

Aquaponics at Mt Gravatt High School

By Geoff Wilson

Three staff from Mt Gravatt High School in Brisbane, Queensland, Australia, are making an important science teaching success with their aquaponics unit.

Their aquaponics leadership can now be expected to benefit many other high schools in Australia, New Zealand, South-east Asia and the Pacific Islands – an area commonly named “Australasia”.

The staff include Brooke Overduin, Science Teacher and Aquaponics Coordinator, Rob Lakie, Science Operations Officer and their supervisor, Sue Perkins, Acting Head of Department. Brooke has degrees in Marine Science and Education, while Rob’s qualifications are in horticulture – making their Mt Gravatt aquaponics partnership most appropriate.

Over two years these three Mt Gravatt High School aquaponics enthusiasts have developed a low cost teaching innovation they know is resulting in better teaching of

science subjects such as physics, chemistry and biology to students who are demonstrably more interested in these subjects.

The starting point of their hands-on aquaponic project was attending the one-day of aquaponics lectures I organized in August, 2006 at the Bribie Island Aquaculture Research Center.

This seminar had the great benefit of expert inputs by long-term aquaponics researcher Dr. James Rakocy of the University of Virgin Islands, Dr. Nick Savidov, Canada’s leading aquaponics researcher, Dr. Wilson Lennard, the Australian aquaponics scientist who proved the economics of small-scale investment and Dr.

Mike Nichols, a retired hydroponics lecturer from Massey University in New Zealand.

Brooke took their technical knowledge and accumulated wisdom and set out to create a high-school aquaponics unit that better instructed and motivated students. The accompanying pictures



The aquaponics unit at the Mt Gravatt High School brings students into key outdoor contact with practical science and technology. Their interest in growing fish, crustaceans and vegetables brings to life the principles of physics, chemistry and mathematics, and brings deeper meaning to simple experiments.

show the unit she proudly developed with Rob and Sue.

Fish and crustaceans in the two tanks in a shaded greenhouse are fed standard fish feed. Their natural wastes (feces, urine, uneaten fish feed, plus minute natural water plants and animals – algae and microbes) are then converted into plant food by the water's living organisms. Vegetable and fruit plants are fed only these nutrients.

This is why many authorities call human-made “aquaponics” systems the closest mimic of “Mother Nature.” If the sole cost input of fish feed can be classed as “organic” (which much of it is) then all fish, crustaceans, vegetables and fruit then grown in an aquaponics system is also “organic.”



Three students being instructed by Brooke and Rob in the vegetable section of the aquaponics unit. The students are, from left Geoff Deller, Daniel Tenbrink and Mark Bergman.

It is a point that registers with students with keen appreciations of human food being as “natural” as possible.

The Aquaponic System at Mt Gravatt High School

The Mt Gravatt High School aquaponics teaching unit cost only \$4,000 to set up. It uses water from the mains supply (but could use roof-water, if necessary). The key elements are:

- *Two lockable “rooms” (3 meters x 6 meters) constructed of wire mesh, shade cloth and plastic roof sheeting.*
- *Two second-hand tanks – one for 25 - 30 Barramundi fish and one for 40 Redclaw crustaceans.*
- *Two old bathtubs filled with crushed rock, along with two purpose-built fiberglass grow beds.*
- *Piping to connect the fish and crustacean tanks with the vegetable growing bath tubs and grow beds.*
- *Two pumps and filters.*
- *Miscellaneous tools for maintenance.*
- *Two solid door locks to deter vandals.*

The unit cost of \$4,000 AD does not include the very large time commitments in construction and maintenance by Brooke Overduin and Rob Lakie. This commitment has their own leisure time after school hours and at weekends.

These important points have given aquaponics a big high school following in the United States and Canada. An estimated 1,500 or more high schools in these two countries now have a simple aquaponics science teaching unit like the one at Mt Gravatt High School. They, too, are reporting superior teaching outcomes in physics, chemistry and mathematics.

What has been the cost at Mt Gravatt? A miniscule \$4,000 AD (Australian Dollars) – but with a massive time input by the three-person team of Sue, Brooke and Rob.

They created the aquaponics unit on a shoe-string budget in which old tanks hold 25 to 30 fish and about 40 or so Redclaw crustaceans – while old bathtubs filled deeply with crushed rock grow vegetable crops that clearly show students what can be done – and what can be much better understood in terms of their physics, chemistry and biology.

Students also well-learn conservation values when they see how an understanding of scientific principles allows them to grow fresh food fish and crusta-



ceans and fresh food plants, successfully without great expense.

So far about 200 of Mt Gravatt High School's students have benefited from using the aquaponics unit in their science studies over the last two years. Brooke and Rob report that these students now have a much better understanding of science as a result of their use of the school's aquaponics unit.

Sue Perkins, Head of the Mt Gravatt High School Science Department shares, "The introduction of an Aquaponics Unit into our Year 9 Science program has gone hand-in-hand with our implementation of the new Queensland Curriculum, Assessment and Reporting (QCAR) Framework which outlines the *Essential Learnings* for students in Years 1 to 9. Within this framework, students use the essential processes of 'Ways of working' to develop and demonstrate their 'Knowledge and understanding.' We have been able to use our

Top: From left, Brooke Overduin and Rob Lakie inspecting the red claw in one of two fish tanks. Red claw is Queensland's native crustacean. They show that aquaponics is not just about fish wastes, but can be about wastes from any aquatic animal. Middle: Head of the science department, Sue Perkins, in the Mt Gravatt greenhouse. Bottom: Some of the many crops grown in the aquaponic system at Mt Gravatt High School.

Aquaponics Project to provide a context for learning so that students can then apply their scientific knowledge to real-life issues such as sustainable food production.”

“The hands-on activities, such as testing the water quality in the Barramundi and Red claw crayfish tanks and the monitoring of plant growth in the grow beds, are an integral part of the students’ active engagement in the aquaponics program, which in turn, has made science more interesting and relevant for them. Through carrying out a ‘long term’ investigation such as this, students are also developing a range of skills that will assist them later on when undertaking Extended Experimental Investigations (EIs) as part of their studies in senior biology, chemistry or physics. We envisage that as we refine and even expand the operation of our aquaponics system, there will be many ways in which we can integrate this project into our curriculum. Hopefully, in the near future, the other year levels will also be using it as a focus for their scientific investigations.”

Brooke Overduin, Aquaponics Coordinator, commented, “The students have responded extremely well to aquaponics at the school. Mt Gravatt High already has an extensive and well-established environmental program where students interact with and help to preserve the natural environment. For us, introducing aquaponics as a teaching tool was a natural progression and complements the work that students are doing in other subjects. Students are continually developing sophisticated ideas about sustainability and the future of food production, especially in Australia, which is mostly water-poor.”

Brooke continued, “In the current climate of education, students are becoming increasingly disengaged with ‘normal’ teaching activities. Aquaponics allows us to provide students with real-life experiences and activities that they can perceive the relevance of. The program has been successful in re-engaging some students and stimulating an interest in science in others. Despite the intense time commitment required of staff, aquaponics is a valuable and successful teaching tool.”

The aquaponics produce is always in great demand for tasting and for taking home by students prepared to donate to the program in exchange for fish, crustaceans, vegetables or fruit if there’s enough left over for this. Any money donated is now put back into the school aquaponics project to improve it each year.

Some students have been motivated to go into fish farming or vegetable farming, at home in their own backyards. None have yet undertaken a full aquaponics hobby unit, but the time may soon be appropriate.

A burden that the team of three teachers at Mt Gravatt High School have yet to displace is the maintenance of the aquaponics unit during the school year. During school year vacations and on weekends, the team shares inspection and feeding work. It is a chore that needs to be given, perhaps, to a competent, paid professional who can service a group of schools during holidays when teachers should have leisure rather than burdensome duties.

Another option over weekends is student rosters. But teachers find this is also a problem and doesn’t solve the vacation-time maintenance needs.

Nevertheless, the Mt Gravatt team of three are dedicated to keeping their aquaponics teaching unit so that students can better learn both science subjects, and better know a new way to farm in their own backyards. It is an outlook well in tune with the changing world likely to now develop to save much of the expense of providing fresh food for families.

About the Author: *Geoff Wilson is a retired agribusiness journalist in Brisbane, Australia, where he heads the Aquaponics Network Australia and is founder of Green Roofs Australia Inc. He is communications director World Green Roof Infrastructure Network, Toronto, Canada, which is currently considering support for “food from the roof” ideas. Geoff is currently emailing 700 science teachers and curriculum advisers in Australia, New Zealand, South East Asia and Pacific Islands with information about aquaponics as a science teaching aid for better student instruction in physics, chemistry, biology and mathematics.*