AQUA Culture AsiaPacific

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Culture and markets

Organic shrimp

Marketing groupers after the tsunami

Clean fresh tilapia

Improving water quality

Feeds

Moisture control in aquafeeds

Hydrolysed poultry proteins

Tilapia feeding and nutrition-part 2

Shrimp health management workshop, Thailand

Victam Asia, Bangkok 2006

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INDONESIA *(NORTH SUMATRA)*- P.T. Gold Coin Specialities Medan, Tel: +62 61 415 5115 Fax: +62 61 451 2748, email: I.mariyanto@gcsimd.goldcoin.ws

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Editor/Publisher
Zuridah Merican, PhD
Tel: +603 2096 2275 Fax: +603 2096 2276
Email: zuridah@aquaasiapac.com

Editorial Coordination
Corporate Media Services P L
Tel: +65 6327 8825/6327 8824
Fax: +65 6223 7314
Email: irene@corpmediapl.com
Web: http://www.corpmediapl.com

Design and Layout
Words Worth Media Management Pte Ltd
wworth74@singnet.com.sg

Direct all enquiries to the editor.
AQUA Culture AsiaPacific is published bimonthly by **Aqua Research Pte Ltd**
3 Pickering Street, #02-36 Nankin Row,
China Square Central, Singapore 048660
Tel: +65 9151 2420 Fax: +65 6223 7314
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Send by fax to Zuridah Merican at +603 2096 2276 or email: zuridah@aquaasiapac.com

Letters may be edited prior to publication

From the editor

The year 2005 in review

Of tsunami and the global shrimp

The year started with the reconstruction of what was lost to the December 26 tsunami. Companies and the aquaculture community, either directly or through the World Aquaculture Society and AwF (Aquaculture without Frontiers), donated funds and initiated projects to rebuild the small-holder 'tambaks' and hatcheries in Aceh, Indonesia and farms in Southern Thailand and India.

The US antidumping duties on shrimp imports were announced for Vietnam, China, Indian and Thailand at the end of 2004. With the tsunami affecting production, India and Thailand applied for a review on their respective levy under the antidumping rules and Thailand asked the EU to lower tariffs to 4% from the current 12% for its shrimp products. With the new GSP tariffs retroactive to August 2005 (see page 4), Thailand will now expand into EU markets. In October 2005, the EU market was reopened to China with the removal of the 100% testing for residues of antibiotics. Today, China is the main exporter to the Spanish market.

In March, there was another damper for shrimp farmers. The US Customs required a bond on all products liable for antidumping duties. Small processing plants, the main channel for small farmers to market their shrimp could not absorb the additional costs and stopped buying shrimp. Prices dropped 16% for 70 pcs/kg of *P. vannamei* and hatcheries in Thailand stopped production when farmers refused to restock ponds. Farmers in Vietnam delayed harvesting when prices dropped 33% for 30 pcs/kg of *P. monodon*.

In the business of shrimp culture, Julian Davies (page 26) said that previously, with high prices for shrimp, the cost structure was not heeded. However, as shrimp becomes an international commodity, it will be subjected to market forces.

As *P. vannamei* becomes a 'global shrimp', its production exceeding that of *P. monodon*, the debate to introduce its culture in India and Philippines continues. For many, the two species share the same market and may directly substitute but others say that there will always be a market differentiation. Despite problems with low productivity and diseases in the culture of *P. monodon*, countries like the Philippines see this niche market for large *P. monodon*. The concern on the spread of diseases endemic to the white shrimp has also taken precedence over industry's needs to increase production.

Nevertheless, each country has made its stand. Not to be left behind in the shrimp market, Malaysia allowed its culture from April 2005. Others like India and the Philippines continue to conduct trials. Dr Sakthivel (page 30) of the Aquaculture Foundation of India was practical when he said, "Risk is sometimes inevitable in such introductions". It is also difficult when a commodity depends on an undomesticated species.

Devastating effects of diseases on shrimp culture operations and pond productivity continue to be reported. Monodon Slow Growth syndrome (MSGs) in Thailand caused USD130 million in losses. White spot syndrome reduced shrimp production by half to 3,500 tonnes in 2005 in Iran. Losses to KHV in carp continues in Indonesia. It is now well understood that the occurrences of disease is related to poor environmental conditions. In shrimp culture, disease experts repeatedly point out the link between management practices and diseases. One important fact was that the use of disease free or resistant stock is the way forward. As the use of specific pathogen free *P. vannamei* is a norm, this brings out the critical & urgent need for a domestication program for *P. monodon*.

Unfortunately, food safety issues continue to swamp both shrimp and fish culture activities such that inspections teams from the EU, FDA as well as Japan have made visits to some Asian countries. Catfish imports from Vietnam into the Southern US states were stopped when some samples contained residues of floroquinolone.

Notwithstanding who is responsible, these cases in 2005 tell us that the ongoing challenge is the production of quality product clean of any residues of antibiotics. One option is organic aquaculture which is gaining interest. Admittedly, this cannot replace semi-intensive or intensive systems as the profit margins will be unattractive. This is however an option for extensive systems to migrate into organic farming with premium prices, whilst at the same time safeguard the environment. This is the niche market that may solve problems of food safety for a small player.

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When this magazine was conceived, our mission was to be the catalyst for information exchange in the industry and bring the industry to the same level of professionalism as the livestock industry. We are on our way to meeting the needs of all members of the industry. These efforts have been possible with the support of friends, companies and contributors. As we move on into the second year, I would like to thank all of you for your support.

Our best wishes for the New Year.

Zuridah Merican
Editor

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An early GSP reduction for shrimp from Thailand

This long-awaited reduction in the duty on Thai shrimp imports into the European Union will give producers in Thailand an opportunity to regain their lead in the EU market.

Erik Haber (left), consultant to the European Commission to Thailand, receives a letter of appreciation from Mr Ekapoj.

On September 1, the European Union (EU) agreed to a temporary measure to reduce the import duties on shrimp. This will see Thai shrimp receiving the same benefits as they would under the new EU Generalised System of Trade Preferences (GSP) scheme. Duty is reduced from 12% to 4.2% for fresh shrimp and from 20% to 7% for prepared shrimp. No quantitative limits (quotas) will be applied. This puts it on par with Malaysia, Indonesia, India and Vietnam.

Thai shrimp farmers led by Ekapoj Yodpinij (right), Chairman of Suratthani Shrimp Farmers Club, greet Dr Friedrich Hamburger, Head of the Delegation of the European Commission to Thailand, for the EU's decision to grant GSP for Thai shrimp.

The measure was published in mid-September but will apply retroactively from 1 August 2005 until 31 December 2005. The new GSP scheme will then enter into force on 1 January 2006 and maintain duties for Thai shrimps at these levels.

"I am pleased to deliver this good news to Thai shrimp farmers. This will give a boost to the Thai economy, in particular the southern provinces affected by the tsunami," said Ambassador Dr Friedrich Hamburger, Head of the Delegation of the European Commission to Thailand.

In 2004, Thailand exported some 2.1 billion baht (USD 52.5 million) worth of shrimp products to the EU. Total Thai exports to the EU in 2004 amounted to some 578 billion baht (USD 14.45 billion) with a 200 billion baht (USD 5 billion) trade surplus in Thailand's favour. (Source: Delegation of the European Commission to Thailand)

Thai shrimp farmers beef up their food safety measures

This reduction in import tariffs is good news for shrimp farmers but in order to boost shrimp export to the EU, Suraphol Pratuangtum, President of the Thai Marine Shrimp Farmers Association, said that farmers and exporters must prove that their shrimp is safe and completely traceable. He added that to be successful in exporting shrimp to the EU is not easy because of the stringent food safety standards on shrimp imports.

Dr Suraphol said Thailand has prepared this by implementing a traceability system throughout the shrimp supply chain and applying a code of conduct on sustainable shrimp farming.

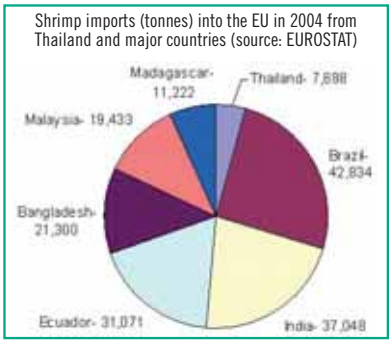
"The Thai shrimp is the best quality shrimp in the world. After the EU granted the GSP for Thai shrimp, European importers reduced importing shrimp from Brazil and Madagascar and turned to buying shrimp from Thailand instead," he claimed.

"Now, the Thai shrimp is the leader in the EU market. We expect that Thai shrimp exports to the EU could increase by 60% to 30,000 tonnes in 2005. To meet this export volume, we need about 50,000 tonnes of shrimp from the farmers," he added.

Besides the safety issue, Dr Suraphon said quality and freshness is very important for shrimp imports to the EU. It demands head-on shrimp, which is easily perishable.

To meet the EU requirements on safety and quality, the association is joining forces with the Department of Fisheries and provincial shrimp farmer clubs to arrange seminars that will educate the farmers on how to produce shrimp for the EU market.

Thailand and the EU shrimp market



Processors say outlook is bright

Following this, the Thai Frozen Foods Association projected that exports to the EU will rise to between 35,000 and 40,000 tonnes in 2005, from 5,000 tonnes last year. The amount will equal to 15-20% of the total shrimp shipments of 250,000 tonnes in 2005. Similarly, Adirek Sripratak, CPF president and CEO said that Charoen Pokphand Foods itself will triple its shipments to the EU to 6,000 tonnes bringing its total shrimp exports to all markets to 45,000 tonnes. This is an increase from 12,000 tonnes in 2004.

Tripilar chosen to lead Dipasena

Southeast Asia's largest, yet long-troubled shrimp farming firm, PT Dipasena Citra Darmaja, was given a much-needed boost as the asset management Company (PPA) managed to seal a USD240 million commitment to help finance the firm's revitalization.

End September, Muhammad Syahrial, Director of PPA PT Perusahaan Pengelola Aset announced that Tripilar through its subsidiary company PT Renaissance Capital Asia, will be the investor to recapitalize the farm. The company was chosen from four others who submitted their bids.

Muhammad Syahrial said that the company was chosen based on four reasons. In the deal, Renaissance Capital Asia will provide a total of USD150 million as Dipasena's working capital and some Rp 900 billion (USD90 million) in loans for the company's shrimp farmers.

Dipasena operates under what is known as a "core-plasma" scheme, in which the company acts as a nucleus providing loans to shrimp farmers, but in return the farmers are required to sell their produce to the company.

"We chose their proposal over the others as they were the only ones willing to provide credit for the farmers, and had better value-added prospects at the end of their debt-to-equity option within two years," Syahrial said.

"They also agreed that the government may retain control of Dipasena's management board and committed that they will not sell Dipasena back to its previous owner."

The government took over Dipasena from Gajah Tunggal Group tycoon Sjamsul Nursalim to partly settle his Rp 28 trillion debt to the state following the 1997 Asian financial crisis. The other three bidders were Transagro Investment which comprised Transpack from the USA, and Union from Singapore, Laranda Powerindo and a consortium of Fortune Alliance Investment comprising of PT Central Pertiwi Bahari.

PT Dipasena Citra Darmaja's shrimp farm in Lampung Province, South Sumatra had 18,064 ponds (totalling 3,613 ha), processing and cold storage facilities (set up in 1990) and a shrimp feed mill which it acquired in 1996. It had 11,000 farmers in its plasma farming scheme. (source: Kompas and Jakarta Post)

An aquaculture business in Myanmar for Texchem

Malaysia's Texchem Resources Bhd will invest in the farming of the softshell crab and seabass in Myanmar early next year. Quoted in the Star, Group chairman and CEO Fumihiko Konishi said that seafood prices were rising due to the depletion in fresh seafood resources and rising diesel prices. Farming crab and fish will reduce their raw material costs substantially. The group's food division business currently contributes about 17% to the group's annual revenue and the plan is to increase this to 20% in the future. Texchem's markets are Japan, US, Europe, Australia and Singapore.

Konishi said the group is now carrying out research and development for the farming of soft-shell crabs and sea bass at its 600 ha property in Myanmar. He added that the Myanmar authorities are "very supportive"' of the group's aquaculture investments in the country.

In its seafood processing business, the company will use biomass fuel for its boilers in seafood plants in Myanmar, Vietnam and Thailand as part of the strategy to reducing energy consumption costs. Savings will be between 70-80% on diesel by December at the plant in Myanmar.

First market link to promote tilapia

The first seafood market link which was held in October in Central Luzon, gathered 25 buyers and 60 producers. This was initiated by the Bureau of Fisheries and Aquatic Resources (BFAR) and Santeh Feeds Corporation. At the meeting, wholesale fish buyers from Hypermart, SM, Rustans, the Navotas fish market, super market and canteen operators association met up with large fishpond operators and cooperatives in Pampanga. Together they forged trading agreements and this is only the start of what hopefully will be a long and constant business connection, according to the Philippine Information Service.

Central Luzon produced 50% of the total tilapia production in the Philippines. In 2003, Pampanga produced 65,000 tonnes of tilapia, earning for it the title "tilapia capital of the Philippines". It is also a consistent top producer of milkfish and black tiger shrimp (sugpo) in the country.

However, the region is beset by problems ranging from typhoons, flooding and pollution. At the meeting, solutions were developed. These included opening up of land for fish aquaculture nationwide. Also proposed was the putting up of a fishport complex, where fishpond operators can bring their produce directly to institutional buyers. The structure of cooperatives and technical assistance from BFAR and support services from other agencies will be strengthened. The Department of Environment and Natural Resources will also closely monitor the pollution situation and water quality of rivers and other waterways.

US Duties to stay for Thai and Indian shrimp

The US International Trade Commission (ITC) in its decision on November 2, said that it will would maintain the 10.17% antidumping duty on shrimp from India and the 5.9% duty on shrimp from Thailand.

In the Bangkok Post, Ralph Boyce, the US ambassador to Thailand, said the ITC commissioners had decided that the current situation did not warrant a change in the tariff. Thailand expressed disappointment with the decision. In the Economic Times, a spokesman of the Seafood Exporters Association of India (SEAI) called the decision "disappointing". He was of the view that chances of a further review were remote as the decision was by a 6-0 vote though companies can seek a review on an individual basis. Both countries had been hoping Washington would lift the penalties in light of the damage their shrimp industries had suffered from last December's tsunami.

News in Brief

KHV in Singapore

Singapore's Agri-food and Veterinary Authority has reported koi herpes virus (KHV) in a consignment of koi carp imported as a trial batch of 30 fish from a new source. The whole batch was destroyed. The detection was a result of PCR (Polymerase chain reaction) testing for KHV

NZ success in breeding eels

A research team from New Zealand has successfully bred the shortfinned eel *Anguilla australis* in captivity. With this breakthrough, there is the potential to end severe shortages constraining the international eel farming industry which relies totally on juveniles sourced from the wild and stocks are dwindling rapidly.

According to Project Manager, David Cooper, the next challenge for the team now is to grow the baby eels through to the glass eel stage. He estimated that full commercialisation of eel farming from supplied artificially hatched stock is now only a few years away. The world aquaculture production of freshwater eels is currently estimated at more than 130,000 tonnes/year, valued at more than USD 1.3 billion. The demand for wild caught juvenile eels to culture is so great that glass eels are currently fetching prices of between USD750 to USD10,000/kg on international markets.

Ultrasonic waves increase spawning efficiency

Scientists in West Bengal, India have shown that ultrasonic and sonic sounds emitted by a device called Fish Chaser produced by Tele Net, a Kolkata-based company, can increase the rate of spawning of carps. In the experiments, fish were injected with varying levels of the pituitary hormone and then subjected to ultrasonic sounds. The quality of eggs released and the spawning rate was higher, irrespective of the doses of hormone. In another trial, they also showed that the sound waves kept fish active during culture. The effect was higher growth and survival. The yield in the experimental pond was 3.5 times higher than in control ponds.

Tilapia imports soar in the US market

US tilapia imports totalled 70,500 tonnes during the first 7 months of 2005, up 11% from the same period in 2004, according to a Globefish report. This was linked to the ban on Vietnamese catfish. Importers then had to look for similar mild white-fleshed fish as an alternative species. The question is how US catfish producers will react to this flood of tilapia from abroad. Between 2000 and 2005, the quantity of tilapia imports to the USA during the first seven months of the year has increased by 226%. This 70,500 tonnes correspond to about 160,000 tonnes liveweight. This figure also shows the importance of the US market for tilapia producers worldwide.

China leads in Spanish market

In the first half of 2005, China was the major exporter to Spain's shrimp market. China's share was 9,790 tonnes up 1,783% from 2004. However, Spain's total volume during the January-June 2005 period was down by 4% but unit values of imports remain unchanged at Euro 5.42/kg for frozen imports. The increase in imports from China followed the easing of EU restrictions imposed during 2002. The current Chinese share of Spanish imports (17%) compares to that of January-June 2001 (16%) before EU restrictions came into effect.

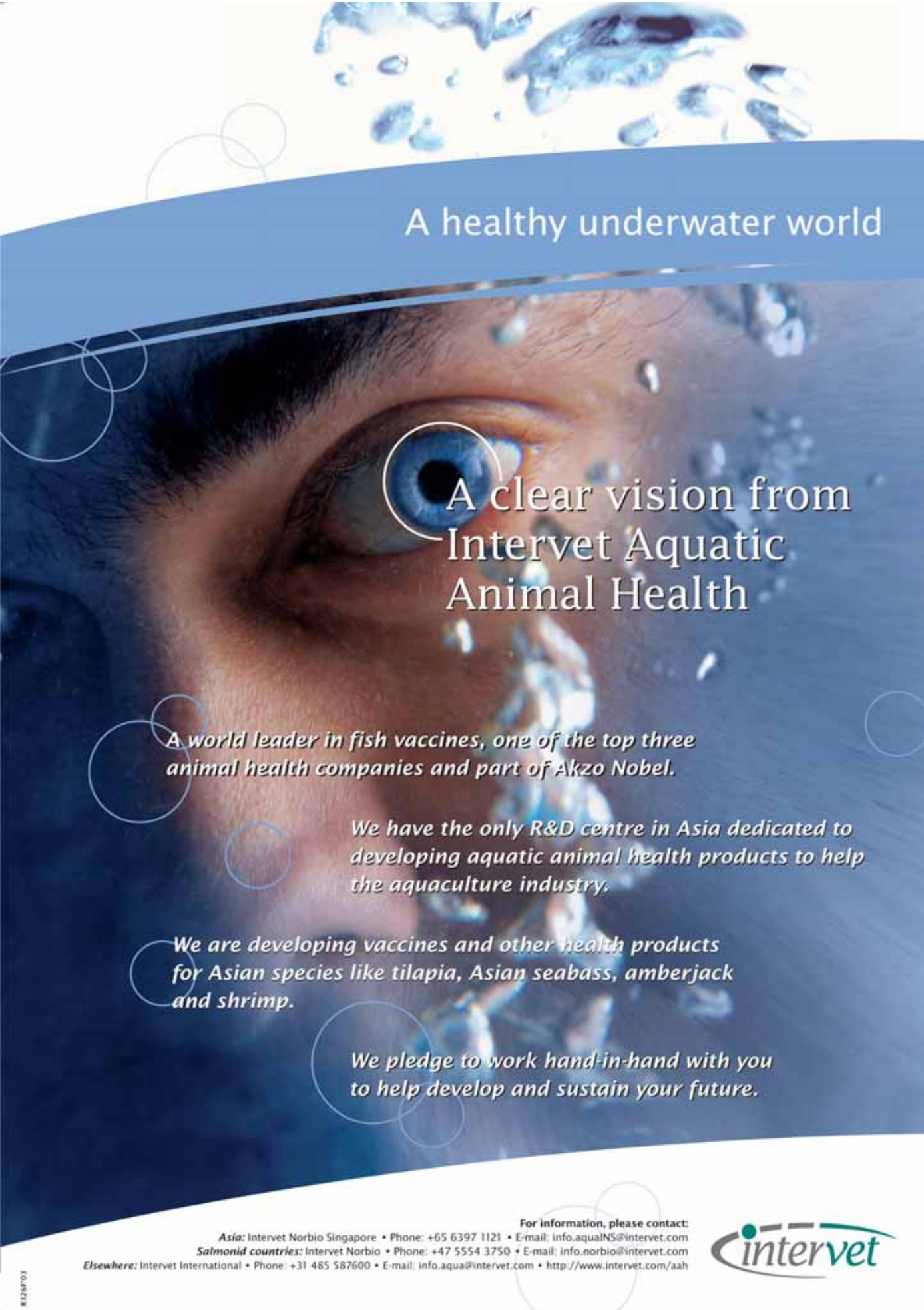
Japan to inspect seafood imports

Viet Nam Association for Seafood Exporters and Producers (VASEP) said that Japan's Food Safety Department will inspect seafood from Vietnam starting in October until March 2006. In a report in Vietnam News Agency, the association said that imported seafood containing antibiotic substances, including nitrofuran, AOZ (3-amino-2-oxazole) and SEM (semicarbazide), would be sent back or destroyed. Besides Viet Nam, many other countries exporting seafood to Japan face the inspections, including China, India, Thailand, Indonesia, South Korea, and Norway.

New ponds for Xian Leng

Malaysia's Xian Leng Holdings, the world's largest producer of arowana, will expand its ponds to 246 at its farm in Parit Sulong, Johor by the end of the year. According to the Edge, the farm has 96 ponds and a stock of 5,000 tails. The new ponds will allow the farm to stock fish at the ideal 30 pcs/pond and increase spawning rate.

Commercial production in these ponds is expected in 2007. The company expects an increase by 10 to 15% of tails. The Cites regulated arowana fish contributes 70% to the company's revenue. Currently there are 27 registered arowana producers in the region, 6 in Malaysia, 5 in Singapore and 16 in Indonesia. However, Xian Leng prides itself on its premium arowana such as the albino variety. Its other activities are the production of other ornamental fish such as the Japanese Koi at its farm in Sungai Suloh, Johor. Further expansion is also foreseen in this segment as the company has been offered 250 acres of land in Kluang, Johor for an ornamental fish farm.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India/USA JV for shrimp feeds in Andhra Pradesh

In September, Matrix Biosciences Limited, a Hyderabad-based manufacturer of additives, chemicals and feeds for aquaculture, announced that it had entered into a joint venture (JV) with Cargill Animal Nutrition-a business unit of Cargill, US. This will be to manufacture and distribute shrimp and scampi feeds in India. The new business will be called Cargill Matrix Feeds Private Limited.

In the press release, Matrix Biosciences said that the joint venture combines the strengths of each partner in India's aqua feed industry to meet international standards. The aqua feed plant is located near Rajahmundry in East Godavari District, Andhra Pradesh.

Matrix Biosciences CEO Siva Prasad said, "Matrix Biosciences has grown in the last five years, bringing with it advanced technology to its feed production facility. Cargill's global technology and its determination to be competitive in global markets would help the joint venture become a leading player in the Indian shrimp feed market".

At the launch of the joint venture, Cargill Animal Nutrition was represented by Dr Lorenzo Mapua, sales and marketing executive, and Omar Saddeque, business development manager in Asia. Matrix Biosciences hosted a farmer program on September 20 in Rajahmundry attended by 300 farmers and feed dealers from all over India. Dr. A. Victor Suresh, who worked with both Matrix Biosciences and Cargill Animal Nutrition (CAN) to facilitate the transfer of feed technology from Cargill Animal Nutrition to Matrix, was the guest of honour at the program. Two new shrimp feed brands, LEGEND and MAGIC, were launched at the meeting.

Matrix Biosciences originally started as a formulations and medicaments manufacturing company for aquaculture, veterinary and poultry in 1999. Within three years, it has become market leader in the latter industry. It has attributed its success to its strong network. In India, Cargill has been mainly involved in grains, soybean meal, foods, etc. This dedicated shrimp feed mill is a first for Cargill in Asia. Through this JV, Cargill is set to enter the shrimp feed market in the country. (www.matrixbiosciences.com; www.cargillanimalnutrition.com)

More capacity for shrimp and fish rations at Lee Feed Mill

Thailand's Lee Feed Mill PLC is optimistic about the future of the aquafeed business in Thailand and will be expanding production of both marine and freshwater fish and shrimp feeds. The listed company is a key player in the country's aquafeed market.

Nipon Leelasithorn

The 21-year-old company was exclusively a producer of poultry and swine feeds until 10 years ago when it started the production of fish feeds. In 2002, production of freshwater fish and marine feeds moved to a new plant in Phetchaburi. At the same time, it began production of shrimp feeds.

Demand has been increasing ever since. Nipon Leelasithorn, executive chairman and managing director said, "Fish feed production contributed about 20% and shrimp 8% of our total feed production of 220,000 tonnes in 2004. In the fish feed business, we have been successful with our strategy of supplying quality feed at a fair price. Today, our fish feed sales are probably the second highest in the country. Shrimp feed is set to become another exciting market because the shrimp feed market is a much larger one".

"Over the past three years, the shrimp culture situation was unpredictable but we decided to enter the market at that time. Furthermore, as a new shrimp feed producer, we had to build up a reputation for our feed and this took time. To make sure, new feeds are tested at our own shrimp farm for years before being launched onto the market. We also developed a technical sales team, different from the one serving the fish farmers. It may have taken us a few years to reach this point, but now we are looking at expanding our capacity because shrimp farmers are convinced that our feeds are top quality," said Nipon.

"With the lowering of the GSP, we can see greater potential in the shrimp feed business, especially in line with gains in the culture industry. However, the company's policy is to emphasise quality, but not on credit terms. Thus, our customer base is different from many of our competitors.

"Our forte is the good teamwork of all departments, and the emphasis that we have put on quality control. This has helped us with such issues as traceability in feed production. All mills have ISO, GMP and HACCP certification," he said.

In marketing aquafeeds, Thailand remains the company's main market, but the company is open to opportunities abroad. There has been some consolidation in the industry for shrimp farming in the last few years with the more discerning farmers surviving due to their careful control of operations. This suits the company well as they focus on serving well-managed farms.

In the future, the company is targeting 30% of revenue from the aquafeeds segment and 50% from swine feeds due to decreased demand for poultry feed.

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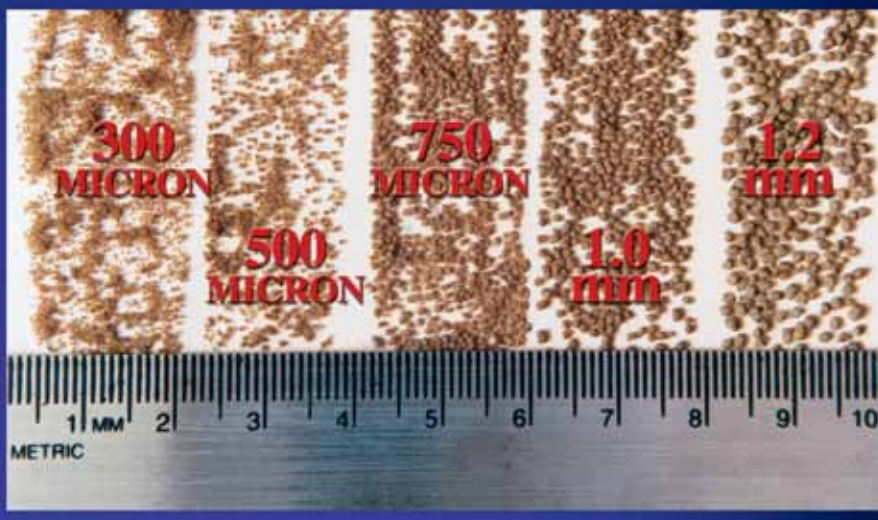

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Organic shrimp culture - issues and trends

By Anaëlle Camillo and Philippe Serene*

A farm in Ca Mau

Today the shrimp culture industry is laden with environmental and socio-economical concerns, which has lead to the initiation of organic certification projects. The organic way of production, thus organic certification and labelling was born from the consumer's wish to eat healthier and safer food, with a taste more authentic, and from their consciousness of the environmental and social issues posed by intensive systems.

According to Naturland, organic aquaculture production was about 7,500 tonnes in 2003, from which 1,500 tonnes was shrimp. If we compare this with the total aquaculture production, the production of organic shrimp is insignificant. Nevertheless, the growth of the organic food market in the world is increasing at a rate of 10-20% annually. Indeed, today the specialized health shops and the organic supermarkets are not the only ones selling organic shrimp. This product is increasingly sold through conventional retail chains as Deutsch See from Germany and big distributors as COOP from Switzerland. Obviously, the organic shrimp market is just in its infancy - but does it have potential to expand?

One issue may be the certification of shrimp farms as organic but for the consumer, the absence of regulations or international standards is confounding.

Naturland, a private certification body from Germany, was the first one to develop standards for organic shrimp farming or "eco-friendly"shrimp culture in 1999. Since then, some projects have been started in Ecuador, Peru, Indonesia and Vietnam, etc. Many other bodies are working on the same kind of standards: BioGro (New Zealand), BioSuisse (Switzerland), KRAV (Sweden) among others. Thus, it is not surprising that the producers in front of their papers and the consumers in front of the supermarket shelves are confused.

What is "organic" shrimp culture?

Globally, according to Naturland's standards, shrimp culture has to be carried out as naturally as possible. This means that antibiotics and other chemicals are banned, only fertilizers certified organic can be used, the culture procedures have to follow the natural scheme (for instance, aeration of ponds is not allowed), polyculture systems instead of shrimp monoculture are highly recommended or possibly integrated aquaculture-agriculture. Finally, the emphasis is on the respect and the protection of mangrove forest and its ecosystem and in the integration of natural plant communities in farm management.

Specifically, the criteria more frequently seen in the literature and from our own experience in the program in Vietnam's Ca Mau region

Organic shrimp

has the following: the stocking density should reach a maximum of 5 postlarvae/m^2, the annual production thus, is around 300 kg/ha/year, the feed source is composed of mangrove leaves and organic matter from the ponds, water exchange comes from the tide and there is a natural diversity of crops (different species of shrimps, fish and crabs). This way, organic production practices can help to guarantee the long-term viability of the natural resources they rely on.

The writing of uniform standards in the *Codex Alimentarius* or international regulations by the WTO is compulsory for the development of organic shrimp product markets. In Indonesia and in Texas, there were two problematic cases because of the nonaccordance between the organic certification given to shrimp farms and the local legislation.

This international certification has to be implemented fairly considering the specific needs of the small producers in every country. The standards have to be very strict especially concerning the respect of mangrove forest. The minimum percentage of mangroves in the ponds allowed in Vietnam's project is 50% but several farmers have tried to cut some of that area in order to increase their productivity. The standard which is the most difficult to ensure is probably that concerning the hatcheries and the origin of black tiger shrimp postlarvae (*Penaeus monodon*). The life-cycle of the this species is still not well controlled. Specific guidelines by country or zone can be added.

Price premium

Another issue to be solved is the premium. The price premium for organically produced shrimp varies between 20% and 40% depending on the importer. When we discover that shrimp culture represents around USD7 billion at the producer level but that once on the consumer's plate it represents USD40 billion in value and we see the living conditions of the farmers, we note that there is a problem. Therefore, the premium, that is supposed to benefit the producer and its distribution have to be clearly defined by all parties. A traceability system reliable for the produce and for the money flow has to be integrated to the system.

On the other hand, as far as the distributors continue to dictate rules to the producers and request for "vertical integration" of the chain, the certification costs should be at their charge from now and then. It does seem appropriate that importing countries provide financial support to the developing countries that implement organic farming and for the conversion from semi-intensive or intensive to organic. The example of the Nature Conservancy's Eco-Enterprises Fund, the limited funds that helped Biocentila to convert from intensive to organic in the Ecuadorian project, should be followed.

Until now we have noticed that there is a lack of technical support and follow up for the farmers. Training on quality and food safety, traceability system, good aquaculture practices, respect of the environment and good management of wastes and effluents is essential for the farmers and the collectors or any other intermediate handling the product between the ponds and the processing factory. Also, the inspection team has to be trained by the certification body. A system of regular follow up has to be in place to update the information and improve communication between all the operators.

For this, governments and the private sector must work together. For instance in Vietnam, the Government developed a programme on mangrove reforestation and protection within the framework of eco-friendly shrimp culture certified by Naturland.

Organic shimp farming – the bottomline

In conclusion we can say that for the moment, it is unlikely that organic farming will replace semi-intensive or intensive systems; indeed, the supply of organic shrimp is definitely too low. For shrimp farmers currently using intensive culture methods, the conversion to organic farming requires considerable effort and sacrifices, mainly because it reduces the financial profitability. These efforts can be made only by farmers well informed and conscious of the issues that intensive farming causes and are convinced of the long term benefits of organic shrimp culture and can afford the financial losses during the initial phases of the conversion.

In countries such as Vietnam, Bangladesh, Burma and some others where there is a majority of small extensive farmers, that have not yet 'discovered' the intensive way of farming, it is worth setting up organic certification programmes. Their culture practices are already 'close to nature' due to a lack of financial sources for buying inputs. Therefore, in these cases organic certification can greatly contribute to a responsible development of shrimp culture and environmental and social sustainability.

Anaëlle Camillo is a food technologist and a graduate from ENSIA-SIARC University of Montpellier (France). She worked for IMO Viet Nam in 2004 and took an active part in the implementation of the Camau Organic Shrimp Development Program. Currently, she is working in New Zealand, for Sealord Ltd. and Crop & Food Institute, in the valuation of seafood industries wastes as part of her M. Sc. Program. Email: anaellecamillo@hotmail.com; camilloa@crop.cri.nz.

Philippe Serene is currently involved in the implementation of some selected Quality Certification Programs such as the one with Naturland in Camau, Viet Nam for organic shrimp, Aquaculture Certification Council for conventional GAP shrimp, MSC for the promotion of sustainable fisheries and the recent Eurepgap development in *Pangasius* and tilapia certification programs. From 1990 to 2002, Philippe took a leading role in the feed mill development of Proconco in Vietnam. Email: aquaserviceps@hcm.vnn.vn

Organic shrimp farming in Indonesia

– safeguarding our heritage

by Iffa Suraiya*

Walking along the bunds of an organic shrimp farm can be likened to walking amongst the mangrove forests of old. The ponds however appear to be in a different mood, calm and serene with still waters. This is the scene at the organic shrimp farming with a program to replant mangrove in the district of Sidoarja, south of Surabaya in East Java, Indonesia.

Planting of mangroves along the pond dike

The shrimp ponds of Sidoarja have traditionally been culturing the black tiger shrimp (*Penaeus monodon*) for many years. Over the last 15 years however, the ponds have deteriorated and productivity has dropped to a point that shrimp farming was no longer a profitable venture. Organic shrimp farming technology was only introduced in the last 5 years and is already showing promising results.

'While conventional shrimp ponds produce only 2 production cycles annually, organic farms have been able to achieve 3 full cycles in a year."

Since 2000, several shrimp farming communities are collaborating with a group known as ATJ or Alter-Trade Japan, later known as ATINA or Alter-Trade Indonesia. ATINA promotes the concept of organic shrimp culture. The system now involves more than 700 farmers from various localities including Sedati, Sidoarjo, Buduran, Tanggulangin and Jabon. According to Ir Sunaryo, Head of Marine Affairs and Fisheries in Sidoarjo district, the total area of shrimp farms that has converted to organic methods of production is 2,850 hectares. This is out of a total of 15,500 hectares. While conventional shrimp ponds produce only two production cycles annually, organic farms were able to achieve three full cycles in a year.

Sustainability of the system

Organic shrimp farming is a system of production which utilises the whole ecosystem and take into account its health and sustainability. Simultaneously, it uses only organic inputs for its crop production. There are prerequisites.

The ponds cannot be located adjacent to any agriculture or farming activity that utilises chemicals or compounds that are not permitted. Different from conventional shrimp farming methods, organic shrimp farming must include complete data collection pertaining to production and management processes for the duration of the culture period.

Another important characteristic is that the farmer must practise holistic management practices. The most apparent requirement for shrimp farms to be classified as "organic" is the need to plant mangrove trees. All the bunds of organic shrimp farms have to be lined with *Avicennia* mangroves such as the 'api-api' *Avicennia marina*, 'imbo' *A. officinalis* or other trees such as the 'kenari' *Canarium commune* and cashew nut *Anacardium sp.*

A minimum distance of 7 metres is required as a buffer zone between the water source and the ponds and which must be planted with mangrove. Likewise, for farms adjacent to the open sea, a minimum buffer zone of 200 metres must also be planted with mangroves. All felling of trees must be replaced with an equal number of saplings replanted.

"We strictly sanction farmers, especially those who do not conform to the requirements pertaining to mangrove planting. Their status will be downgraded to '*transitional farmer*' if they do not fulfil the requirements within the grace period given for compliance, and their names will be removed from the list of organic farms", said H. Syarief, a farmer who also the Field Supervisor from the Internal Control System or ICS.

The ICS team will conduct random checks on the farms during pre-stocking and during the grow out until harvest. In principle, organic shrimp farming requires careful observation and consideration of the ecosystem and also the surrounding environment. This includes the use of organic fertilizers, feeds and sterile water with no chemicals added (except for the containers where they are stored).

Mangrove planting requirements

To obtain an organic farm certification, 4 levels of procedures have to be met. The first level involves the preparation of the ponds, particularly at the bunds. All repair and maintenance work needs to be carried out with only organic components. The second level is more conventional and requires the farmer to initiate the planting of mangroves around his farm, especially in barren areas. The third level involves a transition in the management procedures, chiefly involving the documentation of all activities from pre-stocking until harvest of the shrimp. The administrative procedures are by no means easy for the traditional

HM Nasekh Aminulloh

Harvested organic shrimp

Drying of seagrass as a natural feed for organic farming

farmers. At the final level, the farm can then be considered "organic".

HM Nasekh Aminulloh, an organic shrimp farm operator in Putat, Tanggulangi explained that in producing organic shrimp according to the standards and procedures established by ATINA, one needs to have the land title certificate or petok D, which will prove that it is not adjacent to agriculture or farming land which uses production inputs that are not allowed. Farms will be classified into standards of A, B or C. Nasekh himself operates 60 ponds of which 38 are categorised as A with the balance being C ponds.

Procedures in organic shrimp culture

Producing organic shrimp starts with good soil and pond preparation. The pond bottom is slowly sun dried for a period of about 2 weeks. After this, water in introduced into the pond until a depth of 10cm in order to stimulate production of natural productivity. The water is left to stabilize in the pond for a period of about 1 week depending on the condition of the water. According to Nasekh, the best indicator on the readiness of the pond is the water transparency and salinity. Water transparency can be easily measured with a secchi disc.

Water is added into the pond once a month, usually during the new moon. Additionally, to increase the nutrient content of the water, topsoil which contains dried manure from goats and cattle is spread over the pond bottom. "This promotes the growth of kilung worms (*Pheretima aspergillum*). These are one of the natural foods used to produce organic shrimp", said Nasesh.

Postlarvae

Prior to stocking, shrimp post larvae (PL) have to be acclimatized. The acclimatization will require a container of 60 cm diameter for a period of 1.0 to 1.5 hours to allow the PLs to adapt to the temperature and salinity of the water in the pond. "The maximum density for farming of the black tiger in an organic system is 60,000 PLs per acre or 3pl/m^2.

There are 3 hatcheries supplying the postlarvae for the organic farms. These are the Benur Lancar (Banyuwangi), Kurnia Agrograha and Windu Raya (Situbondo) hatcheries. There is a major constraint in the supply of postlarvae (which must be organically certified also) at present.

Feeding

The food given to the shrimp is obtained from the local environment. No commercial feed is given to the shrimp. At 1 month of age, the benthic algae *Hidrilla verticilata*, locally called 'ganggeng' will start to establish themselves in the pond. This will become the food source for the growing shrimp. Preparation of algae as food begins with collecting them to dry at the pond edge. After 1 week of drying, they are then put back into the ponds. To achieve better results, the algae are minced into smaller pieces before putting back into the pond. At the place where the algae are introduced, wooden spikes are placed at the pond bottom. This is to prevent the algae from spreading to other parts of the pond.

"Algae which first appear are the filamentous algae, 'ganggeng bawangan' and 'ganggang krasa'. Filamentous algae appears moss-like while ganggeng bawangan is shaped like onion leaves." explains Nasekh. Food material from ganggeng can be mixed with grass and leaves from the mangrove trees. The locals call this concoction "*bangeran*".

Fertilisation needs to be started at the pond preparation stage. Organic fertilizers commonly used include cow droppings, limestone and dolomite. Apart from cow manure, droppings from goat, birds and also bats (guano) are also used. Fertiliser from orgnanic sources such as molasses and katu (*Sauropus androgynus*) are also used. Also, to eradicate fishes, predators and pests such as tilapia and clams, farmers use saponin (tea seed cake), tobacco and also tuba (rotenone). "Pesticides and urea or other material which is not included in the standards provided by ATINA cannot be used whatsoever" says Nasekh.

A cultural heritage

In their assessment of the organic farming system, farmers admit that it is very lucrative. For example, in an area of 6 hectares, at a density of 2 to 3pl/m^2 within 3 months about 950 kg to 1 tonne of 25g shrimp can be produced. Presently, black tiger fetches a price of Rp 90,000/kg (USD 9) and the milkfish can also be harvested once a year. Milkfish fry can be stocked at 15,000 pcs per 6 hectares and a harvest of 3 tonnes can be expected. The milkfish are about size 4, and fetches a price of Rp 8,000 per kg.

In addition to the financial gains, Nasekh said, "These ponds are our cultural heritage and we should take care of them. We cannot exploit it without due consideration for its environment. How can we allow the ponds to be idle and unproductive after they have given us so much?"

The hard work and dedication of the farmers have clearly produced results. Suwidji Wongso, Manager from the ATINA Representative Office said, "At present a large portion of farmers in the Sidoarjo area has the "organic shrimp" certificate".

The certificate is produce from Naturland, an international certification board from Germany which have been appointed by the International Federation of Agricultural Movement (IFOAM) to conduct audits on shrimp ecosystems involved in organic projects. He clarified that at present, new organic ponds are established in Sidoarjo only.

"Certification is the ticket to international markets", said Suwidji Wongso.

"At present, in terms of volum e, the impact of organic shrimp is not yet significant. However, if the market trends and demand for this natural product continues to rise, there will be no limit on the possibility of organic shrimp becoming the next boost for Indonesia. However, this must be balanced with hard work and commitment".

Are the farmers in Sidoarjo finally reaping the rewards of their endeavours that began 5 years ago? Yes, when we look at the old mangroves standing strong and proud between the ponds, we can say that this was the result from their commitment. Their ways have given us new meaning to shrimp farming.

Iffa Suraiya *is Executive Secretary of the Shrimp Club, Indonesia. She is based in Surabaya.*

Fast forward after the tsunami

Similar to most marine fish cage operations in South East Asia, the Sarasin Seafoods farm in the northern coast of Phuket Island, Thailand had planned its production cycle to meet the demand for fresh high-value marine fish during the Lunar New Year. In 2004, the farm had 90 cages and blue spotted groupers were ready for harvest in February 2005. Then came the December 26 tsunami. Reports Zuridah Merican

The farm is located close to Sarasin bridge linking Phuket and the mainland

Today, the farm which has a permit for 160 cages based on its location, has been rebuilt. Cages have been expanded to 120. In the cages, there are enough fish for another good harvest planned for the next Lunar New Year. In the reconstruction, the Department of Fisheries helped with an initial subsidy of Baht 20,000 (USD 526). The farm could have applied for further aid but preferred not to.

"Overall, we can say that we were lucky that the tsunami came during our first year. We were just starting culture operations and we were just learning. It would have been more devastating for us if the tsunami had come during the second year when we would have more fish. In addition, the impact on our operations was milder in comparison to others because of our location. An advantage of the tsunami was that it cleaned up the sea bottom", said owner Tipaporn Traithong.

Tipaporn Traithong

Sarasin Seafoods was started in 2003. Tipaporn uses the marketing channel provided by Mr Ho Hung Yuan, a Thailand-based Taiwanese of Yuan-I Co., Ltd. to help in the marketing of fish. In the reconstruction of the new farm, a friend from a large cage operation in Malaysia helped with the design.

In August, the cages are used mainly for the culture of the blue spotted grouper *Plectrophomus maculatus* , and orange spotted grouper *Epinephelus coioides*. There are nursery cages where the fish are stocked and monitored prior to being transferred to cages. The humpback grouper *Cromileptis altivelis* is initially grown for two weeks in leased ponds previously used for shrimp culture before being transferred to the cages.

Obviously, the decision on which species to culture is dependent on market demand and prices. The farm has listed the priority species as blue spotted grouper>humpback grouper> giant grouper *E. lanceolatus* >tiger grouper *E. fuscoguttatus* and blue grouper.

"In most species, we do not know everything about their culture, but to us what is important is that if cages are managed well, one will rarely have problems with diseases. Also, we would like to increase the number of cages used for the humpback grouper but the survival is low and we have difficulties in its culture. Not only are fingerlings expensive but the most effective pellets have to be imported from Taiwan and are too expensive", she added.

Fingerlings of the humpback grouper are imported from Bali, Indonesia at USD 2.3 each for 4cm fingerlings. Ex-farm prices for the humpback grouper are 3,000 to 3,500 baht/kg (USD 77-89/kg) for 700g fish which will take 16 months to reach.

Focus on blue spotted grouper

At the farm, most of the attention is focused on the blue spotted grouper. Deeper cages are used for this species and the highest quality trash fish are fed. Cages are protected with netting which also provide shade for workers. The farm would like to increase the number of cages used for this species but is limited by the fingerling supply from Taiwan.

The blue spotted grouper is also the preferred species for the Lunar New Year season. As for the harvest size, the general market preference is 600-1,200g fish for the Lunar New Year. In 10 months, fish can reach 800g. Ex-farm prices are 1,100 baht/kg (USD 29/kg) for fish up to 1.2 kg. Prices for fish of 1.2kg are then determined on a per fish basis. However, the farm which pays higher prices for fish fry imported from Taiwan prefers to sell 600g fish. Most of the fish are airlifted to Bangkok.

Before the tsunami, there were well boats from Hong Kong collecting

A large section of the cage farm is covered

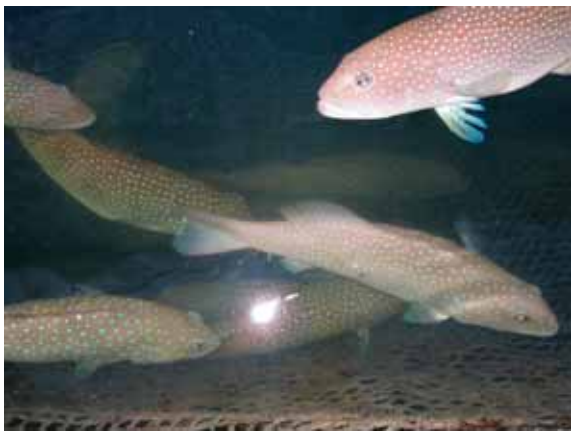
juvenile humpback grouper

fish from farms in the area and it was only in late August, that boats returned to the area. More are expected nearer to the Lunar New Year.

Brown spotted groupers and others

The farm also imports giant grouper fingerlings from Taiwan. Tiger grouper fingerlings are imported from Indonesia and cost only US80 cents per piece. Mortality is much lower for this species. At the farm, orange spotted grouper from wild stock fingerlings are cultured in 50 cages. These are reared to 400g and before being sold for on growing in Hong Kong.

Other species are the cobia *Rachycentron canadum* and seabass *Lates calcarifer*. Tipaporn would like to culture more of the cobia but the ex-farm prices are not attractive enough. Currently prices are 150 baht/kg whereas the cost of production is around 120-140 baht/kg. The fish may have a potential for the fillet market in China. For Tipaporn, before she considers its culture, the market price for the cobia should be 250 baht/kg. An ideal size will be 10kg fish.



Blue spotted grouper in cages

Feeds

Fingerlings of the blue spotted grouper are not weaned onto pellets and thus have to be fed with trash fish throughout the culture period. For the humpback grouper, trash fish is used for the first week and from then on pelleted feeds. Attempts to use pellets for the tiger grouper have not been successful. Only the orange spotted grouper is reared with pellets all the time. As far as they are aware, floating feeds are available from a major feed company at a cost of 37 baht/kg and with an FCR of 2:1. This is a bone of contention as there is limited choice in pelleted feeds for their use.

The quality of trash fish used is dependent on the market price of cultured fish. The more expensive trash fish (15 baht/kg) are fed to the blue spotted grouper whilst cheaper trash fish (12 baht/kg) are used for the other species of groupers. Quality rather than supply of trash fish is a problem. The farm gets a priority as it is able to pay cash for its supplies. However, at low ex-farm prices (110 Baht/kg) for the seabass, it would be practical for them to shift to pellets when trash fish is limited.

Coming up

Next year, the farm plans to start a hatchery for the breeding of most species. It will start with the breeding of the blue spotted grouper. A Department of Fisheries centre in the central region is already producing fingerlings of this species. The broodstock will be obtained from the wild and spawning is planned for April 2006. Other species include the Napoleon wrasse *Cheilinus undulates*. The farm has started to restock this fish, which it lost to the tsunami.

It will also increase the culture of the giant grouper as fingerlings are available in Thailand. Another plan is to culture the orange spotted grouper to market size in Thailand. In terms of markets, the farm plans to start marketing the blue spotted grouper to markets in China. This will be possible, if they have enough fingerlings to expand culture. Hong Kong will continue to be an important market. It will look at the Singapore market only when prices increase. (Email: yui_tipaporn@yahoo.com (Tipaporn Traithong)

Challenging markets for clean and fresh tilapia

By Zuridah Merican

The use of technology in the pond and cement tank culture of the red tilapia has helped PKPS Farm Mart in Selangor, Malaysia to successfully produce and market its tilapia with no off flavour for the local fresh fish markets. As an industry leader, it continues to seek ways to use technological advances to increase competitiveness. The preference of the mass market for price over quality and hygienically produced fish remains a challenge for the farm.

It is the live fish markets that most red tilapia producers in Malaysia are targeting. This is followed by the chilled fish market, comprised mainly of the large supermarkets and wet markets. In comparison to her neighbours, tilapia production in Malaysia is small with an estimated 25,578 tonnes in 2004 (pers comm., DOF) but nevertheless at margins of more that 20%, tilapia farming is profitable compared to other freshwater fish species. The local ex-farm prices have remained relatively stable at RM 4.50 to 5.50/kg (USD 1.18-1.45/kg) but cost of feed, electricity, labour and transportation have been on the rise.

Malaysian consumers are conscious of quality and the producers have to ensure that fish do not have the "off flavour" commonly associated with the pond culture of tilapia. However, this demand must be matched with low prices as marine fish species remains the preferred species and can command much higher prices. These are some of the challenges faced by PKPS Farm Mart in Selangor, Malaysia, which markets its quality tilapia as "Cherifish".

"Although we strive to add value to our red tilapia, wholesalers and large supermarkets sometimes undermine our efforts by bringing down prices and through their poor conservation at point of sales. We find that the value of tilapia is more respected at local farmers markets rather than at supermarkets", said Yong Kim Thai, Managing Director.

At the farm, the culture of the tilapia starts in nursery ponds where fry of 3cm are reared for 2 months. The stocking density in the 0.4 ha ponds is 20,000 fish (5 pcs/m^2). After 3 months, fish of 300-400g are transferred to 1,000 m^2 cement tanks. The stocking density in the cement tank is 20 pcs/m^2. Fish are kept in these tanks for another 2 months. In a year, the farm can achieve 4.5 cycles in each tank with a production of up to 18 tonnes/tank.

Cement tanks at the PKPS Farm Mart

Some 70% of the tilapia is sold to the live fish market in the Klang Valley, where the major towns are located. The rest is sold to markets in Singapore. At current production levels and prices, the marketing of whole fish is preferred as fillet output is only 32%. The current ex-farm price is RM 5.30/kg (USD 1.43/kg) and this can increase to RM 7.00/kg (USD 1.89/kg) in restaurants.

Yong said, "The culture in cement tanks is the most crucial stage in the culture process. The stocking density is high in the cement tanks

A model for tilapia farming in Malaysia

In 2000, cousins, Yong and Sunny Yang Seng, approached the Selangor State government for a joint venture in tilapia farming. Now in their mid-forties, both cousins have been in the family business of poultry and freshwater fish. Yong, with a Masters in Business Administration degree had worked in Charoen Pokphand International trading business for several years.

Sunny Yang Seng (right) and Yong Kim Thai

At the same time, through its subsidiary, PKPS, the state has been active in the promotion of aquaculture as an agro business for young entrepreneurs. The farm PKPS Farm Mart, a joint venture between the cousins and PKPS, with share equities of 60:40, was then developed as a model farming system for tilapia farming.

Construction started in 2000 and the first production in May 2002 totalled 35 tonnes. In 2002, the annual production reached 135 tonnes, exceeding its target of 80 tonnes. Since then production has met its annual budget. In 2003, production reached 400 tonnes valued at RM 1.75 million (USD 460,000) and in 2004, it rose to 615 tonnes valued at RM 2.98 million (USD 0.81 million). In 2005 and 2006, production estimates are 615 and 920 tonnes, valued at RM 4.42 and RM 6.5 million, respectively.

The farm is located in Rawang over 130 acres (54 ha) of land of which 70 acres (28 ha) are developed. The land is adjacent to a water catchment area. Currently there are 6 broodstock ponds, each of 2,000m^2, 28 grow out ponds of 2,000 to 4,000 m^2 in size and 10 nursery ponds (6,000 m^2) and 10 cement tanks (1,000m^2 each) and 2 reservoir ponds of 4 and 1.2ha, respectively.

The farm produces up to 1.5 million fry, mainly for its own use. In the future, the company plans to produce high quality monosex fry for sale. In 2006, a processing plant will be operational. The plant will process whole fish for the frozen fish market. However, the fresh fish market will remain its main market.

Reducing stress during transfer. From left, firstly, farm workers concentrate fish to one corner of the pond, before moving them into large containers which are then lifted by a crane mounted on a lorry for transport to the cement tanks for further on growing.

and fish are fed pellets using automatic feeders. The high flow rate of water and high aeration ensures our tilapia is 100% clear of any off flavour in the flesh. The high flow rate allows the tilapia to swim against the current and firms up the flesh. This is now a prerequisite to market our fish and is what makes us different from many farms in Malaysia".

During the transfer process, extreme care is taken to reduce stress and injuries to fish. At the farm, fish are slowly gathered to one end of the pond and then gradually into a smaller area over a canvas bag. Fish are then transferred batch by batch into large containers which are then lifted by a crane onto a lorry for transport to cement tanks located some 200m away in another part of the farm. At the same time, continuous aeration is provided by the paddlewheel aerators and by the airlift pumping of water through temporary pipes located at the harvest corner of the pond.

In the cement tanks, water quality management is critical. Some 30% of water is exchanged daily to remove the load from feed and from fish. Flushing of tanks is carried out every hour for 1–2 minutes. This will cut down the waste load by 50% and avoid problems related to high ammonia levels. Yong has calculated that a stock of 10,000 fish, fed at 2% body weight per day results in 60kg of faecal waste output.

The farm is actively seeking options in water management. Feed is an important factor in reducing solid waste production in the tanks. The use of extruded feeds and high quality fish meal has helped in reducing this. The use of automatic feeders, aside from reducing human error in feeding and costs in labour, has decreased the amount of feed used. Together with the feed producer, the farm continues to look at ways to improve feed digestibility and reduce feed wastage.

Although it is a model farm in the country, Sunny Yang Seng, Operation Director said that they are still lagging behind, when compared to the levels of intensification in Taiwan's tilapia industry. In Taiwan, the stocking density is about three times higher and the use of recirculating systems is more contemporary. He added that even Thailand's culture techniques are more advanced.

"This is where we wish to head towards. We are looking at the developments in Taiwan and Thailand and modification of applications in the industry in Malaysia. We have begun to produce monosex tilapia which can give faster growth of up to three weeks. The higher cost of the fingerlings at RM 0.25 each as compared to RM 0.04 for the commonly used variety, is compensated by this fast growth.

"We have also expanded ponds for broodstock rearing as we plan to carry out more intensive broodstock selection. In culture systems, we are looking at recirculating systems, to prepare for the time when water resources are scarce or biosecurity requirements will force us to limit water exchange. In disease management, we are embarking on some R&D work to develop vaccines with a Singapore-based company. Whilst disease is not a major problem at the farm, the ability to control and manage diseases is a future priority for us".

End May, the farm was visited by the Prime Minister of Malaysia who declared that the farm is a model for an emerging agro industry in the country.

Tilapia in Malaysia

Tilapia is the most popular freshwater fish in Malaysia accounting for nearly half of the annual production of freshwater fish. Intensive farming is carried out in ponds, cages and cement tanks. Production from most farms is geared towards the live fish market. Here fish quality with respect to size, colouration and bone to muscle ratio are critical factors. Fish with no off flavour are marketed at 20% premium over fish cultured in other systems. Market size is usually 500g (Ng, 1999).

In the region, Malaysia is a small producer of tilapia and 85% of production is of the red variety. Compared to its neighbours, it is a relatively high cost producer at an average of USD 0.95/kg as compared to production costs in Philippines and Indonesia (USD 0.80/kg), Thailand (USD 0.85/kg) and China (USD 0.70/kg) and Taiwan (USD 1.05/kg, Fitzsimmons, 2005). Nevertheless, the industry sustains itself due to the niche and live fish markets in the country and Singapore.

The annual production has increased significantly from the 18,471 tonnes in 2000. By 2010, the Government has planned for a production of 160,000 tonnes of freshwater fish. The tilapia is expected to contribute significantly to this production. (References: Fitzsimmons, K., 2005. Tilapia Production and Markets (www.tilapia.org); Ng Chee Kiat, Aquaculture practices in Malaysia, (eds G.Nagaraj and T.Singh). Malaysia Fisheries Society, Publication no 9. 186pp).

The potential for inoculated nitrification bacteria to control ammonia and nitrite in shrimp ponds

By Dr David J. Drahos

Shrimp from treated ponds (L. vannamei and P. monodon)

During 2003-2004, two separate full-scale shrimp pond trials on the use of nitrification bacteria to control ammonia and nitrite levels were conducted at a commercial facility in central Thailand. Results indicated that this may be a new and vital tool for the farmer facing diverse problems associated with stress and disease. Subsequent effects on yield and feed conversion ratios also demonstrate that this can be a regular water management program for long term culture.

Overall shrimp health and survival is often hampered by high levels of ammonia and nitrite. This is particularly true for low saline ponds or even brackish water ponds. The ability of the shrimp farmer to control waste output from feed and shrimp in high intensity commercial ponds is often limited to indirect measures, such as feed reduction, alkalinity enhancement or alternative pond preparation methods. While such measures are important, a more direct and reliable means to control ammonia and nitrite using specific nitrifying bacteria can provide a valuable tool for both long term culture and short term emergency responses.

The ammonia/nitrite challenge

Healthy shrimp naturally produce ammonia as a waste product, which is subsequently converted first to nitrite then to relatively harmless nitrate by natural chemotropic nitrifying microorganisms typically present in ponds. However, problems arise when the rate of conversion does not keep up with ammonia production and the build up of toxic gases namely ammonia and nitrite begins to occur.

Stress on the shrimp from high ammonia or nitrite levels is well documented and known to cause both acute and chronic effects that can reduce disease resistance and dramatically impact yield. For example, nitrite is now recognized to affect long-term shrimp health even at levels as low as 0.45 ppm under brackish water conditions (Gross *et al*., 2004). Problems can be especially detrimental, particularly under conditions of high density stocking, such as more than 80 PL/m^2 for *Litopenaeus vannamei* and more than 10 PL/m^2 for *Penaeus monodon* and rapid growth. Since naturally present nitrifying bacteria require a much longer time to increase in number than typical heterotrophic strains, the pond biology is simply overwhelmed during such critical periods of culture.

Opportunity for introducing nitrifying bacteria

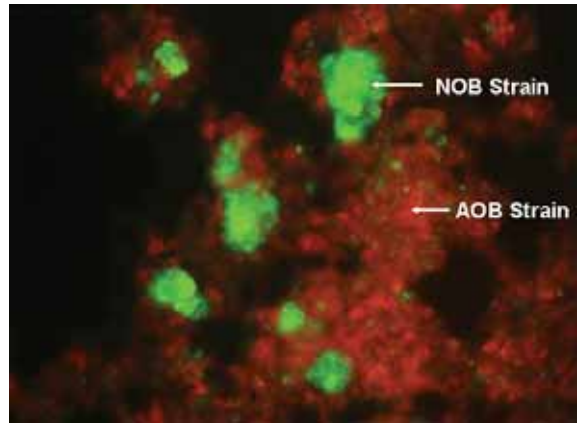
Naturally occurring nitrifying bacteria called nitrifiers can be found in most shrimp ponds at low levels. These organisms are unique in that they derive their energy from ammonia (NH_3) generated directly by the shrimp or indirectly by the activity of other microbial degradation processes in the pond.

Using CO_2 as their carbon source, the nitrifiers are relatively slow growing compared to most other heterotrophic bacteria in the pond. For intensive and even extensive shrimp culture, natural nitrifier populations are often too slow to respond to a rapid ammonia build-up in time to prevent the harmful effects on the shrimp. Furthermore, as ammonia is first converted to nitrite (NO_2) before the nitrite is finally metabolized to relatively harmless nitrate (NO_3), the build up of both ammonia and nitrite can occur quickly.

Using novel high-performance nitrifying stains

Recent intense efforts to identify natural nitrifying bacteria capable of rapid and effective ammonia/nitrite reduction in commercial-scale shrimp ponds have resulted in the discovery of a novel two-strain consortium with broad salt tolerance and good survival characteristics. FISH (fluorescent in situ hybridization) analysis (Figure 1) and full 16S rDNA sequence determination have confirmed that the consortium consists of a novel *Nitrosomonas eutropha* species and a *Nitrobacter winogradskyi* strain co-existing in a large flocculated biofilm structure readily suspended in a pond water column.

Figure 1. The novel nitrifier consortium



Field applications

Two commercial field trials involving a total of 11 treated and 8 non-treated commercial ponds, each of approximately 0.8ha were conducted over a two year period at SAM-D Farms in Chumphon, Thailand. The

ponds were stocked with white shrimp *L. vannamei*. Post larvae from the same production batch were used for each trial and were certified pathologically clean by the Biotech Laboratory, Phuket, Thailand.

The two-strain consortium of nitrifying bacteria was applied as a liquid concentrate at 2 to 3 ppm rate over a 10 week period, starting at 4 weeks post stocking. A total of eight identical non-treated adjacent ponds serve as control ponds in the tests. However, shrimp in only two of the eight control ponds survived to harvest due to ammonia/nitrite stress and disease, possibly exacerbated by the relatively high stocking densities used (100-110 PL/m^2). Shrimp in all the treated ponds survived to harvest. Daily records were kept for ammonia-N, nitrite, alkalinity, pH, dissolved oxygen, temperature, total bacterial counts, applied feed and shrimp weight.

In the first trial, three ponds were treated with the nitrifier consortium and three adjacent ponds served as control ponds. In this test, shrimp in two of the control ponds succumbed to disease within 4 weeks of stocking whilst shrimp in the remaining control pond survived to harvest. Both ammonia (Figure 2) and nitrite (Figure 3) were controlled well in all 3 ponds receiving the nitrifier consortium, while significant spikes occurred in the control ponds during the 93 day culture period. It is clear that all of the ponds at this intensive stocking density (100 PL/m^2) were under significant stress, and the levels of ammonia and nitrite were all beginning to rise by week 4 except in the control pond that did survive to harvest. The addition of nitrifiers at this point did result in a relatively rapid ammonia and nitrite reduction which may have been a strong factor in overall survival. Similar rapid recoveries were also observed in the second trial.

Figure 2

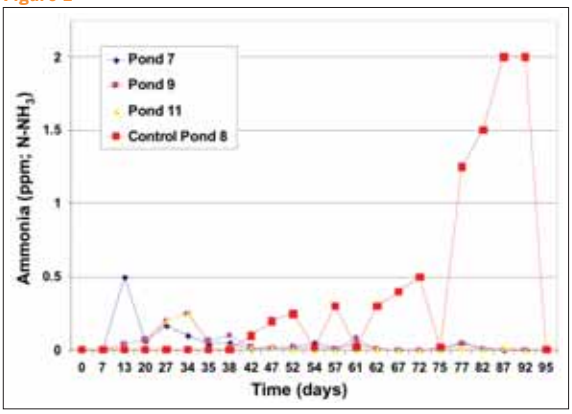
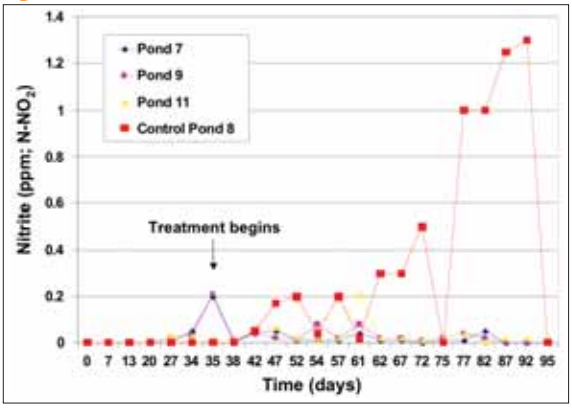


Figure 3



Trial 1. Changes in ammonia (Figure 2) and nitrite (Figure 3) levels in three treatment ponds and control pond (final surviving pond)

In the second trial, six ponds were treated with the nitrifier consortium, while five identical and adjacent non-treated ponds were the control ponds. Once again, shrimp in only one of the control ponds survived to harvest, while other control ponds succumbed to viral infections early in the grow-out period. The ammonia and nitrite levels in these ponds when compared with two control ponds are given in Figures 4 and 5, respectively.

Figure 4

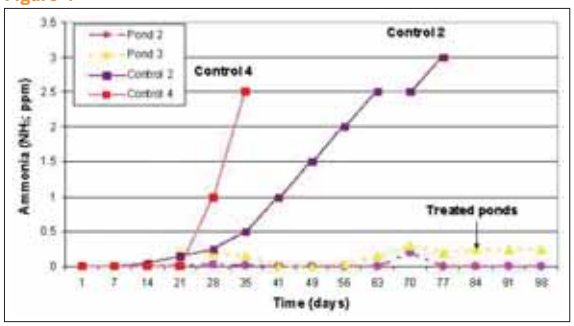
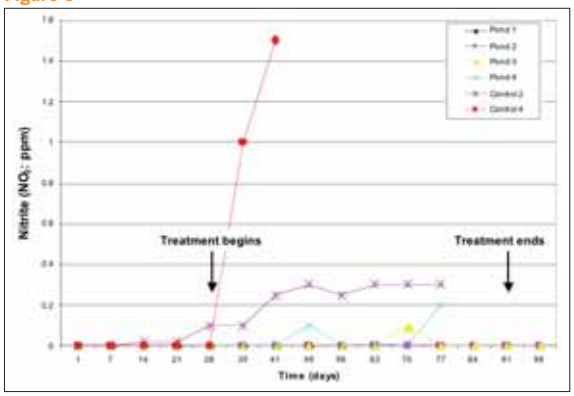


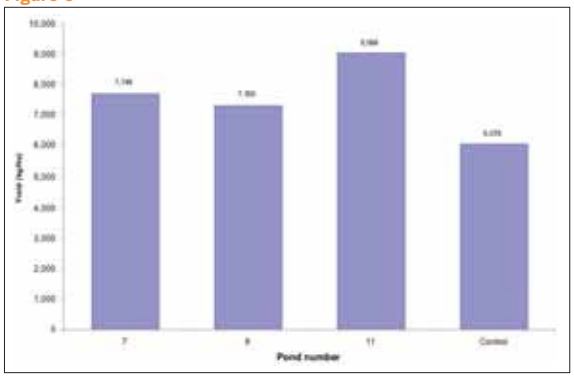
Figure 5



Trial 2. Changes in ammonia (Figure 4) and nitrite levels (Figure 5) in two ponds treated with the nitrifier consortium and two control ponds

In trial 1, shrimp yields in treated ponds were around 25 to 50% more than that obtained from the control ponds (Figure 6). The shrimp yield from trial 1 and 2 are summarised in Figure 7. The average pond yields in each trial are compared against the one surviving control pond from each study.

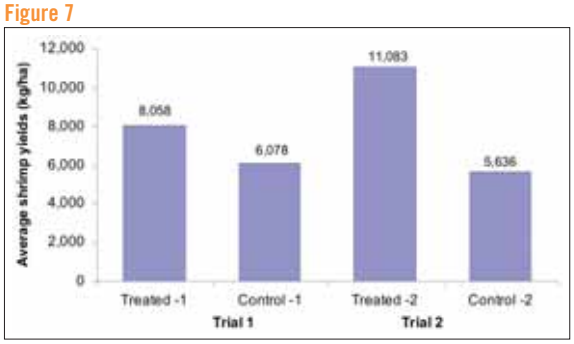
Figure 6



Comparison of shrimp yields (kg/ha) in treatment ponds in trial 1

Shrimp pond at SAM-D farms, Chumphon, Thailand

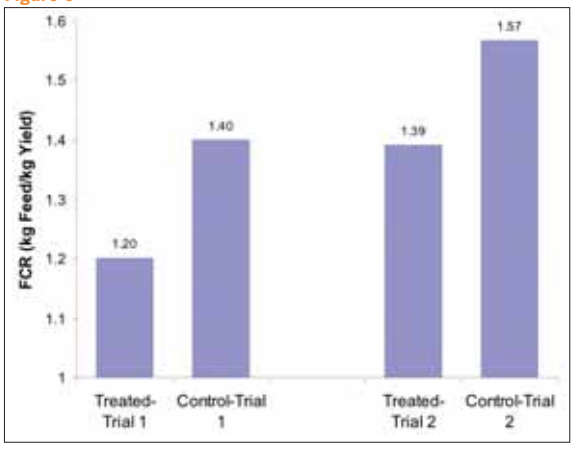
Figure 7



Improvements in average shrimp yields ((kg/ha) in treatment ponds in trial 1 and 2

Another indication of the overall shrimp health and value is provided by calculating feed conversion ratio (FCRs) defined as the kg amount of feed required per kg of shrimp yield obtained. As shown in Figure 8, there were significant improvements (i.e. lower FCRs) in ponds treated with the nitrifier consortium in both trials as compared with non-treated control ponds.

Figure 8



Improvements in average FCR in treated ponds in the trial 1 and 2

Conclusion

This capacity to reliably impact toxic ammonia and nitrite build up in large-scale commercial shrimp culture may provide a new and vital tool to the farmer facing diverse problems associated with stress and disease, even when using the best feed and pond preparation programs.

The control of ammonia levels was often noted in these trials within days of the application of the nitrifier consortium. Thus, an opportunity may exist to introduce nitrifiers on an emergency basis when higher daily ammonia or nitrite readings are noted, particularly during the most critical growth periods. For some treated ponds in these studies, it was also possible to extend the length of the grow out period to up to 113 days, which provided a notable increase in shrimp size and subsequent value.

Acknowledgements

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Dr. David Drahos is the Senior Research Group Leader of Aquaculture for Novozymes Biologicals. He has extensive experience in the application of novel microorganisms in aquaculture and agriculture for over 23 years with Novozymes and with the Monsanto company. He has authored 26 publications and 8 issued patents. He holds a Ph.D. in Biological Sciences from the University of Pittsburgh, USA. Email: ddra@novozymes.com

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Improving pond water quality with clinoptilolites

By Joachim W. Hertrampf and Shravan K. Mishra*

Feed and feeding management alone is not a guarantee for successful shrimp farming. There are management factors of importance which are often underestimated. One of these is ensuring the optimal water conditions. If the environment in which shrimp live in is not of the best quality, then it is not surprising that they do not develop properly. Even the best and most expensive shrimp feed cannot cover the disadvantages of poor water quality.

The number one water polluter is pond sludge. It consists of the faecal matter from the shrimp and unconsumed feed. The quantity of faecal matter is extremely high, if so called "low cost feed" is fed to shrimp because the digestibility of this feed is low. A feed with high digestibility is better utilised and consequently the excretion of faecal matters is reduced (Hertrampf and Mishra, 2002).

Usually, shrimp consume the applied feed within two hours. This is with the prerequisite that the water durability of feed pellets is good. Disintegrated feed pellets are not consumed, leading to pollution of the water environment. In this context it is very important that the daily feed quantity and the number of feeding times is well managed. Trials have demonstrated that the more feeding times there are, the less unconsumed feed there is (Hertrampf and Mishra, 2002).

The accumulated sludge at the pond bottom is chemically converted into harmful gases. The protein component is deaminated into ammonia, toxic to shrimp. To keep harmful gases at bay, farms aerate pond water with paddle wheels. The maintenance of proper bloom of algae is important for a good pond water quality.

However, these will not solve the problems of water quality, particularly if the stocking density is high. There are a number of possibilities for improving pond water quality.

Sorbtive materials for water purification

The function of sorbtive materials is the binding of harmful gases produced by the pond sludge. Zeolites have the greatest potential as water purifiers. This is a large group of natural hydrous aluminosilicates of calcium, magnesium, potassium or barium. Geologists have identified more than 40 natural species of aluminosilicates. Zeolites are crystalline aluminosilicates of different structures, and this consequently means that their absorption characteristics may vary widely (Lopez and Alvarez, 1991).

The zeolite "clinoptilolite" is a hydrated sodium calcium aluminosilicate with the general formula $(Ca.Na_2)(Al_2Si_7O_{18})$. It is found in volcanic rocks and sediments. The pores and structural channels have a three dimensional structure (Lopez and Alvarez, 1991) (Figure 1). These pores or cavities comprise nearly 50% of the total volume of crystals (Prakash, 1995) and makes the structure similar to a honeycomb.

Figure 1. Three dimensional arrangement of silicate tetrahedral aluminosilicate (from: Mumpton and Fishman, 1977).

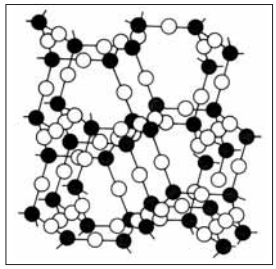
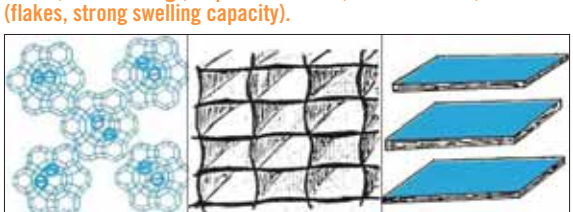


Figure 2: Schematic diagram of clinoptilolite (crystals absolute stable, not swelling), sepiolithe (tubes, able to swell), bentonite (flakes, strong swelling capacity).



The mode of action is based on the channels of this three dimensional structure of the crystals. They are occupied by water molecules and cations which balance the negative charge of crystalline lattice. The channels are similar to a "cage" which has a diameter of only 4.0 Ångström[1] and are responsible for the high cationic exchange capacity and low gel formation. (Lopez and Alvarez, 1991). In this ion-exchange process ions, and molecules are trapped inside the "cage" and will not be released anymore. The catching power of clinoptilolites is tremendously huge. One gram of clinoptilolite has a surface area of 290m^2. The absorption (catching) of cations is in the following order (Dryden and Weatherley, 1987):

$$NH_4^+ > Na^+ > K^+ > Ca^{2+} > Mg^{2+}$$

Contrary to clinoptilolite other zeolites, such as bentonite or sepiolithe cannot release the once absorbed substances (Figure 2).

Application of clinoptilolites

Clinoptilolites are used in the nitrification and binding of sewage sludge of municipalities (Sims and Little, 1973). In human medicine purified clinoptilolite is used as an anti-diarrheic (Rodriguez-Fuentis et al., 1997). After the Chernobyl incident the adsorption capacity of clinoptilolites has been successfully used for reducing the carry-over radiocaesium (^{134}Cs and ^{137}Cs) from contaminated pastures, roughage and feeds to animal produce (milk and meat) (Giese, 1989; Hove et al., 1990,1991).

In terrestrial, productive farm animals clinoptilotites are used as a detoxifier of animal feed. It has the capacity to bind obnoxious substances in the animal's alimentary tract (*Sharma*, 2002). Numerous trials with clinoptilolites in pigs and poultry have been conducted for detoxifying mycotoxin-contaminated feed.

Applications in aquaculture

Studies on the effect of clinoptilolites in pond water treatments are scarce. In fish farming clinoptilolites have been applied either in filter systems or as a so called "clinoptilolite filter bed" (Smith and Piper, 1981; Ciambelli et al., 1983; Colella et al., 1983; Horsch and Holway, 1983). In trials in chinnok salmon (*Oncorhynchus tschawitscha*) and steelhead trout (*Salmo gairdneri*) the clinoptilolite filter bed removed NH_4^+ in the range of 84.4% to 99.5% with a mean value of 93.4%. Dryden and Weatherley (1987) have concluded that clinoptilolites is useful as a water treatment medium in recirculating aquaculture systems.

After the statement by Kohli (1996) that clinoptilolites are used as a water purifier in shrimp ponds by absorbing obnoxious gases like ammonia, preliminary experiments in *Fenneropenaeus indicus* and *Penaeus monodon* were conducted in HDPE plastic tanks with a surface area of 1.0m^2 by Mishra (2001) and Mishra and Biswal (2002). The salinity of seawater used was 30 ppt. There was no water exchange and water was only added to compensate for evaporation.

To simulate conditions in the ponds, sludge from a commercial pond was added to the tanks. The treatment of the tanks with 10g clinoptilolite /m^3 began 15 days after the trial started. Every 30 days the treatment has been repeated with the same quantity. In all these trials, the clinoptilolite ClinAqua from Unipoint A.G., Switzerland, was used. All shrimp trials were conducted by the R&D unit of The Waterbase Ltd., Nellore, India.

In both experiments ammonia levels of the treated tanks were significantly reduced ($P<0.5$) by 27.3% and 28.6%, respectively (Table 1). At the same time substantially less "yellow colonies" and "green colonies" were found in the water. Yellow colonies of more than 500 cfu/ml are often responsible for infections of the gut and digestive

Table 1: Improvement of pond water quality when treated every 30 days with 10g clinoptilolite/m³

	Relative improvement (control = 100%)	
	trial 1[1]	trial 2[2]
ammonia	-27.3	-28.6
yellow colonies	-18.7	-56.7
green colonies	-51.6	-60.4
	[1] F. indicus	[2] P. monodon
all differences are statistically significant at p<0.05		

system of shrimps. The green colony population, on the other hand, is a parameter for the pond's *Vibrio* load and should not exceed 200 cfu/ml. Without doubt, the treatment of the water with the clinoptilolite improved the pond water quality.

In addition, shrimp in the treated water developed faster due to better water quality. The response in the first trial with *F. indicus* was not so pronounced but it was substantially better in the second trial in *P. monodon*, as demonstrated in Table 2.

As a follow-up, a larger scale trial was carried out. Here clinoptilolite was tested in a 110- day pond trial by Mishra and Biswal (2002). The net stocking density was 9 PL/m². The post-larvae (PL) of black tiger shrimp *P. monodon* had a mean initial live weight of 0.01g. The animals were fed with one commercial pelletised starter and one grower feed only, instead of three starter feeds and two grower feeds commonly used.

Table 2: Performance of *P. monodon* reared in clinoptilolite-treated pond water (trial period: 105 days)

	units	untreated water	treated water	control (=100%)
Initial live weight	g	14.3	15.9	
Final live weight	g	21.8	26.5	
Weight gain1	g	7.5	10.7	+42.3
Feed conversion ratio	1:	2.99	2.06	+31.1
1 statistically significant (p<0.05)				

Pond treatment started 45 days after the trial commenced. The clinoptilolite dose was 10 ppm. The treatment was repeated every 15 days at a level of 10 ppm. For the entire trial period, there were five treatments. Prior to the first clinoptilolite application the ammonia and hydrogen sulphide levels and the pH were measured. The results for the treated pond and the untreated (control) pond were not different. Salinity ranged between 36 ppt and 40 ppt for both ponds which is relatively high and was caused by the very dry weather during the trial period.

At the end of the trial period, mean ammonia levels was 0.02 ppm in the treated pond and was significantly 50% lower than in the control pond (0.04 ppm) (Figure 4 a&b). Also, the level of hydrogen sulphide significant improved. Alkalinity in the treated pond was 3.7% higher but statistically non-significant. "Yellow colonies" and "green colonies" were statistically significantly lower for the treated pond (Table 3).

Table 3. Mean values of pond water treatment with clinoptilolite for 110 days

Parameter	units	control pond	treatment pond	control (=100%)
Salinity	ppt	38.0	38.0	-
Ammonia*	ppm	0.04	0.02	50.0
Hydrogen sulphide*	ppm	0.03	0.01	33.3
Alkalinity	ppm	135.0	140.0	103.7
Green colonies*	cfu/m2	150.0	70.0	46.7
Yellow colonies*	cfu/m2	170.0	140.0	82.4
* Differences are statistically significant (P<0.05)				

Figure 3: Weight development of P. monodon reared in clinoptilolite-treated pond water.

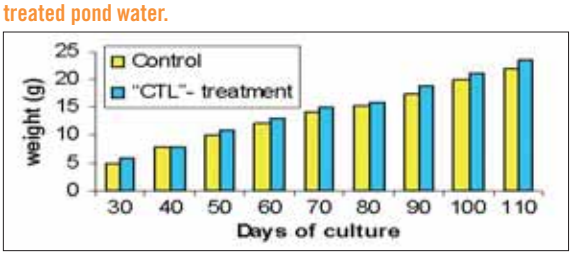
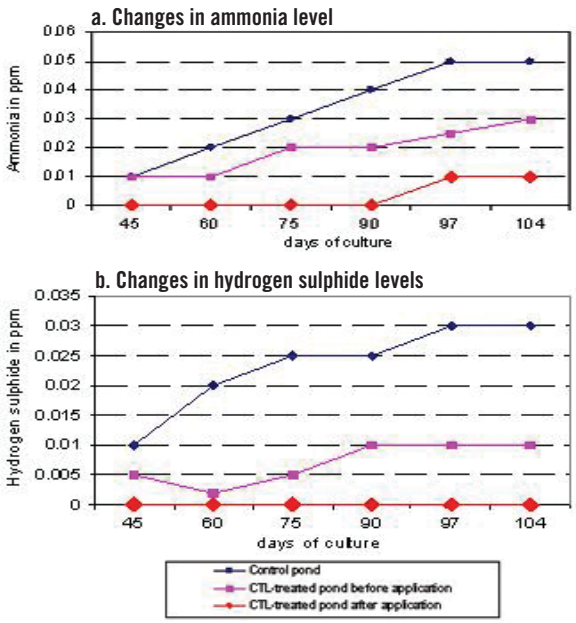


Figure 4. The changes in ammonia (a) and hydrogen sulphide (b) levels in ponds treated with clinoptilolite.



While the standard deviation for the treated pond was low, it was 2.7 times higher for the control pond. This indicated a rather strong fluctuation of the *Vibrio* load.

But the clinoptilolite not only improved water quality but shrimp in the treated pond grew 6.9% statistically significantly faster than their counterparts in the control pond (Figure 3). The clinoptilolite treatment of the pond has also shown significant positive effects with regards to feed conversion and protein efficiency ratio (Table 4). As a comparison, the produced biomass has been converted into performance per ha pond area. The animals of the clinoptilolite-treated pond have produced statistically significantly higher (13.4%) biomass.

Table 4: Mean performances of *P. monodon* cultured in pond water treated with clinoptilolite (trial period: 110 days)

Parameter	units	control pond	treatment pond	control (=100%)
Stocking density	pl/m²	9	9	-
Final live weight*	g	21.96	23.48	106.1
Biomass*	kg/ha	1,425.7	1,646.7	113.4
FCR *	1:	1.63	1.43	87.8
Protein efficiency ratio	1:	0.75	0.46	61.3
Survival	%	73.5	78.0	106.1
* differences are statistically significant (p<0.05)				

Bottomline

The treatment of pond water with the clinoptilolite contributes significantly to better water quality. As a result of the efficacy of the clinoptilolite, shrimp developed faster and consumed less feed, resulting in an improved feed conversion ratio. Clinoptilolite, therefore, has a role in providing a healthier environment for shrimp. In addition, it is an absolutely safe product.

[1]One Ångström equals one hundred millionth of a cm, used for measuring the length of light waves and the radius of atoms

Joachim W. Hertrampf

S.K. Mishra

Joachim W. Hertrampf is a consultant on animal feed production and aquaculture based in Kuala Lumpur. Email: trampf@tm.net.my

S.K. Mishra is Assistant Manager at the R&D Unit of Waterbase Limited, India.

NACA-Alltech Workshop on Shrimp Health Management

The Network of Aquaculture Centers in Asia Pacific (NACA) and Alltech Aquaculture collaborated to run the Shrimp Health Management Training Workshop in Bangkok in October. This popular course, back after a two year hiatus, attracted a record 54 participants from Bangladesh, India, Vietnam, Malaysia, Philippines, Brunei, Madagascar, Tanzania, Indonesia, Australia and Thailand.

The shrimp industry in Asia has undergone many changes in the past five years with the introduction of *Penaeus vannamei* and increasing market pressures on shrimp producers. As part of its commitment to the future of the aquaculture industry in the region, Alltech was aware of the need to develop the knowledge base of aquaculture professionals to cope with the technical and business challenges facing the industry. Through his previous collaboration with NACA on the Shrimp Health Management Workshop, Dan Fegan, Alltech's Asia Pacific Regional Technical Manager for Aquaculture, saw that the course, which had not been run for two years, could be revised to meet today's needs. Following discussions with NACA, Alltech Aqua agreed to organise and underwrite the course with a view to bringing it up to date with industry practices.

The course, the 12th to be held since its inception in 1994, was planned to include as much of the experience and teaching methods of the original. This involved using the same format of lectures and field trips to see actual industry practices. Several of the original lecturers were involved and a few new sessions added to emphasise some of the business aspects of modern shrimp farming.

The first shrimp health workshop was conducted by the Aquatic Animal Health Research Institute (AAHRI) of the Thai Department of Fisheries with support from ODA (Overseas Development Administration) of the UK. After the ODA funding ended in 1998, the Network of Aquaculture Centres in Asia Pacific (NACA) and AAHRI sponsored the continuation of the training course aimed at the training of government staff from NACA member countries.

According to Dr Pornlerd Chanratchakool, who has been involved with the workshop since its inception, "The course was started at a time when shrimp culture was rapidly expanding and disease problems were causing serious losses in many countries." The original aim was to train government staff but, gradually, the private sector joined in the training at their own cost and in the first ten years, around 400 people were trained. A course manual was published, running to three editions, the last published in 1998.

Unfortunately, cost constraints and lack of numbers led to the cancellation of the course for some years and its long-term future was in doubt. At the same time, Steve Bourne, Alltech's Asia Pacific Director, had been discussing setting up an industry-based training program aimed at improving aquaculture production and the idea of developing the NACA course with a more industry-related emphasis seemed an ideal opportunity.

During the Thammachart farm visit, partial harvesting with a seine net.

Dan said, "The fact that attendees came from so far away to attend the school demonstrates the need for such a program. They gained information, from useful strategies for basic shrimp health management to current trends in the shrimp production industry. This year, we also gave more prominence to the business side of shrimp farming than in previous courses".

"It is the current reality that, with increasing competition and pressure on prices, good farm technicians have to be aware of the business factors affecting shrimp farming and be able to make decisions based on sound business as well as good technical principles."

Course participants came from a range of backgrounds, including investors, farm managers, farm technicians and technical service providers for feed companies as well as government staff. The emphasis was on understanding the impact of key management factors on shrimp health rather than simply diagnosis of shrimp disease.

A two day field trip to local hatcheries and farms was included in the program. For some participants from India, the aim was to solve some of the problems in the culture of the black tiger shrimp such as loose shell syndrome and off-flavour. Thailand's achievements in the culture of vannamei shrimp was the pull factor for participants from Indonesia, India and Malaysia.

The course was conducted by experts with a combined total of over 60 years experience in the region's commercial shrimp industry. Both Dan Fegan and Pornlerd (currently Technical Manager for Novozymes), each has over 18 years of experience in the shrimp industry in the region. Professor Chalor Limsuwan is with the Fisheries Department of Kasetsart University and operates his own farm. He has been working on shrimp diseases for over 20 years. Professor Tim Flegel is with the Centex Shrimp at Mahidol University and has been working on shrimp pathology and defense mechanisms for the past 17 years as has Julian Davies, Managing Director of Thammachart Farms and Siam Natural Resources.

Creating a good environment for shrimp

Creating a good shrimp pond environment has a fundamental impact on farming success. According to Dan Fegan, the basic principle is to be able to control and influence the pond environment. This is

From left, Nida A Santiago, Brunei, Mohd Saupee Sudin, Malaysia, Wanidawati Tamat and Pg Hj Ismail, Brunei

Dan Fegan (left) with Suprapto, Tri Ratno, Mai Sony Ardianto from Indonesia

possible within limits by understanding the complex web of biological and chemical processes that take place in the shrimp pond. More recent research has also revealed important effects of temperature on the pathogenicity of some viruses such as white spot (WSSV) and Taura syndrome virus (TSV) and explains why there are more problems when shrimp are stocked at times of lower temperatures.

Interactions between environment and shrimp health were also discussed, including the relationship between pond alkalinity (optimal at >80ppm of calcium carbonate) and incidence of soft shell. A lot of emphasis was also placed on the effect of pH on ammonia (NH_3) and hydrogen sulphide (H_2S) toxicity, especially since the use of high protein feeds and higher stocking densities (and therefore feeding rates) has resulted in an increase of ammonia- and hydrogen sulphide-related problems. At optimal pH levels between 7.5 and 8.5, the toxic forms of both of these gases are minimised and so pH management is a key success factor in commercial culture. As pH increases from 5.5 to 9.5, the toxicity of H_2S decreases but NH_3 increases and a balance is achieved at pH 8.3.

Dan also explained that, contrary to popular belief, the oxygen demand of the shrimp is a small proportion of the total oxygen demand from bacteria and phytoplankton respiration, and that phytoplankton, not aerators, are the major source of oxygen in the pond. Unlike aerators, which mix air, phytoplankton add oxygen to the system. However, in the case of the newer super-intensive bacterial floc systems, phytoplankton oxygen production is small and the high feeding rates used may require direct injection of oxygen to maintain dissolved oxygen levels.

Indications of sub optimal pond water quality

The first sign of bad water quality is dark or blue coloration and slow growth of shrimp, according to Dr. Pornlerd. Other health problems associated with poor water quality are rough shell, gill and shell fouling, leg and tail rot, and white and black spots. Low salinity can result in soft shell and off flavours but excessively high salinity can cause slow growth and increase disease risk. Consistently low DO (<3.5 ppm) reduces feeding and wide pH fluctuation during the day stresses shrimp. Even if such problems are remedied, it can be difficult for the animal to recover and there is usually an impact on growth rates and costs of production. When pond bottom DO is low, postlarvae will move to the surface. Dr. Pornlerd clarified that this is not necessarily an indication of insufficient feed.

Dr Pornlerd Chanratchakool

Water quality is related to pond soil conditions and the aim of pond soil management is to avoid anaerobic conditions. Insufficient drying after a crop can lead to rapid development of bad pond bottom conditions in the subsequent crop. In particular, spots of black soil indicate anaerobic conditions but farmers may fill the pond with water without realising the negative consequences that may arise. Even if the pond water has high DO, an anaerobic layer in the soil can cause problems due to toxic gases such as NH_3, H_2S and NO_2. Benthic algae on the pond bottom can prevent oxygen penetration and, together with dead algae from the water, can quickly drive the pond soil to become anaerobic. This is particularly important in closed water systems.

Bacterial luminescence has also caused problems for farmers in several countries. Following a caution that not all luminescence in pond water is caused by harmful bacteria, Dr. Pornlerd explained some of the ways to reduce luminous bacteria problems in ponds. The use of bacterial products to treat bacterial luminescence is quite widespread but he warned that these are not effective at high salinities (35ppt).

With respect to aeration, Dr. Pornlerd emphasised that the critical

A handle on diseases

Dr Tim Flegel (centre) with Anil Kumar, Tanzania (left) and R Niranjan Reddy, India

Tim Flegel said that the most serious problems from disease are mortality followed by slow growth and bad appearance and taste of shrimp. Causes of disease are multifactorial and there are no simple answers to solving outbreaks of disease in shrimp ponds. Whether a disease is expressed or not depends on the relationship between the shrimp, the pathogen and the environment.

In the case of WSSV, Tim said, "we have learnt that the pond environment is extremely important in determining disease outcome. Some environmental factors that trigger disease outbreaks are rapid changes in salinity, pH and DO_2, and the shrimp factors include nutrition, postlarvae quality and genetics, among others. Evidence also suggests that WSSV outbreaks in *P. monodon* were mostly from postlarvae rather than horizontal transmission since outbreaks have been rare in SPF stocks of *P. vannamei*".

It is important that farmers verify the exact causes of disease and identify the sources of risks. Usually there is a 'panic tendency' to blame unidentified losses on the latest disease agent without any verification, a tendency which Tim calls "flavour of the month". It is also important to realise that gross signs of diseases cannot be taken as conclusive. They merely indicate what to look for in more detailed microscopic examination which he regards as a minimum requirement for disease diagnosis.

Before discussing in detail the diagnosis of each disease occurring in the region, Tim said that, at the farm manager's level, it is important to determine what level of prevalence is acceptable for the culture and what safety margins are to be adopted. This will then dictate the sample sizes and test protocols to be adopted. He also advised that "…any test report should indicate the level of prevalence and the possibility of the disease being present at a different level of prevalence". In the case of WSSV, work by Thakur et al (2002) was cited in which increasing the sample size up to 300 postlarvae increased detection of positive PL batches. PCR test method is also important since 3/73 samples tested positive using one step PCR but 2 step PCR increased this to 33/73 positive samples.

period is the first 30-40 days. Few farmers operate paddlewheels during the first 30 days of culture although, contrary to popular belief, the oxygen requirement during the first 30 days in intensive culture can be more than three times that at later stages as the plankton bloom is not yet stable. Thus the paddlewheels should be run continuously.

The importance of farm records was also emphasised. Many farmers keep records but do not use them well as a management tool. Paying attention to records such as feed, water quality and other parameters can help farmers to identify problems early and take steps to reduce their impact. Therefore, according to Dr. Pornlerd, "…the plan should be to monitor feed consumption, water quality parameters and shrimp health and, by using good farm records, it is easier to identify problems and take remedial steps".

Prof Chalor Limsuwan

Avoiding problems

Current problems in Thailand's shrimp culture include slow growth syndrome in black tiger shrimp and WSSV and TSV in both black tiger and white shrimp, according to Prof Chalor Limsuwan. Of these, WSSV continues to be the more serious problem.

Describing the impact of slow growth syndrome in black tiger shrimp, he said that the size variation at harvest can be from 34 to 300 pcs/kg. In both WSSV and slow growth syndrome, prevention is through using good quality postlarvae. Prof Chalor recommended that black tiger broodstock should be stressed by exposure to low temperature (24-25°C) and then checked for viruses with PCR. He also recommended that nauplii should be tested. If positive, the broodstock or nauplius batch should be discarded. However, he cautioned that hatchery operators are often too disheartened to take such action as they have already paid for the cost of broodstock and nauplius production.

This point was also emphasised by Dan who further recommended that single spawning of females is an important step in preventing transmission of disease between broodstock. Washing of nauplii with clean water, formalin (300ppm/30 secs) and/or povidone iodine (20ppm/30 secs) can also reduce the vertical transmission of viral infections.

"It is unfortunate that black tiger shrimp culture, which is a billion baht industry, is still dependent on wild broodstock and farmers still face the dilemma of unpredictable quality of postlarvae", said Prof Chalor . This makes the task of hatcheries to produce large volumes of quality postlarvae harder. Buyers have to know what they are getting. He advised participants on simple ways to assess the real age of postlarvae such as the number of rostral spines. Each rostral spine represents about three PL stages so that, for example, a PL with 3 spines is around PL9). On prevention of WSSV, he advocated that ponds should not be stocked during rainy and winter seasons, although from his experience, farmers do not heed this especially when previous harvests have been very successful.

Based on his many years of experiences, Prof Chalor went on to explain some success factors in the culture of the white shrimp. These are:

- good quality postlarvae that will grow to 10g in 60-70days and 20g in 90-110 days;
- stocking of larger (>PL12) rather than PL10 (as the gills are not yet developed) and larger shrimp in low salinity ponds;
- using hdpe liners to avoid off flavours from algae and special nets to avoid shrimp curling after harvest; and
- continuous aeration throughout the culture period.

Based on the success of this year's program, Alltech Inc said in its press release, that with NACA, they are now are looking at ways to develop this workshop across the region further in 2006.

Next issue: Details on shrimp diseases and health management will be covered.

Pedro Bueno, NACA with Shery Kurian, Alltech, India, Twinkle Krishna, India and Nida A Santiago, Brunei

Business of aquaculture

Julian Davies, Managing Director of Siam Natural Resources Co. Ltd. (SNR) gave a business perspective of shrimp culture. At SNR's two farms in Trat province, eastern Thailand, the company has farmed both black tiger *P. monodon* and white shrimp *P. vannamei*. Julian explained that some of the important aspects of his management style is to have regular staff training and performance reviews. Openness within the company organisation is also crucial, especially with respect to staff benefits. SNR uses a profit-based system for staff in which the company allocates 8% of annual gross profits. For more transient farm labourers, a direct payment is more effective.

On the some of the technicalities of farming, Julian said that the farm does its own internal checks on the health status of the postlarvae. Water quality parameters such as DO_2, pH and temperature are checked daily. Salinity, ammonia, Vibrio, transparency and alkalinity are checked once every two days. For feeding, the target FCR is 1.4 and, since shifting production to *P. vannamei*, average yields are 12 tonnes/ha.

He said, "We are fairly conservative in our planning for yield. We want to achieve a consistent 10-15 tonnes/ha. We are not interested in maximum yields as we focus on quality of the final product for the fresh/chilled market".

SNR puts a lot of effort into marketing of the shrimp. A major accomplishment was achieving the Carrefour Quality Line (CQL) certification from the French supermarket giant. This took many discussions and 6 months of inspections by Carrefour, Thailand and Carrefour, France to get the CQL certification. This allows SNR to market its produce to outlets in Thailand and they expect to soon be able to export to Korea. However, Julian advised that production should not be targeted to only one outlet. SNR supplies about 40% of its production to Carrefour, the remainder going to other outlets and farm gate sales are through closed bid auctions.

Additionally, they have managed to brand and market seabass, packed individually under the 'Thammachart' brand. For sales in Carrefour and other outlets, they have had to develop in-store displays which adds to their costs.

On future markets, Julian said that shrimp is now a mainstream commodity and as such is subjected to various market forces. Previously, with high prices for shrimp, the cost structure was not heeded. Today, decisions must be based on costs/volume and price relationships. In Thailand, for example, prices went up recently from Baht 110/kg to Baht 160/kg for the 40-50 counts, following the change in the EU's GSP tariff. In the future, he expects prices will continue to fall and thus economies of scale or differentiation to premium markets will be required.

Comments from Industry...

On the developments in the introduction of white shrimp in India

By Dr. M. Sakthivel, President, Aquaculture Foundation of India (AFI) and former Chairman & Director, MPEDA

The Government of India, after witnessing the expansion in the culture of the Pacific white shrimp *Penaeus vannamei* in China and South East Asia, allowed only two companies on a trial basis to import this shrimp to test in the Indian environment, and determine its performance, that is, without any disease problems. Initial trials were successful with production exceeding 8 tonnes/ha. Subsequently there were problems with importing quality brood stock and the companies could not produce quality postlarvae. This led to disease problems including that of white spot syndrome (WSSV).

As a result, farmers could not only culture the shrimp but also developed a feeling that *P. vannamei* was not the right species for India. The Government recently decided at a recent meeting in Chennai not to allow the culture of the vannamei shrimp in India. The word exotic does not bode well for aquaculture scientists in India.

However, white shrimp has attained a global status as the number one shrimp species and the credit goes to scientists who developed it against disease resistance. The progress of such research work is slow in India. The advantages it has over the black tiger shrimp *P. monodon* are unquestionable. If *P. vannamei* culture goes on with such rapidity and without any serious disease problem in the coming years, countries like India which is stuck with tiger shrimp with all its disease problems, will find it difficult to survive.

Since shrimp is the mainstay of India's seafood export, the government may not want exports to fall. A meaningful decision will have to be taken soon to save shrimp production in the country. As long as *P. vannamei* is considered as the global shrimp, its sustainability in the long run will be a major issue for deciding on the introduction of this exotic species. How long does one have to wait and see is a big question. Risk is sometimes inevitable in such introductions. If the majority of farmers decide to take the risk, the government may invariably be obliged to agree in order to avoid its illegal entry.

The efficacy of poultry hydrolysed proteins and peptides on the growth performance and feed efficiency of *Penaeus vannamei* juveniles

By Wutiporn Phromkunthong and Kidchakan Supamattaya

In trials conducted during 2005, the research team at the Prince of Songkla University, Thailand demonstrated that growth performance and feed efficiency of the white shrimp improved with the addition of several sources of poultry hydrolysed proteins and peptides added to diets at inclusion rates of 1 to 2.3%.

The trials were conducted at the university's pond facility in the Satun Campus, Amphur Lagnu, South Thailand. In each cage, 100 *P. vannamei* shrimp of 6g initial weight were held in 1.4x1.4x2.0m cages submersed in an earthern pond measuring 71x83m and 1.7m deep. The cage bottom was about 10cm above the pond bottom. Cages were well aerated. A completely randomized design was used in the 6 week trial. There were 5 replicates for each treatment.

Experimental cages in the pond

In the pond, water quality parameters such as pH, temperature, salinity, transparency and alkalinity were monitored daily. Dissolved oxygen, ammonia, nitrite, plankton and bacteria were checked weekly. The necessary adjustments to water were carried out. These were applications of lime and $NaHCO_3$ for pH and alkalinity, fertilizers for pond fertility as determined by water transparency and colour. Zeolite and dolomite were applied to reduce ammonia in the pond.

Treatment diets

A total of six treatment diets supplemented with various sources of poultry hydrolysed proteins and peptides and which function as attractants and soluble proteins were incorporated into diets. The crude protein levels of the supplements range from 12-14% for the liquid form and 62 to 70% for the powder form. These were added at 1.4% for poultry hydrolysed protein (PHP), 1% for AquaTrac L, 2.3% for AquaTrac SD and 1% for AquaTrac P. The supplements were added in the following way for diets T3, T4, T5 and T6. In diet T3, AquaTract L was dissolved in water whereas for T4, oil was the solvent. In diet T5, AquaTrac SD was mixed directly. AquaTrac P was dissolved in water for diet T6 and mixed directly for diet T7.

Table 1. Proximate analysis of treatment diets (% dry matter basis)

	Diets	Moisture*	Protein*	Fat*	Ash*	Ca	P	NaCl
T1	Control	9.81 ±0.19	35.79 ±0.32	4.16 ±0.10	12.45 ±0.30	2.83	1.56	1.98
T2	PHP**	9.68 ±0.27	35.86 ±0.10	4.19 ±0.19	12.47 ±0.06	2.34	1.38	2.01
T3	Aqua L+ H2O**	11.08 ±0.18	35.12 ±0.64	4.74 ±0.21	12.24 ±0.18	2.51	2.81	1.27
T4	Aqua L+ oil**	10.02 ±0.15	34.59 ±0.39	7.89 ±0.28	12.09 ±0.13	3.37	1.88	1.93
T5	Aqua SD**	9.57 ±0.19	35.56 ±0.34	4.35 ±0.31	12.48 ±0.10	2.19	2.76	2.21
T6	Aqua P+H2O**	13.44 ±0.32	34.00 ±0.44	4.21 ±0.34	11.71 ±0.41	1.43	1.48	2.18
T7	Aqua P mixed**	9.86 ±0.17	35.68 ±0.25	3.77 ±0.40	12.59 ±0.40	2.24	2.23	2.73

**analyses are mean ± standard deviation of three replications*

*** T2: PHP-poultry hydrolysed protein/peptide (min 70% CP); T3: AquaTrac L –prepared with water as solvent (light brown viscous liquid, moisture 70-75%, 12-14% CP); T4: AquaTrac L prepared with oil as solvent; T5: AquaTrac sol SD (light brown powder, min 70% CP); T6: AquaTrac P prepared with water as solvent (fine light brown powder, 62% CP); T7: AquaTrac P mixed into the diet. All products are from GePro Geflügel Protein, Germany*

The basal feed contained 35% protein (Table 1) and was prepared by Inteqc Feed Co, Thailand. The proximate analysis of the experimental diets was according to AOAC (1990).

Feeding at a rate of 3-5% body weight per day was carried out 4 times a day at 0700, 1300, 1900 and 0100 hrs. Feeds were placed in 60x60 cm feed trays. The feeding rate was 5% on the first day of the rearing period and after that shrimp were fed until satiation by checking feed trays every 2.5 hours. The cleaning of the feed tray and cages was carried out at intervals of 2 days and 1 week, respectively. Feed consumption of shrimp was determined everyday. Weight measurement was done every two weeks
by sampling 10 % of white shrimp in each cage (at week 2 and 4).

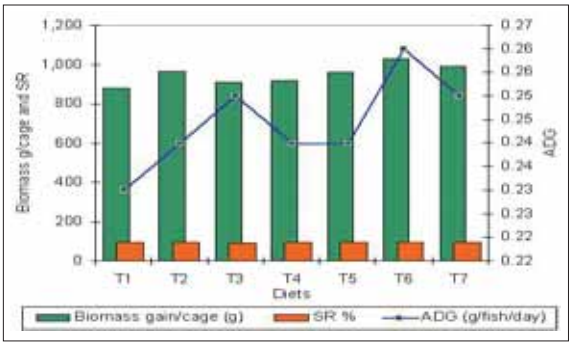
At the end of the trials, all of the shrimp in each cage were weighed. The number of surviving shrimp was recorded. The determination of weight gain was based on the total biomass in each cage. The calculations were made for feed consumption (g/shrimp), average daily gain (ADG) and feed conversion ratio (FCR). Thirty shrimp at the

Table 2. Average body weight of white shrimp fed treatment diets for 6 weeks*

Experimental group		Rearing Period			
		0	2	4	6
T1	Control	6.17±0.14	9.66±0.29^a	13.21±0.52^a	15.78±0.07^a
T2	PHP	6.17±0.21	9.71±0.46^a	12.65±0.66^a	16.25±0.32^b
T3	Aqua L+ H2O	6.17±0.15	9.63±0.68^a	12.65±1.22^a	16.44±0.33^b
T4	Aqua L+ oil	6.17±0.13	9.47±0.43^a	13.51±0.25^a	16.32±0.28^b
T5	Aqua L SD	6.18±0.19	9.66±0.12^a	13.28±0.32^a	16.36±0.17^b
T6	Aqua P+H2O	6.18±0.09	9.96±0.65^a	13.38±1.19^a	16.92±0.50^b
T7	Aqua P mixed	6.17±0.17	9.77±0.75^a	13.69±0.43^a	16.46±0.44^b

** Mean ± standard deviation of five replicates. Means within each column not sharing a common superscript are significantly different (p<0.05).*

Figure 1. Biomass gain per cage, average daily weight gain (ADG) and Survival of shrimp fed 7 treatment diets



beginning and 10 shrimp at the end of the experimental period of each treatment were sampled for protein analysis for the calculation of protein efficiency ratio (PER) and apparent protein utilization (ANPU).

Growth performance

After the 6-week feeding period, the average body weight of shrimp fed treatment diets 2 to 7 was significantly higher than shrimp fed the control diet T1. Individual weights increased to 16.25-16.92 g which was significantly higher ($P<0.05$) than shrimp fed the control diet which was 15.78g. However, there was no significant differences among treatments T2-T7 ($p>0.05$) (Table 2).

No significant difference was noted for ADG (average daily growth) among treatments T1 and T2 which ranged from 0.23 to 0.24. It was however, lower and significantly different ($p<0.05$) than those of T3, T6 and T7 which ranged from 0.25 to 0.26 (Figure 1).

Table 3: Feed conversion ratio (FCR), protein efficiency ratio (PER) and apparent net protein utilization (ANPU) of shrimp fed 7 feeds*

Experimental group		FCR	PER	ANPU(%)
T1	Control	1.82±0.25^{a}	1.68±0.23^{a}	34.69±0.18^{a}
T2	PHP	1.70±0.06^{a}	1.76±0.06^{a}	38.75±1.45^{bc}
T3	Aqua L+ H2O	1.68±0.10^{a}	1.85±0.11^{a}	41.33±1.14^{c}
T4	Aqua L+ oil	1.63±0.10^{a}	1.86±0.12^{a}	37.45±1.78^{b}
T5	Aqua SD	1.69±0.16^{a}	1.80±0.20^{a}	37.56±0.28^{b}
T6	Aqua P+H2O	1.64±0.11^{a}	1.79±0.12^{a}	38.37±2.84^{bc}
T7	Aqua P mixed	1.64±0.09^{a}	1.87±0.10^{a}	40.40±1.03^{c}

** Mean± standard deviation of five replicates. Means within each column not sharing a common superscript are significantly different ($p<0.05$)*

The biomass gain per cage of shrimp was higher for T2 to T7 than for T1. It was highest for T6 (AquaTrac P with water as solvent). There were no differences among treatments ($p>0.05$). Survival ranged from 92.8 to 98% for T1 to T7 with small mortality occurring during weight monitoring and not during the feeding period in the cages. Survival was not significantly different among treatments.

Feed efficiency

Feed conversion ratio (FCR) ranged from 1.63-1.70 for T2 to T7 which was lower than for T1 (1.82). Supplementation of attractants in the feeds improved FCR but these were not significantly different among treatments ($p>0.05$).

Protein Efficiency Ratio (PER) ranged from 1.76-1.87 for T2 to T7 which was higher than for T1 (1.68). This demonstrated that all attractants supported a better utilization of feed protein for shrimp tissue. No significant difference was noted for PER among treatments ($p>0.05$) (Table 3)

The apparent net protein utilization (ANPU) for all treatments differed, forming 3 groups. The lowest value was shown by the group fed T1 diets (34.69%); the second with moderate ANPU for T2 (38.75%), T4 (37.45%), T5 (37.56%) and T6 (38.37%) while the last group with the highest ANPU was for T3 (41.33%) and T7 (40.70 %). Significant difference existed for ANPU among treatments ($p<0.05$).

Conclusion

Results indicated that all four variations of poultry hydrolysed protein and peptides are beneficial to growth and feed efficiency of the white shrimp *P. vannamei*. The survival rates in all treatments were high and did not show any significantly difference. The preparation of poultry hydrolysed protein and peptides using either water or oil produced no difference for all parameters studied. It was concluded that poultry hydrolysed protein and peptides can be used as feed additive enhancing the growth performance and feed efficiency in white shrimp (*P. vannamei*).

Dr. Wutiporn Phromkunthong

Dr. Kidchakan Supamattaya

Dr. Wutiporn Phromkunthong and **Dr. Kidchakan Supamattaya** are Associate Professors at the Department of Aquatic Science, Faculty of Natural Resources, Prince of Songkla University, Hat Yai, Songkla, 90112, Thailand
Email address: yh27394@yahoo.com

Managing feed moisture in aquafeeds

By Steven Goh

Aquafeeds producers in Asia have opted for lower moisture levels to minimize water activity for a better shelf life to maintain feed quality. In this article, Steven Goh explains the theory and practicalities in managing moisture in aquafeeds.

Ideally, fish and shrimp feeds can be produced with 12-13 % moisture on a wet weight basis. However, to contend with free water migration problems to the sealed edges of feed bags and general problems with spoilage, feed producers have opted for lower levels ranging from 9-10% instead. Although this may guarantee pellet stability and quality during storage, it also means unnecessary drying costs and extreme losses due to shrinkage. Thus, in Asia, the challenge is to manage moisture in feed processing and the final finished feed.

What is moisture management?

Attempts to make feeds with higher moisture content are far more complex than what many would otherwise think so. In feed processing, moisture management is basically an understanding of the moisture requirements during the entire feed production process. It is also an understanding of steam quality, how to improve heat and moisture uptake of feed particles to improve conditioning for the best pellet quality and feeding value. The control and adjustment of steam going into the conditioner can be very complex too as the steam moisture content, heat content, and temperature are all closely related. You simply cannot call for one variable without seeing the effects from another. Pellet press operators know too well how their work can be restricted in their attempts to regulate and adjust steam and would normally be contented with a trade-off at the expense of machine performance and pellet quality. This is why it is so important to work with the ideal steam quality.

Understanding the difference in climatic condition

Temperature of the compounded meal plays an important role in water absorption. In cold countries, the temperature of the meal can be between 5-20°C depending on seasons. Compounded meal temperature in the hot tropics normally range from 32-33°C. Lower meal temperature has better moisture absorption capability. Thus compounded meal in a cold environment, have far more moisture uptake capability from steam (5-6%) than compounded meal in a hot environment (3.5-4%), given the ideal steam quality. This will of course dictate the conditioning efficiency and final pellet quality. In general, super-heated steam has worked well in the cold countries, as it provide the necessary heat to warm up the feed at the start of conditioning. On the contrary, countries located in hot climates need to work with saturated steam as moisture from steam is needed to come out first to provide the required water to enable cooking. As a fact, many companies in the hot regions are not aware that they are struggling with super-heated steam, which in combination with a higher compounded meal temperature actually restrict moisture absorption down to about 2-2.5% only, greatly affecting conditioning, pelleting, and overall machine performance.

Steam for pelleting

The function of steam in pelleting is to provide both heat and moisture to the meal so that proper cooking can take place. For example, the proper conditioning opens starch cells and transform the granules within the matrix in raw corn, disrupting the organization of amylose and amylopectin molecules which reform around other ingredient molecules in a process known as gelatinization. The degree of gelatinization (by DSC analysis) will determine how well the feed has been cooked and conditioned. Sufficient retention time in the conditioner will result in proper protein solubilization and starch gelatinization leading to the eventual polymerization of the protein and starch molecules within the feed ingredients that will contribute to the proper binding and formation of the pellet feed, with minimal fines. A well cooked and conditioned feed has a slightly darker color as a result of caramelization of residual sugars. The pellet formed will have a shiny and smoother surface with no jagged or rough edges.

Finding solutions

The science of steam conditioning has been delved by many. In developing a proper moisture management program, we need to understand the physics of steam and the chemistry of binding free water for better moisture uptake. Water is a good plasticizer for the polymerization of protein and gelatinized starch. DMX-7, a conditioning mold inhibitor, provides the ideal "moisture management" program for the feedmill. It has an international patent on the use of deliquescents, chemical substances that physically bond to water molecules and have been proven to aid moisture uptake into the feed particle.

Attributes of a complete moisture management program:

- The pellet press works at its best when we can get the conditioned meal at 16-16.5% moisture content. So how do we get the moisture of the conditioned meal up to this level?
- Back-tracking to the mixer, we need to ensure that the compounded meal has a moisture content (mc) of around 12.5%. Using raw material that is extremely low in moisture would certainly affect the mc of compounded feed. Any amount of moisture brought over by raw material will be beneficial to the conditioning and pelleting process. Moisture management of the raw material will be another issue to work on. Run moisture analysis to determine mc level of compounded feed. If the analysis on a certain ration shows a low mc level, take the decision to add water into the mixer. Due to the short mixing time, it is recommended that water addition into the mixer do not exceed 1.5%.
- Most feedmills are working with super-heated steam without realizing the detrimental consequence to conditioning and pelleting. There is a need to understand that the steam piping needs to be re-configured to get the ideal steam quality i.e. saturated steam @ about 103°C. Saturated steam will readily gives off water when it comes into contact with the meal in the conditioner. This will give out about 3.5-4% moisture to the meal during conditioning.
- Compounded feed with 12.5% mc plus 4% moisture from steam will provide us the 16.5% moisture after conditioning. The use of DMX-7 will greatly enhance moisture uptake from steam into the feed particle. This is a chemical solution as the warmer feed (33°C) produced in a hot environment is basically handicapped in moisture uptake. As explained above, it is inherent that moisture uptake is

chemically assisted for proper heat and moisture uptake for cooking to take place.
- Sufficient uptake of heat and water during conditioning will ensure that the meal is now properly cooked and conditioned for all the right attributes to take place.
- The objective would be to produce a higher moisture feed closer to 13% moisture. However, this finished higher moisture pellet should also maintain a minimum water activity with good shelf life against mold contamination and maintaining feed quality. DMX-7, with the same deliquescents, now plays a pivotal role in keeping all the moisture in place within the feed particle and feed mass in general in maintaining the formulated feed quality.

Bottomline

For the feed producer, better gains are associated not only with the production of feeds with higher moisture levels in accordance with requirements but with increased mill performance, lower energy cost per tonne produced, better pellet quality, better feed quality, better feeding value, and longer shelf life. It is a complete understanding of the entire moisture management concept and the use of deliquescents that can provide for such possibilities. The industry has learnt to keep moisture of feed stuffs and finished product at a low level so that spoilage can be kept at a minimum. We now have the know-how and experience to work with moisture to our benefit with added gains and be able to recover much more of the unnecessary losses.

Steven Goh is Regional Business Director with Delst Inc. He is based in Kuala Lumpur. Steven has been involved in the feed milling industry since 1983. He has carried field research work on grain storage and feed processing in the hot tropics. Email: steven@delstasia.com

Vet Superior in Korea

Thailand's Vet Superior attended the Korea International Livestock Expo 2005 (KISTOCK 2005) in Daejeon, Korea held from 31 August to 2 September, 2005.

Their booth (pictured) displayed animal and aquaculture feed ingredients, fish and shrimp larval feed, fermented and hydrolysed soybean meal as well as organic mineral complexes (chelates and proteinates). Dr Winai Chottianchai, Managing Director said that it was a very successful event as they received a number of visitors with queries on distributorship for the company.

ILDEX 2006 in Vietnam and India

In 2006, NEO, Asia's leading livestock exhibition organizer will team up with local partners and launch brand new international aquaculture and livestock expos in two of Asia's most promising markets, the shows will be designed to serve the technological demands of these two specific countries.

In Vietnam, NEO is teaming up with Vietnam National Trade Fair and Advertising Company (VINEXAD) for ILDEX Vietnam 2006, scheduled for 16-18 March 2006 in Ho Chin Minh City, Vietnam. While for ILDEX India 2006 in India, NEO's partner is PIXIE, or Publication India Pvt. Ltd. ILDEX India 2006 is scheduled on 28-30 June 2006, New Delhi, India.

The exhibitions will be a showcase for the aquaculture, poultry, swine and cattle industries, feed production and management, animal health, transport and packaging. In addition to the trade exhibitions, there will be seminars plus 'Meet & Match' sessions offering excellent business opportunities for both buyers and sellers.

(More information, contact: Mrs. Rungphech Chitanuwat; N.C.C. Exhibition Organizer Co., Ltd. E-mail: ildex@qsncc.co.th Website: www.ildex.com)

Part 2 Feed management

The feeding and nutrition of the tilapia

By David Creswell

In first part of this article, the author discussed developments in the culture of tilapia in ponds and cages and reviewed available data in tilapia nutrition. Here, aspects of feed management are covered with suggestions on what will be required for the industry to move forward.

Feeding tilapia in cages with floating pellets in the Mekong Delta in Vietnam

Feeding frequency

A trial in Thailand compared feeding frequencies of 2, 3 or 4 times daily. Hybrid red tilapia was stocked in 12 cages of 100 m^3 each at a density of 3,800 per cage. Cages were suspended in a one ha pond. Fish were fed ad *libitum* 2, 3, and 4 times daily for comparison. Commercial extruded feed of 25% crude protein was used. Water salinity was 15-18 ppt and dissolved oxygen was controlled at a minimum of 3.5 ppm. The water temperature was 28-32°C. The pond was equipped with 2 long-armed paddle wheels (18 paddles and 3 hp electric motor each). The experiment lasted for 60 days.

Results in Table 1 showed that there were significant differences in harvest biomass, average fish weight, food conversion ratio and average daily weight gain. Feeding ad *libitum* 3 and 4 times seemed enough and suitable for tilapia in the grow out stages. Feeding twice daily led to a higher food conversion ratio. Thus, one could consider feeding only 3 to 4 times per day.

Table 1. Performance of fish fed ad libitum 2, 3 and 4 times daily

Treatment	2 times	3 times	4 times
Culture period (days)	60	60	60
Initial number	3,800	3,800	3,800
Initial mean body weight (g)	320	320	320
Initial biomass (kg)	1,216	1,216	1,216
Harvested number	3,695	3,720	3,725
Harvested mean body weight (g)	595.5	641.5	674
Harvest biomass (kg)	2,205	2,387	2,510
Survival rate (%)	97	98	98
Daily weight gain (g/fish/day)	4.59	5.36	5.9
Biomass gain (kg)	989	1,171	1,294
Feed given (kg)	1,295	1,358	1,449
Food conversion ratio (FCR)	1.31	1.16	1.12

Pellet versus extruded floating feeds

Two studies with similar design conducted by the American Soybean Association (ASA) in China compared pelleted sinking feed with extruded floating feeds. Both trials demonstrated better performance and better economics for extruded feeds. The first study conducted in Linfeng in 1996. Starting weight was 120g and finishing weight was 600g which was attained in 119 days. A floating fish feed without fishmeal gave the best performance in terms of final body weight, feed conversion and net income, taking local ingredient price and feed processing into account (Table 2).

A second study was conducted in Songxi in 1996. Hybrid tilapia was cultured from 17g to 228g in 90 days. Again, the floating feeds gave superior performance in terms of final body weight, feed conversion and net income (Table 3).

Table 2. Effect of sinking vs. floating feeds on tilapia performance and net income

Fishmeal %	Form	Harvest, kg/m^3	Weight, g	Survival, %	FCR	Net income, RMB/m^3
5	Sinking	194	588	100	1.4	540
5	Floating	200	608	99.7	1.4	525
0	Sinking	192	583	100	1.4	504
0	FloatinQ	203	615	100	1.3	562

Table 3. Effect of sinking vs. floating feeds on tilapia performance and net income

Fishmeal %	Form	Harvest, kg/m^3	Weight, g	Survival, %	FCR	Net income, RMB/m^3
5	Sinking	86	216	99.8	1.6	293
5	Floating	101	254	99.6	1.5	417
0	Sinking	84	210	99.8	1.7	275
0	Floating	93	233	99.9	1.5	350

Suggested feeding regimes

Feeding rate and feeding frequency influence fish growth and food conversion ratio. A high feeding rate may result in good fish growth but food conversion cannot be ascertained. The suggested feed type and feeding regime as shown in Table 4 are widely used for intensive

Table 4. Suggested feed specification and feeding practices for intensive culture

Feed type	Feed Size (mm)	Fish size (g)	Protein (% min)	Fat (% min)	Fibre (% max)	Feeding rate (% bw/day)	Frequency (meals/day)
Crumble	<0.6	<0.5	40	4	4	20	6
Crumble	0.6-1.0	0.5	40	4	4	15	6
Crumble	0.6-1.0	1	40	4	4	11	6
Crumble	0.6-1.0	1	40	4	4	9	5
Extruded	1.4-2.4	2	40	4	6	6.5	5
Extruded	2.4	10	30	4	6	6.5	5
Extruded	2.4	15	30	4	6	4.6	5
Extruded	2.4	15	30	4	6	4.6	4
Extruded	3.2	30	30	4	6	3.6	4
Extruded	3.2	60	25	4	6	3	4
Extruded	4.8	100	25	4	6	2.6	4
Extruded	4.8-6.0	175	25	4	6	2.2	3
Extruded	6.0-8.0	300	20	4	8	1.8	3
Extruded	8.0-10	400	20	4	8	1.5	3

culture of tilapia in ponds and cages in Southeast Asia. This table is applicable for a water temperature of 28-32°C. At higher or lower water temperatures, feeding rate and frequency should be adjusted accordingly.

In countries such as Malaysia, Indonesia, and Thailand in which tilapia has been widely cultured, farmers always look for a feed of quality-price advantage. Extruded/pelleted tilapia feed of 20% crude protein is commercialised and regularly used in the grow-out phase. Field data reveal that such feed (20% protein) becomes very economic in pond and cage culture with a harvested biomass of 20 tonnes/ha and 50 kg/m^3 respectively. Carbohydrate sources, which are locally abundant such as rice bran, wheat bran, corn, sorghum and palm oil meal provide energy in tilapia feed formulations. Feed type, specification, feeding rate and frequency are presented.

Tilapia can be fed by hand or by automatic or demand feeders. High feeding rates are used for first feeding tilapia up to a few weeks to ensure enough feed quantity. Juvenile tilapia is often fed 3 to 4% of body weight daily. A 1.5% feeding rate was considered optimal for fish from 250 to 400g. A lower feeding rate of 2% of body weight has been recommended for a species reared in seawater, *O. spirulus*, and also for *O. aureus*.

Practical tilapia feeds

The nutrient requirements for the tilapia are shown in Table 5. Least-cost programs have been widely used for feed formulation. The nutrient constraints and ingredient restrictions depend upon available ingredients, nutritional requirements as well as feed processing.

Commercial tilapia feeds used in Thailand, Indonesia, Malaysia, Vietnam and also China are usually formulated with a high inclusion level of locally available feedstuffs especially carbohydrate sources as rice bran, wheat bran, corn, cassava and, to a lesser extent, sorghum. Such raw materials are very seasonal but have proven to be of high quality and cost-effective.

Table 6 shows some examples of suitable tilapia diets which might be produced in South East Asian countries. Such diets when formulated in early 2005 would have total ingredient costs of around USD 300, 250, 220 and 200 per tonne for the prestarter, starter, grower and finisher diets respectively. The nutrient basis on which these diets were least-cost formulated can be seen in the bottom part of the table.

Table 5. Constraints and restrictions of least-cost program for tilapia formulation

Constraint	% restriction	Prestarter	Starter	Grower	Finisher
Protein	min	40	30	25	20
Fat	min	4	4	4	4
C. fibre	max	4	4	6	8
Lysine	min	2.04	1.53	1.28	1.02
Methionine	min	0.68	0.51	0.43	0.34
Methionine+Cysteine	min	1.28	0.96	0.80	0.64
Tryptophan	min	0.40	0.30	0.25	0.20
Threonine	min	1.44	1.08	0.90	0.72
Arginine	min	3.00	2.25	1.88	1.50
Isoleucine	min	1.72	1.29	1.08	0.86
Valine	min	2.00	1.50	1.25	1.00
Fatty acids (omega-3)	min	0.5	0.5	0.5	0.5
Fatty acids (omega-6)	min	0.5	0.5	0.5	0.5
Calcium	min	1.6	1.4	1.2	1.0
Available P	min	0.8	0.7	0.6	0.5
Starch	min	25	25	25	25
DE, kcal/kg	min	2800	2800	2800	2800
Vitamins/trace minerals	fixed	2	2	2	2
Fishmeal	min	15	12	10	8
Rice bran	max	20	30	no limit	no limit
Wheat bran	max	10	15	no limit	no limit
Rapeseed meal	max	5	10	15	20
Cottonseed meal	max	5	10	15	20
Corn/cassava/sorghum	min	10	10	10	10

Table 6. Examples of commercial tilapia diets (kg/tonne)

Ingredients Feed size, mm	Pre starter 0.6-2.4	Starter 2.4-3.2	Grower 3.2-6.0	Finisher 6-10
Fish size, g	0.5-2	2-30	30-175	175-500
Corn	0	0	31.2	148.8
Rice bran	0	246.4	350	350
Wheat bran	100	100	100	100
Cassava	67	100	100	100
Soybean meal (47%CP)	624	385	273	211
Fishmeal (60%CP)	150	120	100	50
Fish oil	40	30	30	20
Limestone	6	7	7	8
Dicalcium Phosphorus 18	11	9.6	6.8	10.2
Vitamins/trace minerals	2	2	2	2
Total, kg	1000	1000	1000	1000
Protein (actual), %	40	30	25	20
Lysine (min), %	2.04	1.50	1.25	1.00
Methionine (min), %	0.68	0.51	0.43	0.34
Meth & Cys (min), %	1.28	0.96	0.80	0.64
Tryptophan (min), %	0.40	0.30	0.25	0.20
Threonine (min), %	1.44	1.08	0.90	0.72
Arginine (min), %	3.00	2.25	1.88	1.50
Isoleucine (min), %	1.72	1.29	1.08	0.86
Valine (min), %	2.00	1.50	1.25	1.00
Fat (min), %	6	5	4	4
Crude fibre (actual), %	3.5	4.7	5.2	5.2
Calcium (actual) %	1.6	1.4	1.2	1.0
Available P (actual) %	0.8	0.7	0.6	0.5

Note: There is no dietary requirement for sodium for tilapia raised in seawater. However when raised in freshwater, 1.5 g sodium/kg diet is required.

The way forward

The tilapia industry must progress as a specialised commercial industry, moving away from subsistence type of production and to some extent following the broiler chicken production model, which has been so successful worldwide.

This will require:

- A specialised, separate breeding industry, supplying fingerlings and breeding stock of selected, fast growing tilapia strains
- A grow-out industry, producing quality market weight fish within a 3 months growing period.
- High quality feeds, in 4 stages, pelleted or extruded, formulated on a digestible amino acid basis and with amino acid levels 5-10% higher than those indicated in Table 6. Such feeds should allow a FCR close to 1:1, as has been shown experimentally.
- Post-harvest handling and processing to maximise flesh quality on arrival to the consumer.

Dr David Creswell, an animal nutritionist specialises in ingredient quality, use of ingredients, and in current nutrition and formulation concepts for poultry and swine, including digestible amino acids, and in application of nsp and phytase enzymes. He currently runs a consultancy business based in Australia (Creswell Nutrition), focused on providing nutritional support for clients throughout Asia. He has published over 75 research and industry papers. Address: 12 Beaconsfield Road, Mosman, NSW 2088, Australia Email: creswell@zip.com.au

GePro in Asia

German company GePro Geflügel Protein is demonstrating its commitment to the Asian market with a representative office in Bangkok, Thailand. Based in Diepholz, it is a member of the PHW group, one of the largest European manufacturers of poultry products. It is also part of the fully integrated business.

At the inauguration, Ge Pro's team and guests. From left: Ashish Kulshrestha, Joachim Hertrampf, Bernd Grobe Holthaus, Axel Foellmer, Lohmann Animal Health (Thailand) and Franz-Peter Rebafka

At the inauguration of this office in September, Bernd große Holthaus, Managing Director presented a brief background of the company. The company processes 85% of the poultry by products in the German market into digestible hydrolysates and guarantees that products are 100% poultry based and sourced from the human food grade chain. A new processing plant in East Germany will start in October, 2005. Since 1965, GePro, with an annual sales turnover of 42 million Euros, has taken a strong position in aquaculture with its AquaTrac® range of attractant, binders and protein sources.

"In Asia, Thailand is one of the most important markets for us and this is a reason for locating the office here in Bangkok. Our turnover from our activity in Asia was USD 1 million and in two years, this increased to USD 8 million. Next year we will focus more and more on the Asian market where we see a big potential, especially in the aqua and petfood industries".

He added, "We also see increasing demand for high quality products to substitute for fish meal. Our target is to deliver raw material of high quality to meet both the demand in animal nutrition with respect to digestibility and which protects the environment. We will spend more resources on R&D on our products".

According to Dr. Franz-Peter Rebafka, Product Manager, the thrust on the aquaculture market in Asia was derived after the World Aquaculture 2004 meeting in Hawaii. Since then, they have made rapid progress with several trials on the use of these hydrolysates on fish and shrimp in Thailand and India. Trials are ongoing in China and Philippines. Currently, these are already used in shrimp and fish feeds in Thailand and Philippines. At the launch, Dr Wutiporn Phromkunthong of Prince of Songkla University, Thailand presented results of trials on the use of hydrolysed protein based products on *P. vannamei* shrimp in Thailand (see page 28).

Dr Joachim Hertrampf, a consultant in aquaculture nutrition shared his experiences on the use of fish protein hydrolysates in shrimp feeds. All hydrolysates have high protein content and protein digestibility as well as superior chemo attractant properties from the amino acid composition. In earlier work in 1989 in Indonesia, up to 3% hydrolysates from fish protein in shrimp feed showed improvements in growth of up to 60%.

In the more recent trials with these poultry based hydrolysates (delivered by GePro) at the Waterbase's R&D facility in India, additions of 1-2% into 42% protein diets for the black tiger shrimp *P. monodon* resulted in weight gain increases of 115% and 131%, respectively, after 50 days of culture. Improvements in FCR were from 1.49 in the control group to 1.37 in the group fed 1% hydrolysed protein concentrate and 1.09 in the group fed 2%. The molting rate was higher in the treatment groups. Joachim added that preliminary results on the pellet binding effect of the ingredients are also promising.

The representative office will be headed by Ashish Kulshrestha, previously from the Phosphates company of the Aditya Birla Group. Ashish who has a B.Tech. in Biochemical Engineering and a MBA from SP Jain Institute of Management & Research, Mumbai, India will be responsible for the sales and marketing of GePro products for the animal, pet and aqua feed industry in Asia.

'Speed line' postlarvae to speed up harvests in Thailand

Genetic company SyAqua Siam has introduced a new line of postlarvae which promises better growth and survival rates for the 2005 culture season in Thailand. Labeled as "SyAqua Speed Line", this is the result of *P.vannamei* broodstock imported from its genetic nucleus unit in Hawaii.

SyAqua Speedline broodstock

Glen Iling

"Our mission is to deliver genetic improvements throughout Asia to give farmers a competitive advantage. With the new line, we offer shrimp producers two options; shorten production cycles whilst keeping the harvest weights constant or harvest higher weights under the same culture cycle", said Glen Iling, Manager of SyAqua Siam.

According to the company, in any culture activity, there are several economic interactions which are also extremely important. The key influences are the farmers' experiences and techniques which are related to location and environment, nutrition and farm feeding systems. Encompassing all these is the overall health of the shrimp which includes biosecurity feed and genetics of the animal. As a pure genetic company, their role is to develop lines to improve growth rate (g/week), survival rate which can influence stocking density and to improve harvest weight. Simultaneously, they have to ensure quality such as percentage of tail meat.

The first batch of shrimp from SyAqua Hawaii line was imported into Thailand in August 2004 and the first batch of postlarvae was launched in December 2004. Shrimp from the third generation of the program initiated in Hawaii has been introduced into Thailand. There has been a 5% improvement per generation which the company attributes to its genetic improvements program based on family structure and exercising optimal traits both between and within family selection. The phenotypic superiority of this 'speed' line is shown in figure 1, which represents a genetic gain of 2.4g in the next generation versus only 1.6g under standard selection schemes.

"With the 'speed line', we try to hit at improving growth. Small changes in genetics can result in large economics improvements. If growth can be marginally increased by 0.1g/week, survival by 5%, stocking density by 12%, harvest weight by 5%, improvements in revenue can lead a profits increase of 20%, taking into account the added feed costs etc. With the new line, we have achieved targets of 2-3g/week with 90% survival in our research facility. But at the moment, our commercial targets are 1.5 to 2g/week and a harvest of 50pcs/kg in 100 days and 40pcs/kg in 120 days", said Glen.

Parallel trials are being carried out in commercial ponds and at SyAqua genetic nucleus unit. This will evaluate side by side in the same environment, the growth and survival rates of tagged "speed line" animal versus those of regular commercial postlarvae. The last intermediate sampling when average shrimp weight was 6.9g showed a superiority of 1.2g for the 'speed' line animal. Customers' performances from Krabi, Surat Thani, Chantaburi and Songkhla already showed growth rates of 1.4g/week and harvest weight at 50 pcs/kg.

The company said that the 'speed line' concept will continue to be developed and refined alongside a more profound genetic evaluation of the different stock and lines. New and comparative test will continue to be conducted throughout next year and it hopes that by the beginning of 2006, more commercial data of this new product will be available.

Next is to look at increasing stocking density. Laboratory trials indicated the possibility to reach a density to 600 PL/m^2 but this must be matched with quality of products. However, given the level of farm technology in the country, the recommended commercial target is a density of up 150/m^2 for single harvesting and 250/m^2 if partial harvesting is practiced. Farmers will need to improve monitoring protocols for such high intensities of culture.

SyAqua has a long term view of its role in the shrimp industry of Thailand. It is using historic experiences of the parent company, Sygen in swine genetics industry for shrimp culture. And corresponding to the statement "the better the farmer, the more chance of getting the genetic potential", the company prides itself on the health assurance of its postlarvae and advisory services to "assist farmers to be in control of the system".

"As a genetics supplier, we are focused on increasing farm performance. We are not a feed supplier, farming, nor an equipment or chemical supplier. We therefore do not have any conflicts of interest and are dedicated to improving the farmers revenue. aligned to the farmers not in farming but we need to help the whole of this economy work. We look at traits such as growth rate, survival, reproductive performance and tolerance to salinity, cold etc. Our aim is to help farmers to produce the quality of the product their customers will be demanding in the future such as increased tail yields and meat quality, all of which is aimed at providing the farmer and processors with more revenue", said Glen. (more information: www.syaqua.com)

(related article: Self regulation in white shrimp hatchery business of Thailand. Pp20-22. AQUA Culture AsiaPacific, Jan/Feb. 2005).

Livestock Asia
Shrimp culture solutions

This biennial event is part of the series of regional exhibitions for veterinarians, farmers, feed millers, meat processors and retailers in Asia. Organised by AMB Events, this year's show in Kuala Lumpur, held in between larger ones such as VIV Asia in Bangkok and SPACE in France, was much smaller than the last one in 2004. Consequently, less of aquaculture products and supplies were featured.

Nevertheless, **Asia Aquaculture (M) Sdn Bhd**, part of Thailand's Charoen Pokphand Foods Public Group of companies and leading Malaysian integrator, **Dindings** took centre stage amongst companies promoting the aquaculture business.

According to Yip Kam Toh, General Manager of Asia Aquaculture their presence at the show was to promote aquaculture in line with the Government's emphasis on the industry in the Ninth Agriculture Plan (NAP). Shrimp production in Malaysia is already expected to increase to 40,000 tonnes in 2006 from 32,000 tonnes in 2005.

"We continue to culture black tiger shrimp culture in Malaysia but at the same time, with the expertise from Thailand, we are promoting the culture of the white shrimp *Penaeus vannamei*. Specific Pathogen Free (SPF) broodstock from the US are imported for the production of white shrimp postlarvae."

The company has made investments in hatcheries, laboratories, farms and processing plants. It has also leased some abandoned ponds in Johor, Selangor, Sabah and Sarawak. Four hatcheries supply postlarvae to the industry. Three laboratories provide diagnostic services for disease and water quality monitoring. Year 2005 saw the addition of a processing plant in Port Klang with a capacity of 15 tonnes/day. Frozen cooked and raw products are exported to the EU, USA, Taiwan, Japan and Korea.

New to the show but not to the region's aquaculture industry is **Bentoli**, Inc., USA. The Florida based 35 year old global company specialises in feed additives. It develops, standardizes and markets its products for the aquaculture and livestock industries from its regional office in Singapore. At the show, John Robinson said that one of their top priority target markets in Asia is Malaysia. Worldwide, aquaculture represents 40% of their business.

The company, amidst others, has a comprehensive stress management program for shrimp culture under its Efinol range. This comprises combinations of various beneficial microorganisms (bacteria and yeast) and specially identified nutrients that counteract deleterious effects of internal and external environmental stressors. It has been designed for various levels of culture, from hatchery, transport, pond and feed. Efinol EL is for early stages larvae whilst Efinol L is for late postlarval stages. The program is recommended for stages nauplii and zoea. The benefits of stress management include strong and uniform size larvae and higher survival despite changes in the water environment such as temperature and salinity. To complement the Efinol range, the company will soon introduce natural products for the reduction of ammonia in ponds.

For aquafeed production, Bentoli demonstrated products which include the decade old Aqua Savor®, a complex of amino acids which works in synergy with the major components of aquatic feeds and improving on palatability and attraction of feeds. The synthetic feed binder Pegabind® is recommended at very low inclusion rates thus producing quality pellets at low costs. It benefits the farmers as it reduces feed wastage. In a trial report, comparing this with wheat gluten, it was concluded that Pegabind can completely replace wheat gluten. (www. bentoli.com)

CP team Weerawat, Wichit Kongkheaw, Yip Kam Toh, Chong Yew Seng, David Tan, Sean Lai and See King Chang

John Robinson at the Bentoli booth

Health management

Pahang Pharmacy Sdn Bhd which distributes animal health products from Schering Plough Aquaculture (SPAH) in Malaysia presented information on the integrated disease and management solutions of the latter. For prevention of *Streptoccocis* in farmed tilapia, there is AquaVac Garvetil total protection strategy which has been used in many countries except Malaysia, where the registration is still pending, according to Dr Ang Lee Seng, Group Sales Manager. The situation is similar with the Vibromax vaccine which is already marketed in China and Thailand.

Aquafeed production

At the **DelstAsia** booth, Dr Suresh Chandran explained the possibilities of using BPX Dakota Gold dried distillers grain with solubles (DDGs) in aquafeeds. Preliminary results from the trials at Department of Fisheries' Fresh Water Research Centre, Malacca have demonstrated the palatability of the products and its suitability to replace corn and soymeal as well as animal protein in feeds. The product has 91-92% DM with crude protein of 26%, 10% crude fat, 7% fibre and 4% ash. In poultry, the metabolisable energy is 2,750 kcal/kg as information is not available for fish. The composition of lysine at 0.9% and methionine at 0.4% makes it a suitable replacement for soybean meal or corn. Data on availability of phosphorus in fish is not available but values are 80 to 85% in chicken and swine (without phytase addition).

Dr Matthew L Gibson, Executive Director of Dakota Gold Research Association (DGRA), USA, which manufactures the product as well as conducts R&D on using DDGs through animal feeding trials, said that the product has a potential in aquafeeds. However, research on its use in aquaculture is still in its preliminary stages. The by-product from the ethanol industry has been well used in the livestock industry.

He added that its attributes are relatively stable prices, excellent source of available P, energy as well as protein and an assurance in product safety (from mycotoxins and other contaminants). The fine particle size is known to enhance pellet binding capacity. It has proven traceability and low coefficient of variation for amino acids and often gives feed cost saving

Dr Matthew L Gibson

At the Jiangsu Muyang Booth (from left), Deng Xiaochun, Liu Guang Dao, Fan Wenhai

to producers. As the product is of consistent and distinctive quality and premium grade, prices are relatively higher than the usual golden DDGs in the market.

Liu Guang Dao of the **Jiangsu Muyang Group** said that the company has followed the livestock show to display its feed machinery equipment. The company has played a major role in the development of China's feed production, which is the largest in the world with 80 million tonnes. Aqua feed production was estimated at 16 million tonnes. He said that the Muyang group is the largest feed processing equipment provider in China. It has supplied 70% of the equipment for aquafeed production in China. Since 2004, it has undertaken 8 turnkey projects in India, Thailand and Indonesia and 3 in Vietnam. From its 84 feed mills projects in China, some 25 mills are for aquafeed production. (www.muyang.com).

Tony Go, Netherlands (centre) with Shaukat Hussain Chaudhry, Pakistan (right) and Peter C Chiaravanont, Thailand

Korean biotechnology company Hanson Biotech has developed bio products such as stable vitamin and feed additives for the animal feed industry. The liquid and powder vitamin C has excellent stability and bioavailability, according to the company representative. In the pipeline for 2006 are insecticides and antibiotics for fish. (www.hansonbio.com)

Future shows are Indo Livestock 2006 for the industry in Indonesia (11-13 July, 2006, Jakarta) and Vietstock 2006 for the industry in Vietnam (6-8 December, 2006, Ho Chi Minh City).

Networking at the show, from Singapore, Dr Chin How Cheong (left) and Dr Ong Hai Aun

Hatchery and farm diagnostics

INVE Aquaculture has introduced a new range of diagnostic and detection tools to monitor the sanitary conditions of the culture environment, facilities and also the health status of the animals. These kits, as dip slides and test strips, are designed to be used on site with a high level of accuracy, according to the company. The dip slides are a combination of general and selective bacteriological agars for *Vibrio* spp.

Patrick Lavens said, "These are meant to simplify the way for counting and isolating bacteria. They can be used for the diagnosis of bacterial disease outbreaks and the routine monitoring of the bacterial quality of water, Artemia, rotifers and algae culture, animal tissues and for disinfection of tanks and working surfaces".

As for the slide strips, he explained that these have been developed by scientists from Biotech, Thailand. These are monoclonal antibody based tests to identify the presence of shrimp viral and bacterial pathogens. The D-WSSV is for the diagnosis of white spot syndrome, D-YHV will diagnose yellow head and gill associated virus diseases and D-Vibrosis is for the diagnosis and identification of *Vibrio harveyi* and *V.campbelli*, pathogens responsible for vibrosis.

The advantage of these test strips is that they do not require the backup of a laboratory and well trained staff. The time lag between sampling and diagnosis is also avoided as with the test strips, results can be available within 5 minutes. Another advantage is that the test is not a 'post mortem' diagnosis as is usually the case with samples sent to laboratories. An accurate diagnosis is possible with moribund and weak animals which are found along the sides of the ponds.

It was however furthermore explained that the sensitivity of the WSSV and YHV/GAV strips may be as high as some one step PCR protocols, depending on the conditions of sampling. It is therefore recommended that the sensitivity be increased by sampling weak and moribund shrimp. For the pre stocking of postlarvae, the farmer is advised to use the PCR for pre screening of postlarvae. (more information: email: sop@ invethailand.com; web: www.inve.com)

The Asia/Pacific's animal feed and grain processing exhibition sold out

The organisers of Victam Asia 2006, the premier event for animal and aquatic feed production and rice and grain processing technology in South East Asia have announced that the show has exceeded the size and number of exhibitors at their last show held in Bangkok in 2002.

At the 2006 exhibition, to be held at the Queen Sirikit National Convention Center, Bangkok from 8 to 10 March 2006, there will be a Pavilion for China and Thailand. Ten companies from China, have confirmed their participation. These include feed additive suppliers, Beijing Sunpu Biochem Tech. Co., Ltd. and Shenzhen Zobo Natural Biotechnology Co., Ltd., feed processing equipment companies Jiangsu Muyang Group Co.,Ltd and Jiangsu Zhengchang Group Co., Ltd. Companies from Thailand include Inteqc Feed Co Ltd, a premier livestock feed and aquafeed company and veterinary supplier, Innovet.

Besides the conferences outlined by the organisers (see box), exhibitors at Victam Asia 2006 will be able to present individual technical presentations. These will be open to all visitors to the show free of charge. A programme will be published on the website (www.victam.com) nearer the event. The seminars will enable all visitors to hear in greater detail about technology, products, ingredients and services that are on display in the exhibition halls.

Some of the confirmed exhibitors involved in aquafeed processing and industry as at press time

	Feed mill equipment	Aquafeed processing	Feed additives and ingredients	Highlights
Aeroglides Corporation, USA	x	x		Process drying and moisture removal.
Almex b.v., Netherlands	x	x		Extruders and expanders
Amandus Kahl GmbH & Co. KG, Germany	x	x		Extruder for fish feed
AquaFeed.com, USA				On line information on aquafeed industry
Aqua Culture Asia Pacific, Singapore				Publication
Awila Agrar- & Industrieanlagen GmbH, Germany	x			Conditioner system
Beijing Sunpu Biochem Tech. Co., Ltd, China			x	Feed additives
Brilliant Alternatives Inc, USA	x	x		Feed formulation
Buhler, Switzerland	x	x		Single-screw and twin-screw extruders
Clextral Group, France	x	x		Twin screw extruders
CPM, USA	x	x		Grinding
Dinnissen b.v., Netherlands	x	x		Multi functional feed production process
E.S.E. & INTEC (Midland Companies) USA	x	x		Turnkey feed mills
Extru-Tech, Inc., USA	x	x		300 micron starter feeds to juveniles feeds, densification control, sphere-izer, coating systems
Forberg International AS, Norway	x	x		Rotating vacuum coater/mixer
Foss Analytical AB, Sweden				Analytical solutions
Geelen Counterflow, Netherlands	x	x		Counterflow cooling drying
Insta-Pro Europe, United Kingdom	x	x		Dry extrusion equipment
Inteqc Feed Co., Ltd., Thailand	x	x		Shrimp and fish feeds
Jiangsu Muyang Group Co.,Ltd, China	x	x		Turnkey feedmills
Jiangsu Zhengchang Group Co., Ltd., China	x	x	x	Additives, turnkey feedmills
Koangee Machine Industrial Co. Ltd, Taiwan	x	x		Super pulveriser for shrimp feeds
Norvidan, Denmark	x	x		Control and automation systems
Ottevanger Milling Engineers B.V., Netherlands	x	x		
Shenzhen Zobo Natural Biotechnology Co., Ltd, China			x	
Sprout-Matador, Denmark	x	x		High capacity extruders
Stolz, France	x	x		Extrusion, dust prevention,
Thai Department of Fisheries, Thailand				
Triumph Engineering Co., Limited Thailand	x	x		Machinery for animal feed production.
Unipoint AG, Switzerland			x	mycotoxin binder, activated clinoptilolite
Wenger Manufacturing, Inc. USA	x	x		Total control of pellet density for aquatic feeds.

Wednesday 8th March
AQUAFEED PRODUCTION WORKSHOP "Optimize for Profit"

This is organised by aquafeed.com and supported by the Thai Department of Fisheries. The aim is to provide solutions to improve efficiency and increase the profitability of the Asian aquafeed manufacturer. Confirmed speakers are as follows;

- Moisture uniformity, why should you care? Paul D. McKeithan, Aeroglide Corporation
- Optimizing size reduction technology to process better quality, more profitable aquafeeds. Gary Minor, Mill Technology
- Making more profit with new technologies for aquafeed. Dr. Mian Riaz, Texas A&M University
- Optimization of formulation and product quality parameters of extruded aquafeeds. Stuart Howsam, Buhler AG
- Increasing aquatic feed production rates through plant audits. Galen J. Rokey, Wenger Mfg., Inc.
- Formulation software and handling variability. Merryl Webster, Format International Ltd
- Nutritional approaches to aquatic animal health and performance improvements: What can we learn from terrestrial nutrition? Dan Fegan, Alltech Aquaculture
- Tailoring the feed formulation for maximizing profitability: farm demonstrations with white shrimp in Latin America. Dr. Peter Coutteau, INVE Aquaculture

The organiser said that spaces at the workshop are limited and pre-registration is mandatory. For more information, contact: editor@aquafeed.com or visit: www.aquafeed.com.

Thursday 9th March
WORLD GRAIN CONFERENCE "Key Asia Pacific grain issues"

Invited speakers include top executives from grain organizations, including International Grains Council, Cargill, Rabobank, World Aquaculture Society, FAO, US Wheat, AWB International and the American Soybean Association.

Topics discussed will include:

- Global and regional supply and demand outlook for grains and oilseeds in 2006/07 and beyond.
- Impact of China on the grain industries in Asia Pacific.
- Impact of the WTO Doha round negotiations on the grain sector in the region.
- Animal feed markets in Asia Pacific: supply, demand and quality criteria.
- Aquaculture feed markets is Asia Pacific and impact on grain usage.
- Status of biotechnology acceptance and regulation in Thailand and the wider region of South East Asia.
- Overview of Asian wheat markets, including end product trends.
- Status of milling industries in the region.

Places are limited and early registration is encouraged to ensure a place in this exclusive meeting. For more information, contact: seminars@sosland.com or visit: www.world-grain.com.

22-27 January
16th Annual Practical Short Course on Feeds & Pet Food Extrusion
Texas A&M University, USA
Contact: Dr Mian Riaz
Tel: +1 979 845 2774 Fax: +1 979 458 0019
Email: mnriaz@tamu.edu
Web: www.tamu.edu/extrusion

3-5 February
India International Seafood Show
Kolkata, India
Contact: MPEDA
Tel: + 91 484 231 1979/2812
Fax:+91 484 231 3361/4467
Email: raj@mpeda.nic.in
Web: www.indianseafoodfair.nic.in

19-24 February
6th International Abalone Symposium
Puerto Varas, Chile
Contact: Roberto Flores
Email: rflores@abalone2006.cl
Web: www.abalone2006.cl

12-14 March
The International Boston Seafood Show and Processing America
Boston, USA
Contact: Lisa Keller
Tel: +1 207-842-5624
Fax: +1 207-842-5603
Email: lkeller@divcom.com

8-10 March
Victam Asia 2006 Exhibition and Conference
Bangkok, Thailand
Email: expo@victam.com
Web:www.victam.com
(see pages 38 & 39)

29-30 Match
Mahseer 2006
Kuala Lumpur, Malaysia
Contact: Malaysian Fisheries Society
Tel: +603 8946 8288
Fax: +603 8948 8246
Email: myfisoc@time.net.my
Web: www.vet.upm.edu.my/~mfs
(see below)

May 9-13
World Aquaculture 2006
Florence, Italy
Tel: +1 760 432 4275
Email: worldaqua@aol.com
Web: www.was.org

14-16 June
Vietfish 2005
Ho Chi Minh City, Vietnam
Contact: Vo Thai Phong
Tel: + 84 8 511 0930/511 0932
Fax: +84 8 511 0931
Email: vasep-org@hcm.vnn.vn
Web: www.vietfish.com.vn

3-8 July
The Second International Symposium on Cage Culture in Asia
Hangzhou, Zhejiang Province, China
Tel/Fax: +68 571 86971960
Email: CAA2@zju.edu.cn

20-23 July
6th International Conference on Recirculating Aquaculture
Roanoke, Virginia, USA
Contact: Dr. George Flick
Tel: +1 540 231-6805
Email: aqua@vt.edu

List your events in AQUA Culture AsiaPacific Magazine for FREE.
Mail details to: Aqua Research Pte Ltd., 3 Pickering Street, #02-36 Nankin Row, China Square Central, Singapore 048660
or email to the Editor at zuridah@aquaasiapac.com, Fax: +603 2096 2276

First international Symposium on Tor

"Mahseer 2006' organised by the Malaysian Fisheries Society together with several national and international organizations, will be a 2 day symposium from 29 to 30 March, 2006 in Kuala Lumpur, Malaysia. It will focus on various aspects of the Mahseer ranging from taxonomy and genetics, breeding and culture, conservation practices and social impact. It is targeted at scientists, aquaculturists, fisheries managers, policy makers as well as fish hobbyists.

The Mahseer, known scientifically as Tor, is a very important group of fish in Asia, with an estimated 17 known species distributed throughout the region. Some species support artisanal fisheries and most are excellent game fish. In recent years, there has been an increasing interest on the culture of selected species, as a food fish as well as for the aquarium trade.

As the fish generally occurs in pristine, flowing waters, developments in the watersheds in the last twenty to thirty years have affected the habitats of many species and consequently in certain regions they are threatened. Nations have begun to initiate long term conservation strategies to preserve and protect them in the wild. The symposium is an extension of the FAO initiated "Trans-Himalayan Network " for cold water fishes in the Asia Pacific.

There will be post conference tours such as to an indigenous fish breeding station in Tarat, Sarawak where the first successful breeding of the Mahseer in Malaysia was carried out. Other tours will be to several conservation projects for indigenous riverine fishes both in Peninsula and East Malaysia.

More information: Malaysian Fisheries Society, Tel: +603-8946 8288 Fax: +603-8948 8246; Email: myfisoc@time.net.my; Website: www.vet.upm.edu.my/~mfs

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The Annual Meeting of the European Aquaculture Society

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Programme Chairs: Gavin Burnell (Ireland), Geoff Allan (Australia)
Programme Committee: Wagner Valenti (Brazil), Michael Schwarz (USA), Denis Lacroix (France), Marco Saroglia (Italy), François René (France)

Local Organizing Comittee: Marco Saroglia, Biancamaria Poli, Mario Tredici, Mario Falciai, Silvano Focardi, Pierantonio Salvador, Agostino Barbi, Marco Gilmozzi

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mario.stael@scarlet.be
www.was.org

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Slijkensesteenweg 4
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