Finding the Proper Place for Recirculating Aquaculture

Someone attending the trade show at a WAS conference for the first time might be excused for thinking that recirculating aquaculture plays an outsized role in contributing to global seafood production. This skewed perspective seems to be rather pervasive among the general public and the environmental NGO community. A casual internet search returns many links to articles about recirculating aquaculture.

The reasons for the popularity of recirculating systems are not clear. Many are enamored of the technology and equipment and the idea of a "fish factory." Perhaps it is the high degree of control over production compared to other systems. Another reason is the degree to which some aquaculture scientists and engineers advocate for particular technology approaches, almost to the point of evangelism.

So, what is the appropriate role for recirculating aquaculture? Arguably the best applications of RAS are in hatchery and nursery settings, where control over water quality and the ability to hold fish at high densities can be advantageous. Perhaps the best example of this is the widespread production of salmonid smolts in recirculating systems. Marine Harvest is currently making large new investments in recirculating hatchery and smolt operations to support net-pen grow-out in Norway, Scotland and Canada. Other companies are investing in facilities in Iceland, Finland and elsewhere.

In the last issue of ***World Aquaculture***, Josh Goldman described the rather dismal business success of RAS built for grow-out, which could be as low as 10 percent. Despite this, companies continue to make rather large investments in RAS technology for grow-out. Recent news reports indicate that US$261 million is being invested in a 600-t grouper farm in Oman. Nissui is investing in a 200 t/yr RAS facility for sashimi-grade white shrimp in Japan. Inland farming of shrimp in RAS is taking place in Europe (Spain, Germany, Greece, Latvia) and the US (Indiana, Texas).

One of the more notable investments in commercial recirculating aquaculture is taking place in China, where Sino Agro Food, Inc. is developing the Zongshan MegaFarm on some prime real estate in the Pearl River Delta in Guangdong. When fully phased in by 2025, the farm will have an estimated production capacity of around 200,000 t and possibly 300,000 t of freshwater prawns, Asian cod and eels. The focus markets are middle-class Chinese consumers and the high-end live market.

It remains to be seen whether or not such a massive facility will be successful but the multi-million dollar capital investment required is obvious. In general, business success of such ventures depends on much more than technological success. The economic performance of RAS depends on a specific set of conditions, often linked to being able to obtain a price premium for a high-quality or high-demand product because production costs in RAS are often higher than in other production systems and so return-on-investment is much less than with other systems.

Getting the scale right is also critical for success with RAS technology. Part of the issue with scale is that commercial RAS facilities often exist in isolation from one another. As such, it is difficult to achieve economies-of-scale with respect to other parts of the value chain, such as feed supply and processing, when RAS facilities exist in scattered isolation. Regional production of multiple RAS facilities is needed for successful sector development. In many places, RAS-based production facilities target specialty or local niche markets because they cannot compete with low-cost commodity producers.

Other initiatives are underway for land-based grow-out of Atlantic salmon in RAS. The research team at The Freshwater Institute has developed a technology package and has rolled it out for commercial application. Analysis of economic performance and environmental footprint appear to show that RAS technology is at least competitive and comparable with the net-pen approach. One of the first facilities to grow salmon using RAS (Kuterra) is operated by the Namgis Fist Nation on Vancouver Island, Canada. A business unit of Nordic Seafood has started to construct 2,400-t RAS salmon production facilities in Norway and Denmark. It remains to be seen if these facilities will be economically sustainable without investment subsidies and price premiums, and if issues such as disease management, off-flavor and general product quality can be resolved to make production in RAS comparable to salmon raised at sea.

Culturing shrimp and fish in RAS has also caught the attention of the environmental NGO community. The approach is considered "eco-friendly" or "earth friendly" aquaculture by the Monterrey Bay Aquarium Seafood Watch program, which recommends shrimp and salmon produced in RAS as a "Best Choice" for consumers. The Food and Water Watch is advocating that only salmon produced in land-based RAS should be considered for organic labeling under the proposed USDA organic standards for aquaculture. This view seems rather myopic. While it is true that RAS can address certain environmental impacts associated with shrimp or salmon farming, this production system is very energy intensive, resulting in increased carbon footprint per unit production. The tradeoff between local and global effects seems to be worth it to those organizations advocating RAS as a solution to environmental problems.

Another appropriate place for recirculating systems is in so-called "backyard" aquaculture, as developed nearly 40 years ago by organizations such as the Rodale Institute and the New Alchemy Institute. The stepchild of backyard aquaculture – aquaponics – now dominates the interest of aquaculture hobbyists. Recirculating aquaculture also has a place in primary and secondary education, where it represents an excellent tool to teach ecology, nutrient cycling, and using waste as a resource.

The community of aquaculture professionals needs to be responsible to potential investors, environmentalists, consumers and the general public in describing the advantages and disadvantages of RAS technology. A balanced and comprehensive perspective about what RAS can and cannot do can foster a realistic outlook and thereby serve to promote further commercial applications of this promising production technology.

— *John A. Hargreaves, Editor-in-Chief*