

# THE VALUE OF AQUACULTURE TO SCOTLAND

A report for Highlands and Islands Enterprise  
and Marine Scotland.

Executive Summary - June 2017





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## THE VALUE OF AQUACULTURE TO SCOTLAND

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# INTRODUCTION

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Front cover image:  
Employees at Loch Duart Ltd

This impact study was commissioned by Highlands and Islands Enterprise (HIE) and Marine Scotland (MS) to understand the composition of the aquaculture sector in Scotland and consider the opportunities and challenges relating to the potential growth of the sector and its wider value chain through to 2030. The aquaculture sector in Scotland spans finfish, shellfish and seaweed.

This study report provides material that will help inform the considerations of the newly formed Aquaculture Industry Leadership Group (AILG) and complements the industry-led strategic plan, “Aquaculture Growth to 2030”, published in October 2016, which sets out the industry’s objectives and aspirations for growth (broadly to double production by 2030), and recommends steps that should be taken to achieve this.

Also, the new strategy, “Ambition 2030”, published in March 2017 by the industry body, Scotland Food & Drink, concludes that there is an opportunity to approximately double the turnover in the food and drink sector in Scotland by 2030.

The report has drawn on recent and trend data collated by Marine Scotland, Seafish and others on production, employment, distribution of activity within Scotland, supply chain linkages, etc.

Our interpretation of this information was aided through speaking to representative organisations across the aquaculture spectrum, businesses, and public bodies involved in supporting and regulating the industry and granting permissions and leases for new developments.





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These contacts also provided insights into the perspectives and plans of key businesses, which confirmed the strong growth aspirations up to 2030 that underpin the industry's new strategic plan and their appetite and financial capacity to commit the required investment.

In order to assess the potential growth in economic impacts from aquaculture in Scotland up to 2030, our consultations with organisations and businesses spanned, for each aquaculture sub-sector: market development (UK and overseas); growth capacity at existing sites; potential new production sites; potential growth in productivity in production and processing; supply chain growth as output grows; innovations that would increase productivity; workforce development requirements; and potential constraints – including reduced production in particular years

due to disease, sea lice and other biological causes, regulatory controls (including biomass limits and planning consents), the ramifications of the UK leaving the EU, international competition, and sufficient labour supply.

How these and other positive and negative factors will play out will determine the nature and extent of growth across the aquaculture sector in Scotland, and two indicative scenarios are given for employment and GVA (Gross Value Added) impacts that might stem from particular output growth scenarios by 2021, 2025 and 2030.

## CURRENT STATUS OF THE SECTOR AND RECENT TRENDS

### FINFISH

Atlantic salmon production dominates the Scottish aquaculture sector by volume and value, accounting for 95% of finfish production by volume.

According to the annual MS survey, the production of farmed salmon in Scotland increased from 129,588 tonnes in 2005 to 171,722 tonnes in 2015 (plus 32.5%), peaking in 2014 at an all-time high of 179,022 tonnes.

Site employment in Scotland increased from 915 full time equivalent jobs (FTEs) in 2005 to 1,310 FTEs in 2015 (plus 43.2%).

This implies a reduction in productivity in terms of volume produced per hour of labour input at farm sites; although this trend did not adversely affect Scottish producers' profitability as indicated by strong price per tonne produced increases over the period, or the sub-sector's competitiveness due to productivity improvements in the value chain – including transport by well boats of increasing size and mechanisation and scale economies in processing.

The five largest salmon producers accounted for 92% of production in Scotland in 2015.

Employment in smolt production grew from 231 FTEs in 2005 to 267 FTEs in 2015 (an increase of 12.7%), with smolts produced per FTE increasing by 9.2% over the period – a modest labour productivity increase.

In Scotland, employment identified in Seafish's annual survey of UK processors fell by 12% from 4,007 FTEs to 3,551 FTEs between 2008 and 2014 in units principally processing salmon (though with growth between 2012 and 2014 following the recession), while growing by 62.6% in the rest of the UK over the period to 1,096 FTEs. In 2016, employment in salmon and freshwater fish processing (as now categorised) was shown by the survey to

total 3,225 FTEs in Scotland – a reduction of around 4% on 2014 – although the reduction in the UK as a whole was 15%. This reflects the lower output tonnage of Scottish salmon in 2016 discussed in the report and due principally to the impact of increased sea lice.

Export sales of salmon from the UK are difficult to interpret from available statistics, but appear currently to have a value in the region of £400-500m excluding re-exports and processing of imported salmon, with the USA, France and China the principal overseas markets.

The main other finfish species farmed in Scotland is rainbow trout. Total production was 8,588 tonnes in 2015, mostly for food consumption, though a small proportion of production is for restocking of recreational fishing. This volume is a 46% increase from the previous year, and the trend is towards seawater cages (54.5% of production in 2015) along the salmon production model. The highest previous annual total was 7,670 tonnes in 2008. Site employment in 2015 totalled 118 FTEs, a reduction from 137 FTEs in 2002 when production, at 6,659 tonnes, was 22% lower than in 2015. Producers' expectations for 2016 were for a slightly reduced total of 7,415 tonnes.

Other finfish employment in 2015 totalled 43 FTEs, a significant reduction from 101 FTEs in 2006, which was due in large part to the failure in 2008 of the Shetland organic cod farming operation, No Catch. The other species produced were halibut (90 tonnes) and brown trout/sea trout (58 tonnes). "Cleaner fish", lump sucker (15 tonnes) and wrasse (7 tonnes), used as a biological control for parasites on Atlantic salmon, are increasingly being farmed, with Marine Harvest planning a new wrasse hatchery in Machrihanish.

ATLANTIC SALMON

DOMINATES 95%  
SCOTTISH FINFISH PRODUCTION



## SHELLFISH

Mussel and pacific oysters are the main shellfish species produced in Scotland, with mussels for the table accounting for 7,270 tonnes in 2015 and 2.7 million pacific oysters produced according to Marine Scotland's annual survey.

There were 144 shellfish businesses operating in Scotland in 2015, with 171 of 335 sites producing in that year. Scottish Shellfish Marketing Group has 16 members and is the leading supplier of rope-grown mussels and cultivated pacific oysters. There were 15 oyster operators across West Scotland supplying two seafood processors. The shellfish sector employed 344 people, 166 of whom were full time. The value of aquaculture shellfish production at first sale was £10.1m in 2015, but the sector in Scotland increasingly extends beyond production to value added processing and marketing.

Tonnages of mussels produced for the table grew from 4,219 tonnes in 2006 to 7,270 tonnes in 2015 (plus 72.3%), peaking in 2014 at 7,683 tonnes. The 2.7 million pacific oysters produced for the table in 2015 were lower than the 3.1 million produced in both 2006 and 2011 and the 3.4 million produced in 2014, but numbers for on-growing have increased greatly in recent years, averaging 6.3 million over the 2013-15 period compared with 1.4 million in 2011.

Other shellfish species farmed are of much lower volumes, comprising native oyster, queen scallop, and king scallop.



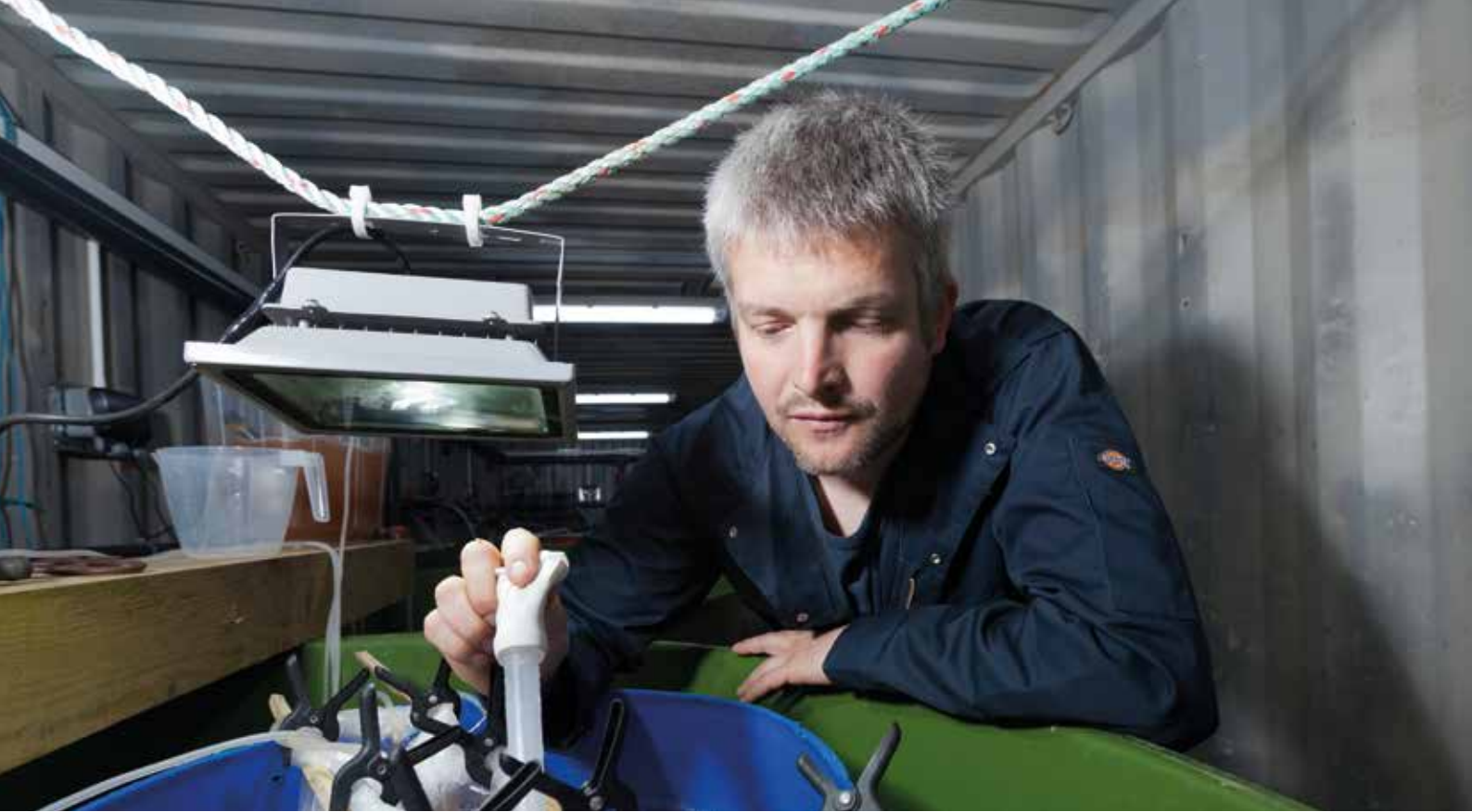
## MUSSELS PRODUCED FOR THE TABLE



**7,270**  
TONNES

**4,219**  
TONNES

2006 2015



## THE VALUE OF AQUACULTURE TO SCOTLAND

## GEOGRAPHICAL SUMMARY OF CURRENT ACTIVITY

Almost all Scottish production of finfish and shellfish is in the Highlands and Islands, with processing and supply chain employment (including feed supply, pharmaceutical services, sea and road transport and equipment suppliers) also important to different parts of the region, as well as to other specific places in the Central Belt and the North East of Scotland.

Salmon production is focused in the North West (32%), Shetland (25%), the South West (21%) and the Western Isles (16%). Orkney (6%) has grown from 3,724 tonnes in 2006 to 11,074 tonnes in 2015, with more new sites planned.

76% of rainbow trout production was in the West of Scotland in 2015, with Dawnfresh the one large scale producer as well as the principal processor.

The greatest contribution in regional mussel production in 2015 was from Shetland, accounting for 77% of Scotland's total. The former Strathclyde region (principally Argyll) accounted for 79% of Scotland's pacific oysters.

**25%  
SHETLAND**

**77% MUSSELS**  
produced in Shetland

**SALMON  
PRODUCTION**

**32%  
NORTH WEST**

**16%  
WESTERN  
ISLES**

**6%  
ORKNEY**

**76% RAINBOW TROUT**  
produced in the west of Scotland

**21%  
SOUTH  
WEST**



## BASELINE ECONOMIC IMPACTS

Impacts in Scotland, in terms of FTEs, associated earnings and GVA (Gross Value Added), were estimated using the most recent data in the 2015 Finfish and Shellfish Survey reports (see above). To allow for year to year variations due to production cycles and other factors, the baseline year for the purposes of this report was taken as the average of the 2014 and 2015 calendar years.

The aggregated estimated impacts summarised below for each sub-sector include on-site and off-site employment associated with production and sales, processing, transport and all indirect impacts through the supply chains of these industry components.

Also, induced impacts in Scotland through the spending of direct and indirect FTEs were estimated and are included in the table.

This estimated employment impact is higher than was estimated in the report by Imani, jointly funded by MS and HIE, that was published by Marine Scotland in 2014 on the Benefits to Scotland of Aquaculture that are quoted in the industry's new strategy due to the more comprehensive coverage of the value chains of the aquaculture sub-sectors undertaken for this new study (with impacts from capital investment included), and increases in output since the Imani report's baseline year of 2012. The Imani report was conservative in its estimates where value chain data were not available.

**TABLE 1:**  
**FTEs, ASSOCIATED EARNINGS AND GVA FOR EACH SUB-SECTOR**  
**(AVERAGE OF 2014 AND 2015)**

	FTEs	Earnings (£M)	GVA (£M)
Salmon	10,340	271.0	540
Rainbow Trout	472	12.3	25
Other Finfish	61	1.7	3.5
Shellfish	1,054	25.9	50
Relevant Organisations, Research Institutes, etc	95	3.1	4.5
<b>Totals</b>	<b>12,022</b>	<b>314</b>	<b>620</b>

FTEs  
**12,022**

EARNINGS  
**£314<sub>m</sub>**

GVA  
**£620<sub>m</sub>**



**AQUACULTURE  
PROVIDES A RANGE  
OF SOCIAL AND  
COMMUNITY IMPACTS  
IN REMOTE AND  
RURAL AREAS  
WHERE FARMS AND  
RELATED ACTIVITIES  
ARE LOCATED**





## SOCIAL AND COMMUNITY IMPACTS

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Aquaculture provides a range of social and community impacts in remote and rural areas where farms and related activities are located.

The employment that the sector provides in rural areas has helped to compensate for long term declines in agricultural and fishing employment as these sectors have increased their productivity, whilst the year-round employment offered by the sector has contributed towards the sustainability of family livelihoods, with tourism and agricultural employment in rural and remote areas highly seasonal.

Surveys carried out for businesses on their impacts in particular rural and remote areas have identified the following as important in sustaining local areas economically and socially:

- increased local populations and improved age structures through new employees and their families moving in and people not having to leave their home area for work
- additional employment and income (some of which is spent locally)
- new and enhanced skills with employment that has proved sustainable over time
- more families in rural and remote areas which improves the demographic structure and sustainability of communities
- the important work carried out locally by partners of aquaculture employees (teaching, nursing, etc)
- roles that staff and their families play in voluntary activity (including coastguard, fire services, etc)
- the contribution made by employees' children to the survival of local schools with small rolls; use of company harbour facilities for other commercial and leisure purposes
- the survival of small local businesses (hotels, fuel supplies, local maintenance services, etc)
- and financial support that companies have given to local groups and causes, enabling events and activities to take place and for people to travel to participate in activities elsewhere.

## SUMMARY OF CHALLENGES AND OPPORTUNITIES

Scotland's aquaculture sector has a more certain future in terms of customer demand and scope to grow to meet this than many other sectors of its economy. This confidence relates to:

- The rapidly growing world population, with a large number of people in developing countries each year moving into income brackets where they can afford to buy Scotland's aquaculture produce. Allied to this is limited scope for growth in wild fisheries and the limited number of countries that can farm salmon healthily and cost-effectively.
- The international focus of the companies that farm salmon, which means that Norwegian and Chilean production growth will tend to be focused on supplying world growth in demand (which is expected to be high) rather than competing in the UK or with the export markets targeted by the multinational companies and the smaller Scottish companies for Scottish whole and processed product (which is small in relation to international supply).
- The scope for productivity improvements across Scotland's aquaculture value chains – including efficiencies in feed production costs; new systems for rearing young fish to shorten their time in sea water; increases in permitted biomass through a better understanding of the biomass limits of sites; larger sites for salmon further offshore; increased mechanisation in processing; and production increases and economies of scale in other aquaculture sectors through co-operation and amalgamations.
- The appetite for growth and the financial strength (from their past profits) of the major businesses in the sector.

Specific opportunities include:

- Growing the UK market through messages about the health benefits of eating farmed salmon, trout and shellfish, increasing product diversification (including sauces), strong Scottish branding, and maintaining price competitiveness.
- Growing overseas markets through maintaining a margin for Scottish provenance, collaborating with other Scottish food and drink producers in marketing and establishing new forward linkages with processors and agents.
- Stressing the low carbon footprint of aquaculture compared with typical agriculture to those concerned with the climate change impacts of their consumption – countering, for some people (e.g. councillors making planning decisions), local negative environmental impacts.
- Creating additional relatively skilled and well paid jobs in Scotland through the value chain as the sector grows through a transition from manual work to supervisory and technical roles as mechanisation increases – particularly in processing.
- Increasing R&D employment through collaborations between companies, support organisations and academic institutions across the supply chain, with a combination of public and private funding.
- Success, through R&D, in developing larger sites for salmon in deeper waters that can be developed and operated (without damage to cages, nets or moorings) cost-effectively through producing large volumes – which will be necessary given the higher development and operational costs per site that will be involved.
- Growing employment in Scotland in equipment supply and maintenance, with import substitution and increasing scope for exporting equipment as company scale and expertise grow.
- Identifying innovation sites, as recommended by the industry working group, to permit controlled trials and development of innovative equipment, technologies, disease control measures, and regulation. These sites might be shared by public and private users.
- Continuing to play a role in supporting peripheral and fragile areas that are losing population and have ageing resident profiles through increasing year-round sustainable employment through investments in new sites and other facilities in local areas.



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The main challenges in achieving potential growth currently identifiable are:

- The problem of sea lice on salmon that has been increasing and which the sector is attempting to alleviate through a range of measures.
- Achieving environmentally sustainable higher biomass limits on a significant number of sites through the new depositional zone regulation (DZR) that SEPA proposes to introduce, and enabling new sites further offshore to be given higher biomass limits through the scientific work being undertaken. The potential increases in annual production through the DZR is based on more reliable modelling beyond 2,500 tonnes of biomass than has been possible to-date.
- Maintaining and developing international trade relationships with suppliers and customers after the UK leaves the EU, together with sterling's exchange rate in the short and longer term keeping its exports competitive and competing food imports relatively expensive.
- Attracting and maintaining an adequate labour supply as the regulations on employing overseas nationals change, and encouraging young people in Scotland to take up aquaculture as a career. Interesting young people in outdoor work is an increasing challenge.
- Improved access to loan finance and other private investment by shellfish producers, with production growth constrained if reliant on re-investment of profits.
- Alleviating local concerns around existing sites and new developments – making the case across the value chains that activity is on balance beneficial to livelihoods, with due consideration of the economic, social and environmental impacts.
- Identifying value added product development opportunities for Scottish seaweed producers as this industry expands internationally, with scope for cultivation to supplement harvesting.

**SCOTLAND'S  
AQUACULTURE  
SECTOR HAS A MORE  
CERTAIN FUTURE  
IN TERMS OF  
CUSTOMER DEMAND  
AND SCOPE TO GROW  
TO MEET THIS THAN  
MANY OTHER  
SECTORS OF ITS  
ECONOMY**



**A LARGE NUMBER  
OF FACTORS  
WILL HAVE  
SIGNIFICANT  
POSITIVE OR  
NEGATIVE  
INFLUENCES ON  
GROWTH ACROSS  
THE SECTOR  
AND ITS VALUE  
CHAINS TO 2030**





## POSSIBLE FUTURE SCENARIOS TO 2030

The industry's Aquaculture Growth to 2030 report states that "sustainably achievable projections for 2030 could be in the range of 300,000 to 400,000 tonnes per annum for finfish production, with "a medium production figure of 350,000 tonnes of salmon". This would be approximately double the average 2014 and 2015 years harvest of 175,372 tonnes. The industry report also suggests that "in shellfish production there is potential to reach 21,000 tonnes of mussels per annum by 2030 and to significantly increase the value of oyster production". Some 21,000 tonnes of mussels would be a 133% increase on the average 2014/2015 production of 9,029 tonnes.

In order to assess the impacts that this scenario might generate in Scotland, indicative estimates for related employment, earnings and GVA growth in Scotland up to 2021, 2025 and 2030 were calculated for our report. Assumptions were made on future labour productivity growth across value chains, and it was assumed that earnings per FTE and the GVA to earnings ratio would both stay as currently – although these impacts could grow proportionately more than employment.

The impact estimates, which relate to the complete value chains in Scotland of the aquaculture sub-sectors other than seaweed, showed increases of almost 50% in FTE employment, earnings and GVA by 2030 on an assumed average annual increase in labour productivity of 2%.

Our analysis of the factors that would facilitate this 100% increase in production by 2030, together with our consideration of the challenges that would need to be overcome, however, suggested to us that a 50% increase in production across the aquaculture sector might be more likely. Indeed, relative to past trends during a period of strong market growth, a 50% increase might be considered a good achievement.

This alternative scenario, assuming an average of 1.5% rather than 2% labour productivity growth across the sector's value chains (which is considered more likely if the output increase is smaller), would give the following increased impacts.

These would represent increases on the 2014/15 baseline of 9.8% by 2021, 14.9% by 2025, and 20.0% by 2030 in each of employment, earnings and GVA. This assumed productivity growth applies to existing employment as well as increased employment – i.e. should there be a lower output growth, employment impact could fall if productivity rises at a faster rate than output.

As the report emphasises, however, due to the large number of factors that could have significant positive or negative influences on growth across the sector and its value chains by 2030 (the most important of which are highlighted above under Challenges and Opportunities), the outcome in practice could range from little change from current production levels by 2030 to (potentially) greater growth than the industry has projected, depending mainly on how effectively the challenges are overcome and whether the "game changers" in output are achieved.

Indeed, reductions in salmon output in 2015 and 2016 (due principally to sea lice) suggest that the impact scenario above for 2021 might be delayed.

**TABLE 2:**  
**INDICATIVE MEDIUM GROWTH SCENARIO BASED ON 50% GROWTH IN  
OUTPUT BY 2030 AND 1.5% AVERAGE PRODUCTIVITY GROWTH PER ANNUM)**

	2014/15 average	2021	2025	2030	2030 Totals
Employment (FTEs)	12,022	+1,173	+1,791	+2,402	14,424
Earnings (£M)	314	+30.8	+46.7	+62.7	377
GVA (£M)	620	+60	+90	+120	740



## THE VALUE OF AQUACULTURE TO SCOTLAND

# ACTIONS TO MAXIMISE IMPACTS BY 2030

The report tabulates the main activities by time period considered to be required if the sector is to be able to capitalise on the opportunities summarised above and overcome the challenges (or minimise their impacts). These suggestions have some read across to those put forward by the industry in its strategic plan, and will involve companies, support organisations, public bodies, research and development institutions, and training providers working together with a focus on achieving the higher end of the sector's sustainable growth potential.

Key actions and outcomes will include:

- Success in ameliorating the effect of sea lice (and gill diseases) on salmon through a range of methods with continuing significant investment by the industry in solutions.
- Obtaining robust site by site information that will enable biomass limits to be increased for certain existing and new sites without adversely affecting the environment.
- Investment in onshore recirculation systems for producing and ongrowing smolts, shortening the time fish are required to spend in sea cages and giving significant annual increases in salmon production and productivity.
- Success in identifying models for salmon production from sites further offshore that are cost-effective, with the trial sites proposed by the industry playing a part in this.

- Securing loan finance for shellfish production growth.
- Workforce development measures that provide the sector's employees across the value chain with the skills they will require to work with new technologies and encourage sufficient numbers of people to enter the industry across the occupational spectrum.
- UK and export market development that successfully capitalises on Scottish provenance, maximises value added in Scotland, and convinces the public of the health benefits of eating salmon and other farmed finfish and shellfish. The industry expects that strong output growth scenarios will entail a high proportion of increased sales being to export markets, with China and other rapidly growing countries offering particular opportunities.





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