RURAL ECONOMY AND CONNECTIVITY COMMITTEE

SALMON FARMING IN SCOTLAND

SUBMISSION FROM DOUGLAS LOW

My Background

I have an MA in Natural Sciences and have recently retired from a 40-year career working in aquaculture, seafood Processing and lastly aquafeed where I held senior executive positions at EWOS (major salmon feed producer) for 11 years. I have spent a great deal of my working and private life on the Scottish west coast and islands and am also a keen trout angler.

I am a trustee of the West Sutherland Fisheries Trust, a non-executive director of the Scottish Salmon Company and an advisor to Cargill Aqua Nutrition but my views and my submission are not associated with any of these organisations and are restricted to the subject of RAS and closed containment.

The Status of Recirculation Aquaculture Systems (RAS) for Salmonids

I have followed much of the proceedings of the both the REC and ECCLR enquiries and read all the submissions. Many of the contributors call loudly for a move to closed containment and specifically land-based RAS and some are pushing for this to be done in as little as five years. The SAMS report covered RAS, briefly but correctly, but it is clear that most of the authors of the submissions to the inquiry are poorly informed of the current status of RAS technology, its development and application in salmon farming and of its economics in relation to Scotland.

I would like to share my understanding of the status of RAS for salmonids, based on an in-depth review of current developments and technology which I have recently undertaken. I have had access to numerous RAS facilities, RAS technology suppliers, RAS scientists and technical experts and investors involved in RAS on-growing through my extensive industry network.

Freshwater RAS

Freshwater RAS is being successfully used for the production of salmon smolt in all farming regions – Norway, Chile, Scotland, Canada, Faroes and Australia. RAS related investment in Norway in the last decade exceeds $1.3billion (£1bn) and by the end of this year investment in Scotland in Freshwater RAS will have reached about £100m. The % of the total smolt production which comes from RAS is estimated to reach about 50% globally by 2020 and the level in Scotland will be similar. Scotland is not lagging significantly behind the rest of the world as has been suggested.

The benefits of Freshwater RAS for smolt production are many, including the ability to produce larger smolt of up to 150g average weight compared to around 80g from flow-through systems and to some degree, to control the timing of a crop’s readiness for transfer to sea.

System failures and significant losses in Freshwater smolt RAS have occurred but design and level of operational control are improving and the risks considered manageable and acceptable.

The economics of Freshwater RAS and the huge investments involved make sense for salmon farmers in the context of the overall farming operation. The actual cost of production per kg of smolt is at least double that of market size, cage-reared salmon (and well in excess of the actual market price).

The tonnage of salmon expected to be produced in Freshwater RAS in Scotland could reach 4000-5000 tonnes in the next couple of years – a small volume however compared to the 170,000 tonnes of seawater production.

Post-Smolt production

The next phase of development, particularly in the Faroes and Norway is to rear much larger smolt and post-smolt in excess of 500g, so as to reduce production cycle time in the sea down to around 12 months or less. This is in part a strategy for lice and disease avoidance and mitigation. The investment in RAS facilities required to do this is huge – up to £65m on a single facility such as at Leroy Kjaerevla where the production of 12 million fish at 500g would be around 6000 tonnes which again is a relatively small volume in terms of marketable fish.

The bigger the RAS facilities get the more complex and challenging their operation becomes. The introduction of saltwater into RAS brings an additional dimension, changing both water chemistry and the composition of the bacterial fauna in the bio-filters. Seawater RAS science and technology lags behind freshwater. Dealing with effluent from seawater RAS is also more difficult given its salt content.

Production of Harvest weight salmon in land-based RAS

There has been a great deal of optimistic publicity around announcements of the development of land-based salmon farming facilities. There are several websites for such RAS projects, particularly where investment is being sought, that give the impression growing salmon to harvest weight in RAS on land is currently technically possible and economically viable at an acceptable risk. This is far from the case in the majority of circumstances and locations.

The development history of growing salmon in land-based RAS has seen system failures, technical challenges such as off-flavours, large or total fish kills and financial losses and the total global production in 2017 is probably less than 5000t. Langsand, Danish Salmon, Jurassic Salmon, Niri, Sustainable Blue, Kuterra and Shandong Oriental have all publically admitted to some form of major setback or published economic results that at very best show marginal viability.

The DNB “Deep dive” report is also frequently incorrectly cited as evidence that land-based RAS for salmon on-growing is a proven viable technology that would allow traditional farmers in Scotland to move production ashore. This report overestimates the commercial and technical success of current land based projects and the real status of announced projects, many of which lack investors. What it does say is that land-based RAS is possibly a competitive alternative to sea cage expansion or market entry in existing farming regions like Norway where the value of biomass consent is estimated to be in excess of £10million per 1000 tonnes.

It also highlights the competitive advantage of land based farming close to markets through reduced logistical costs. Conventional Norwegian farmers meanwhile are spending their money on RAS for smolt production and to trial novel seawater systems such as offshore farms (Salmar Ocean Farm 1) or moveable ship-like farms (Nordlaks Havfarm).

Technical Challenges
Progress has been made in solving issues such as maturation and off odours and flavours but there is still much to be learnt about monitoring and controlling water chemistry and the impact that feed composition has on the bio-filtration capability of a system when fish reach larger sizes.

There are considerable differences of opinion between the technology suppliers about the correct approach to biological filtration system design and operation.

It is possible to grow fish in RAS to market size but it is hugely challenging to do so at the necessary stocking densities and more importantly, with the level of biomass growth per m3 per day necessary to be economically viable.

Investment costs
There is some consensus on the capital investment required for a land-based RAS capable of producing 2000t of harvest fish at £8000-£10000 per tonne of production. However larger projects will have lower cost per tonne.

The Atlantic Sapphire project in Florida is expected to make capital investments of $200m for a production capacity of 30,000 tonnes on a single site and Nordic Aquafarms quote $450 million for a 33,000 tonnes project in Maine.

However the large RAS projects that have been announced are located in places close to markets in the US and China giving them a freight advantage in their local markets over Scotland and Norway of £1/kg. Industrial energy costs in the US, specifically electricity, are about half of those in Scotland and this is a key driver of RAS operating cost.

Land-based RAS in Scotland
The scale of facility investment in RAS required to replicate the 170,000 tonnes currently produced in Scotland would therefore be in the order of £1.4bn- £1.7bn with a unit size and geographical spread similar to sea cage farming assuming the availability of appropriate land. Rationalising and centralising production into six 30,000 tonnes units could reduce that cost to below £1.3bn.

Given the distance to the main salmon markets and high logistical and energy costs, Scotland is unlikely to be a competitive location for land-based RAS for on-growing salmon and developments closer to markets constitute a threat to traditional cage farming. These aspects were recognised in the 2014 HIE sponsored review of RAS technologies and application.

Land-based RAS for salmon in any location is only viable at comparatively high market prices and itself is vulnerable to the success of other farming strategies such as offshore operations and closed containment at sea. If conventional farming solves some and hopefully all of its current disease challenges reducing production cost and growing supply, land-based RAS will be uncompetitive and a disaster for those early movers. Whilst premium pricing is achievable at the moment for RAS produced fish it is likely to be a niche market of only a few thousand tonnes.

A robust business case for investing upwards of £1bn to move Scottish salmon farming on to land just cannot be made.

Other closed containment developments

There are developments in Norway for floating closed-containment systems (Flexifarm/Cermaq and the MH Egg) and Canada (Agrimarine) with flow though treated water technology that may prove to be a more realistic alternative to land-based RAS.

These systems are designed to keep sea lice, predators and pathogens out and fish securely in. Solid wastes can be collected for distribution over a controlled sea area depending on environmental assimilation capacity.

This may be a technology that has applications in Scotland that provide a win/win scenario for farming and environment and should be closely monitored.

Conclusion

Land-based RAS is an important technology for salmon farming but it is not currently a viable alternative technically or economically for cage farming of Scottish salmon to market size in significant volumes.

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