APRIL 2025

Fish Farmer



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Editor's welcome

WHERE does the future of aquaculture lie? Some argue that, with the increasing pressure on coastal space, the next frontier will have to be further out to sea in exposed, high-energy locations.

A lot has already been spent on developing the technology that will make offshore fish farming possible, but so far it has not taken off. That may change in the near future, though, and, as Sandy Neil reports in this issue, Shetland may well be one of the locations to see this finally happening at a commercial scale.

Meanwhile, new thinking in the industry is focusing not only on different locations but also on different species. The idea of halibut farming is not new, of course. Research on farming this premium flatfish goes back to the 1980s, and halibut farming has been tried commercially in different locations across the northern hemisphere.

Halibut fetches a top price and in many ways is more robust than most other farmed fish species, but it comes with its own challenges, particularly at the early stages of life, and many ventures have come to nothing for one reason or another. Now, however, we are seeing businesses with ambition to produce halibut at scale, and this month we report on an international workshop that brought together enthusiasts from around the world.

Also in this issue, we feature a Swedish land-based fish farmer with a philosophy based on sustainability; a campaign to get the government to take trout welfare seriously; a report from the Fish Vet Society conference in Edinburgh; and a business set up to extract a valuable ingredient from seaweed.

You can find all this and much more in your April edition of *Fish Farmer*!

Best wishes
Robert Outram

Robert Outram



Cover: Bird's eye view of SalMar's Ocean Farm 1

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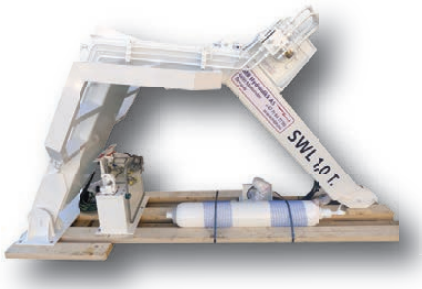






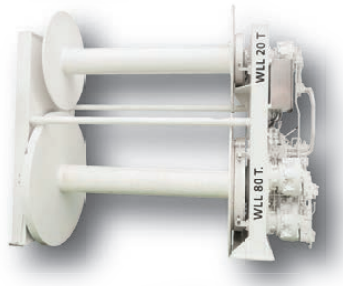

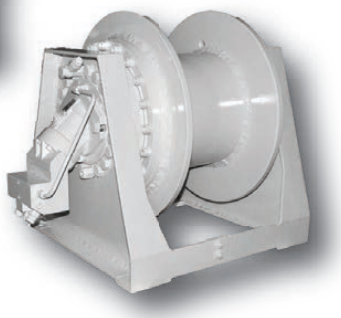

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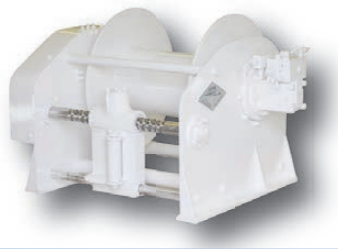

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United Kingdom news

Seafood Scotland calls for industry 'cluster' to maximise value from waste



This page from top: Salmon processing; Donna Fordyce; Alexandra Leeper

INDUSTRY body Seafood Scotland is calling for industry partners to back the creation of an innovative Scottish "ocean cluster", which it says could unlock three times more value from by-products in Scotland's seafood industry.

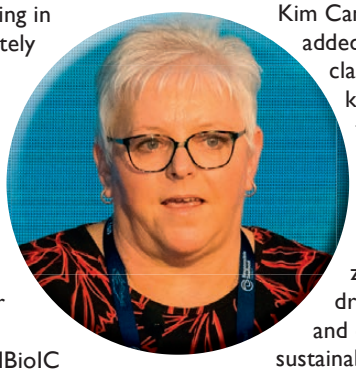
Seafood Scotland CEO Donna Fordyce officially announced the establishment of the group at the prestigious Industrial Biotechnology Innovation Centre (IBioIC) Conference – a focal event for the industrial biotechnology community in Scotland – calling on organisations across Scotland's seafood industry to get behind the initiative as it seeks to secure funding.

Seafood Scotland has partnered with IBioIC, Zero Waste Scotland, Opportunity North East and Aberdeenshire Council to drive producers, processors, investors, researchers, retailers, government and biotech companies to work collectively to unlock the full potential of seafood "side stream" products, over and above the actual fish protein.

The initiative is inspired by the pioneering and globally successful Iceland Ocean Cluster, which has successfully driven value-creation from under-utilised marine resources, particularly cod. In just one decade, Iceland has witnessed the production of its first biotech "unicorn", which utilises fish side streams.

Subject to funding, the would-be cluster's first area of focus will be to increase the value of fish side streams harnessing biotech expertise to create, for example, added value nutritional supplements.

According to a recent report by public body Zero Waste Scotland, *Characterising Fish Processing By-products*, the current market value of the 166,000 tonnes of fish "waste" from processing in Scotland is approximately £21.58m. The Scottish cluster steering group estimates it could potentially treble its market value in the space of three years, by being diverted to more profitable uses than low value feed or fertiliser.



Commenting at the IBioIC Conference, Donna Fordyce, CEO of Seafood Scotland, said: "Scotland is one of Europe's largest seafood producers, and also boasts an innovative and fast-growing biotechnology sector. This gives us an exciting advantage.

"Bringing biotech expertise together with the innovators in the seafood industry - in the same way as the Iceland Ocean Cluster has done - has the potential to triple the value of Scotland's seafood side streams, by extracting even more value from the country's fish and shellfish. By working together across the industry, we can improve food security, actively encourage innovation and high value job creation, champion environmental sustainability and attract funding and investment to foster economic development in Scotland.

"In short, it could be game-changing for the sector, and the organisations at its heart. That's why we're calling on the backing of stakeholders across the industry - so we can secure the funding to progress with a Scottish ocean cluster that can realise and accelerate these ambitions, bring economic prosperity to our coastal rural fishing communities, and get ahead of any potential future challenges facing the industry."

From waste to value

At the conference, Fordyce joined IBioIC's Senior Impact Manager, Kim Cameron; Director of the Global Seafood Alliance and Ambassador for the Iceland Ocean Cluster, Melanie Siggs; and Director of Lornal Consultancy, Alastair Kennedy, on a panel discussing clusters as critical drivers of regional success.



Kim Cameron of IBioIC, added: "Scotland's world-class biotech sector is key to unlocking the full potential of the country's seafood industry. The Iceland Ocean Cluster has demonstrated how a zero-waste model can drive both economic and environmental sustainability, maximising value from every part of the seafood supply chain. By harnessing Scotland's cutting-edge biotech expertise, we can emulate this approach to create exceptional value, turning underutilised resources into high-value products."

Alexandra Leeper, CEO of the Iceland Ocean Cluster, has voiced her support for a Scottish Ocean Cluster. She said: "Iceland Ocean Cluster is thrilled to see steps being taken to launch a Scottish ocean cluster, which we are keen to welcome as part of our global sister cluster network. Their leadership in working to bring '100% Fish' to life in a country with such a rich seafood heritage is a great example of doing more with less and we look forward to working together."

Aqua Agenda: Harmful Algal Blooms

FISH Farmer's Algal Blooms webinar on 4 June will feature a panel discussion on the causes of harmful algal blooms, how prediction can be improved and what mitigating actions can be taken. While algae are part of the marine ecosystem, under some circumstances they can create dangerous conditions for farmed fish, or toxins that can make shellfish unfit for human consumption.

With our panel partner Poseidon Ocean Systems, we'll be talking to the experts to find out how the aquaculture sector is dealing with the problem. Panel members will include Poseidon's Robert Wyvill, Sarah Riddle of the Sustainable Aquaculture Innovation Centre (SAIC) and Jill Couto-Phoenix of skills body Lantra.

1130-1230 (UK time), Wednesday 4 June 2025.

Register for this FREE webinar at bit.ly/aqua-agenda-habs or see the QR code on page 21.



Right: Phytoplankton

Bakkafrost Q1 harvest in Scotland down by 1,000 tonnes



BAKKAFROST has reported that its Scottish harvest for the first quarter of this year was 1,000 tonnes lower compared with Q1 2023 – but its output from the Faroe Islands was considerably higher, the company says in its latest trading update.

Bakkafrost Scotland, which has been undergoing a steady improvement process, turned out 6,300 tonnes between January and March against 7,300 tonnes in the same period last year. March was the top month at 2,300 tonnes.

The average weight in Scotland was good, ranging between 6.5 and 6.7 kilos, the company said.

The Faroe Islands produced 18,900 tonnes compared with 14,300 tonnes last year and 11,000 tonnes in Q1 2023. The average weight was between five and 5.2 kilos.

The smolt release in Scotland was 0.6 million and the equivalent figure for the Faroes was 3.2 million.

Group feed sales totalled 31,300 tonnes while fish meal sales were 3,600 tonnes.

The group's sales performance for last year remained solid with total revenues hitting DKK 7.3 billion (£8.18m), up 2.7% on the previous year. Operational EBIT (earnings before interest and taxation) was DKK 1.55bn (£174m), compared with DKK 1.54bbn (£173m) in 2023.

The total harvest for 2024 rose by 24% year on year, to 90,700 tonnes.

The full Q1 report will be published on 19 May.

Fish trimmings are a more efficient source of nutrients for aquafeed, scientists say

A NEW way of measuring the efficiency of aquafeed could help make better use of scarce marine ingredients, a study has concluded.

Fish-In Fish-Out (FIFO) metrics measure the biomass of wild fish used to produce farmed fish but fail to account for nutrient retention. The authors of the new study propose a new measure – "nutrient Fish-In Fish-Out (nFIFO)" – which builds on the FIFO metric but includes the important aspect of nutrient retention, and also takes by-products into account – which are not edible to humans but can be a sustainable resource for producing marine ingredients to be used in aquaculture.

The study *Fish as Feed: Using the nutrient Fish In: Fish Out ratio (nFIFO) to enhance nutrient retention in aquaculture*, published in the journal *Aquaculture*, was carried out by researchers at University of Stirling's Institute of Aquaculture, in collaboration with the universities of Lancaster, Aberdeen and Cambridge.

The new approach analyses the retention of omega-3 and other nutrients from marine ingredients. It will, the scientists say, aid the aquaculture industry to become more efficient in retaining valuable nutrition.

The team identified that if all marine ingredients in aquafeeds were derived from fishery by-products instead, nutrient retention efficiency could improve dramatically.

The team have also developed a calculation tool to encourage widespread adoption of the nFIFO metric within the industry. This will be made available online through sustainability consultancy Blue Food Performance's suite of indicators.



Above: Dr Richard Newton

Dr Richard Newton, Lecturer in Resilient Food Systems at the Institute of Aquaculture, who led the study, said: "Currently, retention of key omega-3 fatty acids is only around 38% and we would hope to improve that going forward. Our approach highlights the importance of promoting better feed management and circular economy principles within aquaculture, enabling the industry to make better use of finite marine resources, reduce waste, drive improvements in sustainability, and enhance the nutritional output of our farmed fish."

Holyrood debates Scotland's salmon industry





FRIENDS and foes of Scotland's salmon farming sector clashed in a fierce debate at Holyrood last month – but sometimes it was hard to tell who was which.

On 20 March the Scottish Parliament was debating the report of the Rural Affairs and Islands Committee on the salmon industry, published in January this year.

The report was a follow-up on recommendations made by the committee's predecessor, the Rural Economy and Connectivity (REC) Committee in 2018.

The REC report had concluded that urgent action was needed to improve regulation and address fish health and environmental challenges, and set out 65 recommendations on regulation, reparting and managing the environmental impact of the salmon farming industry.

The RAI Committee's overarching conclusion, it says, is that: "The slow rate of progress in improving the regulation and enforcement of the Scottish salmon farming industry needs to be addressed as a matter of urgency, to future-proof the industry and enable it to grow sustainably."

It calls for "stronger leadership" from the Scottish Government, and "requests a clear timetable be provided setting out how both the outstanding 2018 recommendations, and its own recommendations, will be implemented within the next year".

The committee also asks the Scottish Government "to set out how implementation will be measured and for dedicated ministerial oversight of the workstream to drive delivery".

in the debate, RAI Convener Finlay Carson expressed disappointment that so many of the 2018 recommendations had not been actioned, and many of the problems identified in the earlier report still exist within the industry.

In particular, he said: fish mortality was up to 25% which was above the level the RECC described as unacceptable (although Carson noted that in 2024 it had been brought down to 18%); more research was required into environmental impacts; more transparency was needed in reporting data, including mandatory reporting of mortalities for farmed fish; and sites deemed to have excessive mortality should be required to halt production.

Carson said it was disappointing that the Scottish Government had not agreed the extension of mandatory reporting especially as firms already record data, privately, on a farm by farm basis.

He also said that welfare standards should be placed on a regulatory basis rather than set out as voluntary "best practice".

Mairi Gougeon, Cabinet Secretary for Rural Affairs, Land Reform and Islands, responded, outlining key actions the Scottish Government had taken following the REC report in 2018, including setting out a Vision for Scottish Aquaculture, introducing a new mandatory sea lice reporting requirement, extending the powers and responsibilities of the Scottish Environment Protection Agency and commissioning the Griggs Report, which has led to the creation of a Consenting Task Force to help cut some of the red tape involved in gaining approval for new fish farms.

She pointed out the importance of the salmon industry which was responsible for £844m in exports, an estimated gross value added of £760m for the Scottish economy and employed around 2,500 people directly, and more indirectly.

But Gougeon added: "Economic benefit must not come at the expense of our environment."

Greens demand a 'pause' on growth

For the Green Party, Ariane Burgess said: "Scotland's seas are being sacrificed for profit", and she dismissed the Scottish Government's response as "empty words and half measures".

She said there should be a pause on any new farms, or expansion for existing farms, until the industry cleans up its act.

Burgess, along with SNP committee member Emma Roddick, dissented from the majority view of the committee, which did not take the view that a moratorium is required.

Burgess predicted that unless action is taken, the salmon farming industry will inevitably collapse under the pressure of global warming, leaving local communities with nothing.

She also called for more data on how many wrasse are being caught for use as cleaner fish, and from where. And she said there should be heavy fines for escapes – as in Iceland.

In contrast, Fergus Ewing, Mairi Gougeon's predecessor as Minister, said: "Salmon farming is one of the greatest







success stories of modern Scotland – but also one of the most undervalued."

He said: "The Green Party are peddling matters that are simply untrue – and they are talking down Scotland. It's time for a bit of truth about the value of the industry."

He pointed out that critics liked to condemn the foreign ownership of salmon farms, but in other industries, inward investment is heralded as a success.

'We are listening'

For the Conservatives, Edward Mountain and Tim Eagle both said they were in favour of business, but had concerns over salmon welfare and the impact of salmon farming on wild fish.

Mairi Gougeon said she was "disappointed" that the RAI Committee had raised the question of revisiting the idea of a moratorium on new or expanded fish farms should the committee not be satisfied with progress after 12 months.

She said: "There should not be any question of whether we want salmon farming in Scotland – because we do."

She argued that a "pause" in growth could stifle research and investment, and actually hold back improvements in the industry.

The Minister added that the Scottish Government is working with "our partners" to see how the collection and presentation existing data could be improved and made more accessible. She stressed that simply making more data mandatory would not represent "proportionate" regulation.

On the cleaner fish issue, Gougeon said a number of improvements had been brought in since 2018 and the government is currently carrying out a fisheries assessment for wrasse. For welfare generally, the government is looking to see how this can be put on a better footing, she said.

Although the Scottish Government has not accepted all the findings of the RAI Committee, Gougeon said: "We are listening."

Opposite from top: Mairi Gougeon; Ariane Burgess; Fergus Ewing
This page from top: Emma Roddick; Edward Mountain

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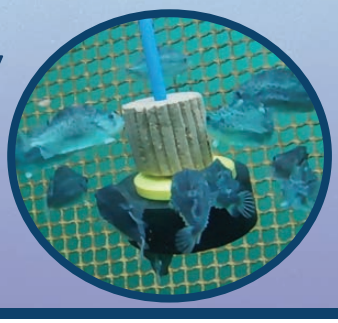

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NEWS IN BRIEF

Mairi Gougeon set to quit Holyrood next year



THE body representing Scotland's salmon industry has paid tribute to Mairi Gougeon, Cabinet Secretary for Rural Affairs, Land Reform and Islands in the Scottish Government, who has announced she will step down as an MSP before next year's Scottish Parliament elections.

Tavish Scott, Chief Executive of Salmon Scotland, said: "Scotland's salmon sector wishes Mairi Gougeon (pictured) all our best wishes for her future career. She has been a friend to people across the sector and has always made the positive case for salmon to Scotland.

"We have valued her commitment and professionalism and look forward to continuing to work with her during the remaining months in this parliamentary session."

Mairi Gougeon, MSP for Angus North and Mearns, was elected in 2016 and has served as Cabinet Secretary for Rural Affairs since 2021 in the SNP government.

Co-op signs up to prawn welfare policy

CO-OP, one of the largest food retailers in the UK, has become the latest organisation to introduce welfare policies for farmed shrimp. The retailer says that none of the shrimp – prawns to UK consumers – in its supply chain will be subject to the practice of eyestalk ablation. It has also committed to implementing electrical stunning for all farmed prawns by 2027.



A spokesperson for the organisation said: "At Co-op, we are committed to continuously improving animal welfare standards, and all our fresh and frozen prawns, including where used as an ingredient, are 100% ablation free and we will implement electrical stunning across our entire prawn supply chain by 2027. Support from organisations such as Aquatic Life Institute has been invaluable, and we're proud to be making this change."

Grant funding for Machrihanish

THE University of Stirling's Marine Environment Research Laboratory (MERL), at Machrihanish in Argyll is to receive £3.84m investment as part of the Argyll and Bute Rural Growth Deal. The award is part of a 10-year programme that will deliver £70m of investment to develop the region's economic potential. The Scottish and UK Governments have each allocated £25m to the programme, and Argyll and Bute Council and its partners will contribute at least £20m of match funding. The investment will add to the MERL's capacity to carry out marine aquaculture research and innovation.



Above: University of Stirling's MERL

Farmers dismiss 'safety protocol' as activist stunt



Above: Fish farm safety protocol meeting, Corran Halls, Oban

THE salmon industry has rejected calls to get involved in a public consultation on safe navigation around salmon farms, on the grounds that adequate safety protocols already exist.

Last month, a meeting convened in Oban by volunteers at Seal Scotland and anti-salmon farm campaigner Don Staniford drew up a draft "safety protocol", intended to set out guidance for fish farm operatives and other water users to ensure their mutual safety.

The meeting involved "marine users" including divers, swimmers, kayakers, tourist boat operators and animal rights activists. Some of those taking part also met privately with Argyll and Bute Police Inspector Matthew Shaw, who set out the police's understanding of the law applying to this area.

Don Staniford told *The Oban Times:* "Whether Mowi or Bakkafrost like it or not the fact is that anyone has the freedom and inalienable right to dive, swim, snorkel, fish, film, sail or kayak alongside cages."

Mark Carter of Seal Scotland, who chaired the roundtable discussion, said; "It was disappointing that nobody from the salmon farming sector, the Scottish Government or Crown Estate Scotland showed up."

Look, don't touch

The draft protocol sets out a "look, don't touch" protocol for marine users navigating past or around salmon farms.

The draft also sets out requirements for those working on the farms, for example requesting them not to "create a wake or wash which causes unnecessary danger to other water users", and requiring that warning signs be displayed when the fish are undergoing any treatment. It also demands that "no firearms or weapons" should be kept on site.

Comments on the protocol are requested by 30 April.

A spokesperson for Salmon Scotland said: "Any meaningful discussions on farm operations should include regulators and industry experts, so the idea that a small group of anti-salmon activists... should dictate how our members operate is risible.

"This is yet another misguided attempt by long-time activists to undermine a thriving sector that supports thousands of jobs, enjoys strong consumer confidence, and produces the UK's top food export.

"Our members take their responsibilities seriously and work closely with regulators and local communities to uphold the highest standards of safety, sustainability, and animal welfare."

The right to navigate – or to protest?

Existing advice from Salmon Scotland is to "respect the buoys" which clearly mark the area around a salmon farm in which marine users risk coming up against moorings and other equipment.

Salmon Scotland advises: "You should avoid swimming, diving or kayaking closer than 15 metres to a fish farm."

RYA Scotland, the body for sailing and water sports in Scotland, says: "It is wise… to give the cages a generous berth, particularly when a workboat is present." It adds: "It is perfectly safe to sail in waters with aquaculture farms. Good seamanship, particularly with regard to keeping watch, is the key."

River Carron study shows potential for restocking programmes

A GROUND-BREAKING genetic study has shown that the salmon in a stocking programme in a Scottish river survive to return as adults.

The research, a collaboration between the River Carron Conservation Association (RCCA) and the Institute for Biodiversity and Freshwater Conservation at UHI Inverness, offers one of the most comprehensive investigations of conservation stocking in the UK.

Some conservationists are sceptical of restocking programmes, on the grounds that the young salmon produced in hatcheries are effectively domesticated fish and therefore less fit to survive in the wild.

The latest report demonstrates, however, that fish stocked as eggs or juveniles survive to return as adults and in some years account for over 50% of the rod catch. Importantly, the study also provides crucial insights into ecologically sound methods for mitigating population decline.

The report draws on recently analysed genetic material and other data, collected over three decades by the RCCA's award-winning scientist Bob Kindness, to accurately differentiate between wild-spawned and stocked salmon across multiple generations.

Among the findings, the study reveals that by breeding from wild-caught fish in the hatchery for a single season, rather than retaining females in captivity for multiple breeding cycles, it is possible to mitigate the risks to long-term genetic health associated with captive broodstock programmes. It also demonstrates that fish released at the autumn (late) fry stage exhibit significantly higher survival rates compared to those released at different life stages.

'Real risk of extinction'

Bob Kindness said: "Before the Carron Conservation Programme, salmon stocks had dropped so low that the native fish faced real risk of extinction.

"Once the programme was underway, a clear correlation emerged between the number of fish stocked and the number returning as adults. The resulting historically high rod catches were a testament to years of dedication and effort - an immensely rewarding outcome for me, as someone with a passion for the King of Fish."

Genetic material from Norwegian strains, introduced by commercial aquaculture escapees, was detected in both wild-spawning and captive broodstocks. However, the RCCA stocking programme does not appear to be increasing the level of Norwegian DNA beyond what would occur naturally in a wild-spawning scenario.

Moreover, the study highlights a strategy that could actively reduce Norwegian ancestry in the wild population. Incorporating fast-turnaround genetic testing into conservation stocking programmes could enable selectively avoiding breeding from genetically compromised fish. While this approach may not yet be fully practical, it represents a critical step toward best-practice conservation protocols for mitigating Norwegian aquaculture introgression in wild salmon populations.

Jon Gibb of the Salmon Scotland Wild Fisheries Fund, whose financial assistance made this project possible, said: "Atlantic salmon are in deep trouble, due mainly to climate and habitat change, and we need to do everything we can to work together in understanding how we can mitigate against this collapse. The study's findings are an important milestone in that journey and point towards the most judicious use of stocking for the most threatened populations. I am delighted that the Wild Fisheries Fund could underpin this vital study into the impacts of long-term stocking into the River Carron."

• *See also Martin Jaffa, page 24.*



Photos: Elliot Roberts

Above and inset: Scientist Bob Kindness releasing late fry into the River Carron

European news

Grieg CEO and Chairman step down as troubled company prepares for strategic change

ANDREAS Kvame is quitting as Chief Executive of Grieg Seafood after 10 years in the post, as the company faces a period of turmoil. Per Grieg Junior has also announced that he is stepping down as Chairman.

Both announcements came late on Sunday 30 March, and followed rumours swirling around Oslo on the previous Friday that a group of rebel shareholders were demanding the removal of Per Grieg Jr with a possible takeover of the company in mind.

Grieg reported heavy losses from its British Columbia business last year and it has suspended work on its post-smolt facility in Newfoundland.

A sale of those businesses now seems even more likely but Grieg could have problems finding a buyer while the threat of US tariffs hangs over Canada, even if the latest announcement from the White House (see *World News*) suggests that the UUS is not extending its protectionist measures as far as Canada is concerned - for now at least.

The Grieg announcement said: "The board has initiated the search process for a new CEO. Nina Willumsen Grieg, Regional Director of Grieg Seafood Rogaland, has been appointed interim CEO, with Andreas Kvame supporting the CEO transition process.

"In line with good corporate governance, Per Grieg Jr steps down as Chair of the board of the company and takes a position as a regular board member."

The statement added: "In February, the company initiated a financial transformation programme, aiming to transform Grieg Seafood into a focused Norwegian seafood producer, concentrating on core operations in Rogaland and Finnmark.







"By streamlining the company's portfolio and reinforcing its financial foundation, Grieg Seafood is positioning itself for a return to profitability and long-term sustainable growth in its home market.

"This programme will be executed as planned. Nina Willumsen Grieg has worked in Grieg Seafood for 10 years in various executive, strategic and operational roles. During her four years of managing Rogaland, the region has shown strong results both financially and biologically."

Andreas Kvame said: "It has been a true privilege to lead Grieg Seafood for more than 10 years, and I want to thank all of my colleagues for their efforts.

"A main priority has been the development of post-smolt production, which I strongly believe will play an important part in the future of the entire salmon farming industry. Currently it is a challenging time for Grieg Seafood."

He added: "As a result of the financial transformation programme initiated, the company has been stabilised financially and is positioned to take the measures needed for operational improvements. I wish my successor the best of luck and believe Grieg Seafood has a bright future ahead."

From the top: Andreas Kvame; Per Grieg Junior; Nina Willumsen Grieg

Iceland's First Water raises extra €39m

FIRST Water, the Icelandic land-based salmon farmer, has completed a €39m (£32.5m) share capital raising round.

The latest investment was led by existing shareholders, including Stoðir hf, FW Horn slhf, Framherji ehf, Lífeyrissjóðurverslunarmanna, Brú lífeyrissjóður, Líra ehf and LSR.

First Water said shareholders had reaffirmed strong confidence in its sustainable land-based aquaculture project.

Before this capital injection the company had raised €122m (£101m) in equity. With the latest round, total equity financing now stands at €161m (£134m).



Above: First Water flow-through planned farm

At the end of last year, the company also secured €80m (£66m) in loan financing from Landsbankinn and Arion Bank.

This means in total that First Water has now secured approximately €240m (£200m) in funding, with investment in the project exceeding €137m (£114m) to date.

First Water is building a 50,000-tonne capacity facility at Laxabraut in Þorlákshöfn south of the capital Reykjavik, which is set to be completed in six phases by 2029.

It will operate a hybrid flow-through process, combining some of the aspects of a recirculating aquaculture system (RAS) and a flow-through farm.

The facility is being developed in a series of six meticulously planned phases, each designed to incrementally increase production capacity and operational efficiency.

Currently, the project is in its first phase, which, once complete, will yield 8,300 tonnes of head-on gutted salmon annually.

The announcement said this latest share increase enables it to complete the construction of phase one of six in Þorlákshöfn.

First Water has already sold approximately 2,000 tonnes of premium-quality salmon, "demonstrating the company's ability to meet the growing global demand for sustainable and eco-friendly seafood products," the statement added.

It said: "Upon completion, First Water's land-based aquaculture facility will produce around 50,000 tonnes of salmon annually, developed in six phases, and is expected to be fully operational by 2030."

Benchmark Genetics sale now completed

THE sale of Benchmark Genetics, the aquaculture breeding, egg supply and genetics services business, has now concluded and the company is now part of the Novo Holdings portfolio.

The Benchmark Group announced in November that it had agreed to sell its genetics arm to Novo Holdings, the holding and investment company responsible for managing the assets and the wealth of the Novo Nordisk Foundation.

The sale valued Benchmark Genetics at up to £260m, including an initial consideration of £230m and an additional contingent consideration of up to £30m in the form of an earn-out.

As of 1 April, Benchmark Genetics' headquarters has moved to Bergen. The company said: "This acquisition marks a significant milestone in Benchmark Genetics' journey toward greater innovation, expansion, and leadership in aquaculture genetics… under Novo Holdings' ownership, Benchmark Genetics will grow its position as a global leader, enabling the aquaculture industry to benefit from the huge potential of genetic improvement and technologies."

Geir Olav Melingen, CEO of Benchmark Genetics, said: "We believe in the power of genetics to transform aquaculture to improve animal welfare and make food production more sustainable.

"With Novo Holdings as our new owner, we will realise our mission to provide high-performing sustainable genetic solutions that bring value to aquaculture producers worldwide and more healthy food to the table of consumers."

Benchmark Genetics will also gain full ownership of its land-based breeding facility in Salten, Norway, with the aim of further strengthening its operational capabilities and ensuring the security of supply all year round. The 25% share in the facility, previously owned by Salten Stamfisk AS, is now under the control of Benchmark Genetics.



Above: Benchmark Genetics

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NEWS IN BRIEF

AKVA sells off stake in marine services company

AQUACULTURE technology and services group AKVA is selling its stake in Norwegian marine services business the Abyss Group. The sale of the 21.55% equity portion is expected to raise NOK 140m (£10.1m) which AKVA said will free up capital for continued development of AKVA's core business segments. The buyer is private equity firm Arcus Infrastructure Partners LLP. Abyss Group is one of Norway's leading service boat companies for the aquaculture industry. It operates a fleet of boats ranging in size from 15-metre workboats to 25-metre vessels.



Above: Abyss service vessel at pen

BioMar takes full control of aquaculture research business

MULTINATIONAL feed producer BioMar has taken over full ownership of LetSea, a Norwegian testing and research business which carries out trials and projects for the aquaculture industry. The two companies have been collaborating on research for some years, with BioMar as a minority stakeholder. LetSea was established almost 30 years ago. Prior to the BioMar acquisition it was two-thirds owned by the investment fund KapNord, with the remaining shares owned by BioMar.



Above: The LetSea facility

Icelandic seafood workers enjoy a weekend break



EARLIER this month, more than 1,000 fishing and aquaculture workers were treated to a short holiday on the Baltic coast, courtesy of their employer, Samherji. Iceland's largest seafood company paid for its staff to enjoy a three-day break in the Polish holiday resort of Sopot (pictured above), famous as a health spa and music festival venue. A fleet of six jet airliners were chartered to take the lucky staff to their destination.

Anna María Kristinsdóttir, Human Resources Manager at Samherji, said: "The staff, both at sea and on land, truly deserve to have fun together and at the same time strengthen their friendships even further."

Kingfish Company sees big surge in 2024 sales and revenue

THE Kingfish Company achieved high volume growth and increasing market demand for yellowtail fish last year, while reducing its operating losses per kilo.

The volume sold by the land-based fish farmer in 2024 increased by 37% to 1,992 tonnes, while the harvest was up by 41% to 2,323 tonnes. Revenues rose by 26% to €27.7 million (£23m).

The operational EBITDA was -€3.4m (-£2.9m), compared with an EBITDA loss of -€3.9m (-£3.3m) in 2023. Operating losses (EBITDA) per kg showed a significant improvement, at -€1.70 per kg (-£1.40) against -€2.70 per kg (-£2.30) in 2024.

The Kingfish Company produces yellowtail kingfish in its RAS (recirculating aquaculture system) facility in Zeeland, in the Netherlands.

Kingfish CEO Vincent Erenst said the company closed the year with strong commercial momentum, achieving over 60% volume growth in the final quarter and surpassing 2,000 tonnes in annual shipped volume for the first time.

He added: "This growth reflects both the increasing market demand for our sustainably farmed yellowtail kingfish and the success of our increased sales capabilities.

"Meanwhile, we have taken important steps to optimise operational efficiency, align production with demand, and ensure we remain on track to reach profitability.

"With broad support of our shareholder base through a fully underwritten equity raise in January, we started 2025 with a strengthened financial foundation and a clear strategy to capitalise on the growing demand for high-quality, sustainable seafood."

The Kingfish report for 2024 said the company had managed its biomass levels strategically during the year, to align production with sales demand.

By the year-end, the standing biomass had reached 1,118 tonnes, a 16% increase compared to 967 tonnes at the end of 2023.

As the farm operated above its optimal biomass level for part of the year, the company implemented growth control measures to align production with sales. This led to a temporary decrease in productivity and an increase in eFCR to 1.53, compared to 1.36 in 2023.

As outlined previously, the Kingfish Company initiated a biomass reduction plan in Q4 2024 to bring the standing biomass down to around 900 metric tonnes over the first quarter of 2025.

As a result, an exceptional reduction of the biomass fair value was taken in Q4 2024 of approximately €1.2m (£1.01m).

A year ago its new processing facility began operations, equipped to handle the current maximum production capacity of 4,000 tonnes and prepared for future expansion to 6,500 tonnes.



Above: Kingfish tanks system

Fire rips through Norwegian salmon farmer's new buildings



Above: The fire damage

A MAJOR fire seriously damaged up to five new buildings belonging to Norwegian salmon farmer Alsaker Fjordbruk last month.

The fire, at Tysnes, south of Bergen, affected most of what are still fairly new buildings which were either destroyed or very badly damaged. There were no injuries.

The incident brought in crews from at least four firefighting centres along with a coastguard vessel.

Due to strong winds, the fire also lay a blanket of smoke over the entire area for at least three hours, cutting down visibility.

The buildings had been under construction for several years, and were nearing completion when the fire broke out, said the local newspaper *Bladet Tysnes*.

The outbreak was reported around lunchtime on Saturday after a member of the public saw smoke coming from one of the buildings.

It is not yet known how the incident will affect production but because the buildings were still largely unoccupied, serious disruption may be avoided.

They belong to the fish farming group Alsaker Fjordbruk AS which was formed in the 1980s and has grown impressively to become one of Norway's leading salmon farmers when it comes to production. The company farms salmon and supplies eggs and fry.

New Frøy wellboat starts operations with Mowi



LEADING wellboat company Frøy has signed a five-year time charter agreement with salmon farmer Mowi for its latest vessel.

Frøy took delivery of the *Frøy Saga* (pictured), built by the Sefine Shipyard in Turkey, at the end of February. The vessel is already in operation with Mowi.

Frøy Saga is a hybrid diesel-electric, 4,500 cubic metre all-round wellboat from the Møre Maritime series. It is the sister ship of *Gåsø Odin*, another Frøy vessel which is currently in service with Mowi's competitor, SalMar.

The new wellboat is specially designed to transport fish and is equipped with advanced technology for efficient processing of salmon. The vessel has 12 cabins with 14 berths.

Tonje Foss, CEO of Frøy, said: "The vessel is developed to ensure optimal fish welfare and meets both current and future requirements for circulation, oxygenation, filtration and UV treatment.

"At the same time, it offers high comfort for the crew, with high-level facilities. *Frøy Saga* represents not only a boat built for future emission requirements, but also a vessel that sets the standard for the crew's working environment."

With a service speed of 12 knots and diesel-electric propulsion, optimal fuel utilisation is assured, Frøy said.

The boat is 84.5 metres long and 20 metres wide and is equipped with four Yanmar generators of 1,300 kW each, as well as a battery hybrid solution of 510 kW that helps reduce peak load.





Canadian seafood company buys into Norwegian aquaculture



Above: Andfjord Salmon waterways

CANADA'S seafood industry is looking for new investment opportunities – and Norway is one of them.

The latest move is by Canada's High Liner Foods, which has decided to make a sizeable investment in the land-based salmon farming company Andfjord Salmon.

High Liner is already investing CA $6.75m (£3.6m) in another major aquaculture business, Norcod.

High Liner Foods is a leading North American processor and marketer of value-added frozen seafood with a number of leading brands, with a strong private label business.

High Liner will pump CA $10m (£5.4m) into Andfjord, which has a major development project in the north of the country at Kvalnes, where it is constructing a flow-through salmon farm.

Last month it was reported that Andfjord is planning to raise more than a billion kroner (around £72m) through a possible new share issue and the sale and leaseback of part of its port facility in Kvalnes on Andøya.

Andfjord has also reported strong progress across all key workstreams at its land-based aquaculture facility at Kvalnes, Andøya.

In an operational update, the company said the waterway system, initially anticipated to be one of the most technically demanding aspects of the project, is now 98% complete.

The tunnel system beneath the pool pits is finished, with only 6-7 metres remaining of the outlet waterway and approximately 70 metres left to complete the inlet waterway.

Andfjord Salmon plans to execute the final breakthrough from the inlet/outlet tunnel to Andfjorden in the next few months.

CEO Martin Rasmussen said: "Filling the tunnels with water for the first time will mark a significant milestone in preparing the facility for fish farming operations. This step brings us closer to realising our vision, and we look forward to achieving this important breakthrough."

Last month Andfjord Salmon announced that it had identified an optimised build-out plan that will enable a 20% increase in production capacity at its Kvalnes site.

Gigante Salmon completes its second production basin

LAND-BASED fish farmer Gigante Salmon has passed another milestone in the construction of its hybrid flow-through facility at Lille Indre Rodøy in northern Norway, with the completion of a second production basin.

This means only one of the planned three basins has still to be built.

The company said in a stock market announcement: "This is accordance with the previously communicated project plan. Gigante Salmon AS therefore continues to follow the planned progression towards full production capacity from 2026, with a gradual ramp-up to an annual production of 16,000 tonnes HOG from 2028."

The company said it aims to start harvesting its pilot production during Q2 2025, expecting approximately 550 tonnes HOG (head on, gutted).

Gigante Salmon is a land-based salmon farming company with its first production facility under construction at Lille Indre Rodøy in Rødøy. Early last year, it reported large increases in its estimated construction costs, which led to the replacement of its CEO.

The company's aquaculture concept is based on a flow-through system, combining the benefits of conventional and land-based aquaculture while eliminating issues associated with conventional, sea based, farming.

The largest owner in Gigante Salmon is the family company Gigante Havbruk, established by Kjell Lorentsen who still leads the business. It has been producing salmon since 1988.



Above: Gigante Salmon Rodøy under construction

Norcod raises further £12m to fuel growth

NORWEGIAN cod farmer Norcod has successfully raised NOK 165m (almost £12m) to develop new sites and step up production at its farms.

The move was completed through a private placement following the allocation of just over 13.7m shares at NOK 12 (87p) per share. One of the investors was the Canadian seafood company High Liner Foods, which has been seeking new opportunities in Norway recently and has also invested in salmon farmer Andfjord (see story on left).

Norcod said that the net proceeds from the placement, together with the net proceeds from the new debt commitment and operational cash flow, will be used to fund biomass and site investments necessary to reach its 25,000 tonne whole fish equivalent (WFE) annual target harvest capacity.

The following investors and primary insiders have pre-committed, subject to conditions, to subscribe for offer shares, which in total covers the minimum size of the private placement:

- The shellfish business Artha Norcod A/S, the company's largest shareholder and a close associate of Norcod's board member Jan Severin Sølbæk (NOK 67m, £4.8m);
- High Liner Foods, the company's second largest shareholder currently holding approximately 10% of the outstanding shares in the company and a close associate of Norcod's board member, Paul Jewer (NOK 75m, £5.4m);
- Sirena Group AS, a close associate of Norcod's board member Boe Romorus Spurre (NOK 8m, £580,000);
- Christian Riber, Norcod's CEO (NOK 499,000, £36,000);
- Jan Severin Sølbæk (DKK 1m, £115,000);
- A separate investment by board member Boe Romorus Spurre (NOK 100,000, £7,200); and
- Berners AS (NOK 3,000,000, £345,000).

DNB Bank ASA is committing an additional NOK 130m (£9.3m) with the possibility to subsequently increase debt commitment up to NOK 150m (£10.7m) in debt financing.



Above: Norcod in box

Sole and turbot farmer reports record year

STOLT Sea Farm, the Spanish-based land turbot and sole farmer, enjoyed an excellent performance last year, with higher turnover, an increase in production and profits up nearly 20%.

The company is the aquaculture arm of the Norwegian shipping and logistics group Stolt Nielsen and specialises in two of the most popular high-end white fish species. It has won a succession of awards in recent years.

Stolt Sea Farm reported operating revenues of €116m (£97m), an increase of 14% on the previous 12 months.

Both turbot and sole hit record sales, with 6,861 metric tons of turbot and 1,806 metric tons of sole sold during the year, increases of 0.7% and 4.5% respectively.

Stolt said the boost in sales helped to contain production costs for turbot and decrease costs for sole.

At the same time, sale prices for both turbot and sole improved from 2023, rising 14.3% and 8.8%, respectively. The two varieties are popular in quality restaurants. As a result, the operating profit increased by 19.8% to €26.8m (£22.5m). Excluding fair value adjustments in both years, the increase was $9.4m or 46.2%.

The company said in its annual report that: "2024 was a year of excellent production, steady demand and strong pricing, all of which contributed to a strong performance overall."

During the year, the company completed an upgrade on its sole broodstock facility in Merexo, Spain, and extended its sole hatchery in Cervo, also in Spain, and the world's largest flatfish hatchery.



Above: Stolt aquaculture farm

It also started construction of a new recirculating aquaculture system (RAS) facility for sole production at its farm in Tocha, Portugal.

The report added: "The upgrades support the company's plans to double sole production capacity in the next three years, and reach an overall annual production target of 23,000 metric tons of turbot and sole by 2035."

Across 14 farms and two hatcheries, Stolt Sea Farm has current annual production capacity of 7,200 metric tons of turbot and 1,800 metric tons of sole.

Stolt Sea Farm President Jordi Trias said: "2024 was a year of excellent production, steady demand and strong pricing, all of which contributed to a strong performance overall. This is only possible thanks to our people, who are dedicated to delivering the quality, care and innovation behind our award-winning seafood, and I would like to thank them for their efforts."

Stolt is a subsidiary of the Norwegian marine group Stolt Nielsen.

Escape alert at Arnarlax salmon farm



Above: Arnarlax pen

ICELANDIC salmon farmer Arnarlax has alerted the authorities to a possible escape situation following the discovery of a hole in one of its seine bags.

The incident took place at its location at Vatneyri in Patreksfjörður, where some 117,000 salmon are located.

The Icelandic Food and Veterinary Authority received a notification from Arnarlax in mid-March.

The hole was discovered during a routine underwater inspection and the repair was completed the same day.

According to Arnarlax, the hole was a 50 x 25 cm slot at a depth of 20 metres. In this particular pen, there were 117,133 salmon with an average weight of approximately 3kg.

The last underwater inspection was carried out on 23 February and the net was intact at that time, the company said.

The Icelandic Food and Veterinary Authority has since ordered that all fish pens in the farming area be inspected by divers to ensure that similar holes were not present in other fish pens.

In addition, the Authority ordered that the specific fish pens affected be dived under in search of possible escaped salmon.

Nets were set out near the fish pens in consultation with the Icelandic Fisheries Agency to capture any salmon that may have escaped, but no salmon were caught in the nets or seen during the dives under the pens.

The Authority said it is investigating the matter and is looking into, among other things, whether a spill occurred and whether Arnarlax has activated and followed its own procedures and response plans.

When the investigation into the incident is complete, a monitoring report on the investigation will be issued.

Arnarlax is part of Icelandic Salmon AS which is turn is majority owned by the Norway salmon giant, SalMar.

World news

Trump unleashes tariff chaos

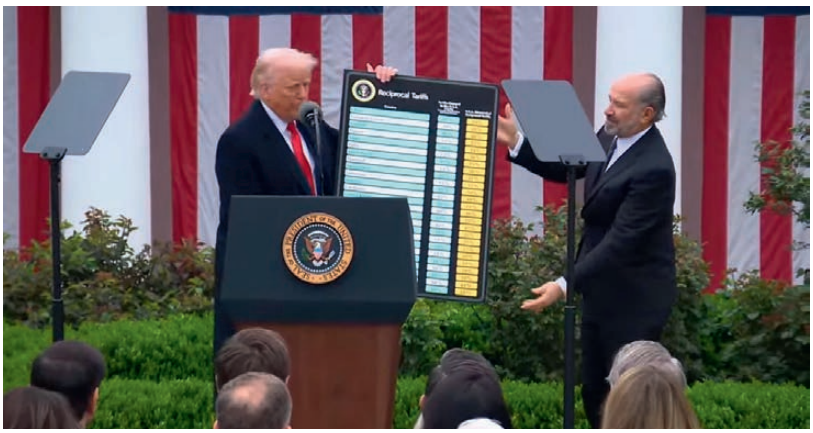

Photo: White House

Above: Trump and Howard Lutnick, US Secretary of Commerce. **Below:** Cecilie Myrseth

THE Scottish salmon industry is expected to have a considerable advantage over its rivals when exporting to the United States following Donald Trump's tariff announcement on 2 April.

The UK faces a tariff rate of 10% against 15% on Norwegian fish and 25% on any fish processed in EU countries such as Poland and Denmark.

Iceland, also a major exporter to the US, also faces the lower 10% rate but the situation with Canadian salmon remains unclear.

Canada and Mexico were excluded from the list of newly tariffed countries published by the White House, offering minor relief to businesses and consumers who feared further escalation of the ongoing trade war they have been trying to navigate since Trump took office. The Trump administration has already hit Canadian goods with tariffs twice this year. In early March, the US imposed 25% tariffs on all Canadian goods coming into the country, except for energy and potash, which were subject to 10% tariffs.

However, the White House offered a reprieve for all exports that are "compliant" with the US-Mexico-Canada (USMCA) free trade deal, which Trump himself negotiated.

"USMCA compliant goods will continue to see a 0% tariff, non-USMCA compliant goods will see a 25% tariff, and non-USMCA compliant energy and potash will see a 10% tariff," reads the fact sheet published earlier this month by the White House.

Trump has announced 25% tariffs on all auto imports, though that also included a carve-out for vehicles and parts covered by USMCA. Trump also confirmed his administration would begin collecting those tariffs at 12:01am on 3 April.

Seafood industry braces for impact

It is too early to tell how the announcement will affect the aquaculture and fisheries sectors, with some analysts suggesting that it could lead to a big reduction in sales and prices in the short term.

Americans are the second largest consumers of Atlantic salmon and other seafood, accounting for 25% of all sales, with most of it imported.

It was also a growing market until the announcement. Norwegian salmon farmers will now be looking to Europe and China, where sales are growing rapidly, to make up any shortfall.

Norway's Trade and Industry Minister Cecilie Myrseth said that Trump's announcement would have consequences for Norwegian seafood with one in five jobs dependent on exports.



Analyst Professor Ola Grytten told the Norwegian business website e.24 that the fish farming industry has a significant market in the US.

If prices are 15% higher, fewer people will buy fish, he said, adding that jobs will certainly be lost in these industries and in various individual companies.

Others are predicting that the salmon industry can eventually outride the tariffs and the situation will not be too bad.

Chile's salmon industry, which faces the baseline rate of 10%, is predicted to be the big winner.

The UK is hoping that a free trade agreement with the US, which is reportedly in the process of being negotiated, will mean exemptions in at least some sectors from the global 10% baseline, but in the case of food exports, disagreements over food safety standards and animal welfare may prove an obstacle.

20,000 flock to Boston for seafood show

SEAFOOD Expo North America/Seafood Processing North America attracted an estimated 20,000 seafood industry professionals from around the world at the 43rd edition of North America's largest seafood trade event in Boston on March 16-18.

This year's event spanned 249,665 net square feet of exhibit space with 1,215 exhibiting companies from 51 countries, including the team from Seafood Scotland (pictured), who had a stand promoting the best of Scottish fish and shellfish.

Seafood Processing North America showcased market-leading processing and packaging equipment companies, along with logistics services and other service providers. Seafood Expo North America (SENA) featured seafood companies offering a variety of fresh, frozen, canned, value-added, processed and packaged seafood products.

Wynter Courmont, Vice President, Seafood at Diversified, the company organising SENA and SPNA, said: "This year's event growth was evident on-site with lots of energy and engagement in both the exhibit hall and the conference area.

"Seafood companies, processing equipment, packaging and services companies and buyers all welcomed the opportunity to meet face to face and learn about new products and innovations, achieve their business goals and discuss their unique challenges and opportunities for growth."

Next year's event will take place March 15-17, 2026, at the Boston Convention & Exhibition Center.



Above: The Seafood Scotland team

Nordic Aqua back on track after off-flavour problems

NORDIC Aqua Partners, the Norwegian salmon company operating a facility in China, has reported the resumption of harvesting and sales, which were suspended in November following a geosmin contamination issue.

Presenting its final quarter report to the Oslo Stock Market in February, Nordic Aqua gave an upbeat picture for 2025.

It said that the fish now being harvested were of premium quality, adding there was a good underlying operational and biological performance for all batches with excellent fish health and welfare.

Geosmin arises from a microbial contamination and can be a persistent problem for RAS systems. While harmless to fish and humans, it leads to an unpleasant, earthy flavour to which the human palate is very sensitive.

The issue was successfully tackled during the final part of last year, the company said, with a Q4 2024 biomass production of 525 tonnes and total biomass of 2,232 tonnes by the quarter end, due to reduced feeding to optimise stock.

The company said it has taken corrective measures with industry specialists AKVA Group and others to reduce the risk for geosmin issues in the future, including preventive investments and operational protocols.

The company also reports that it has shown the capability to produce 7kg fish at scale with no maturation.

The company said that stage two construction at its Ningbo site was on schedule and it had also completed a private funding round, raising €30m. Nordic Aqua reported final quarter revenues of €1,568m (£1,316m) and €6,497m (£5,452m) for the year to date.

The loss for the period was €1,824m (£1,531) against €3,983m (£3,342) in Q4 2023.

It added: "Nordic Aqua entered 2025 with a fortified production system, enhanced operational protocols, and a commitment to delivering premium quality salmon under its Nordic PureAtlantic brand."

CEO Ragnar Joensen said: "We are pleased that our Ningbo facility is back on track and stronger than ever. With comprehensive corrective actions now in place, the Ningbo facility is fully optimised for sustainable, high-quality salmon farming.

"Overcoming operational challenges has demonstrated the resilience of the Nordic Aqua team and the robustness of our business model. I am grateful for the confidence of our stakeholders throughout the transition period in 2024, and we now look forward to a year of growth and value creation for our shareholders."



Above: Nordic Aqua Partners processing facility

China's seafood tariffs against Canada now in force



Above: Geoduck clams

SEAFOOD producers throughout Canada, including salmon farmers, are bracing for a tough time ahead as China starts to impose 25% tariffs on their fish.

They also face the threat that tariffs imposed by the United States, which were immediately suspended, could be reintroduced some time in the future.

The BC (British Columbia) Seafood Alliance says the Chinese move could devastate the multi-million-dollar geoduck clam export industry, which is built almost exclusively on Chinese markets.

The tariffs were levied in retaliation after Canada applied a 100% levy on all Chinese-made electric vehicles and 25% on steel and aluminium. They will also hit seafood producers, both wild caught and farmed, in other Canadian provinces such as Newfoundland, Nova Scotia and Prince Edward Island.

The entire Canadian seafood industry has been thrown into a state of turmoil by the latest round of tit-for-tat trade wars. The vast majority of the country's exports go to the United States and China with 60% to the US and around 20% to China.

The industry is fearing the worst but says the new taxes are in place now and it may be better to wait and see how things develop.

Salmon farmers in British Columbia are also facing a ban on future open pen operations and Canadians will be voting in a general election on 28 April.

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Salmon production 'set to grow 5%' in 2025

THE supply of Atlantic salmon is set to grow by 5% this year, according to analysts at Kontali.

Norway-based Kontali's latest forecast for 2025 is based on the expectation of higher biomass, strong production and lower losses in the first quarter of this year.

The 5% forecast is in contrast to bullish predictions from Oslo-listed salmon companies, which project volume growth of nearly 11% this year, while at the other end of the spectrum, industry commentators expect growth as low as 3%, or even 2.5%.

Kontali's estimate is based on three- to five-year averaged productivity parameters, which serve as the reference point for the most likely scenario.

Lead Analyst, Salmonids with Kontali, Lars Daniel Garshol, said: "With fourth-quarter 2024 results now in, supply growth estimates for 2025 are all positive, but projections vary significantly.

"Company guidance suggests a growth potential exceeding 80,000 tonnes WFE, or nearly 11% year-on-year, but industry projections have often been overly optimistic.

"The gap between company guidance and actual harvests over the past decade underscores how extraordinary events and shifts in productivity have led to inflated forecasts.

"Historically, company guidance has factored in expected biological improvements - such as reduced losses, increased weights and improved yields - more optimistically than final outcomes.

"While this aligns with production trends in recent years, we believe it underestimates the current fundamentals and outlook."

Kontali believes that optimising idle capacity in 2025 will depend on reducing losses and improving growth performance in the first half of the year.

Maximising biomass utilisation from September to November will be key, alongside fewer sea lice treatments and lost feeding days. Increased turnover and shorter production time at sea will drive efficiency, while new cage technology - such as closed and sheltered systems - will play a crucial role in unlocking growth, Kontali argues.

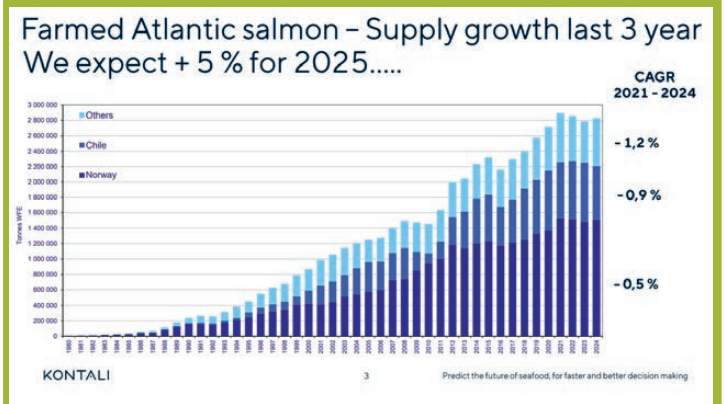
Garshol said: "As ever, biosecurity is key to unlocking growth in the salmon sector, reducing losses and improving turnover and utilisation.

"Despite 70 million more fish being stocked in the sea since 2019, Maximum Allowable Biomass (MAB) capacity has grown just 1%, leaving untapped potential.

"With strong growth expected in the 2024 generation, MAB utilisation could see major gains in late 2025 and into 2026.

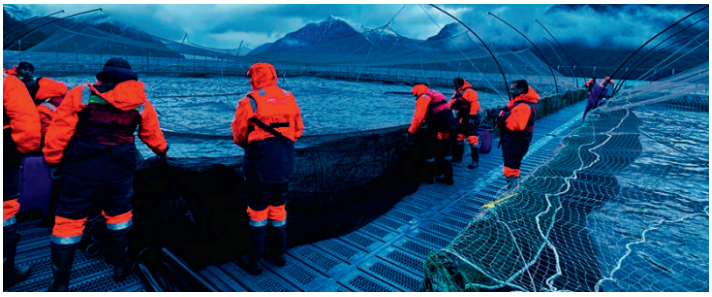
"Furthermore, the 2023 generation had the weakest smolt yield in over 20 years, nearly 10% below the 10-year average.

"As such, a conservative recovery in smolt yield is expected, but regulatory limits will cap weight gains in the second half of the year."



Above: Kontali salmon forecast 2025

Cooke gets EU certification for organic salmon production in Chile



COOKE Seafood group has received European Union certification for its Chilean organic salmon.

The accreditation will guarantee that salmon farming is carried out in compliance with European Union (EU) organic production standards.

Cooke said: "The certification was achieved after a lengthy process, which involved additional efforts throughout the entire production chain. This is because organic production reflects a comprehensive aquaculture and food production management system that combines the best environmental and farming practices, a high level of biodiversity, the conservation of natural resources, and the application of strict animal welfare and production safety standards."

The company added: "This milestone not only represents a new standard for salmon production in Chile, with a method that is more environmentally friendly and healthier for consumers, but also symbolises our country's entry into the international organic salmon market, considered by many to be a fundamental part of the food solution of the future."

Cooke announced last year that its Chilean organic salmon, marketed under the brand name Shima, would be aimed primarily at the EU and UK markets. The company said it planned to produce 3,200 tonnes annually.

New Zealand unveils ambitious aquaculture growth plan

THE government of New Zealand has unveiled a long-term development strategy for developing the country's aquaculture industry.

The government has said it will partner with industry, the Māori people, councils, communities and agencies to enable sustainable growth for the sector.

Led by Fisheries New Zealand, the plan sets out actions the government will take to enable the aquaculture industry to reach NZ $3 billion (£1.3bn) in annual revenue by 2035. These actions are organised into four "pathways for growth".

Pathway One aims to maximise value from existing space. The government says aquaculture already produces high value seafood, but adds there is potential to derive even greater value from existing farm space. It could add NZ $1.5 billion (£663m).

Pathway Two is even more ambitious, involving the extension of aquaculture into the open ocean.



Above: Fish farm, New Zealand

"Farming in the open ocean is an opportunity to significantly grow production," says the report.

Pathway Three involves working with the Māori community, driving innovation, and seeking opportunities to grow the industry.

Pathway Four involves identifying the best new opportunities to ensure that the industry is resilient and will grow New Zealand's unique position in the world market.

Proximar's Fuji salmon finds a market in Taiwan

PROXIMAR Seafood, the company behind the Mount Fuji Atlantic salmon farm project in Japan, has announced its first export contract – and the target market is Taiwan.

The deal was announced in Taiwan's capital, Taipei, at a joint press conference together with local seafood business Tamsuo and Japan's Marubeni Seafoods, and attended by over 100 participants including 20 media companies and three TV channels.

Amongst the participants were representatives from the HORECA (hotel, retail and catering) market, as well as the retail market in Taiwan.

At the end of the session, Fuji Atlantic salmon was served by sushi chefs to the participants and it received very positive feedback.

The Taiwanese market for Atlantic salmon totals approximately 16,000 tonnes HOG per year, and the fish is now a popular part of the Taiwanese menu.

Proximar said exporting to adjacent Asian countries is part of the strategy to develop demand, also taking future capacity expansion into consideration.

Although the demand remains strong in Japan, building demand from other markets is important to maintain its long-term pricing strategy, the company added.

Proximar says it continues to see strong interest from the Asian markets and is well positioned to supply fish to this high-growth region.

The net price for Proximar's salmon is expected to stay at least at the same levels as for the Japanese market.



Above: Proximar Fuji Atlantic salmon

New Canadian Fisheries Minister facing tough debut

CANADA has a new Fisheries Minister – and this time she comes from province with a strong seafood tradition.

The new minister is Newfoundland and Labrador MP Joanne Thompson (pictured), who has been appointed as Minister of Fisheries, Oceans and the Canadian Coast Guard by incoming Prime Minister Mark Carney. She replaces Diane Lebouthillier, who steamrollered through the ban on open pen farming on the Discovery Islands in British Columbia, which had been introduced by her predecessor, Joyce Murray.

Canada's incoming Prime Minister Mark Carney has appointed Thompson as part of a new team that will contest the next federal election.

It is not known yet if she will offer some relief to the beleaguered salmon sector in BC.

But already Canadian seafood



is facing an immediate potential double tariff blow – from the United States and China.

China has imposed 25% tariffs on many seafood items while the United States has suspended a threat to impose a similar measure.

The Fisheries Council of Canada says tariffs spell disaster for the industry.

"A lot of companies have a big problem here," Alberto Wareham, Council Chairman, said. "We need government of Canada support, we need the provincial government supports across Canada to find a way to keep these businesses going."

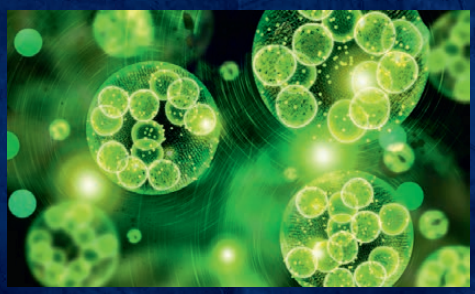
Fish Farmer WEBINAR

In association with our Panel Partner

POSEIDON OCEAN SYSTEMS

HARMFUL ALGAL BLOOMS

Fish Farmer's Algal Blooms webinar will feature a panel discussion on the causes of harmful algal blooms, how prediction can be improved and what mitigating actions can be taken. While algae are part of the marine ecosystem, under some circumstances they can create dangerous conditions for farmed fish, or toxins that can make shellfish unfit for human consumption. We'll be talking to the experts to find out how the aquaculture sector is dealing with the problem.



WEDNESDAY 4 JUNE 2025 11.30 AM - 12.40 PM (UK TIME)

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Processing news

Lithuanian group to build new €100m salmon plant to meet European demand





Top: Vičiūnai processing plant at Plungė
Above: Vici stand
Below: Vičiūnai truck

LITHUANIAN seafood company Vičiūnai and partners (VIP) is starting construction of a €100m (£83m) salmon processing complex.

The facility will be built in the town of Plungė in Lithuania, about 50 kilometres from the coast.

The Vičiūnai group (VIP) described the project as "one of the largest and most modern salmon processing plants in Europe".

The company said: "With the completion of one of the world's most modern specialised plants, VIP will steadily increase its salmon and salmonid processing volumes from 18,000 to 50,000 tonnes per year, placing it among the top five European producers of similar products.

"The expansion is expected to increase VIP's annual revenue from €150m (£125m) to €500m (£418m)."

The factory is being built next to the existing production and warehouse complex of the Vičiūnai Group in Plungė, with an area of more than 13 hectares and a total area of more than 29,000 square metres of new buildings. The area for production alone is more than 16,000 square metres - 4.5 times more than the current production unit.

The group also said that due to uncertainty and the difficult geopolitical situation, large-scale greenfield manufacturing investments in Lithuania had recently declined sharply, so an export-oriented project of this magnitude would be of great significance for the country's economy.

The plant will employ around 900 people when it reaches capacity, and more than 95% of its production will be exported to Western Europe, the US and other Western markets.

'Consistent and patient expansion'

The company said: "The Vičiūnai Group's consistent and patient expansion is paying off with growing demand and undisputed leadership in European markets, while at home we pride ourselves on creating new jobs, providing opportunities for growth and increasing our contribution to the common good in the form of taxes paid and domestic product created. "

It also said that when designing the new plant, it focused not only on state-of-the-art production technologies, but also on sustainability and environmental solutions. The new building will be equipped with a 1.5MW solar power plant on the roof, eliminating the use of natural gas in the process and using all surplus energy for space and water heating. The production process will focus heavily on automation and robotisation of the supply, preparation, packaging and storage processes, not only to reduce manual labour but also to maximise employee safety, the company said.

Dainius Matijošaitis, member of the board of Vičiūnai Group, said: "The new production solutions will not only allow us to significantly increase production volumes, but also to expand our product range. We are responding to the trends in salmon products and consumer habits in the major Western markets, which will lead to a significant increase in the number of packaging types and methods, more fresh and frozen salmon products with spices, and new slicing methods.

"However, Lithuanian consumers remain cautious and conservative in their choice of high-value fish products, so no major changes are expected on the shelves of the country's supermarkets, at least in the near future. This is a bit of a shame, because the demand for salmon, which is farmed under strict rules and has a very high nutritional value, is growing steadily and rapidly in the Western world.

"We hope that a change of attitude in the Baltic countries will also take place in the coming years."



> "We are responding to the trends in salmon products and consumer habits"

Witzøe company snaps up premium salmon brand

THE high quality Norwegian salmon brand SALMA has been sold to the seafood group Insula.

Launched in 2016, the SALMA brand was suspended by its owner Bremnes Seashore towards the end of last year because it had been running at a loss. SALMA salmon had become a particular favourite with sushi lovers.

Bremnes Seashore CEO Linda Litlekalsøy Aase said at the time it had been a difficult but necessary decision.

Now what has been described as Norway's best-known quality brand has gone to Insula, which will be responsible for distribution and further development. The brand is likely to become available in Norway again, probably later in the year.

Insula is overwhelmingly owned by Gustav Witzøe, founder of SalMar (no connection with SALMA) through the family's investment company, Kverva.

It is thought SalMar will eventually take over production of the SALMA products.

Linda Litlekalsøy Aase said: "SALMA has been very important to the history of Bremnes Seashore. We are proud to have built a brand that has set the standard for quality and freshness in the Norwegian market.

"It has been a work characterised by innovation, courage and skilled people at all levels. Now we are happy that SALMA has found a new home at Insula – a company with strong brand expertise, a solid distribution network and, not least, talented and committed people who know the industry well."

Insula Norway said it viewed the acquisition as an opportunity to preserve and further develop a brand with a unique position and quality.

The company's Managing Director, Sigvald Rist, added: "SALMA is a lighthouse in the Norwegian seafood industry and the result of impressive brand building and product development over many years.

"We have great respect for the work Bremnes Seashore has put in, and would especially like to thank Olav Svendsen for his role as founder and driving force behind SALMA."



Winners announced for 2025 Seafood Excellence Awards



Above: 2025 Seafood Excellence Awards winners

SEAFOOD business Icy Waters celebrated St Patrick's Day with a win for a salmon offering that includes Guinness in its flavours.

Icy Waters LLC won the "Best New Retail Product" award in the 2025 Seafood Excellence Awards for its "Atlantic Salmon with a Guinness Sweet Honey Mustard Melt & Panko Crumb". The offering is produced in collaboration with the Good Fish Company of Ireland.

American Unagi Inc won the "Best New Foodservice Product" award for its "Gluten Free Eel Kabayaki Fillet".

The awards were announced at the opening of Seafood Expo North America/Seafood Processing North America in Boston, Massachusetts, North America's largest seafood trade event.

The 2025 winners were selected from a group of 11 finalists during a live judging by a panel of seafood buyers and industry experts from the retail and foodservice industries.

This year's judges included Paul Chapman, VP of Seafood, Stop & Shop; Kimberly Price, Procurement Supervisor, C&S Wholesale Grocers; and Josue Avila, Sr Procurement Category Manager, The Cheesecake Factory. The new products were judged based on several criteria, including uniqueness and appropriateness to the market, taste profile, market potential, convenience, nutritional value and originality.

Out of a total of 68 entries, 11 finalists were previously selected through a screening of market-ready products participating in the Seafood Expo North America New Product Showcase.

Nordic Halibut acquires processor – and launches new equity issue

FISH farmer Nordic Halibut is set to take full control of Måsøval-owned processor Pure Norwegian Seafood, in a move that Nordic says will secure its value chain.

Nordic Halibut has entered into an agreement with Pure Norwegian Seafood (PNS) for the right to use the latter's processing facility on Averøy, it announced to the Oslo stock exchange.

At the same time, Nordic Halibut and Måsøval, the main shareholder in PNS, have reached an agreement that gives the former an option to purchase 100% of the shares in PNS for an undisclosed purchase price.

This assumes that necessary agreements are entered into between Måsøval and the minority shareholders in PNS.

Pure Norwegian Seafood exports fish, mainly salmon, and provides processing and freezing facilities for local farmers.

In January, Nordic Halibut raised NOK 285m (£20m) in a share issue, of which NOK 100m (£7m) was earmarked for increased investments and design improvements related to the Tingvoll facility.

The company said access to the PNS facility on Averøy will be an important factor as Nordic Halibut now aims to scale up volumes to 10,350 tonnes (HOG) in annual production by 2031.

Nordic Halibut CEO Edvard Henden added: "With this partnership, we take the final step towards full control over our entire value chain – from genetics to slaughter, processing and refining. Having control over the entire value chain enables us to maintain the highest quality standards and optimise efficiency.

"By investing in local expertise and integrating all production links, we ensure long-term stability, strengthen our market position and promote economic development in the region."

The production line at the Averøy facility is described as "very flexible" and can process multiple species. The facility also has capacity for hygienic slaughtering, as well as "significant freezing capabilities".



Photo: PNS

Above: Pure Norwegian Seafood truck

Meanwhile, Nordic Halibut said that the subscription period for its offering of the launch of 1,150,000 new shares in the company at a price of NOK 20 (£1.48) per share is expected to raise up to NOK 23m (£1.7m).

• *See International Halibut Workshop report, page 46.*



To stock or not to stock?

Dr Martin Jaffa considers the insights from a study evaluating a ground-breaking restocking programme

Photos: Elliot Roberts



I FIRST met Bob Kindness in the late 1980s after he had moved over to the west coast to provide college courses to salmon farm workers. It was also at the beginning of his journey to bring back wild salmon to the River Carron.

Bob is a passionate angler and was dismayed to find that wild salmon in his local river were few and far between. The problem was that the river spates were so powerful that they were washing the gravel beds away along with any eggs that wild salmon had laid. Bob then committed two cardinal sins. He begged for old equipment from the local salmon farming companies and he began what developed into a long-term restocking programme which over the years boosted catches from almost zero to in the hundreds.

Bob's sins were, first, talking to salmon farmers, and, second, developing a stocking programme releasing fish into the river - fish that others believed could be thought of as being "domesticated". There is a view that stocked fish do not offer the same sport as truly wild fish. These sins have meant that over the years, Bob has never really received the wider recognition that he deserves.

In early March, the River Carron Conservation Association (RCCA) and the Institute of Biodiversity and Freshwater Conservation at UHI Inverness held a reception at the New Club in Edinburgh to announce the results of the second phase of their ground-breaking study of conservation stocking of a river.



The study, funded by Salmon Scotland's Wild Fisheries Fund, looked at the genetic make-up of fish released, and fish caught, and of various different crossings. Over the years Bob has clipped the fins of all the fish caught, and many of the fish released, providing a database of genetic material for UHI to analyse.

The main conclusion of the genetic study conducted by Dr Victoria Pritchard of UHI was that contrary to a wider view that stocked fish do not survive, in some years over 50% of the fish caught on the river were stocked by Bob.

One of the questions asked after the presentation was: "If Bob stopped stocking the river, would the population continue to be sustained?"

Some years ago, a Scottish Government scientist was adamant that the answer was no, but he also believed that stocked fish would not survive, so that answer could be discounted. The answer is that we cannot be certain but the real problem is that there are fewer salmon than ever returning to Scottish rivers, so the numbers will fall regardless of whether the fish are stocked or wild.

Conservation stocking may give rivers like







Opposite: Fry being released into the river
This page from top: Bob Kindness preparing to release the late fry; late fry ready to be released into the River Carron; Bob Kindness

the Carron a chance whilst other small west coast rivers become devoid of salmon.

The report mentions that as expected, genetic material from Norwegian strains introduced by commercial aquaculture escapees was detected in both wild spawning and captive broodstock. However, it was discovered that the stocking programme has not increased the level of Norwegian DNA beyond what would have occurred otherwise.

Diving deeper into the report, it seems that just five fish caught by anglers were likely to be aquaculture escapees, one every year from 2013 to 2019 except 2018, although two of the fish were recorded as wild fish. The genetic analysis also suggested that 69 fish might be hybrids.

What the study doesn't mention is that, back in the 1980s, river managers were queueing up at the door of salmon farm hatcheries to buy young fish to restock their rivers. Genetic markers from any of these fish that managed to subsequently breed are likely to have remained in the wild fish population.

The report suggests that if stocking is continued, there could be opportunities to reduce the levels of Norwegian ancestry, by developing broodstock protocols which involve a quick turnaround testing of wild caught fish before they are used in the stocking programme. It is also suggested that the broodstock should be used for just one year and then released, rather than over a number of years.

I think that the key message of this study is that stocked fish do survive, and do return back to the river. After that, I believe that Darwinian evolution will determine which fish do well and which are unable to compete. What Bob has shown is that it is possible to turn round the fortunes of a river and ensure that salmon return when they didn't before. The difficulty ahead is that the future for all rivers is uncertain, as the declines on the east coast show all too well.

What was most disappointing about this event was the notable absence of anyone from Marine Scotland. They are the ones dictating stocking policy so should have been in the room to learn about this major study. Equally, I didn't see any official representation from the wild salmon representative organisations. Given their commitment to improve the lot of wild salmon, their absence was particularly noticeable.

Stocking still seems to be a contentious issue amongst the wild fish sector, but it is only through research such as that conducted by RCCA and UHI that knowledge of stocking can be improved and decisions made as to whether this is one of the ways forward for wild salmon.

• *See also News, page 11.*

> Conservation stocking may give rivers like the Carron a chance





Tea parties and tariffs

Tavish Scott, Chief Executive of Salmon Scotland, reflects on lessons from a key American seafood event and what Holyrood must learn

MANY moons ago, I studied American history. The Boston Tea Party was a pivotal moment in the republic's emergence, so during my recent visit to Massachusetts for Seafood Expo North America, I walked part of the city's Freedom Trail.

The striking thing about American cities is that buildings of historical importance are dwarfed by skyscrapers. In Faneuil Hall, the reasons why 342 tea chests were dumped in the harbour are explained to visitors.

At the time, it was about much more than tea. It was about power, taxation and control. These issues still define global trade today.

Fast forward from 1773 to 2025. The talk of SENA was tariffs and trade.

Glenn Cooke, the owner and CEO of Cooke Seafood, observed that US consumer demand was the metric to watch. If American households start feeling the pinch, the ripple effect will be felt everywhere.

April 2 has been declared tariff day by the US President. Canada, Mexico and China have already been targeted. The rest of the world is set to follow.



Whatever the implications for the UK, and there will be some, inflation in the US will rise as tariffs push up prices for imported goods, including food.

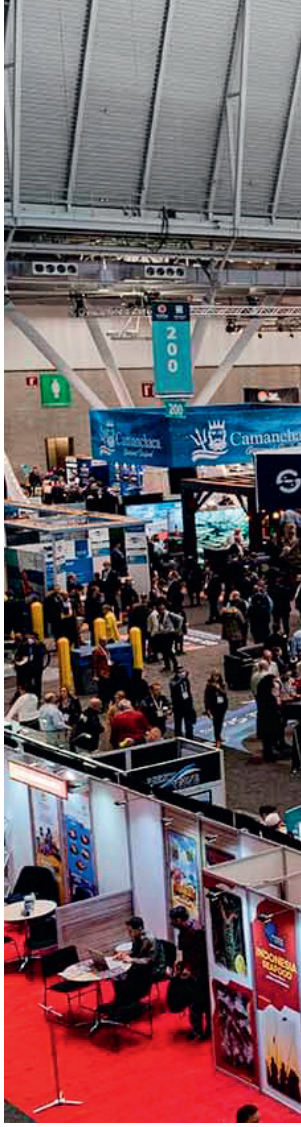


There is a myth that tariffs protect domestic industry. In reality, they often do the opposite.

A tax on imports raises costs for businesses reliant on global supply chains, and those costs are passed on to consumers. In a country as vast as the United States, where much of the seafood industry depends on imports, the effects could be severe.

Trump was elected because ordinary Americans were struggling with the rising cost of living. As much as Trump won, the Democrats who controlled the White House and Senate lost. Governments tend to lose elections rather than the opposition winning them.

Trump has changed his position on tariffs daily. I had always thought he was the ultimate transactional politician, where everything involved a deal. But a deal that puts recession on the table and drives up inflation makes no economic or political sense.



Left: Glenn Cooke
Below left: Faneuil Hall, Boston
Opposite: SENA – Seafood Expo North America

> How the world builds trade policy against this backdrop is a challenge



What does drive Trump? US political author Matthew Wolfe dismisses the idea that he is purely transactional. Instead, Wolfe argues that Trump wants to be the most famous person in the world every single day.

The blizzard of announcements and running commentary on global events are part of that. He is a walking and talking news channel. Whether that is good or bad is for everyone to decide.

How the world builds trade policy against this backdrop is a challenge. Diplomacy requires predictability, yet Trump thrives on chaos. For global seafood businesses, that uncertainty is deeply problematic.

Supply chains are finely balanced, and markets rely on stability. If tariffs become a bargaining chip in a wider political game, businesses in Scotland and beyond will face difficult decisions.

A vision for the West Highlands

Meanwhile, back home, the next stop was Fort William for the West Highland Chamber of Commerce vision event. What does the area need to succeed?

Frazer Coupland and his team ran an excellent day with speakers from many sectors of local and national employment. The big takeaway was the need for a West Highlands manifesto aimed not just at the 2026 Scottish elections but at the UK Government too.

Many key policy areas fall under the UK Government. From rural connections to investment in infrastructure, this part of Scotland needs real support to grow.

For the next West Highland event, attendance by both governments would be welcome.

If decisions are being made without those affected in the room, what hope is there for meaningful change?

The challenge for places like Fort William is ensuring they remain competitive while keeping their unique character. Tourism is vital, but so is investment in jobs and industries that sustain communities beyond the peak visitor months.

Transport links, digital connections and housing all play a role. None of these issues can be addressed in isolation.

That is why economic resilience matters. It is not just about attracting visitors but about strengthening industries that provide long-term security for rural Scotland.

One of those sectors is salmon farming, yet judging by the recent Scottish Parliament debate, you would hardly know it.

Would it have been too much to hope that our politicians in Scotland would lift their eyes to the world around them? Food security is a growing challenge, global events are unpredictable, and yet there seems to be little recognition of the need to support a Scottish sector that produces wealth, employs 12,000 people, and keeps the economy moving.

Based on re-reading the Holyrood debate, with the honourable exceptions of Rural Affairs Secretary Mairi Gougeon and former minister Fergus Ewing, the answer is no.

The usual anti-business rhetoric dominated, with little recognition of the bigger picture.

Scottish salmon is an export success story. It is a world leading product, yet the industry constantly finds itself having to justify its existence. Regulations are necessary, but there is a difference between scrutiny and obstruction.

The sector needs a government that sees the value it brings rather than one that views it with suspicion.

So when politicians come knocking next year asking for your vote, think back to the March debate and ask if they and their party supported our sector. The answer might be quite revealing.

Scottish businesses need politicians who understand trade's impact on money, jobs and livelihoods. For Scotland to succeed, it must engage globally, supporting industries that create opportunities, not indulging ideological opposition.

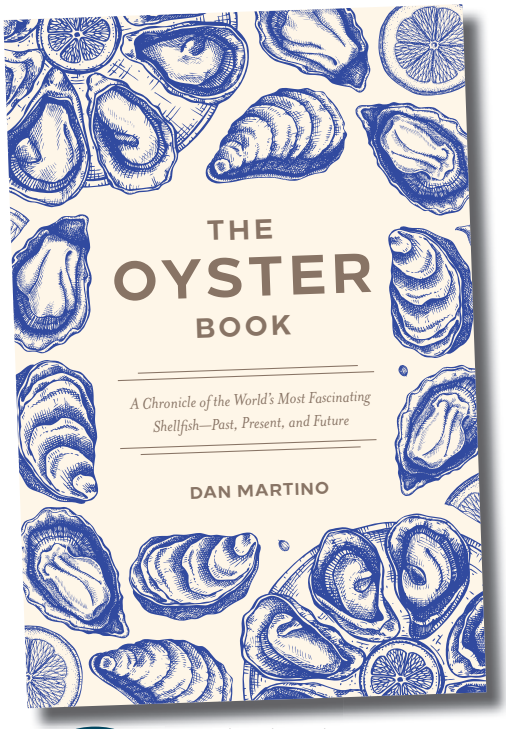
There is a global fight for economic success. America is wrestling with it in its own chaotic way. Scotland must be smarter. ●





The oyster is his world

Nicki Holmyard reviews the latest read for oyster aficionados



OVER the decades, many books have been written on oysters, including *A Passion for Oysters*, by Shirly Line, who was known to many as "Lady Oyster"; *The Big Oyster* by Mark Kurlansky; *Oyster: A World History*, by Drew Smith; *A Geography of Oysters*, by Rowan Jacobsen; and my favourite, *Oyster Isles*, by Bobby Groves.

Brian Bayne's tome, *Biology of Oysters*, offers an in-depth academic study of this bivalve, while children are catered for with books such as *Olly the Oyster Cleans the Bay*, an American publication by Elaine Ann Allen. There are also cookbooks aplenty, from all over the world.

The latest to hit the shelves is *The Oyster Book: A Chronicle of the World's Most Fascinating Shellfish - Past, Present, and Future*, by Dan Martino.

According to the book's flyer, it is "the first to chronicle the global history of oysters, the current state of the oyster farming industry - including a how-to guide for starting a farm - and the promising environmental solutions that oyster farming presents in this age of food challenges and climate change."

Martino knows a thing or two about oysters, having farmed them for over a decade on a four-acre farm off the coast of Martha's Vineyard in the USA, a popular summer destination for the wealthy and famous.

A former TV producer and cameraman, Martino became fascinated by oysters after visiting farms to undertake research for a TV show.

"Over the course of several months of research, I learned about the ways in which oysters can renew ocean environments, feed our growing human and animal populations, combat climate change, and sequester carbon. I filmed oyster farmers on location, and I saw first-hand the sustainability of farming a food without the need for fresh water or nutrient inputs.

"I was hooked. I wanted to be an oyster farmer!" he said.

As a result, Martino quit his career and co-founded Cottage City Oysters with his brother Greg in 2014, and has since added mussels, scallops and seaweed into the mix.

The company also works closely with academic institutions such as Woods Hole Oceanographic Institution and Massachusetts Institute of Technology (MIT).

The brothers have developed a first-class reputation for their Cottage City oysters, which are EU organic certified and which they claim are "one of the most expensive and sought-after in the world".

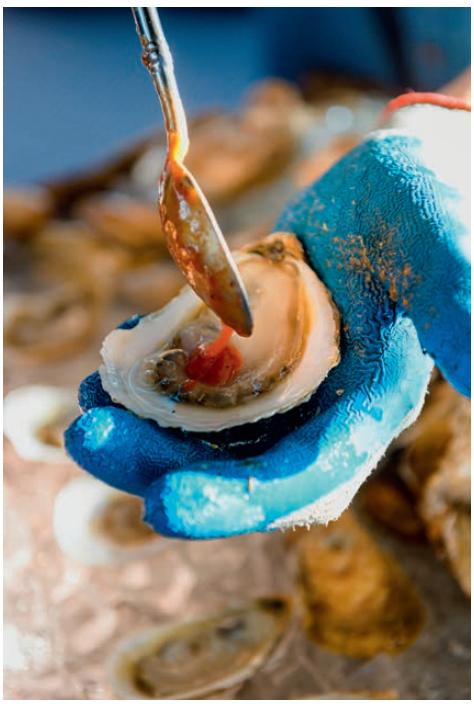
The 300-page book, which is an enjoyable read, started out as research for Martino's own oyster farm tours. The self-confessed oyster obsessive says he wrote it because he had not found one that adequately covered all the aspects of oyster history and production that he wanted to know.

"This is the book I (was) searching for, an all-encompassing journey of everything oysters - past, present, and future," he said.

Back from the brink

Martino reminds us that the oyster is one of the oldest animals on the planet, and shows up in fossil records dating back many millions of years. However, as was the case in the UK, wild oysters in the USA were driven to near extinction by overconsumption and pollution. Today, we see a renaissance for the oyster, thanks to improvements in water quality in oyster-growing nations (although some may like to argue that point!), the development of aquaculture and breeding techniques over the last half-century, and a growing demand from consumers for oysters.

Chapters on global production take a tour through Australia, France, Japan, China, Korea and many US states. The excellent sections on breeding, including the arguments around diploid vs triploid,







plus hatchery, nursery and production techniques, leave the reader in no doubt about the complexities of becoming an oyster farmer, but somehow, also keen to get involved. The book offers many amusing oyster anecdotes, discusses pearl fisheries, the role of the Japanese in shaping the modern Pacific oyster farming industry, the importance of oysters in American culture, and the use of child labour in the USA in the late 1880s – early 1900s to shuck oysters to feed the masses. New Yorkers apparently ate, on average, 600 oysters per person per year at that time, whereas today, the average is just three oysters per person.

Just a handful of the 200+ different species of oysters that exist globally are farmed, and the oyster aquaculture industry has been growing at roughly 5% per year since the 1990s. Improved hatchery technology and techniques have reduced the reliance on natural seed sources and enabled more productive strains to be grown. This is especially important in areas impacted by wild stock collapse. In addition, advances in production gear design and materials have improved efficiency, productivity and the quality of shellfish.

According to EUMOFA, total production was circa 6.4 million tonnes in 2020, which was a 39% increase on 2011. China is the largest producer globally, providing 85% of the total volumes of oyster production. The EU-27 produced 98,000 tonnes in 2020, 81,000 tonnes (83%) of which was grown in France, which is also the largest consumer. It should be noted that these figures are slightly different from those in the book, which uses information from 2018, but are in the same ballpark.

Martino was excited to find that the oyster industry, like that of wine, produces regional variances, and that the species farmed, the techniques used, the water in which they are grown, the sediment type and climate, all contribute to distinctive differences in shape, colour, and especially taste.

"In the wine world, the environmental influences on the product create the terroir... [which is] the taste of the land. … In the oyster world, the French have created a word for these environmental variations: merroir, the taste of the sea."





> "I was hooked. I wanted to be an oyster farmer!

Opposite from top: *The Oyster Book* cover; Cottage City oyster shucked

This page clockwise from top left: Cottage City oysters; Dan Martino left, and Greg Martino; Cottage City oysters at a food event (photo: Marnely Murray); oyster boat

The Martinos have also fully embraced tourism in their business, hosting thousands of visitors each summer on a one-hour trip around the oyster farm. Guests bring their own drinks to accompany a plentiful supply of freshly opened oysters.

Dan Martino enjoys talking about every aspect of oysters with the guests and especially answering the questions that arise. Over the years, he has never ceased to be surprised at how little people know about oyster history or culture and hopes that the new book may go some way to educating the public.

He is a firm believer in the potential of oyster farming to solve a "large percentage of our food and climate change issues," suggesting that growing more shellfish would go a long way towards helping to reduce the effects of climate change, feed a growing population, restore biodiversity and generally repair some of the damage that humans have inflicted on marine ecosystems.

In line with his conviction, Martino also explores how our land-based food production systems risk collapse as farmers try to keep up with growing demand. He considers that oyster farming, on the other hand, which uses no land, has minimal freshwater input, and produces a delicious food that is exceptionally good at capturing carbon, is a necessary component of future climate change solutions.

The Oyster Book: A Chronicle of the World's Most Fascinating Shellfish - Past, Present, and Future by Dan Martino (£21.99, published by Agate Surrey). ●

FISH VETERINARY SOCIETY
Specialist Division of the BVA

Welfare matters

The FVS annual conference 2024 focused on the emerging topic of fish welfare. **Robert Outram** reports on some of the main takeaways



FISH welfare was the theme for the annual conference of the Fish Veterinary Society (FVS), held at Norton House Hotel & Spa, Edinburgh, over 4-5 March.

Introducing the conference was Máirin-Rua Ní Aodha, President of the FVS – she is also a veterinary surgeon with Mowi. She shared the legend of the Salmon of Knowledge, a powerful symbol in Irish mythology, representing wisdom and prophecy, and added that there is still much more to learn from the salmon.



The first speaker was Wasseem Emam, Founder and Director of Ethical Seafood Research. His organisation has been applying the concept of "One Welfare" – which includes animal welfare, human wellbeing, and environmental sustainability – to the tilapia industry in Egypt.

Egypt accounts for 75% of African aquaculture and the industry is predominantly focused on tilapia. Egypt is the third largest producer of tilapia globally. Most farms are based in the Nile Delta and typically use earthen ponds. In Egypt, tilapia is considered a low-cost protein source rather than a premium product like salmon in Europe and North America, making it challenging for farmers to prioritise fish welfare over cost.

ESR began with focus groups involving farmers, supply chain businesses and feed mills. It found a general lack of familiarity with the concept of fish welfare, no monitoring of water quality and minimal record keeping. During harvest, crowding and slaughter processes were issues.

ESR collaborated with specialist teams who travel between farms to slaughter the tilapia, providing them with basic training on fish welfare. The organisation also worked with farmers, with support from FAI Farms, to help them monitor water quality. Additionally, FAI developed a tilapia welfare app to assist the farmers and worked with a behavioural change expert to find strategies to change farmer behaviour.

Emam concluded: "We have improved the lives of around 260 million tilapia through this partnership with FAI."



Daniel Sanchez Lacalle, a Research Manager with not-for-profit organisation Compassion in World Farming, talked about the "One Welfare" concept – "Animals, People, Planet" – as it applies to aquaculture.

As he defined it: "Animal welfare encompasses both the physical and mental wellbeing of an animal as well as their ability to engage in behaviours that are important to them."

He gave as a case study the CIWF campaign on eyestalk ablation in shrimp farming. The organisation was able to show that farmers could achieve the same levels of productivity without resorting to ablation.

Consumers are increasingly aware of welfare issues, he noted. A consumer survey carried out for Eurogroup for Animals found that 71% of consumers agreed that "fish feel pain". 91% said fish should be protected to the same extent as land animals. 69% would like to see rearing and slaughter information on the labels and 61% said fish welfare impacts their buying choices.

Lacalle concluded with three key takeaways:

1. It is useful to take strategic decisions regarding welfare implementation.
2. Communication is essential for this framework.
3. We can shape future aquaculture into something more sustainable and ethical.

Felix Scholz, Head of Clinical Services, STIM UK & Ireland, spoke about "Welfare in a changing marine environment."

On average, sea surface temperatures in the waters around Ireland are 0.4% warmer in the 21st century relative to 1960-1990. About half that increase can be attributed to the Atlantic's normal cycle of temperature changes, and half to global warming.

There has also been a significant increase in marine heatwaves, up to six more per year in some areas, comparing 2000-2016 with 1982-1998.

In 2023 a severe marine heatwave developed in the eastern north Atlantic and in a region west of Ireland, the sea surface temperature reached 4C above average.

This rise in temperatures over the past few years, Scholz said, has been associated with increased environmental challenges. These have included increased instances of phytoplankton and gelatinous zooplankton (jellyfish) and a longer risk period – now April to December.

There is also a higher risk of gill disease and skin diseases, and an increased variety of problematic species, from "Portuguese man o'war" siphonophores (*Physalia physalis*) to toxic phytoplankton blooms.

Managing these risks is not easy, Scholz



said. Understanding the critical thresholds is hard to assess and there are trade-offs – for example, withholding feed is resorted to but how long is too long without feed?

Scholz said: "The challenge is managing multiple diseases, with conflicting management strategies."



Humane slaughter

Professor Jimmy Turnbull, formerly of the University of Stirling, spoke about a project studying slaughter techniques, funded by the Humane Slaughter Association.



Among the key principles for humane slaughter, he said, are: stress free handling; effective stunning with a rapid loss of sensibility; sustained insensibility following stunning; and effective killing, with confirmation of death.

In terms of stunning, he said, in-water electrical stunning (with percussive backup if required) makes for an excellent method. Prof Turnbull said this, combined with killing by percussion and bleeding, with additional percussive stunning if required, could be regarded as "best practice".

Percussive stunning, which is still commonly used, needs very careful setup and is not suitable for small fish or many common species.

Dry electrical stunning has a number of issues, not least because taking the live fish out of the water itself is likely to cause distress.

CO_2, used to suffocate the fish, is "not a humane option… quite horrific."

Welfare considerations should take account of species characteristics, he stressed. For example, percussive stunning is quite effective with Atlantic salmon, but less so for tilapia, which has a skull that protects its brain and can also vary in its structure. There are similar problems with pangasius ("basa").

He gave a special mention to Dundee based company Ace Aquatec, which has been working around the world in countries like Mexico, Honduras and Indonesia to introduce humane electrical stunning.

The science behind stunning can be quite complex, Professor Turnbull stressed. The physics of running an electrical current through water can depend on several factors and the effectiveness of the process can be affected by the "wave form" of the energy as well as the strength of the electric current.

Assessing "insensibility" or "consciousness" is important, he added, but it is something that is hard to define or measure, whether for fish or for humans. It is not a binary question and there are graded states of consciousness and unconsciousness.

Yannick Rohrer, of Fair Fish, spoke about implementing fish welfare in practice in Switzerland where most fish farms are small flow-through farms rearing salmon, perch or pike-perch.

Fair Fish had developed operational welfare indicators (OWIs) covering issues such as farm management, water quality, fish behaviour, external appearance and internal appearance (when a sample fish is examined by a vet).

Farmers were sceptical, Rohrer said, but Fair Fish emphasised the benefits of early detection of problems, and also of incorporating OWIs into routine procedures.

Shannon Davis, of the Shrimp Welfare Project, talked about how the SWP (which is based in the US but largely works in India with Sustainable Shrimp Farms of India – SSFI) had developed a shrimp welfare index. This is a points-based framework assessing a farm against a "gold standard" on criteria such as stocking density, slaughter methods and whether eyestalk ablation is used.

Next steps will be implementation, data collection, engaging other certifying bodies and helping producers to draw up a "roadmap" to better welfare.

Also, Professor Amaya Albalat of Stirling spoke about shrimp welfare at slaughter.

The 2022 Animal Welfare (Sentience) Act introduced in the UK recognised decapod sentience (shrimp, crabs, lobsters etc) – at least in principle. The legislation has not changed (yet) on welfare and slaughter, but retailers and the seafood industry are driving change.

Stirling is now investigating the effectiveness of electrical stunning and other slaughter methods for crustaceans, measuring neurological



Opposite from top: Wasseem Emam (left) with former FVS President Matthijs Metselaar; Felix Scholz; Professor Jimmy Turnbull
This page from top: Rose Ruiz Daniels; Howard Cox; Máirin-Rua Ní Aodha; FVA Panel L-R: Máirin-Rua Ní Aodha; Iain Berrill; Kristian Natland; James Sibley; Sean Black

> We have improved the lives of around 260 million tilapia



readings and visual response. So far, it appears that cold shock is faster – and the aversive reaction seen with cold shock can be eliminated by prior electrical stunning. The next step will be field trials in commercial farms in Vietnam and Thailand.

> We must do better than simply avoid suffering

Panel discussion

The afternoon session began with a panel discussion on welfare, featuring:

- Jonathan Balcombe – author, *What A Fish Knows* (joining online);
- Iain Berrill – Head of Technical, Salmon Scotland;
- James Sibley – podcaster;
- Kristian Natland – Patogen / Fisketimen podcast;
- Sean Black – RSPCA; and
- Máirin-Rua Ní Aodha – FVS – Panel Chair.

The first question was deceptively straightforward: "What does fish welfare mean?"

For Jonathan Balcombe, the key concept was "sentience". As he put it: "The evidence for sentience in fish is very robust. They react to pain and noxious substances, and they problem solve. They are sensitive, and they are vulnerable."



Iain Berrill pointed out that welfare is not an easy thing to define: "Everybody has a view that fish welfare matters, but we tend to have a problem articulating it."

Kristian Natland said: "We should be thinking about freedom from pain, hunger and so on, but we should also think about the positives. We must do better than simply avoid suffering."

Sean Black stressed: "For the RSPCA, welfare is about the quality of life throughout the animal's life cycle."

The panel also discussed the importance of narrative in understanding aquaculture and explaining it to the public.

Trust and transparency were key, the panel agreed. Iain Berrill pointed out there are consumers who don't want to know the detail of how their food was produced, but they do want to know who they can trust.

James Sibley argued the digital side to this is key, and fish farmers need to work together to tell their story.

Communication and earning the "social licence" to operate were crucial, the panel concluded.

However, Jonathan Balcombe warned: "We do need to be concerned about the welfare of the animals we farm, but consumers also have to be aware that they have a choice not to consume the product."

The final session of day one covered the role of AI and technology in forecasting welfare issues. John Costantino, CTO with Manolin, talked about how his company had developed software to systematise the data collected at fish farms.

Rochak Sharma, of Tidal, explained how Tidal combines AI with underwater cameras. This had a number of potential applications, from identifying what makes some individual fish "lice magnets" to predicting growth rates and mortality events, correlated with environmental data.

Gunnar Berg of Aquabyte described his company's machine learning product, which not only can be used for biomass estimation and lice counts, but also can assess welfare based on a scoring system and monitor fish behaviour to spot signs of a fish with problems.

Clinical conclusions

Starting day two, Ezra Herman of Esox Biologics talked about the importance of the fish microbiome – the community of micro-organisms living on and in the fish – and explained the Esox approach to analysing it, which uses metagenomics – analysing genetic material to see which organisms are present.

In the first of the "Clinical Club" sessions, Chris Mitchell of Laxsal gave a report from the Bergen Trinations Conference last year, in which fish vets from different countries compared notes on the emerging threats in different regions, from piscine ortheovirus (PRV) to heart problems.

Richard Hopewell of Ocean Ecology explained the spinal deformity scoring system his company has developed, which allows comparisons between groups and populations.

Rose Ruiz Daniels of the University of Stirling described a study on wound healing that sought to understand why some wounds heal and others do not. The "wound atlas" the scientists developed shows how different types of cells heal at different rates, with the potential for future research.

Howard Cox of Mowi Scotland explained how Mowi had been experimenting with "bubble curtains" using compressed air to protect fish in pens against jellyfish.

Cox described the results as "promising" with a 31% reduction in jellyfish numbers and a positive impact on fish welfare. In particular, the fish were able to feed more regularly as less fasting was required. He stressed: "Maintenance and reliability are key."

Johanna Baily of Patogen gave a talk on gill pathology and how a new approach to the graphical representation of gill health issues could help to communicate complex data.



Also at the conference, delegates heard about a range of topics including the role environmental enrichment could play in improving fish welfare; how observing fish behaviour can give an insight into cumulative stressors; what behaviour can tell us about the welfare of ornamental fish; and the welfare implications of purse seine fishing.

Finally, looking ahead to the future of fish welfare, Sara Barrento of FAI explained how a welfare application for tilapia had been developed and applied in the field, while Alice Di Concetto of the European Institute for Animal Law & Policy gave a European perspective on the protection of fish in law.

The FVS is a specialist group of the British Veterinary Association.

Sponsors for the conference were Aqua Pharma, Aquatreck, Cooke Scotland, Esox Biologics, HIPRA, Patogen, Standard Biotools, The Fish Vet, Scottish Sea Farms, STIM and Ocean Ecology. ●

This page from top: Jonathan Balcombe; tilapia; *L.vannamei* shrimp

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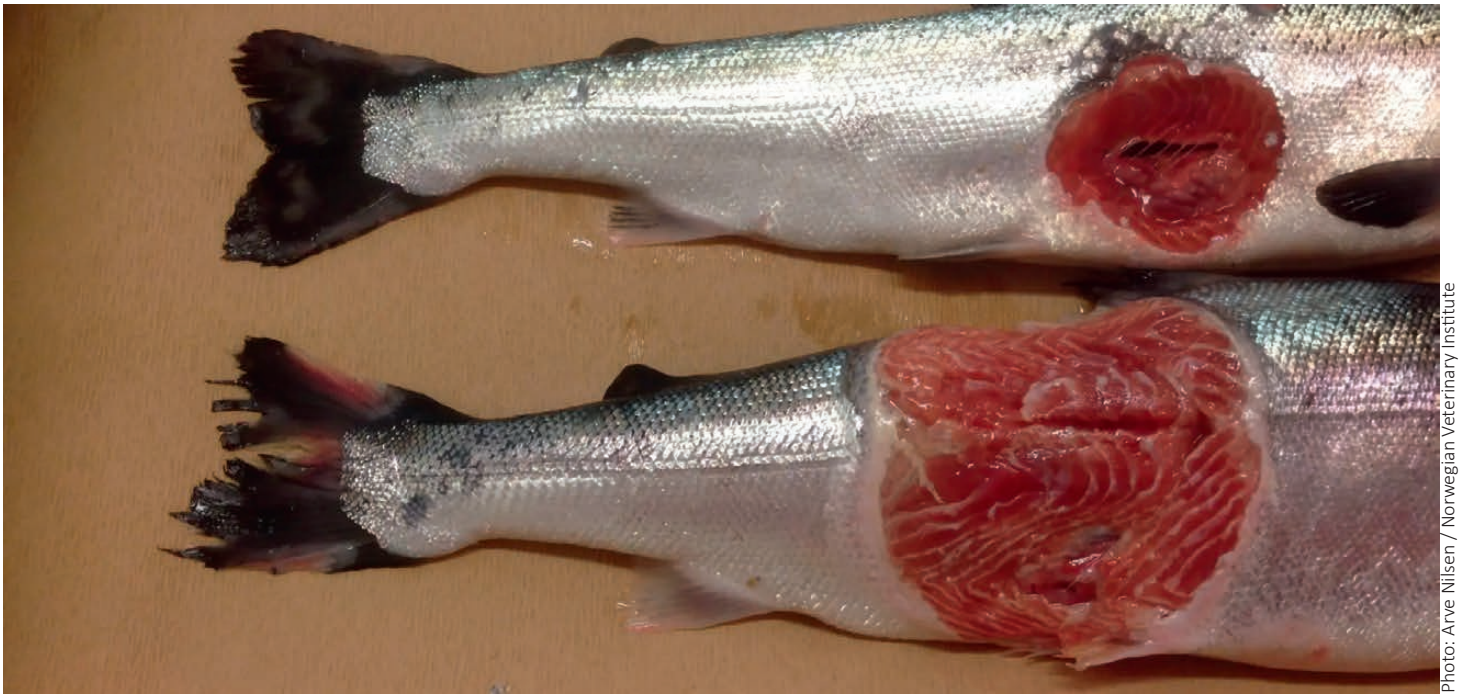


Photo: Arve Nilsen / Norwegian Veterinary Institute

Mortal concerns

Fish losses are falling slightly in Norway's salmon industry but, as the latest official report shows, the numbers are still too high. **Vince McDonagh** reports

'Step in right direction' – Seafood Norway

THE employer organisation Seafood Norway has described the report as a "step in the right direction" but warns against it becoming a resting place for the industry.

The decrease was particularly positive, it says, adding "that there is no such thing as zero risk in biology, but in animal food production, as an animal farmer you have a responsibility to be aware of this risk".

"This is specifically about having a plan and taking the necessary measures to safeguard the health and welfare of the fish in the best possible way based on current knowledge of causal factors and effective measures," says Karoline Skaar Amthor, Specialist Manager and Veterinarian at Seafood Norway.

In addition, the systems must be revised to avoid a recurrence of unwanted incidents, she says, adding with a note of optimism: "For the first time since 2020, mortality is decreasing."

THE effort to reduce the high level of mortality in Norway's salmon farms is proving a tough challenge.

Figures for last year show a modest improvement of 1.3% on 2023's mortalities, but they are still far too high, according to most observers.

To be fair, some of the causes, such as rising sea temperatures are, more or less, currently beyond human control and may only get worse.

But the human factor continues to play an unwelcome part and there is still a lot the industry can do to alleviate what is becoming something of an animal welfare scandal in Norway.

The fish health report is published annually by the Norwegian Veterinary Institute and much of it doesn't make for pleasant reading.

Based on official data, the statistics come from various groups and diagnostic laboratories, channelled through an industry initiative known as AquaCloud which aggregates data from large and small fish farmers.



Ingunn Sommerset, Acting Director of the Norwegian Veterinary Institute, says: "There are still serious health and welfare challenges in Norwegian salmon farming, even though mortality in 2024 has decreased slightly.

"Injuries as a result of lice treatments, wound problems and gill disease are the biggest challenges.

"However, we are seeing a positive development for several viral diseases. However, some bacterial diseases for which there are no good vaccines have had a negative development. We must monitor this closely."

Environmental pressures

Infectious diseases accounted for approximately 33% of the total deaths , "injuries" for around 27%, "unknown cause" for approximately 21%, and "environmental conditions" for 9%, while the other categories accounted for a smaller share.

Environmental conditions played a larger part last year than in 2023, which was mainly down to damage caused by jellyfish, especially in the north of the country.

But inspectors and others ranked injuries after delousing as a significant cause of mortality, with gill disease, jellyfish and wound infections also major issues.

There are some hopeful developments. Disease statistics show a continued decline in the number of cases of pancreatic disease (PD) in 2024. Furthermore, the number of confirmed outbreaks of infectious salmon anaemia (ISA) was below the average for the last 10 years. Both these are viral diseases.

Of the bacterial diseases, winter sores continue to be a major problem, says the report. And while though pasteurellosis has declined in western Norway, some outbreaks

were registered in northern Norway in 2024.

Furthermore, piscirickettsiosis has been detected for the first time in several locations in northern Norway. In addition, problems with bacterial kidney disease continued in central Norway in 2024.

"The detections of piscirickettsiosis, particularly in the north, are probably related to high sea temperatures. If sea temperatures continue to rise, there is a risk that bacterial problems in general will increase in scope," says Torfinn Moldal, Editor of the Fish Health Report.



There have until last year been few outbreaks in Norway in recent years, most recently detected by the Norwegian Veterinary Institute in 2020, but the disease has been an increasing challenge in Scotland and Ireland in recent years, says the report.

When it comes to mortality at sea, the category "dead fish" accounted for the largest losses in the sea phase with 57.8 million salmon and 2.4 million rainbow trout deaths (other categories within "losses" include escapes, fish rejected at the processing stage and counting errors).

This is lower than in 2023 when 62.7 million salmon were registered as dead, but most agree the figure needs to come down much further.

Infectious salmon anaemia (ISA) was confirmed at 13 sites in 2024 and was suspected at a further nine sites.

This is an improvement on the 2023 figure of confirmed cases at 18 sites and suspected at five others. Bacterial kidney disease (BKD) was confirmed at eight sites.

The Institute says that wounds after delousing still affect many locations along the coast every year, but infected wounds can also occur without prior treatment.

Some 289 locations were diagnosed with classic winter wounds in 2024 after infection with the bacterium *M. viscosa* compared to 320 locations the year before.

Around 159 locations were diagnosed with atypical winter wounds or tenacibaculosis after infection with the bacterium *Tenacibaculum spp.* compared to 155 in 2023.

More fish were vaccinated with a new winter wound vaccine last year.

The viral diseases cardiomyopathy syndrome (CMS) and cardioskeletal myositis (HSMB) are among the most frequently detected diseases in salmon in the food fish phase, and both can cause increased mortality following treatments against sea lice.

In the survey, both CMS and HSMB are attributed a certain importance for mortality, although somewhat lower ranked than two or three years ago.

For infectious pancreatic necrosis (IPN), the situation appears to be stable with a low incidence, but the IPN virus was detected in more locations than in 2023.

Salmon gill pox virus (SGPV) was detected in more locations last year than in 2023, but the importance of the salmon pox virus is considered small by the survey.

Sea lice remain the biggest parasite challenge for Norwegian aquaculture, says the Institute. Lice levels were lower in early 2024 than in previous years, but lice numbers increased sharply throughout the summer and autumn.

For four weeks in September and October, the average was over 0.3 adult female lice per fish, which has not been recorded since 2014.

High lice levels were particularly observed in central and northern Norway, and were associated with abnormally high sea temperatures.

Increased biomass of farmed fish in the same areas has also contributed to more lice and increased production of lice larvae.

Humans must also take a fair share of the blame. The report says the number of welfare incidents at salmon hatchery facilities reported to the Norwegian Food Safety Authority increased in 2024 and a large proportion of these incidents were considered serious.

It explains: "Often these will involve human error, water quality and equipment failure. There was a reduction in the number of welfare incidents reported from food fish or broodstock facilities in 2024 compared to the previous year."

The three most common categories of welfare incidents at sea were "Medication-free delousing with handling", "Other" and "Unexplained mortality".

In the survey, damage in connection with handling-intensive delousing operations - and there were more last year – is again ranked highest as a cause of reduced welfare in salmon food fish, while gill disease and jellyfish come in joint second place as a cause of reduced welfare. ●

> "There are still serious health and welfare challenges in Norwegian salmon farming



Opposite from top: Winter sores; Ingunn Sommerset
This page from top: Torfinn Moldal; salmon farm, Hardanger fjord; salmon farm, Norway

Fresh thinking



Two Swedish entrepreneurs have developed a fish farming model that integrates with traditional agriculture. **Robert Outram** reports

JOHAN Ljungquist is used to hearing: "It's not possible."

But Gårdsfisk, the fish farming business he co-founded with Mikael Olenmark, has shown that it is possible to create a land-based system that truly embodies the principles of circularity and sustainability.

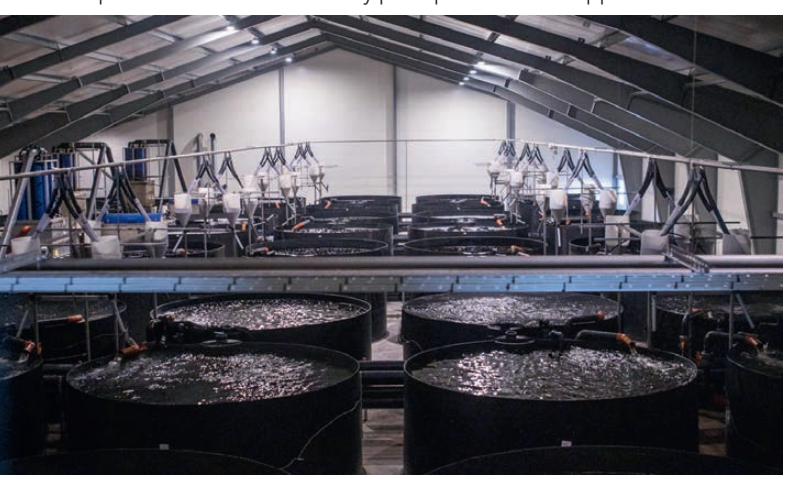
The company, based in Skåne in the south of Sweden, has just raised 50m Swedish kroner (£3.8m) in its Series A funding round. The latest investment was led by Hatch Blue's Blue Revolution Fund and Industrifonden, a Swedish venture capital fund focused on projects with a positive environmental impact. Novax and LRF Ventures, previously the largest current external investors in Gårdsfisk, also supported the latest round.

What did they see in this aquaculture company? Compared to its Nordic neighbours, Sweden lags behind when it comes to aquaculture. The country certainly consumes seafood, but imports more than 80% of the fish that Swedes eat.

Founded in 2013, Gårdsfisk has developed a vertically integrated recirculating aquaculture system (RAS) that enables land-based fish farming with minimal environmental impact.

Johan Ljungquist admits to being fascinated with fish – whether sports fishing or fish farming – for many years, but his experience of nearly five years in the fishing industry in Norway led him to believe that there had to be a more sustainable way to go about it. He went back to college and studied marine biology, focusing on integrated multi-trophic aquaculture (IMTA), an approach that seeks to find the advantages in farming different species of plants and animals together.

Ljungquist and Olenmark started looking at aquaponic systems, but soon realised that this would entail growing a large amount of vegetables and a small amount of fish. Instead, they started to explore how circular economy principles could be applied to RAS farming. How can a fish farm best be integrated with a conventional farm growing crops?



One key implication was that they had to work with freshwater species. Ljungquist says: "If you look at the global market, we have to produce another 100 million tonnes by 2050, but we really need to do it in a sustainable way. So we went back to the drawing board and listed everything that we wanted to solve.

"We wanted to have different species. We wanted to have robust species so we didn't have to treat them with antibiotics, and we wanted to feed them with a plant-based diet.

"We wanted to have freshwater species so we could use the irrigation water or the outlet water from the fish for the fields. We wanted to use the effluents from the fish as fertilisers on the fields."

Very few plants can tolerate salt water, so a seawater fish like salmon was out of the question. Instead, the founders have opted for trout – on a small scale – and two species that are already farmed extensively, albeit not in the Nordic region.

Gårdsfisk raises Nile tilapia (*Oreochromis niloticus*) and – the biggest part of its production – African catfish (*Clarias gariepinus*). This itself created another challenge. Catfish is a popular food in many parts of the world, but is not a traditional part of the Swedish diet. African catfish does have some advantages, however, as Ljungquist stresses. For example, it can grow to harvest size in seven months from hatching. While tilapia is also a fast grower, an African catfish can grow to 2.2 kilograms in that time, while

This page from top: African catfish (*Clarias gariepinus*); Tilapia (*Oreochromis niloticus*); inside the farm

Opposite from top: Branded products; the Gårdsfisk farm; the Gårdsfisk team

> When you don't have any money, you have to invent everything yourself

the tilapia will have only reached around 600-700 grams.

The catfish can also tolerate higher stocking densities and they are resilient fish – Gårdsfisk has not yet had to resort to antibiotics, for example. They can also take a lot of their oxygen directly from the air, so they could survive a temporary failure of the RAS system for much longer than most species.

As a product, Ljungquist adds, catfish has firm flesh that retains its moisture: "Even if you're the worst home chef ever, you can let it be on the frying pan for like one and a half hours and it's still juicy inside!"

That property also helps in processing catfish. Ljungquist says: "You can use it as a meat alternative… we can make meatballs, hamburgers, we can make fish fingers, fish nuggets, and it's really neutral in the taste and rich in omega-3 fatty acids. So I think that parents can get their kids to eat more fish, pretty much without knowing that they are eating fish."



Gårdsfisk started with the acquisition of a run-down farm, and a major construction project to make it fit for use. The founders soon discovered that they would also need to build their own RAS system – off the shelf alternatives proved to be prohibitively expensive.

As Ljungquist explains: "When you don't have any money, you have to invent everything yourself. So we started building systems and it was pretty much trial and error."

Fortunately Mikael Olenmark had a background in engineering and the pair were able to combine their skills.

The renewable theme also applies to the farm's energy supply, which includes solar panels and renewable energy from the Swedish electricity grid.

The RAS system at Gårdsfisk has been designed to be low-cost but also to make maintenance as easy as possible. Now, the business primarily produces African catfish (around 300 tonnes annually, which is expected to up to 400 tonnes this year), with a smaller amount of trout (20 tonnes annually) and a small amount of tilapia.

As a side stream, by-products from processing the catfish will be used to contribute to the trout feed – reducing the dependence on wild caught marine ingredients.

Now, as well as production at the original site, Gårdsfisk's business model involves collaborating with other farmers who produce fish in addition to their crops and terrestrial livestock. Gårdsfisk provides them with the equipment and technical expertise, and licenses the software. At the end of the growing cycle, the company also purchases and processes the fish. This decentralised approach is seen as more sustainable and less risky than large-scale centralised facilities.

It's a model Ljungquist believes would be



easily transferable to neighbouring countries such as Finland, Denmark or Germany: "We use around 50 litres of water per kilo to produced catfish, which is very little compared to beef, and you can of course use the water as irrigation, either in a greenhouse or on the field. So even in the regions where you have very little water, you can use it through the fish system before you irrigate your tomatoes, or cucumber or whatever."

Gårdsfisk's hatchery, GF-Hatchery, also sells fry to fish farmers in 45 countries around the world, including selling African catfish to Africa. The quality of the fish and guarantee that they are disease-free are major selling points.

The future – if Gårdsfisk's catfish can become profitable in Sweden then it should be easier to enter other markets such as central Europe, where catfish is a traditional part of local cuisine, Ljungquist believes.

The company will be using the capital from the latest fund-raising exercise to double its revenue by 2026 and further build the brand in the Swedish market.

Georg Baunach, Managing Partner at Hatch Blue, is looking forward to the next phase of the project. He says: "Gårdsfisk has impressed us with the high quality of their farming system and their product. It is a truly mission-driven organisation and their commitment to creating a positive environmental impact aligns perfectly with our mission to change the aquaculture food system.

"I'm very excited to work with Johan, Mikael and the team to support the next phase of commercial growth." ●







Risky exposure

A recent study suggests that wild salmon in the vicinity of fish farms face a higher risk of infections

HOW much of a threat do farmed fish present for their wild cousins? Much of the research on the interaction of wild and farmed fish has focused on sea lice, but a study by researchers at Fisheries and Oceans Canada investigated the role of infectious agents.

Could concentrations of farmed salmon enhance the risk of infections for wild fish in the area?

The study, "*Infectious agent release and Pacific salmon exposure at Atlantic salmon farms revealed by environmental* DNA" (A Bass et al, *Scientific Reports*) was carried out by a team at the Fisheries and Oceans Canada's Pacific Biological Station.

As their paper explains, domestic animal production facilities can be difficult to isolate from their surrounding ecosystems, especially as regards infectious agents, which can be carried by wildlife vectors or even by the flow of air and water.

This can entail a risk to livestock, such as brucellosis transmitted from wild ungulates to cattle in North America, or avian flu transmitted to farmed poultry as we are witnessing with the unprecedented ongoing H5N1 pandemic.

The risk can also go in the other direction, however. As the study puts it: "Compared to other types of animal production facilities, net pen aquaculture faces enhanced risk for IA [infectious agent] transfer because nets provide no barrier against the flow of water, which can both convey agents long distances and provide a matrix within which they may persist.

"In marine aquaculture regions, IAs can be transmitted horizontally between high density culture populations that are in close proximity to one another and through movement of equipment and personnel between facilities.

"While it is well established that large numbers of cultured stock are lost to wild-domestic transmission, the evidence of domestic-wild transmission impacting wild aquatic populations is much sparser due to the difficulties in observing mortality and sub-lethal effects in wild populations.

"However, studies have demonstrated that wild fish species (and in turn, their predators) are attracted to active aquaculture sites due to abundant and consistent nutrient subsidies in the form of feed and waste, as well as the presence of a physical structure."

Assessing the threat to wild fish is based on three factors:

- "Release" of infectious agents (IAs)
- "Exposure" of wild fish to IAs; and
- "Consequence", that is how likely is it that exposure would lead to a negative outcome

For the third factor, "Consequence" the study relied on existing literature, but the other two factors were tested by analysing environmental DNA ("eDNA").

This relatively new technique involves testing nucleic acids in the water to gain an idea of which species are present – both in terms of the wild fish and the organisms that can cause infection.

Since eDNA in seawater degrades, the presence of these acids is a clear indication that the species concerned is present or has been present very recently.

The study used a novel dataset featuring eDNA detections of Pacific salmon and IAs to inform the potential release of dozens of IA taxa from net pen aquaculture sites and exposure of Pacific salmon to these releases.

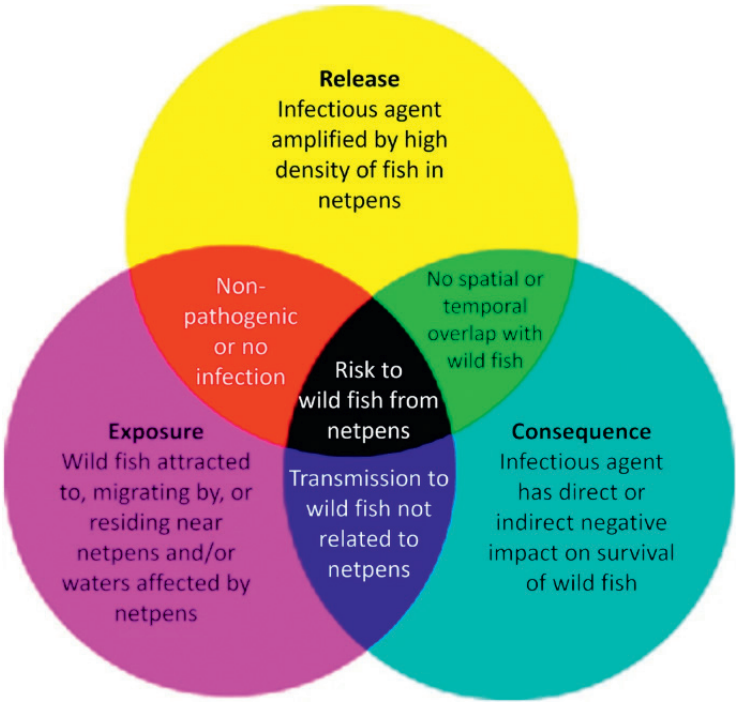
Environmental DNA samples were collected at active and inactive net pen sites (fallow or decommissioned) to compare the presence of both Pacific salmon (exposure) and IAs (release) between active and inactive sites. The researchers drew information regarding the impacts of these IAs from the literature to score the consequences of infection for each of the various taxa.

While the results should not be seen as a formal risk assessment, the researchers stress, they do indicate where the problem areas might lie.

Chinook at risk

The wild species deemed to be most at risk was the chinook salmon (*Oncorhynchus tshawytscha*). Chinook were found to be more in abundance near active sites than inactive sites.

In terms of IAs, the researchers determined that *Tenacibaculum maritimum*, *Tenacibaculum finnmarkense*, *Ichthyobodo*



spp, and *Piscine orthoreovirus* are potential risks to Pacific salmon exposed to marine net pen aquaculture.

Arthur Bass, an Aquatic Biologist with the Molecular Genetics Laboratory, Pacific Biological Station, Fisheries and Oceans Canada, and one of the report's authors, explained: "*Tenacibaculum* has been found in many oceans across the globe and thus we believe it originated in wild (non-cultured) organisms. Thus it is likely that in BC, *Tenacibaculum* was (or is repeatedly) transmitted from wild fish to cultured fish.

"Once within a farm, however, an infectious agent may become more spatially 'established' – more so than it would be in a population of migratory salmon. In the example of *Tenacibaculum*, this bacterium is adept at forming plaques on the various structures found at aquaculture facilities which may contribute to its persistence over time. But what we are concerned with in this study is that once an infectious agent is occurring at a farm, it is in ideal conditions for rapid growth and subsequent release into the environment at much higher levels than would be observed in the absence of active aquaculture – and this is exactly what we saw with *Tenacibaculum* in this study and in Shea et al (2020) [another recent Canadian study that also used eDNA].

"The concern is that this scenario creates an unnaturally high and consistent 'point source' for *Tenacibaculum* to which nearby wild fish could be exposed (including chinook salmon, which our study indicated are more likely to be detected at active farms than inactive sites)."

Tenacibaculum is the IA linked with tenacibaculosis, an ulcerative disease that causes high mortalities for various marine fish species worldwide. Several external clinical signs can arise, including mouth erosion, epidermal ulcers, fin necrosis, and tail rot.

Also, some IAs may actually be present because of the introduction of farmed Atlantic salmon in the Pacific.

Bass explains: "There is one virus called PRV1 which phylogenetic analysis (*Mordecai et al 2021*) indicated was moved from the Atlantic Ocean to our region sometime in the 1981-1997 range.

"Another similar study from our region suggested it was a broader range – sometime in the 20th century (*Siah et al 2020*). Exactly how PRV1 was physically moved to our region cannot be demonstrated – Atlantic salmon were moved to the Pacific ocean first for some failed attempts at establishing hatcheries with these fish and then later on for aquaculture.

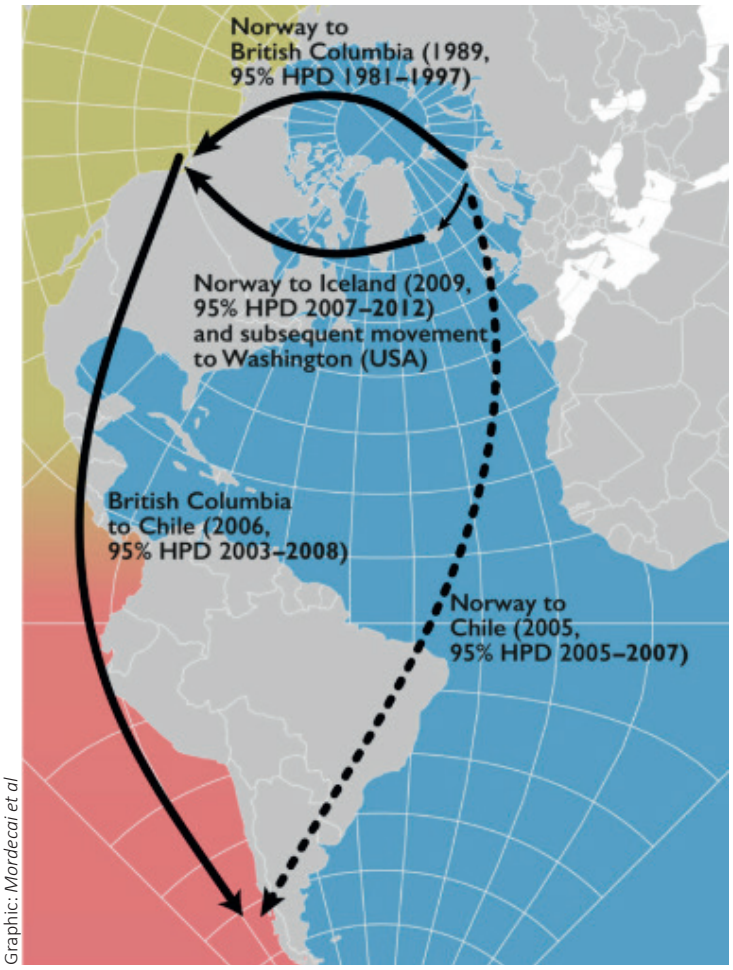
"Both the above studies did indicate with some certainty that an Icelandic strain of PRV1 was moved to nearby Washington State in 2016, and following escape, some fish with that strain were sampled in BC. While not being the first instance of PRV1 in our region, the Icelandic strain demonstrates the mechanism of movement through shipping aquaculture broodstock."

The study does not come with policy recommendations, but there is a clear implication that we need to understand the possible interactions with both wild fish and infectious agents when siting farms, and when deciding when to take action to deal with pathogens found in farms.

Bass says: "The basic science tells us that reducing the amount of infectious agents released will reduce the risk of domestic-wild transmission. So any actions farmers can take to minimise infection and release would be beneficial. Perhaps eDNA could be useful for detecting agents prior to full blown outbreaks and thus taking preventative action earlier than if they were waiting to see sick fish.

"A great place to start conservation efforts for wild fish is to look for places where human activities elevate potential sources of mortality and changes can be made quickly. In the case of predation, one such example could be moving log booms (which provide attractive artificial haul-out locations for seals) away from salmon estuaries, and in the cases of sea lice and infectious agents we could find ways to minimise their elevated release from net pen aquaculture, or the exposure to wild fish." ●

> "Once an infectious agent is occurring at a farm, it is in ideal conditions for rapid growth



Graphic: *Mordecai et al*

Opposite: Chinook salmon
Above: Venn diagram graphic
Right: PRV1 virus spread

Open seas



Norway's offshore salmon farming ambitions appear to extend to Shetland, as **Sandy Neil** reports

NORWAY'S SalMar has identified Shetland as a possible location for its proposed new generation of offshore fish farms. Why might SalMar be looking beyond Norway, and what could this mean for Scotland?



Currently fish and shellfish farms are located in sheltered bays and lochs, but the salmon industry is moving more and more offshore into the open sea, due to a lack of inshore site availability.

Just a few years ago, salmon farming in these exposed locations seemed unfeasible, but thanks to improved engineering, and remote monitoring and control technology, it is now possible, if not necessarily profitable.

Ole Fretheim, Head of Aquaculture Technology at Seafood Norway, says: "Aquaculture at sea represents a gigantic opportunity for Norway, not only to increase food production of sustainable proteins, but also to secure Norway's position as a leading seafood nation in the future as well."

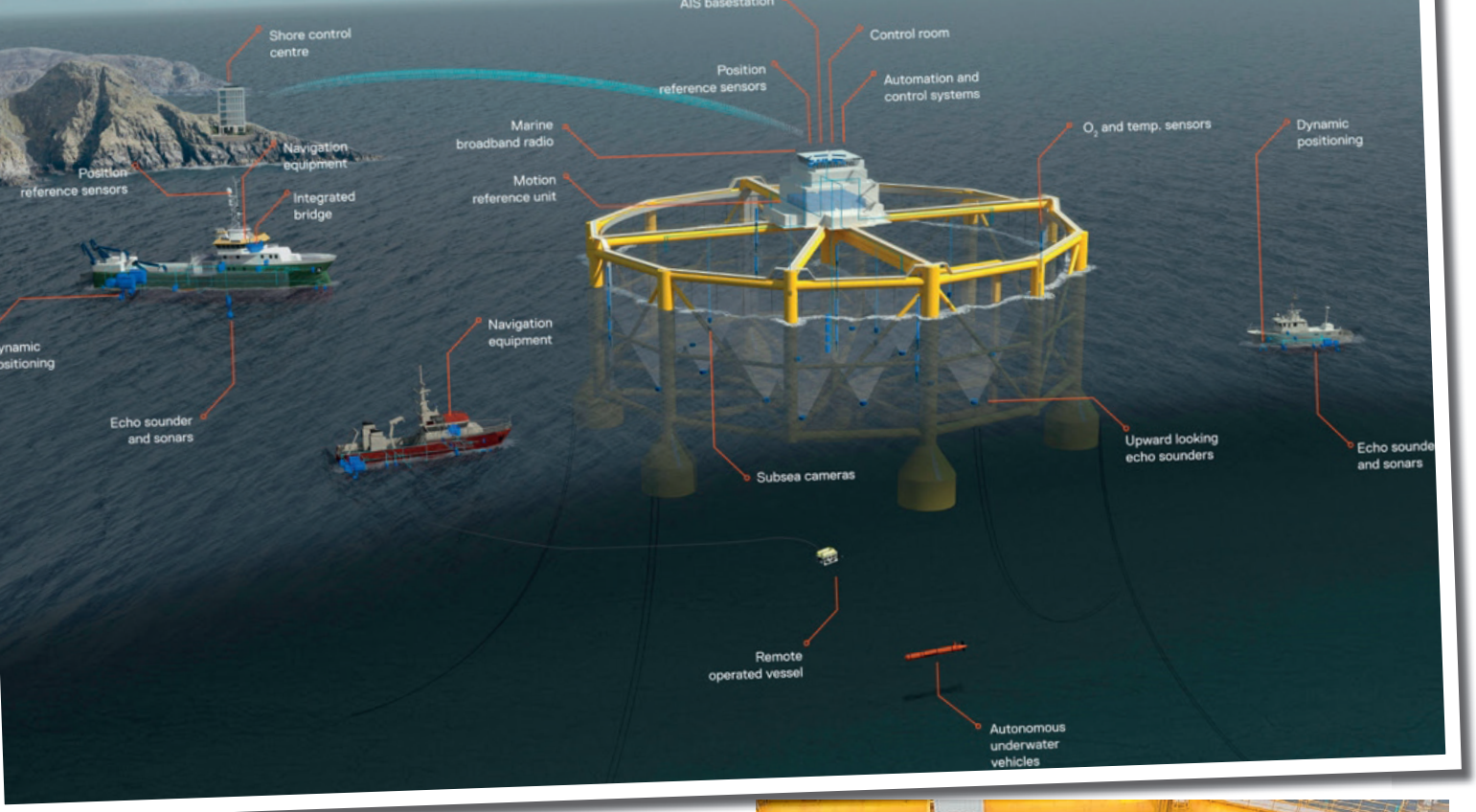
The world's first offshore fish farm, called Ocean Farm 1, began operating in 2017, run by Ocean Farming, a subsidiary of SalMar Aker Ocean, a company formed by Norwegian salmon farming heavyweight SalMar (which owned 85%) and offshore engineering company Aker. Ocean Farming was to become "SalMar Aker Ocean" and now, with its 100% acquisition by SalMar in a surprise announcement in March this year, "SalMar Ocean". The deal involves acquiring Aker's 15% stake consisting of a million SalMar shares and cash worth NOK 76 million (£5.4m). Whether this means SalMar wants to accelerate the programme or mothball it, is still unclear.

When SalMar launched the venture with the industrial investment group Aker, Salmar Aker Ocean said the aim was to go worldwide with offshore salmon farming with the aim of providing the world's most reliable and intelligent operation.

But now, SalMar said, "following extensive evaluations and discussions, the two partners, SalMar and Aker, have concluded that the technological development and opportunities for offshore/semi-offshore aquaculture, both within and outside Norway, can be more effectively managed as an integrated part of the SalMar group. The same goes for evaluating technical and regulatory frameworks across locations and production areas."

SalMar's Strategy Director, Runar Sivertsen, said the company would continue to develop offshore farming, but it depended on regulatory developments and the capital needed for a particular





project. A statement added: "SalMar's ambitions and plans for offshore and semi-offshore aquaculture in and outside Norway remain unchanged."

SalMar Aker Ocean is now changing its name to SalMar Ocean. Its new Managing Director, Anders Fjellheim, said: "Through several production cycles in our facilities, we have already demonstrated and documented good results, and we have identified interesting and relevant new projects both in Norway and elsewhere."

Frode Arntsen, CEO of SalMar, added: "Our ambitions and plans remain unchanged. Realising offshore aquaculture is one of several challenges that the industry and we at SalMar must solve to continue to grow and produce healthy salmon on the salmon's terms. Now, we at SalMar will together lift SalMar Ocean further to realise the significant potential that lies in offshore aquaculture."



Boom times ahead - maybe

Norway could be on the cusp of an offshore aquaculture boom – if key challenges are addressed. Analysis by Menon Economics and research organisation SINTEF found "significant potential" for increased production and value creation for offshore aquaculture, with Norway leading the way in innovation and regulation. As well as SalMar, companies like Nordlaks have invested in this field.

A scenario analysis within the report estimated that, in a year of significant activity, offshore aquaculture could generate a total value creation of NOK 13.9 billion (£1.02 billion) and support around 7,400 jobs.



The authors suggested a conducive tax framework, including the application of resource rent tax, the so-called "salmon tax", to offshore aquaculture, could further incentivise industry growth. The "salmon tax" is a 25% tax on the value added to farmed salmon and trout during the sea phase and comes on top of Norway's 22% tax on profits, taking the tax level to 47%.

"For the actors to be willing to take that chance, the uncertainty surrounding the development of offshore aquaculture should be reduced as much as possible," the report states.

It goes on: "It will be important for public authorities to give clear signals to the actors that if public requirements regarding safety, environmental sustainability, coexistence, etc, are satisfied, permission

Opposite from top: Ocean Farm 1; Ole Fretheim; Nordlaks' Havfarm 1 is an alternative offshore farming concept

This page from top: Ocean Farming AS experimental offshore farm, supported by Kongsberg Maritime AS, was a precursor to SalMar's Ocean Farm 1; Scotland's Cabinet Secretary for Rural Affairs Mairi Gougeon visits SalMar Aker Ocean, 2023

> Aquaculture at sea represents a gigantic opportunity for Norway



to expand production will be granted."

Last April, SalMar chairman Gustav Witzøe said the company won't develop a fully offshore farm in Norway until the government extends its "salmon tax" to offshore developments. Offshore farms will require considerable investment and time before becoming profitable and the rationale for Witzøe's request appeared to be that if offshore farming has a ground rent tax applied now, salmon producers can offset that expenditure against their tax bills, effectively getting a government subsidy to develop offshore.



Even though the Norwegian government has mapped out three sea zones as testbeds for offshore aquaculture, "Norskerenna sør", "Frøyabanken nord", and "Trænabanken", development so far has been slow largely due to lack of official action.

Last year, the Ministry of Trade, Industry and Fisheries assessed the possible environmental impact of salmon, trout and rainbow trout aquaculture. The results will be decisive to decide whether all or parts of an area are suitable for offshore aquaculture, and which parts of the area should be advertised first.



The Norwegian government was due to announce its first fish farming "far out at sea" licences in the New Year. "This is an important and correct step by the Minister," welcomed Ole Fretheim, Head of Aquaculture Technology at Seafood Norway, in August 2024. "Since the establishment of the Hurdals platform, the Støre-led government has had a stated goal of developing a separate licensing regime for farming at sea."

The Hurdals platform is the agreement that set out the basis for Norway's governing Labour-Centre Party coalition, under the premiership of Labour's Jonas Gahr Støre.

Ole Fretheim continued: "It is therefore important that the first offshore licences are now awarded so that the aquaculture nation Norway can continue to develop its globally leading position."

Waiting for a government green light

With no announcements by March, we asked the Norwegian Ministry of Trade, Industry and Fisheries when the licences are due to be awarded, but it did not respond by the time we went to press.

Meanwhile, following years of planning and collaboration with government agencies, the Ministry has released a proposal for new regulations aimed at expanding offshore aquaculture.

It seeks to address the technical, logistical, and safety challenges of operating in harsher sea conditions, such as stronger waves, currents, and winds. The regulations are designed to provide predictability for investors, improve safety for workers in remote locations, and ensure the well-being of both fish and the environment.

The Scottish Government is also keen to explore offshore potential. Its Vision for Sustainable Aquaculture vows to encourage offshore development, defined as between three and 12 nautical miles off Scotland's coast.

This year SalMar has been sounding out community groups in Shetland over a possible "exposed" fish farm, reported Shetland News in March, partly because development of an offshore sector in Norway appears to have stalled in the face of regulatory and tax issues, while Scotland is seen as more open to the idea.

SalMar Aker Ocean (as it was then) gave a presentation to Yell Community Council on January 25. The minutes, from the meeting in Mid Yell School that night, record that its Manager of Sites and Regulatory, Kjersti Bruserud, and its Chief Operating Officer Anders Fjellheim spoke

> "Our ambitions and plans remain unchanged

This page from top: North Sea from space; Sheila Keith; Trine Sæther Romuld
Opposite from top: Fishing boats; Ocean Farm 1 lowered

about "…a potential exposed aquaculture east of Shetland. They introduced SalMar Aker Ocean, Ocean Farm concept and operation, Ocean Farm potential at Shetland."

Trine Sæther Romuld, who was Chief Financial Officer at SalMar Aker Ocean (she has since announced her decision to step down following the takeover by SalMar), told Shetland News that the potential area has not been narrowed down yet. Romuld said SalMar Aker Ocean has been exploring "international opportunities", with the north-east of Scotland being one region in the company's sights.

"The entire eastern side of Shetland is considered prosperous for exposed aquaculture, ie further offshore than traditional aquaculture," she said. "We have a good dialogue with the relevant authorities and we are in the early phase of community engagement."

Romuld said SalMar Aker Ocean has experience in producing salmon in exposed areas in Norway, with "very strong biological results". This is "by using technology able to operate in [a] harsher environment but at the same time on the terms of the salmon". Romuld added: "Our ambition is to bring this experience and expertise also to other regions."

Fishing friction

Local fishermen, however, are not happy with the idea of a large structure out at sea, telling the paper that it could be another element of spatial squeeze alongside offshore wind farms.

Shetland Fishermen's Association Executive Officer Sheila Keith said SalMar Aker Ocean presented its ideas to the association in mid-January, and it had been advised that the Scottish Government was interested in its offshore developments.

Keith added that, from the association's point of view, offshore salmon farming potentially "creates the worst of both worlds" for the fishing industry. She said there would still need to be "nursery sites" located inshore to grow salmon before they can go offshore.

"From a fishing point of view, we'll be squeezed inshore and offshore," she said. "What's the next thing? We've got offshore wind, we've cables, we've got environmental protection measures.

"We really need to do the best we can to ensure that we can all be good neighbours in an environment where ultimately the profits of the fishing industry stays here and doesn't go outside like salmon farming."

The Scottish Fishermen's Federation (SFF) echoed the concerns of the Shetland Fishermen's Association.

SFF's Chief Executive Elspeth Macdonald said: "Scotland's fishing industry, including in Shetland, is facing an unprecedented 'spatial squeeze' where our sector is facing progressive and long-term loss of long-established and productive fishing grounds through the expansion of other sectors such as aquaculture and offshore wind farm developments, and through government policies on issues such as nature conservation.

"SFF expressed its opposition to the Scottish Government's recent proposals on extending marine planning zones out to 12 nautical miles because this will lead to further spatial conflict between commercial fishing and aquaculture, and because salmon farm developments further offshore may also lead to increased safety risks.

"Fishermen already experience problems with entanglement with ropes and other equipment that has become detached from fish farms and we do not want this problem to extend further offshore, where the risk of damage to aquaculture infrastructure will be greater due to harsher weather.

"Furthermore, intensive fish farms may create pollution risks that could impact on important wild fish and shellfish stocks within the 12 nm zone, and we are also concerned that the development of fish farms further offshore may create





connectivity that could spread disease and invasive non-native species.

"We recognise that aquaculture creates important economic activity around Scotland's coast and islands, and is an important part of both Scotland and the UK's export trade, but SFF does not support the expansion of aquaculture out to 12 nautical miles, as we believe that this will have a range of impacts on our sector that have not been properly considered or addressed."

Innovation welcomed

The Scottish Government, when asked if it was interested in SalMar Aker Ocean's offshore salmon developments in Norway, responded: "Innovations in technology mean that farms can now be located in more exposed locations and siting farms in higher energy waters has the potential to reduce environmental interactions and to support fish health and welfare.

"We are aware that there is growing interest from the aquaculture sector in developing farms further from the shore in more exposed locations, with a number of aquaculture businesses having approached us in recent years regarding the regulatory processes for consenting farms located between three to 12 nautical miles.

"Work is currently underway to clarify the consenting process for aquaculture developments between three and 12 nautical miles, including our recent consultation on fish farm planning controls."

The next steps in offshore fish farming will depend, therefore, on how quickly the governments in both Norway and Scotland can move to update regulations and the tax system – and, crucially, on the big salmon farmers' appetite for risk.

• *See also Vince McDonagh, page 44.*





Good neighbours?



> Several hazards and risk aspects have already been identified

How can offshore fish farms, wind turbines and fishing crews share the same seas safely? As **Vince McDonagh** finds, this question is already being addressed by the Norwegian Directorate of Fisheries

ANYONE who has flown across the North Sea over the past few years cannot help but be awed by the number of static structures in the water.

Hundreds of wind turbines, oil rigs, gas platforms and static barges scattered across its 675,000 square kilometres go to make a vast picture of offshore activity that was not there two or three decades ago.

Now they may soon be joined by offshore salmon farms and it is a development that has both the marine authorities and fishermen worried.

Norway has already designated the first three areas for this new form of aquaculture, with a fourth site just east of Shetland also in strong contention.

This news is concerning local fishermen who already have to navigate dozens of other obstacles as they go about their work.

The Norwegian Directorate of Fisheries last year commissioned risk management specialists Safetec to investigate various safety aspects (and hazard possibilities) between aquaculture at sea, fishing and offshore wind.

The investigation took as its starting point the possible dangers these three activities can expose each other to, but it also looks at safety-related relationships with activities such as shipping and petroleum.

The recent collision off the Humber between an American military jet fuel tanker and a Russian crewed container vessel dramatically demonstrated this last danger.

The number of offshore North Sea salmon farms is going to multiply over the next

Top: Fishing boat
Above: Offshore wind farm
Opposite: Fishing boat with wind farm in the distance



couple of decades as pressure to move away from coastal sites grows.

SalMar, the company looking at Shetland, has big plans and Bakkafrost in the Faroe Islands is seriously considering this latest development. Others will follow.

The Directorate says the Norway investigation is based on an analytical approach where relevant literature has been reviewed, and relevant professionals and representatives from the industry have been involved.

The report finds that wind farms in the vicinity of offshore aquaculture structures can have both positive and negative synergies around safety.

The report has mapped possible risk and safety aspects of offshore aquaculture in the vicinity of offshore wind installations; security-related synergies of co-existence; as well as what distance between offshore aquaculture and offshore wind is acceptable in terms of safety. In addition synergies with regard to safety are considered.

The identification of common dangers, and how the industries affect each other, forms the basis for the assessments and recommendations given regarding safety distances and safety-related synergies between the industries.

The findings from the investigation indicate that the required safety distances for different groups of fishing gear vary widely and depend on many different factors.

Necessary safety distances have been discussed and exemplified, but it is difficult to give general recommendations that take into account all the factors, including variations with respect to location-specific conditions.

Instead of closing off large areas to fisheries, it is recommended to create "caution areas" or safety zones around aquaculture and energy-related structures that take location-specific conditions into account.

These areas will be designated as places with possible dangers, where fishermen should be careful or should not travel or fish. Several other risk-reducing measures have been identified in the study that the Directorate hopes will increase safety when fishing in the vicinity of various structures.

The investigation discussed how vessel movement needs can be solved in different ways. This can be solved by allowing fishing boats to cross offshore static structures or by creating traffic corridors and safe routes through such sites.

The directorate believes there will be large local differences and warns that these must be taken into account when choosing a solution for facilitating shipping and fisheries.

For each area, traffic analyses should therefore be carried out that map the need for various industries and assess the effects of various measures, both preventive and impact reduction measures.

Several hazards and risk aspects have already been identified for aquaculture at sea in the vicinity of offshore wind.

The Directorate believes that distances between offshore wind power plants and aquaculture plants in the same area will make an effective barrier against possible conflicts between them.

The third conclusion is that there is too little knowledge about environmental effects for good recommendations on distances to be given that take account of environmental and fish health-related issues.

In the report, several relevant "synergies" with regard to safety have been identified for aquaculture at sea in the vicinity of offshore wind.

Recommendations have been made on how these synergies can be further developed and put to use by the industry players. When assessing synergies, the report says, it is relevant that other established industries at sea are also included.

The Directorate has made a number of recommendations. As mentioned earler, these include ensuring there is sufficient distance between offshore wind and aquaculture facilities in the same area will be an effective barrier against conflicts.

The calculation of safe distances should take into account various facility- and location-dependent factors, it says.

It also says marine wind farm sites can affect fish welfare and health, but this will vary for different locations. Since the Directorate believes there is too little knowledge about environmental impacts (such as pollution and the spread of infection) it has not given specific recommendations on distances.

More research should be done on the consequences for the environment, biosecurity and fish welfare/health, and possible negative effects related to escape, safety and fish welfare/health should also be considered.

The Directorate concedes that the recapture of farmed fish is considered demanding in open sea areas.

So, if fish gravitate towards nearby offshore wind power plants, the development and testing of methods and tools that could be placed between the wind turbines to recapture fish would be of interest.

Another point it makes is that when using common resources (including shared emergency resources), technical solutions and procedures should be developed to avoid infection.

Salmon farming is entering a largely unknown era, so there will be new issues that will need to be quickly sorted out. The Directorate has made a good start.

• *See also Sandy Neil, starting page 40.*





Fish of the future?



An international workshop last month revealed continuing interest in the idea of taking halibut farming to the next level, as **Robert Outram** reports

THE long single track road that winds along the western shore of the Cowal peninsula in Argyll will eventually take you to the Kilfinan Hotel. It was there, just along from Otter Ferry Seafish's hatchery and farm, that a group drawn from the UK, Canada, Norway and elsewhere met last month to consider the question: can halibut be farmed at scale?

The invitation had come from Otter Ferry's Alastair Barge and his colleagues at Amar Seafoods, now Otter Ferry's parent company. Present were an international group including fish farmers, consultants, feed specialists, academics and the public sector.

Acting as facilitator was Robin Shields, aquaculture specialist with innovation body the UK Agri-Tech Centre. He set out the aims: "To sharpen thinking, and to inspire action."

Atlantic halibut (*Hippoglossus hippoglossus*), a large demersal flatfish found in colder waters, has long been seen as a premium fish thanks to its superior flavour and texture. Ingrid Lein, senior scientist with Nofima, gave some historical context. Interest in farming halibut started in the early 1980s, in Scotland, Norway and Canada, and in Iceland from 1990 onwards. Research establishments and public bodies such as the then UK Ministry of Agriculture, Fisheries and Food, and Nofima and the Institute of Marine Research in Norway, supported studies into halibut farming.

Commercially, the pioneers included companies like Stolt Seafarm (Norway), Fiskeldi Eyjafjardar (Iceland) and in the UK, members of the British Halibut Association, including Otter Ferry Seafish, Kames and Marine Harvest, the company that was to become Mowi.

As she explained, the challenges were real. In particular, the first three weeks of development are critical. Feed, water quality, flow salinity and temperature are all important factors and so is light – it turns out the larvae suffer more deformities if exposed to light.

As she pointed out, we have bred dogs for 30,000 years and cattle for 10,000. Since 1970 we have raised 15 generations of salmon, but in terms of halibut we are still essentially rearing a wild fish.

Alastair Barge gave an overview of how the industry developed in Scotland. Research facilities at Ardtoe and Hunterston played a key role, and the British Marine Fish Association (BMFA) brought together funders, farmers and scientists.

As he explained, Marine Harvest was an important driving force, encouraging smaller companies to set up hatcheries. In 1998-99 Otter Ferry produced 140,000 juveniles. But this period also saw major rationalisation in the salmon industry and the "cod rush" also diverted resources away from halibut. By 2005 Kames and





Otter Ferry were the last of the BMFA's halibut producers.

In 2006 Kames was attacked by activists from the Animal Liberation Front who "freed" the fish, actually killing them in the process. It was the end for that company's halibut production and Kames now specialises in steelhead trout.

Marine Harvest decided to quit halibut production to focus on salmon. Otter Ferry opted for a vertical integration strategy and acquired a former flow-through salmon farm on the small island of Gigha, off the Kintyre peninsula. Gigha Halibut produced high quality, award-winning fish but as Barge explained "…it was fundamentally in the wrong place".

The shallow waters around Gigha meant that in the height of summer, temperatures were uncomfortably warm for a fish that likes cold seas.

Barge recalled: "The Gigha Halibut brand was extremely powerful even though we spent little on marketing. We were able to harvest every week and the quality was unsurpassable."

In 2023, however, it was clear that the site needed refurbishment if it was to continue, and the difficult decision was made to shut down production.

There is now no more production of adult halibut in Scotland, although Otter Ferry maintains broodstock and rears juveniles for grow-out overseas. The company has this year retained some stock for ongrowing, and Barge estimates it could produce up to 3,000 tonnes of fish at around 6kg.

Last year, Otter Ferry was acquired by Canada's Amar Seafoods, which has farms on the Atlantic coast of Canada and in Norway.

Nonetheless, Barge maintains, Scotland has many advantages when it comes to raising halibut. Its climate is suitable, with mild winters and cool summers; farms would be relatively close to target markets (UK and EU), and to a supply of eggs and juveniles; and there are sources of renewable energy.

Further, there are salmon farm sites in the big producers' hands not currently being used, which could be suitable for halibut production.

He said: "Otter Ferry represents an ember, for Scotland. All it needs is fuel for the fire. Give the market what they want, and give the fish what they want, and you'll have a business."

The international perspective

As Edvard Henden, CEO at Nordic Halibut, explained, his company has been around for around 30 years – but it is now scaling up at an impressive pace.

Nordic Halibut operates a fully integrated value chain all the way from genetics to sales, with a dedicated broodstock programme currently in its third and fourth generation. With a second production facility on the way at Tingvoll to join the existing site at Averøy (estimated to be completed during 2026), Nordic Halibut aims to reach a production level of 10,000 tonnes or more.

Halibut is eminently scaleable, Henden stressed: "There is no limit for it."

He added that 99.1% of current production meets "superior" quality standards and the survival rate is 93.5%. Halibut is not troubled by sea lice and does not need the treatments that cause so many problems for salmon farmers.

For the Americas, Nick Brown, COO at Aquacare, gave a history of halibut production on the eastern seaboard of Canada and the US. He had personally moved from the UK to North America with Marine Harvest, and worked with that company, the University of Maine and a number of smaller producers. It had not been easy, with storms and financial pressures providing serious challenges to the industry while it was still in its infancy. An initiative by the University of Magallanes to rear halibut in Chile also fell foul of funding cuts.

The Amar group in Canada is, however, making a success of halibut farming – alongside spotted wolffish – and is currently building a new facility on Prince Edward Island which aims



Opposite from top: Atlantic halibut; smoked halibut
This page from top: Alastair Barge; stripping broodstock at Otter Ferry

> Give the market what they want, and give the fish what they want, and you'll have a business

to produce 600-700 tonnes annually. As Thomas Langhalle, COO at Amar, explained, raising these fish does not require antibiotics or chemicals.

The marketing issue

Of course, producing great quality fish is not sustainable if it cannot be done at a price people are prepared to pay for it.

Andrew Davie, Head of Aquaculture at seafood business Aquascot, a dedicated supplier to Waitrose, is also Chair of the Waitrose Fish Forum. He stressed that from the retailer's point of view "price, provenance and perception" are key. In terms of price, halibut is not a cheap product. Protein alternatives such as beef, chicken or basa (pangasius) work out at around £1.40 per portion, while white fish such as cod, haddock or sea bream are more like £3-£4 and pricier fish like tuna, or organic salmon, sell for at £5 per portion or more. Halibut is more like £6-£7 per portion.

The question for consumers, Davie said, is: "Why should I buy halibut?"

Taste is one factor, but so is sustainability and a premium fish needs to have credible credentials. Some observers have questioned halibut's sustainability as a net consumer of protein – the amount of wild fish used to feed halibut needs to be addressed or reduced, Davie argued.

A good start in life

Børre Erstad, R&D Manager with Sterling Halibut in Norway, which produces up to 1,500 tonnes a year of halibut, said his company aims to produce 10,000 tonnes annually by 2030.

He noted that good care at the larval stage is absolutely crucial. This includes monitoring and control. As he put it: "The fish can't talk, so you have to understand what it is they are saying to you."

There are challenges involved in breeding halibut. One of these is time – it takes between eight and 10 years to get good eggs from a breeding female and – Erstad estimated – ideally you need between 300 and 400 individuals to get an optimal genetic pool.

One bottleneck for growth is the capital cost of hatchery and grow-out installations. Another is the commercial supply of the kind of specialist feed that halibut require at the larval and juvenile stages. A substitute for *Artemia* will be needed if the industry is to scale up, Erstad said

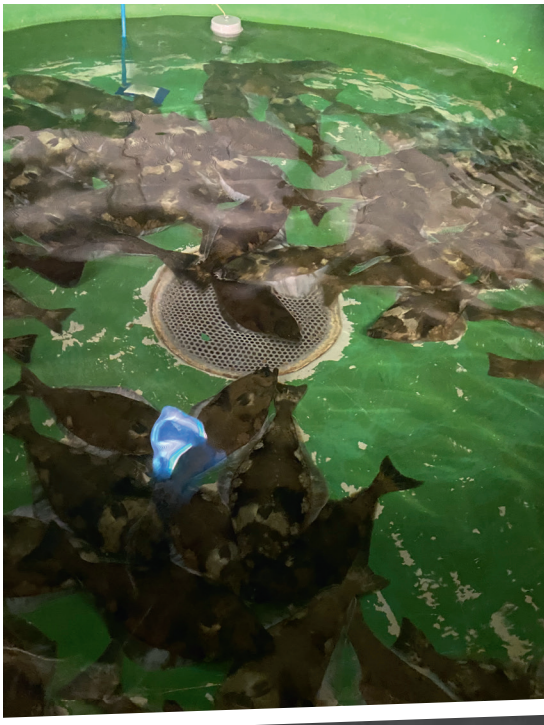
Sterling is currently partway through a study that aims to address the latter issue, in cooperation with feed specialists SPAROS, Flatlantic (a flatfish farmer based in Portugal) and CCMAR (the Centre of Marine Sciences, based in Faro, Portugal). Results so far are "promising", Erstad said.

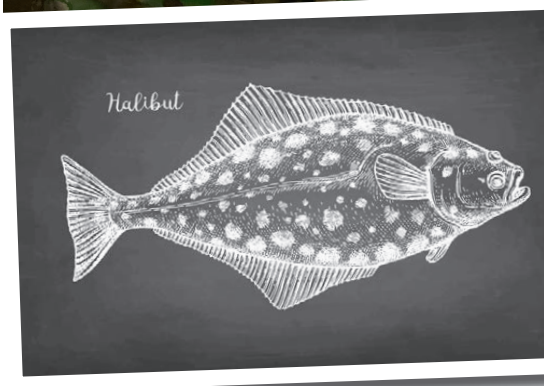
Torill Fladvad, COO Landbased with Nordic Halibut, gave an overview of halibut as a farmed species. The fish has some major advantages, she said, not least:

- It can be harvested all year round with predictable quality;
- It does not suffer serious parasite problems (in contrast to salmonids);
- No chemicals are required for treatment during the sea phase; and
- There are minimal issues with maturation.

There are challenges in however, including:

- Scaling – establishing good systems and routines is essential, as are flexibility and capacity;
- Ensuring juvenile quality, balancing the need for genetic diversity with the need to sort out the lowest quality fish;
- Bacterial disease and eye problems; and
- Developing a feeding regime.







The final challenge, Fladvad added, is "everything you don't know!"

Farming this species is capital-intensive and takes time. For Nordic Halibut, the grow-out phase at sea takes three to 3.5 years, taking the fish from 150 grams to 6kg. Nordic keeps its halibut in flat-bottomed pens, adapted from cages designed for salmon to create an environment suitable for a fish that, in nature, likes to spend time on the seabed. In the past the company has used shelves to provide more flat surfaces for the fish, but found these require a lot of cleaning and maintenance.

The company has increased the size of its pens – just as the salmon sector has – and these now go up to 160 metres.

She noted that fish farming regulations have been set with salmon in mind, so for example the requirement that sites must be fallowed is geared to addressing the sea lice problem, which is not relevant to halibut. But Fladvad advised: "Work with the authorities, not against them."

Genetics and health

Andrew Davie gave an update on the latest developments in genetic improvement and reproductive management. One of the issues for broodstock is the reliability and quality of spawning, and hormone treatments can be useful in dealing with "inhibited" individuals and also in extending the functional spawning period. Light and temperature manipulation have also been found to help.

Male halibut have sometimes been found to mature too early. As Davie explained, various solutions have been tried for this including photoperiod manipulations and "ploidy" manipulation to create triploid fish.

What has worked best, however, is all-female production.

Finally, he observed that while funding for genetic research for this species has been reduced, the cost of genomics technology has come down significantly, and he argued: "The time is right now for embracing the genomics age."

Robert Tillner of feed business Aller Aqua said his company sees halibut as an attractive market. Aller Aqua has developed specialist feeds for each of the halibut's life stages, as well as a feed specifically for broodstock.

There is a lot we know already about halibut feed, he said, but also a lot we don't. For example, we know this species thrives on high protein, high energy feeds and seems to prefer diets with a high percentage of marine ingredients. We don't know to what extent marine ingredients could be substituted with alternative proteins, or – for example – how much potential there may be for adding functional feeds.

João Henriques, product manager with SPAROS, introduced HATCHTOOLS, a data-driven application designed to enable feed trials. SPAROS has been working with Otter Ferry on halibut, (and with Portugal's Flatlantic on sole and turbot), on feed trials at the post-larvae, juvenile and weaning stages, using HATCHTOOLS to process and present the data.

The studies, he said, had helped to identify diets that could improve growth and the weaning process.

Finally fish veterinary consultant and pathologist Gerry Johnson, Professor Emeritus at the University of Prince Edward Island, outlined some of the factors that make halibut a special fish.

The halibut is a long-lived fish which can take 10 years or more to become mature. It has a well-developed, reactive immune system and it is protected by thick, viscous mucus which appears to have strong antimicrobial properties. It tolerates a wide range of salinity from high to low.

Perhaps surprisingly, he said, halibut are



social animals and often prefer to clump together even when stocked at a low density. They can even be seen "grooming" each other.

Despite being robust fish, he said, halibut are subject to some diseases and threats, such as the *trichodina* parasite or the *tenacibaculum* bacterium. There is much still to learn, he said, about halibut behaviour, intelligence and welfare.

Next steps

The enthusiasm for this exceptional fish was apparent – but can that be translated into the creation of a thriving industry?

Workshopping potential solutions, one key issue emerged: the sector needs to scale up. More production volume would encourage a better commercial supply of feed, for example, but a large-scale, reliable feed supply would be needed to get to that volume.

Similarly, while infrastructure designed for species like salmon can be adapted, it would benefit the halibut producers if more was available that has been specifically developed with this fish in mind.

Increased production could help to make halibut more affordable, although it is likely to remain a "higher end" product for the foreseeable future.

A serious effort in terms of marketing – and education – will be needed to educate chefs, and after that convince retailers and consumers, of the merits of farmed halibut.

The track record of Gigha Halibut, and the excellent dinner provided for attendees following the workshop, suggests that there is a strong case to be made for farmed halibut as a top of the range seafood product.

Quality and genetics will be crucial as the industry grows, as will the ability to adapt infrastructure developed for the much larger salmon industry.

Halibut farmers will need somewhere to locate their farms – but if regulators and politicians could be persuaded, there is an argument that some inshore sites currently or previously used for salmon or trout could be repurposed for halibut.

Attendees at the workshop agreed that more research and more dialogue are required to give the halibut farming industry a chance to scale up. It looks as if this conversation will continue. ●

> "The fish can't talk, so you have to understand what it is they are saying to you

Opposite page from top: Young halibut at Otter Ferry; halibut chalk sketch; Gerry Johnson speaking at the workshop
Above: Edvard Henden at the workshop



The right stuff

A new process holds the key to extracting more value from marine algae, says the CEO of BioMara

FUCOIDAN may not be a familiar word to most consumers – yet. But if Jay Dignan has his way it will soon be appearing as a common ingredient in many of the health products we buy.

Dignan is CEO of BioMara, a company focused on extracting and commercialising high value compounds from seaweed. He's not alone in believing in the business – earlier this year BioMara raised ~$150,000 (£120,000) in further pre-seed investment to accelerate development of its products and get key customers on board.

Since its launch, BioMara has raised £520,000 in private funding and secured more than £600,000 in non-dilutive grant funding through competitive research and innovation programmes. That brings total funding to date to more than £1.1m.



BioMara uses a proprietary process to extract a high-quality unique fucoidan range and high-fibre food ingredients from brown seaweeds. The extraction technology is optimised to retain beneficial characteristics and bioactivity of target compounds and to isolate multiple products from the same input biomass. This innovative approach maximises impact, reduces waste and enables scalability, aligning with industry demands for price-competitive food and wellness ingredient production, as well as supporting the broader value-chain of this promising nascent industry.

Dignan's journey into the seaweed industry began when he was taking an MBA course at Warwick University. His dissertation was on start-up strategy in the Scottish seaweed industry, focusing on learnings from working with a community-owned seaweed farm on the Isle of Mull set up by South West Mull & Iona Development (SWMID).

He says: "It was a great introduction into the world of seaweed. A key question out of this experience was how to build this industry and keep the value from seaweed farming in coastal communities."



This page from top: Sugar kelp; BioMara extraction facility; Jay Dignan, CEO, BioMara **Opposite from top:** Thalivra; bread with Seafibrex; Beaessence anti-ageing application with Revyntra; kelp bed

> It has a unique application as a natural solution solving a health problem





The answer, he realised, was value-added processing.

"What I learned was you need to create real product-market fit by adding value, and the best way I saw to do that was through processing to extract the valuable compounds from the seaweed."

He argues that everything should start with the customer. Start with what problems the customer wants solved. Then you can align and organise the business to meet that demand. He stresses: "Each organisation in the value chain should follow that demand."

Hatcheries, farmers, specialised processors, finished product manufacturers and retailers are all part of that chain.

Stabilising the seaweed at harvest is a key part of that chain, and this is where coastal communities can benefit, Dignan explains. This is done by drying, ensilage using enzymes or freezing; this is key to unlocking year-round extraction. BioMara buys stabilised seaweed primarily from Scottish producers, with plans to expand sourcing across Europe as it scales.

Seaweed extracts have long been used in agriculture as biostimulants (see "Green fingers" Fish Farmer, February 2025) and fertiliser, but Dignan says: "What we're more focused on delivering is higher value products the customer wants. I'm talking about food and supplements – that is, human food and human supplements."

A 'unique compound'

BioMara's bespoke process using novel technologies, Dignan says, delivers a distinct form of fucoidan with unique structural and bioactive properties.

He explains: "That means that it has a unique application as a natural solution solving a health problem for our customers. So you can think of it like, say, manuka honey or lyprinol (the green lipped mussel extract used to help with arthritis), and so on. These products have a defensible position in the market because they're known as the natural product with clinically backed benefits and a strong consumer story."

There is already an established market for fucoidan in the Far East, but it is still relatively little known in the West. However, Dignan believes this is changing.

"You don't have to be first. If you are positioned in the right place with a strong product and you're ready when the trend hits, that's when you win. That's exactly where we see ourselves."

BioMara's specific core offerings are two fucoidan extracts: Thalivra (for supplements) and Revyntra (for cosmetics) – and Seafibrex, a high-fibre food ingredient produced from the same biomass.

"Seafibrex is getting a lot of good feedback from food manufacturers," Dignan adds. "It boosts fibre content, improves nutrition, and can be integrated into everyday products, even benefiting taste and texture."

Thalivra is now heading into human trials, supported by UK Research and Innovation (UKRI). Scientists at the Well-being and Assessment Research Unit at Aberystwyth University's Department of Life Sciences, alongside researchers at the Institute of Biological, Environmental and Rural Sciences (IBERS), have produced Thalivra and are now starting a dietary trial with this product.

Dr Jessica Adams, a seaweed expert from IBERS at Aberystwyth University, said: "We are very excited to be using our expertise to progress this project. Seaweed contains different compounds to land plants, some of which have distinct properties which we can tap into such as fucoidan. We will be using our knowledge and skills to produce a new extract of fucoidan at scale within food-grade facilities. Seaweed compounds are already used extensively in the food industry, but this project also develops products towards the nutraceutical market, potentially benefiting the health and wellbeing of people globally."

BioMara has contract manufacturers lined up ready to go to fulfil customer orders.

The company buys in stabilised seaweed from farmers and harvesters, mainly in Scotland. Dignan says: "At the moment we're buying dried seaweed, but the process can handle wet seaweed and different species of seaweeds."

"If we scale up in the next two years, probably we'll also need to source from other farms within Europe."

Farming seaweed has advantages, he argues, not least because it provides a stable and scalable supply chain – delivering consistency, quality and traceability.

Currently, the seaweeds BioMara has been working with are *Alaria esculenta* (winged kelp), *Saccharina latissimi* (sugar kelp) and other brown seaweed species like *Fucus vesiculosus* (bladderwrack).

For BioMara's customers – large ingredient buyers and product formulators – it's not just about the backstory. It's about the solution. As Dignan puts it: "They want to know: is it the price right? Is it scalable? Is the science solid? What evidence do you have? How will it benefit their customers and solve their problems?"

After that, the story adds credibility and marketing opportunities. "Being a Scottish company, using Scottish seaweed, with a clean, green process and no harsh chemicals resonates with customers."

He concludes by talking about the Seafibrex ingredient: "The Western consumer is not just going to suddenly start eating seaweed. So that's why we're focused on something called a 'health by stealth' approach, which basically means you're embedding it in these foods people already eat - because it improves nutrition, function and it tastes good – without them even realising it. That's how you build real, lasting impact."





Welcoming the next generation

Attracting and developing new talent is critical for the success of fish farming in Scotland

ANY industry needs to be able to attract and retain a skilled and enthusiast workforce, and aquaculture is no exception.

Recognising the talents of trainees in the rural industries is the ethos behind the ALBAS, the annual Awards for Land-based and Aquaculture Skills organised by Lantra, the sector skills council for the land-based, aquaculture and environmental conservation industries.

At this year's ALBAS, held at the Crieff Hydro Hotel in Perthshire on 7 March, aquaculture was well represented, with PhD student Robert Stewart and aquaculture trainees Derek Dunning, Robaidh Halliday, Lewis Henderson and Mary Collins all winning awards.

Aquaculture Learner of the Year winner Derek Dunning from Lochgilphead is doing an SVQ through UHI Shetland while working in fish husbandry for Kames Fish Farm in Oban.

He said: "I'm so glad to win this award, it's been hard work, but worth the effort. Thanks to Lantra Scotland for the award, to Stuart Fitzsimmons my tutor at UHI and my employer Kames Fish Farm for giving me this opportunity."



Aquaculture Learner of the Year joint runners-up were Lewis Henderson and Mary Collins.

Lewis from the Isle of Gigha and Mary from Glasgow are both doing an SVQ in aquaculture at UHI Shetland while working in fish husbandry for Bakkafrost Scotland.

Robert Stewart was highly commended for a research project and is doing a PhD in aquaculture at the Roslin Institute in Edinburgh. He said: "It's a great feeling to win this award and makes all the hard work worthwhile. Thank you to my tutors at the Roslin Institute for their continued support and Lantra Scotland for presenting me with this prestigious award."

Meanwhile, Robaidh Halliday from Portree on the Isle of Skye came runner-up in the Higher Education Award BSc category. He is doing an SVQ in aquaculture management at UHI Shetland while working as a Site Manager for Organic Sea Harvest in Staffin.

Over 200 finalists, event supporters, employers, training providers and industry leaders, including Agriculture Minister Jim Fairlie, attended a glittering awards ceremony, hosted by Dr Jenna Ross OBE and Mike Duxbury of Inclusive Farm.

Industry awards were made for agriculture, aquaculture, equine, game and wildlife, horticulture, land-based engineering, trees and timber, and veterinary nursing.

As well as prizes for Overall Winner, Runner-up and Modern Apprentice of the Year, there were awards for Higher Education, School Pupil, Secondary Schools, Research Project, Mentor award, the Tam Tod Trophy for outstanding young learner, and the Anna Murray Award for partnership working.

Dr Liz Barron-Majerik MBE MICFor, Scotland Director, Lantra, commented: "It is a privilege to be part of the ALBAS and to help put the spotlight on some of the incredible people in Scotland's land-based and aquaculture sector, while also encouraging employers to look ahead at their future workforce."





She continued: "Everyone who was nominated for our awards should be proud of that achievement, but with the standard of entries continuing to get better each year, it means that our winners are quite simply the best of the best from our sector. As well as being important to Scotland's rural economy, they also play a vital role in their local communities and in caring for the environment."

Celebrating apprenticeships

Meanwhile over 3-7 March Scottish Apprenticeship Week 2025 celebrated the value of apprenticeships to businesses, individuals, and the economy, with its hashtag #MadeForBusiness.

DYW (Developing the Young Workforce)





Opposite from top: Robaidh Halliday with Sharon Gooding-Hill of SRUC; Derek Dunning (left)
Above: Pupils hold a selfie frame at the Lochaber High School event
Above right: Lewis Henderson (centre)

West Highland focused on apprenticeship activities for pupils during the week. Salmon farmer Scottish Sea Farms took part, along with other businesses such as TSL Contractors, BSW Timber, NHS Highland, The Ross-shire Journal, Lochaber Housing Association, Shiel Buses, Aldi, Alvance, Lochaline Quartz Sandmine, Laudale Estate, and S&K MacDonald Homes.

The employers highlighted the benefits of exciting and rewarding careers in sectors such as engineering, customer service, care, and outdoor industries. Businesses introduced students to their apprentice opportunities and to pre-apprenticeship programmes. Sessions also provided young people an opportunity to speak with young apprentices and potential employers to learn about the skills needed for apprenticeship roles.

Reaching out to schools

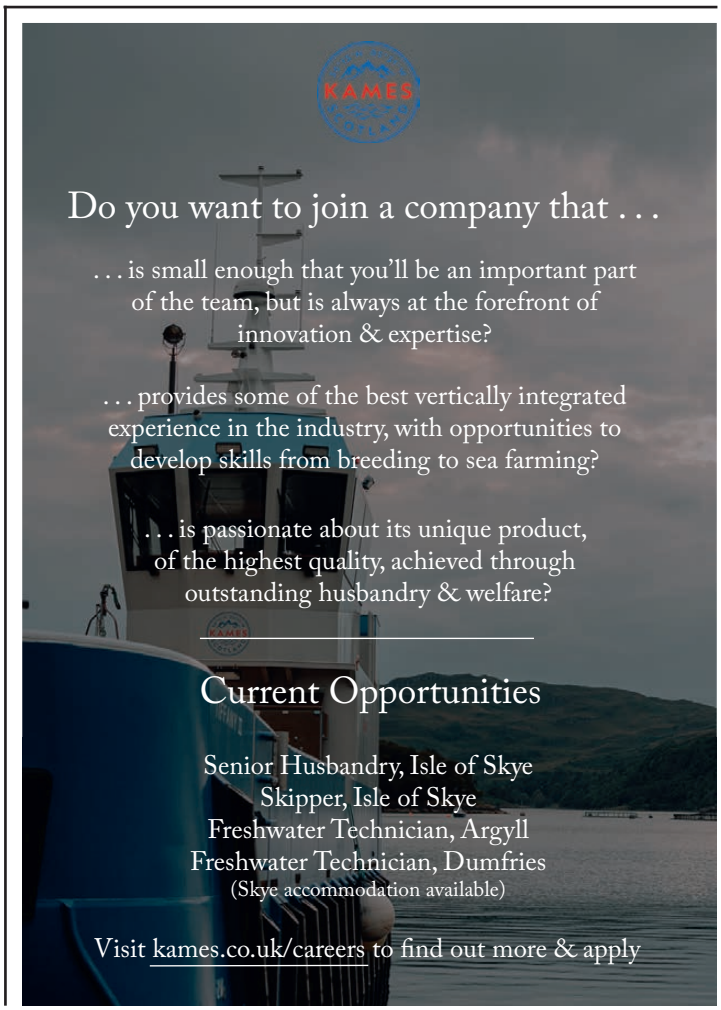
Last October, an aquaculture careers event at Lochaber High School allowed local secondary school pupils to meet aquaculture professionals, learn about farm-raised salmon and explore career options.

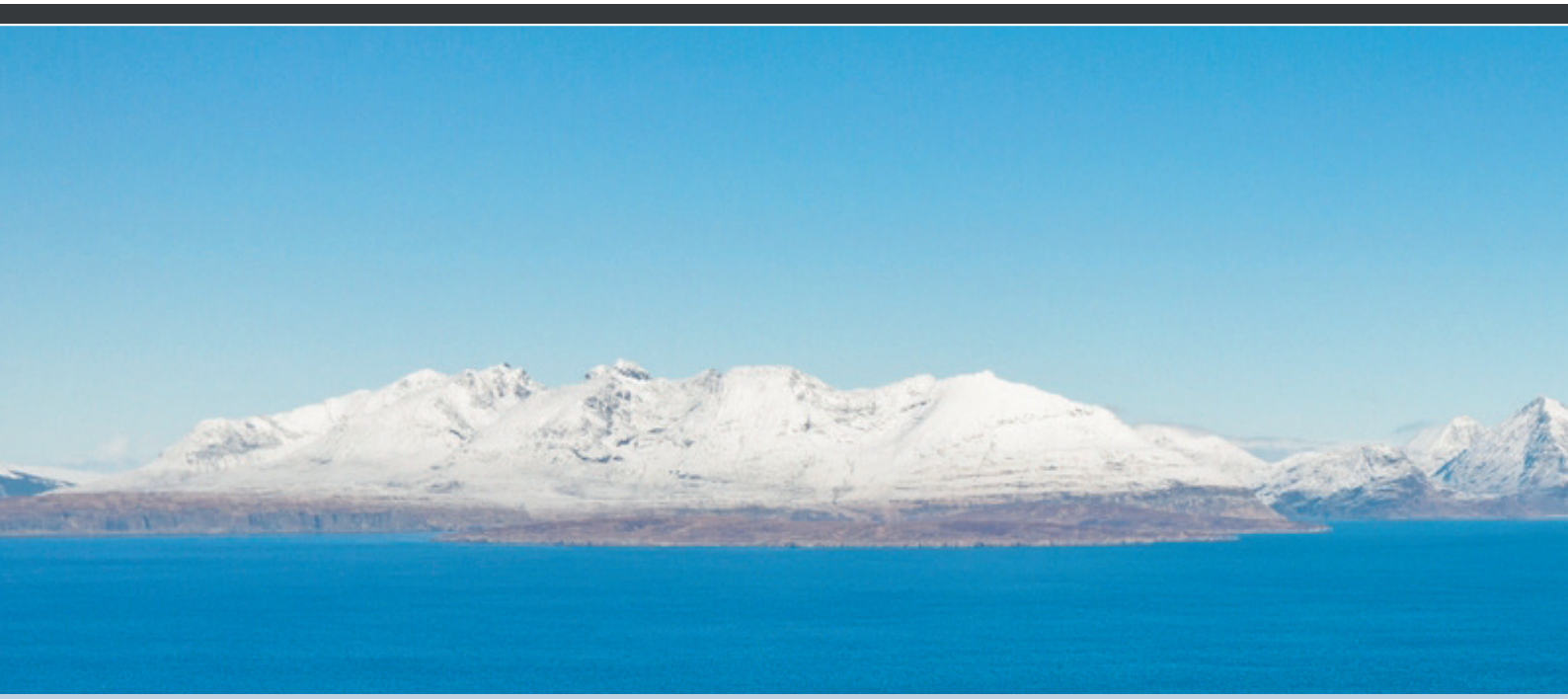
Scottish salmon directly supports 1,000 jobs in the north-west Highlands, with many more in the supply chain, generating £224m a year for the local economy.

The event was part of an ongoing series designed to highlight employment opportunities in the expanding sector.

Local employers Bakkafrost Scotland, Scottish Sea Farms, AKVA and Gael Force took part in the event, organised by Salmon Scotland, Mowi Scotland and Developing the Young Workforce West Highland. ●

> It makes all the hard work worthwhile





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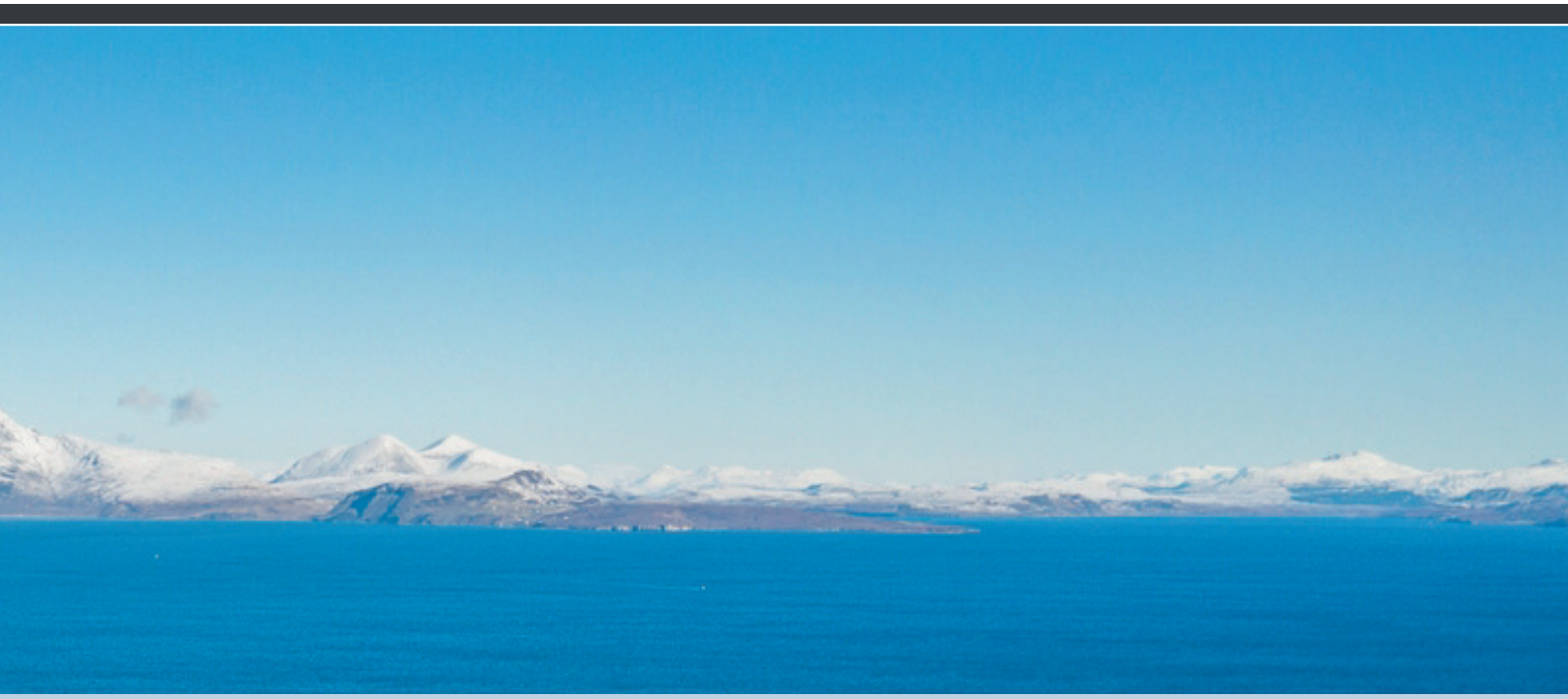

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The case for welfare protection in trout farming

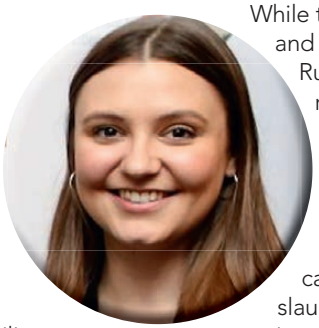
Trout farms should be subject to regular welfare inspections, says a leading charity

TROUT farming should be subject to statutory animal welfare checks, according to an organisation that is campaigning to raise the profile of fish welfare.

The Humane League UK argues that even existing laws would allow the authorities to carry out welfare inspections, if they chose to. A Freedom of Information request by the Humane League has revealed that no such visits are taking place in the UK, outside Scotland.

Up to 16 million trout are farmed in the UK, making them the third most numerous farmed species, after chickens and salmon.

Many of these are farmed in England, Wales and Northern Ireland, where there is little oversight of their welfare at slaughter and no legal provisions detailing how to minimise pain at the point of slaughter. This means, the Humane League said, that animal abuse is less likely to be detected or punished, as welfare is currently regulated by the fish farming industry itself.



While the Animal and Plant Health Agency, part of Defra, and the Department of Agriculture, Environment and Rural Affairs of Northern Ireland claim the law does not require them to conduct inspections, this is arguable.

This is because while they lack specific protections at slaughter, they are still required to be "spared avoidable pain, distress or suffering during their killing and related operations".

Scotland is the only one of the UK nations which carries out welfare inspections on farmed fish at slaughter, with the last one occurring 16 May 2024. Even so, inspections happen once a year and are announced in advance.





Photo: Viva!

Georgie Hancock, Public Affairs Coordinator at The Humane League UK, said: "Trout are not only found in Britain's iconic chalk-streams but are routinely packed into farms across the country. These fish receive no welfare inspections at slaughter whatsoever, not to mention there being no legal mandate for CCTV in their slaughterhouses. The lack of oversight is unforgivable, especially as we are talking about animals who can feel pain, and who are our third most farmed animal. Trout aren't just an icon of British rivers, they are also victims of factory farming who need our help. The Government must introduce legal protections for these animals at slaughter."

Are voluntary inspections enough?

Some trout farms are subject to voluntary inspections by the animal welfare organisation RSPCA Assured.

A spokesperson for the organisation said: "RSPCA Assured is the only farm assurance scheme solely dedicated to improving the lives of farmed animals, and we are regularly out on farms ensuring the RSPCA's strict welfare standards are being met.

"All RSPCA Assured members receive annual inspections by our specially trained team of assessors and can be subject to any number of unannounced spot checks throughout the year. These inspections and spot checks include all RSPCA Assured certified slaughter facilities.

"We also have a really experienced farming and technical engagement team on hand to support members with meeting the standards.

"Ensuring the welfare of farmed animals is our driving priority. Without our work and the RSPCA welfare standards, many millions of animals would live worse lives.

"The RSPCA's new welfare standards for trout are due to be published in the coming months and will include a number of important welfare updates."

While the Humane League welcomes the role of RSPCA Assured, it points out that its role is voluntary, and while most salmon production is subject to its oversight, it is estimated that around half of trout production is not.

A spokesperson for the Humane League said: "We don't think that RSPCA Assured inspections fall short of what the Government could do. However, we also think that it shouldn't be solely up to animal charities to monitor welfare at slaughter, particularly as not all trout producers are signed up to RSPCA Assured."

The society also stresses that the only sanction RSPCA Assured can apply is to suspend or terminate a farm's membership of the scheme, while a statutory body could apply fines.

Regulations called for

The importance of protecting welfare at slaughter was highlighted in a 2020 investigation into a Hampshire trout farm by vegan animal rights charity Viva!, which showed mishandling and kicking of animals at slaughter.

With increasing concern over the cost of living, trout is becoming popular as a less expensive alternative to salmon. According to market research firm Statista, £2 million more worth of trout was sold in 2024 compared to 2023, with restaurants and supermarkets reporting growing interest in trout.

The Government's Animal Welfare Committee (AWC) issued an opinion in 2023 affirming the need for the UK's farmed fish to receive better legal protections at slaughter.

The report argued that the Government must legislate to ensure that fish are stunned before slaughter and killed before regaining consciousness, that they should be killed in water or shortly after being removed from it, and that a back-up stunning process must be available.

The Humane League UK's Forgotten Fish campaign is asking the Government to include detailed slaughter regulations including stunning for fish in law. This would include regular inspections of farmed fish welfare at slaughter, as well as providing guidance on how to calibrate slaughter machines.

Furthermore, the Humane League said, revising the law could allow for those producers who are found guilty of welfare violations to be prosecuted, deterring future cruelty. ●

> "The lack of oversight is unforgivable



Opposite from top: Rainbow trout; Georgie Hancock
This page from top: Farmed trout with lesions; rainbow trout

Alaska at the crossroads

Julia Hollister and **Robert Outram** look at Alaska's current state of play in aquaculture – and its potential future



THE proposal to relax the rules that currently bar any finfish farming in Alaska might seem limited, but it has already met with a backlash from the state's catch fishery sector.

As reported in Fish Farmer's March issue, Alaska's Republican Governor, Mike Dunleavy, introduced draft legislation in February this year that would partially lift the state's ban on finfish aquaculture.

So far, those representing the Alaskan fishing community are less than happy – even though Alaska's iconic salmon fishery would arguably not be directly affected.

The Bristol Bay Regional Seafood Development Association (BBRSDA), which represents more than 1,800 fishermen in the sockeye salmon fishery of Bristol Bay, Alaska, said: "Finfish farming directly contradicts BBRSDA's mission to maximise the value of our fishery for Bristol Bay's fishermen. Alaska's wild salmon are the gold standard for quality and sustainability - allowing farmed fish in Alaska would compromise our industry and weaken the market for our fishermen."

And writing in the *Anchorage Daily News*, Tim Bristol, Executive Director of not-for-profit organisation SalmonState, which advocates for wild salmon and wild salmon fisheries, said: "Not only does Gov Dunleavy's fish farm bill amount to a giant 'go to hell' message to Alaska fishing families, it's emblematic of his long-standing lack of stewardship of Alaska's lands and waters. In his mind, clean water, intact habitat and carefully managed wild fisheries are obstacles to unfettered resource extraction.

"Attempting to bring fish farms to our wild state illustrates just how divorced Dunleavy is from the real Alaska."

Currently, Alaskan law prohibits finfish farming except for private non-profit salmon hatcheries. The draft bill HB 111 ("Finfish Farms and Products") would authorise the Commissioner of the Department of Fish and Game, in consultation with the Commissioner of the Department of Conservation, to permit the cultivation and sale of certain finfish in inland, closed system bodies of water.

The legislation:

- Requires all finfish acquired with a finfish farm permit to be sterilised triploids which are unable to reproduce
- Prohibits cultivating pink, chum, sockeye, coho, chinook and Atlantic salmon



> "Allowing farmed fish in Alaska would compromise our industry

This page from top: Seagrove kelp farm; Governor Mike Dunleavy's video on food security
Opposite from top: A brown bear catches a wild salmon at Brooks Falls, Alaska; salmon hatchery in Juneau, Alaska; sea otter in wild kelp bed off Homer, Alaska; kelp

- Requires finfish farms to be enclosed within a natural or artificial escape proof barrier
- Authorises stocking a lake on private property with finfish for personal consumption without a permit if the lake is enclosed with a natural or artificial escape-proof barrier.

The proposed legislation would continue to ban any form of open net pen farming at sea, and it would also not allow the raising of farmed salmon species – even in enclosed, land-based facilities.

If enacted, even the reforms would leave Alaska with one of the strictest regimes, as regards finfish farming, of any jurisdiction in North America.

Governor Dunleavy recently posted a video on social media in which he lamented the number of farmed, imported varieties of seafood available on Alaskan supermarket shelves – which he said could be replaced by homegrown varieties of fish such as tilapia and catfish, both of which are farmed in a number of other US states.

The primary reasons for the prohibition of fish farming in Alaska include:

- Environmental concerns: There are fears that fish farming could lead to pollution, habitat destruction, and the spread of diseases to wild fish populations.
- Genetic risks: There is a risk that farmed fish could escape and interbreed with wild fish, potentially altering the genetic makeup of wild populations.
- Economic considerations: Alaska's economy relies heavily on commercial fishing, and there are concerns that fish farming could undermine this industry.

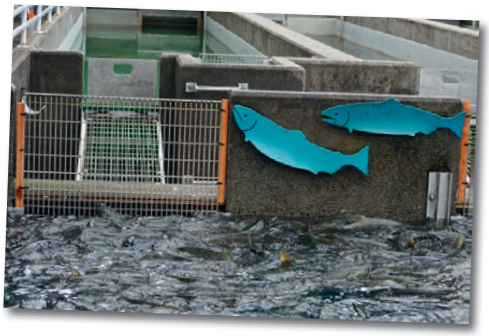
Arguments in favour of legalisation include:

- Economic benefits: Legalising fish farming could create new jobs and stimulate economic growth in rural areas.
- Food security: Aquaculture could help ensure a stable and sustainable supply of seafood, reducing dependence on wild fisheries.
- Technological advances: Innovations in aquaculture technology can minimise environmental impacts, making fish farming a more sustainable practice.

The question of whether fish farming will ever be legal in Alaska remains open. It is a complex issue that requires careful consideration of environmental, economic and social factors. As technology advances and the global demand for seafood continues to rise, the state may be persuaded revisit its stance on aquaculture.

Until then, the preservation of Alaska's wild fish populations and their habitats, on which a significant proportion of the state's economy relies, remains a top priority.





Fish farming or fish ranching?

Given the fierce opposition to any form of fish farming on the part of the Alaskan salmon fishing sector, it might come as a surprise that the industry relies quite heavily on salmon hatcheries.

Michelle Morriss, with the Alaska Department of Fish and Game, said: "In contrast to hatchery programmes in other areas, Alaska's salmon fishery enhancement programme was not built to mitigate habitat losses associated with human projects.

"Alaska has healthy well-managed wild stocks and a robust and healthy hatchery programme that was designed to minimise wild stock interactions and enhance fisheries.

"Our hatchery programmes for commercial fisheries are stakeholder driven and overseen by fishermen who strongly support Alaska's mandate to protect wild stocks while enjoying the economic opportunities derived from renewable resources that are well managed."

The Department of Fish and Game estimates that, in 2023, hatchery production accounted for 81% of the commercial fisheries harvest in Prince William Sound, 39% in Kodiak, and 24% in Southeast Alaska.

Pink and chum salmon are the species most commonly raised in this way. Only local, native stocks are permitted for use and the fish are released into the wild as juveniles. Most of their growing is done at sea.

Supporters of the programme would say this is fish "ranching", not "farming".

Meanwhile, shellfish offers a less controversial form of aquaculture that is already well established in Alaska. The state's pristine waters offer a unique environment for the farming of various shellfish, and the combination of cold, clean waters and nutrient-rich ecosystems contribute to the high quality and sustainability of shellfish farming in the region. In particular oysters, mussels and clams – including littleneck clams, butter clams and geoducks, a kind of large, burrowing clam – are widely farmed.

Seaweed – crop of the future?

The next big thing to come out of Alaska's seas might not, however, be one that arrives on the end of a hook or in a net, and it might not even end up on a dinner plate…it's seaweed!





Seaweed farming, particularly kelp farming, is a growing industry in Alaska, with the state's cold, nutrient-rich waters proving ideal for cultivation, and farms are beginning to emerge, offering economic and environmental benefits.

Some of the largest kelp beds in the world are found in Alaska.

Different types of red, green, and black seaweed are also farmed and gathered in Alaska.

Marine algae has been used by Alaskans as a source of food and materials for centuries. Recently, the farming of seaweed has gained attention for its commercial, food security, and climate change mitigation possibilities. Alaska presents an ideal location for the seaweed farming industry, as it has the longest coastline in the United States and more than 500 species of seaweed.

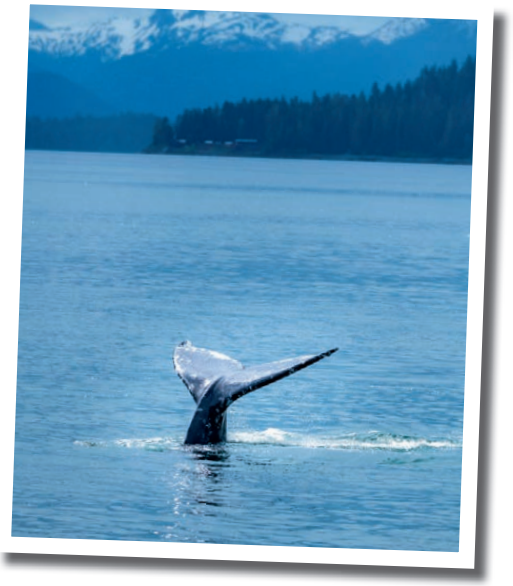
Seaweed production does not require fertiliser, fresh water, or arable land. Alaska has cold, fertile waters, lively community waterfronts, and a skilled maritime workforce interested in pursuing mariculture (the cultivation of fish and marine life for food). As such, Alaska could be at the cutting edge of the growing seaweed farming industry in the United States.

Jennifer Angelo, of NOAA, the National Oceanic and Atmospheric Administration, advises that all aquaculture projects in Alaska are located within state waters and are subject to leasing and permitting requirements by the state of Alaska.

In addition, many projects require federal permitting that may trigger both Endangered Species Act and Essential Fish Habitat consultation requirements.

Angelo says: "NOAA Fisheries does not regulate aquaculture projects in state waters, but we are providing links and information to assist applicants with seeking approvals from federal and state agencies with regulatory jurisdiction.

"The Alaska Aquaculture Permitting portal [https://akaquaculturepermitting.org/] outlines the steps necessary to receive state and federal lease and permits to conduct commercial marine aquaculture activities in the state of Alaska."



Back in 2021, Markos Scheer, CEO of organic kelp and oyster farmer Seagrove Kelp Co, told local news site Raven Radio: "This is the kind of industry [seaweed] that could be a really significant leg on the economic stool for coastal Alaskans because you can do it in so many different places and do it viably.

"You know if we get the industry to a size that it needs to be, it's gonna be a pillar of the economy for the next 100 years." ●

> "Marine algae has been used by Alaskans as a source of food and materials for centuries

Above: Humpback whale, Alaska



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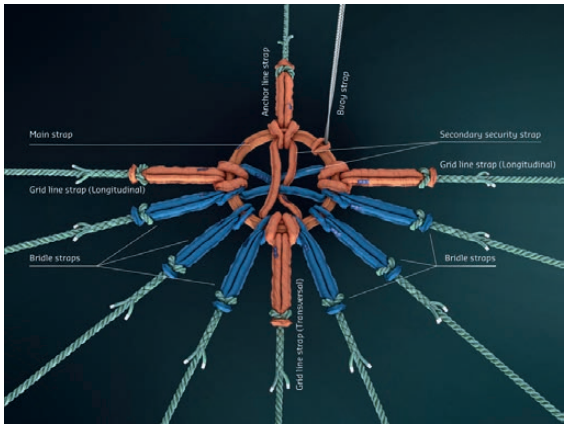
Monthly update on industry innovations and solutions from around the world



Vónin wins exclusive distribution contract for Flexilink

Vónin has secured its position as the exclusive supplier of the Flexilink to the aquaculture markets in the UK and the Faroe Islands. Flexilink, a groundbreaking, hardware-free mooring grid, offers a robust solution that enhances the durability and operational efficiency of fish farms. Designed to eliminate mechanical failures, Flexilink has been installed successfully in over 300 locations worldwide since its launch in 2012. The system's easy installation, extended inspection intervals, and compliance with stringent quality standards make it a wise choice for aquaculture operations seeking reliable and cost-effective mooring solutions.

www.vonin.com/product/flexilink/

Net cleaner system completes latest round of trials

An innovative net cleaning pump system has successfully completed its latest round of trials at a fish farm in Scotland. The NetJet system, developed by engineering firm Brimmond, recently concluded its second live industry campaign with AKVA Group. The net cleaning pump was deployed to Loch Fyne in late 2024 for a 60-day trial, to test out some product improvements following an earlier project on a fish farm near Mull. Brimmond said feedback from the clients during this latest trial was extremely positive, highlighting the unit's ease and efficiency of operation, as well as Brimmond's rapid response customer service and support.





Photo: NIBIO.

Grass could be alternative protein source for aquafeed

The search for new protein sources for fish feed has led a team of Norwegian scientists to one that has been used in land based agriculture for thousands of years – grass. The Norwegian Institute of Bioeconomy Research (NIBIO) recently opened Norway's first pilot plant for green biorefining.

Research scientist Steffen Adler told the Global Seafood Alliance's *Responsible Seafood Advocate*: "Our work opens up the possibility of a domestically produced feed, while for species like salmon, it's crucial to have a high-quality protein feed that meets their nutritional requirements. We are looking for local protein that could be used in salmon farming, and are trying to find it in plants such as grass and macroalgae."

Mowi's Rosyth processing operation goes paperless

Mowi Consumer Products UK, which operates the largest fish processing site in the UK, has transformed its production, safety and quality processes after a digitisation drive. Through a company-wide digitisation initiative, Mowi has managed to cut its paper-based records by 90% using the mobile-first workplace operations platform SafetyCulture. It aims to become near-paperless in future. Digitisation has also enabled faster processes and increased capacity, meaning the company has more than doubled its product and quality audits to over 7,000 per month, compared to 3,000 when processes were paper-based. Having digital records in the SafetyCulture platform has not only saved employees time, but also significantly improved traceability, Mowi said.



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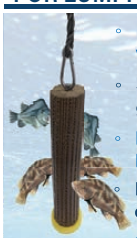

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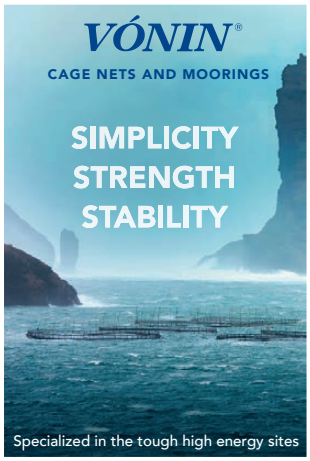

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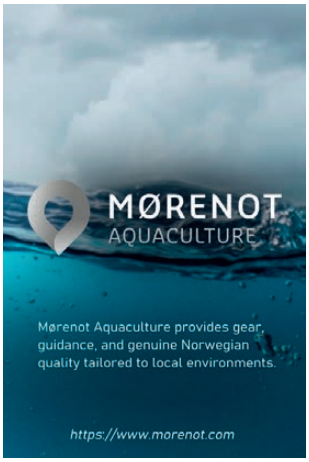

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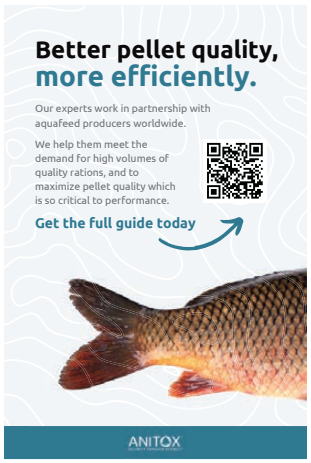

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Recirculation



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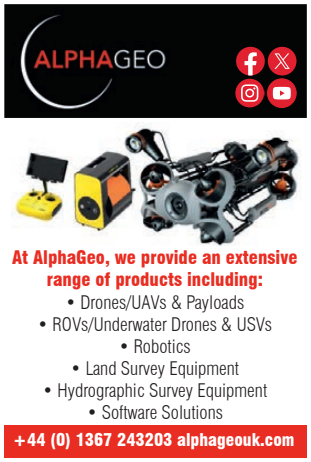

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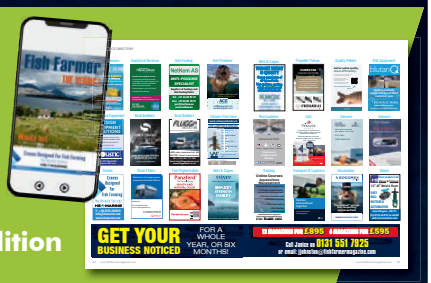

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Industry DIARY

The latest aquaculture events, conferences and courses

MAY 25

AQUAFUTURE SPAIN 2025

www.aquafuturespain.com
Vigo, Spain
May 20-22, 2025
Venue: IFEVI Exhibition Center
An international meeting space for the Spanish aquaculture industry.



FISH FARMER WEBINAR
Harmful Algal Blooms

Online
June 4, 2025
11.30am - 12.30
Fish Farmer's Algal Blooms webinar, in association with Poseidon Ocean Systems, will feature a panel discussion on the causes of harmful algal blooms, how prediction can be improved and what mitigating actions can be taken. Join us on Wednesday 4 June to find out more.



JUNE 25

SEAWORK 2025

www.seawork.com
Southampton, United Kingdom
June 10-12, 2025
Europe's largest on-water commercial marine and workboat exhibition.



SEAGRICULTURE EU 2025

seagriculture.eu
De Doelen, Rotterdam, The Netherlands
June 17-19, 2025
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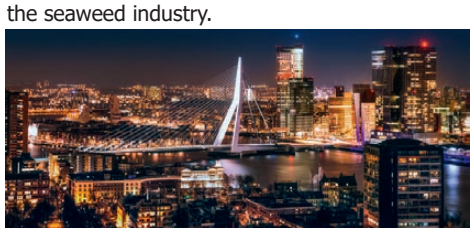

WORLD AQUACULTURE SAFARI 2025

www.was.org
Entebbe, Uganda
June 24-27, 2025
Dubbed "Aquaculture Safari 2025," it will be organised with support from the ongoing EU-funded True-Fish project.

AUGUST 25

AQUA NOR 2025

www.aquanor.no
Trondheim, Norway
August 19-21, 2025
The world's largest aquaculture technology showcase.



SEPTEMBER 25

FISH FARMER WEBINAR
Feed & Feed Strategies

Online
September 10, 2025
11.30am - 12.30
Fish Farmer's Feed & Feed Strategies webinar, in association with TidalX AI, will look at how to ensure that the feeding regime is efficient and sustainable, and meets the nutritional needs of the fish.



AQUACULTURE EUROPE 2025

www.aquaeas.org
Valencia, Spain
September 22-25, 2025
The annual conference of the European Aquaculture Society (EAS)

OCTOBER 25

LACQUA 2025

www.was.org
Puerto Varas, Chile
October 6-9, 2025
Latin American and Caribbean Aquaculture.

NOVEMBER 25

WORLD AQUACULTURE INDIA

www.was.org
Novotel Hyderabad Convention Centre, Hyderabad, India
November 10-13, 2025
This event is the perfect time for the World Aquaculture community to focus on India.



DECEMBER 25

ALGAEUROPE 2025

algaeurope.org
Radisson Blu Latvija Conference & Spa Hotel Riga, Latvia
December 9-12, 2025
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The world order has changed

By **Nick Joy**

I DON'T suppose that anyone has difficulty with the title of this piece, though there are many who would berate me for suggesting that Trump has changed the world.

My support or bias for Trump is primarily because of two things. Firstly, he says what he is going to do and does it, and secondly, because he is dealing with corruption and fraud on a massive scale.

There is of course the other thing which is that he has made the people who elected him his priority, the American people. I look forward to people attacking me because he is withdrawing support from Ukraine but I would like them to remind me how long it took to get the USA to join the Second World War.

Despite what he has been doing, he is the last person on earth I would like to have to my house for dinner as I feel he is a deeply unlikeable person. I don't mix up likeability with leading a country well.

So this brings me back to the insanity of this country, where how likeable or supposedly decent you are should decide whether you run the country. For all of those of us involved in rural business, the current government would have you believe that they are people of deep conscience and decency. I am not going to argue with that. They may or may not be, but would you hire them at interview to run a business? I wouldn't, because they don't understand the principles of investment nor the prime drivers of successful business.

Rural business is under even greater pressure than it has been for some time, precisely because this government is trying to virtue signal to the radicals in this country. For both agriculture and aquaculture, the future is looking tougher and tougher. There will be more legislation, more regulatory burdens and more civil servants, monitoring your business. They will give credence to so-called experts and activists over those who actually do the business, at the same time as increasing tax on business and through that, employees.

What it will take for businesses in the rural environment to stand up and resist? At what point will we all say: "Enough"? Agriculture has had a pretty supportive public for a long time. Aquaculture has had to put up with some of the most radical, misleading liars attacking the industry. What will it take for us to stand up and challenge the government properly? Or do we secretly believe that the activists are right?

I have always believed that sea lice are not a significant cause of the decline of sea trout and salmon in the wild. It's not just that I have seen wild salmon, netted on the east coast, bleeding off their backs from over 100 gravid female lice. Nor is it that no-one can find the juvenile lice despite all of their modelling. Nor even that the decline matches on east and west coasts, which it has since the 1960s. It is simply that it makes no sense for a fish, adapted over millennia, not to have a strategy against a parasite which has always hung about in the estuaries. It never made any sense and it still doesn't.

So now we are starting to hear that the traffic light system in Norway is not improving the lot of wild salmonids. Are they going to review whether they got it right? Apparently not, as they are talking about making it even more draconian. The more government uses "experts" and statistical modellers, the more they are going to get it wrong but at what point is the industry going to cry: "Enough"? The industry has been proven guilty without any evidence. There is plenty of theory but almost no evidence. So why are we allowing it to happen? This is not like fertiliser run-off in agriculture where controls were based on evidence.

> "What it will take for businesses in the rural environment to stand up and resist?

Surely it is time to use the law to challenge the grounds behind this attempt to control the industry, by using statistical models as though they were fact. If we do not, I fear for where we will end up. ●



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