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SPF Black Tiger Shrimp in Malaysia

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Shrimp Pond Management in the Philippines

Pompano Cage Culture in Indonesia

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WRITE TO THE EDITOR

We want to hear from you. Write your comments on the industry to the editor.

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Letters may be edited prior to publication

From the editor

Review 2006 – On the right track but still a long way to go

Throughout 2006, the US antidumping action on shrimp exports and the continuous bond imposed by US Customs continued to reel its effects the shrimp sector. In November 2005, the US ITC announced that it would maintain the respective rates for the antidumping duties for shrimp exports from Thailand, India, China and Vietnam. Despite citing the damage caused by the tsunami in 2004, Thailand and India failed in their bid to get a change of circumstances. The financial effect of the continuous bond for Thailand was estimated at THB4 billion over two years for the shrimp imports into the US. Appropriately, Thailand took its next step and brought the case to WTO in March. The outcome will be known in 20 months from the date of the second appeal. The Thai Shrimp Association is optimistic that the country will win its case against US antidumping duties.

Notwithstanding, the US continues to be a major market for shrimp from Thailand. It imported 68,622 tonnes in the first half of 2006. On the other hand, China has managed to become the number one shrimp supplier (27%) to the Spanish market (Eurofish, 2006). To tackle issues of trade barriers on shrimp, countries belonging to the Association of South East Asian Nations decided to establish an ASEAN Shrimp Alliance (ASA) in June. While playing its role in trade and industry issues, ASA provides an avenue for member countries to work cohesively rather than individually. This could work out to be an excellent lobby group.

The culture of vannamei continues to gain momentum, especially in Malaysia where the ban on its culture was lifted in mid 2005. Production increased 30% in the first half of 2006. In June, the Philippines said that it would start the process to lift the ban while India is assessing the pros and cons of vannamei culture. Irrespective of country, the industry has mentioned that they would like to continue with black tiger shrimp, if only domesticated and disease free broodstock are available, similar to that of the vannamei shrimp. This does not seem far off as domestication programs in Thailand and Malaysia are producing results (see page 28 for Malaysia). A private company is also introducing SPF stocks developed in Hawaii into Asia (see page 40). The market has recently seen higher (35%) prices for 50/kg for black tiger shrimp (Thailand, June 2006) as compared to vannamei shrimp. This could be a driving factor for a monodon revival. Perhaps a bonus factor is the segmentation of markets for monodon and vannamei such that they do not directly compete with each other.

Throughout 2006, both shrimp producers and feed manufacturers lamented on the escalating production costs. For producers, operational costs increased with higher fuel and feed costs. For the feed producers, the short supply of quality fish meal pushed prices to a peak. In dire straits, feed companies are now focusing on how to partially replace fish meal with plant or animal protein meals. As fish meal prices are expected to stay high, this is their only resolution for the new year. Perhaps now, necessity will be the mother of invention.

The year also saw rapid developments in the marine fish cage culture sector. Many countries expressed interest in expanding culture activities off shore as coastal areas become scarce. Eyes are on the success achieved with southern blue fin tuna and yellowtail kingfish culture in Australia and cobia culture in China, Vietnam and Taiwan. Experts at the Cage Culture in Asia Symposium in China in July warned that it was time that stakeholders relook at the current way of cage culture in many parts of the region which is not sustainable in the long term. The concept of 'feeding fish to grow fish' does not win any support with the NGOs nor the consumers of the west. This sector must make efforts to switch to commercial pellets and then move on to using less fish meal in the feed. Consumers have already been alerted to the idea that we are using depleting marine resources to produce fish. We have to look no further than a recent report in Science where international experts calculated that by year 2048, wild caught seafood stocks would have depleted. While initially seen as a threat, this also provides the industry with a great opportunity. This is where the aquaculture industry can show itself as a producer of fish in an environmentally correct and sustainable way.

In the assurance of food safety and the production of quality produce, it was a bad start to the year with notifications on nitrofuran residues in black tiger shrimp from Indonesia and vannamei from Vietnam and leucomalachite green in pangasius fillets from Vietnam during week one of the rapid alert system for food and feed. The issue of mislabelling did not help matters. In April, two companies and an individual pleaded guilty to conspiring to import and sell more than a million pounds of Vietnamese catfish mislabeled as grouper and other wild-caught species in the United State and Canada. In August, the Australian Seafood Importers Association asked that catfish exports to Australia bear the Basa label; otherwise the shipments will be deemed violations of labeling regulations of the country.

Although these incidences are less frequent than in 2005, we realise that all it takes is a few rotten apples to destroy the progress the industry has made over the past 12 months. This reiterates the fact the industry needs to self regulate, or governments will enforce their regulations upon us. Part of Aquaculture Asia Pacific's vision is to act as a forum for the promotion of self-regulation in the industry. We realise we are on the right track but we still have a long way to go.

Our best wishes for a HAPPY NEW YEAR!

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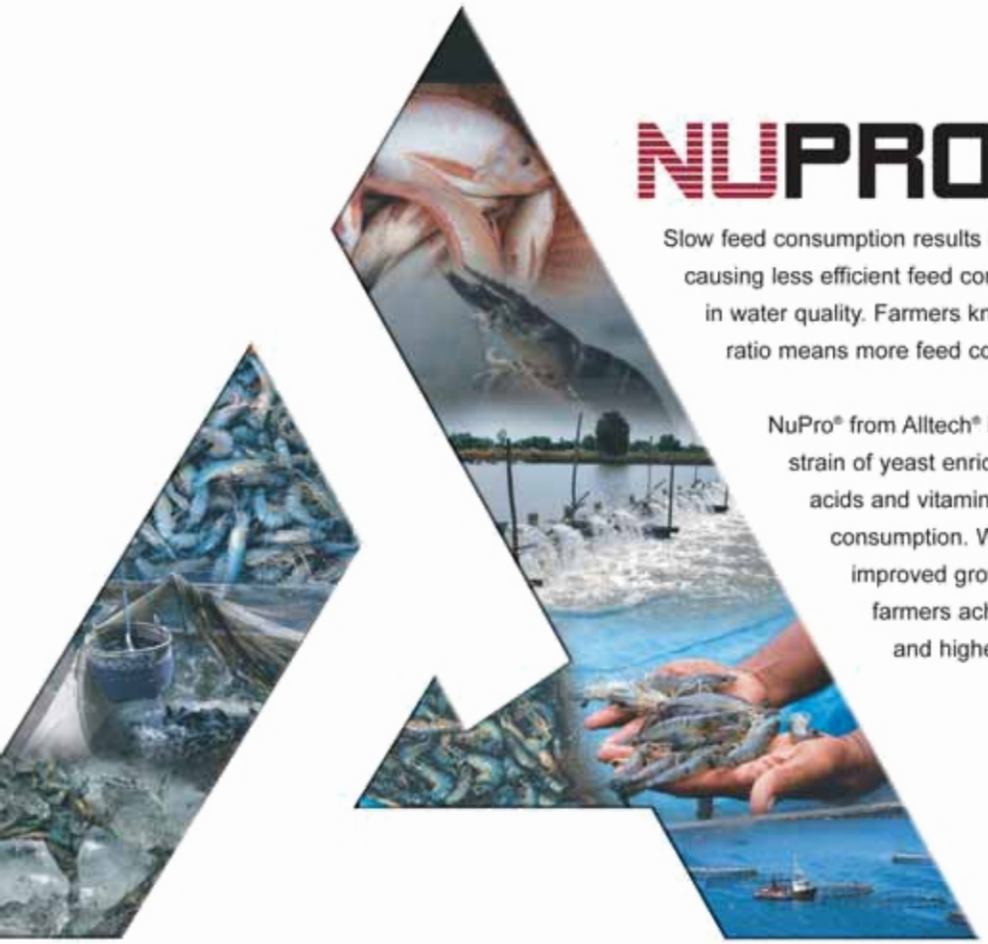

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Abalone disease outbreaks

In Australia, an outbreak in early December 2005 of the viral disease ganglioneuritis in four abalone farms in Victoria highlighted the need to establish national bio-security protocols for abalone aquaculture and wild fisheries, according to Peter Appleford, in the Fisheries R&D News (August, 2006).

Investigations into the outbreak by the Department of Primary Industries of Victoria showed positive links between the farms. All farms have destocked and disinfected. In one land based farm, losses were 2.4million abalone. However, the disease reappeared in one farm in April 2006. Land based farms grow abalone in seawater pumped from the sea into tanks and discharge the water into the ocean through settling tanks.

An epidemiology report said that it was likely an endemic agent in wild abalone that had become pathogenic in farmed stocks, killing blacklips, greenlips and hybrids. The disease has an incubation period of 2-6 days and causes swelling around the mouth. In severe cases, swelling is around the band of teeth, radula and protrudes. It also makes it difficult for the abalone to attach to the substrate.

KHV vaccine trials to start in UK

A British pharmacological company is to start field trials for a vaccine against the deadly fish virus Koi Herpesvirus (KHV). London based Henderson Morley PLC, has been working on a vaccine against KHV for the past 10 months. It said that it is now ready to start field trials for its candidate vaccine, which it plans to undertake under the supervision of Professor Ron Hardy of the Hagerman Aquaculture Research Institute in Idaho. The company has also appointed Professor Ronald J Roberts, a well-known academic in the aquaculture and fish veterinary medicine field, to assist with the development of the vaccine.

The company believes that there is a huge and lucrative market for a vaccine against KHV, or Cyprinid Herpes Virus-3 (CyHV-3) as it is now officially known. It said that in the UK, the widespread outbreaks of mortality occurred in both fish farms and ornamental ponds, when some 85% to 100% of infected fish have died within a few days in 1998. The virus has now been isolated in at least 28 countries including the USA, Japan and the UK, and it has become a very significant problem for koi breeders and enthusiasts. Large-scale production losses of farmed koi or common carp have been reported from Israel, Japan, Germany, Indonesia and Poland and these are well documented. In Indonesia, it first occurred in Indonesia in 2002. Since then has spread rapidly through Java Island with mortality up to 90% and losses of IDR 150 billion (USD 16.6 million) in 2003.

Bank focuses on investment opportunity in tilapia in China

In its forecast on the seafood consumption trends in China and globally, Glitnir Bank expects a strong demand for quality seafood. It added that Chinese consumers prefer fresh produce and are sensitive to product quality, regardless of the level of disposable incomes. This information was detailed in a report on the China Seafood Industry displayed at the China Seafood and Fisheries and China Aquaculture Exhibition in Qingdao in November 2007.

China has 35% of global seafood production and local aquatic production totalled 49 million tonnes. The import value of seafood was USD2.5 billion in 2003. The main imports were cod mainly from Russia. China has reduced its import tariffs on seafood products when it joined the WTO. Per capita seafood consumption is expected to increase to 36 kg in 2020. In 2004, the major increase was in the consumption of freshwater fish.

Among the species, the production of tilapia will continue to increase. The main production area is Guangdong Province. Production is expected to reach 1.07 million tonnes in 2006. More than 80% is consumed domestically as tilapia is an affordable fish. The average retail price is USD1.60/kg. Investment opportunities are in the culture and processing of tilapia.

China is the largest supplier of tilapia to the US. Products are mainly frozen tilapia fillets. The report added that fillet exports are likely to increase further whilst the portion of frozen fish is expected to decline. Increasing demand for fillet in world markets will encourage the growth of tilapia culture.

Glitnir is a global player in the financial market. Formerly known as Íslandsbanki, the Glitnir brand was adopted in 2006 to consolidate its growing international operations. It focuses on niche segments worldwide and in aquaculture it has funded farming activities in Chile and Norway. In Asia, the company has a representative office in Shanghai, China. (More information: seafood@glitnir.is, Web: www. Glitnir.is/seafood).

Related article: Redmayne, 2006. China's growing seafood market. Vol 2 (5); p40.

India looks at crab and high value finfish culture

In different parts of the country, Rajiv Gandhi Centre for Aquaculture, the R&D wing of the Marine Products Development Authority (MPEDA) of the Ministry of Commerce & Industry, India has set its plans on the development of eco-friendly aquaculture. Following the success with the pilot scale project on the production of crab seeds, the agency will build a hatchery to bring production to 50,000 crablets/month. An average 63% survival rate has been achieved for 28 cycles of the mud crab *Scylla serrata* aided by the development of algal and live feed lines.

"This project on the breeding of the crab is a more sustainable way of developing its culture. Gradually, it will replace the fattening of wild crabs. In the farming of the species, we are also looking at the development of dry formulated feeds with M/S Waterbase Feed Company and encourage farmers to move away from using fresh fish as feed", said G. MohanKumar, the chairman of MPEDA.

The domestication of the black tiger shrimp is ongoing in the Andaman and Nicobar Islands in biosecure facilities. The project is being managed by Aquatic Farms Ltd. of Hawaii. To date they have established three families. Only the Indian strain of *P. monodon* is being used and which has been screened free of known diseases.

India is also looking at the potential culture of high value marine finfish. MPEDA started projects in the culture of the Asian seabass in cages and brackishwater ponds. In the Andaman and Nicobar Islands, the focus is on the culture of the tiger grouper. With the assistance of the Asia-Pacific Marine Finfish Network, MPEDA will establish a hatchery in Port Blair. There is also a pilot scale off-shore cage culture unit near Port Blair.

Third INDAQUA in Chennai

MPEDA is organising the third INDAQUA at Chennai from January 11-13, 2007 to give further impetus to the country's aquaculture sector and bring linkages to export markets. There will be an exposition for companies to display products and technologies. Technical sessions on various current topics and matters of interest to all stakeholders have been organized. World experts will speak on developments in global aquaculture. The additional attraction of INDAQUA 2007 will be a special focus on the present status and future potential of ornamental fish exports from the country. For more information: www.mpeda.com

Best attended tilapia conference in history*

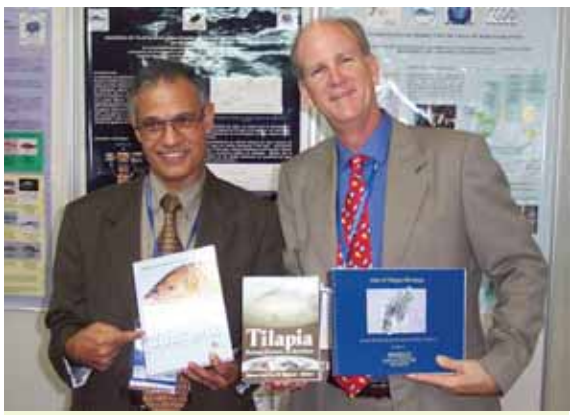
The Seventh International Symposium on Tilapia in Aquaculture was recently completed in Veracruz, Mexico. The workshops, trade show, technical presentations, farm tours and tilapia dinner were attended by a total of 971 participants. This demonstrated the rapid growth of tilapia aquaculture as a global industry.

ISTA 7 was organized by US and Mexican scientists from the Aquaculture CRSP and Aquaculture TIES projects, both supported by US-Agency for International Development, and their partners from Panorama Acuicola Magazine based in Mexico. The symposium was hosted by the Government of Veracruz and the Governor, Fidel Herrera Beltran, provided the opening address. The governor's address included a description of the rapid growth of aquaculture, especially tilapia, in the state of Veracruz and he announced a new package of investments in further support of aquaculture education, research, and production for the state.

The main conference was preceded by a three day workshop on recirculating aquaculture systems attended by 117 participants conducted by a team including Drs. Mike Timmons, Raul Piedrahita and James Ebeling. Dr. Dallas Alston, from the University of Puerto Rico provided an excellent keynote address, "Global outlook of tilapia aquaculture with emphasis on Latin America". Concurrent sessions over the next two and half days covered the entire field of tilapia aquaculture with presentations on reproduction and genetics, pathology, nutrition, production systems, and processing and markets. A trade show held in conjunction was well attended and included most of the major suppliers of aquaculture equipment, feeds, and fingerlings.

On the final day of the symposium a farm tour visited four farms in close vicinity and even within the city of Veracruz. These ranged from a large industrial farm focused on international sales, to intermediate farms for local sales, to a small farm integrated to a restaurant chain that sells all their products.

**Contributed by Kevin Fitzsimmons*



The Tilapia International Foundation also presented the Jan Heijne Memorial Award to Kevin Fitzsimmons (right) in recognition of his life-time contributions to tilapia aquaculture.

During the conference three new reference books debuted with strong sales at an author's signing party. "Atlas of Tilapia Histology", co-published by the Aquaculture CRSP and World Aquaculture Society, was presented by one of the co-authors, Kevin Fitzsimmons. "Tilapia: Biology, Culture, and Nutrition", published by the Haworth Press was presented by one of the co-editors, Chhorn Lim and "Tilapia Culture" published by CABI was launched by its author, Abdel-Fattah El-Sayed.

Brief news

Thailand shrimp case at WTO, India to follow

On Thursday, 2 November, 2007, the World Trade Organization (WTO) launched a formal investigation into the US antidumping duties on shrimp imports, which according to Thailand are devastating its shrimp culture industry. This followed the first request by Thailand which was blocked by the US. Under WTO rules, a panel is established automatically with the second request.

In December 2004, the US imposed antidumping duties on Thailand and 5 other countries, China, India, Vietnam, Ecuador and Brazil. In the case of Thailand, the review in 2005 maintained the duties at 5.79%. In addition, from March 2005, the US Customs Department imposed bonds equal to the amount of antidumping duties.

Thailand has also argued that the US improperly calculated antidumping fees through a complicated procedure for determining tariff rates known as "zeroing." It added that the procedures for paying the levies were overly cumbersome. In October, the US blocked India's first request for the WTO to launch a formal investigation. India will now make a second request to investigate US antidumping duties on shrimp. Ecuador has also initiated a WTO investigation against Washington.

Rise in value added products to US

US imports of shrimp continued to rise during the second half of 2006, according to a report by Eurofish. Volumes increased by 15% to 238,051 tonnes and 18% by value. The main players are Thailand, 29%, Ecuador, 14% and Indonesia, 13%. Combined with China, they have a 67% import share. Volumes of imports from China increased 52% and value increased 59%. However, the higher prices in the EU markets are attracting some countries especially as they face difficulties exporting to the US with the antidumping duties. Brazil has reduced exports to the US by 90%. In contrast, the value of imports of shrimp from Vietnam increased but not volumes. The report attributed this to an increase in value added products. In general, the volume of value added products to the US increased. This was led by frozen breaded shrimp (23%) and other frozen products (38%). (Source: www.Eurofish.dk).

Brunei targets black tiger shrimp

The Brunei government will increase its funding to the shrimp culture industry to B$70 (USD 47) million in the next development plan. A prawn consultant from USA, Integrated Aquaculture International, has been engaged by the government to help implement and enhance shrimp breeding productivity. Brunei is targeting the production of large species such as black tiger shrimp. Research has indicated that the aquaculture sector can contribute B$200 (USD 133) million by 2023. It contributed B$81.7 million (USD54) in 2003. (Source: Borneo Bulletin)

Japanese importers watch shrimp from Vietnam

In October and September, Japanese authorities have discovered shrimp contaminated with antibiotics from Vietnam. They then ordered the total examination of imports. If this does not improve, Japan might issue a prohibition order on shrimp imports from Vietnam, according to VietNam Net. This will be a setback for Vietnam as Japan imports USD 500-600 million worth of shrimp out of its total turnover of USD1.2 billion.

Taking action, the Ministry of Fisheries in Vietnam announced that it will control the supplies of chemicals. The solution proposed by NAFIQAVED (National Fisheries Quality Assurance and Veterinary Directorate) is that all consignments of shrimp must be examined by the agency and it will grant an export certificate. The industry is unhappy with this proposal as it will cost large companies as much as VND 300 million (USD20,000) for each export consignment. Furthermore they said that the certificates are not recognised by importers.

Firm prices for fishmeal and fish oil in 2007

Approximately 350 delegates attended the International Fishmeal and Fishoil Association (IFFO) 2006 conference in Barcelona, Spain in October. The theme was Sustainable Business Development and various speakers explained that this was not restricted to environmental responsibility, but dealt with how businesses need to build for the longer term and see themselves as part of a financially sustainable value chain.

Delegates were also informed that a weak El Niño now seems likely to occur during the coming months and its impact on fisheries is unknown at this stage, but could be rather small. The overall market message is that for 2007 global fishmeal and fish oil supplies will remain tight and prices are therefore likely to stay firm. The lower production in 2006 compared with 2005 reflected the responsible precautionary approach to catch limits on the part of the relevant governments, especially in Peru and Chile. Producers are committed to managing this situation for the sake of their customers on the basis of an open market and to aim for stability favouring longer term relationships. (www.iffo.net)

Toxin free tilapia from Hainan

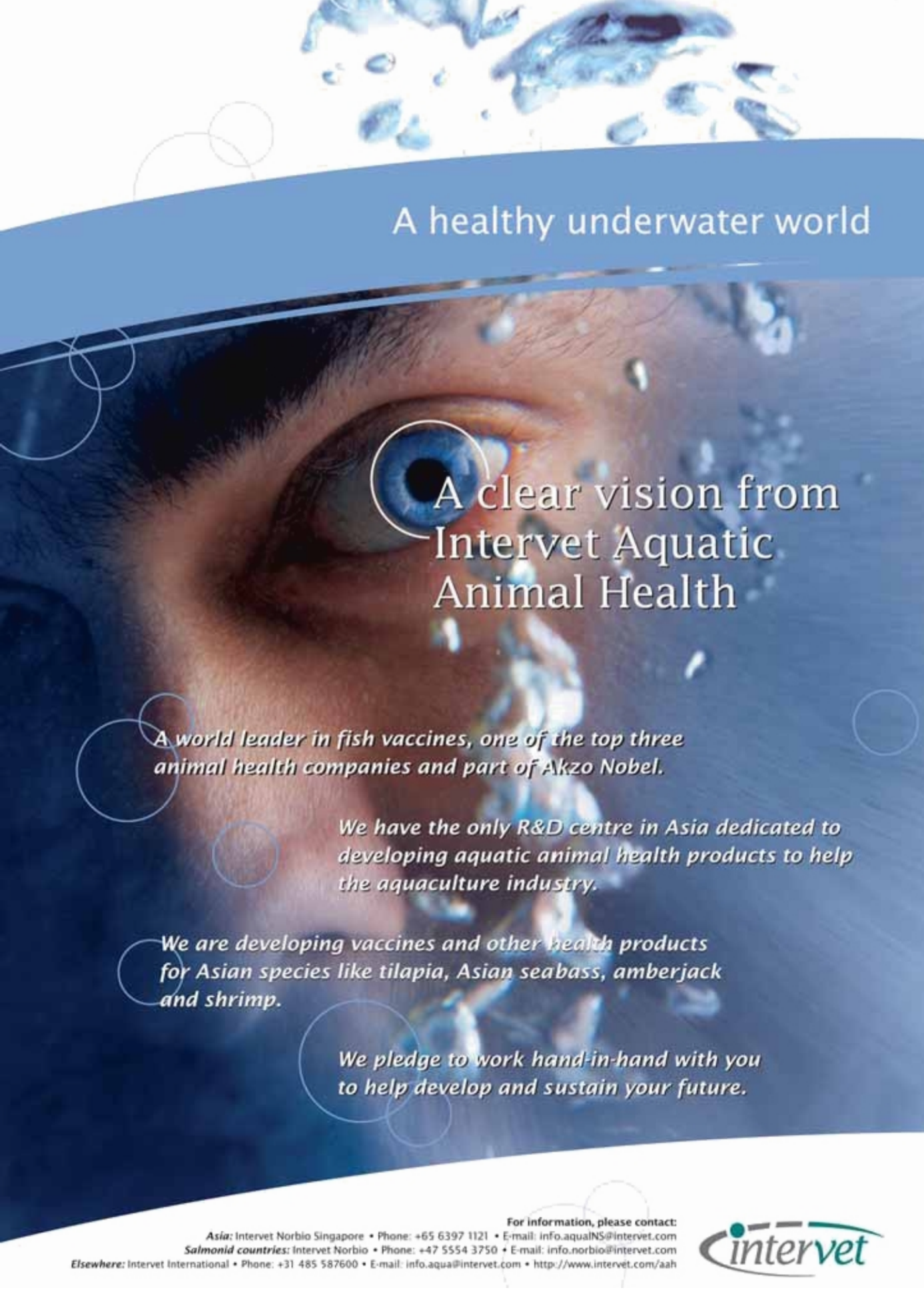
At the West Coast Seafood Show in Los Angeles, HQ Sustainable Maritime Industries Inc, a leader in integrated aquaculture and aquatic product processing, announced that it has produced a series of new products under its toxin free Tilapia brand "TiLoveYa."™ In a press release, it said that the brand is designed to show the health benefits of HQ's tilapia produced in the pristine Hainan Island in China.

The tilapia products are produced without the use of hormones, antibiotics and are free of the levels of heavy metals and other toxins associated with wild caught fish. The release also said that HQ practices sustainable aquaculture and uses nutraceutically enriched feeds. The company owns a nutraceuticals and health products company, which is HACCP certified.

Concerns on fluctuating prices of *Pangasius*

Pangasius catfish from Vietnam has been making in-roads into Western markets as a cheaper whitefish alternative. However, fluctuating prices are also making it difficult for planning by buyers, according to a report in Intrafish. Prices have shifted dramatically over the past year, with 100-percent net-weight fillet prices including freight varying between USD 4/kg mark and USD3/kg, according to European importers and Vietnamese exporters of the product.

The rapid price shifts are also destabilizing the culture and export business of the fish. A variety of factors are behind the price fluctuations. Some of these are seasonal and some the consequences of new markets discovering the fish. Others include growing pains as the industry matures. It added that when demand drops, small farmers in the fragmented pangasius farming industry will often exit the business, creating further disruptions to supply. A report at www.fishenet.gov.vn also said that as prices increase, farmers waited to sell at higher prices. The ex farm prices quoted were VND 11,800 to 14,000 (USD 0.79 to 0.93) in October.



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Australasian Aquaculture 2006

From innovations, seafood marketing to a successful business

The conference and trade show which took place in Adelaide, South Australia, from 28-30 August 2006 was the second international event organised by the National Aquaculture Council of Australia and the Asian Pacific Chapter of the World Aquaculture Society. It was also hosted by the South Australian Aquaculture Council. This show attracted more than 1,400 participants, mainly from Australia and the region. There were 141 trade exhibitors.

The plenary session focused on international opportunities for Australian products and how consumer attitudes are changing. Consumers expect higher levels of food safety and there should be responsible sourcing of products and eco labelling. With issues of obesity in the population and the bird flu scare, more attention is on seafood products as healthy alternatives. The national markets are important as consumers pay higher prices. The message was that aquaculture can supply the gap in demand if driven by innovations.

International marketing

Viggo Halseth, Skretting International said that given the changing nature of the international consumer, it is important that producers are able to recognise and react to possible opportunities and threats. Consumer concerns are on whether products are good for health and good for the children. There is also an increasing attention on production methods i.e. animal welfare and sustainable methods of production. An example of this is Wal Mart which only takes supplies from MSC certified sources.

The organic sector is growing but as non organic products are being subjected to strict certification programs such as Euregap, the gap between organic and normal standards is narrowing. In the use of materials for feeds, he said that the use of animal and poultry meals remains an issue in the EU in comparison to the US. Animal welfare is emphasised more in the UK and in the EU but less in the US. On the impact of NGOs on the industry, he added that in the case of Nutreco, the company works together with factual oriented NGOs and together they seek better practices.

Andi Alisjahbana, PT Fega Aquafarmindo (left) and Prof Adel K Soliman, Alexandria University, Egypt

Innovations

Throughout the conference, most of the audience attention was on innovations and aspects of aquaculture where the industry in Australia is leading. Several presentations discussed innovations in recirculation systems for shrimp and fish hatcheries.

RAS for marine fish and oysters

The design criteria for an intensive tropical hatchery and nursery for the barramundi *Lates calcarifer* was described by **Jerome Bosmans**. The production is for 2 million weaned fingerlings per year. European technology was adopted for the system. The focus was to design a 'stress free' hatchery with biosecurity to prevent the spread of Nodavirus (VNN). The different areas of the hatchery are maintained under strict quarantine with limited access. Larvae and fingerlings are subjected to a rigorous health monitoring and testing program. The entire hatchery has three 40,000l recirculated bloodstock tanks and two 6,000l larval rearing tanks, amongst others. Based on this modular design, Jerome expects that the hatchery can be expanded to increase production 2-3 times and to produce another tropical species. **Nik Duyst** gave a virtual tour of his oyster hatchery, New Tech Aquaculture Pty Ltd which uses a seawater recirculation system to produce and grow out Sydney rock oysters. The husband and wife team produces 5-10 million pearl oyster spats per batch on an intensive basis.

Robotics for soft shell crab harvesting

Angus Cameron of Watermarks Seafoods presented his experiences in the commercial production of soft shell crabs at his facility in Queensland. Production is for restaurants and crabs are supplied on a weekly basis to domestic markets. This is labour intensive and production is on 24/7 basis. To be competitive with suppliers from SE Asia, the farm has developed a robotic system which detects the moulting crab and picks this up. The company took three years to develop the system.

Hatchery system for selective breeding of shrimp

A hatchery system for shrimp breeding developed at the Australian Institute of Marine Sciences (AIMS) was described by **Matt Kenway**. With selective breeding, what is required is a hatchery system which can rear large numbers of families from specific matings concurrently. This system is for a small scale multi replicate rearing of large numbers of shrimp families under controlled conditions and following the standard protocol. Key features are its low costs, modular design and biosecure recirculation and economical environmental control. In the systems at AIMS, up to 200 batches can be reared.

Malaysian and Singapore participants at the AAP booth. front row, from left, Khor Cheng Chye, Confa Farms, Malaysia, Ismail Abu Hassan and Mazuki Hashim from Department of Fisheries Malaysia with, Dr Ngiam Tong Tau, United Engineers Ltd, Singapore.

The Australian experience in marketing

In the session on getting there, being there, staying there and beyond, presenters agreed that advances have been made in husbandry practices and technology but is also vital that industry is committed to robust business models. Marketing governs profitability. Companies should take the supply relationship seriously. The surety of supply is important. An inconsistent supply source effects all along the chain and consistency in specifications is critical. In the seafood retail business, they are continuously looking at improving with R&D and to drive down costs. In the retail market, it is important to continue innovating such as with meals for kids. Species can have the potential for commercial development only if there is a ready market. New opportunities are in the supply of Atlantic salmon, barramundi, yellowtail, kingfish and trout.

To promote seafood consumption, the Fisheries Research and Development Corporation introduced a guide for seafood marketers, 'What's healthy about seafood'. This is to help industry tell consumers about the benefits of eating seafood.

The Australian Seafood Industry Council is also promoting exports to Hong Kong SAR with a guide book. It said that Hong Kong offers a trading environment with zero tariffs and taxes and has few technical barriers. It is the world's sixth largest importer of seafood valued at AUD 3.5 billion in 2003. It has increased volumes by 23% in the past five years. It is also a hub for seafood trade in the Asian region. In 2003-04, Australian exports to Hong Kong totaled AUD 590 million.

Successful aquaculture business

In developing a successful aquaculture business, **Dr Graeme Dear**, Skretting, UK said that this depends on not only who you work for but also what are the aims, ambitions and targets of the business. It is important to identify where you are going and how you think you can get there. A plan is required but he added that it is okay to change it.

In a large company such as Nutreco, there are three key forces in the business- strategy, flexibility and people. Corporate Nutreco looks at the drivers and in their case this is the share prices vs. salmon vs. chick prices. In their strategy, one decision was whether to divest Marine Harvest or not, as shareholders do not like volatility. In the case of a medium size company, he quoted SSF, a salmon producer in Scotland. The mission of this company is to produce quality products at a competitive price and adapted to consumer requirements. In an example of a owner operated small business he quoted Loch Duart where Nick Joy the Managing Director believes that low volume high quality production is the key to the future for the salmon industry especially since consumer knowledge about food quality and animal welfare is increasing. It is the passion for the fish and business that returns profits despite low salmon prices. Overall, the key points for success are to grow them, keep them alive, control costs, meet consumer expectations and have the right people. On regulatory pressures, he said, "This is the age of consultation, community education, participation and the industry must accept these and work with them to bring about success".


Graeme Dear

The next annual meeting of the Asian Pacific Chapter, WAS will be the Asian Pacific Aquaculture 2007 which will be held at the Melia Hanoi Hotel, Hanoi, Vietnam from 5-8 August 2007. For more information: worldaqua@aol.com

Post conference visit to Port Lincoln

by Michael Cheah


Abalone tanks at SAM

The 50 minute flight to Port Lincoln was most pleasant as the plane flew over cropland and the blue sea. The coastal city of Port Lincoln has a population of some 20,000 people and was once a thriving fishing port. However the decline in the capture fisheries mainly for tuna led to the development of aquaculture projects and the city has not looked back.

Next morning we were welcomed by David Ellis Research Manager with the Tuna Boat Owners Association of South Australia and boarded a recreation boat Princess II, with a rear fitted with shark cages. The first stop was to see the feeding of kingfish in 20 to 40 m in diameter cages operated by Clean Seas Aquaculture. Feed was thawed-out herring and the kingfish responded in a feeding frenzy. Next was the Kinkawooka Mussel farm to watch the harvesting of black mussels. We then moved on to the Southern Bluefin Tuna farms owned by DI Fishing Pty Ltd. Here we saw divers in the water coaxing the tuna to the harvesting area of the cage. A giant hook was passed through the gill region of the fish and pairs of tuna were lifted out of the water at a time by a winch. Gutted and cleaned fish were packed and moved to shore based facilities for freezing. A shipment was being prepared for export.

At Coffin Bay, we saw the grading and packing of oysters at Marshall Oysters. Undersized oysters were repacked in the grow-out baskets and returned to the sea. The final stop was the South Australia Mariculture, an abalone farm at Boston Point. Good size green lip abalone of about 6-7 cm were kept in shallow raceways. In the nursery section the spats were growing on plastic plates suspended in seawater tanks about 2 m x 1 m and 50 cm in depth. Water flow was by gravity as the farm was built on a gentle slope.

In all, I am glad to see the developments in aquaculture here and the positive benefits flowing on to the rural economy and community.

Dr. Michael Cheah is with Central West TAFE, PMB 103, Geraldton, Western Australia 6531


Michael Cheah (left) with Steve Martin, Supervisor, South Australia Mariculture (SAM)

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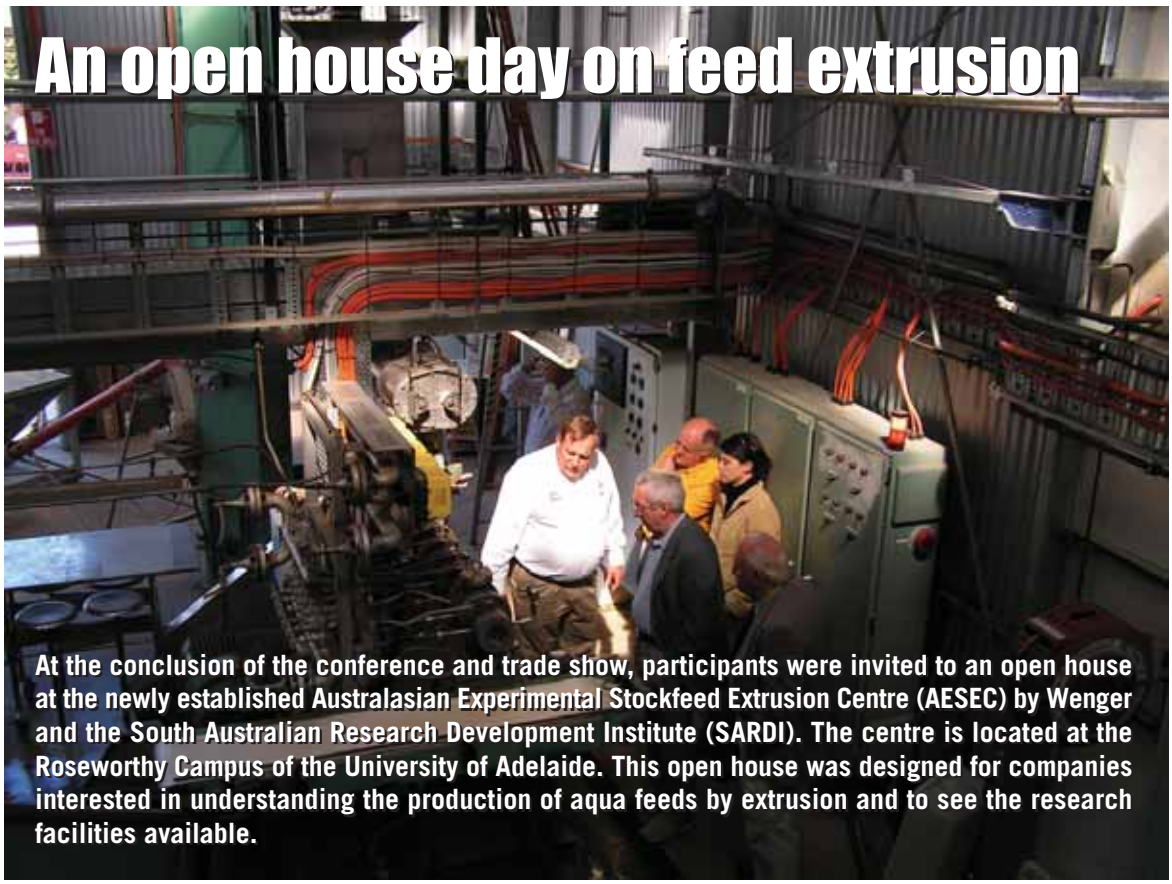
An open house day on feed extrusion



At the conclusion of the conference and trade show, participants were invited to an open house at the newly established Australasian Experimental Stockfeed Extrusion Centre (AESEC) by Wenger and the South Australian Research Development Institute (SARDI). The centre is located at the Roseworthy Campus of the University of Adelaide. This open house was designed for companies interested in understanding the production of aqua feeds by extrusion and to see the research facilities available.

The demonstration on extrusion

At AESEC, Joseph Kearns, Wenger Manufacturing Inc presented the first principals of extrusion. He also covered drying and cooling. After this session, he conducted a demonstration run to produce a floating fish feed and a sinking 2mm diameter shrimp feed. Other areas of discussion covered the use of organic ingredients in abalone feeds, protein sources and extrusion in general. Dr. Jeff Buchanan, Aquafin CRC/SARDI Project Leader for Tuna Production presented an overview of SARDI and the work he has been carrying out on tuna and other feeds at AESEC.

"This was the first introduction to extrusion and we will be doing trials for one of the attendees later in the year", said Gary Pearse of Allied Industries Pty. Limited a co-sponsor of the centre.

AESEC is part of the Aquaculture Nutrition & Feed Technology Subprogram's efforts to develop capacity in the production of extruded feeds for aquaculture and livestock sectors. The program is supported by Wenger Manufacturing Inc., Allied Industries Pty Ltd, UAS Industries, Adelaide University and the Aquaculture CRC Ltd.

The key objectives of the program are to provide services in the following areas:

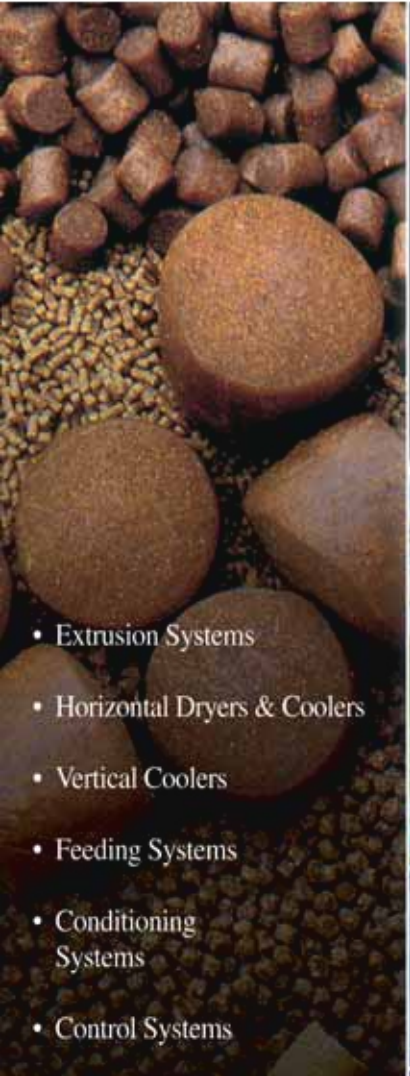
- Product development and core research
- Training
- Contract research
- Toll manufacture of non-commercial quantities of extruded feed
- Commercial facility hire
- Collaborative research and development

The AESEC comprises of a Wenger X-85 extruder capable of producing between 100 and 600 kg/hr of product depending on the diet and barrel configuration. The equipment can be configured to accommodate production of 1.2 - 20 mm sinking or floating pellets. All extrusion equipment is fitted with data logging capacity, from the live feed bin, along the barrel heads and screws to the die plate and knife cutter. This enables production parameters to be monitored during the course of product development and for later use in up-scaling to larger commercial machines. As little as 0.5 - 1 tonne of mixed ingredients is sufficient for use in pellet development processes, but production runs as small as 100 kg are possible once the process and extruder configuration has been defined.

Complementing the extruder is a two stage, steam fired dryer and a single stage cooler. This leads to a UAS vacuum infusion system that can be used for micro-ingredient addition, pellet coating and the incorporation of fats and oils. Depending on the formulation, pellets can be produced with fat levels exceeding 30% using this system.

More information: Steven Clarke, Aquaculture Program Leader, Email: clarke.steven@saugov.sa.gov.au

Attendees at AESEC. Back row left is Joseph Kearns and right is Gary Pearse.



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Waves of change in animal nutrition

by Kurt Wegleitner

In September, 500 feed industry professionals met in Vienna for Biomin's 2nd World Nutrition Forum. Appropriately, this was held amidst changes in animal production and the feed industry in Europe. In early 2006, the European Commission on Food Safety (EFSA), instituted the ban on antibiotic growth promoters in livestock feed. This was followed by the debate on welfare issues in intensive animal husbandry.

In his inaugural presentation, Biomin´s Director, Erich Erber said that some of the major events in world economics and politics will certainly have an impact on animal production, especially the feed industry. His question was 'How to ride the wave of change in the years to come?' (see box).

The forum covered issues related mainly to the animal feed industry, some of these are also significant to the global aqua feed industry. Summing up the meeting, R&D director, Franz Waxenecker repeated his closing remarks from the first meeting in 2004 and added "but we have to consider consumer opinions." Using some of the examples highlighted during the meeting, he explored the possible effects of three key areas of change on the animals we feed, feed raw materials and consumer perceptions.

- The continuing genetic improvement of livestock will create the need to refine our knowledge of nutrient requirements.
- Diverting grains and oilseeds into ethanol and biodiesel production will leave feed manufacturers competing for dwindling supplies of these commodities. By-products such as distillers dried grains will be a common feature of livestock diets in the future as we overcome problems such as energy and protein content, digestibility and mycotoxin contamination.
- While surveys reveal repeatedly that price is still the major concern of the consumer and satisfying the demand for more, cheaper animal products will always be a challenge, to prevent future problems. He concluded that we have to make the consumer trust us in animal nutrition.

How key players rate animal nutrition

To get a regional perspective on industry trends, participants answered seven key questions during the forum. Their responses analyzed on a regional and global perspective, showed some unexpected results.

1. On antibiotics usage- 54% said that it will decrease whilst 32% said that it will remain stable. In general, participants believed that the ban on antibiotics is a worldwide trend.
2. On consumer acceptance of antibiotics- 65% think that consumer acceptance will decrease but 16% in Asia see a rise in consumer acceptance.
3. On the acceptance of GMOs (genetically modified organisms) in feed and food- in Europe, this is likely to decrease. Elsewhere, there is a possible rise in acceptance. The rest of the world is indifferent to GMOs usage. GMO free ingredients are already highly priced.
4. On public concern of environmental pollution caused by animal production-65% said that this will increase.
5. On consumer awareness of harmful substances such as dioxins, heavy metals and mycotoxins- globally 85% expect this to increase or remain as is.
6. On legislation of harmful substances, globally the industry wants stricter regulations. In North American, many believe that these are already strict enough.
7. On price development of feedstuffs such as plant proteins, the majority of industry in Asia and North America expect prices to increase from higher demand and competition for biofuel.

Kurt Wegleitner is Marketing Manager of Biomin Singapore. Email: kurt.wegleitner@biomin.net

How to ride on the wave of changes in the years to come? By Erich Erber

The major influences in the global economy and politics will have an impact on animal production and the animal feed industry. So what will be the trends shaping the future of our industry?

The first trend is undoubtedly the fact that the raw material base will become more expensive. The demand for raw materials for bio ethanol and biodiesel production has suddenly become a competitor for commodities such as corn or rapeseed. However, an interesting by- product of this development has resulted in a huge amount of DDGS and palm kernel cake available for use as feed ingredient. The cost for other ingredients such as amino acids and vitamins will remain in the current levels due to the severe competition posed by Chinese producers.

However, because of the growth in human population and GDP in some countries, world feed production will continuously rise with 3-5 % annual growth and it will be mainly in Asia and Brazil.

The shift of consumer behavior to the more "healthy" white meat versus the red meat is ongoing in most developed countries. This is being supported by an increase in the elderly population and a strong 'well being' trend. The clear winner of this trend is the aqua products.

In the aqua feed industry, the limiting factor is the supply of fishmeal. So the carnivorous fish species such as salmon and shrimp will face an ever increasing price pressure. The research to use more plant proteins to feed these fish is ongoing. But the clear winners will be the herbivores such as tilapia, which in the next ten years is expected to triple production numbers.

In poultry, the discussion of a feed conversion ratio of 1.1 is already open already. Companies involved in breeding are putting a lot of efforts to further increase daily weight gain and feed conversion rates. However, feed conversion economics of pigs will improve and their faster growth paired with higher proficiency will exceed that of poultry and fish.

The increasing regulation on environment in which the farms can operate will in turn lead to more stringent regulations to the producer and increased cost of production. EFSA has imposed the most stringent EU feed and food safety concept. Then there are animal activist groups expressing this view. The concept of complete traceability, animal welfare and feed safety makes the EU a very expensive place of production.

Erich Erber is the Director of Biomin Singapore

The information was extracted from the inaugural presentation at the 2nd Biomin World Forum, 8 September 2007.

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Strategies in using plant meals in aquafeeds-learning from animal nutrition

How the 'ideal protein' concept commonly applied in animal nutrition can be used in reducing the proportions of fishmeal in aquafeeds

By Eddy Sunanto

Aquaculture production is a rapidly growing food producing sector. Demand for aquatic products is on the rise as per capita consumption of seafood is expected to increase to 19–31 kg by 2030 from the current level of 16kg. However, modern aquaculture is increasing the pressure on marine resources as feeds used in the production of shrimp and eel continue to use large volumes of fishmeal. Today aquaculture uses about 40% of the world's supply of fish oil and 31% of its fishmeal. A general formulation of eel feeds would contain 20–30 % fishmeal and for shrimp feeds 40–50 % of fish meal with more than 65% crude protein. In contrast, in the production of feeds for the poultry and pigs, this has been drastically reduced from 10–15 % in poultry feed and around 10% in pig feed to almost nothing at current level. And now, most of animal feeds are formulated by least cost formulation without fish meal inclusion.

Pressures with fishmeal usage

However, there are also several negative issues with the use of fishmeal in aquafeeds. For the aquaculture producer, it is using marine animal protein sources to produce another protein source. The use of fishmeal in feeds comes under pressure from environmental groups and consumers as several kilograms of wild caught fish are needed to feed every kg of farmed fish, eel, and shrimp.

The steady increases in prices of fish meal are also creating a strain on feed formulation cost for the feed producer and consequently, the cost to aquaculture. Besides the cost factor, there is also a pressure on fish meal supplies which cannot be fulfilled by existing supplies. Although, on average, fishmeal content of fish feed has been reduced from 70% in 1972 to a current 35%, these have been made without reducing levels of fish oil. It is however, the fish oil rich in omega 3 fatty acids which gives fish its healthy food image.

Replacing fishmeal in aquafeeds

The substitution of fishmeal with plant protein meals such as soybean, rapeseed meal and corn gluten is constantly being developed. Since fishmeal and fish oil are commonly used in diet formulations for aquafeeds, mainly those for the salmonids, eel and shrimp, the potential negative effects of their removal are still unknown. Research has indicated that by using fishmeal or an animal protein source rather than a plant protein source, better growth and disease resistance have been achieved. It is implied that the amino acid profile of fishmeal or animal protein source is better than plant protein sources. Un-identified growth factor (UGF) becomes dominant in fishmeal or animal based protein when the feed formulated based on total amino acid.

However, recent experiences in the animal feed industry and knowledge on potential risks have improved and strategies to overcome these could be developed. These experiences are also highly valuable for aquaculture producers, because recently numerous feed companies worldwide have switched to all vegetable diets.

In the case of shrimp which require diets with high density nutrients, the chief option is to use more soybean products. It is only in adult fish which require a lower density of nutrient that other vegetable protein sources, such as rapeseed meal, sunflower meal and peas may fit better into the formulation. In addition, the use of several plant protein sources in feeding fish and shrimp are limited as they contain anti-nutritional factors (such as phytate) and are lower in digestible amino acids.

Based on concepts already developed for the animal feed industry, there are several opportunities in using plant meals for aquafeeds

'Ideal protein' and amino acid supply

A comparison of the essential amino acids composition and protein digestibility value in different protein-rich feed ingredients (Table 1) with the requirement of several fish species for amino acids (Figure 1), indicates that there should be no problems in using high-quality soybean meal as its amino acids are highly digestible. However, when alternative ingredients such as peas or rapeseed meal are included, any diet formulated on total amino acids will lead to an overestimation of availability for several amino acids.

Tabel 1. Protein and amino acid content (% in dry mater) and the digestibility value (% of content)

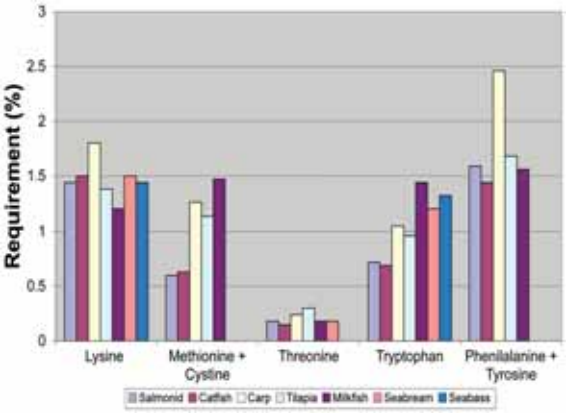
Ingredient	Crude Protein		Lys		Met + Cys		Thr		Try	
	Content	Dig	Content	Dig	Content	Dig	Content	Dig	Content	Dig
Fishmeal	63.68	85	4.68	89	2.32	85	2.60	88	0.68	86
Meat and Bone Meal	49.93	74	2.43	77	1.16	67	1.58	74	0.32	73
Soybean Meal	47.03	87	2.82	89	1.35	86	1.82	86	0.62	87
Fullfat Soybean Meal	35.89	82	2.18	83	1.06	78	1.41	79	0.48	82
Corn Gluten Meal	61.53	87	0.98	87	2.54	93	2.04	90	0.33	86
Rapeseed Meal	35.77	73	1.91	74	1.58	75	1.53	71	0.47	71
Peas	20.66	79	1.48	81	0.52	70	0.77	76	0.19	70

Source: Sunanto and Ramli, Thesis : Bogor Agriculture University.

Table 2. The variation of amino acid content (Source: Amino Dat 2.10. Degussa AG, Germany)

Amino Acid Content	Soybean Meal (SBM)				Soybean Meal (SBM) Ex. USA			
	Mean	CV	Min	Max	Mean	CV	Min	Max
Methionine	0.64	7.80	0.50	0.78	0.68	5.40	0.51	0.78
Met + Cys	1.35	6.50	1.08	1.70	1.40	4.80	1.13	1.70
Lysine	2.82	4.80	2.23	3.40	2.84	4.90	2.27	3.40
Threonine	1.82	4.70	1.55	2.08	1.86	3.90	1.57	2.08
Tryptophan	0.32	6.70	0.50	0.83	0.64	7.00	0.50	0.83
CP	47.03	3.80	41.04	51.33	47.76	3.00	41.43	51.33

Figure 1. Amino acids requirement in selected species. The data of methionine + cystine requirement and phenylalanine + tyrosine is not available for seabream and seabass.



These interactions were demonstrated by research conducted in Bogor Research Station. The plant based feeding trial compared high and low diets and low digestible diets supplemented with crystalline amino acids on nile tilapia feed. The feed formulation using equal protein and amino acid of marine sources fish diet has a different response on growth performance. The growth performance of fish group fed on the diet with low digestible amino acid was significantly lower compared to the group fed with a diet containing highly digestible amino acids. The addition of pure amino acid feed additive can compensate a growth depression.

This trial provided clear evidence that diet formulation should be based on digestible amino acid values, especially if feedstuffs other than corn and soybean meal are included.

The role of feed formulators is to ensure that the feed has an adequate amino acid supply despite any inconsistencies in data available. Another concern is the impact of the variation in the amino acid content of raw material on the actual amino acid content of the diet (Table 2). In aqua feeds, it has been shown that the deficiency of amino acids has a significant impact on animal performance.

Inconsistencies in the final amino acid profile of compounded feed are due to variation in amino acids profile in the single feed ingredient. This is turn is due to genetic, regional or seasonal variation. The more the selection of protein sources is focused on only one ingredient, the greater is the need for frequent monitoring and adjustment of its nutrient specification by the supplier. In using several sources of protein, there is also the balance of total amino acids.

'Ideal protein'

This has been an important progress in terrestrial animal nutrition in recent years. The basic idea of this concept is that the animals need amino acids in a certain balance to ensure optimum performance. Any absorbed amino acid which is in relative excess compared to the first limiting amino acid will be oxidized and nitrogen will be excreted. Therefore, adjusting the dietary amino acid supply according to the 'Ideal Protein Concept' helps to maximize nitrogen utilization.

Therefore, the responses of only one single reference amino acid –usually lysine– to changing production conditions have to be evaluated while the remaining amino acids are then to be adjusted simply by calculation. Usually, only essential amino acids are considered in this concept. However, there is still a scientific discussion about the adequate ratio between essential and non-essential amino acids especially in low protein diets.

In animal nutrition, this concept has allowed for a practical application of low protein diets allowing for the same animal performance if compared to unbalanced high protein diets. A second basic idea of this concept is that while the requirement by the animal for essential amino acids may vary between various practical situations, the ratios between these amino acids remain fairly stable at the same time.

When applied in aquaculture nutrition, this means that by using the digestibility value of its individual feedstuffs, the compound feed can be formulated based on correlation with another amino acid supply.

Balancing the variation in amino acids composition

The variation in amino acids composition is due to plant genetics, production systems, harvesting, post harvesting treatment, processing, warehousing etc. The feed manufacturing process and compound feed handling can contribute to this variation. In order to counter balance the variability of the nutrient content in raw materials, feed formulators normally put a safety margin on the nutrient specifications of a feed formulation. A safety margin is assigned either by increasing the specification on the nutrient requirement side, or by a reduction of the nutrient matrix value ingredient on the ingredient side.

Metabolic enhancers

An addition of a nutrient metabolic enhancer (enzymes, probiotic, prebiotic, organic acid, etc) is a solution to cope with nutrient variability in plant feed ingredients. Making nutrients like amino acid consistently more available to the animal with dietary metabolic enhancer means that the inclusion of a safety margin by reducing the nutrient matrix value is no longer necessary. As a result feed cost can be reduced significantly. However, the application of probiotic and enzymes is limited with high temperature treatment on aqua feed processing.

Synthetic amino acids

By using an equal formulation program for aqua feed, the formula with more soybean meal or other vegetable proteins may put a space limit in diets in order to achieve the required minimum nutrient levels. This can make the formulation impractical. The first limiting factor is protein and to achieve minimum levels of protein and amino acid digestibility, the addition of synthetic amino acid or soy concentrate may be required.

The second limited factor is energy value and to reach a minimum level of metabolic energy (ME), an increased addition of fats, oils or full-fat soybeans are required. These may negatively affect pellet quality. However, a very important aspect is the lower energy density of vegetable proteins caused by relatively high contents of poorly digestible nonstarch polysaccharides. The particularly soluble arabinoxylans and beta-glucans have been recognised as being anti nutritive factors in cereals and therefore, the use of enzymes to overcome this problem in cereals has become obligatory.

Antinutritional factor (ANF)

Some of plant feedstuffs contain anti nutritional factors (ANF) which can reduce nutrient utilisation by fish and shrimp. Phytate (or phytic acid) is a common ANF in plant feedstuff. Its composition varies as shown in Table 3. In plant seeds, phytate binds mineral cations like Ca-Mg, K-Mg, Fe or Zn and forms a poorly soluble complex.

Table 3. Phytate Content of Ingredient (g/100 g DM)

Ingredient	Phytate Content
Corn	0.24
Wheat	0.27
Wheat Bran	5.56
Rice	0.89
Rice Bran	10.31
Soybean	0.39
Peanut meal, defatted	1.70
Sesame meal, defatted	5.18
Cottonseed flour, glandless	4.80
Barley	0.27
Oats	0.77
Coconuts	2.38
Whole grain millets	0.47
Sunflower meal	0.99

Source: Phytase in Animal Nutrition and Waste Management. Page 73 - 74

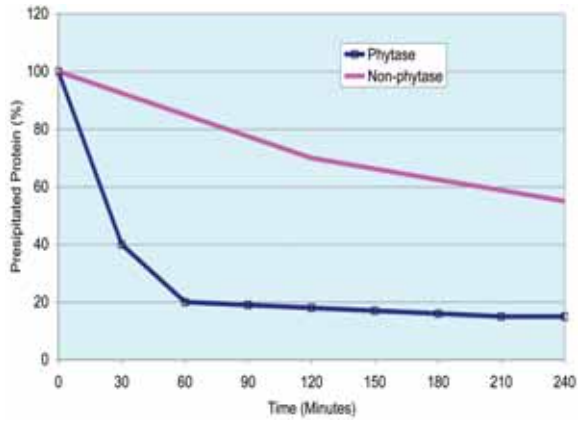
Phytate is also able to form complexes with proteins and amino acids. The side chain of amino acids is thought to be one of the main functional groups involved in protein-phytate interactions. Therefore, a significant proportion of amino acids that are frequently supplemented to diets may complex with phytate. These decrease the digestibility of proteins and of supplemented amino acids. Knuckles et al. (1987) reported that phytate can reduced a solubility of alpha-amylase. A deactivation of pepsin after an addition of phytate was also reported.

An exogenous enzyme of phytase is the smart solution for plant based feed to maximized potential of the raw material. Some laboratory and commercial trials confirmed the effectiveness of nutrient digestibility after addition of phytase. In an in-vitro study, Jongbloed et al. (1997) reported the effectiveness of the *Aspergillus* phytase in increasing protein digestibility. With phytase addition, the protein precipitation in feeds with soy protein concentrate was significantly decreased indicating an increase in protein digestibility as shown in Figure 2.

Jackson et al. (1996) also reported an improvement of phosphorous and daily weigh gain after addition on recombinant *Aspegillus* phytase on catfish. The commercial trial in Brazil reported tilapia performance improved with addition of 500 unit of *Apergillus* phytase. The BASF Research station also reported an improvement of phosphorous utilisation after addition of phytase, and when fishmeal was completely replaced by soybean meal phytase significantly improved weight gain (Carter and Hauler, 1998).

This research concluded that phytase is able to unlock the potential phosphorus source associated with the phytate molecule. This enables the feed formulator to cut back on supplementation with inorganic

Figure 2. The effect of Aspergillus phytase on precipitated soybean protein (Jongbloed et al. 1997)



phosphorus using naturally occurring phosphorus more efficiently and saving feed cost at the same time. In addition, phytase releases other bound nutrients which improve the general quality of plant derived raw materials and contributes to an environmentally friendly fish production at competitive costs.

Conclusion

It is critical that aqua-feed producers reduce dependency on fish meal usage as the main source of protein/ amino acid. This is not only a result of consumers concerns on product safety and ecology but also an opportunity to reduce feed costs. Consequently, the use of plant ingredients is increasing. However, compared to animal protein sources, most of the plant feed ingredients have a higher variability in nutritional value.

The essential amino acids are one of the first limiting nutrients in animal feed formulations and amino acids have a significant impact both on feed formulation cost and on animal performance. Hence, amino acids levels are key factor for nutritionists to assure that a formulation matches the animal's requirement at the lowest possible variability and at reasonable cost. Thus by learning from the experiences from terrestrial animal nutritionists, aqua feed formulators can quickly learn to do this.

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Letter to the Editor

On pigmentation of shrimp with natural carotenoids

The article 'Shrimp pigmentation with natural carotenoids' in the May/June 2006 issue (pp 34-35) is interesting. However, the economical aspects are not satisfactory. It is not important whether the alfalfa concentrate is less expensive than other carotenoids. Of much greater interest is the question whether a feed formulation can absorb the cost.

In addition, a shrimp feed formulation normally contains shrimp head meal. This feed component has natural carotenoids and provides sufficient colouring which gives the cooked shrimp an "acceptable" colour. As long farmers do not get a premium for the colour of cooked shrimp, it cannot be recommended to use a supplement with carotenoids in shrimp feed which will no doubt increase feed costs.

The stability of natural carotenoids is limited. About 40 years ago, prior to the development of synthetically carotenoids, the feed milling industry used alfalfa juice, paprika and *Tagetes* (marigold) for the colouring the egg yolks. This was not very successful because of the instability of the natural carotenoids. Also the treatment with an antioxidant has hardly solved the problem. It would be, therefore, of interest to learn something about the carotenoid stability of alfalfa concentrate.

~ Dr Joachim Hertrampf, Kuala Lumpur, Malaysia

The answer

Firstly, the key is the 'acceptable' colour of shrimp for the cooked shrimp market. The market situation is changing because supply is increasing faster than demand. In fact, most of the exporters of white shrimp, from Latin America and from Asia like to export to the European cooked shrimp market because this is where the offer prices are higher but the quality specifications are also higher. The situation is simple. The producer could comply and have a good price when exporting to this market.

One specification is colour. Consumers like reddish head-on cooked shrimp. If the shrimp are too pale it would be very difficult to sell them on the retail market. For example *Penaeus indicus*, cultured in Iran, is not well received in this market although the shrimp could have a very good taste.

On the use of shrimp head meal as a carotenoid source, it is known that buyers often mention that this meal must be banned because it increases the risk of disease propagation, as recommended by the international organization of the animal health.

On the extra cost for carotenoids, the mentioned concentrate of alfalfa contains 52% of proteins with a very good amino acid profile. For this reason, we do not consider this ingredient as an extra one but as a substitute. The average inclusion rate would be 4% which could substitute 4% of fish meal. Considering the actual cost of the fish meal, the farmers should not have to support any extra cost. It is also important to consider that this feed with a high content of carotenoids will also help shrimp overcome stressful conditions.

Hervé Lucien-Brun

On the stability of the carotenoids, today, the situation has "slightly" changed during last 40 years.

It was only from the 1980s, that the industrial exploitation of this technology really began. One of the results is 'Pigmentech'. Progress was not only with the use of ethoxyquin, as mentioned, but also on the control of the industrialisation of the process. Today the product is recognized and its xanthophylls rate is the subject of a guarantee. At present, it is used to increase colouration of egg yolk or poultry flesh in Europe.

The tests presented in the article were realised with the currently available commercial product. Other tests with very positive results have been done in sea bream, Today sea bream farmers currently use 'Pigmentech' as an ingredient in the feed.

I hope that this will explain your queries.

~ Hervé Lucien-Brun, Aqua Techna, France

The Extrusion Technology Program of the Food Protein R&D Center (FPRDC) completed their 13th Annual Practical Short Course on Aquaculture Feed Extrusion, Nutrition, and Feed Management, held from September 24 to 29, 2006. The aquaculture course is held every year on the campus of Texas A&M University.

Truly international, it attracted 40 participants from 18 different countries for the demonstrations and practical instruction. These countries included Barbados, Bolivia, Brazil, Canada, Chile, El Salvador, Honduras, Indonesia, Jamaica, Malaysia, Netherlands, Peru, Philippines, Thailand, United Kingdom, United States of America, Uzbekistan, and Vietnam.

Four major types of extruders were emphasized during the the course: dry, interrupted flight, single screw, and twin screw as well as extrusion principles and the differences between each type of extruder.

Demonstrations at the FPRDC pilot plant, focused on dry extruders manufacturing aquatic feed, full fat soy, and fisheries by-products recycling, interrupted flight expander creating aquatic feed and full fat soy, a single screw extruder making floating catfish feed, a twin screw extruder producing ultra-fine fish feed, and an automated on-line monitoring system for moisture and bulk density. Also included was a demonstration on a continuous spray coating system and single screw extruder manufacturing salmon feed (sinking), a twin screw extruder creating high fat yellow tail feed (slow sinking), and a vacuum infusion system.

In 2007, the course will be held September 23-28. More information is available from www.tamu.edu/extrusion or contact Dr. Mian Riaz at mnriaz@tamu.edu

An effect of nucleotides in the Asian Seabass

A uniform and faster growth of fish fed chopped trash fish with nucleotides was demonstrated in this trial with Asian seabass in Thailand

By Thanit Yoonaisil and Joachim W. Hertrampf

The euryhaline Asian sea bass *Lates calcarifer*, otherwise known as sea perch or barramundi, can be cultured in freshwater as well as in brackish water. The maximum salinity is 24 ppt. The species is of economic value because it has a high market value.

Sea bass is a carnivorous fish. When farmed, it is commonly fed on chopped trash fish. The effect of nucleotides in sea bass has not yet been studied. The efficacy of nucleotides in shrimp, on the other hand, is very well documented (Ancieta-Pröbstl et al., 2005; Hertrampf and Mishra, 2006). In order to obtain information on whether nucleotides are just as effective in sea bass as in shrimp, an experiment was conducted in Thailand.

Trial conditions

In a 96-day aquarium trial, fish of a mean weight of 34.4 g and an average length of 14.4 cm were randomly divided into two groups with two replicates each. The fish were fed with chopped trash fish twice daily at 9.00 h and 15.00 h. Trash fish for the treatment group was fortified with 0.5 g nucleotides/kg trash fish. The nucleotides product was from Chemoforma A.G. Augst, Switzerland. The nutritional value of trash fish as fed is shown in Table 1. The weight gain and the length of the fish were recorded every 30 days (Table 2)

Table 1. The composition of trash fish, as fed basis

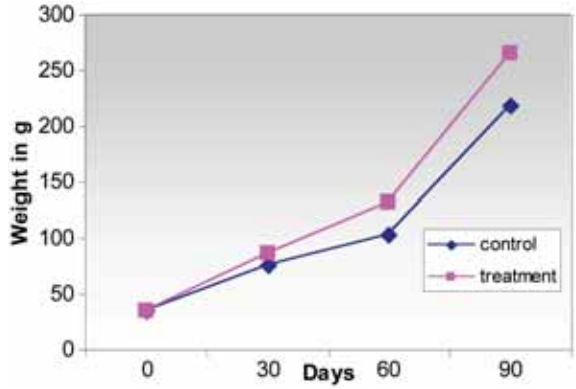
Moisture	69.2%
Crude protein	11.2%
Crude fat	2.6%
Crude fibre	0.5%
Crude ash	12.1%
N-free extract	4.4%
Calcium	2.14%
Phosphorus	1.21%
Digestible energy	2,649 kcal/kg

Results

At the end of the trial, the sea bass group fed nucleotides fortified trash fish had a weight gain of 241.3 g which was 0.8% more than the weight gain of the control group. The difference was statistical significant at 5.0% level. Improvements were also observed in the treatment group for specific growth rate and the daily weight gain.

However, in the period 30 to 60 days of the trial the temperature declined drastically. This affected the control animals substantially. The difference in the weight gain of this period was 28.2% in favour for the nucleotides animals (Figure 1) compared with 10.8% for the entire trial period. During the low temperature period the weight gain of the treatment group increased by 52.3% while the live weight of the control group increased by only 35.5%. The decline of the temperature stressed the fish. This stress situation may not have affected fish in the treatment group because of stress relieving properties of nucleotides.

Figure 1. Weight development of Asian sea bass (*Lates calcarifer*) fed on trash fish fortified with nucleotides



The standard deviation (SD) of the live weight at the beginning of the trial was similar for both trial groups. However, at the end of the experiment the SD for the control group was as wide as ±35.3 while for the nucleotide group it was only ±17.8. This meant that the fish performance of the nucleotide group was more uniform than that of the control group.

On the length development of fish, there was no effect of nucleotides. The difference in fish length between both groups was only 1.9% which was statistically non-significant. However, the SD for the control group with ±1.42 is almost three times as high as for the treatment group

Table 2. Response of feeding nucleotides fortified trash fish to the Asian sea bass *Lates calcarifer*

	Unit	Control	±SD	Treatment [1]	±SD	Control=100
Replicates	No	2		2		
Salinity	ppt	2.0-2.5		2.0-2.5		
Initial weight	g	34.4	7.00	34.4	7.01	
Final weight	g	252.1	35.27	275.7	17.75	
Weight gain	g	217.8		241.3		110.8
Specific growth rate*	%	633.1		701.5		110.8
Daily weight gain*	g	2.27		2.51		110.7
Feed conversion ratio	1:	2.60		2.01		77.3
Initial fish length	cm	14.38	0.30	14.38	0.30	
Final fish length	cm	26.70	1.42	26.93	0.53	100.7
Change in length	cm	12.32		12.55		101.9

[1] *Trash fish fortified with 0.5 g Vannagen/kg (Chemoforma A.G. Augst, Switzerland)*
** Differences were statistically significant at 5.0% level.*

(±0.53) (Table 2). This indicated again that fish fed the diet with nucleotides was more uniform. The differences of the weight gain as well as the length of the fish was in favour for the treatment group and can be attributed to the efficacy of feeding nucleotides fortified trash fish.

The feed conversion ratios (FCR) with 2.60 (control) and 2.01 (treatment) were relatively high. This refered to the feeding of nutritionally unbalanced trash fish. In sea bass trials with balanced pelletised compound feed, feed conversion ratios of 1.16 and 1.44 were reported by Mishra and Venu Gopalakrishna (2004, 2005). Nevertheless, the feed conversion of the nucleotide group was 22.7% better than the same of the control group (Table 1). This effect may be attributed to be to the performance enhancing properties of nucleotides.

During the entire trial period, no mortality was reported in both groups.

Conclusion

In this 96-day trial and under the above conditions, the fortification of chopped trash fish with 0.5g nucleotides/kg trash fish demonstrated the efficiency of the additive in the feeding of Asian sea bass. Compared with the control group the nucleotides group developed significantly faster, the size of the fish was more uniform, the feed conversion rate was substantially improved and, last but not least, a stress situation (change in temperature) could be managed successfully.

These results showed that for the sea bass, nucleotides supplemented feed can act as a stress reliever and a performance enhancer.

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Success with probiotics in New Caledonian shrimp farms

Specially selected probiotics for aquaculture are assisting farmers in New Caledonia to improve production and overcome losses due to vibriosis in the commercial species *Litopenaeus stylirostris*.

By D.J.W. Moriarty, O. Decamp, D. Pham, S. De Decker, D. Ansquer, Y. Harache, Régis Bador and P. Lavens

In New Caledonia, this domesticated stock of shrimp has been cultured in a closed cycle for about 25 years. It has been resistant to Infectious Hypodermal and Hematopoietic Necrosis (IHHNV), the only known virus present there. However two bacterial diseases have affected its production respectively since 1993 ("Winter Syndrome" or syndrome 93 was caused by *Vibrio peneicida*) and 1997 ("Summer Syndrome" caused by *Vibrio nigripulchritudo*) (Goarant et al., 2006a). The French Institute for Marine Research (IFREMER) has been conducting a research program to assist the farmers to overcome these culture problems (Goarant et. al. 2006b).

With the good results obtained by Sanolife® probiotics in the control of vibriosis in other countries (Moriarty et al. 2005), a collaboration funded by New Caledonian authorities was set up by IFREMER with INVE and a farmer who was affected by the "Summer Syndrome" to improve shrimp production. The study involved three aspects:

- 'in vitro" determination of *Bacillus* spp. on the prevailing vibrio pathogens in New Caledonia
- Tests in fibreglass tanks for the effects on growth and survival
- Field test on the affected farm

The manager of Société D'Aquaculture Calédonienne (Sodacal) also decided to test these probiotics in two ponds on the farm. After successful results in trials on the two farms earlier this year, six farmers are now running more extensive trials in grow out ponds.

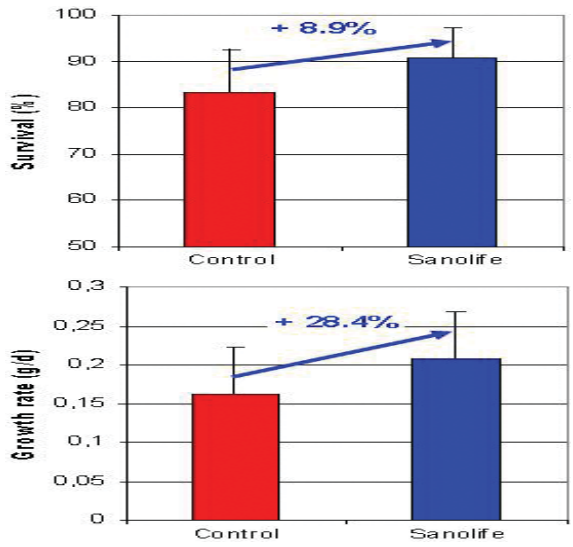
In vitro study

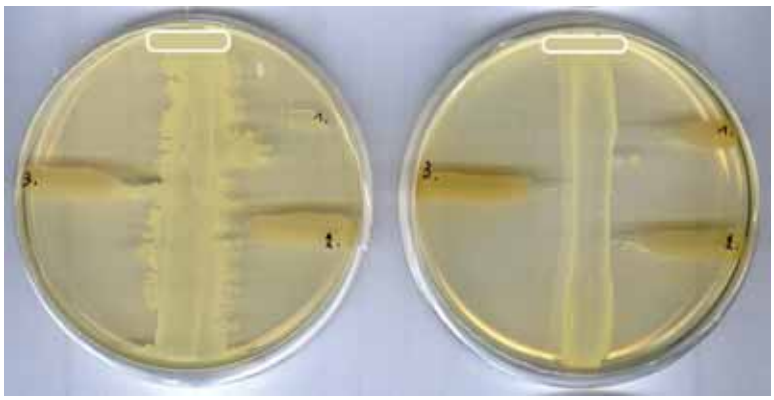
Two strains of *V. nigripulchritudo* and one of *V. penaeicida*, part of the IFREMER collection of shrimp pathogens (Goarant et al 2006a), were sent by IFREMER to the INVE Technologies research laboratory in Belgium for challenge tests against various strains of several *Bacillus* species. The *Bacillus* strains were selected earlier for their ability to control pathogens by direct inhibition and through competition, to degrade waste products and withstand the conditions prevailing in shrimp ponds, etc. The inhibitory activity of the selected *Bacillus* strains was evaluated by the cross-streaking method, using tryptone soy agar plates (see photo). It was confirmed that these specific INVE strains directly inhibited the 3 New Caledonian strains. Based on these test results, the PRO-1 and PRO-2 formulations were optimized for maximal control of these pathogenic vibrios.

Tank study

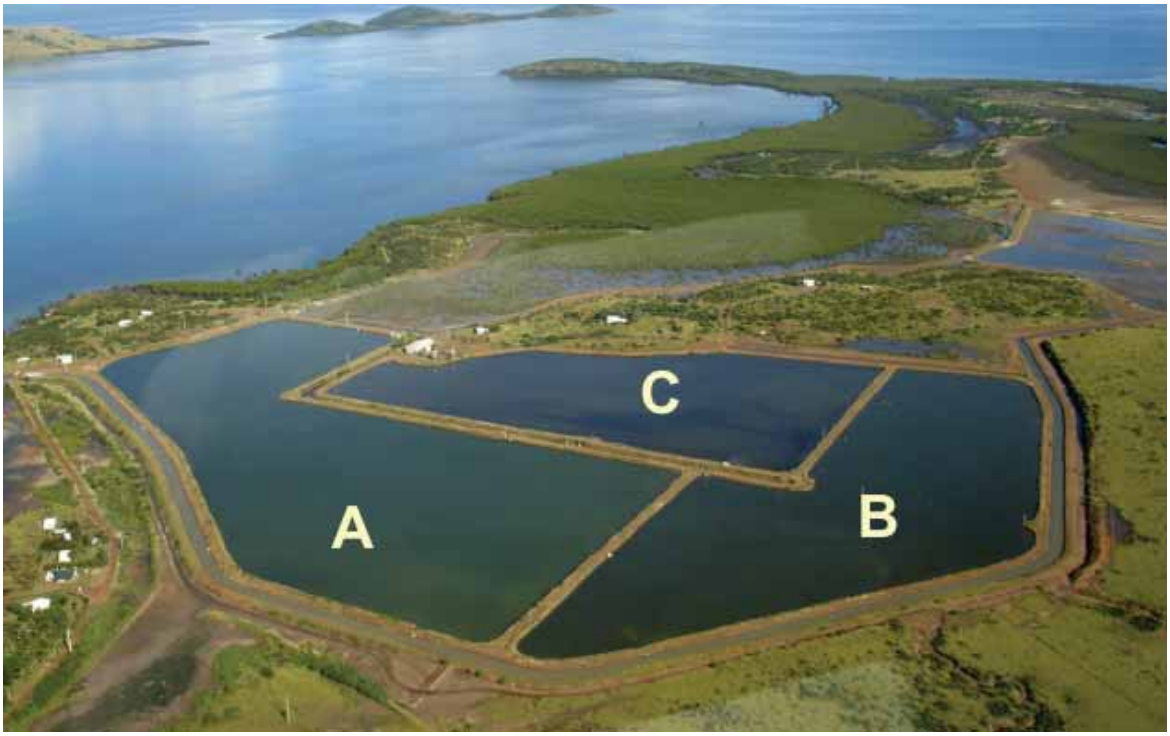
Scientists at IFREMER showed, in a controlled experiment using indoor tanks, that there was a highly significant increase in growth rate when the probiotics were mixed with the feed pellets shortly before feeding the shrimp (Fig. 1).

Figure 1. Growth rates of *L. stylirostris* fed with Sanolife® PRO-2 coated on feed pellets in tanks over a 26 day period at the IFREMER laboratory, St. Vincent, New Caledonia. The difference in growth was highly significant (P= 0.0001).





Several Bacillus strains were found that inhibited the growth of Vibrio penaenicida and V. nigripulchritudo on agar plates. Bacillus are streaked vertically and vibrios horizontally.



Seafarm where the farm test was conducted (Courtesy of Y. Harache, IFREMER).

Field studies

Seafarm has been affected by the Summer Syndrome since 1997. Since then survival in a good year has fallen to less than 30%, making shrimp production unprofitable. After several (unsuccessful) trials of different bacterial products as probiotics in feed, Denis Goxe, the farm manager, was approached by IFREMER to apply these probiotics to water and feed. This was started in February 2006 in Pond A (see photo).

As survival was only expected at around 25 – 30%, Denis was pleased when the survival at harvest reached 40%. In comparison, shrimp survival was 31% in two control ponds. Furthermore, the feed conversion efficiency (FCE) was much better (2.1 versus 2.55: Table 1). This resulted in an increase in revenue for pond A with these probiotics compared to the control ponds. The increase in survival and lower FCE raised the gross income by about USD1,500/ha with a stocking density of 16/m^2. The production increase was 300 kg/ha, of which about 100 kg covered the cost of the probiotics.

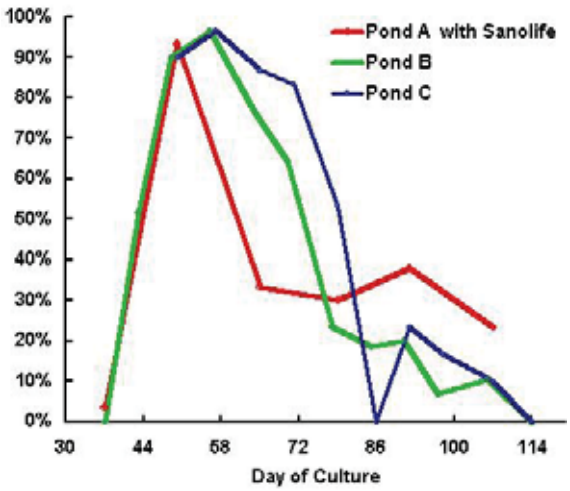
An important aspect of the study was the treatment of water in the ponds with probiotics as well as the feed. The IFREMER studies have shown that the pathogenic strains of *V. nigripulchritudo* probably remain in wet zones of the pond soil between crops (Goarant et al 2006a). Therefore, to assist in controlling the abundance of the vibrios, the pond water was also treated directly with a special INVE water conditioner twice per week during the crop.

Table 1. Effect of probiotics in water and feed for the whole crop period at Seafarm. See Fig. 2 for the probiotic treatment. Stocking density 16 – 18 PL/m^2

Pond Treatment	Survival (%)	Feed Conversion Efficiency (FCE)
A (10 ha) with probiotics	40	2.10
B (7 ha) Control	31	2.55
C (7ha) Control	31	2.55

At the same time, the other farm, Sodacal, which has not been badly affected until now by mortalities due to the Summer Syndrome, participated together with INVE in a trial at their farm using the probiotics (see photo). Growth rates of shrimp with the probiotic Bacillus were faster than in control ponds, confirming the results obtained in the IFREMER laboratory.

Figure 2. The prevalence of *V. nigripulchritudo* in shrimp. Sample sizes were usually 30 shrimp and data are expressed as the percent of animals carrying *V. nigripulchritudo* in the haemolymph. Most mortality occurred at about 40-60 days of culture, when shrimp are 4-6 g in weight. As can be seen in this figure, prevalence of *V. nigripulchritudo* is highest at that time, but the prevalence decreased more rapidly in the shrimp treated with Sanolife® PRO-W twice /week in water & PRO-2 in all feed at 5g/kg feed.



David Moriarty (left) with Regis Bador checking feed with the probiotics at the Sodacal farm.

Feeding the shrimp ponds at the Sodacal farm in New Caledonia. Feed top coated with Sanolife® PRO-2 mixed with fish oil are firm enough to be distributed by gravity feeding from the boat.

The probiotic *Bacillus* strains should not be expected to kill all pathogenic vibrios. However, they would be effective in lowering the abundance of pathogenic vibrios (Figure. 2). Some *Bacillus* strains colonise the shrimp intestinal tract and displace vibrios in the gut as well as improve the feed digestibility by secreting a wide range of digestive exo-enzymes. The *Bacillus* species in the Sanolife® probiotics are found naturally in ponds and in the shrimp, but their abundance is too low in aquaculture ponds to be effective. Therefore, species and strains of *Bacillus* need to be selected and applied in dose rates that increase in relation to stocking density, feeding rates and shrimp biomass in ponds. Furthermore, the species used must be safe for shrimp and humans (Decamp and Moriarty, 2006).

In addition to a direct inhibition of vibrios, the *Bacillus*, through their exo-enzyme activity, speed up the degradation in the ponds of waste organic matter from feed and faeces, which would otherwise provide food for the vibrios. The special water conditioner was designed to improve water quality through these activities of the *Bacillus*, and through their action as denitrifiers in removing nitrites and nitrates. The technicians at Seafarm noted that the phytoplankton community was more stable in Pond A with the water conditioning *Bacillus* during the trials reported here. Many shrimp farmers have reported that the phytoplankton community in ponds was more stable when these *Bacillus* are applied regularly.

Further work

Trials are now underway for this current stocking season on 6 farms to confirm the findings of increased survival, better FCE and faster growth rates during the August-December season, and to try different application rates to determine the optimum for maximising net profit.

It is important that the probiotics not only be effective in improving productivity; they must also enable the user to achieve greater net operating profit, after taking into account all costs, including that of the probiotics.

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Dr Olivier Decamp is responsible for the Health Product Group with INVE Technologies. Email: o.decamp@inve.be At the Laboratoire Aquacole de Calédonie, IFREMER, **Dominique Pham** is biologist/hatchery manager; **Sophie De Decker** and **Dominique Ansquer** are researcher and technician, respectively, in pathology & epidemiology, and **Dr Yves Harache**, its Director. **Dr Patrick Lavens** is Business Unit Manager with INVE Aquaculture Health, Dendermonde, Belgium. Email: p.lavens@inve.be

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Scanning Electron Microscopy of several potential probiotic bacteria

By Partha Bandyopadhyay

This study provides clear morphological characteristics of the potential probiotic bacteria of the Indian major carps, which will be helpful for the future research of probiotics of Indian major carps

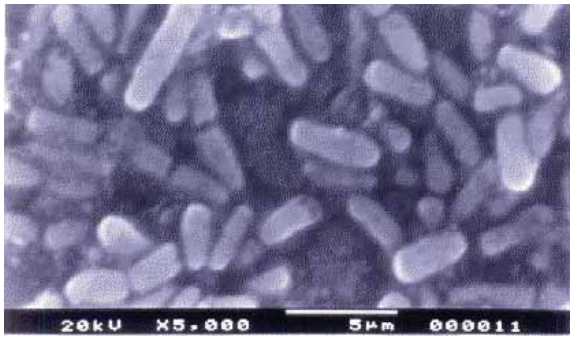


Plate 1A. Micrograph of Bacillus circulans PB 7

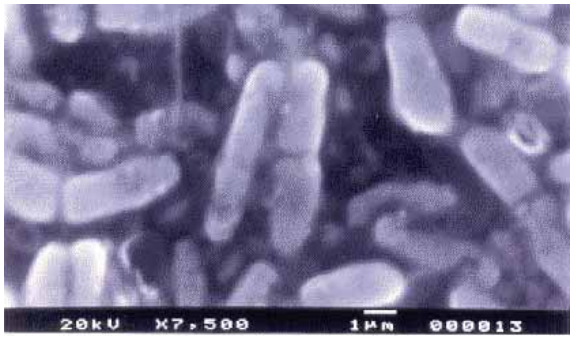
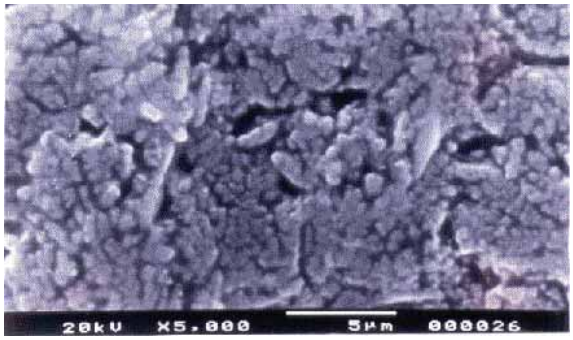


Plate 1B. Micrograph of Bacillus circulans PB 7 showing the binary fusion of the organism



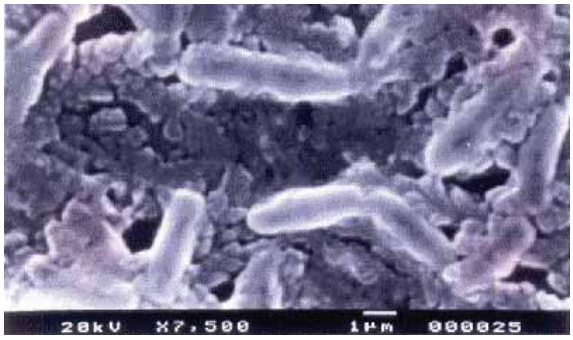


Plate 2 Micrograph of Pseudomonas aeruginosa PB13

During the past sixty-five years, electron microscopy has been used to study an ever increasing variety of subjects. In the era of rapidly expanding technology, scientists today are more frequently required to observe and explain phenomenon occurring on a micro scale. Scanning Electron Microscope (SEM) is a powerful instrument which permits the characterisation of heterogeneous materials and surfaces.

In this study, we used SEM to assess five potential probiotic bacteria (*Bacillus circulans* PB 7, *Pseudomonas aeruginosa* PB 10, *Aeromonas* sp. PB 11, *Pseudomonas aeruginosa* PB 13 and *Bacillus* sp. PP 9) isolated from the Indian major carps (*Catla catla, Labeo rohita* and *Cirrihinus mrigala*). As there has been a lot of information on the use of probiotics in pond culture, use of this study may suggest the specific structure of the bacterial cell, which will be helpful for the identification of the probiotic strains.

All the micrographs showed that stains were rod shaped. The average length of strains PB 7, PB 10, PB 11, PB 13 and PP 9 were 2.5 µm, 3.4 µm, 1.8 µm, 3.4 µm and 2.8 µm respectively, whereas the average diameter were 1.2 µm, 0.9 µm, 0.7 µm, 0.9 µm and 0.9 µm respectively.

Methodology

The present study was conducted at the Aquaculture Research Unit, Department of Zoology, Vidyasagar University, Midnapore, India and University Science Instrumentation Centre, Jadavpur University, Kolkata, India. The culture broth was taken from the exponential stage of the growth and centrifuged at 5000 g for 10 min. and washed twice with PBS (pH 7). Cell palates were diluted with the same buffer up to desired volume. The 20 µl of the culture were transferred to 1 cm2 glass slide and dried in hot air oven at 45 ° C for 10 – 12 h.

The samples were then coated with gold - palladium malloy (160 ° A thickness) for 5 – 15 minutes in three consecutive series on a sputter coater (Polaron Equipment Ltd., SEM coating unit E 5000) for uniform coating to enhance material density and electrical conductivity which is necessary for emission of secondary electrons for fine and perfect image. Samples were then observed under a phlips – 515 Scanning Electron Microscope at varying magnifications and selected areas were photographed using Indul / ORWD 125 ASA Black and white 120 mm roll films.

Micrographs

The SE micrograph of *Bacillus circulans* PB7 are presented in plate 1A and B. These two micrographs showed that a cell was rod shaped and about 2.5 µm in length and 1.2 µm in diameter. Plate 1B showed the binary fusion of the organism. SEM of *Pseudomonas aeruginosa* PB13 is presented in plate 2. This strain was also rod shaped and average length and diameter of a cell was about 3.4 µm and 0.9 µm respectively. Plate 3 and 4 represented the SEM of *Aeromonas* sp. PB11 and *Bacillus* sp. PP 9 respectively. The two strains were also rod shaped and the average length and diameter of a cell of *Aeromonas* sp. PB11 is about 1.8 µm and 0.7 µm respectively whereas the average length and diameter of a cell of *Bacillus* sp. PP9 is about 2.8 µm and 0.9 µm respectively. From the SEM data, it may found the ratio of length and

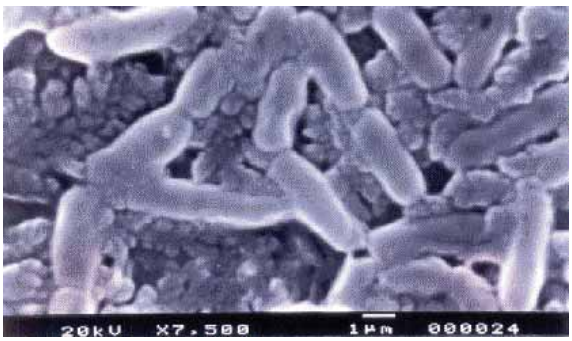


Plate 3 Micrograph of Aeromonas sp. PB11

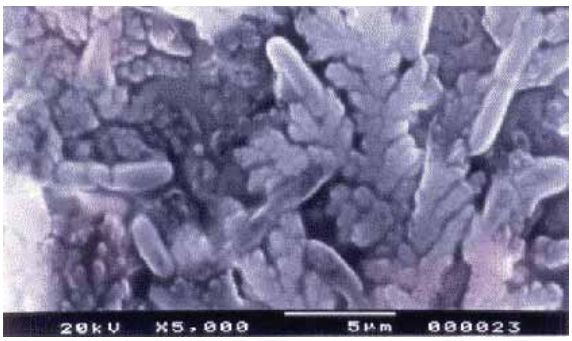


Plate 4. Scanning Electron Micrograph of Bacillus sp. PP 9

diameter of potential probiotics were varied greatly, which is arranged in the order PB 10 and PB 13 (3.70 µm) > PP 9 (3.10 µm) > PB 11 (2.57 µm) > PB 7 (2.80 µm).

Summary

Probiotic research for aquatic animal is increasing with the demand for environment friendly aquaculture (Gatesoupe, 1999) and Indian major carp contributing about 78 % to the total aquaculture production in India (Jana and Sena, 2004). There a clear documentation of the probiotic bacteria is highly essential for the sustainability of the production of Indian major carps. This present study gives clear morphological characteristics of the potential probiotic bacteria of the Indian major carps, which will be helpful for the future research of probiotics of Indian major carps related to these organisms.

Acknowledgement

The author is highly thankful to Indian Council of Agricultural Research, New Delhi, India for financial assistance.

**References are available from the author.*
**The article was published as Partha Bandyopadhyay and Bidhan C. Patra, 2005.Molecular identification of the potential probiotic bacteria and three fish pathogenic Aeromonas hydrophila AH1, AH2 and AH3 in the Indian major carps. The Ekologia 3 (2): 107 – 116.*

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Pioneering a commercial production of SPF black tiger shrimp

By K.Subramaniam, Randall L.Aungst and Nancy ES Tan-Wong

In Malaysia, the collaboration work on the domestication and production of specific pathogen free (SPF) black tiger shrimp *Penaeus monodon* broodstock has successfully reached the F3 stage with SPF post larvae available for commercial culture. Additionally, through selective breeding, the F3 generation is showing significantly improved growth performance in both hatchery and commercial shrimp farms. Dependency on unpredictable wild broodstock of unknown disease status could be phased out eventually.

The Department of Fisheries (DOF) Malaysia has an ambitious program to increase the annual shrimp production to 180,000 tonnes by the year 2010, (DOF, 2004). This requires 10.0 billion high health shrimp post larvae (PL) from about 100,000 pieces of clean and healthy shrimp broodstock.

Presently, shrimp hatcheries in Malaysia are wholly dependant on wild broodstock for PL production. In reality, close to 70% of the wild broodstock are either infected or are carriers of one or more of the pathogenic viruses. Usually, stringent disease screening is required to separate out the 30% of 'clean and healthy' stock. From the 30% screened, only 50% of the clean stock survive the stringent tests and are thus available for PL production. This means that the actual number of broodstock required to meet the national target would have to increase by 6-7 times (Subramaniam et al, 2004).

In such a situation, how has the commercial shrimp farms managed during the last five years? Black tiger shrimp throughout the Asia Pacific region has been increasingly infected with multiple viral diseases. Malaysia too, has experienced White Spot Syndrome Virus (WSSV), Monodon Baculovirus (MBV) and the Yellow Head Virus (YHV) disease outbreaks since 1999. Having faced heavy economic losses due to slow growth and epidemic mortality, many shrimp farmers have now shifted to *P. vannamei* culture to continue their business.

Collaborative work to domesticate *P. monodon*

The development of SPF broodstocks was initiated by Black Tiger Aquaculture Sdn. Bhd. (BTASB) in collaboration with DOF. The first phase of the program started in 2001 using locally available wild shrimp broodstock caught off the coast of Terengganu, Penang and Sabah. In October 2003, due to several unsuccessful attempts to obtain sufficient numbers of clean and healthy broodstock and the high cost of viral screening, the SPF breeding program then moved to the next phase using stocks from other countries. These were clean and revealed no incidences of WSSV, YHV, or GAV infections.

Screening of founding stock

Every batch was brought into the primary quarantine for holding and monitoring. The broodstock were then subjected to multiple virus pathogens screening for WSSV, YHV, Gill-Associated Virus (GAV) and Taura Syndrome Virus (TSV) three times at intervals of 2 weeks. Screening for MBV and Hepatopancreatic Parvo Virus (HPV) was done five times during the same period. Any contaminated stock detected during the screening process was discarded with predetermined precautions.

Production of F1 and F2 SPF broodstock

Clean founder stocks selected through the screening process were transferred to the secondary quarantine area, consisting of shrimp maturation and larval/PL rearing units. Extra precautions were taken to avoid cross contamination and movements were prohibited from primary to secondary quarantine areas.

Aerial view of the facility

Stage IV maturation broodstock (berried females) were transferred to spawning tanks. The spawns were collected separately to provide offspring from a unique female, which constituted a family. Individual families were raised separately in tanks to provide the F1 progeny.

Postlarvae of 15 days (PL15) from F1 progeny were transferred to the outdoor, plastic lined, broodstock grow out ponds for direct stocking (mass selection) and were raised to adult size by maintaining tight bio-security conditions. For family selection, PL28 were stocked in cages till they are 2g. These 2g juveniles were then tagged and then released to the ponds for grow out. All grow out broodstock were screened for multiple viruses at two month intervals and till maturity. Adult males and females were then selected for production or breeding.

Generally, batches of broodstock are produced at two month intervals. Only the active nauplii and healthy PL, which exhibited good growth and survival in the SPF Breeding Centre were selected. Further selection by culling was also done for high health and fast growth. Inter-breeding among families of a founding population and between two populations was done to minimize inbreeding and increase the gene pool.

The selection procedure was repeated from December 2003 to this year (2006) for the production of F1 followed by F2 brood-stock to obtain the F3s which continue to be free of the six viruses. The first batch of F3 broodstock in the Breeding Centre is now 40g+. There are 4 batches of F3 broodstock of various stages as of Sept 2006. Some of the F3 SPF PL are being evaluated for culture performances at several farms in Malaysia. Some SPF PL of F3 generation are also being evaluated at the DOF experimental ponds in Brackishwater Aquaculture Research Centre (BARC), Gelang Patah, Johor.

F3 generation broodstock

An important question is whether the F1 and F2 generation broodstock show any improvements as compared to the founder stock.

Successive improvements have been seen in average gain in body weight from one generation to the other for the broodstock raised in outdoor, plastic lined, grow-out ponds. Close to 13% weight gain was observed in F2 as compared to F1 in 105 days of culture (DOC) even though the F2 group was cultured at higher density (Table 1).

Table 1. Growth performance of SPF F1 and F2 broodstock

DOC	Batch No:	Gene-ration	SD (pcs/m²)	Av. body weight (g)	Weight diff (g)	Change (%)
84	0408	F1	4	27.8	0.3	+1.1
	0507	F2	7.5	28.1		
105	0408	F1	4	35.7	4.9	+13.7
	0507	F2	7.5	40.6		

From the F2 to F3 generation, there was a 7.3% gain (at 56 DOC, Table 2), even though the F3 group was raised at a stocking density (SD) three times higher. These improvements were more pronounced, as the culture duration increased.

Table 2. Growth performance of SPF F2 and F3 broodstock

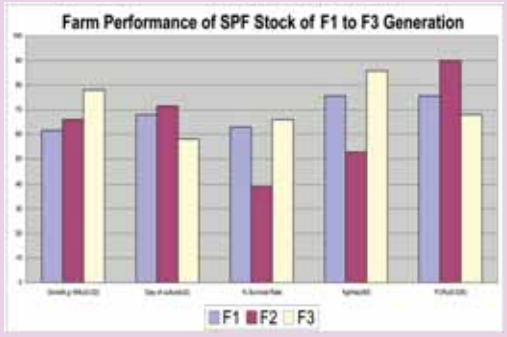
DOC	Batch No:	Gene-ration	SD (pcs/m²)	Av. body weight (g)	Weight diff (g)	Change (%)
21	0505	F2	10	6.0	(0.1)	–
	0604	F3	33	5.9		
56	0505	F2	10	16.4	1.2	+7.3
	0604	F3	33	17.6		

Notable also is that the F1 generation took 11 to 12 months to attain maturity and the duration was reduced to 9 to 11 months for the F2 generation. This would mean shorter cycle and higher turnover with progressive generations.

Will the SPF postlarvae face any viral disease outbreak once out in commercial shrimp ponds?

SPF PL produced are free from six diseases; WSSV, MBV, HPV, YHV, GAV and TSV. To date, none of the farms using the SPF PL has reported any virus disease outbreak. However these farms have GMP and GAP measures. Overall the PL of the F3 generation have performed better than the F1 and F2 stock in commercial farm although there was a drop in performance of the F2 PL compared to F1 due to circumstances mentioned in the text.

The culture period to obtain the average shrimp body weight of 25g/pc has also reduced significantly from 135 days to 116 days and survival rate increased from 63% to 66% and food conversion ratio also improved from 1.89 to 1.7. On top of this, there was very little difference in size variation at the time of harvest. All these characteristics could be translated to 5 crops in two years, increase yield, better crop value and reduced production cost at farm level.



Will the F1 and F2 be suitable for hatchery operations?

There is no doubt as the mating performance of the SPF broodstock improved from an average of 1.8% per day in the wild stock to 3.3% per day in F1 and F2 group. A greater number of the F1 and F2 female shrimp broodstock spawned up to ten times, whereas, it is generally uncommon for the wild local broodstock to spawn more than three times.

The number of nauplii per spawn of F1 and F2 generation were found to be higher from the founder stock but has stabilized at 200,000 per spawn. This is because the wild broodstock were larger in body weight at more than 120g/pc, as compared to F1 and F2 generations which were only 80 -100g/pc.

The survival rate from the nauplii stage to PL15 improved greatly from 27.8% in the wild-F1 populations to 57% in the F2-F3 generation, although there was a drop in the F1-F2 generation (11.8%). The reduction could be attributed to the disturbance during the construction phase and also partially due to mass selection during the breeding process.

Table 3 Hatchery Performance of SPF F1, F2 and F3 broodstock from founder population of other origins

Generation	Total operation	% good spawn** / day	No. of Females used for breeding	Av. no of nauplii per good spawn	Av. nauplii used /month	Av. PL production /month	Av. survival rate (%)
Wild -F1	19 months	1.8%	111	285,000	31,368,421	8,744,736	27.8%
F1-F2	12 months	2.1%	110	200.000	31,753,000	3,722,500	11.8%
F2-F3	4 months	3.3%	111	200,000	29,011,000	16,539,250	57.0%

***Good spawns are those with fertilized eggs.*

A harvest of the F3 generation

The next step

Many of the farmers are now more confident of reverting to culturing *P. monodon* using SPF PL. By family selection, the non- or lesser performing families are discarded. This will result in selection for overall faster growth, more uniform size and higher survival. F2 to F3 in commercial shrimp farms have already shown significant improvement on the growth and survival rate. The practice of selecting only the best performers is expected to provide F4 generation, which would show even better performance than the F2 and F3 generations.

With further selection and breeding processes, at a conservative expectation of 5% genetic gain (as opposed to 10%) improvements in each of the subsequent generation, the SPF stock could be greatly improved by 2010.

This collaborative SPF program of DOF and BTASB is in progress to further improve the broodstock performance especially in developing best pedigrees with improved qualities of colour, texture, growth, head:thorax ratio, efficient FCR and better survival for better crop value. As farmers gain confidence in using SPF PL, more farms are expected to switch back to *P monodon* culture in the near future. This will contribute towards the annual shrimp production target of 2010.

Acknowledgements

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From left, K.Subramaniam, Nancy ES Tan-Wong and Randall L.Aungst

K.Subramaniam is a Senior Researcher with DOF Malaysia since 1978. He currently heads the Brackishwater Aquaculture Research Centre, Gelang Patah, Johor and coordinates the SPF Breeding Program on behalf of DOF. Email: suballi@tm.net.my **Randall L.Aungst** is the Managing Director and one of the founders of BTASB. It was his initiative and directive that the implementation of the SPF Breeding Program could progress this far at BTASB. **Nancy ES Tan-Wong** is the Head of the SPF Selective Breeding Center of BTASB and has been working in this project since 2001.

SPF stock is characterized by the reddish tail

cooked shrimp

What are the morphological differences between SPF *P. monodon* and local stock?

There is a distinct colour difference at the tip of the uropods in SPF stock. This is reddish in colour compared to the bluish colour in local stock. There is a distinct white colouration in the pleopods compared to the yellowish nature in local stock.

The head to thorax ratio is slightly lower in SPF stock as oppose to local stock. This could further increase the meat content in shrimp and better value for the product purchased by consumers.

The SPF stock is also selected for colour. Harvested F3 generation in commercial farms when processed and cooked exhibited an even tone of reddish color as compared to some dark bands in local stock. Such colouration is preferred in certain markets

Part 2: Developing the right protocols in shrimp health management

Using science to drive black tiger shrimp culture

By William Kramer

How a team in the Philippines developed the right protocols to restore operations and achieve consistent harvests of black tiger shrimp

In Part 1, volume 2 (5), the steps taken by the Business Development Group of Hoc Po Feeds Corp (HPFC-BDG) to revitalize six farms and produce consistently good harvests of black tiger shrimp were discussed. The article continues with a description of culture trials conducted to find ways to alleviate specific problems and to improve the general health and quality of shrimp. These form the protocols practiced at six farms of the group.

Pond and water management

All six farms follow a standard pond preparation and water culture protocol. Before drying the ponds prior to pond preparation, soil samples are analysed for Vibrio and bacteria levels. Soil pH is maintained at 6.8 to 7.2. Depending on the pond situation further tests are made for organic matter, iron, sulphates and phosphates. Drying of the ponds takes 30-45 days and pond preparation takes 15 days.

In certain ponds where there is a problem with high levels of ferric iron, such as some of them at the Mina farm, the technicians follow a different pond preparation program. This entails a series of flushing, tilling and liming of the pond bottom until the iron level drops to less than 1,000 ppm.

The following physico-chemical and biological parameters are consistently checked, collated and evaluated.

Table 1.

Parameters	Frequency
Water temperature	2 times/day
Water level	2 times/day
Water pH	2 times/day
Transparency	2 times/day
Salinity	2 times/day
Dissolved oxygen	2-3 times/day
Alkalinity	2-3 times/week from day of water input to 80 days of culture
Phytoplankton profile	2 times/week
Bacteria and vibrio profile for water and shrimp	2-3 times/week depending on count
Bacteria and vibrio profile in soil	2x during culture period starting at 80-90 days of culture depending on stocking density
Unionised ammonia and nitrite	2-3 x per week starting 70 days of culture depending on stocking density
Redox potential	2 times per week depending on the farm.

In pond preparation, prior to stocking, phytoplankton levels are required to be more or equal to 350,000 cfu. During the culture period, population levels should not exceed 850,000 cfu. When high populations of some species of blue green algae occur, the farm uses a product which contains various micro minerals. Rice bran and molasses are used to help improve C:N ratio in the water thereby maintaining a stable phytoplankton bloom during the early stages of culture.

Close up of 45gram prawns at 151days of culture in HPFC_BDG VIVEROS farm

Aeration

During the early stages, up to 110-120 days of culture, there is no water exchange except to add to maintain water levels to as close to 1.2m as possible. Water is only exchanged in the case when non beneficial phytoplankton proliferates to more than 10% of total composition. Based on experience, the required ratio of aeration for these low water exchange ponds was calculated at one horsepower for every 350-400kg of *P. monodon*. However, this ratio depends on the organic matter as well as biological oxygen demand of the soil.

Generally, there are 12 aerators in one ha pond stocked at a density of 12 postlarvae/m^2. A combination of aspirators and aerators are used as much as possible. During the first 60 days of culture, aeration is limited to only 2-4 hp. Two units are operated during the day and another two units are switched on just prior to sun down. Readings of dissolved oxygen are taken 2-3 times a day, at 4-5am, 10pm and at 3pm. The reading at 10 pm is optional. When the dissolved oxygen goes below 6.5 ppm at 3 pm, more paddlewheels are added. When supersaturation takes place, water is flowed through the pond.

Stocking and PL quality

Usually, the stocking of ponds is carried out in March/April, but this year, stocking was delayed to late June as daytime temperatures at 35°C were deemed too high for the stocking operation. It was also discovered from PCR (Polymerase Chain Reaction) tests that more postlarvae (PL) were found to be WSSV positive during the period from February to May.

The farms obtain its postlarvae from 5 hatcheries as no single hatchery can meet the requirements at a given time. The supply of good quality fry come from highly reputable hatcheries located in Iloilo, Cebu and Negros Oriental. Some 90% of their supply comes from the

At the Viveros farm, William and Noël, production/operations supervisor, inspect newly arrived postlarvae in their stocking boxes

Use of aspirators (AireO2) in combination with paddlewheels

provinces of Panay and Cebu. A standard practice is for hatcheries to provide an allowance of 5-10% in each order. A final count of fry is made at the farm. Postlarvae exceeding the required density will be discarded. This allows the team to estimate the postlarvae population accurately during stocking.

Prior to each purchase, the farms require that the hatchery sends samples from the same tank for morphological, stress and disease tests. These are necessary for stages PL5-8, 12-15 then finally at PL 16-18. Then, prior to confirmation of an order, laboratory analyst Job Madrona then takes the final samples from the hatchery to confirm the health status of the batch. Independent PCR tests are also conducted at the laboratory of the Negros Prawn Producers Marketing Cooperative Incorporated (NPPMCI).

On arrival at the farm, postlarvae are placed in stocking boxes for acclimation. These floating shaded acclimation boxes have side openings which allow the postlarvae to gradually exit into the pond once fully acclimated. Two survival hapa nets ($1m^2$) are then installed in the pond with 100 PLs per net. Survival is then monitored at intervals of 7, 14, 21 and finally at 30 days.

Pond bioremediation

Observations had indicated that shrimp were prone to stress due to the deteriorating pond conditions during the late stages of culture. There was a need to develop a reliable protocol to control the toxic levels of un-ionized ammonia and nitrite. This was also important to extend the culture period to grow larger size shrimp. Changing water was not the solution as a low water exchange procedure was vital as this helps mitigate the risks of WSSV infestations.

Since 2005, several commercial trials in 16 ponds were conducted to test out the effectiveness of bioremediation products available in the market. With good results, the farm decided to use the following protocols routinely in all of the 108 ponds.

During the early stages, an in-house formulated direct fed microbial (DFM) is used at a dosage of 20-40g/kg of feeds. These are top dressed on to feeds and used 3-5 times/day depending on bacteria and vibrio level in the water, shrimp and soil. DFM is a mixture of microbial carriers and Pond Plus (Novozymes, USA).

Table 2. Minimum bacteria and vibrio levels in the water and shrimp

	water and postlarvae	shrimp at less than 1g	shrimp at less than 5g	soil
Unit	**cfu**	**cfu/hp**	**cfu/hp**	**cfu**
Bacterial count	$<1x10^4$	$<1x10^5$	$<1x10^6$	$<1x10^7$
Vibrio Count	$<1x10^3$	$<1x10^4$	$5x10^4$	$<8.9x10^3$
Luminous bacterial count	$<1x10^2$	$<1x10^2$	$<1x10^3$	$<1x10^3$

DFM as pond bioremediator is used until 70-80 days of culture and as probiotics mixed into the feed until harvest. The initial dosage for DFM at the start of water culture is 1ppm then applied subsequently at 0.5 to 0.75 up to 1ppm on a weekly basis until harvest. Dosages depend on the carrying capacity of the soil, organic load during culture, shrimp biomass and salinity of the water.

After 70-80 days depending on the organic load of the pond, Pond Plus is used to the last week of harvest. The initial application is 0.1ppm and this is reduced to 0.05 ppm for every 7-10 days depending on pond soil conditions, biomass and salinity. The optimum salinity during culture is usually between 10-20ppt. However the bioremediation products perform well up to 35ppt.

However, when there are spikes of unionized ammonia and nitrite in the pond, Pond Protect is used at an initial dosage of 0.4 ppm from day 80 and successive dosages of 0.2ppm are used on a weekly basis. These are applied during the day with full aeration for a more effective and efficient distribution in the pond system.

The effects are reduced to safe levels luminous vibrio and bacteria both in the pond water and shrimp. Pond Protect is also used whenever unionized ammonia & nitrite level reach more than 0.1ppm. As a precaution, the lower limit of 0.08ppm is adopted.

In instances where excessive benthic algae proliferate during water culture or at early stages of culture, the farm uses Pond Plus. This is a bioremediation product that effectively inhibits the growth of these algae. It is added into the pond at intervals of 7-10 days after the first 80 days of culture.

Good water quality condition even at 151 days of culture as shown by water splashed by paddlewheels

Redox potential

The monitoring of redox potential has helped to understand some inherent perennial problems of low dissolved oxygen in most of the ponds at the Viveros farm. This phenomena occurred even during the early stages of culture which somewhat perplexed management. Even though these ponds had normal soil pH levels of 6.8-7.4, with <1.5% organic matter, dissolved oxygen in these ponds was low. However in ponds especially along the river, sandy bottom was observed on the subsoil layer. In these ponds, dissolved oxygen levels were as low as 4ppm even during the early stages of culture. This was not the case in the other HPFC_BDG joint venture farms.

Through the monitoring of redox potential, it was shown that low redox potential readings of equal to or less than -300mev results in low DO_2. The pond then required more aeration and liming to neutralize possible hydrogen sulphide (H_2S) and methane (CH_4) toxicity. However, despite additional aeration, the ponds continuously showed low levels of DO_2 even with a high ratio of aeration to biomass. In two closely monitored ponds observations using redox potential, the readings were as follows:

- Pond 51 had higher readings of more than -350mev. At 140days, shrimp reached 36.4g, FCR was 1.59 and survival rate was 89%.
- Pond 52 had lower readings of less than - 350mev. At 120 days, shrimp was 30.25g, FCR was 1.78 and survival rate was 84%. This pond was harvested earlier.

Improving feed efficiency

Aside from problems associated with WSSV and luminous bacteria, inconsistent molting, fouling and loose body to chronic soft shell syndrome have been observed in some ponds. Feed intake was also reduced during cold spells. Previously, the farms were using wet feeds made from fresh water golden snails as a supplement which also served as prophylaxis.

At the Viveros farm, with the hypothesis that immunostimulants can improve feed efficiency, shrimp health and quality, the use of the yeast based product NuPro (Alltech, USA) was investigated. The product was used as top dressing of feeds. Vitamic C was also added whenever necessary. Molasses was used as the binder. The top dressed feed was then air dried for 20-30 minutes, prior to feeding. The rate of application of NuPro was determined at 10-20g/kg of feed.

In the initial trials conducted in three ponds (two treatment and one control) at the Viveros farm, FCR improved from 1.76 (control ponds with shrimp fed commercial feeds) to 1.62 with shrimp fed with top dressed feed. Harvest size was 35 to 37g and production at 4.5 tonnes as compared to 3.6 tonnes for the control pond.

The results have been encouraging as FCR and overall performance improved. Although feed cost may increase per unit kilogram but so did its benefits with higher survival, growth rate and better shrimp quality. Net income on operations were higher due to survival rate of treated ponds at 96% versus 80% for the control pond.

In a second commercial trial, similar results were obtained at the ALP farm on the Western side of the island. Further observations and benefits showed the tolerance of shrimp to luminous vibrio and absence of WSSV infestation. Shrimp appetite was not affected even at temperatures of less than 28ºC during the months of December 2005 to January 2006.

Production outputs

In a comparison of the production in 2004 and 2005 at the BDG farm, it was shown that with these protocols and reducing stocking density, the culture period can be reduced to 136 days with increased size to 36g. Some results of commercial trials showed the mean FCR decreased to 1.94 (Table 3).

**(Extracted from the presentation "Documented field experiences in shrimp health management", 5th National Shrimp Congress, Bacolod City, Philippines, 27-29 June, 2006).*

Effect of Pond Plus in eliminating growth of benthic algae on pond

William Kramer (left) pictured with Philip C Young, CEO of HPFC at the 5th Shrimp Congress held in Bacolod City, June 2006

Table 3. Summary of production performance at the ALP Farm in 2004 and 2005

	2004	2005
Stocking date	9/4 to 1/5	7/5 to 12/5
Area (ha)	2.62	2.62
Av. stocking density (PL/m^2)	19.13	16.80
Mean survival rate %	77	111
Total biomass (kg)	13,484	16, 603
Av. biomass (kg/ha)	5,147	6,337
Mean FCR	2.05	1.94
Av. body weight (g)	33.75	36.05
Av. days of culture	142	136

William Kramer, an agribusiness management graduate from the University of the Philippines at Los Baños, Laguna has post graduate studies in aquaculture. He has been involved in aquaculture for the last 22 years. From 1984 to 1995, he managed three farms producing black tiger shrimp, seabass, grouper, milkfish and tilapia. He then managed on contract a semi closed recirculating and semi-integrated tilapia farm in Southern California, USA. In 1998, he joined on contract HPFC initially as a part time grow-out production consultant for clientele farms and then became the Marketing and Sales Manager. In 2003, he established the Business Development Group of the company.

'Bawal Jepang' from Indonesia

In the waters off Pulau Seribu, an increase in pompano production is required to meet demand

By Zuridah Merican and Iffa Suraiya

In Japan, there is a high demand for the pompano *Trachinotus blochii*. The fish is called 'marukoban' in Japanese and 'bawal bintang' in Bahasa Indonesia. PT Lucky Samudra Pratama cultures the fish in the waters off Pulau Seribu and carefully processes the fish, mainly for the discerning Japanese market.

The processing plant

Misai Tsai, President Director at his booth during the Jakarta Seafood Show held from August 2-6, 2006

Produced under conditions compliant with HACCP and GMP procedures, fish are vacuum packed and cryogenically frozen using liquid nitrogen at -95°C.The range of products are whole round, whole round gutted, fillet, shashimi and portion cut. These are mainly exported to Japan. The smaller markets are Korea and Germany. There is also the market among the Japanese diaspora. Products are marketed under the trade name "Bawal Jepang". In August, the company participated in the Jakarta Seafood show, held from 1-3 August. Another previous exhibition was a seafood show in Japan in 2004.

Controlling production

PT Lucky Samudra Pratama started as a seafood processing company with a processing plant in North Jakarta. As traceability became important, the company went into upstream integration to control production methods. Currently, it has two cage culture farms in Kayuangin Island and Yahoo Shima Island located in the waters off Pulau Seribu (Thousand Islands) of Indonesia.

At each of the locations, the company operates two kinds of cages; the traditional style square wooden cages and Norwegian style round HDPE pipe cages. The 12X12X12m square wooden cages produce 10 tonnes of pompano/cage whereas the 25x25x25m cages produce 15-20 tonnes of pompano/cage. There are 10 units each of the Norwegian style cages with diameters of 12..5m and 16m, producing 10 tonnes/cage and 20 tonnes/cage, respectively.

President Director, Misai Tsai, is happy with the current cage configurations and designs. The rectangular cages are used for the culture of fingerlings to 300g fish. These are space efficient, cheaper and easier to handle. Though more expensive, the larger circular cages are more suitable for the grow-out of the 300g fish to harvest size and as fish tend to swim in a circular motion.

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3. **Petfood Forum Europe 2007 – "New products, New opportunities"**, organised by Petfood Industry magazine and Watt Publishing Co. *8 May 2007*
4. **"Pellets for bio-energy: addressing the challenges"**, organised by AEBIOM (European Biomass Association). *10 May 2007*

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Vaccum packed fillet 'bawal jepang' and whole fish

The local community is employed for the management of cages. Nets are cleaned with fresh water using high water pressure jets. The smaller mesh size nets (<1cm) are cleaned once a week and those with larger mesh sizes (>1cm) are cleaned every two weeks. Tsai is looking at using an antifouling agent, but as flushing with fresh water has been very effective, this is not his top priority at the moment. The farm uses 20 workers to feed the fish. Each worker is in charge of 2 cages. A feed supervisor oversees feeding activity.

Prior to harvest, fish are starved for 4-5 days to meet the taste requirements of his Japanese buyers. The specification from Japanese buyers is precise. Harvest size is 1.3 to 1.6 kg and the fillet must be between 300-400g each.

The farm cannot meet the present demand for pompano fillet which is around 500 tonnes per year. Their target production is 250 tonnes of the pompano in 2006 and Tsai expects to increase production to 400 tonnes in 2007.

Currently, fingerlings for the culture are imported from Taiwan and Japan but Tsai has been keeping broodstock which now weigh 8kg. He is planning to produce fingerlings in his own hatchery.

Feed challenge

Fish are fed with 50% crude protein feed imported from Uni President Taiwan (an ISO 22000 certified feed manufacturer) as well as from Skretting in Australia and Japan. Fingerlings are fed 4 times/day, fish of 100-300g are fed 3 times/day and the 300g to 1.2kg fish are only fed twice a day. The average FCR is 2.6:1 for the duration of the culture period of 14 months. The recent high prices of fish meal have been a challenge for the farm.

"We have been working on how to vary feed formulations to reduce the use of fish meal in our feed and replace with more of plant meals as protein sources.. Each change of formulation will affect the flesh taste and quality. After each change in diet, we get the broker to test the appearance, colour and texture of the flesh and the taste of the fish", said Tsai.

Pricing

According to Tsai, many years ago, farmed marine fish were more expensive than some wild caught species. Prices are declining as aquaculture picks up. The challenge will be to look at ways to bring down costs of production and develop a technically sound production system.

"We have to look at reducing feed conversion ratios and increasing survival rates. In future, we may have to look at vaccines to prevent diseases. When we look at the production of fillet for the mass markets, we do not look at competition with other species, but our fight is with the beef and pork industries".

From Taiwan to Indonesia

Misai Tsai is the 4th generation of a Taiwan family business in aquaculture which started in 1916. He is happy to be in this industry despite the numerous challenges when dealing with an aquatic species. He moved to Indonesia in 1986.

Tsai said, "Although the supporting services in the industry in Taiwan are good, marine cage culture is often interrupted by the typhoons and the changes in temperature. In offshore cage farming, we require deep waters and these are limited in the Taiwan Straits which has a shallow channel. In Indonesia, there are vast areas suitable for marine fish culture in large cages. Here we do not have the problems of red tide nor typhoons. Any mortality will be due to stress and this is within our control. The local workforce on the island has helped to ensure the security of the farms".

It has taken him a long time to decide on this species. The objective now is to learn all there is to know on this species and to develop the production methods well. He will then apply this knowledge to another species.

**Iffa Suraiya is based in Surabaya, Indonesia*

Live pompano in an aquarium at the show

Low cost and typhoon resistant offshore ocean cages for China*

The American Soybean Association-International Marketing (ASA_IM) program in China began its work with marine fish cage culture in 1999. The program was initiated to develop cost efficient, high soy-inclusion feeds for marine fish species being cultured in China. The program initially focused on the culture of marine fish with soy feeds in small (8-27 m³) cages within protected, near shore waters. Increasing water pollution, however, forced the program to move offshore to conduct feeding trials. Offshore cages were not submersible, and early offshore trials were unsuccessful due to cage damage and net deformation from frequent typhoons. As a result, ASA_IM developed and is currently testing a prototype, self-submersible offshore cage suitable for the China marine fish culture industry.

The development of this prototype offshore ocean cage is being funded by the US soybean industry through its Ocean Cage Aquaculture Technology Project (OCAT). Two prototype cages were constructed and deployed in 2004. The cages were assembled on site and towed by a local fishing boat to the site, 4 km offshore in Lingshui Bay in Hainan Island. The cages are operated with the top of the cage at the surface in 20-m deep water.

The ASA_IM cage design has a truncated pyramid shape and utilises a single point mooring to allow the cage to remain down current. The cage has a rigid frame made of high density polyethylene (HDPE) piping materials readily available from Asia. Frame components are replaceable. A feed enclosure at the top of the cage is also made from HDPE. The fish culture net is suspended inside the cage frame and is non-collapsible. The cage is submerged by fully flooding the bottom HDPE pipe ring and partially flooding the vertical HDPE pipe units so that only the top feeding ring of the cage remains above the water surface.

The cage employs the ASA_IM low-volume high-density (LVHD) approach to cage fish culture. The 100 m³ cage is intended to be a low cost option for China marine fish farmers, with a capability to culture a minimum of 5 tonne of fish per production cycle. The cage is designed to be managed by just a few people, using technology readily available to coastal fish farmers. Fish transfer for net changes and harvest is done through the use of an underwater tunnel that connects to a surface live car. One to two net changes are required during each production cycle to clean bio-fouling.

At-sea tests were conducted in 2004 and 2005 to evaluate the capability of the cages to withstand typhoon storm conditions. In 2005, typhoon Damrey, with winds of 80-85 mph, confirmed the ability of the cages to submerge and withstand typhoon conditions. Minor modifications were made to auto submerge the cages in as quick a time as possible.

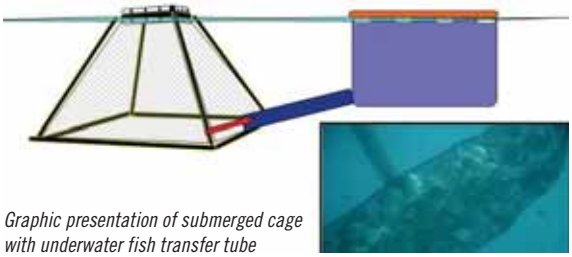
Initial feeding trials with the goldenfin pompano yielded up to 6.4 metric tons from the 100 m³ cages in 123 days. Harvest fish size was 400g. The next step is to extend culture to harvest >500 g fish. For more information on these trials, refer to Vol: 2 (5), Sept/Oct, p38-39 and http: //www.soyaaqua.org

Continuing development of the OCAT cage will help provide China fish farmers with a low-cost option for offshore ocean culture of fish. The OCAT project is part of an on-going research and extension program funded by the U.S. soybean industry to provide quality, soy-based feeds to the global marine fish farming industry.

* The article was based on information obtained from the American Soybean Association International Marketing (ASA_IM) and the presentation by Dr Michael Cremer at the Second International Symposium on Cage Culture in Asia, 3-8 July, 2006, Hangzhou, China.

We also thank Dr Cremer for his assistance in the preparation of this article.

The completed cage ready to be towed to sea and installed



Graphic presentation of submerged cage with underwater fish transfer tube

Fish in cages were fed twice daily with extruded, floating feed

Bioscience Centre in Thailand for Alltech

As a part of its global development and commitment to the emerging Asia-Pacific region, Alltech opened its third Bioscience Centre in Bangkok, Thailand in September. The other centres are located in the USA and Ireland.

The new laboratory will have an active research program focused on the use of regionally important substrates and by-products for use in solid state fermentation enzyme production and applications. It will also provide technical laboratory support for research activities, quality control assurance and the analytical services associated with routine product comparisons and applications.

Dr. Pearse Lyons, President of Alltech said, "The Bioscience Centre in Thailand will enable our feed industry professionals to provide faster and more efficient local services in terms of research and development".

Dr. Keith Filer, Research Manager will lead activities at the centre. Since 1997, Dr. Filer has been a research scientist at Alltech's Bioscience Center in Kentucky. He has significant knowledge of enzyme technology, fermentation chemistry, and biochemistry as well as knowledge of solid state fermentation.

Cutting the ribbon for the centre were Dr. Morakot Tanticharoen, Director of the National Centre for Genetic Engineering and Biotechnology (BIOTEC) (centre), Dr. Richard Chong, General Manager, Alltech Thailand (left) and Dr. Karl Dawson, Director of worldwide research.

Aquaculture Research Centre in Kentucky for Alltech

To keep pace with the increasing demand for aquaculture products, Alltech has expanded its research capacity with an Aquaculture Research Centre.

The Centre will conduct research on a variety of species, including tilapia, catfish, salmon, cobia, perch, shrimp, and many others. All research will be carried out in the new facility which has 10 independent recirculating systems of varying sizes. The systems will include tank sizes in the range of 100 gallon nursery tanks to 1,500 gallon grow-out tanks. This facility will enable the company to complete in excess of 10 experiments annually with the possibility for further expansion.

Alltech President Dr. Pearse Lyons said that aquaculture related products are one of the fastest growing areas for them. The new facility will allow it to stay at the cutting edge, providing the latest solutions to those in the aquaculture industry.

The new Aquaculture Facilities Manager will be David Wood, formerly from the Harbor Branch Oceanographic Institution in Fort Pierce, Florida. Wood graduated with a degree in Marine Science from Savannah State Savannah, Georgia.

Alltech will also be working closely with the leading aquaculture research universities in the US and abroad. Some of the potential projects include a student training centre and the hosting of visiting scientists. This is similar to the Alltech-University of Kentucky (UK) Nutrition Research Alliance at Coldstream Research Park, a partnership with UK students to conduct poultry research. This collaboration produced more than 35 experiments in 2005. More information: www.alltech.com

Good half year results from Asia and Latin America

In a press release, Aqua Bounty Technologies, Inc. announced its first half performance. Elliot Entis, Chief Executive said that with USD 28.1 million of funds received from the IPO, they are strengthening the management team, building the sales structure and developing products in the pipeline.

Some of the highlights of the company's activities in aquaculture included the launch of lead shrimp product Shrimp IMS in Ecuador. This was followed by further development of the product in key target markets of Asia and Latin America, with registration packages issued to ten major shrimp producing countries and rapid approvals expected. The company was appointed by the Vietnamese Fisheries Inspection and Veterinary Agency to supply SybrShrimp virus diagnostic kits for the nationwide quality control program. Aqua Bounty also reported a continued progress with the second shrimp health product, the White Spot Virus inhibitor VPX. Commercial field trial for this have been scheduled in November 2006.

At the Australasian Aquaculture 2006 trade show

The trade exhibition was a show case of the success of Australian aquaculture companies. Leading the way was Clean Seas Tuna Ltd, 67% owned by the Stehr Group. It was also a main sponsor for Australasian Aquaculture 2006. Cleans Seas Tuna is an innovative aquaculture enterprise which operates from Arno Bay in South Australia. The company cultures Southern Bluefin Tuna (SBT), mulloway (jewfish) *Argyrosomus hololepidotus* and kingfish *Seriola lalandi* for the domestic and international markets. Currently 15kg wild SBT juveniles are caught and reared in large sea cages for 3-8 months to 30-40kg each. In three years, the company wants to close the lifecycle for the SBT at its land based hatchery. The objective will be increase production to meet a growing global demand.

Shellfish Culture Limited has cutting edge technology in the production of triploid Pacific oysters *Crassostrea gigas* and blue mussels *Mytilus galloprovincialis*. It has the exclusive rights to the 4Cs method of natural triploid seed production in Australasia. The company operates out of farms in Tasmania and South Australia. It also produces flat oysters *Ostrea angasi*, blue mussels, scallops *Pectin fumatus* and abalone *Haliotis spp*. This is a public unlisted company with the majority of shareholders being industry-based farmers. It supplies the majority of the Pacific oyster seed to Tasmania and South Australia and also to New South Wales, Victoria and for export.

Fish Protech Pty Ltd has developed a technology to create a fully controlled culture environment. The fully integrated recirculation system has been designed to maximize fish production and each fish rearing module has a built in water treatment system. The first prototype was developed in 1990 and since this has been installed in 16 locations in Australia and elsewhere. The company has supplied this complete farm package with technology, management and operation and training services to Malaysia, Brunei and China.

In feed manufacturing, 100% owned **Ridley Aquafeed**, a division of the Ridley Corporation emphasized on their state of the art aqua feed mill in Brisbane. It produces feed for the barramundi, mulloway, native fish species, salmon, trout, prawns and yellowtail kingfish. Feed are supplied to both domestic and export markets. **Skretting**, the main sponsor launched its portfolio of products in the Spectrum range at a Marine Finfish Hatchery workshop. According to the company, this provides for a total feed strategy for marine fish hatcheries, from broodstock to live feeds and products are designed to suit the varying approaches in fish culture. **Tiger Biotech, China** was also there to introduce Tiger L-C, a highly stable vitamin C. It has also T Peptein, a high protein feed ingredient produced through a special fermentation process which removes the anti nutritional factors of soybean meal.

From the Philippines, From second left, Kaylin Gonzales-Corre, Seafdec, Prof Valeriano L. Corre, UPV, Christopher Co, Overseas Feeds (extreme right).

The material also contains selected probiotics. The company has proposed this for replacement of fish meal.

At the show, Canadian based **Ketchum Manufacturing** presented their brand identification fasteners at the show. This is a way for companies to label their products. Attached to the gill of processed fish, these tags increases brand visibility and can show information such as country of origin, product species, product quality etc. Malaysian based **Rotomas Technology** displayed its moving bed bioreactor with carbon dioxide stripping for use in recirculating systems. The system is energy saving, efficient and has a small footprint. Also at the show was Scotland based **Idema Aqua UK** with equipment for the cleaning of cages (See page 43 for more details).

Bluey Chew (right) at the Rotomas Technology Booth

New BT parent stock for industry in Thailand

Hawaii based Moana Technologies LLC is now ready to bring to the Thai shrimp industry, a line of domesticated black tiger shrimp *Penaeus monodon*. These will be specific pathogen free (SPF) produced in complete biosecure facilities situated in Kona, Hawaii. In early 2006, Moana Technologies announced the set up of a nucleus hatchery in Vietnam. This is a pilot multiplication centre mainly to introduce the concept to the region and also to conduct verification trials.

At their booth at the Thai Fish show in June, Yuan L Wang, President, said, " Using various populations of black tiger shrimp stocks from South East Asia, South Asia and Africa and after five years of establishing families, we now have a founder stock in Hawaii consisting of several hundreds pedigreed and unrelated families. These will be used to produce commercial breeder stocks with desired traits such as fast growth and hardy shrimp".

"In Thailand, we will develop multiplication centers for seed production to supply to farmers. Shrimp will come to these facilities as young parent or grandparent animals, grown to maturity to produce marketable seed. By 2008, only SPF seed may be available but by 2009, we intend to produce significantly improved breeds to the market in Thailand".

Although many farms in Thailand have shifted to the culture of *P. vannamei* shrimp, the company believes that black tiger shrimp will co-exist with vannamei shrimp. In Thailand, shrimp production has increased but its value has dropped 25%. In the US, European and Japanese markets, demand for larger size shrimp is reflected in higher prices. The average ex warehouse whole sale price of Black Tigers in the US between June and April 2006 was 77% higher at USD 5.27/kg) when compared to that for the white shrimp.

Wang said, "Therefore it will benefit the Thai shrimp industry if we could increase the level of black tiger shrimp production. The Thai Government Road Plan is to triple the fraction of black tiger shrimp for export from the current 10% to 30% by 2009".

Moana Technologies was established in 2000 by Inve's Flor Indigne. Its principal business is in the selective breeding and genetic improvement of the black tiger shrimp. The project was to develop domesticated and genetically improved broodstock and the use of pathogen free post larvae which will allow industry to move away from the risks and unsustainable use of wild broodstock for postlarvae production. The steps are the domestication of the species, building a large and pedigreed SPF founder stock, build and run a most sophisticated shrimp breeding facility and develop molecular tools to support the breeding process.

Yuan L Wang at the booth during the Thai Fish Show.

It was crucial that the work be conducted in a bio secure location with minimal threats from natural occurring diseases. The quarantine and screening of the founder stock is located on Hawaii Island. The work on domestication took three years. The genetic selection work is conducted in nucleus breeding centre (NBC). It is located in a State Government owned aquaculture park (NELHA) on the Hawaii Island. In late 2004, Moana Technologies' domestication work was largely completed and the NBC was fully functional. Currently the work is on selection of lines for several traits. The first sets of shrimp are now being field tested for suitability to farming conditions. In the next 1-2 years, the company will continue to work on testing of its stocks as well as produce SPF seed to supply farmers on a limited basis.

More information: email: moanatech@monantech.com

Black tiger brrodstockbroodstock

Aerial view of the NBC

At the Australasian Aquaculture trade show

Sleepy cod fingerlings from Sleepy Haven Hatchery

The sleepy cod *Oxyeleotris lineolatus* is one of the most promising fish for inland aquaculture in Australia. With an annual production of 60,000 fingerlings, Sleepy Haven Hatchery is a primary source of sleepy cod fingerlings. In Asia, there is a high demand for the highly priced marbled goby *Oxyeleotris marmoratus* which is very similar to the Australian sleepy cod. Both fish have high flesh recovery, moist white flesh and do not have an off flavour. Its 'sleepy' state of activity makes it easy to transport at high densities.

At the Skretting Australasian Aquaculture trade show, Ed and Lynn Marriage, owners of the hatchery, anticipate some demand for his fingerlings in Asia. "Our 16 acre (9.6ha) hatchery uses a recirculation water system well suited for high density breeding. Today, our markets are mainly in Queensland. Small quantities have been exported to the US and Taiwan. In the coming season, we wish to triple the number of broodstock and increase production of fingerlings. Then we will be able to develop a sustainable supply chain to new markets in the Asia Pacific region".

In 2001, when farmers were having problems with obtaining fingerlings of the sleepy cod in commercial quantities, Ed and Lynn decided to convert their silver perch growout facility in Childers, Queensland to this species. However, although breeding success can be easily achieved, the main obstacle was how to overcome the low larval to fingerling survival rate. As growth of the fish is slow, it is a time consuming process. Finally, using information from research conducted at the Walkamin Research Facility, they are now able to supply 4-6 inch (6-15cm) fingerlings from February through June.

Research at the Walkamin Research Facility has suggested that sleepy cod is most suitable for culture in recirculation systems. In Queensland, where temperatures are more constant than other parts of Australia, the fish grows to1-1.5kg in three years. Restaurant size (500g to 800g) fish takes 2 years. In the early stages, fish are fed on plankton but they are easily weaned onto artificial pellets at later stages.

More information: www.aaq.com.au/shh.htm; email: emarriag@bigpond.net.au

Ed and Lynn Marriage at the Queensland Booth

Sleepy cod fingerlings

What's up in AQUA Culture Asia Pacific in 2007

	Issue Focus	Features & Technical	Shows
January/February DL-7/12/06	Disease Management	Shrimp/Larval nutrition	• World Aquaculture 2007, San Antonio, USA, 26 Feb-Mar 2 • VIV Asia, March 7-9, Bangkok, Thailand
March/April DL-15/2/07	Aquafeeds in Asia	Marine fish/Additives	• Victam Europe 2007, Utrecht, 8-10 May
May/June DL-16/4/07	Tilapia in Asia	Organic production/Probiotics	
July/August DL-15/6/07	Responsible Aquaculture	Vietnam/Feed Processing	• Aquaculture Asia, Hanoi, Vietnam, August 1-5
September/October DL-15/8/07	Shrimp Health & Pond Management	China/Feed Technology	• China Aquaculture 2007, Dalian, 6-8 November 2007
November/December DL-17/10/07	Aquafeeds in India	Cage culture/Shrimp markets	• 8th Asian Fisheries Forum, Nov 20-23, Kochi, India

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New appointments

New GM in Malaysia

Alltech has announced the appointment of **Max Purser** as General Manager for Alltech Malaysia. Max graduated with a degree in Agricultural Science from University College Dublin and worked with Alltech Chile as an Account Manager. On completion of his MBA at Cambridge University, he was Project Development Manager for the Asia-Pacific region in addition to carrying out a number of other responsibilities including Product Champion for Allzyme SSF® and training manager for the Asia-Pacific region.

"The Malaysian market has grown rapidly in recent years and there is huge potential for Alltech and our products. Max will lead the Malaysian team to ensure that we are meeting our customers needs while also expanding our presence in the marketplace," said Steve Bourne, Alltech's Vice President for the Asia-Pacific Region. More information: www.alltech.com

An International sales veteran for Pacific Rim expansion

In September, Aqua Bounty Technologies, Inc., a Waltham, Massachusetts-based biotechnology company announced the appointment of **Gerry McGuire** to lead the company's sales effort in Southeast Asia.

Gerry, a veteran sales manager with more than a decade of experience in Pacific Rim shrimp farming markets, will direct the roll-out of the company's integrated line of health management products in the region. Aqua Bounty, a company that develops products to manage health and increase productivity in the fast-growing aquaculture sector, provides diagnostic tools, feed additives and therapeutics under the SYBR ShrimpTM and Shrimp IMSTM brands.

As a multilingual executive with substantial experience in international market development, Gerry has focused on delivering client-centered solutions during more than 12 years in the shrimp feed and technology sector.

"Gerry combines an unusually sophisticated insight into global markets with a down-to-earth ability to translate innovative science into farm management routines," said Henry Clifford, the Vice President of Marketing and Sales at Aqua Bounty.

A solution for net cleaning

One of the main concerns of operators of large offshore cages for marine fish culture is cleaning nets effectively. This is a labour intensive and time consuming operation. Dave Thorburn of Idema Aqua UK came all the way from Scotland to demonstrate a simple and practical system to do this at the Australasian Aquaculture show held in Adelaide, 28-30 August 2006.

The system uses circular stainless steel discs that work their way along nets operated by a high pressure water pump. It can be operated from the surface, or underwater by a diver. Nets of 10 meters in diameter (80m in circumference) can be cleaned using this method within 2-3 hours. Dave said, "The system is hydraulic (water pressure) driven and is easy to use. It cleans effectively and generally only needs two people to operate. Depending on the size of nets, the cleaning can be completed in minimal time. It reduces the frequency of net changes and if used regularly can eliminate that need completely. The practice of anti-fouling nets can also be eliminated. This clearly benefits the environment as well as being extremely cost effective".

These cleaning disks, available in various configurations, are designed to clean nets underwater i.e. neither the nets nor the fish need to be removed prior to the cleaning process. A note of caution is attached with the use of the equipment however, as high pressure water cleaning is potentially dangerous unless safety precautions are followed. At an operating pressure of 250-300 bar, the water flow is up to 60 litres/minute. Idema's cleaning disks are designed to withstand up to 700 bar pressure. The pumps recommended for the cleaning operations come in petrol, diesel and hydraulic driven versions, with 18 l/min to 28 l/min for a single disk or a pair of disks. There are also the larger versions with 60 to 140 litres/minute of water flow to operate a row of four disks i.e. two sets of paired disks. The largest volume is for a special head which has been developed with six disks in a row.

The single disk technology started some 20 years ago and it was only two years ago that multiple disk technology was developed. The number of disks required for a successful cleaning operation will depend on the size of the nets. In the case of a net with 150m in circumference, a four disk system with a larger pump will complete cleaning in 1.5 hours.

Dave stressed that the time for cleaning to be completed will depend on the size of the nets and the degree of fouling. The disks can be used on all types of netting up to a mesh size of 100mm, from plastic coated to steel netting material, and also with predator nets. In the case of cage culture using predator nets, the disks operate between the two nets".

Idema is a Norwegian owned company with offices in Norway, Scotland and Chile. The company can also build specialized systems to meet the specific needs of clients. More information: www.idema-aqua.co.uk; email: dave@idema-aqua.co.uk

A dual head at work on a tuna farm 90mm mesh net

At their booth, David and Linda Thorburn holding a dual head cleaning disk.

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