

Recirculating aquaculture systems, or RAS, provide a constant and controlled environment to rear farmed fish. They minimise water consumption, control culture conditions and allow effective management of waste streams. They can also provide some degree of biosecurity through measures to isolate the stock from the external environment. The rate of adoption of RAS in the aquaculture industry has been growing fast worldwide. The [English Aquaculture Strategy from Seafood 2040](#) highlighted the growing investment in RAS and its potential to become a major contributor to English aquaculture and seafood production. This [Aquaculture Common Issues Group](#) looked at what is happening in the UK.

[The sustainability credentials of RAS, including opportunities and constraints that RAS attributes present for different types of sustainability certification.](#) Francis Murray, Associate at [ForesightAqua](#).

This presentation covered: investment trends in grow-out RAS and sustainability drivers; life cycle assessment (LCA) of environmental impacts of grow-out RAS; and environmental certification and potential use of LCA in setting metric requirements for grow-out RAS. Key comments:

- The story of aquaculture RAS is now dominated by salmon with announced projects suggesting investments of between US\$ 10-20 billion. There are substantial new investments for shrimp and yellowtail with research and pilot projects in other species inc. jade perch, pike-perch and sole. RAS has also become important to produce wrasse for salmon lice control. However, the use of RAS for grow-out production has a long history with many commercial failures.
- Sustainability is at the heart of marketing products from RAS.
- The drivers for RAS are: projected growth in global salmon/seafood demand; static or reducing access to suitable sites for conventional 'open' systems (due to environmental regulation); increasing societal (inc. certification) and regulatory attention to sustainability indicators inc. GHG emissions, nutrient release, acidification etc; and changing cost-benefit v conventional production.
- **Conclusions**
 - Salmon leading investments in grow-out RAS adoption
 - Differentiation on sustainability attributes essential re. competitiveness with conventional open net-cage systems
 - A key attribute is potential for co-location with markets (subject to energy and feed sourcing constraints)
 - RAS attributes facilitate compliance with many existing requirements for environmental certification – RAS specific requirements being added
 - Challenges remain for use of LCA for setting metric requirements
 - Feed dominant contributor across most LCA impact categories – all systems
 - Energy intensity is a primary farm-level sustainability constraint for RAS
 - All of this points to a gap. Many of the sustainability criteria do indicate premium/organic.

Discussion

- **Q. Transport. I think this shows a big proportion of cost is air freight, is that right?**
A. Air freight for fresh salmon is a big issue. There are moves towards shipping more, but the reality is that most fresh salmon is air freighted out of the country of production.
- **Q. My understanding is that RAS cannot legally be certified as organic because it is not grown in a natural habitat?**
A. There are at least two organically certified RAS facilities. There are some certification differences which support this and certainly there are some loopholes. So different sustainability attributes will secure that status.

[RAS industry veteran presenting on his activities in RAS, including the trials and tribulations of RAS set-up and operation.](#) Richard Prickett, [Dorset Cleanerfish Limited.](#)

- Explained the history to Dorset Cleanerfish Ltd (DCL) – a successful (small) RAS project. The capacity of the farm is now approximately 1 million fish at 30g size with a market value of approximately £1.5M achieved. DCL now employs 13 local workers' full time.
- RAS offers solutions for rearing some but not all species. However, there are more failures than successes (and stock insurance is very expensive). RAS production costs must be competitive when compared to alternative supplies of the same species.
- Richard highlighted the practical technical and business lessons he has learnt over the years.

Discussion

- **Q. The utilisation of nanobubbles are making headlines, have you considered using this tech on your farm?**
A. We did look at this technology a few years ago and at that time it was not really developed and was not what we needed. We might investigate this a bit further but need to consult an expert.
 - **Q. Would you welcome an English aquaculture apprenticeship scheme?**
A. We do have a lot of work experience students and do try to support the local college. We would welcome this idea and very open to taking this approach.
 - **Q. Will you utilise any of the funding streams currently being promoted?**
A. We spend a lot of time filling in grant applications. DCF is 51% funded by MOWI which does preclude some applications. This can be quite a complicated process, and this is especially true now with a lot of short-term schemes. We are always very happy to chat collaboratively with interested parties.
 - **Q. What is your policy on visitor?**
A. This is a little tricky because this is a very cramped facility and is not really an option for large groups to walk around. Special cases will be considered. There is also a big biosecurity issue and health and safety issues we need to be aware of. People with a specialist interest can contact Richard directly and each request will be considered on a one-by-one basis.
 - **Q. Are there one of two reasons for the success of DCF? What has made this journey successful?**
A. There are a number: 1. Lumpfish as a species is hardy - a forgiving species. Ballam wrasse is the other cleaner fish candidate, and this is much more difficult to breed. 2. Temperature control is crucial. Our building and tunnels are excellent insulators. 3. We designed this as we went along. We can get in and clean the system out. 4. We use a juvenile species with a short life cycle. 5. A willing business partner.
 - **Q. What are the long-term prospects for cleaner fish for bio control means?**
A. This really depends on other developments. We have seen the use of SLICE (but lice have evolved and are now resistant). So cleaner fish provide a biological solution and an alternative to using chemicals. Ballam wrasse has a very good future prospect, lumpfish is more difficult to determine. Lumpfish will be part of the toolbox of ways to treat lice.
 - **Q. Does demand continue to rise?**
A. Offshore may be where lumpfish will struggle. Also, only some lumpfish actually eat the lice – so this could be looked at as well. Could potentially train them to all eat the lice.
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We also heard from two new two RAS-orientated ventures bringing a different perspective and focus – on development (Andrew Whiston, [RASTECH](#)), and production ([Noola Redclaw](#)).

- Andrew spoke about 'boring RAS' with slow and small developments, rather than big venture projects. Organic growth, low exchange rate, low energy use, resilient and redundant design, waste management, use of waste from other industries and processes – beyond net zero.
- Noola Redclaw uses technology to sustainably produce a new exclusive crustacean (redclaw crayfish) for the seafood menu of high-end restaurants. This is being established in Dorset. Simple life-structure and robust. Early start with a long way to go. Took over a year to get established in Dorset.

Discussion

- **Q. What does the panel see as the future for RAS in the UK? Is it high value close to conurbation or niche species?**
A. Looking at salmon stories – raises the question - is this the right time to do this? For the consumer price is a governing factor (RAS will have higher costs). We have seen the failures over the years. Whole mass of technical problems. Lessons to be learnt. It is about stocking density versus price points that can be gained. So probably more niche. Not enough learning from failures.
- **Q. With the consumer driven by price can we drive the sustainability message? Can we change the message for consumer so that it is not just price?**
A. There are a whole host of issues. Certification just gives access to market, but it does not guarantee a premium. It does need to provide more of a premium.
- **Q. Could your model for cleaner fish be moved out to other locations?**
A. It is possible. Weymouth is not necessarily your typical location. On location, it is totally controlled by the salmon companies. There is always a historical starting point for these ventures. Getting the permits is not easy. If you can walk into a building with all the permits that is a great starting point.
- **Increased seafood consumption. There have been ventures launched such as Feed UK and the English Aquaculture Strategy? Can we work with these to support the promotion of RAS systems?**
A. We need to raise this up the agenda. Many schemes have tried to increase seafood consumption. We can learn from other markets. All the consumer data shows that people buy protein by price and fish competes with chicken, pork, beef and even plant sources of protein. A consumer may go in to buy fish, but if something else is on offer they are very likely to switch their choice. RAS is not always RAS – there are different ways of doing this. Depending on the age profile of consumers – there are different buying incentives.
- **Bottlenecks.** The challenge is getting started. You need the capitol first, and there are gaps in the investment market. The investment terms all include a model in terms of return on investment and RAS systems do not match that model. Need more companies to do this to learn from example.