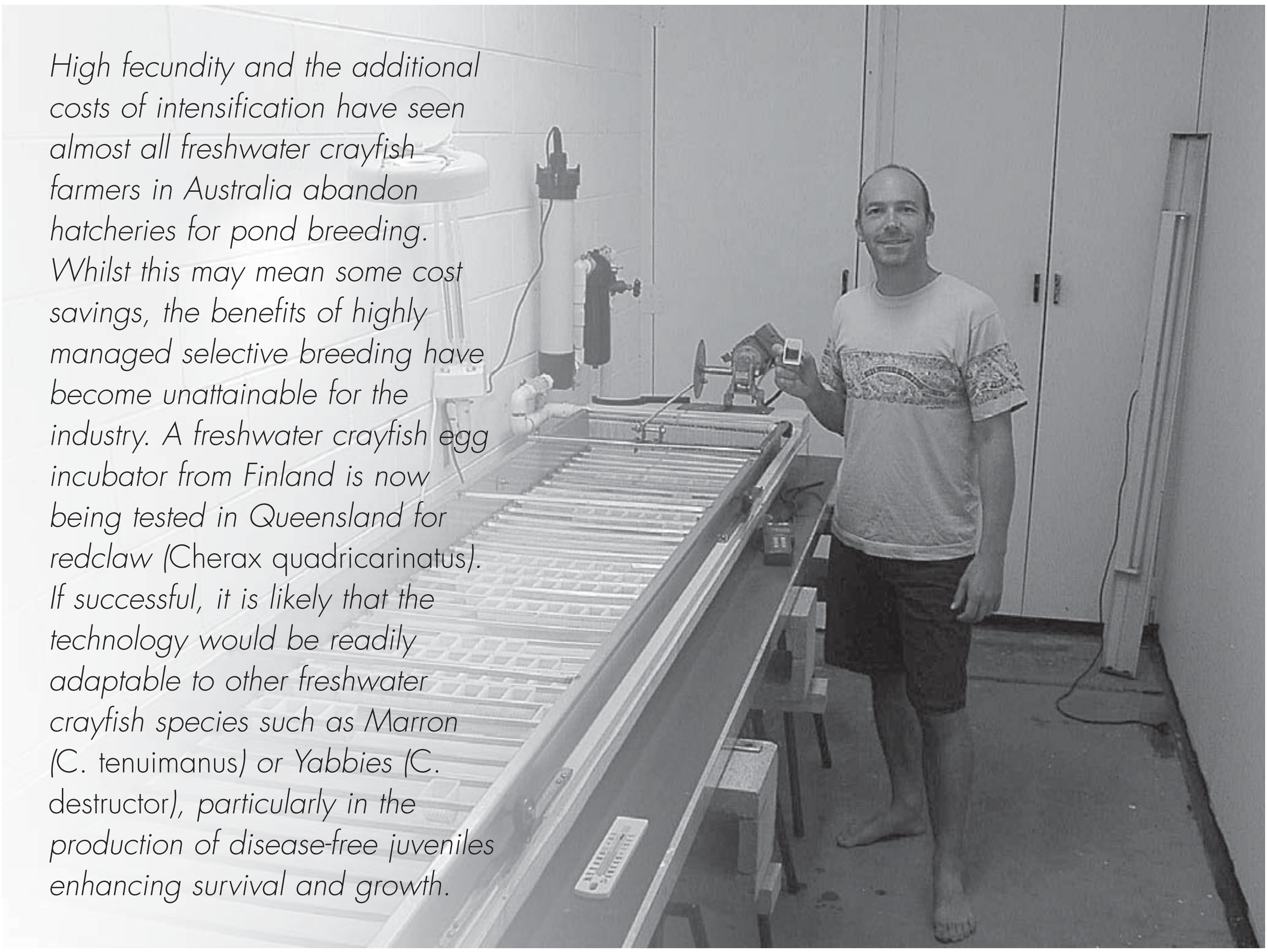
Egg incubator shows promise for redclaw

*High fecundity and the additional costs of intensification have seen almost all freshwater crayfish farmers in Australia abandon hatcheries for pond breeding. Whilst this may mean some cost savings, the benefits of highly managed selective breeding have become unattainable for the industry. A freshwater crayfish egg incubator from Finland is now being tested in Queensland for redclaw (*Cherax quadricarinatus*). If successful, it is likely that the technology would be readily adaptable to other freshwater crayfish species such as Marron (*C. tenuimanus*) or Yabbies (*C. destructor*), particularly in the production of disease-free juveniles enhancing survival and growth.*



Colin with the first Aussie Hemputin.

As a boy growing up in Perth, Colin Valverde was always interested in creepy crawly things. About 13 years ago Colin and his Swiss wife Ursula, visited a few marron farms in Western Australia, a trip which changed their lives.

"We were hooked on the idea of becoming crayfish farmers. After a six year stint in Switzerland we returned to Australia in 2003 to re-establish an old run down redclaw farm on the Atherton Tablelands near Cairns Queensland. The property had been left for a few years and was in quite a state, but with our two young boys Nicolas (now aged 11) and Samuel (aged 9) we are well underway to getting it up to production again. I have nearly finished a Post Graduate Diploma in Aquaculture at Deakin University. We have since been working towards becoming poor crayfish farmers which we have now achieved!" Colin says with wry humour.

Their AquaVerde Crayfish farm has 38 ponds covering a total of 4ha. Until recently, Colin and Ursula have used pond breeding to maintain their stocks of redclaw. But they had been thinking of another way.

"I met Dr Brett Edgerton (a retired crayfish pathologist) at a redclaw conference in 2003 where he explained the technique of crayfish egg incubation that he had seen while visiting Finland. It sounded very interesting and so I travelled to Finland in October 2004 to speak to local crayfish biologists Teuvo Jävenpää (Helsinki) and Jappo Jussila (Kuopio University). Both were kind enough to take me on a tour around Finland's very old and culturally significant crayfish farming industry."

Crayfish is a very important part of life for the Finns and they were desperate to restore native populations of the noble crayfish (*Astacus astacus*) after the American Crayfish plague (*Aphanomyces astaci*) had decimated them. The plague had been introduced into Italy in 1860 with the accidental introduction of the American red swamp crawfish (*Procambarus clarkia*). The Signal Crayfish (*Pacifastacus leniusculus*) was introduced to Europe in the early 1900s because it was resistant to the plague. Unfortunately it still carried the plague and was ultimately responsible for it's spread through-out Europe.

About 25 years ago Teuvo and a government team began work trying to develop a crayfish egg incubator as a means of producing plague-free juveniles for restocking lakes and waterways.

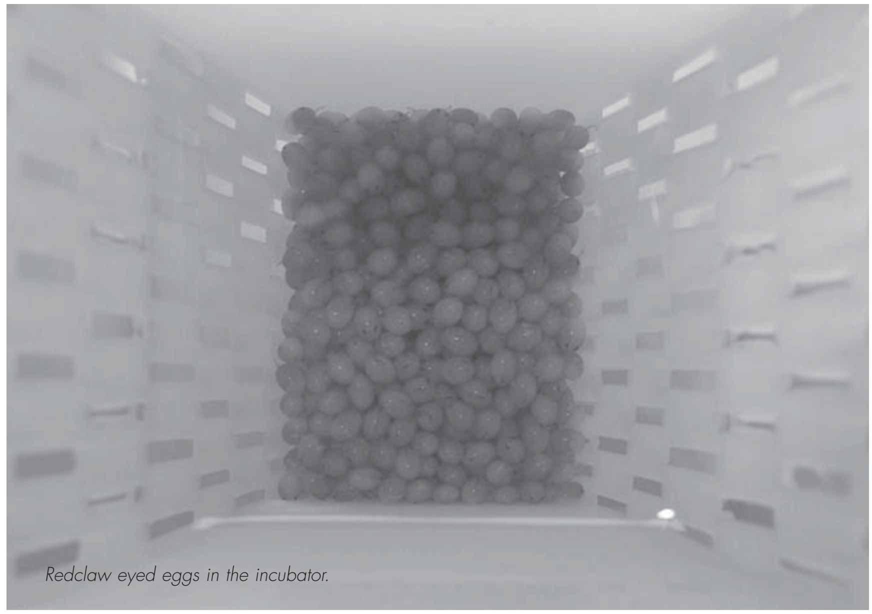
Colin explained that after many trials and tribulations using methods similar to fish egg incubation (such as air bubbles to suspend eggs in a conical glass vessel and trapping eggs between netting), Teuvo had a flash of insight and came up with a crayfish egg incubation system that was eventually called the *Hemputin*.

"In a *Hemputin* the eggs are stripped from the female's tail and are held in over 500 specially designed 100ml plastic baskets which are held in place by a stainless steel rack. The rack sits in a fibreglass tray (3m long by 550mm wide by 100mm deep). An electric motor connected to the rack rocks the baskets backwards and forwards and up and down to generate a careful and gentle current of water that probably simulates the mother's pleopod (swimmerets) movements. In conjunction with the basket design this keeps the eggs tumbling within and allowing the entire egg surface to be available for oxygen uptake."

Colin says the incubator had enjoyed success in Finland and has produced large numbers of crayfish free from the plague. "So today a reasonable proportion of Finland's 140,000 lakes are now sustaining populations of plague-free crayfish." But the war against the plague still rages on.

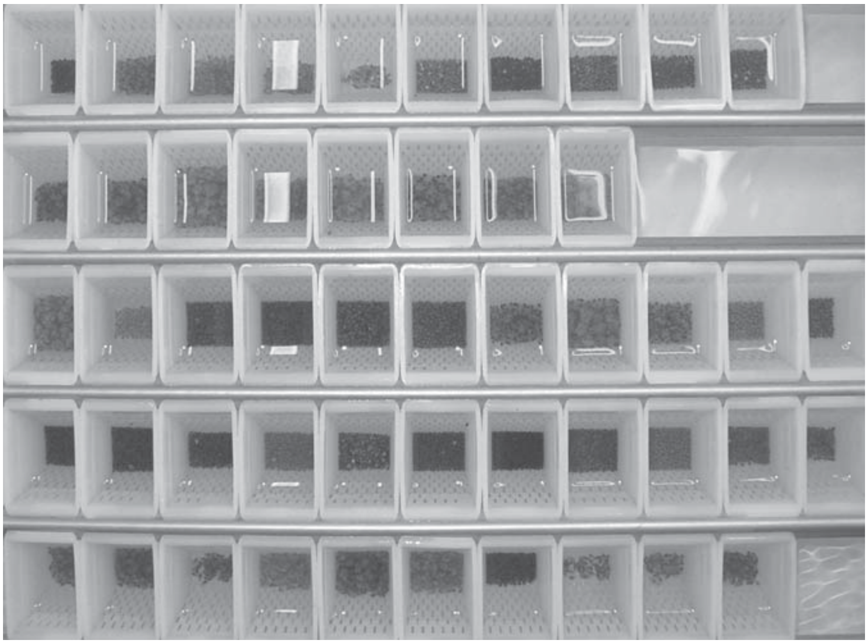
Disease free offspring

However, it is in the production of disease-free offspring that makes Colin very excited about how the Hemputin could provide benefits to freshwater crayfish growers around Australia.



Redclaw eyed eggs in the incubator.

Reclaw just after their second moult in the incubator.



Baskets of eggs in the Hemputin.

This is possible due to the following disease transmission principles:

- The mother does not pass viruses to the eggs. Rather, the viruses are transferred after the eggs hatch or more specifically once the juveniles begin to feed.
- Fungal (i.e. *Psorospermium*) and bacterial infections along with protozoan (i.e. *Epistylis*) and metazoan parasites are restricted to the outside of the egg. Therefore if the eggs are stripped from the female and their outside is sterilised, and then incubated separately from the mother, the juveniles produced are Specific Pathogen Free (SPF).

"Although the SPF properties of the Hemputin have not been systematically and scientifically tested for redclaw, the anecdotal evidence is starting to accumulate that SPF Redclaw are produced." (NB: Post graduate students who would like to test this as a project might like to contact Colin).

"SPF crayfish result in better survival and increased growth rates as the crayfish does not have to combat disease. In addition, there could be a reduction in the amount of crayfish that were unmarketable due to parasites, including unsightly ectocommensals, such as Temnocephalids, and other Helminth worms that normally co-exist with crayfish."

This fellow has a long way to grow.

Colin says it's hard to know (at this stage) if it is possible to completely eradicate diseases from an existing farm. "New farms, however, could start by stocking with juveniles from the Hemputin and be in the fortunate position of starting and maintaining a disease-free farm."

Colin's decision to try the Hemputin with redclaw came after "a big night out with the Finnish farmers eating crays, drinking wine and Schnaps". He had the two major components shipped back to Australia and constructed the rest to make a working system.

"Murphy's Law applied exceptionally well," he continues. "I suppose that's what you get when you are trail blazing." A few unforseen circumstances – like Cyclone Larry taking out his hothouse and breeding tanks, depriving him power for ten days and killing 50,000 hatchlings – didn't help either.

"My experiences with the Hemputin have been frustrating for the first year but I am now getting on top of the problems and beginning to get good consistent results. However there is still room for improvement and I suppose there always will be."

A special insulated room (21m^2) has been built for the incubator and the temperature is maintained at 25-28°C. Colin says temperature regulation has been a problem, particularly during hot weather and he's considering purchasing an air-conditioner.

The Hemputin is kept it total darkness to inhibit the growth of algae and water is circulated at around 60lt per minute

Whilst natural spring water on the property is used for the growout ponds, water for the incubator comes from a 5m deep well, which was also used for drinking water. This is filtered (50µm) and UV filtered (Lifegaurde 40 watt).

"The water from our well is very clean but unfortunately quite acid at around pH5.5 with low hardness of round 20ppm. pH is increased to between 7 and 8.5 and hardness increased to 100ppm."

Colin says dissolved oxygen has to be kept as close to saturation as possible for the five-week incubation period And regular cleaning of filters, tray and partial water exchange are essential.

Eggs are stripped from the females by gently grabbing the base of each pleopod with tweezers and drawn upwards. This does no damage to the female and surprising little damage to the eggs.

Colin says his incubator has 540 baskets with each one holding up to 450 eggs. "Eggs from one female go into one basket and, if there are too many eggs, they will be split into another basket. But the eggs from different females are never mixed."

Dead eggs and/or dead hatchlings must be removed by hand to limit exposure to *Saprolegnia* infection. Depending on how successful or unsuccessful the incubation is progressing, this task can become quite tedious and labour intensive. "We are currently testing ways to see how we can remove them more efficiently.

"In Finland, the Hemputin reliably allows up to 150,000 eggs to be incubated in one go, with previously unheard of survival rates approaching 90%."

Although Colin's best result to date is 65% survival rate, this is a marked improvement on the estimated 10 per cent survival rate from usual (pond) breeding practices.

He's he set a target of 150,000 juveniles per batch and five batches per year. Once this target is reached he'll be able stock each of his growout ponds with 10,000 juveniles each weighing 0.02 grams and 9mm long (with plenty spare for sale).

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▶ Key Management Tool

Colin says it quickly became apparent the technology was useful to all types of crayfish farmers as a farm management tool. He sees the following advantages or benefits from the Hemputin:

- Survival rates are much greater than natural breeding (of around 10 per cent).
- Post incubation pond survival rates should be positive because all the juveniles are going into the ponds at the same weight and age, which means less cannibalism.
- High survival rate of juveniles significantly reduces the quantity of broodstock required, freeing up broodstock ponds for grow out.
- Faster growth as the crayfish are not wasting energy fighting disease.
- Managing smaller quantities of broodstock makes it easier to breed out of season and therefore have juveniles ready for stocking at the very beginning of the growout season (usually early spring).

The Finish take their Crayfish seriously.

- The farmer knows exactly how many juveniles are stocked into each pond.
- Ponds can be stocked immediately after filling, giving juveniles a head start before the waterborne predators can move in.
- Allows for the possibility of a specialist redclaw hatchery to free growers from having to maintain their own brood stock and breeding programs.

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Positive plans for the future

Colin says having a functioning example of the Hemputin to produce SPF Redclaw juveniles in Australia has given the North Queensland Crayfish Farmers Association (NQCFA) an incentive to make plans for its genetic breeding program. "The Department of Primary Industries and Fisheries in Queensland finished with its redclaw genetics program a few years ago. Many farmers are now realising how important such work is and having no one to turn to, meant we have begun to make plans for our own genetic improvement program."

Colin says stock from as many farms as possible from around Far North Queensland will be cross-bred using a system designed by James Cook University through Dr Dean Jerry (geneticist and his scientific consultant). He says the selected crayfish would be mated, the eggs incubated (using the Hemputin away from the farms that participate) and the juveniles then sent back to the farmers for grow out.

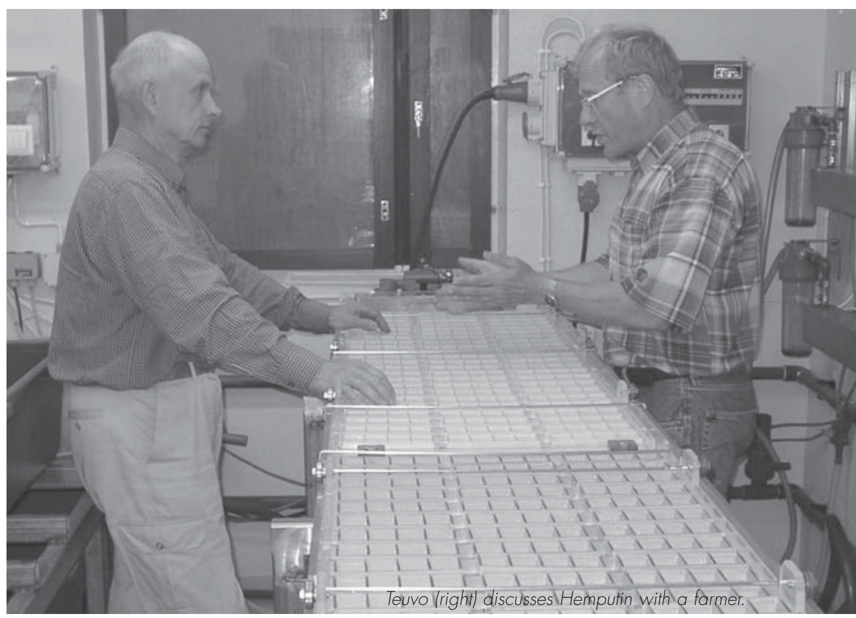
"The best performing crayfish will be returned next year to the genetic improvement program for cross-breeding and incubating and the cycle repeats indefinitely. The Hemputin gives the farmers the confidence they won't spread or acquire any disease they didn't already have, as only the SPF juveniles will ever make it back to a farm."

Not wanting to get too far ahead of the job at hand – building a successful redclaw crayfish farm – Colin says he sees a lot of potential for the Hemputin and is very interested to see if it would work with marron and yabby farms as well. Another use is for the conservation of hard to breed or threatened species such as the many colourful giant spiny crayfish (*Eustacus* spp) or the world's largest freshwater crayfish (*Astacopsis gouldi*). "These species could also have their populations enhanced by using the Hemputin to incubate their eggs for better survival and restocking."

By Emma Rudge and Dos O'Sullivan

For more information contact Colin Valverde by email: info@aquaverde.com.au or by post: PO Box 830, Atherton, QLD 4883

The final product: one basket of 400 juveniles



Teuvo (right) discusses Hemputin with a farmer.