Two fish tanks for young smolt salmon in Scottish Sea Farms' Barcaldine hatchery

At Scottish Sea Farms salmon hatchery thrives with reliable pumps

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Possibility in every drop

The Scottish Sea Farms Barcaldine hatchery in the Scottish Highlands near Oban, UK.

“You can't control the temperature, you can't control the water quality very well”

Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms

The situation

Scottish Sea Farms – a land-and marine-based salmon farmer – used to operate its hatcheries with the “flow-through” water technique. They brought fresh water into their plants from nearby rivers or lakes, let it flow through their tanks and systems and then flow out again, back to the original water sources.

This method posed a challenge, however. There was little control over what nature gives you.

“You can't control the temperature, you can't control the water quality very well,” says Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms Barcaldine atchery. For instance, inside the hatchery, the water must be 12°C (54°F). But incoming water temps in Scotland can swing wildly, depending on the season – as low as 2°C or as high as 20°C. The hatchery must thus spend a lot of resources heating or cooling the water. And that’s only one challenge – among several others relating to having control over a system that was increasingly unsustainable on different levels. Swinging temperatures and other factors also have the potential to stress the salmon, affecting growth.

The hatchery reuses 96% of the water and can carefully control temperature, pH, salinity, feed amounts and so on.

“Recirculation means you're recycling 96% of the water. Therefore, the energy you're putting into it, you're reusing it, you're not wasting it at all.”

Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms

Reducing water use by 100x

Around the time the company was planning a new hatchery in Barcaldine in the Scottish Highlands in the mid-2010s, a new technology had matured, called recirculating aquaculture system [RAS].

“Recirculation means you're recycling 96% of the water,” Ewen Leslie says. “Therefore, the energy you're putting into it, you're reusing it, you're not wasting it at all.”

Denmark-based RAS system builder Billund Aquaculture built the plant in 2017. It was in full production by 2019. Billund Aquaculture’s Chief of Sales, Bjarne Hald Olsen, explains that flow-through systems use 50,000 litres of water to produce one kilo of fish. “If we start to reuse the water, use mechanical filtration to take out the excrement, add some air – then you can reduce water consumption to around 16,000 litres. If you reduce the water even further to what we call moderate RAS systems, then we are using around 500 litres of water to produce one kilo fish – a factor of 100.”

The RAS system has other advantages, says Ewen Leslie. This hatchery grows salmon from egg up to the juvenile smolt size, then transports them out to a marine farm for on-growing.

“In the natural environment, a salmon reproduces in a freshwater river. When the fish goes to smolt and heads back down to the river mouth to go out to sea, from that egg to that smolt in the natural environment, you have a 95% mortality rate, 5% survival rate,” he says. “In a RAS production area where you control the environment, we've turned that around, achieving a 90% survival rate.”

Read more about the Scottish Sea Farms case at **grundfos.com**

Each room of fish tanks has a corresponding room of pumps of various types and sizes to control the RAS system.

> **"If a pump went down on one area, we could lose as many as 1.5 million fish. So it's very important that we have redundancy. And we have reliability, which we get from Grundfos."**

Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms

The solution

The Barcaldine hatchery has 37 kilometres of pipework on five levels to make the RAS system work, says Ewen Leslie. "And we use pumps to move everything."

Billund Aquaculture's Bjarne Hald Olsen says, "When choosing the pump brand for a recirculation system, we must look into the sustainability, reliability, the maintenance and service. And there we have had Grundfos as a reliable partner since we began in 1986."

The Barcaldine facility has more than 250 Grundfos pumps in different capacities moving water and fish around the hatchery.

"When we're in full production, we could have up to 12 million juvenile fish from egg right through to 120-gram smolts in 12 production areas," says Leslie. "If a pump went down on one area, we could lose as many as 1.5 million fish. So it's very important that we have redundancy. And we have reliability, which we get from Grundfos."

Pumps in the Energy Central send warm glycol to heat exchangers to help keep fish tanks at a steady 12°C.

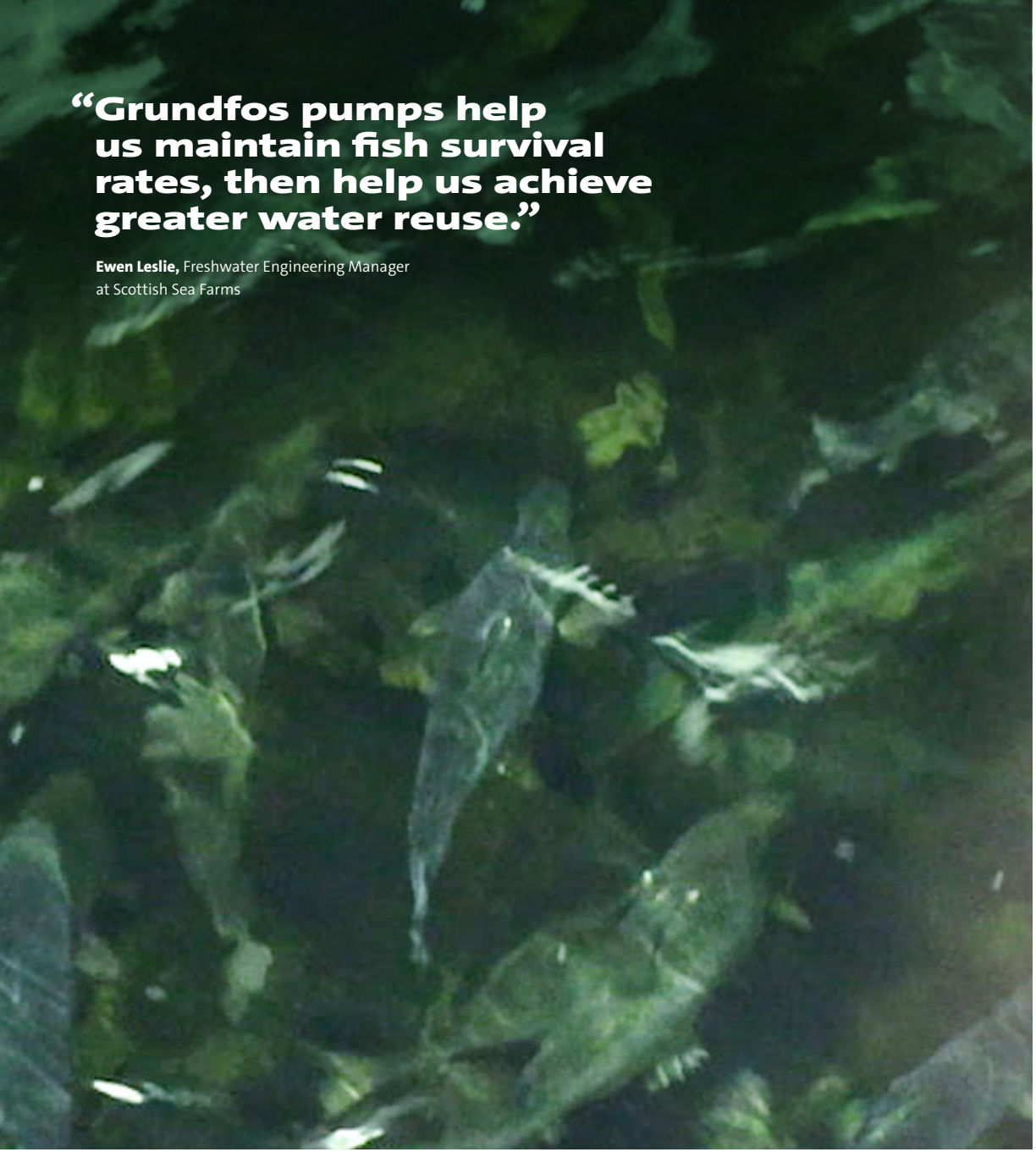
“So our energy usage is controlled that way. We need a steady 1.6 MW to run the facility and move the fish and water about the hatchery. So every little bit of energy we can save is a bonus to us – and reduces our carbon footprint as well. That’s another factor for choosing Grundfos pumps.”

Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms

RAS pump applications

A few of the main pumping applications in the Barcaldine hatchery include temperature control – moving warm or cold glycol to and from heat exchangers to help keep the water temperature at a steady 12°C in all fish areas. There are also pumps needed to move water from a return sump up through the RAS system’s biofilters, back down into a trickling sump and then pressurising again through UV disinfection units. From there, the pumps move water into oxygen cones and further into the fish tanks, Leslie says.

“Grundfos pumps can deliver the same output water-wise for less current,” he says. “So our energy usage is controlled that way. We need a steady 1.6 MW to run the facility and move the fish and water about the hatchery. So every little bit of energy we can save is a bonus to us – and reduces our carbon footprint as well. That’s another factor for choosing Grundfos pumps.”



The outcome

Ewen Leslie says that RAS can help with future global food production in a more sustainable way. “Having a facility like this means that we can better mimic the natural environment of the fish, which means they are going to grow quicker, bigger, and more robust. When they go to sea, they then have a stronger chance of survival. Which means more fish at the end of the day that we can then provide to the world.

“Grundfos pumps help us maintain fish survival rates, then help us achieve greater water reuse,” he adds. “And we move it around quicker, easier. And we will know that when we switch on the pump, it's going to run for us 24/7 for the duration that the manufacturer has specified.”

He says that since it started in 2019, the Barcaldine has had no major breakdowns. Further: “We've had no fish losses in the facility. And we've had compliments back from our marine farms that we are now producing the biggest, most robust smolts they’ve had. The smolts are also fed straightaway on day one, which has never happened before from other smolt suppliers. So that, to me is our biggest achievement.”

Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms

Read more about the Scottish Sea Farms case at **grundfos.com**

Mark Bennett, Grundfos UK & Ireland Sales Engineer, with
Ewen Leslie, Freshwater Engineering Manager at Scottish Sea Farms

Grundfos Supplied

Grundfos supplied more than 250 pumps for the Barcaldine hatchery RAS system, built by Billund Aquaculture for Scottish Sea Farms. Read more about Grundfos aquaculture solutions here.

Case story info box

Topic: Recirculating aquaculture systems (RAS)

Location: Barcaldine, Scotland, UK

Customer: Scottish Sea Farms

Fact box on Scottish Sea Farms

Locations: Scottish west coast (including Barcaldine), Orkney Isles and Shetland Isles

Freshwater hatcheries: 3

Marine farms: 57

Processing facilities: 3

Barcaldine: Contains four individual hatcheries, each with its own dedicated water treatment system for the highest levels of biosecurity.

Product: 120-gram smolt salmon for further production at marine sites

Annual production: 12.5 million/year, resulting in 40,000 tonnes/year after full production (gutted weight, 2022)

Performance: 90% annual average fish survival

Customers: Premium markets, restaurants in 24 countries (50% UK, 50% rest of world); plus secondary producers

“When choosing the pump brand for a recirculation system, we must look into the sustainability, reliability, the maintenance and service. And there we have had Grundfos as a reliable partner since we began in 1986.”

Bjarne Hald Olsen, Chief Sales Officer, Billund Aquaculture

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Sources. The facts in this story come from interviews on site at the Scottish Sea Farms Barcaldine Hatchery Barcaldine, Scotland, UK, and at Billund Aquaculture in Denmark on April 11-13, 2023.

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