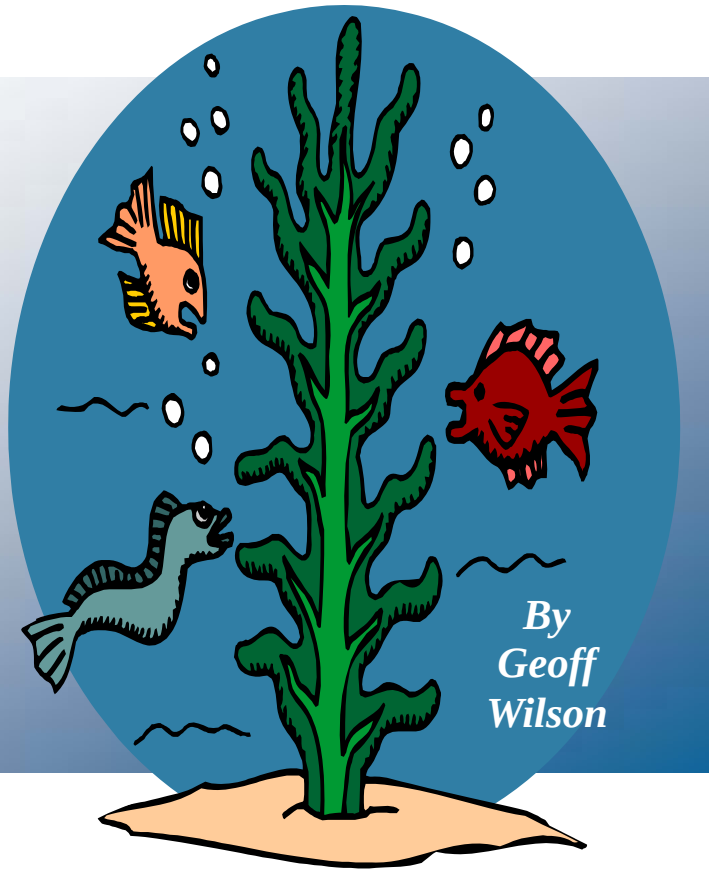
Seaweed is the common denominator in exciting saltwater aquaponics



By Geoff Wilson

A small but influential number of Australians have been enthused by the common denominator of seaweed in saltwater aquaponics now moving more clearly into view as a significant land-based technology.

It promises to set in motion some interesting saltwater aquaponics research and development in Australia, which could enlarge upon the brilliant pioneering of saltwater aquaponics (also named integrated mariculture) in Israel.

The catalyst in this thinking has been a visit to Australia by an Israeli aquaculture scientist, Dr. Amir Neori. He is one of the world's leading advocates of edible seaweed culture in association with the raising of fin fish and invertebrates such as shrimp, abalone and other edible species.

Dr. Neori is a senior scientist at the National Centre for Mariculture at Eilat, in Israel (see a report on his saltwater aquaponics work in "Aquaponics Journal," 1st Quarter 2003).

The event that triggered much Australian enthusiasm for saltwater aquaponics was a week-long visit by Dr. Neori to the Australian state of Queensland to speak with fellow scientists.

It also included an industry-based, five-hour "luncheon seminar" on November 2, at Bribie Island Aquaculture Research Centre (BIARC) just north of the city of Brisbane in Queensland.

The aquaponics study group of the Aquaculture Association of Queensland (AAQ) organised the event in the interest of showing its members (some 150 fresh water fish farmers) the potential of land-based aquaponics in which seaweed is used to harvest the wastes of fin fish.

The five-hour seminar was mostly financed by the Queensland Department of Primary Industries, which funded the visit to Queensland by Dr. Neori after he presented a paper at the 'Australasian Aquaculture 2004: Profiting from Sustainability' conference that attracted 1,350 participants in Sydney in late September 2004.

The title of his Sydney conference paper was "The Blue Green Revolution: the role of seaweed

cultivation in a sustainable seafood industry." He enlarged considerably upon this theme at BIARC on November 2 – pointing out seaweed culture in some parts of the world was already considerable.

In China, for example, some seven millions ton of edible seaweed was produced along its coasts for human food, livestock fodder and for soil fertiliser.

"Most people do not realize that seaweed and shellfish, not fin fish, are by far the biggest elements of the world's marine aquaculture industry," he said.

An important point was that an edible seaweed crop for whatever use, could be grown for sale in six weeks instead of six months or more for fin fish and crustaceans and up to six years for abalone.

At the Sydney conference in September, from left, Dale Young, from GHD, Australia's largest professional services company involved in many aquaculture projects, Dr. Amir Neori, from Israel's National Center for Mariculture and Professor Rocky de Nys, a marine biologist from James Cook University in Queensland. Dr. Neori visited James Cook University in early November to see its work with prawn and reef fish aquaculture.

But of very real commercial interest is that many successive cash crops of seaweed could be grown in conjunction with the farming of fin fish, crustaceans and molluscs in one farm. The role of the seaweed in commercial aquaculture was the same as in nature – the uptake of organic wastes that would otherwise pollute water. Seaweed is nature's nutrient capture system.

Dr. Neori said the wastes of every ton of fin fish could produce up to seven tons of plant material such as lettuce in fresh water aquaponics and edible seaweed in salt water aquaponics.

In pilot commercial operations in Israel the production of 10 tons of fin fish in seawater piped from the sea to shore-based operations were now producing 40 to 80 tons of edible seaweed from the fish wastes which, in turn, was growing 4 to 8 tons of abalone.

That edible seaweed could then be used to grow molluscs or other valuable food crops (one ton of abalone for every two tons of fin fish producing the wastes) or the seaweed could be used for either human foods that replaced salad vegetables or for domestic livestock fodders and soil fertilisers.

Dr. Neori explained that a big advantage of such an aquaponic system was that many seaweeds produce the most valuable omega-3 oil. It is probable that seaweeds can therefore replace fish oil in diets for fish and humans to better balance with the omega-6 oil content that has become out of balance with the needs of human nutrition. It is now dawning on the world's nutritionists that omega-3 oils from sea vegetables and fish will play a vital role in future human health.

This simple fact has enormous implications for the global change to aquaponic food production systems that are not only kinder to the environment but are also healthier for humans.

Will we see aquaponic farms in the future based on seaweed production? The answer appears to be a resounding "yes" because it makes such economic, environmental and human health sense.

"Seaweed is nature's nutrient capture system."

In Australia, Dr. Neori's technological advances come at a crucial time.

Another notable scientist, Dr. Geoff Allen, past president of the World Aquaculture Society, is leading the inland saltwater project that involves five state governments and the Australian federal government. He and a most impressive team of other Australian aquaculture researchers are currently completing research and development that promises to make Australia a world leader in environmentally-friendly land-based aquaculture and aquaponics.

Dr. Allen told the Sydney aquaculture conference last September that currently about 2.5 million hectares of Australia's cultivated land was badly affected by salt problems caused by poor irrigation drainage and increased cyclic salt salinity caused by over-clearing of trees in a fragile environment.

Algal culture allows the sustained development of aquaculture, because it is friendly to:

Marine Eco-Systems
Coastal Eco-Systems
Society
Health
Economy

Harvesting algae by hand. In some parts of the world the major livelihood of some hundreds of thousands families is seaweed cultivation.

Acadian Sea Plants, Nova Scotia, Canada, land-based seaplant cultivation. All natural pink, green and bright yellow algae are produced and sold to Japanese market.

Integrated abalone and seaweed farms in South Africa

But worse is to come. By 2050, Dr Allen said, the area of Australia affected by salt water problems was estimated to rise to some 12 million hectares.

Sadly, rising saline groundwater would adversely affect 74 rural and metropolitan towns and cities in Australia. Dr. Allen said that the inland saline water project had already identified 11 potential sites where salted waters had potential for sustainable aquaculture investment. Such investment could be "industrial-scale" aquaculture that allowed economical infrastructure development in processing and marketing.

Mulloway and snapper, two popular Australian sea fish species, have been tested successfully on these inland waters. So have prawns.

The promise of edible seaweed in the equation has yet to be tested. But if Dr. Neori's successful saltwater aquaponics work in Israel (and his possible work at BIARC) influences the research budgets of Australia's Fisheries Research and Development Corporation (FRDC), then Australia could take a world lead in commercial saltwater aquaponics.

Dr. Allen said that the challenge in Australia was to develop a scale of aquaculture investment based on inland saline waters that would make it economic and sustainable.

The challenge that now appears to be just as important is the aquaponics that takes the fin fish and prawn wastes from inland saline aquaculture investment and does something with them in providing other revenue streams – in edible seaweeds and other crustaceans and molluscs.

However, there are problems to solve in aquaponics for a predicted massive expansion of Australia's inland saline aquaculture.

One pointed out by scientist Dr. Stewart Fielder to the Sydney conference in September was that Australian saline waters from irrigation and land clearing problems was variable in quality and pond operations using it faced great temperature variation – from 10 degrees Celsius overnight to 30 degrees Celsius during the day.

But this was not so for some inland saltwater resources, notably:

1. Many of Australia's aquifers of ancient seawater that could be tapped for surface ponding and the growing of sea species of fish, crustaceans and molluscs.
2. Saline farm dams and waterways that could have floating units that keep fish in flexible plastic containers from which wastes can be harvested for land-based production of halophytic crops.
3. The Australian long coastline with access to seawater that can be brought to shore-based aquaponics of the Israeli style. An estimated 20,000 kilometres of coastal seawater await tapping by on-shore aquaponic investors.

"I believe expanding use of such a non-polluting aquaponic system using perhaps the world's most plentiful resource – seawater – is likely to be the major paradigm shift in humankind's food production this century."

Like many other countries, Australia has had problems with protests about sea cage aquaculture.

It can be intrusive into tourist and fishing recreation areas and is not allowed in offshore national parks, such as Australia's massive Great Barrier Reef. Rightly or wrongly, pollution of the seabed by fish wastes from sea cages is also criticised by environmentalists.

Fish meal alternatives are a part of the exciting story

One of the major criticisms of world aquaculture is that it is heavily dependent on fish meal and fish oil from a declining wild catch. That criticism is starting to be answered in Australia in three ways:

1. By developing fish feeds based on grain legumes that displace most, if not all, of the wild-caught products.
2. By developing alternative plant proteins such as edible seaweed and high-protein duck weed that can be pelleted.
3. By developing aquaponic systems in which wastes from fish and crustacean farms can grow edible seaweeds on substrates that can be grazed by estuarine mullet or rabbit fish – each of which can be fed to more valuable species.

Further work will be needed on seaweed and duck weed as successful ingredients of commercial fish pellets so vital to low-cost, mechanised feeding of fin fish.

But if a pipeline from the sea takes in pristine seawater to a pond or raceway aquaponic system, it avoids completely all the objections of tourism promoters, recreational or commercial fish catchers, yacht or motor boat enthusiasts or noisy environmentalists.

The aquaponic technology pioneered by Dr. Neori and his associates at Eilat uses that piped-in seawater to grow, in succession, fin fish, seaweed and molluscs and crustaceans. The small quantities of water coming from the enterprise back into the sea can be as pristine as it went in. Only the dissolved sea salt balance has been altered slightly as water evaporated while fish, seaweed, molluscs and crustaceans have used up such things as calcium, phosphorus and micro nutrients.

I believe expanding use of such a non-polluting aquaponic system using perhaps the world's most plentiful resource – seawater – is likely to be the major paradigm shift in humankind's food production this century.

The Israeli system has the big advantage of being able to locate close to many major coastal cities in the world.

Dr. Neori points out that the aquaponic or integrated mariculture system he and his team are developing in Israel is probably best suited to coastlines where land a short way inland is cheap and inexpensive labor is plentiful. That surely describes many countries of the less-developed world where food and job security have been inadequate.

Little wonder then that the farsighted sponsorship of Dr. Neori's visit to the Bribie Island Aquaculture Center by the Queensland Department of Primary Industries and Fisheries, is creating some excitement. So it is his intention to have a year-long sabbatical in Australia to work on saltwater aquaponics with Bribie's aquaculture scientists.

Stay tuned for further developments.

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