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TASMANIA
HUON'S FOREST HOME HATCHERY

Capable of producing two million 100-200g smolt a year, Huon's new hatchery/smolt RAS underwrites the company's 20,000 tonne annual salmon production for the domestic and overseas market.

BY JOHN MOSIG

Huon Aquaculture is at the forefront of innovation in Tasmania's salmon farming sector. Their new hatchery/smolt production facility at Forest Home, Judbury, on the Huon River, is part of that innovation.

David Mitchell is Huon's General Manager of Freshwater Operations. He said the planning and construction rollout was a well-timed 'just in time' operation:

"In response to increased market demand for high quality salmon there was an increased requirement for a reliable supply of high quality smolt," he said. "In a country that regularly suffers from drought conditions, the answer these days is a RAS facility. Based on our experience from our Lonnavale RAS plant that has been operating since 2006, the benefits of having control over environmental factors give optimum feed performance, and extraordinary quality and growth."

Huon took several things into consideration when choosing a manufacturer. Fish welfare and performance were top of the list and to ensure this the size of the treatment area is important.

"You get better outcomes from a large de-gassing and bio-filter area," Mitchell noted. "Our environmental footprint was also a major factor in making our decision. Minimal water usage and waste treatment were high priority items for us as well. Aquatec Solutions and Billund both offered proven commercial systems that would fit our specifications on this scale."

"We completed our first cycle while the building was still under construction. The planning permit went to the Council in July 2014. By June 2015 we were stocking our first eggs from Springfield and Saltas. The first fry were ready in August 2015; the first parr by February 2016; and the first smolt were put to sea in June 2016."

To give some idea of the commitment Huon has made, the capital outlay was over $30m.

HARD WATER HELPS

Water is drawn from both the river and a bore (well). The farm — tanks and treatment plant together — hold approximately 5,400m^3 of water. The bore water has a high alkalinity that helps buffer the pH in the system. The water is mechanically filtered down to 25µm before being ozonised to kill any microbes that might be present and to oxidize and precipitate any unwanted minerals such as iron and manganese. The water is mixed according to the farm's buffering needs. When the river is in flood, turbidity can make the bore water the preferred option.

Water exchange through the tanks is every 45 minutes and water replacement — due to evaporation and splash, but primarily sludge removal — is a very low 5-7% daily.

Water flow through each system is driven by one set of main pumps and through individual oxygen cone pumps for each tank. The whole facility is on one level, which reduces the number of pumps required and energy costs. Overall there are five separate modular, quarantined, recirculating production units: two for incubation; one for 12 fry tanks; one for 12 parr tanks; and one for 12 smolt tanks. Fry tanks measure 5 x1.6m @ 30m^3; parr: 7.4 x 2.3m @ 96m^3; and smolt 11 x 2.3m @ 220m^3.

THOROUGH WATER TREATMENT

Water treatment starts with the removal of suspended organic matter in a 50µm drum filter. The water is then de-gassed before going through the up-welling bio-filter, the media beads of which are only 15% of the void. The flow is slowed at this stage to allow any remaining particulate matter to precipitate. Four minutes of ozonation follow before the water passes through another de-gassing chamber to remove residual O_3 and CO_2. The water also passes through a side stream vacuum de-gasser to remove supersaturated O_2 and other foreign gases before being picked up by the main pumping system. The treated water is then supersaturated through the O_2 cones to 100-110% and returned to the fish tanks

David Mitchell examines the Comphatch incubators.

Belt separator removing floculated sludge. It becomes a valuable by-product of the hatchery process.

The 5-7% side stream flow that goes through to the sludge treatment plant passes through a plate separator to remove the large particles that are transferred to the sludge tank before passing into a denitrification filter that converts nitrate into nitrogen gas. The phosphorus remaining in the flow complexes into particles after the addition of ferric chloride, which is then settled out and added to sludge tank from where it's collected for re-cycling as manure. The separated liquid, after passing through a large ozone contact chamber, goes to two storage reservoirs from which it's used to irrigate Huon's surrounding agricultural land.

The solid waste stream passes through an anaerobic digester, where bacteria reduce the volume. The resultant by-product is dewatered through a belt filter and is now in a form that can be used as a highly nutritious plant food.

Forest Home facility is fully computer controlled, and is backed up by two generators of 900kVA and 1,200kVA, respectively.

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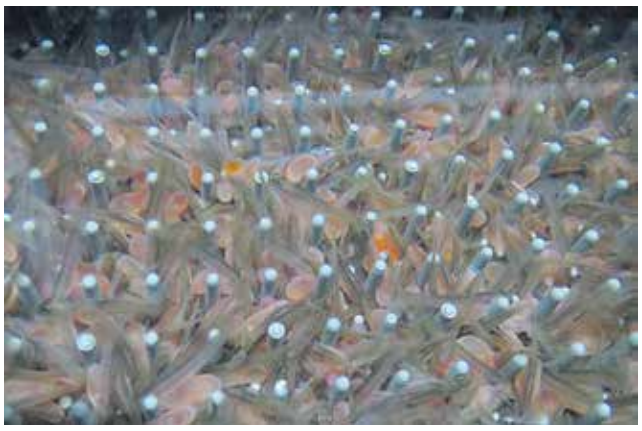
The fry rearing room (parr- and smolt- halls are similar but with larger tanks). The blue box in each tank is the Fish Tank Collector. A pipe (not visible in the picture) takes away water and leads to the central drain (brown standpipe), and on for treatment beginning with the suspended solids filter. The central standpipe is for harvesting fish: a U tube comes up to a stub in the floor beside each tank to which a trolley-mounted Biostream pump can be attached to deliver the fish, via a hose, to wherever they are needed. The black hoppers on each tank are part of the centralized feed delivery system: A button/chain auger delivers food into each hopper from a central store via the grey overhead pipe. Food in each hopper is dispensed by an augur into the blue pipe that lies horizontally across each tank, and through holes in the pipe into the water. Finally, the brown pipe close to the tank wall receives water from individual oxygen cones in pits beside each tank. Water enters the tank through inflow holes from top to bottom so flow is distributed evenly. Overhead LED lights run 24hr for fry. For smoltification, fish need six weeks on a 10-12hr day followed by four weeks pre-transfer on a 24hr day.



Newly hatched alevins.

Chillers for fry, parr and smolt tanks.

One of the smolt rearing tanks at Huon Aquaculture's Forest Home hatchery.

The upwelling bio-filter.

POINTS WITH THE PUBLIC

The other benefit from this extremely efficient technology is that it adds good will to the company's brand. Aquaculture, as the new primary food industry, comes in for some intense scrutiny from the environmental movement. The Aquatec facility built for Huon Aquaculture at Forest Home produces 400 tonnes of fish per year, has a 5-7% daily water intake and negligible nutrient discharge. It would be fair to say that few other food producing sectors could make that boast. As David said, "We are not an industry that can afford to pollute the water in which we make our living."

TEMPERATURE-CONTROLLED INCUBATION

Spawning is in May/June with incubation using Comphatch Incubators designed and built by Alvestad Marine AS in Norway. The spiky substrate is for the alevins to sit amongst. The eggs sit on a removable tray that sits above the substrate. When the alevins hatch the egg tray is removed leaving the alevins among the substrate.

Initially eggs are held at 7-8°C until they reach 150 degree days. Thereafter the incubation temperature is changed for different batches dependent on when they are scheduled for commercial harvest. Stock due for transfer to sea cages in April (Batch 1) continue incubation at 7-8°C and will be harvested from April to July the following year. Stock due for transfer in June (Batch 2) are incubated at 4-6°C to slow their development and will be harvested from August to November, The last batch is incubated at 2-3°C which slows their development significantly. This batch will be transferred to sea in September and harvested from December to February.

Once the alevins hatch, the temperature is brought up to a standard 8-10°C for a few days. They're held in the Comphatch trays until their yolk sacks are exhausted, usually 30 days. At this stage they're moved to the fry rearing room and fed a starter diet The fish are batched in sequence through the tanks in the fry- parr- and finally the smolt-hall before transfer to sea.

Smolt are transported in custom-converted milk tankers to the company's well boat, the *Ronja Huon*, moored at the wharf at Port Huon, approximately 45 minutes from the hatchery. Dependent on fish size, this

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can mean up to 14 truck transfers per day. After the last truckload has been discharged into the boat, the fish will be in the *Ronja* for 1-3 hours before reaching their destination sea cage. Such short transfer times ensure good water quality is easily maintained for the whole journey.

EFFICIENT STAFFING

As the aquaculture industry becomes more automated, staffing numbers can be reduced. The farm runs a standing staff of two shifts working 7 days on and 7-off. Each shift consists of a senior manager, a leading hand and three technicians and a maintenance engineer. There is someone at the plant on a 24-hour basis for alarm cover. However, as David said "…labour input becomes relevant in comparison with an open system," but automation will reduce that differential.

Huon Aquaculture employs over 500 people, drawn both from local talent and from overseas. David Mitchell is one of the managers in the Tasmanian industry who learnt their craft on Northern Hemisphere salmonid farms. His wide experience in Tasmania and Scotland gives him an overview that benefits the whole business, from R&D to operations management.

As part of its risk mitigation strategy, Huon produces fry at four of its hatcheries, Forest Home, Lonnavale, Springfield and Bridport, and also on-grows fish at two freshwater sites at Meadowbank and Millybrook. These different locations give Huon a safety net of different operational and temperature options. With the threat of global warming sharpening the focus of many vulnerable food-producing industries, Huon Aquaculture has a very clear view of what has to be done to future-proof its assets and income flow, and at the same time, assure its clients of a reliable supply of high quality produce grown in an environmentally sustainable way.

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Smolt being loaded for sea-release.

TASMANIA'S SALTAS

How the Tasmanian government and salmon industry effect genetic selection for changing environmental conditions

Atlantic salmon (*Salmo salar*) culture began in Australia in the 1960s with shipments of eyed eggs from Nova Scotia, Canada, to the New South Wales Fisheries' Gaden hatchery. All the Atlantic salmon grown in Australia since then come from those original shipments.

The Tasmanian industry was established in 1986 with three shipments of eyed eggs from Gaden to the Tasmanian Fisheries facility at Taroona. The first commercial crop from those eggs was 53 tonnes, shared among the commercial participants.

In the beginning, all the smolt were produced in the government/industry hatchery under the Saltas (Salmon-Tasmania) banner. Back then there were 14 industry shareholders, who, in collaboration with CSIRO, set Saltas up in 2004.

As the industry rationalized over the years, this has been reduced to three major commercial producers — Tassal, Huon Aquaculture, and Petuna. All three have established their own hatcheries and smolt-growout nurseries. In addition to their own production, they receive an annual allocation of smolt commensurate with their shareholding in Saltas. Tassal is, through acquisition, the largest shareholder.

Saltas houses the Tasmanian Atlantic Salmon breeding program and CSIRO continues to provide technical services and research to support the program, coordinated by geneticist Dr. Brad Evans. The breeding program is drawn from 180 family lines, and has delivered positive benefits to the industry. Five weighted criteria are considered: growth, disease resistance, maturity, flesh pigmentation and oil content. Selection is targeted with three points allocated to growth and resistance to amoebae, with the others traits receiving one point each.

Growth has improved each year since the program began in 2004 achieving a 30% improvement against the base population, and Amoeba resistance, measured as an increased freshwater bath interval, has increased by 34%. These improvements have been achieved whilst maintaining positive trends for the three minor traits: age at maturity, pigmentation, and flesh oil content.

Shareholders also receive a proportional allocation of broodstock from approximately the top ten ranked families (called the "Elites"), to on-grow themselves. This mitigates the risk of having all the broodstock at one site.

Currently Huon and Tassel both run a marine pen, each with 2,500 individually pit-tagged fish from the 180 families. Marine performance of these fish is closely monitored with weight gain and amoeba resistance measured for each fish.

David Mitchell, Huon's General Manager of Freshwater Operations, said that in a changing environment they are able to pick the best performing fish in that changed environment.

Winter water temperatures have risen by 1-2°C in the last 10 to 20 years, and in summertime El Nino weather events, peak sea-water temperatures are higher and may last longer than formerly. This takes the salmon out of their normal comfort zone but does allow selecting the best performing fish as future broodstock for these changing conditions.

Future-proofing the broodstock pool genetically is an on-going priority. However, it is not only temperature that is changing. Aware that no single attribute should be selected for in isolation, David pointed out that dissolved oxygen, phytoplankton and zooplankton assemblages, predator trauma, and any new health issues were all considered. These are all experienced in the indicator pens enabling selection of the most robust fish for anticipated production conditions.

- JM