

reach over 20°C only briefly. A network of PVC pipes and valves allows water to be supplied to all the raceways and tanks. We have aeration at the inlets to increase the oxygen levels. At some of the raceways at the bottom of a series we're adding three-phase power to provide additional aeration."

**Hatchery for own use**

The farm is able to produce all its own fingerlings. A 64m<sup>2</sup> hatchery facility is able to produce more than one million fertilised eggs a year. "This year we used eggs from Tasmania, which we're very pleased with", Carl says. "After fertilisation the eggs are placed in upwellers and the rest is pretty well standard like other hatcheries. We've put aside several thousand fish for next year's caviar program."

"In addition to the trout, we have brook trout (*Salvelinus fontinalis*), browns (*Salmo trutta*), and Atlantic salmon (*Salmo salar*). We're looking at breeding the brooks this year and will try some growout. We use the browns for the fly-fishing lake we intend to build and we're trialing the salmon at present."

At 10mm the fingerlings are transferred from the hatchery into one of six 25m x 1m x 0.5m nursery raceways;

another six raceways are used for larger fish. Shadecloth has been erected over the nursery ponds to keep out predators and provide protection from the sun. In addition, all the incoming water is screened to keep out redfin (*Perca fluviatilis*) and other water-borne predators.

"We have a lot of space for the fingerlings, which we feed crumble from Gibsons. At about 4-6 weeks they're split and moved into bigger raceways and then into the growout areas after another couple of months. We're getting more fish to allow us to play around with stocking densities, feed rates, and other parameters."

**Bruce Malcolm: the codfather**

Australian warmwater aquaculture is relatively new but it does go back to the 1970s. One of the pioneers, a founding father if you like, is Bruce Malcolm of Uarah Fisheries at Grong Grong, about 30km east of Narrandera in NSW's Eastern Riverina.

The first fruits of Carl's work are already at the marketplace and more will be there before the end of 1999. Production is expected to increase over the next few years and Carl's group is examining opportunities for leasing other farms to further increase production.

Dos O'Sullivan

For more information contact Carl Young, Hume Weir Trout Farm, RMB 5029, via Wodonga, 3690. Tel: 02 6026 4334, Mob: 0407 771 506, Fax: 02 6026 4065, Email: carlyoung@oze-mail.com.au

Bruce started back in 1977 when he came home from college and moved into picturesque Uarah on the banks of the Bundjerry Creek. Austasia Aquaculture caught up with him there at the beginning of his 21st breeding season and found he had plenty to say about the industry that has been his life for over two decades.

Murray cod is without doubt the best known fish in Australia. Over the years Bruce has made the name Uarah synonymous with this premier fish of the Murray Darling basin. His knowledge of breeding and growing techniques is second to none. That knowledge has been acquired through personal experience without any government assistance.

For the technically minded, Uarah Fisheries has 26 hectares under water in 56 ponds. It produces around 1.2 million fry each year made up of Murray cod, silver and golden perch. The Murray cod and silver perch growout ponds are aerated by 6hp/ha but the power delivery to the ponds allows for 16hp/ha of aeration to be applied in an emergency. Predator control is total exclusion bird netting rigged on ridge wires at pond level. They can be pulled back on runners to allow access to the ponds for harvesting and maintenance. The rest of the infrastructure is equally impressive and reflects years of development. As an example of the scale of the overall budget the power bill exceeds \$25,000 a year.

Bruce began research into weaning

cod onto dry diets in the late 1980s after approaches to NSW Fisheries had been rejected (it is interesting to note that Murray cod and golden perch have low research priorities yet both have high market demand). The first commercial crop went off to market in 1991. Uarah is the only hatchery in Australia breeding from pellet-reared brood stock. It is also a leading producer of golden and silver perch and is on its second generation of performance selected silvers.

Production methods for Murray cod have been perfected over the years. Fry are weaned at a minimum of 2g and reared through the winter in recirculation systems. By October they range from 300g to 500g.

"When we send fish off for restocking in the wild we pool the spawnings to ensure genetic diversity; that's important. But our own fish are F1 stock", says Bruce. "We hold our fish in the weaning system for about eight weeks. We'd grade twice in that time before moving them over to the growout. The bigger system is run at 21Co to 22Co and the smaller one a bit warmer. It would be nice to have the growout warmer but the cost of heating through winter is fairly substantial so

the gain's not worth it. Once spring comes and the water temperature in the ponds matches that in the tanks, out they go. The fish have reached their market size of 2kg to 3kg by the end of that summer."

In the pig and poultry industries genetics were one of the most powerful levers used to crank up productivity and lower costs. Bruce believes that gains through genetic improvement in cod will be slow. "As far as commercial production of the fish are concerned, to select for non aggression is difficult when in some ways you need an aggressive fish to feed well. And bear in mind that you're looking at five year old fish to produce another generation. That's an extremely long term program. With other aquaculture species you're looking at 2-3 years. In the span of two generations of cod you'd have up to five generations of the others."

When it comes to silver perch, the situation is simplified by the fact that farm-reared fish can mature at two years for males and three years for females. Uarah are already breeding from second generation, performance-selected silvers. However Bruce feels that "it's too early to say that we've seen any marked evidence (of gains)

that you couldn't get from the top end of any spawning.

"I do know that the fish we supply perform as well as the best fish used in NSW. I use the same fish the farm supplies to other commercial growers and we're pretty happy with them". The benefits appear in early life cycle. "We get better larvae survival, better egg quality, the larvae are more resilient and we get really even batches of fry coming through in the 35mm-40mm size ranges. I notice it that way more than in the end product. We only grade once and we don't have much size variation in the fish at harvest time. 95% of the fish will be within 100g of each other. The balance will be made of bigger and smaller fish. I don't think you can ask for much more than that."

There have been a lot of claims on the benefits of hybrids. Bruce is not so sure. "These claims need to be substantiated scientifically," he says "and I feel that it's Fisheries' responsibility to do that work. It's not expensive trial work and can be done on a small scale. It's only a matter of running a comparative trial and would clear up the issue."

Uarah's philosophy is simple "The grower has to be successful if the

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hatchery wants to continue to sell product so it's in our interests to give the grower a good product. All the fish that we produce are weaned onto a dry diet in the fry ponds. I have seen batches of fish that for some strange reason just didn't want to wean. Obviously you don't sell those to a commercial grower. They're destined for farm dams and restocking. It puts a bit more on the cost of production but it's important to me. I've been in this industry nearly longer than anyone and the reason we're here is that we give people what they want."

Stocking densities are closely monitored. Bruce has run cod in recirculation systems at 60/m<sup>3</sup> but found it was "stretching the friendship".

"They're more comfortable with densities closer to half that. A lot depends on the system but you still get that hierarchical thing. Even with grading,

you'll still get dominant ones and submissive ones. Some fish don't perform well in those circumstances, so if you take them out and put them in different circumstances, where you remove that dominance, they'll kick on."

As there appears to be two production streams in the cod aquaculture, Austasia asked Bruce for his views. "We've grown fish in ponds at up to 14t/ha. There's plenty of areas where you can grow cod in ponds, and people who produce cod in ponds will be able to grow fish more cost effectively than in recirc systems. They can produce the fish cheaper and will be able to sell at lower prices. Prices will come down. When we first started we were getting \$32/kg. That was fine because it was a novelty. The prices now are around \$20/kg or a bit better, for either live or chilled. It will come back from there.

We won't be producing huge numbers of fish because there's no money in it — the market is demand driven."

Seed stock availability has been mooted as a bottleneck to the rapid growth of the aquaculture. Mid last year there was even talk that the Murray cod hatch for the coming season had been pre-sold. Bruce is sceptical. "On two farms in NSW so far this year (mid Nov '99) there's been between 1.1 to 1.2 million larvae hatched."

Yet one of the reasons given for research into the culture of Murray cod was that there was a seedstock shortage. "Research just for the sake of it has to stop," Bruce counters. "It's about time research was based on industry needs and is industry driven, not academically driven."

Weaning plays an important role in the husbandry at Uarah. "We've weaned at all different sizes this year," says Bruce, "from yoke sack larvae to 70mm fish. The diets that are available today, compared to when we first started, are like chalk and cheese. In the old days we had feed delivered that was 30% dust and the attitude of feed manufacturers was like it or lump it. Things are very different today and it makes weaning so much easier." Gibsons feed is used at Uarah and the Bruce has nothing but praise for the quality of the pellet and the range of products available.

He sees a big future for silver perch. "It is a rarity, one of those species where the farmed fish actually taste heaps better than the wild fish, which have been looked down on purely because of tainting"

"So the thing with silver perch is that it's coming from a very low base and a poor reputation. The majority of the fish eating people in the population have never heard of it. There's been heaps and heaps of work on the farming of the fish and it's a good quality fish."

"But there's a lot of product that is going onto the market that is very inferior and it's damaging the industry no end. They're only purged a couple of days; their guts aren't even evacuated. The clients come back to us because we purge our fish from 10 to 14 days. The simple thing is giving the client what the client wants."

"But as far as the fish goes it's a great fish. It yields well, it keeps well and if the cost of production can come back a little bit it will take a giant leap forward in the chilled market place, and it deserves to. It's an excellent fish for caterers. Its shelf life is good; it holds its texture, all the sort of attrib-

utes the trade is looking for if it's handled the right way."

He's much more guarded about the future of the Murray cod aquaculture.

"I've got real concerns about the industry. The normal prices of fish on the floor of the Sydney Fish Market are around \$22 to \$23/kg. But if just six (extra) boxes of small cod, (450g to 500g) go on the market the prices falls to \$16.50/kg. So if just under 200kg of fish can beat the price down \$7/kg in the biggest fish market in Australia, how can by some Victorian Fisheries bureaucrats claim there's not a 500 tonne market, or a 1,000 tonne market, or a 2,000 tonne market."

"They've got no idea of commercial reality and have spent no time in the market place yet go around bandying these types of figures. This idea of 500 tonnes in recirculation systems is probably going to bring the price down to the same price as barramundi: \$10/kg."

"When it comes down to the bottom line, to the majority of Australians fish is fish."

In fact, size seems to be everything for cod. "The cod that brings the high prices is product in the two, three, four kilo range."

Bruce believes that the cost of rearing cod in recirculation systems exceeds that of pond-reared cod. "We use recirc as part of our production cycle, but in the long term I just can not see how Murray cod can be reared in stand-alone recirc systems and grown to the size the market wants."

"The small fish, the 400g and 500g fish that come out of such systems will give the fish a poor reputation. Those small fish are watery and mushy and do not exhibit the qualities that the larger fish do; and that's what the reputation is built on."

He says that when Uarah began growing our cod ten years ago, it did detailed market surveys on which sizes were best. "We gave them to chefs and sought their opinion. It's all about giving the customer what the customer wants, not what you want to grow. We have based our work on the cod purely on that. We send a very small percentage of fish to the live market at 1.2kg but none of the rest are sent out under 2kg with most around 3kg."

"We have built our relationship with chefs and wholesalers based on quality, continuity of size and guaranteed supply; week in, week out, 12 months of the year."

To prove the point about price sensi-

tivity according to supply volumes, he runs through a few numbers. "The number of restaurants in Melbourne and Sydney with a client base able afford a meal of high-priced cod are very very small. If the grower is to get \$20/kg and the wholesaler gets his bit, you're looking at fillets that are over \$50/kg. So the claims of government promoters about the fish bringing \$25/kg to \$30/kg are 'pie in the sky' stuff. The majority of fish that are eaten are around \$10/kg or less. You'll see plenty of fillets that sell for under \$20/kg but you can't produce cod for \$8/kg."

"And if people think there's a 1,000 tonne market out there for Murray cod at \$20/kg it just shows you how little they know about the commercial realities of aquaculture."

"Government agencies have a moral responsibility to tell the whole truth and nothing but the truth to prospective aquaculturalists. If they don't they should be financially liable."

"Make no mistake, this is a great, great fish and one of the few you can grow in aquaculture and still exhibit the flavours of the wild fish. That's part of its mystique."

Bruce feels that the fish is only suitable for the live trade on a small scale. "When you stop feeding the them they become aggressive. They're not going to fit into the live market the way silver perch and barramundi have. It's a real shame but that's just the way it is."

And he says the idea of exporting the surplus doesn't hold up. "There's already cod in Asia. I've never met a dumb Asian businessman — if there's a good product somewhere, and they see a market for it, they'll grow it them-

selves; even if they grow them in recirc systems over there."

"This stuff about exporting huge quantities of fish at top dollar is just a non event. All that will happen is that these people rushing to grow Murray cod and make a fortune will end up selling product on the domestic market. Faced with a flood of fish the buyers will turn around and say this is what we'll give you for it; and it's likely to be below the cost of production."

"Aquaculture's a funny thing. For over 20 years now people have come to me and said they want to grow fish for the market place. They're going to produce 100 tonnes of silvers. When I ask them where they're going to sell them they look blank and can't answer, because they've got no idea. In any other business that's the first question people are going to ask: how big is the market, how sustainable is it at certain levels of production, what's the cost of production and what return is required to remain viable?"

"We've got around 15 tonne of cod being sold and the price is under a bit of pressure now; what's it going to be like when we've got 100 tonne to sell?"

"Perhaps it's this get rich quick mentality. People just don't seem to use the same criteria to assess aquaculture as they do for other industries. If they did there'd be a lot less failures and aquaculture in this country would be a lot better off."

"The most important thing to me is to see a good industry and that means an economically viable industry."

John Mosig

Bruce can be contacted at Uarah Fisheries on (02) 6956 2147



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