AQUACULTURE FRONTIERS

PART 1: CAN RAS TURBO-CHARGE AQUACULTURE?

Recirculating aquaculture technology is being used to revive species in decline and improve smolt farming. The next evolutionary step is salmon mega-farms.
Learn how RAS farming is going mainstream.

Spheric Research

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REPORT SCOPE

Matt Craze spent a year researching the current global state of the recirculating aquaculture systems (RAS) industry starting at the 2017 Aquanor show in Trondheim, Norway after getting curious about their impact on salmon industry. This research has taken him to West Virginia to learn about the work carried out by the Freshwater Institute, and the sites of the future land-based salmon farms in Maine. More recently, Matt visited Camanchaca's state-of-the-art RAS smolt facility in southern Chile. Matt interviewed dozens of executives involved in the RAS industry and analyzed the return of investment models and operating cost structures of these systems versus traditional open pen aquaculture. Larisa Culeac studied a growing trend in Russia and neighboring countries to raise sturgeon in RAS tanks and revive the caviar industry that has been decimated from overfishing in the Black and Caspian seas.

INTERVIEW LIST

- The Freshwater Institute
- Center for Cooperative Aquaculture, University of Maine
- Kingfish Zeeland
- Nova Austral
- Maine Aquaculture Innovation Center
- Candor Seafood LLC
- Maine & Co
- Marine Harvest ASA
- Hudson Valley Fish Farm
- Matorka
- Aqua-Spark
- Rabobank
- Pareto Securities
- Broodstock Capital Partners
- Billund Aquakulturservice
- AquaBounty
- Atlantic Sapphire
- Nordic Aquafarms
- Whole Oceans
- Nova Austral
- Pentair Aquatic Eco-Systems
- Salmones Camanchaca
- RecircInvestBiotech
- Saudi Fisheries Company
- AquaGen
- Chilean fishing regulator Sernapesca
- Superior Fresh
- Ctrl Aqua
- Kepler Cheuvreux
- AKVA

CHARTS + ILLUSTRATIONS

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EXECUTIVE SUMMARY

Recirculating aquaculture technology (RAS) is going mainstream.

During the past two years, the aquaculture industry collectively shook its head in disbelief as a group of Norwegian entrepreneurs turned a utopian vision of a giant salmon farm in tropical Miami into reality. Atlantic Sapphire is the talk of the town, and it's listed on the Oslo Bors.

With Atlantic Sapphire under construction, two other companies announced major RAS salmon farms in the state of Maine this year, starting what could be deemed as a land-based revolution in the United States. Outside of salmon, innovators are raising other species in a RAS environment. Kingfish Zeeland, a Dutch firm, is successfully farming tropical yellowtail fish at a site near the North Sea. Hudson Valley Fish Farms started a steelhead trout farm, just a short drive from New York City.

"That's the beauty of recirculating aquaculture systems (RAS)," said Steve Eddy, the director of the University of Maine's Center for Cooperative Aquaculture (CCAR). "You can grow anything, anywhere."

The US-based RAS announcements came in a year when Washington governor Jay Inslee said the state would phase out salmon farming following the pen collapse of Cooke Aquaculture last year, effectively ending the activity in the United States. Wild salmon captures from Alaska and Canada also plummeted in 2018, making the world's largest salmon importer more dependent on Chilean and Norwegian imports than ever. Meanwhile, US salmon demand is growing at double digits, and the massive Chinese market is just waking up to the taste of Atlantic salmon.

RAS is already a major business. The industry started off in the 1980s as a group of intrepid Danish innovators started eel farms using technology similar to that used in a swimming pool, with a recirculating water system. A pivotal moment occurred when the salmon industry realized that RAS could significantly improve processes used in their smolt hatcheries. Salmones Camanchaca became a pioneer in 2001 when it built its first ever hatchery using RAS technology in southern Chile.

Now, the conventional salmon farming industry is adopting RAS technology at a frenetic rate. Major providers of turnkey RAS systems, such as Norway's AKVA Group and Denmark's BillundAquakulturservice A/S, have sizeable project pipelines and are reporting double digit growth in the sector as they cater to the salmon industry.

Converting a salmon hatchery from a traditional flow-through system to RAS reduces variability and better prepares fish for their life at sea, said Hugo Cajas, head of freshwater for Chilean producer Salmones Camanchaca. It can also significantly reduce the time that fish spend in coastal pens, effectively freeing up that seawater capacity for more cycles, according to Grieg Seafood ASA.

Black and Caspian seas.

Steve Eddy at the CCAR is attempting to restore dismally low Atlantic halibut stocks through RAS farming. In Asia, Gus Wemes, one of the earliest employees of Danish RAS supplier Inter Aqua, is growing sea cucumber in a multi-storey RAS operation in Xiamen, China. He expects the technology to explode in China as the government starts to clamp down on the country's many informal fish farms. The Middle East has been experimenting with RAS technology for many years using sovereign funds.

Summerfelt left the Freshwater Institute in June to join Superior Fresh, a massive aquaponics farm located in the Wisconsin countryside that harvested its first Atlantic salmon on July 4. Water from the so-called blueHouse where the Atlantic salmon are kept irrigates a 100,000 square-foot greenhouse of leafy greens before being pumped back to the fish again. This technology could revolutionize farming and food production systems in the United States, Summerfelt said.

"We are changing the world," Summerfelt said. "RAS creates jobs in areas that need it and provides everyone with a healthy protein source."

Despite these advancements, RAS technology is still under serious doubt because of a high failure rate among start-ups. The technology is still prone to biological and budgetary errors and the jury is still out whether RAS will go mainstream anytime soon, according to food industry lender Rabobank.

Biologically, operating a RAS farm requires highly skilled staff to avoid fatal human errors, according to Steve Summerfelt. A system such as the Superior Fresh blueHouse requires at least a "couple" of biology doctorates to avoid failure, he said. While these systems are effective at keeping pathogens out, once in, they can quite easily wipe out the entire population of a RAS farm.

This variability is gradually decreasing, said Brian Centanzaro, aquaculture research center manager for US-based technology supplier Pentair. In the early days of RAS, skilled individuals would assemble different parts of equipment to make a RAS system. Now that situation has "flip-flopped" as the systems have become generic and surpass the knowledge of any one individual, he said. This in itself poses problems because it's hard to find operators of the sophisticated equipment used in modern RAS systems, he said.

Also crucially important are service providers to the RAS space. The industry has attracted major companies such as French water company Veolia, which designs the biofilters that collect fish feces and recirculate fresh water back into the tanks. There are a host of other companies that supply oxygen, transport sludge, control pressure valves and other key steps. Energy utilization rates are still high and costly, making RAS prohibitively expensive in some parts of the world.

There is still much room for improvement in the standardization of technology, said Kjetil Haga, an investor in RAS technology for Oslo-based investment firm Investinor Capital Partners. The firm bought 51% of Billund last year and plans both on acquisitions that can further optimize RAS systems, he said.

"RAS is going to boom," Haga predicts.

Perhaps the biggest challenge of all to operating a RAS grow-out farm is in the financial capability required to raise the large sums of capital needed and executing the project on time, and on budget.

On paper, RAS is a no-brainer. RAS providescheaper operating costs than coastal pen farms because transport costs are close to zero, said Erik Hatrs, CEO of Nordic Aquafarms, which plans a major RAS salmon farm in Maine.

These Maine sites will pay less than ten cents per kilotx truck salmon to processing plants in the U.S. Northeast Corridor, by virtue of being close to Route 1 on the Atlantic Coast. By comparison, Chilean farmers pay more than $1

BILLUND AQUAKULTURSERVICE: RAS 128 Projects Built Since 1984

REPORT AUTHORS

Matt Craze

Matt started Spheric Research in 2017 to provide research and consultancy services to the seafood and food industries. Matt is a regular contributor of articles on global seafood trends for Undercurrent News. Previously, Matt was part of a team that founded Bloomberg LP's commodities news desks in Europe, the Middle East and Africa, and Latin America between 2004 and 2015. Matt also works with New York-based management consultancy firm 10EQS and holds an MBA with Cornell University.

Larisa Culeac

Larisa has spent the past six years working for LG Corp., developing the Korean company's commodities division in South America. Larisa studied at Babson College in the United States, completed an MBA at Chile's Universidad del Desarrollo and worked for the European Bank for Reconstruction and Development in her native Moldova.

Spheric Research

Provides key insights into the global seafood industry, and has now provided research to numerous major companies in seafood and several of the world's largest agricultural companies. Spheric Research provides research on major global seafood topics that are sold exclusively by Undercurrent News and also offers tailor-made research and consultancy services to the seafood industry.

Undercurrent News

Undercurrent News is the most read seafood industry news service globally. UCN was started by journalists Eva Tallaksen and Tom Seaman in 2012 and has become an authoritative voice in the industry, placing an emphasis on high quality journalism and sending reporters to key trade shows and industry seminars around the world.