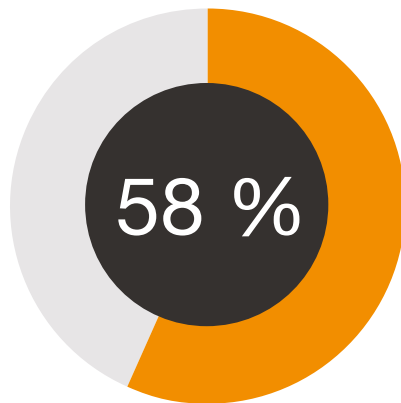
PwC's seafood Barometer 2023

The fishing sector believes it has not fully exploited the profitability potential, despite increasing operating margins in recent years

The profitability in the fishing fleet has increased substantially since the 1980s. Several regulatory changes have contributed heavily to this, for example the closing of coastal fisheries in 1990, and the introduction of the structure quota scheme in 2005.

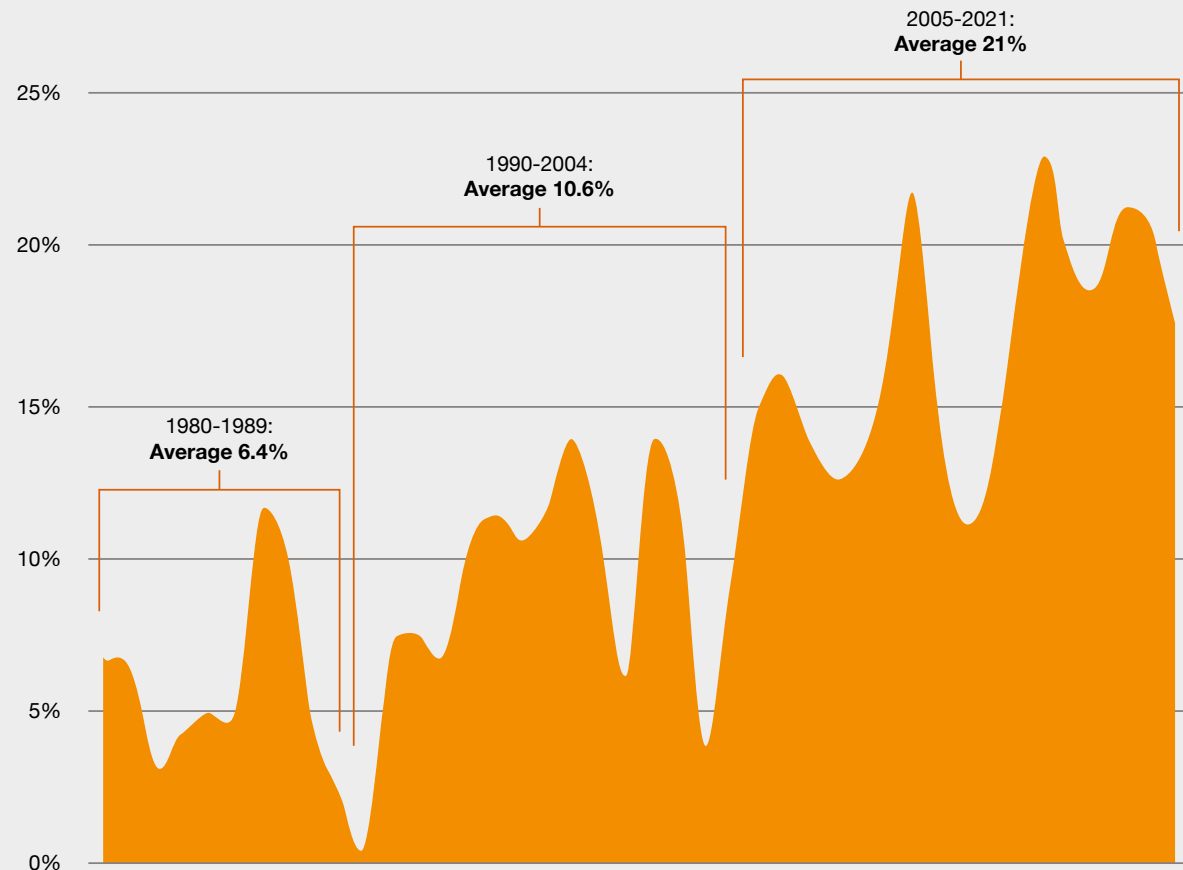
Despite the high operating margins in the fishing fleet, the sector believes that there is still unexploited potential.

To what extent has the profitability potential been exploited?



of respondents say that the profitability potential has become realised to some extent.

Operating margin in the fishing fleet
1980 - 2021



Will the lack of MSC certification pose a challenge for increased value creation?

Previously, Norway had among the highest shares of certified fish landings globally. In the past few years, the share has declined drastically, with reasons described in the next paragraph. While the Norwegian MSC share has experienced a decline, Iceland on the other hand achieved an impressive 98% in 2022, and the average global share of MSC-certified catch was 15% in the same year.

Suspensions are primarily due to external factors

The root causes for the change in the status for these fisheries are

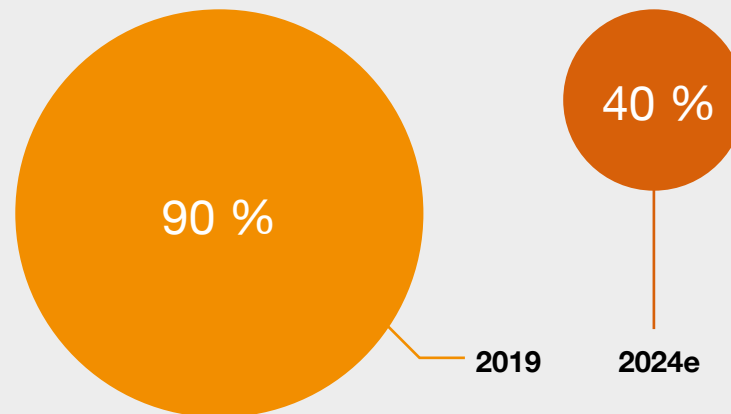
- Lacking coastal state agreements that determine the total allowable catch and distribution of quotas
- Bycatch of coastal cod in the fishing for cod and haddock (inshore) is above MSC threshold values.

The loss of MSC-certificates emphasises the need to continuously strive and improve, as standards are raised and stakeholders' demands increase. We see that international collaboration and better control of the fishing activity and value chain are key success factors in order to regain certification.

Tougher market conditions going forward?

For the pelagic fisheries and fishing for cod in the North Sea, the loss of MSC certification will not impact competition between nations, as this applies to all participants in these fisheries. However, it will be interesting to follow developments in demand and price for cod going forward. Not to mention the potential consequences products which use these raw materials as inputs.

Drastic decline in share of MSC-certified landings % of volume landed in Norway



Since 2019, six Norwegian fisheries have lost their MSC-certification.

Fisheries	MSC-certificate suspended or expired
Mackerel	2. March 2019
Cod in the north sea (south of 62°N)	24. October 2019
Blue whiting	20. December 2020
NVG-herring	30. December 2020
Cod (inshore)	26. April 2021
Haddock (inshore)	26. April 2021



PwC point of view:

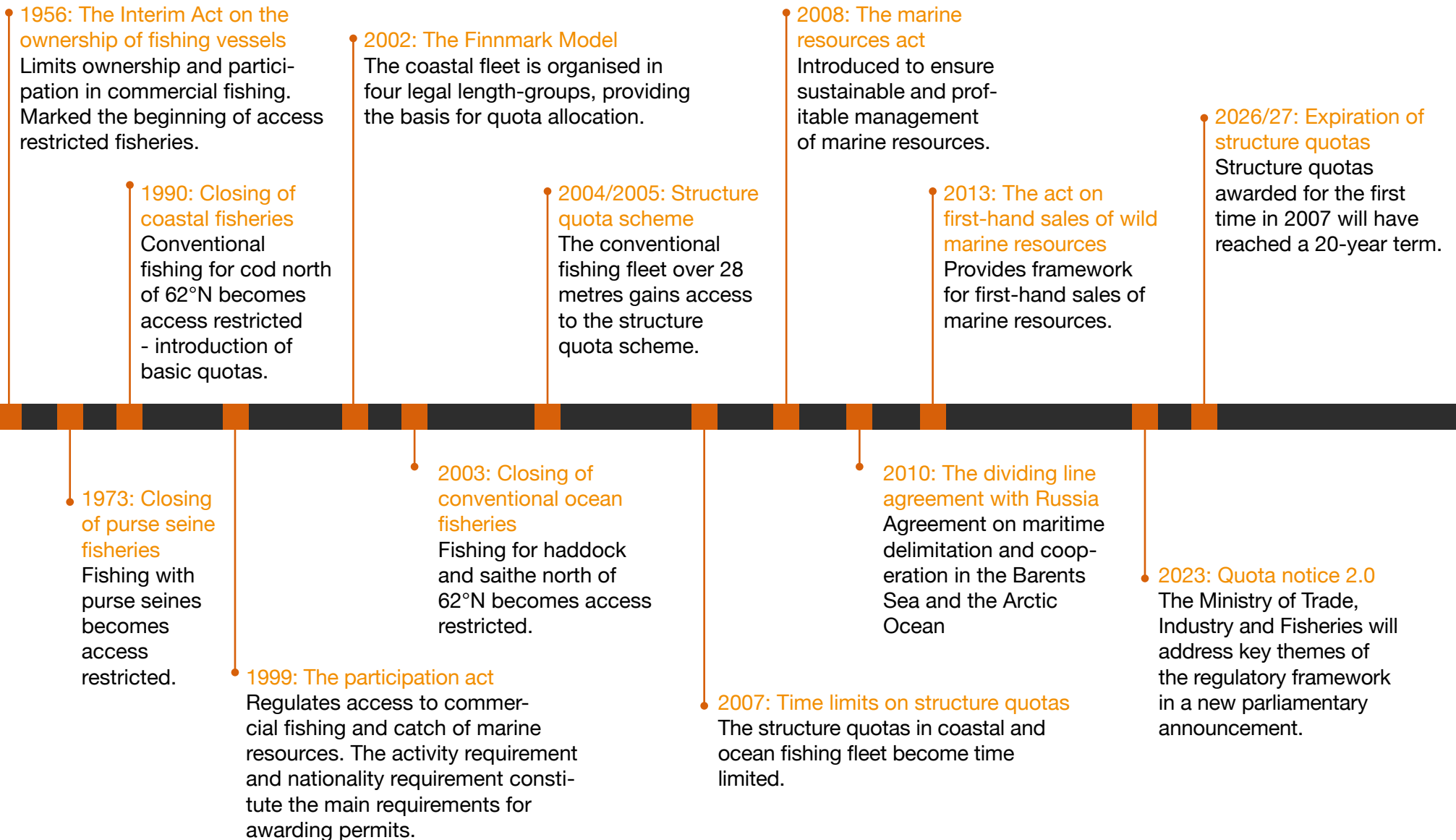
The Norwegian fishing sector has not yet seen any clear and significant market impact from the loss of MSC-certificates. Nonetheless, we expect that sustainability will become an increasingly important premise for both market access and price going forward. Norway should aspire to take a world-leading position in sustainable fisheries management. This will be more demanding in the future. Industry standards such as MSC are getting stricter, and we expect to see other stakeholders introduce new requirements.

Fisheries

Regulatory framework

05

Regulatory timeline - key events

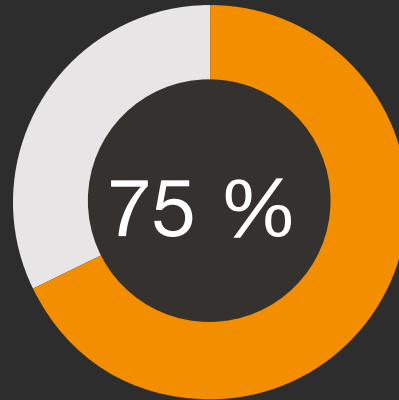


The fishing sector is experiencing great political risk and emphasises lacking predictability and stability

The fishing sector expects to be affected by regulatory changes

Uncertainty associated with the future regulatory environment is presumably a key reason for the increased political risk. In the fishing sector, important questions tied to the fleet structure, structural gains, and quota distribution remain unanswered.

Moreover, the majority of our respondents believe that they will need to adapt to regulatory changes in the next five years. Taxation, quotas, and trade barriers are emphasised as areas in which they anticipate regulatory changes that will affect them the most, as illustrated in the figure on the right.



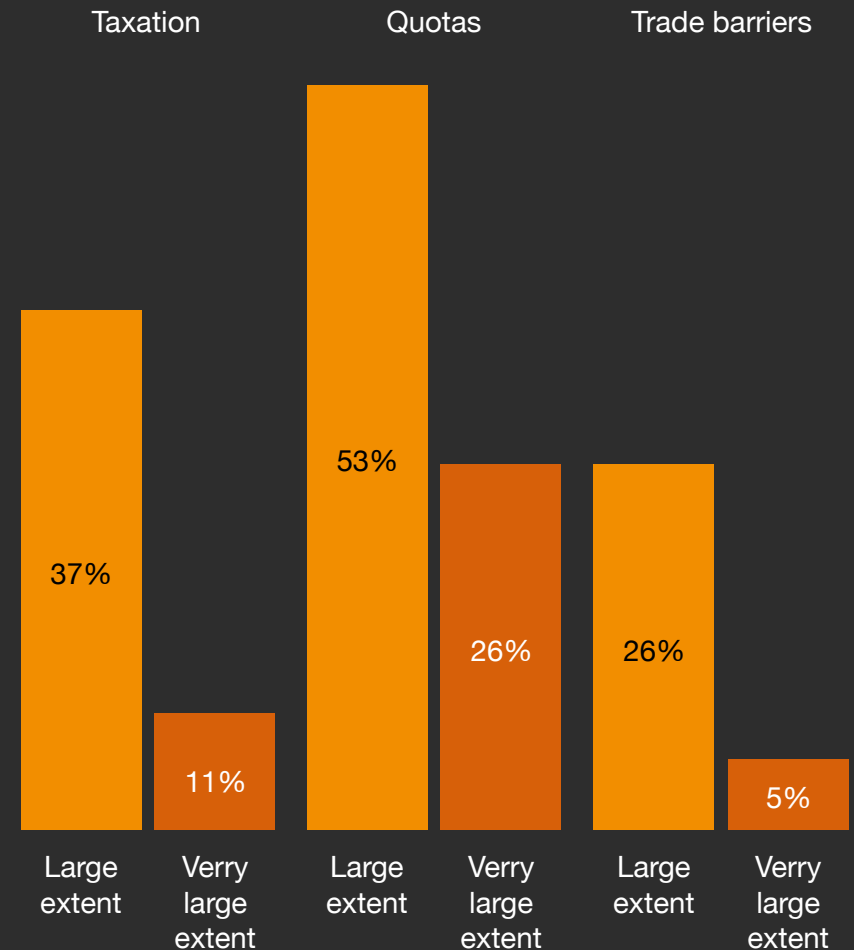
of respondents in the fishing sector experience increased political risk

PwC's seafood Barometer 2023

“There is a complete lack of predictability and stability with regards to political and regulatory conditions”

Industry representative, PwC's seafood survey

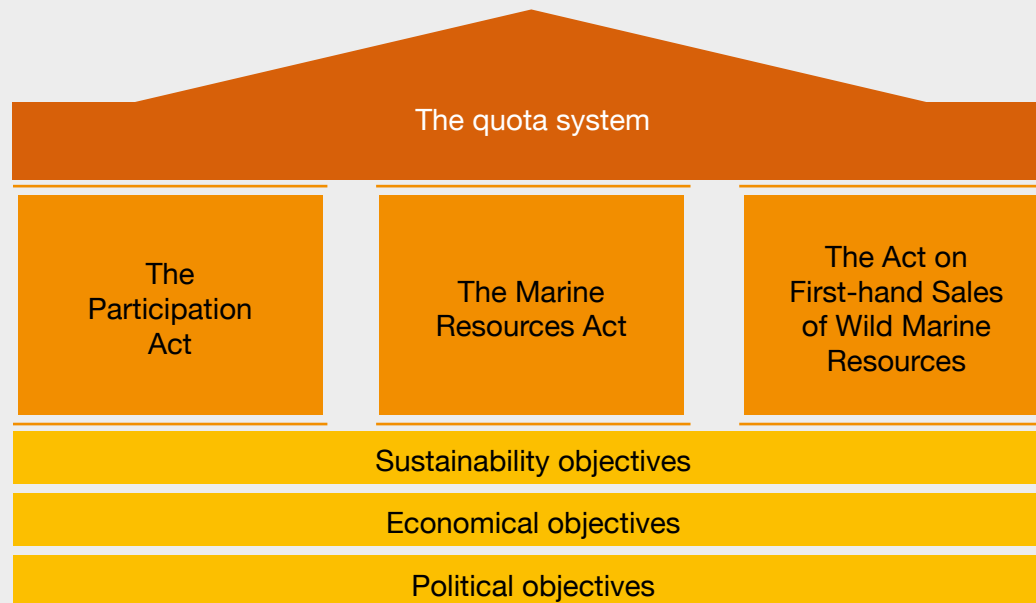
To what extent will your company be affected by changes in the following in the next five years?



Regulation in the fishing sector seeks to balance sustainability, economic, and political considerations

Three pillars of the regulatory framework

In 1977, Norwegian authorities presented a long-term plan for the Norwegian fishing industry. Sustainable resource management was introduced as a political objective, together with preserving coastal settlement patterns and providing competitive employment opportunities. The Participation Act (1999), the Marine Resources Act (2008), and the Act on First-hand Sales of Wild Marine Resources (2013) all serve as important pillars of the legal framework for commercial fishing.



Lovdata (2023) - Participation act, Marine resources act, act on first-hand sales of wild marine resources

The Participation Act's three important purposes

- To adapt the capacity of the fishing fleet to the resource base, ensuring a rational and sustainable utilisation of marine resources;
- To increase profitability and value creation in the industry, thus securing jobs and settlement in coastal regions; and
- To facilitate the harvesting of marine resources which continue to benefit the coastal population.

Marine Resources Act works to benefit the coastal communities

Similarly, the Marine Resources Act's aim is to ensure sustainable and economically profitable management of wild marine resources. Additionally the act aims to protect any associated genetic material and to ensure employment and settlement in coastal communities.

The purpose of the law is to contribute to a sustainable and economically profitable management of wild marine resources by providing a good framework for first-hand sales and by ensuring documentation of resource extraction.

The regulatory framework has a number of mechanisms governing the distribution of quotas

A complex system

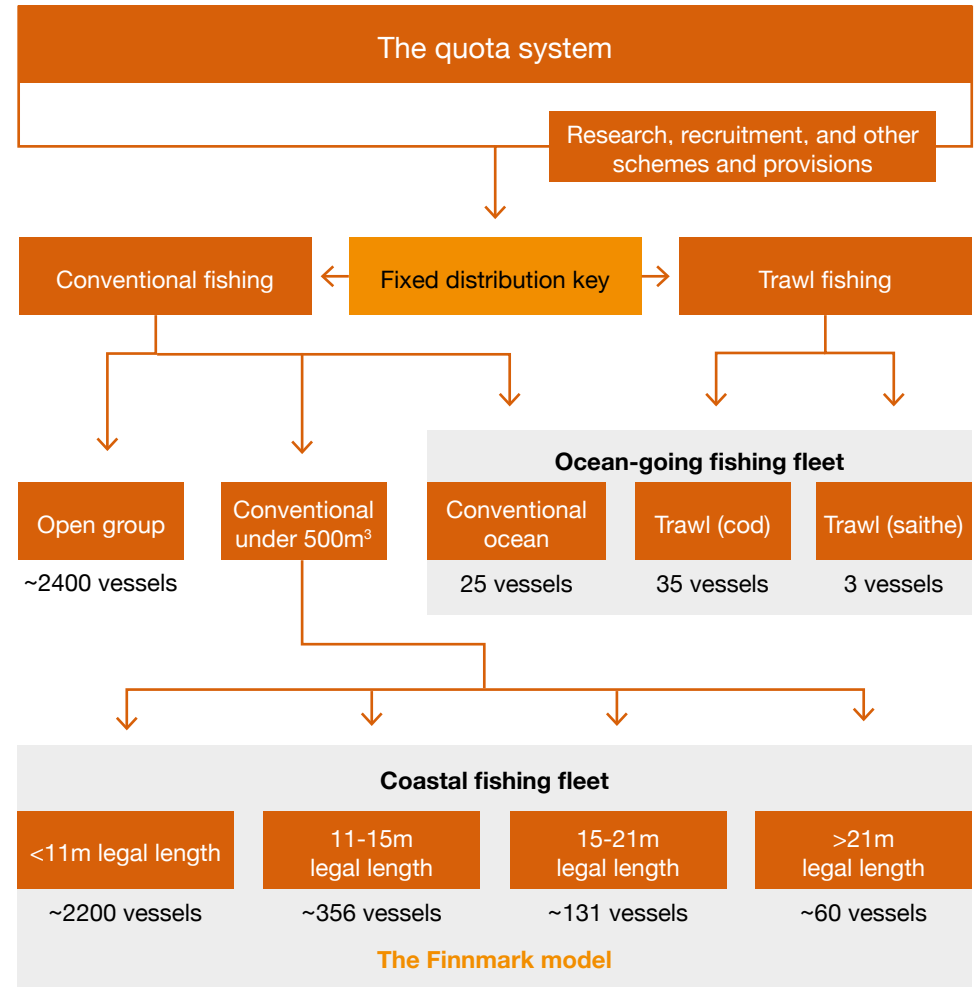
The distribution model for cod quotas in the Barents Sea is illustrated on the left. Over time, the quota system has evolved to become relatively complex. Like the regulatory framework as a whole, the quota system must reflect a balanced consideration of an array of factors. For instance, the quota system seeks to ensure sustainability, efficiency, and profitability for all those engaged in fishing. At the same time, through mechanisms limiting the centralisation of fishing quotas, the system contributes to geographically spread settlement and employment.

Today's quota system has a number of mechanisms to limit developments which are in opposition to stated political objectives. The same mechanisms may pose a barrier for increased efficiency for each individual player and the fishing sector as a whole. Examples of such mechanisms include quota caps - a limitation to the number of quotas permitted per vessel, reductions in quotas obtained through acquisition of other fishing vessels, and geographical limitation on transaction of fishing quotas and vessels. Another mechanism to safeguard political priorities is the group division and size limitations in the coastal fishing fleet, known as the Finnmark model.

The Finnmark model seeks to ensure a differentiated fleet structure

Since 2002, the coastal fishing fleet, consisting of conventional vessels with a maximum hold capacity of 500m³, has been divided in four groups according to overall length. The purpose of this model is:

- to safeguard a differentiated physical fleet structure;
- to shield the small vessels against competition from larger vessels in the annual regulations; and
- structuring and distribution of structural gains within the length groups.



Fiskeridirektoratet (2023), NFD (2022), Fiskarlaget, Norges kystfiskarlag

The “activity requirement” stands firm, and will be safeguarded by key industry players

The activity requirement of the Participation Act states that a commercial fishing permit can only be granted to someone who has engaged in commercial fishing on or with a Norwegian vessel for at least three of the last five years. For a company, a permit can only be granted if persons who meet this requirement hold majority ownership and have corresponding control over the business. The activity requirement has been subject to two key criticisms;

1. Obstructing generational succession; and
2. Limiting growth and investment in the sector.

Does the activity requirement obstruct generational succession?

In family-owned companies, the next generation of owners often does not fulfil the

“It has created, and will in the future create even greater challenges for family-owned companies in the third or fourth generation change”

Industry representative, PwC’s seafood survey

activity requirement. In practice, the activity requirement can also be met from shore, as a managing shipowner. An important aspect of the activity requirement is that the applicant must be close to day-to-day operations, and hold an ownership stake in the vessel. In addition, the Participation Act allows for a time-limited business permit for up to five years in cases of inheritance and generational change, or an unlimited business permit in cases of an undivided estate. This should certainly provide the inheritor(s) with sufficient time to meet the activity requirement.

Does the activity requirement limit growth and investment?

The sector has developed to become increasingly capital intensive, particularly in the larger vessel groups. Investments in new vessels and quotas can be in the hundreds of millions. Active fishermen might not be able to raise the required amount of capital and therefore may seek private investors, who may have interests that are not aligned with stated political objectives. The activity requirement prevents external investors from having majority ownership.

Relaxation of the requirement may increase investments and growth in the sector, but this would oppose the political objective of a fishing fleet owned by the fishermen. As such, we

“There is concern that relaxation of the requirement will lead to a situation where large external players, for example from the aquaculture industry, will acquire too much capacity in the fishing sector”

Industry representative, PwC’s seafood survey

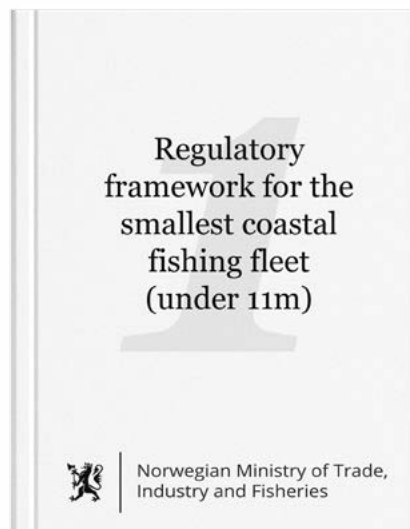
see that the activity requirement balances two conflicting objectives of the Participation Act, a) increasing profitability and value creation in the industry, and b) ensuring that value creation will benefit coastal communities.

The industry wants to safeguard the activity requirement

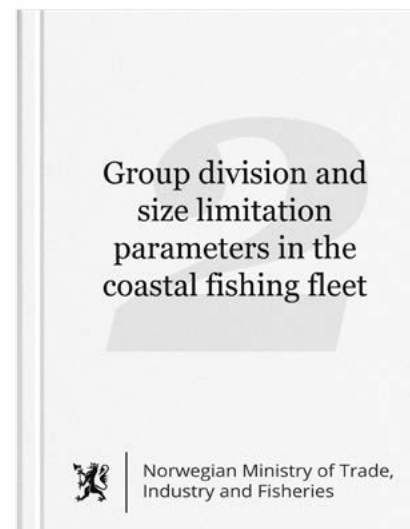
Results from our survey show that 68% of respondents believe that the activity requirement will remain. The largest membership organisation for the ocean-going fishing fleet, Fiskebåt, states that the common attitude in the sector is to safeguard the activity requirement.

The industry is waiting in anticipation of decisions regarding the quota system

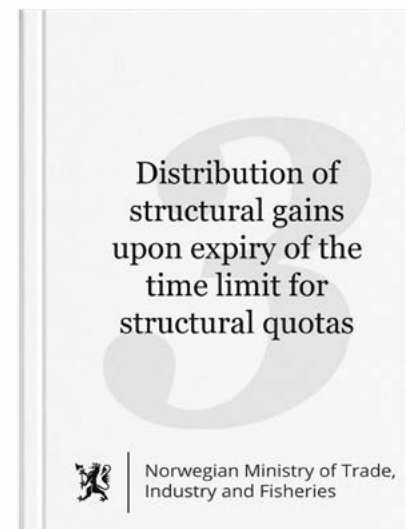
The Ministry of Trade, Industry, and Fisheries posted a parliamentary consultation in 2022, containing four key themes associated with the quota system. The four themes were discussed in four corresponding documents.



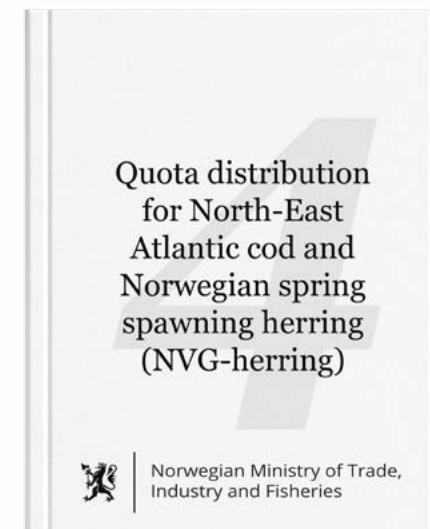
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In the following, we explore and discuss the key questions within each of the themes.

Kilde: Nærings- og fiskeridepartementet, Høringsnotat - Rammebetingelser for den minste kystflåten, Høringsnotat - Gruppeinndeling i kystfiskeflåten og relevante størrelsesbegrensninger, Høringsnotat - Fordeling av strukturgevinst fra utløpt tidsbegrensning i strukturvoteordningen, Høringsnotat - Kvotefordeling for nordøstarktisk torsk og norsk vårgytende sild



What does the future hold for the coastal fleet under 11 metres?

Two main types of quotas in the fishing fleet:

Basic quotas: A vessel's original quota, governing how and how much the vessel can catch. Basic quotas are not time limited.

Structure quotas: An addition to a vessel's basic quota, obtained by acquiring another vessel and transferring the quota to the first vessel. Structure quotas are time limited.

A vessel group of political importance

The smallest vessel group holds a significant portion of the national quota. As such, they generate substantial value throughout the value chain. They also contribute directly to several political objectives, such as providing employment and settlement opportunities in rural areas, ensuring size variation in the fishing fleet, and representing a fleet owned by fishermen. They have also played an important role in the Norwegian coastal and fisheries history. Finally, it is an important arena for recruitment for those who wish to establish themselves with their own vessel.

Two key debates

In the parliamentary notice no. 32 (2018-2019), it was concluded that:

1. vessels below 11m actual length shall not have access to structure quotas

2. access to co-fishing with oneself, i.e. the possibility for owners of two vessels to fish both vessels' quotas on one vessel, shall be discontinued in cod fisheries by 2026.

In the consultation letter regarding the smallest vessel group, these key questions were raised once again.

Access to structure quotas?

Structuring provides a means to increase productivity in the group, through reducing capacity and improving the quota basis for each remaining vessel. This strengthens the economy for each player, increases competition for labour as well as improves safety and working conditions.

It is widely accepted that structuring would have positive effects on productivity, and thus on value creation from catch. The indirect effects on value creation are more difficult to assess. Similarly, fewer and more efficient vessels will have a negative effect on direct employment, although it is difficult to quantify the impact on indirect employment. Theoretically, there is a lack of arguments as to why structuring would lead to geographic concentration.

However, we have seen in other vessel groups that, over time, there tends to be a concentrating effect from structuring. This could have

a ripple effect on the processing industry and supplier industries.

Structuring in the smallest fleet would make the quota system more holistic, and arguably this is a simplification of the system. Political objectives may still be achieved through other mechanisms such as quota caps, reductions and time limitation. However, effects will be difficult to reverse - we have seen in other groups that particularly quota caps are being challenged when some vessels are pushing this limit.

Access to co-fishing with oneself?

The co-fishing scheme was introduced in 2010 as a temporary scheme and enabled an individual vessel to fish all or part of the quota allocated to another vessel. In February 2011, the scheme was extended so that it became possible to "co-fish with oneself". While vessels under 11m are exempted from the structuring scheme, to safeguard political objectives, the scheme has in essence had significant structuring effects. According to the Office of the Auditor General (Riksrevisjonen) (2020), the scheme has led to almost 250 vessels practically being taken out of fishing, as they are not used to land catch. Although the scheme is in theory reversible, it has been in operation for more than 10 years, and many fishermen have made investments and adapted their operating model accordingly.



The industry is content with the current group divisions and size limitations in the coastal fleet

Transition towards larger vessels over time

The second letter in the parliamentary consultation debates whether the current division of the closed group in the coastal fleet (The Finnmark Model) should be adjusted, and thus whether the quotas should be determined on the basis of the legal length of the vessel or other criteria.

The relevance of this is linked to the origin of basic quotas. Whilst it is no longer permitted to transfer quotas between length groups in the coastal fleet, it was originally possible to replace a vessel with a larger vessel, or to split quotas from a smaller vessel to a larger one.

Fishing vessels and their corresponding quotas are now regulated on the basis of the actual length the vessel had at the cut-off date for the change in regulation, i.e. the legal length. As such, vessels belonging in a given length group may in fact have an actual length exceeding the group limit.

Over time, a growing proportion of quotas have been placed on vessels with a greater actual length than the group from which the quota originates. About one in four vessels which obtain their quotas from the smallest group

(under 11 metres) are in fact larger than 11 metres.

Arguably, this complicates the current quota system, where legal length is used as the basis for allocating quotas. Regulation on the basis of legal length has also led to a gradual transition towards larger vessels. While this may enable a more efficient catch of the marine resources, it may also impede the system's ability to address other considerations. Besides, we have also observed a trend of adaptation to the length limitation, known as paragraph vessels. Paragraph vessels push the limits of all other dimensions, but comply with the length limits.

Other parameters have been considered

Height, width, and engine power have been considered as alternative parameters. However, the government believes that length is clear and well incorporated, and has advocated using actual length rather than legal length.

A review of responses to the parliamentary consultation shows that several key players in the industry conclude that length has worked well, in congruence with the government's perspective. In contrast, a large share of the

respondents to the consultation believe that there is no need to replace legal length. Some advocate for actual length, but emphasise that it should not be implemented until the redistribution of structural gains has been completed. The industry has acted on the basis of and aligned itself according to the current regulations. Changing this may introduce unnecessary uncertainty, especially ahead of the expiry of structural quotas and subsequent distribution of structural gains.



Kilde: Nærings- og fiskeridepartementet, Høringsnotat - Gruppeinndeling i kystfiskeflåten og relevante størrelsesbegrensninger



Several players call for reintroduction of dynamic distribution keys

A fixed distribution key presents higher volatility in the volume allocated to each fleet

A key question discussed in the parliamentary consultation was whether the quota should be distributed between groups based on a fixed or a dynamic distribution key.

Since 2021, the distribution key between conventional and trawl fishing has been fixed at 68% and 32%, respectively. Previously, a dynamic distribution key called the trawl ladder was used. The trawl ladder works so that with a decreasing quota, the coastal fleet's share of the total increases. This means, on the other hand, that as the total quota increases, the share of the trawl fleet decreases. The introduction of a fixed distribution key aimed to simplify the quota system. However, several actors have expressed that they did not support the transition to fixed distribution keys and others have advocated reintroducing the trawl ladder.

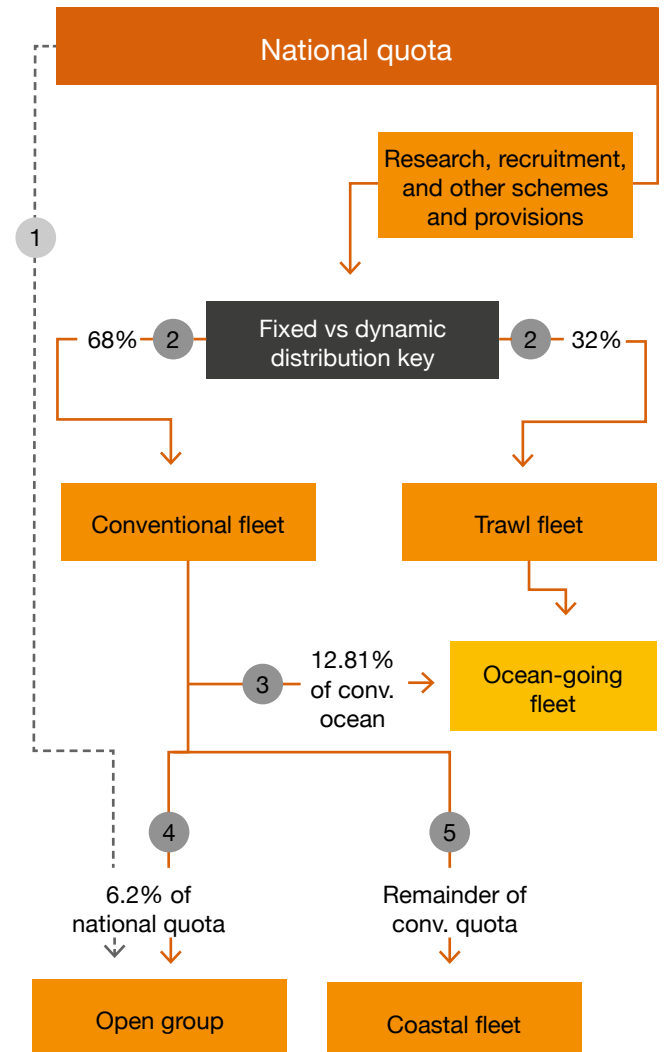
A fixed distribution key provides stability in terms of percentage share, but volatility in the actual volume allocated to each fleet. In contrast, a dynamic distribution key aims to limit the effects associated with large changes in the national quota.

Which vessel groups should contribute towards the quota for the open group?

The second interrelated question is whether the quota for the open group shall be deducted from the national quota or the conventional group.

Since 2021, the open group quota has been calculated based on the national quota, but deducted from the conventional fleet quota, after the quota for conventional ocean-going vessels has been allocated. Finally, the coastal fleet gets allocated the remaining of the conventional fleet quota. Combined with a fixed distribution key, this has adverse impacts on the coastal fleet, particularly in times of declining quotas. As such, the existing model undeniably challenges established political objectives.

Given a fixed distribution key, deducting the open group quota from the national quota will reduce the quota for conventional ocean-going vessels and the trawl fleet, and increase the quota for the coastal fleet. The effect can be managed by altering the percentages of the fixed distribution key.



Kilde: Nærings- og fiskeridepartementet, Høringsnotat - Kvotefordeling for nordøstarktisk torsk og norsk vårgytende sild



The fishing fleet has undergone significant structural changes to increase efficiency and profitability

Adapting capacity to the resource base

The term structuring refers to the transfer of one or more vessels' quotas to one and the same vessel. Structure quotas are thus an addition to the basic quota that the vessel has obtained through making use of the structure quota scheme.

Structure quota schemes are special quota arrangements that make it possible for a vessel's total quota to be increased through the allocation of structural quotas. It is a prerequisite that another vessel (the ceding vessel) is taken out of fishing and gives up its quota basis. Currently, all vessel groups in the quota system, except the group under 11m have access to the structure quota scheme. Structuring is not a goal in itself, but a tool for adapting the capacity of the fishing fleet to the resource base, so that the sector will be socially and economically profitable.

The fishing fleet has undergone vast structural changes

The structure quota scheme has proven to be a highly attractive means for players to increase their total quota, increasing the efficiency and profitability of the fishing fleet. In the past

decades, the Norwegian fishing fleet has undergone considerable structural changes. The number of vessels has fallen drastically in most fisheries in the period 2004-2018.

Structuring shall benefit the entire fleet a

Players who have opted out of exploiting the structure quota scheme have also benefited from the structuring process. It has been a political objective that the structuring process shall benefit all the remaining vessels in the fleet in the form of an increase in each vessel's quota. This is referred to as structural gain, and has been achieved through three mechanisms in the structure quota scheme.

1. **Structural gain from reductions:** In some vessel groups, a reduction has been made to the ceding vessel's quota, before it is allocated as a structure quota for the overtaking vessel. The reduction has immediately been distributed to the remaining vessels in the group (incl. the overtaking vessel)
2. **Structural gain from withdrawn/expired licenses:** For vessel groups without access to structure schemes, licenses have

nevertheless been withdrawn as a result of condemnation, or for other reasons. These have been redistributed to the remaining vessels in the respective group.

3. **Structural gain from expired time limits on structure quotas:** In 2007, the structural quotas in the coastal and ocean-going fishing fleet were given a time limit of 20 years for structure quotas allocated in 2007 or later, and 25 years for structure quotas allocated for the first time before 2007. No structural quotas have expired yet, but many are approaching expiry. These quotas are to be redistributed, but how that will happen remains to be determined.

Kilde: Nærings- og fiskeridepartementet, Høringsnotat - Fordeling av strukturgevinst fra utløpt tidsbegrensning i strukturkvoteordningen, Riksrevisjonen (2020) Undersøkelse av kvotesystemet i kyst- og havfisket

The fishing fleet has undergone significant structural changes to increase efficiency and profitability

Estimated value of structure quotas¹: **NOK 50 billion**

No structural quotas have so far expired, but many are approaching expiry. Prompt clarification of how the structural gain is to be distributed is therefore necessary to safeguard the industry's need for stable conditions, and to support other political objectives.

In the parliamentary consultation documents, the total value of all the Norwegian quotas in the closed fisheries are estimated to be worth NOK 120 billion. Around 40% of the quotas are structure quotas, valued at around NOK 50 billion. Hence, it remains uncertain how structure quotas valued at NOK 50 billion will be redistributed in the period 2027-2041. The largest values are to be redistributed in 2027 and 2032.

Uncertainty regarding distribution of around half of the fishing quotas

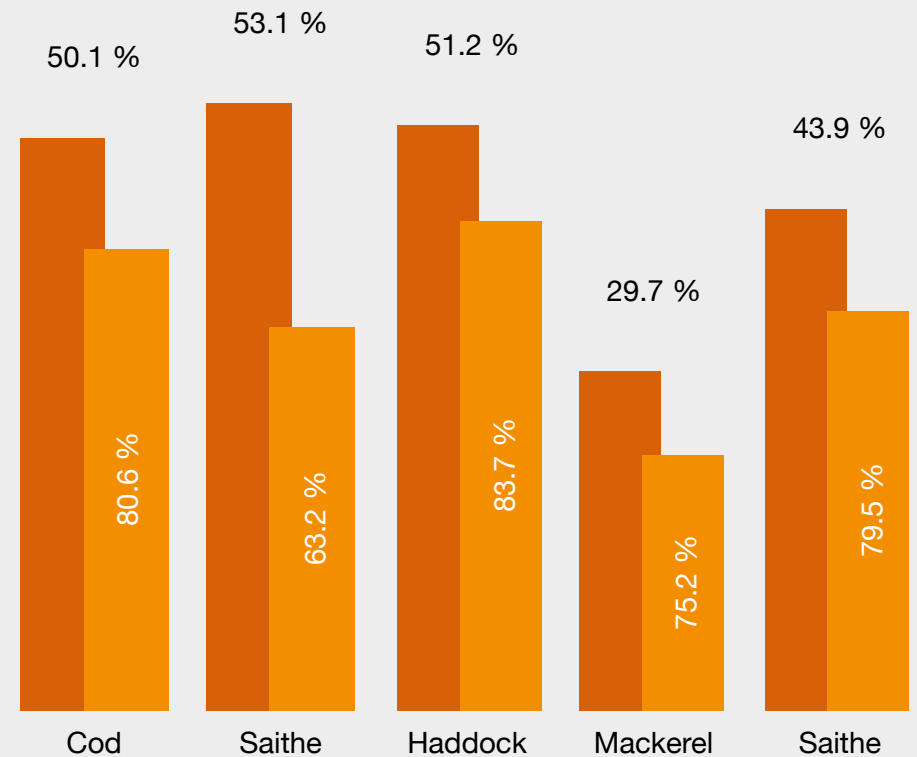
The illustration on the right shows the current situation with respect to structure quotas in the five most commercially important species.

For the time being, the number of structural quota factors to be redistributed in the period 2026 to 2041 is known, given the current regulations.

It is less than four years until the first time limits expire and structural gains are to be distributed. There is still time for structural changes in the fishing fleet. This would impact the future distribution of structural gains by influencing precisely how many basic quotas are left for structural gains to be distributed to.

Degree of structuring and expiration of structure quotas

- Share of total on structure quotas
- Share of structure quotas expiring in 2026-2032



1 Nærings- og fiskeridepartementet, Høringsnotat - Fordeling av strukturgjavnst fra utløpt tidsbegrensning i strukturkvoteordningen

There is partial agreement on distribution principles among stakeholders, but several models are still relevant

The ministry presented three models for distribution of structural gains

In the parliamentary consultation documents, three alternative models for distribution of structural gains are presented.

1. Distribution according to basic quotas, to new groups (actual length)
2. Distribution according to basic quotas, to the current groups.
3. Distribution according to both basic quotas and structure quotas, to the current groups.

After the consultation, it is apparent that the industry agrees that structural gains from expired structure quotas must be distributed to the current groups. From around 50 consultation responses, 24 has explicitly presented a view on the choice of model. Among these, none advocate for model 1. Six recommend distribution according to model 3, while 18 advocate for model 2.

A hybrid alternative has been presented

The Norwegian Fishermen's Association has proposed a hybrid model. The ministry has taken this into consideration and presented an alternative model based on this proposal. The alternative was posted to consultation in december 2022.

The hybrid model, referred to as Model X, combines model 2 and model 3. In this model, structural gains is distributed according to both basic quotas and structure quotas, but with a double effect on basic quotas. Essentially, if there are 10 structure quota factors to be redistributed in a given year, 2/3 shall be distributed according to basic quotas, while 1/3 shall be distributed according to structure quotas.

The industry is in anticipation of a final decision, which is expected at some point during 2023.



Kilde: Nærings- og fiskeridepartementet, Høringsnotat - Fordeling av strukturgevinst fra utløpt tidsbegrensning i strukturkvoteordningen

Is the fishing sector facing a new tax regime?

Respondents expect to be affected by changes in taxation

PwC's seafood Barometer 2023



Of our respondents say that changes in taxation will affect their company to a large or very large extent in the next five years.

The sudden introduction of ground rent taxation in the aquaculture industry had a substantial impact on experienced political risk, also in the fishing sector. Not only due to concern that ground rent taxation may also be applied in the fishing sector, but also due to the abruptness of the process and the profound consequences observed in the aquaculture industry.

Ground rent tax for fisheries has been discussed in several Norwegian Official Reports, most recently by the committee, led by professor Ragnar Torvik. Here they propose that ground rent taxation should be introduced in the fisheries.

Do you experience increased political risk in fisheries?

PwC's seafood Barometer 2023: Percentage of yes

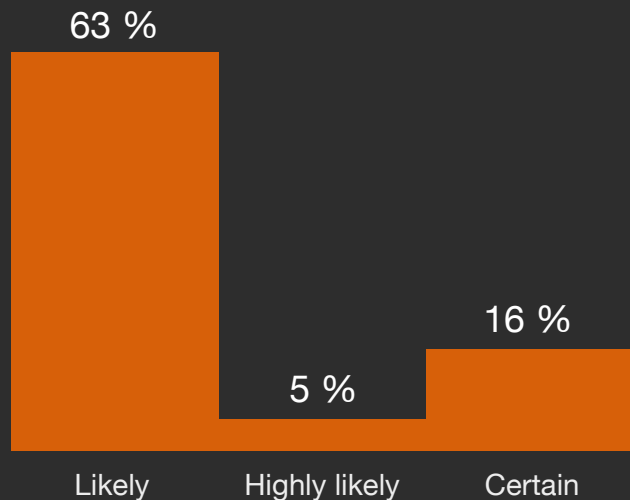


Before: 75 %

Ground rent taxation announcement
28 September 2022

After: 88 %

The majority is likely to invest in technology in the next five years



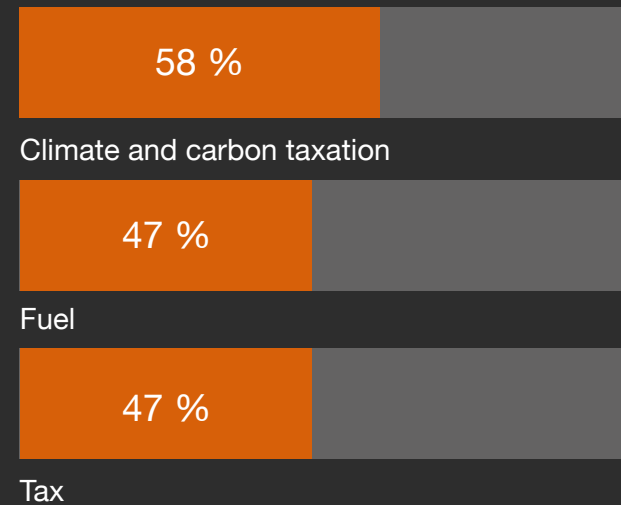
The vast majority of respondents find it likely that their company will make significant **investments in new technology** in the next five years.

The industry believes that Norwegian policies are reducing competitiveness



4 in 5 respondents in the fishing sector believe that Norwegian policies are reducing competitiveness

Certain costs are expected to increase significantly in the next five years



The fishing sector is particularly concerned about, and expects a **significant increase in costs** associated with energy consumption and carbon emissions.

In the fishing fleet, investments in new technology is generally associated with modernisation of existing vessels or building new ones.

Climate and carbon taxation, fuel and energy are primarily driven by the fishing vessels' propulsion system and energy source, and other technologies onboard. This will be an increasingly important factor to consider in relation to renewal of the fishing fleet going forward.

The fishing fleet continues the transition toward green energy sources, but energy efficiency has not been sufficiently prioritised

Large vessels account for the majority of CO₂ emissions in the fishing fleet

Vessels over 28m account for only 5% of the total number of vessels in the Norwegian fishing fleet, but a large share of the CO₂ emissions. While the number fishing vessels has decreased drastically in the last decades, the total engine power (ability to consume fuel) has increased. This underpins the need to transition into alternative energy sources.

Energy efficiency is not sufficiently prioritised

Replacing old vessels with new ones may provide significant benefits in terms of energy efficiency. Energy efficiency is an important element when designing new fishing vessels. Modern ship designs are estimated to be roughly 20% more efficient than older designs. Moreover, nearly all new vessels are installing a selective catalytic reduction system which reduces NOx pollution by using urea. Still, emissions from the fishing fleet has increased continuously since 2014. It does not seem that energy efficiency has been prioritised sufficiently, and the potential for energy efficiency presented by new technologies has not been fully exploited.

Two in five new-builds make use of alternative energy sources

In our assessment of the ocean-going fishing fleet, we find that in total, 42 new-builds over 28m have been completed since 2018. From these, 17 vessels (40%) installed propulsion systems utilising alternative energy sources. The most common solution was hybrid solutions combining diesel and electricity, but most recently some vessels have also made use of LNG.



Kilde: Fiskeridirektoratet - Fartøyregisteret, Zerokyst (2022) Kartlegging av utslipp fra fiskeri og havbruk i Norge, Miljødirektoratet (2020) Klimakur 2030

While CO₂-reduction is incentivised, fossil fuels are still highly relevant

Funding for emission reduction projects

The Norwegian authorities have established the Enova fund, to support development and adoption of novel technologies which can reduce emissions of CO₂ and NOx. The fishing fleet can apply for funds from Enova for a variety of new technologies, such as installations of battery packs, onshore power supply, and preliminary projects on innovative technologies for the maritime sector.

The Norwegian Coastal Administration has a similar support scheme for investment in efficient and environmentally friendly ports. The maximum amount of support is 80% of the eligible costs and support per project is limited to NOK 50 million.

In addition, players in the fishing fleet can become a member of the NOx fund. All vessels must pay a tax per kg of NOx-emissions, but members of the NOx-fund pay a significantly lower rate. Moreover, the NOx fund processes applications from member organizations for measures to reduce NOx emissions.

Substantial support for new-builds in the fishing sector

These support schemes present an incentive for renewal of the fishing fleet and transition to alternative energy sources. Many players have made

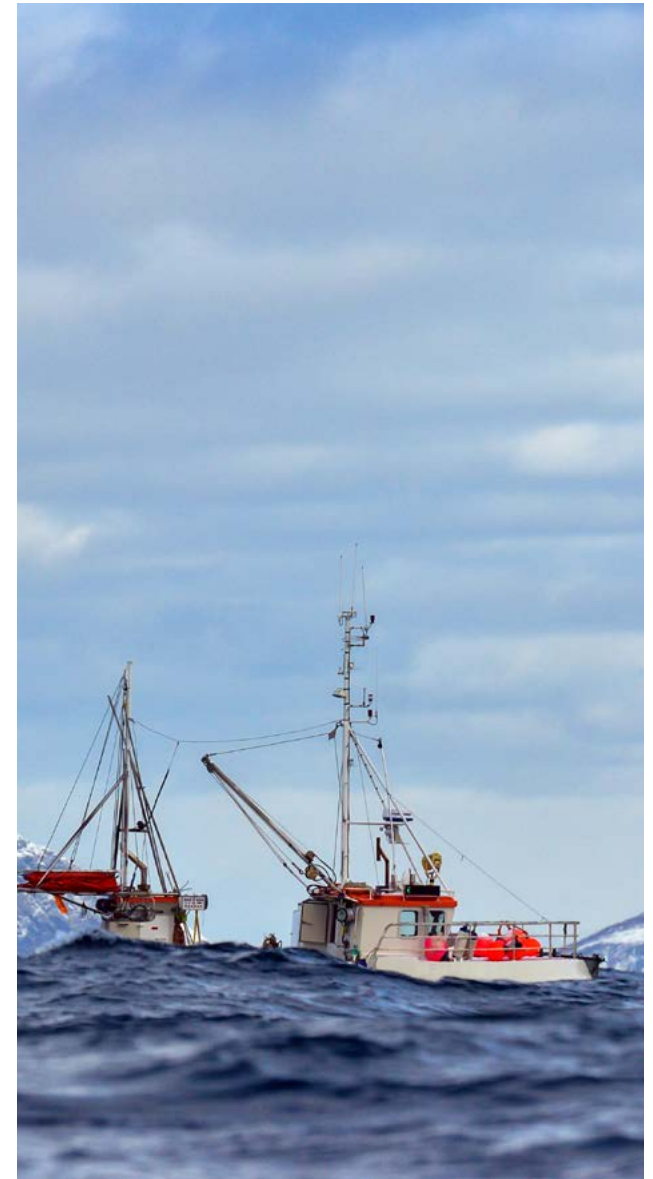
use of this in recent years. Examples of beneficiaries from the scheme include the vessels “Talbor” (NOK 31.6 million) and “Leinebris” (NOK 28.5 million) which have received funds for the installation of battery packs.

Another example is the new-build “Libas”, which has received funds from both Enova and the NOx fund. The vessel is the first fishing vessel running on LNG. In addition, it houses environmentally friendly technology, a large battery pack and an electricity-producing stabiliser tank. “Libas” will produce electricity itself when it rolls on the waves. Most recently, other vessels have been or are being built with similar technology.

Diesel is still relevant

Despite incentives and financial support, not all new-builds implement use of alternative energy sources. The Halstensen Group recently launched plans for the new-build “Gardar” with diesel propulsion.

“We are reliant on diesel engines, and they are constantly getting better in terms of effect and emissions” said Inge Halstensen. He estimates a 50% reduction in emissions and fuel consumption, due to the nearly double capacity of the new vessel, compared to its predecessor.



Kilde: Enova (2023), The Norwegian Coastal Administration (2023), Marsteinen (2022), Fiskeribladet (2022)

A number of energy options are plausible solutions for the future fishing fleet



Battery

Pros: Quieter operation, lower fuel cost, improved energy efficiency

Cons: Limited range, higher upfront cost, dependency on electricity, battery performance in marine environment



Biogas

Pros: Increased energy security, lower fuel cost, increased energy security, lower costs

Cons: Limited availability, lower energy density, refueling infrastructure, technical challenges



LNG

Pros: Improved energy efficiency, availability, lower fuel costs

Cons: Upfront costs, refueling infrastructure, storage and handling, limited supply chain



Hydrogen

Pros: Improved energy efficiency, longer range, refueling infrastructure

Cons: Higher upfront costs, limited hydrogen production, hydrogen storage, safety concerns



Biodiesel

Pros: Increased energy security, lower fuel costs











Cons: Limited availability, quality and stability, refueling infrastructure, technical challenges



Ammonia

Pros: Higher energy density than hydrogen, known technology,

Cons: Higher emission of NO_x and N₂O than diesel and petrol, lower energy density than diesel and petrol and thus require larger tanks to complete one trip

												
	Suitability	Effect	Suitability	Effect	Suitability	Effect	Suitability	Effect	Suitability	Effect	Suitability	Effect
 Trawl for groundfish	Green	Green	Red	Green	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Yellow
 Pelagic trawling and seine fishing	Green	Green	Red	Green	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Yellow
 Conventional ocean fishing	Green	Green	Red	Green	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Yellow
 Coastal fishing	Green	Green	Yellow	Green	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Yellow

Source: Regjeringen: Klimatiltak og virkemiddel i fiskeflåten

The Norwegian fishing fleet is subject to substantially higher CO₂-taxation than other fisheries nations

Ambitious goals for CO₂-reduction

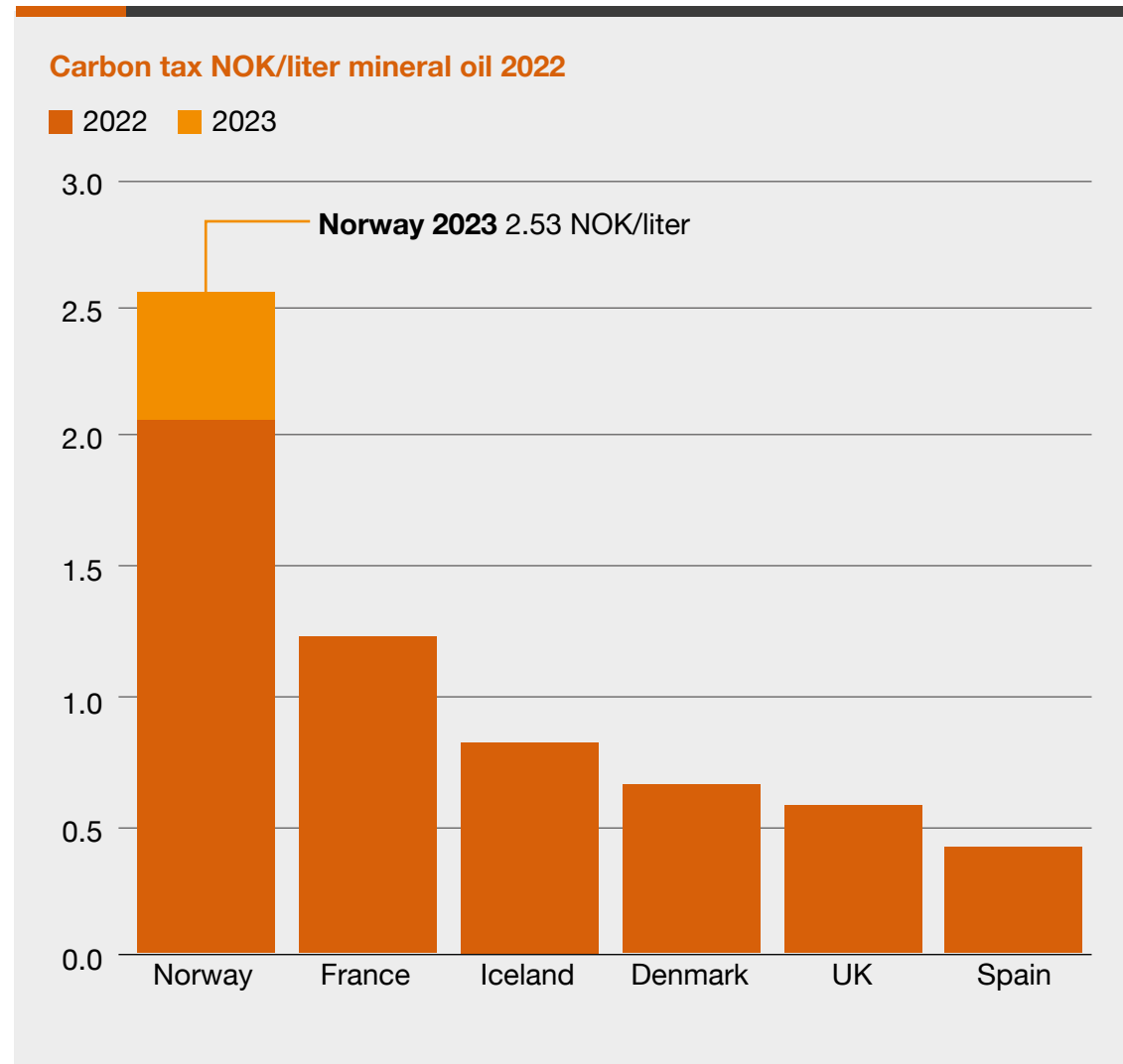
Norway has committed to substantial CO₂ reduction through ratification of the Paris Agreement (2016). Specifically, Norway has committed to minimum 50% reduction in emissions compared to 1990, by 2030. The government's main instrument for emission reductions in the fishing sector is the CO₂ (carbon) tax on mineral oil.

A heavy burden on the fishing fleet

In 2022, the carbon tax rate was NOK 2.05 per litre of mineral oil. From 2023, the carbon tax increased to NOK 2.53 per litre, and it will continue to increase in the years to come. With an average price of around NOK 5 per litre of mineral oil in recent years, the carbon tax presents an additional cost of almost 50%. It is becoming a heavy burden and may represent a source of comparative disadvantage for the fishing fleet.

Norway has a significantly higher carbon tax than other fishing nations

Carbon tax in itself has been implemented across many European countries. However, Norway has the 4th highest rate in Europe, only behind Sweden, Switzerland and Liechtenstein. If we compare the carbon tax to other coastal states, we see that the fleets in France, Iceland and Denmark have a significantly lower tax burden. UK and Spain have some of the lowest carbon tax rates.



Kilde: FHF (2021) Klimaveikart for norsk fiskeflåte: En oppdatering av rapporten fra 2017, Zerokyst (2022) Kartlegging av utslipp fra fiskeri og havbruk i Norge

The carbon tax scheme is not efficiently designed to achieve CO₂ reductions in the fishing sector

Regional differences may cause CO₂-leakages and skew competition

We have seen that there are great variations between the carbon tax rates between coastal states. There is significant incentive to refuel outside the Norwegian tax zone to avoid the carbon tax. For large vessels with fuel tanks of several hundred thousand litres, it is economically justifiable to undertake very long transports in order to bunker in a country where the CO₂ tax is avoided. In effect, actual emissions may increase, thereby defeating the purpose of the tax scheme. Moreover, regional differences can skew competition in favour of vessels that have access to fuel outside Norway versus vessels that do not.

The unintended consequences discussed above will in turn have ripple effects in the shape of economic losses along the Norwegian coast. Turnover for suppliers of bunker oil will fall, as ocean going vessels refuel outside the Norwegian tax zone. To limit steaming distances and time spent at shore, other economic activities may also be moved. Examples of such activities include, but are not necessarily limited to, landing of fish, provisioning, repairs and maintenance of vessels.

The compensation scheme is insufficient

Today the Norwegian fishing fleet can apply for a carbon compensation scheme, through which a portion of the carbon tax is reimbursed. In 2020, when the compensation scheme was introduced, NOK 255 million was set aside for compensation. This was increased by 36%, to 346.8 million in 2023. In comparison, the CO₂ tax has increased by 60% from 2020 to 2023 and will continue to increase.

Compensation is based on the vessel's catch turnover from nearby waters, and calculated as the vessels share of turnover in its respective vessel group. The purpose is to incentivise energy-efficient fisheries. The use of revenue as the basis for reimbursement, rather than actual fuel consumption is meant to stimulate towards more energy-efficient fisheries. However, it is argued that this might favour larger vessels due to their higher revenue per vessel. The refund is paid annually in arrears, adding extra liquidity pressure on the fishing fleet.



Kilde: FHF (2021) Klimaveikart for norsk fiskeflåte: En oppdatering av rapporten fra 2017

PwC point of view:

Fisheries present part of the solution to the global food crisis, but effective and sustainable fisheries are a key success factor. However, recent developments in fisheries are not particularly cheerful. Globally, the degree of overfishing is not under control. At the same time, we see that geopolitical unrest disrupts sustainable fisheries management.

The Norwegian fishing sector is on hold with regards to future regulations. Uncertainty around future business conditions complicates decision-making, particularly with regards to long-term investments, such as renewal of the fleet. In turn, this slows down the green transition in the fishing fleet, and thus our progress towards the goals of the Paris agreement.

Market orientation will be increasingly important to sustain or increase export value in times of lower quotas, as we anticipate in the coming years. The fishing sector is positive that there is still untapped growth potential. We consider the most important aspect for the sector is stable, long-term conditions.



Sustainability

Aquaculture and fisheries

06

Focus on sustainability is growing and is becoming more integrated in day to day operations

Deep dive into selected sustainability topics

Sustainability is pervasive throughout this report and a foundation for continuous growth. On the next pages, we examine how the industry assesses climate changes as risks and opportunities and how the industry expects to be affected by the implementation of the EU taxonomy.

The industry views sustainability as one of the main drivers for demand for seafood

We are witnessing a change in the industry with an increased focus towards more sustainable production. The need to act on climate change has given a sharpened focus from banks, investors and the government on the subject. Also, the global market is shifting its focus and changing its priorities. The industry is working increasingly towards prioritizing sustainability in business decisions.

Maturity on sustainability

With sustainability as a clear driver, it should be natural that the industry is actively seeking to improve and make sustainability a clear factor in decision-making. What we are observing is that the gap between those companies that are working actively with sustainability at every level and those that only have established ambitions is growing.

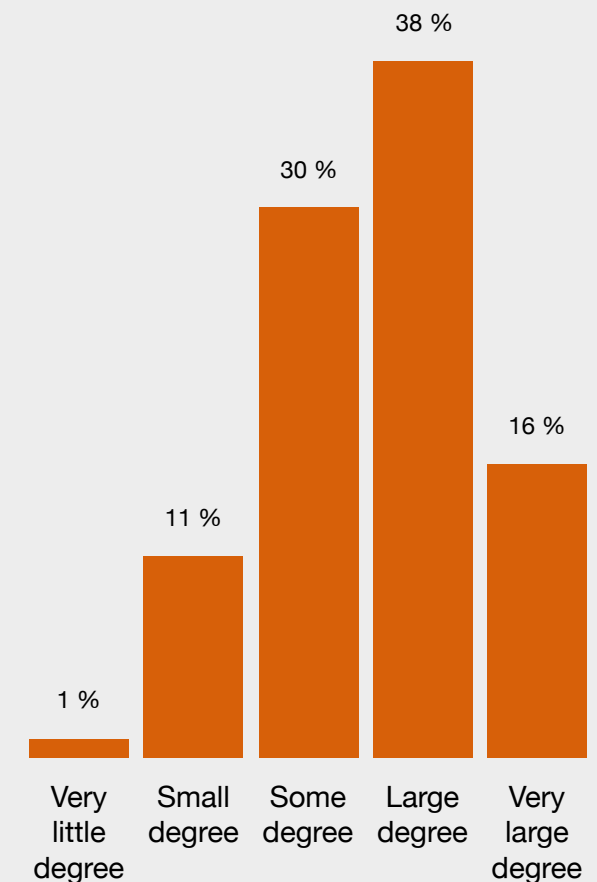
This leads to the question; will the companies that actively evolve on sustainability gain a competitive advantage and possibly have better access to market opportunities?

When we asked our respondents how mature their company was in their sustainability work, almost half of our respondents said that sustainability was an integrated part of their business strategy. Compared to our survey from 2020 this number was below one-third. This increase is an indication that seafood companies are integrating sustainability more and more into their day-to-day operations

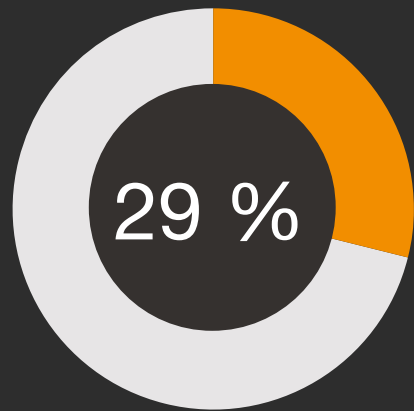
The industry is starting to adapt towards sustainability becoming an integral part of operations

The majority of the respondents have stated that they will be affected to a large or very large degree in the next five years. There is a big increase in the number of companies that actively use sustainability as one of the parameters for making decisions. We believe the industry recognises the wave of sustainability regulations that are starting to demand more and more focus.

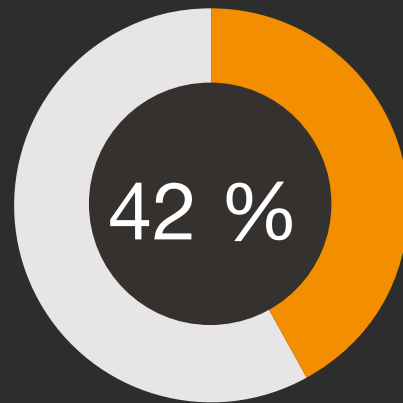
Will your company be affected by requirements for sustainability the next 5 years?



The industry has identified sustainable production as one of the top three drivers for increased demand for seafood 2017 vs 2023

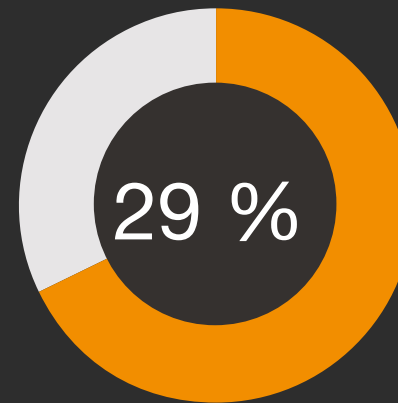


PwC's seafood Barometer 2017

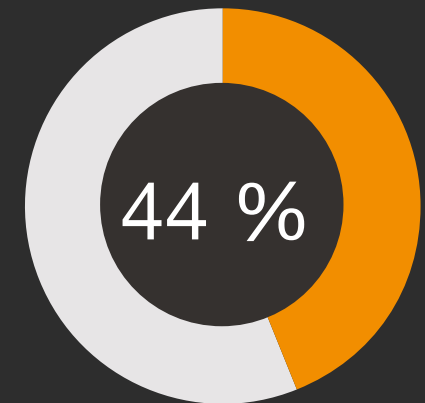


PwC's seafood Barometer 2023

Percentage of respondents that have sustainability as an integrated part of their business strategy 2020 vs 2023



PwC's seafood Barometer 2020



PwC's seafood Barometer 2023

Question: How mature is your company on sustainability?*

PwC's seafood Barometer: From 2021 to 2023

*6% answered "I don't know" to this question

We have measured how the industry is maturing when it comes to sustainability. We can observe that from 2021 to 2023 there is a significant increase in the top level of maturity and correspondingly a decrease on the low end. This would explain the shift we are witnessing towards sustainability becoming a parameter for decision-making.



Climate is still a big risk factor for the industry






The changing climate is directly affecting the seafood industry

The seafood industry is exposed to climate change and climate risks. Since the industrial revolution, the sea has absorbed about 27 per cent of all man-made CO₂ emissions. This, in turn, is leading to ocean acidification, meaning the pH-level is reduced. We are also witnessing an increase in the sea temperature. Atlantic salmon and trout are most comfortable at lower temperatures. The fish has poorer conditions for living and growing in warmer waters, especially in summer.




The temperature and salt levels of the ocean greatly influence the types and diversity of marine life. In this century, it is projected that the North Sea will experience a rise in temperature between one to three degrees and two degrees in the Barents Sea. As a result, various species may shift their migration patterns further north. This could lead to an increase in anchovies and sardines in the North Sea and an expansion of herring and mackerel populations in the more northern regions. These changes in migration patterns can present challenges for managing fishing quotas, potentially leading to an abundance of fish in some areas and a decline in others.






Last time we asked the industry about their biggest concerns for climate risks, the majority answered increased sea temperatures. This is still one of the main concerns, but risks such as more frequent extreme weather, consumer requirements, change in climate and environmental requirements and pricing of climate emissions are also very prominent.

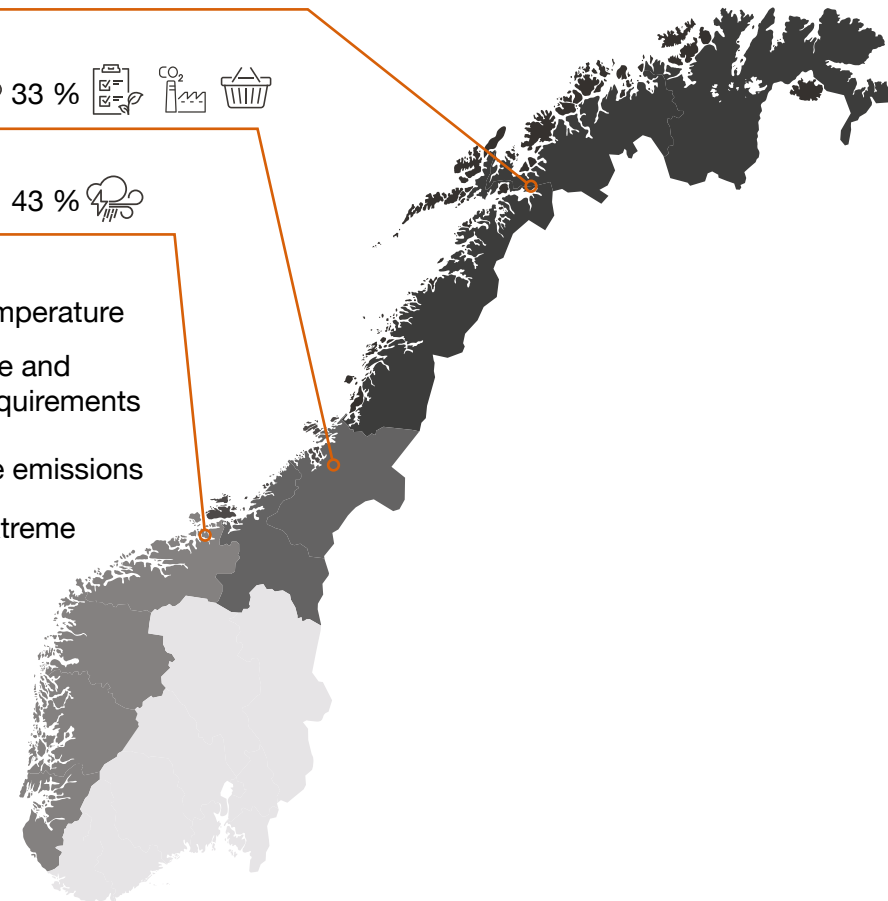
What climate risks are most important the next 20 years? PwC's seafood Barometer 2023

50 %   43 %   27 % 

67 %  78 %  33 %   

60 %  51 %  43 % 

-  Increased sea temperature
-  Change in climate and environmental requirements
-  Pricing of climate emissions
-  More frequent extreme weather
-  Consumer requirements



Transition to a more sustainable Europe will require a staggering amount of capital

EU's taxonomy will become the “gold standard”

With its Green Deal, the EU has set ambitious climate targets and a clear course for the transition to a climate-neutral Europe in 2050. This transition requires extensive capital, 1 billion euros annually until 2030 and the EU's action plan for sustainable finance aims to channel private capital to sustainable investments.

The EU taxonomy is the hub of this action plan. It defines sustainable and non-sustainable activities and will become the “gold standard” for sustainability. This classification is necessary for the other measures in the action plan to function as intended.

If the implementation of the taxonomy is successful, it will have a very positive impact on how sustainable different sectors operate. It will also contribute to the development and implementation of newer more sustainable and efficient technologies needed to become aligned.

Update on the EU taxonomy for the seafood industry

The EU taxonomy is now implemented in the EU. From 01. January 2023 the Norwegian government passed a law implementing requirements for eligible companies to begin reporting in 2024 for the fiscal year 2023.

The EU commission is due to implement the technical screening criteria (TSC) for fisheries.

We were expecting implementation on December 22. However, the commission has stated that they are significantly delayed with the process. No date is set, but we expect implementation later this year.

The industry is far from ready to face the strict reporting scheme they will be subjected to

The threshold for deciding who is in scope for reporting on the EU taxonomy is currently only for public interest companies of a given size. However, in line with the introduction of the Corporate Sustainability Reporting Directive (CSRD) this threshold will be considerably lowered. While the norm in recent years has been for the largest companies to report on

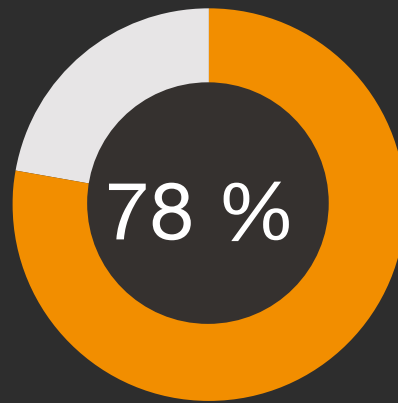
sustainability, in the future we will have to see increased transparency from far more companies and in a wider scope of the value chain.

There seems to be a misconception in the industry that the EU taxonomy is not relevant to fisheries and aquaculture. However the TSCs for fisheries and aquaculture are not yet implemented. There are still many economic activities that are eligible for these companies and which they are obligated to start evaluating and collecting data on.

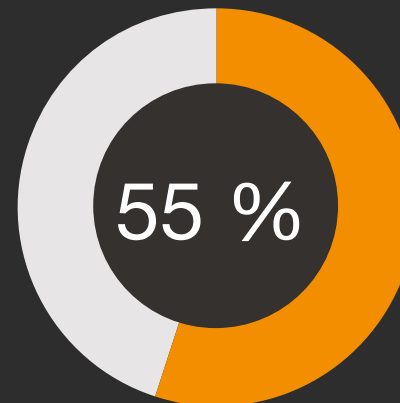
We asked our respondents where they are in the process when it comes to implementing reporting in line with the EU taxonomy. The majority do not know how the taxonomy will affect their company.

Especially surprising is it that fisheries are so uncertain considering there is a draft available for TSC's for fishing. There are no obvious signs that the TSC's will change significantly before implementation.

How do you think the EU taxonomy will affect your company in the next five years?



Aquaculture



Fisheries

of respondents does not know how the EU taxonomy will affect them

PwC's seafood Barometer 2023



PwC point of view:

The seafood industry is considered a sustainable industry compared to other animal protein producers. However we believe implementation of directives like the EU taxonomy will put this in perspective by defining what is sustainable. This will increase comparability between industries and secure equal conditions for competition. As new regulations will have a significant impact on both access to and pricing of capital going forward, we are surprised that such a large percentage of industry participants are unfamiliar with the coming regulations.

Survey Methodology

About

The objective of the PwC Seafood Survey is to raise important questions related to the current and future of the Norwegian seafood industry. By targeting industry professionals, we obtain a unique front-seat view of the most important factors shaping the industry.

This year's edition has addressed the regulatory framework for sustainable growth towards 2050. In light of recent events in the political landscape, we have paid particular attention towards understanding the perception of political risk and the importance of mutual trust between private actors and legislators.

Survey distribution

We prepared and distributed the survey using Typeform, a software specialised for form-building and online surveys.

We distributed two identical questionnaires. One was targeted towards industry leaders and sent out personally, and the other was made publicly available. The latter was advertised through the industry newspaper iLaks. The first response was recorded 19th August and the last entry on 7th November

Sample size

The median respondent is between 35 and 45 years of age and holds a leading position in the seafood industry. The median firm size

in aquaculture (fisheries) has between 10 and 20 licenses (revenue between MNOK 100 and 250). The total sample holds 93 observations, where 74 and 19 are from aquaculture and fisheries, respectively. 57% of all respondents reside in the western part of Norway, 32.3 % in the northern and 9.7% in the Trøndelag area. The residual lives abroad.

We obtained 47% of the responses from the targeted survey and 53% from the public. There are no significant systematic differences in the opinions between the two.

About 58% of the total responses were submitted before the ground-rent taxation was publicly known (28th of September 2022).

Calculations

All computations are relative to the number of participants in the survey and follow the basic formula

$$Opinion_{i,j} \% = \frac{Number\ of\ answers_{i,j}}{Number\ of\ participants_j}$$

where $Opinion_{i,j}$ is the share of respondents in industry j that answered alternative i on a given question. j can be aquaculture, fisheries or both.

Survey structure and question categories

The survey was split into two parts - aquaculture and fisheries

About the company

(2 questions)

Marked and production

(5 questions)

Future outlook

(3 questions)

Technology and development

(3 questions)

Cost and production development

(Aquaculture 5 questions, Fisheries 5 questions)

Regulations

(4 questions)

Sustainability

(9 questions)

Tabloids

(8 questions)

Final

(3 questions)

Abbreviations

CAGR - Compound annual growth rate	Kg - Kilogram	R&D - Research and development
CO ₂ - Carbon dioxide	Kwh - Kilowatt hours	SDG - The United Nations Sustainable Development Goals
CSRD - Corporate Sustainability Reporting Directive	LNG - Liquefied Natural Gas	SSB - Statistics Norway
DKNVS - The Royal Norwegian Society of Science and Letters	MAB - Maximum allowed biomass	TAC - Total allowable catch
EEA - European Economic Area	MSC - Marine Stewardship Council	TSC - Technical Screening Criteria
EU - European Union	N ₂ O - Nitrous oxide	TLS - Traffic light system
EUR - Euro	NOK - Norwegian krone	UK - United Kingdom
FAO - Food and Agriculture Organisation of the United Nations	NOU - Norwegian Official Report	UN - United Nations
FTS - Flow-through system	NOx - Nitric oxide	US - United States
FOS - Fish Farmers' Sales Organisation	NTVA - The Norwegian Academy of Technological Sciences	USD - United States Dollars
HOG - Head-on-Gutted	OSE - Oslo Stock Exchange	WFE - Whole fish equivalent
ICES - The International Council for Exploration of the Sea	pH - Potential of Hydrogen	
	RAS - Recirculating Aquaculture System	

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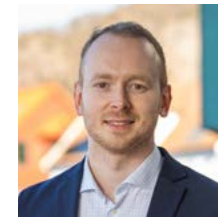
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