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AQUA Culture AsiaPacific

Focus on Aquafeed Production in Asia

- Market Trends
- Feed Producers Share their Views

The Promise of Aquaculture in India

Filling the Gaps in Indonesia's Shrimp Industry

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WRITE TO THE EDITOR

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

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

We are all stakeholders!

The 23 Jan 2007 issue of the IHT carried an article entitled 'Seafood market may hurt reefs' – desire for live fish a threat to Asian ecosystems, study finds. The original article was a study for the Swiss-based World Conservation Union and appeared in The Proceedings of the Royal Society. The study quantifies the effect of the hunger for live reef fish in greater China on the declining population of wrasse, grouper and coral trout in the seas of South East Asia. In addition to this, the destructive fishing practices – namely explosives and the use of cyanide were as much to blame as overfishing because they destroy the crucial reef habitats, affecting reproduction. The fishermen on the other hand, argue that there are plenty of fish and that they have few options.

However, the demand for live fish grows stronger by the day (as purchasing power increases) and traders are interested in ensuring they have constant supply of the product. What I find sad about articles like these is that they do not offer a solution or a way forward. We, in the industry would immediately shout – 'aquaculture is the solution'.

Let us examine that 'aquaculture is the solution'. With reports of world fish stocks being depleted by 2048 (although later contested), we would certainly need an alternative to fishery management. Fishery management ensures that minimum fish stocks are maintained so that reproduction allows for regeneration and natural renewal of the population. However, enforcement may be difficult and its success may be limited. We would encourage fishery management to continue and aquaculture to be developed in parallel.

However, there are antagonists who can be divided into 2 groups. One group is the consumers who claim that 'farmed fish are less tasty and fresh'. Although this is arguable, I would like to leave this to the scientists and the industry to address via education. It is the other group that I would like to address – the NGOs who believe that aquaculture destroys mangroves and depletes sea fish stocks (due to the fishmeal industry).

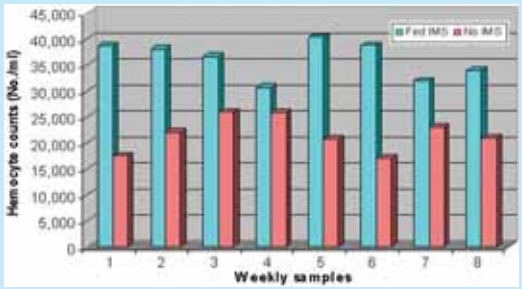
We will be the first to agree that irresponsible aquaculture does lead to mangrove destruction but to brand aquaculture as bad would be Orwellian and wrong. Feeding fish (directly as fresh fish, trash fish or via fishmeal) to fish and shrimp does seem to be inefficient and nutritionists are working at substitutes and reducing fishmeal inclusion in feeds. Aquaculture contributes nearly half (43%, FAO, 2006) of the sea food industry today. Without this, the demand imbalance would only push the fishing industry to further overfish and where would that leave mother earth? There is no silver bullet or a perfect solution. We know that demand will always increase. Hence we have to find a way to supply this demand while minimizing the risks to the earth. Together with NGOs, we are all stakeholders in the seafood industry. We have to take a holistic approach to reach an equitable solution and what better way than sustainable aquaculture? We need NGOs to work with us to find the right direction to develop sustainable aquaculture because working against us would only alienate certain quarters to practice irresponsible aquaculture and destructive fishing methods as described in the IHT article.

Later this year we will have the Asian Pacific Aquaculture Conference closer to home in Hanoi, Vietnam. This will be held from 5-8 August (see page 5). Hope to see you there!

Zuridah Merican

In the January/February issue, there was a printing error on page 29. The correct graph is given below. We apologise for this error.

Figure 1. Comparison of total haemocyte counts in IMS-fed shrimp vs control (no IMS) shrimp.



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P. vannamei

Should industry in India follow the rest of Asia?

India wants to maintain its share of the global shrimp market, particularly exports of the black tiger shrimp *Peneaus monodon*. However, the unpredictable production of this species due to diseases continues affect farms. At the same time, exporters are seeing declines in volumes of shrimp produced, leaving their processing capacity under-utilized. Feed companies are anxious to increase sales, something that is not happening with a trend to lower stocking densities.

The Indian government has started a program to domesticate *P. monodon* shrimp and production of Specific Pathogen Free (SPF) broodstock. However, commercial availability is not expected before 2008. There is also the option of sourcing these from other ongoing broodstock programmes and this requires that Indian authorities permit the importation of SPF *Penaeus monodon* into the country.

White shrimp culture as stop-gap

This situation is leading to increasing pressure from some in the farmed shrimp industry to look towards allowing *Peneaus vannamei* production. However, both industry and authorities in India are now concerned with the possible unregulated introduction of the whiteleg shrimp *Penaeus* (or *Litopenaeus vannamei*), similar to what happened in some countries prior to the lifting of a ban to culture this shrimp. Vietnam, Thailand, Malaysia, Indonesia and lately the Philippines have already taken the step of permitting the importation of the SPF *P. vannamei*, usually requiring that imports of SPF broodstocks are from credible and recognized SPF suppliers.

Some in the industry feel that *P. vannamei* should be allowed as a stop-gap arrangement until the domestication of the black tiger shrimp is achieved. Others are deterred by negative reports on the pilot trials that were permitted to be carried out by two companies in Tamil Nadu. There are legal limits to intensifying shrimp culture in India with current stocking densities limited to 6-7 PL/m^2 by legislation. Indeed, for *P. vannamei* culture to really be profitable, high stocking densities are going to be necessary to compensate for the smaller size of shrimp produced and lower market prices.

Uniqueness of Indian shrimp

In his presentation on the global overview of *L. vannamei* culture, at the technical session of Indaqua in January, Dr Simon Funge-Smith, FAO, Bangkok pointed that although the trend in Asia is towards the culture of this species, any action by India has to consider the unique characteristics of the Indian shrimp production sector. India currently has the global lead in black tiger shrimp production at 127,802 tonnes, more than Thailand's production of 110,000 tonnes. However, in terms of reported value, India's *P. monodon* production total is USD 789,816,400 which is close to the total value of the 276,600 tonnes of *L. vannamei* produced by Thailand (USD 791,089,700). This is a persuasive argument for looking closely at any real income benefit that might be created by switching to the vannamei shrimp. Important, in India the legal restrictions on stocking density will prevent farms from producing the large volumes they will need to offset the low price of vannamei shrimp.

Key driver

Simon said, "The key driver should be value rather than volumes. As for markets, the international supply for smaller size shrimp is meeting demand and prices may be dipping or stabilizing. A point to note is that prices of monodon shrimp, particularly larger sizes, will remain competitive whereas it is more likely that prices for the *vannamei* shrimp will remain or more likely decline as Thailand, Indonesia, China and Vietnam increase production in 2007".

Dr Simon Funge-Smith (right) is FAO, Aquaculture and Inland Fishery Officer based in Bangkok, Thailand. He is pictured here at the Indaqua trade show with Dr Pornlerd Chanratchakool, Novozymes, Thailand.

Black tiger shrimp from ponds in Tamil Nadu.

Mr G. Mohan Kumar, Chairman of MPEDA said, "India is the last outpost for black tiger shrimp. We are working on its domestication and once SPF stocks are available, we can strengthen our position with black tiger shrimp culture".

A different situation in India

Simon also looked at the reasons why *L. vannamei* culture has been so attractive to farmers elsewhere. He compared this to the situation in India. With regards to stocking density, he said that this is not applicable to the Indian situation where culture is extensive. Indian farmers cannot reap the returns of high stocking density as is obvious in Thailand, China and Indonesia. The tolerance for low salinity and cooler weather does not give any advantage as farms here use water with high salinity water, and temperatures are high. He also questioned the real opportunities of culturing the species.

"Despite the possibility of reducing losses from disease if using only SPF stock, experience has shown us that importation of SPF stock can be difficult to control. We know that there are no clear policies on responsible introduction and movement between most countries and in many cases no clear certification of SPF suppliers. Even when regulations exist, control is weak, including in hatcheries and farms".

"There are already known risks with the introduction of the *vannamei* shrimp. The spread of some disease from the *vannamei* to *monodon* shrimp and vice versa has been documented in several countries. Ultimately, the decision depends on whether we can identify critical points that can be effectively controlled. India needs to address whether authorities and all stakeholders are ready and understand the need for and training in Import Risk Assessments (IRA). Another issue is whether the private sector is ready with investments into biosecurity at the hatchery and farm level. The long-term goal should be certified hatcheries.

Simon concluded, "It is clear that India's advantage lies in challenging for market share of better quality *P. monodon* product, rather than trying to wrestle for a slice of the *L. vannamei* cake".

More on this in the show report on Indaqua, pages 8-10.

Asian Pacific Aquaculture 2007

The Vietnamese Ministry of Fisheries will co host the biennial conference and meeting of the Asian Pacific Chapter of the World Aquaculture Society (APC-WAS). This was announced by the current APC-WAS President Graham Mair. This will be held from August 5-8 in Melia Hotel, Hanoi, Vietnam.

"All involved are very excited about the prospect of hosting a meeting amidst what is probably the region's most dynamic area of aquaculture growth. The plans are developing well, the program is taking shape and we are confident that it will develop into an excellent conference and I look forward to seeing many of you there", said Graham.

This is the first time a major aquaculture conference will be held in Vietnam. Over 800 delegates from across the Asia-Pacific are expected to attend the conference which has a three day scientific program accompanied by a large trade show showcasing the latest in aquaculture technology.

The main scientific program for the conference will focus on a range of topics of relevance to aquaculture development in the region including major sessions on catfish aquaculture, marine shrimp, freshwater and marine finfish and the role of aquaculture in integrated coastal zone management. Whilst the conference will cater for an international audience, organisers and co hosts wanted to ensure that the needs and interests of local producers were met.

Vietnamese producers session on August 7

This concept was welcomed by Uni President, Gold sponsors of the conference, who have agreed to support a "Vietnamese Producers Session" through the funding of six international keynote speakers. This Vietnamese Producers session will take place over the entire day of August 7 and will cover a range of issues with the morning session focusing on the production of vannamei shrimp. Vietnamese producers will be invited to attend for the day at a special rate of USD 40. There will be simultaneous translation into Vietnamese.

Graham was delighted that local producers are being encouraged to attend the conference and expressed confidence that the Uni-President sponsorship would enable an impressive cast of speakers to attend. Those interested in participating in the conference can subscribe online www.was.org. Those interested in the special Vietnamese Producers session, can register onsite.

At the World Aquaculture 2007 in San Antonio, Texas, Jeff Chuang, VP Uni-President, Vietnam (second from right) agreed to be a Gold sponsor with Graham Mair. Also present were Ming Hsun Wu (left) and Maple Hung, UniPresident, Taiwan.

Asian Pacific Aquaculture 2007 will be the second such conference that APC-WAS will host in Asia. In 2004, the meeting in Bangkok's Ambassador Hotel attracted around 800 participants and 20-30 exhibitors. Previously, APC– WAS sponsored and co-organised the inaugural Australasian Aquaculture '04 in Sydney which was deemed an outstanding success. This was followed last year by a similarly successful event held in Adelaide. APC-WAS events are held annually and alternates between Australia and Asia.

At the trade exhibition, there will be120 booths available, At print time, 50% of the booths have been sold. To be an exhibitor, go to www.was.org or contact mario.stael@scarlet.be

Dates to remember

Conference and trade show: 5-8 August, 2007
Early bird for registration: Before May 25
New deadline for abstracts: 15 April

MOU with SIPPO to market organic shrimp

Organic shrimp in India

During the opening of Indaqua in Chennai in January, the Marine Products Export Development Authority (MPEDA) signed a memorandum of understanding with the Swiss Import Promotion Programme (SIPPO) for the marketing of organic shrimp from India. This will allow India to access the growing organic market in Europe. A three year project to produce organic shrimp will initially be implemented in Kerala, Andhra Pradesh and West Bengal, and then expanded to other states. This project with SIPPO will help India enter this market using international standards and certification, first in the shrimp processing plants, and then in farms and hatcheries.

In his presentation at the conference, Markus Stern, Director of SIPPO said, "There are opportunities for organic products in Europe as consumers seek more sustainable, environmentally friendly and healthy products. Some 74% of consumers prefer organic products for health reasons, whilst 58% of them are environmentally conscious and 23% choose organic products for the taste".

Relevant article in this issue, Indaqua 2007: The promise of aquaculture in India, pp8-10.

Brief news

US increases antidumping duties

In the preliminary determination of the first administrative review carried out in 2006, the US Department of Commerce (DoC) raised the antidumping duty on Indian shrimp imports from 10.17% to 10.54%. Brazil also saw an increase from 7.05% to 48.13%. The rates for China and Vietnam remain unchanged at 112.81% and 25.76% while that for Thailand came down from 5.95% to 4.24% and Ecuador from 3.58% to 2.25%. The duty for some of the exporters who failed to respond to the DoC queries has now been fixed at 82.3%. The final determination is due in August. Meanwhile the process for the second review has started.

The report in the Financial Express said that exporters in India were shocked as they expected the rates to go down by at least 2-3% rather than up. The increase was because of the rise in the duty fixed for Hindustan Lever Ltd (HLL) which went up from 15.56% to 24.52%. It came when HLL had already decided to leave the marine business with the closure of three marine units.

Thai farmers protest Australian standards

In February, a group of 50 farmers led by Thai Marine shrimp Farmers Association president Dr Surapol Pratuangtum submitted a letter of protest to the Australian embassy. This was on the implementation of new import risks analysis (IRA) procedures which will tighten imports of Thai shrimp into the Australian market. The newly issued standards require certification to guarantee that Thai shrimp products are free from diseases. The farmers claimed that the new measures are unfair especially when there is a free trade agreement between the two countries. They claimed that it will affect about 300,000 Thai farmers whereas the measure may protect only 100 shrimp farmers in Australia. (Source MCOT news).

Catfish prices up and new product in the UK

In Vietnam, the price of tra and basa catfish rose to VND18,000/kg in February from VND16,000 in January, said the Vietnam News Agency. The price hike was due to the reduced supply after farmers in the southern provinces of An Giang, Can Tho, Tien Giang decided to switch their ponds from tra and basa to fish species that offer a more stable income.

In the UK, Young's Seafood has launched a its first UK retail product made using Vietnamese basa, selected from accredited farms in the Mekong Delta and filleted one hour after harvest. Young's Lime & Ginger Fish Goujons, it is a frozen product, consisting of fingers of top quality basa fillet, coated in breadcrumbs infused with lime and ginger. The company said that it intend to use *Pangasius hypothalamus* products as basa and is encouraging the rest of the seafood industry to do the same. Marketing director, James Turton, said: "Research established that 'Basa' was a clear favourite with consumers and we hope that other manufacturers and retailers will also use this name – if there is consensus it will help this important species to be more quickly understood and accepted by UK consumers."(Source: fishfarmer-magazine.com).

Debate on private food safety standards

The pros and cons of private sector standards on food safety were debated by the Committee on Sanitary and Phytosanitary (SPS). Recently the discussion was on the Australia's stringent new risk management measures on imported shrimp. This affects imports from China and South East Asian countries. It said that these measures were too restrictive and asked Australia to accept its safety testing measures. The proliferation of private standards (today estimated at 400) is also of concern. In a background paper (http://docsonline.wto.org), it was indicated that the voluntary private and official measures are becoming increasingly blurred such that private requirements become industry norm and force many that do not comply out of business.

Trade conference on aquaculture in China

Aquaculture's future role in bringing jobs, income and food security to developing countries will be discussed at the Global Trade Conference on Aquaculture to be held from May 29-31 in Qingdao, China. In a press release, FAO said that there are many unanswered questions regarding the outlook for this rapidly-growing sector and its future contributions to hunger reduction and poverty alleviation. Presentations and discussions at the conference will cover a range of issues, including the success stories in aquaculture: shrimp, salmon, tilapia, pangasius and China's booming aquaculture industry.

Cell Aquaculture in Malaysia

Cell Aquaculture (CAQ), Australia and the Trengganu Agrotech Development Corporation (TADC) in Malaysia will commence with a joint venture company to develop a 700 tonnes/year finfish production unit using its proprietary Cell™ system. The deal will generate USD 7 million for CAQ during the 18 month development phase. The export strategy will be to sell products to Japan, Hong Kong and Singapore. The JV company is called TRG Cell Sdn Bhd. CAQ is listed on the Australian stock market and provides a full range of environmentally sustainable vertically integrated services for seafood production with its proprietary Cell™ equipment. It has successfully built facilities in the Netherlands and Bulgaria and is completing production facilities in the US.

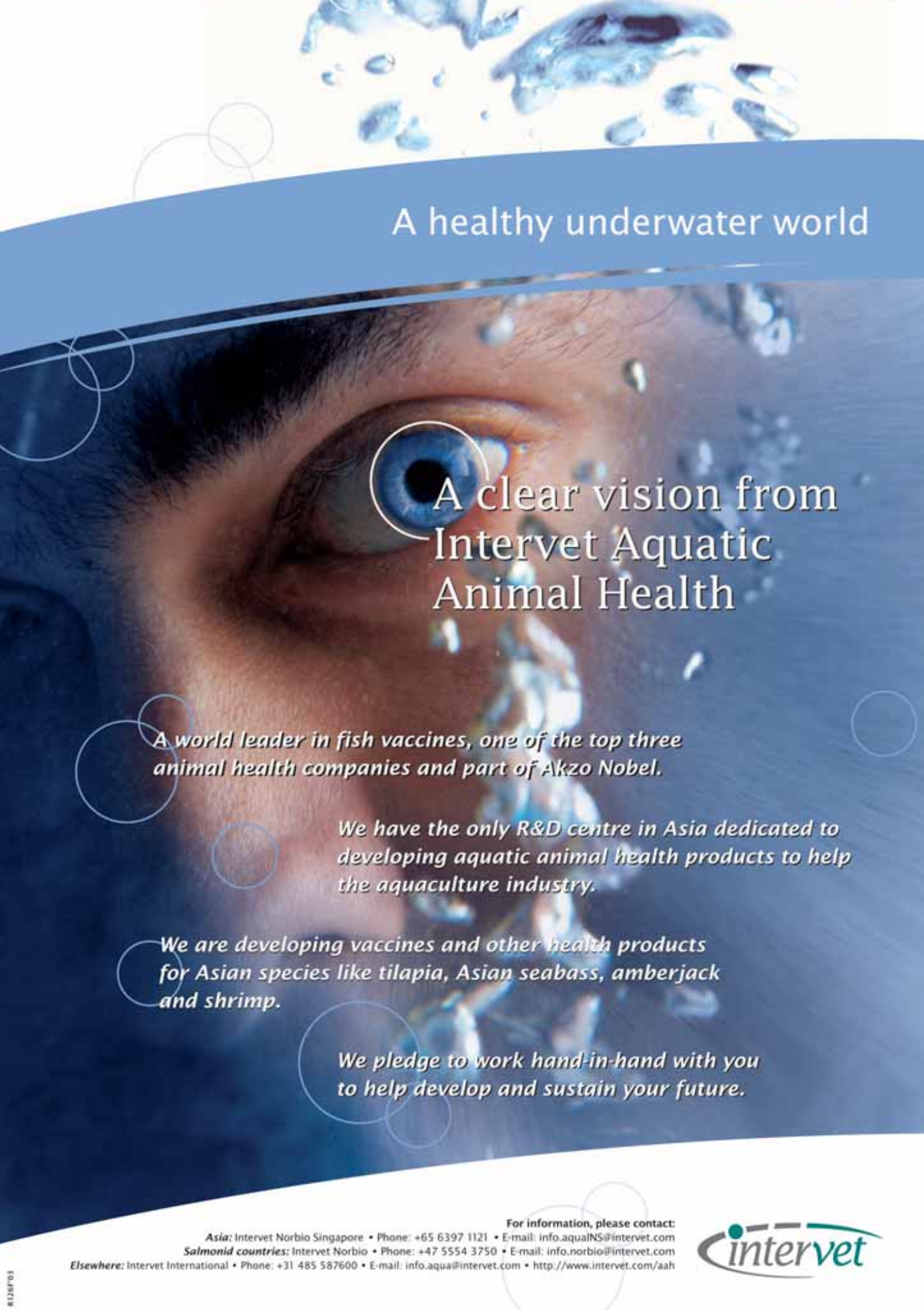
Ocean farming to supply seafood

For the first time, the US wants to allow ocean farming for shellfish, salmon and saltwater species in waters three miles to 200 miles offshore. This is to gain a greater share of the USD 70 billion aquaculture market. The farms will be under Federal jurisdiction. The plan, to be presented at the International Boston Seafood Show, would help the USD one billion US aquaculture industry roughly double over the next few decades. The report quoted that about 70% of all seafood eaten in the US is imported, and half of which is farmed. The trade deficit in fish alone is about USD 9 billion in fish. (www.hpj.com)

Cobia from low saline water

Using patented technology, Virginia Cobia Farms, will soon produce the fast growing cobia in tanks. "We believe that freshwater-raised cobia is the next chicken of the sea – one that will fill growing consumer demand for marine fish high in omega 3 fatty acids without burdening the ocean's already depleted fish stocks," says Bill Martin, chairman of Virginia Cobia Farms, LLC, Saltville. He added that its feed components are carefully monitored, so there's no risk of mercury content, a growing concern in some marine species.

The farm will produce up to 9,000 tonnes annually of cobia, with its first harvest in May. Virginia Cobia Farms is a joint venture of Blue Ridge Aquaculture, Inc., a tilapia producer, and MariCal, Inc., of Portland, Maine, an animal health and nutrition biotechnology firm that discovered a way to raise saltwater species in low-salinity fresh water, without compromising taste, texture or nutritional content.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Indaqua 2007

The promise of aquaculture in India

Aquaculture in India contributes 55% by value to India's total exports of seafood. In turn, seafood exports account for 1.5% of India's Gross National Product (GNP) and 2% of her export earnings. Marginal increases in the production of marine shrimp and freshwater prawn, the two main exports commodities is affecting seafood processing and aqua feed production. Confidence is low, fueled by frequent reports of poor quality products and production failures due to diseases. Market sentiment is also low due to uncertainties posed by the US antidumping action on Indian shrimp. Therefore, little investment is entering the industry.

The industry feels that government attention to aquaculture had been taken over by the IT industry, despite its role as a major employee of rural populations. It is looking at developments in Vietnam and Thailand. Vietnam exported USD3 billion of seafood although it is a much smaller country. More can be done in India which has vast resources and technical expertise. The potential for further expansion is possible as only 15% of the total brackish water areas suitable for shrimp and fish culture has been utilized.

This is the challenge taken up by MPEDA- Marine Products Export Development Authority, Ministry of Commerce. This agency is responsible for trade in seafood but also carries out R&D in new technologies and conducts field extension in aquaculture. MPEDA organized Indaqua 2007 to show this promise of aquaculture in India to investors.

The three-day technical session and trade show was attended by 700 participants. It brought the industry together to exchange information and look at how, in particularly marine shrimp producers, can adopt improvements in technology to increase productivity in a controlled and sustainable way. The two previous Indaqua exhibitions were held in 1993 and 1995, respectively.

From left: Dr David Drahos, Novozymes, USA, Huan Ung and Claire-Emmanuelle Bue, Global Satria, Malaysia and Anil Ghanekar, Ecosecure Systems, India.

Reinventing the Indian shrimp

India was a latecomer to commercial marine shrimp farming that started in Asia in the early 1980s but nevertheless, she quickly caught up and by 1994, production was 80,000 tonnes. These were from ponds using water from salt lake creeks in the coastal states. With support from Government, banks and insurance sectors, several national and international companies entered shrimp farming on a large scale. Farmed shrimp comprised 30% of shrimp exports. By 2006, there were 137 hatcheries producing more than 4 billion postlarvae and 30 feed mills (Vishnu Bhat, 2007).

All was well until 1994 when fishermen protested the development of large farms which they said prevented their access to the sea. The salination of ground water resulted in a writ by an environmentalist in

A new vision and action plan

G. Mohan Kumar

Mr G. Mohan Kumar, Chairman of MPEDA has a vision to raise seafood exports to USD 6 billion by 2020 and be one of the top five seafood exporters. Exports reached USD 1.63 billion during 2005-2006. The one billion mark was achieved in 1994 and since then growth has slowed. At Indaqua, an action plan for aquaculture was revealed. Here, Mr Mohan Kumar elaborates on the strategies for development.

... On improving culture

"We are already a major producer of the carps although this is mainly for the domestic markets in the eastern part of the country. However, there is no value adding and fish is consumed fresh. The National Fisheries Development Agency is working to increase productivity".

"We are also concerned with sustainability and a National Centre for Sustainable Aquaculture (NCSA) will be set up. This agency will look into quality and sustainability issues, which industry in India has been hampered by. It will be the body to guide farmers towards producing quality products. It will institutionalize the concepts of Aqua Clubs which India has pioneered".

"Just like many countries in Asia, our farms are fragmented and controlling product quality from small farms has been difficult. Ultimately, there should be a consolidation of farm into cluster groups. These are organized entities, registered as societies and which can carry out production in a similar way as large farms. We expect some large companies to enter the industry too".

...On expanding culture areas

"India has spent some 43 billion INR (USD 0.95 billion) to develop its shrimp farming. There is, however, a clear imbalance in that growth has been in the eastern coastal states. Under the Action Plan, production will mainly be from 50,000 ha in Gujarat under special schemes using government owned lands. Together with developments in Orissa, Andhra Pradesh, West Bengal, Tamil Nadu and Pondicherry, shrimp culture will employ one million people".

"Another focus will be to redevelop scampi culture. In 2005, India produced 39,000 tonnes but yields have declined mainly because of diseases (runt deformity syndrome and white tail diseases) and use of inbred stocks. In the next few years, the focus will be to develop and consolidate culture in saline affected sugar cane areas in Maharastra state as well as in inland areas. This envisages an additional production of 68,800 tonnes employing 600,000 persons".

S. Santana Krishnan, Maritech (second from left) with participants

the Supreme Court in 1994. The final judgment of the Supreme Court in 1994 ruled that no shrimp farm can be sited less than 500m from the Coastal Regulation Zone or CRZ (Murthy, 1997).

However, Dr Saktivel, President of Aquaculture Foundation of India, who fought the case said, "Yet, when ponds are sited further inland, they would then contravene the ruling on salination of agriculture lands. To add to this, after the tsunami, no development is allowed up to 200m from the coast. The industry is in a dilemma".

At the same time, farmed shrimp was facing threats from disease outbreaks. Culture area has decreased 7% in 2005. Marginal increase in production to 143,170 tonnes in 2005-6, from 115,320 in 2002 was reported (Vishnu Bhat, 2007). It is not only this but also inconsistent product quality. Declining farmer population in Andhra Pradesh from 70,000 to 30,000 was the result of the decline in shrimp prices. Dr Saktivel said, "Costs of production in India is already high at IDR 180 -200/kg. Often only one out of 2 –to 3 crops is successful".

In shrimp farming, Indaqua 2007 addressed how the Indian shrimp producers can move forward. Presenters covered markets issues and what producers of farmed shrimp need to do to gain market share and improve the image of Indian marine shrimp. Health management at hatchery and production stages was emphasized. Whether *vannamei* shrimp should be introduced alongside the black tiger shrimp to increase production was deliberated by Simon Funge-Smith, FAO, Bangkok (see page 4).

BMP for quality shrimp

To increase productivity, farmers need to reduce risks from diseases. This is the objective of the ongoing technical collaboration between MPEDA and NACA (Network of Aquaculture Centres). The first step is to develop 'Better Management Practices' or BMP. Next is to have a participatory approach. This team approach in culturing shrimp and in managing problems also gives farmers buying power for the best sources of disease free and quality tested postlarvae. Here, farmers using the same water sources form cluster groups called Aquaclubs.

N.R. Umesh, Project Supervisor for the MPEDA-NACA Village Demonstration Programme, India highlighted the progress over the last 6 years of the program. There were declines in outbreaks in demonstration ponds in Andhra Pradesh and in those in Karnataka (Table 1). By 2006, no incidences of disease were reported in demonstration ponds in Karnataka. In Tamil Nadu, some aquaclubs reported 6% incidences in diseases as compared to 67% in non cluster group ponds.

Umesh described the key success factors as advance in cropping, avoidance of continuous stocking, bulk orders for postlarvae, better post stocking management and cooperation in the use of water supply and drainage during disease outbreaks. Ultimately, what is important is that farmers learnt to prevent diseases instead of treating it with antibiotics. Another step with BMP will be the production of organic products that can provide a premium in prices.

BMP farmers meet the team for organic certification of shrimp

...On developing marine fish

"We have no name in marine fish culture. However, soon this will change as we have achieved a breakthrough with the hatchery production of seabass at the Rajiv Gandhi Centre for Aquaculture (RGCA). We may just need to standardise this for industry. We will also look into the propagation of our grouper resources".

"We cannot use trash fish for the long term as there is the issue of food security. Thus, developing suitable feeds locally and going offshore for marine fish culture will be an important priority. We may need some collaboration for this".

... On value adding in processing

"Our processing industry may not be as contemporary as in Vietnam and Thailand. Most comprises small and medium plants which specialize in block freezing. However, we do have large plants capable of producing value added products. About 170 plants are approved to export to the EU, US and Japan. With the lack of raw material, there is still a lot of spare capacity, MPEDA is supporting schemes to help plants to modernize and enter the reprocessing industry. We could be producing up to one million tonnes from the current 200,000 tonnes of farmed shrimp and fish".

...On the introduction of the vannamei shrimp

Similar to other countries in Asia, there has been an endless debate on the introduction of *P. vannamei* into India. MPEDA's position was explained.

"Our position is that we will not be dictated by short term trade requirements, although we are a trade organization. Today, it is the buyers that are asking for the shrimp. For national interests, we have to look at the consequences of the introduction of any alien species. I have a respect for environmental concerns. Any decision has to be preceded by studies on the long-term effects. Cross contamination as reported in other countries will be a problem in India".

"This does not mean that we are incapable of doing well in its culture. However, I am very skeptical on the importation of specific pathogen free (SPF) broodstock as some may not be true SPF. Regulations in a country as large as India will be a nightmare. We have open borders with several countries. By air-freight, wrong declarations can be possible. The good thing is that industry understands our position".

...On culture of P.indicus

We also want to relook at the role of our native species *P. indicus*. The species is cultured extensively in Saudi Arabia using domesticated stocks. Here in India, because of diseases and the small size of the shrimp (maximum 20 g) and low value, we have stopped its culture. Currently our resources are limited but in the long term we should look at developing stocks able to grow to larger shrimp of at least 25 g and with a faster growth rate.

Global shrimp markets*

Dr George Chamberlain

"The strategy is to cooperate to stimulate demand by addressing issues and promoting health benefits"
- Dr George Chamberlain, President of Global Aquaculture Alliance

It is not just 'eating seafood is beneficial to human health' but also the fact that quantities of seafood consumed by the general US population presently are below the recommended levels of two servings per week. This means that the US market is increasingly attractive for importers. The US restaurant sales have surpassed the 0.5 billion mark in 2006.

The growth of shrimp imports into the EU is growing at 8% per year with new records in Spain and Italy. Japan still leads with the highest import per capita. Asia remains the main supplier of shrimp to the EU. China's is also a large consumer. It was estimated that 833,000 tonnes was consumed from a production of 971,000 tonnes (46% farmed). China imported 63,000 tonnes of shrimp in 2005. The price differentiation for shrimp continues. In China, higher prices were offered for *P. japonicus* and *P. monodon* as compare to that of the white shrimp. However, prices for farmed Thai tiger follow closely that of Ecuador origin *P. vannamei*, both of size 26-30.

Production issues include increasing cost of feed & energy, risks to disease, low profitability and environmental and food safety concerns leading to certification. Nevertheless, production from Asia is expected to increase. Ecuador is recovering and should increase production to 140,000 tonnes. Industry in Brazil is stabilizing production to 65,000 tonnes.

** Keynote address; 'World Review and Present Status of Shrimp Culture.'*

Table 1. Disease prevalence in demonstration and non demonstration farms in 2003 to 2006

Year	State	demonstration	non demonstration
2003	Andhra Pradesh	82%	89%
2004	Andhra Pradesh	37	52
2005	Andhra Pradesh	15	42
2003	Karnataka	100	-
2004	Karnataka	71	52
2005	Karnataka	33	46
2006	Karnataka	0	55

Challenge is certification

Retailers usually translate what the consumers want. The key is traceability and high quality. However, supply chain management and traceability pass liability back to producers. For the small scale producer, certification is a challenge, said **Aaron McNevin**, World Wildlife Fund (WWF, USA). In addition there are requirements for low environmental impact, social equity and fair labour. This requires that processors play a larger role in tracing products back to farms.

Certification and standards development becomes complex when there is a proliferation of corporate purchasing standards (e.g. Eurepgap, Walmart and GAA, Environmental Defense and Wegmans, Seafood Watch and Bon Appetit, Ahold and New England Aquarium). This makes access to these types of markets difficult for the small producer because large integrated farms can adapt and manoeuvre quicker in a changing market. Some seafood is tested 6 times before reaching the consumer and the producer pays for this. Stakeholder involvement can be difficult in certification but measures have to be taken to get smallholders involved and allow for open market access. WWF is playing a role to help ensure that ideal standards with measurable performance indicators, are objective, sufficiently transparent and apply to the full spectrum of producers.

Value addition is the future

Fatima Ferdouse Razeghpanah, Infofish, Malaysia emphasized that it is not only volumes but also the type of products that is important. She said that demographics are changing the Japanese shrimp market. In Japan, the preference for eating out is increasing. Imports of block frozen fishery products are declining whereas imports of processed products are increasing.

Fatima Ferdouse Razeghpanah

Import volumes of prepared shrimp increased by 43% during January -September 2006 against that 2005.

There are also opportunities in value added meals for the Australian markets which imported 7,000 tonnes of value added shrimp (excluding canned shrimp) in 2005. This increased from 4,800 tonnes in 2003. Asian markets for value added products are also expanding rapidly. India, though a dominant player in the shrimp market after China and Thailand, exports mainly block frozen shrimp.

"As production costs are increasing which, in many cases, are not compensated, by import markets, particularly if the product is the traditional block frozen type, it may be wise to move to value addition. The trend is value addition, notwithstanding whether shrimp is *vannamei* or black tiger", said Fatima.

Carp production in India, has increased from 1.7 million tonnes in 2000 to 2.11 million tonnes in 2005. These are common, Indian and Chinese carps. Another segment is freshwater prawn production which expanded to 42,820 tonnes in 2005-06, compared to 24,230 tonnes in 2002-03. A recent development is the culture of *Pangasius hypophthalmus* (called 'tra' in Vietnam). The fish was introduced from Thailand to Bangladesh and crossed to India. Culture is mainly in Andhra Pradesh, alongside carps by a number of farmers (MC Nandeesha, pers comm.). Official figures of production are not available but estimates are 150,000 tonnes.

The Indian domestic market for farmed freshwater fish (generally carps) is limited to the fresh fish form and to the fish eating population in West Bengal and northeastern parts of India (Nadeesha, 2007). Fatima said that evidently, the industry must look beyond these markets/ areas when they start to increase production. Potential markets for farmed fish could be the Middle East and Russia. The latter imported 30,000 tonnes of fish fillets from Vietnam in 2006.

On value adding to gain market share, she said that globally the preference is for convenience products. This is in both domestic and export markets. This trend is obvious for exports from Thailand and China. However, the export volume of prepared product from India remains small.

"The future is in ready-to-eat foods. Indian processors should look at salmon products from Norway designed for Indian consumers. This undoubtedly shows that Indian domestic market could be developed for fish-base ready-to- cook or ready meals. The other example is how Vietnamese producers have developed value added products from the *Pangasius* fish. My challenge will be for seafood processors in India to follow suit and move to this segment".

References available on request.

Indonesian shrimp

There has been no significant development in the Indonesian farmed shrimp. Production figures are similar to that of 2005. Several technical issues related to farming techniques remained unresolved.

Piecing the puzzle by Iffa Suraiya

White shrimp *Penaeus vannamei* remains an important export commodity. However, its increase in volume is low. From the 2000 to 2004, the annual growth of shrimp exports was only 5.58%, increasing from 116,187 tonnes to 143,550 tonnes. Volumes dropped in 2005 to 124,985 tonnes. According to Johan Suryadarma of the Association of Indonesian Coldstorage (APCI), for 2006, the export data available showed estimates of volumes to be only 115,824 tonnes.

Iffa Suriaya is Secretary of the Shrimp Club Indonesia

Meeting 2006 targets

The national production target for 2006, was 350,000 tonnes. This was to be from small scale traditional farmers (140,000 tonnes), large scale corporate farms such as like Central Pertiwi Bahari, Wahyuni Mandira, and Dipasena (100,000 tonnes) as well as intensive farms which form the Indonesian Shrimp Club or SCI (110,000 tonnes). Based on estimates available from the SCI, production year to date (September 06) reached only 74,200 tonnes. The last quarter may only add another 35,800 tonnes.

How to increase production

Apart from optimizing intensive shrimp ponds, there is also a revitalization of traditional ponds. These traditional farms were formerly used for the culture of the black tiger shrimp *P. monodon*, and subsequently switched to semi-intensive farming of the *vannamei* shrimp. At stocking densities of 30 to 40 pcs/m^2, productivity of 5 to 8 tonnes could be achieved. Iwan Sutanto, president of SCI said, "Farmers ultimately have the ability to carry out various strategies to achieve targets."

In several intensive farming centres, farmers have also started using the GSF Line System (GSE Geomembrane). Nefo Ng, a farmer in Bali said, "We can increase productivity of shrimp with this system." According to him, the main advantage of the system is that it protects pond walls from erosion and reduces water losses from seepage.

Iwan Sutanto

Issues

Fuel costs

The increase in crude oil prices at the end of 2005 was a major problem farmers faced especially in terms of costs of production. On a per kg basis, production costs for shrimp in 2005 was as high as IDR 30,000 or IDR 6.8 trillion annually. The main components are the cost of feeding at 48%, energy costs (fuel and electricity) at 26% and post larvae costs at 17%. The other costs including labour totalled 9%.

Diesel fuel is used by intensive shrimp farms for power generation to run the aerators, pumps and lighting. The estimated usage is 1.5 to 2 litres of fuel per kg of shrimp produced. With a national target of 350,000 tonnes of shrimp annually, the fuel requirement for shrimp

farms is estimated at 525 million litres. Any increase in the costs of fuel is borne by the farmer. At the current fuel rates, production costs may increase by as much as 16.3%.

Market prices

Hassan Wijaya

International market prices have been relatively stable. At the farm level in Jawa, the prices of shrimp was IDR 47,500 for 40 pcs/kg, IDR 39,500 for 50 pcs/kg, IDR 35,500 for 60 pcs/kg and IDR 33,500 for 70 pcs/kg. However these prices differ based on location. Hassan Wijaya, a farmer in Medan, said, "The recent bumper harvest from shrimp farms in North Sumatra and also from Pontianak lowered market prices. In Medan, the market price dropped to IDR 35,000 for 50 pcs/kg. As a result, many farmers delayed harvesting."

Apart from this, farmers also have to depend on the schedule of the cold storage trucks or their buying agents for the harvesting of their shrimp. "Problems of limited capacity and the number of processing plants in Medan are also a major issues for shrimp farmers in North Sumatra," added Hassan.

Gunawan Jaya Hendra

Postlarvae quality

Gunawan Jaya Hendra, a farmer said "The main problem for expansion of shrimp farming in Sumbawa (West Nusa Tenggara), is the supply of quality shrimp fry. Hatcheries in Sumbawa cannot meet the demand here. This is in spite of the fact that Sumbawa is ideal for shrimp farming and has the potential to become a major production area in Indonesia."

The performance of the shrimp farms in Indonesia in 2006, can be summarized as follows

PL costs	F1	IDR 35 to 40 each
	Local	IDR 16 to 23 each
Density		80 to 250 PL/m^2
Growth (120 days):	F1	20 grams
	Local	14 to 16 grams
Harvest size		40 to 70 pcs/kg
Survival:		60% to 80%
FCR	F1	1.8 (size 40, 130 days)
	Local	1.5 (size 70, 120 days)
Production costs:		IDR 23,000 to IDR 28,000 / kg
Productivity:		14 to 35 tonnes/ha

Virus recorded:
WSSV, TSV, IHHNV, IMNV

Note: Shrimp prices: (Dec 2006)
Size 40- IDR 47,500, Size 50-IDR 39,500
Size 60-IDR 35,500, Size 70-IDR 33,500

Increasing competition

According to Made L. Nurdjana, Director General for Aquaculture, Ministry of Marine Affairs and Fisheries, the challenge is the competitive global trade. "On the one hand, quality requirements and consumer safety standards have become more stringent. This includes the implementation of Good Aquaculture Practices (GAP). On the other hand, market information is still weak".

Antibiotics issue

For many years, the bitter experience relating to antibiotics for exports to the European Union (EU) has affected industry. Until an action plan to check on antibiotics residues for exports to the EU was resolved in July 2003, all shrimp from Indonesia had to undergo 100% testing since 2001. However, based on inspection results in April 2004, the quality control system in Indonesia is still not equivalent to the system used in the EU. Shidiq Muslim said, "Indonesia has taken steps to improve, such as adoption of methods and operational techniques which will be verified by EU authorities."

Johan Suryadarma

More recently, nitrofuran residues were reported by Japan in shrimp exports from Indonesia last month. Dani Santrio from Bumi Menara Internusa Cold Storage said, "The screening data carried out by BMI between 2005 and 2006 found residues of antibiotics, chloramphenicol and nitrofuran in raw material samples received from farms." Johan Suryadarma from the APCI said, "There is a zero level tolerance of residues for medication and substances that are prohibited. In order for Indonesian shrimp exports to grow, the quality control matrix must be harmonized with that of importing countries such as the USA, EU, Canada, Japan and Australia."

Coming together

According to Iwan Sutanto, "The time is right for all the stakeholders in the industry in Indonesia to tackle the problems together. All this while, the crisis has been borne by only one group and this has resulted in the slow resolution of issues and increasing accusations and finger pointing between the various groups."

At the meeting in Situbundo, all the stakeholders in the shrimp industry in Indonesia agreed that "The time has come for us to act and not to blame others".

The panel discussion ended with the signing of the Kesepakatan Situbondo (Situbundo Agreement) by all the associations, stakeholders of the shrimp industry in Indonesia.

The agreement may only have ended on two pages of document but it has also provided the spirit for achieving a bigger vision: to be a main player in the global shrimp industry.

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Aquafeeds in Asia

Intense competition leads to innovation

by Zuridah Merican

Last year, the focus was not only on cutting costs for shrimp feed production but anticipating the future demand for fish feeds with product diversification. In this article, we look at market trends, expansion and consolidation of industry and provide an outlook for 2007.

In 2006, there was a general increase in shrimp feed demand in most countries in South East Asia and India. The exception was the Philippines. It was a good year for shrimp production in Thailand, which utilized 690-750,000 tonnes, according to industry. Usage was already 650,000 tonnes in 2005 (Orachuwong, 2006). Indonesian and Indian shrimp producers said that shrimp production stabilized in 2006. Shrimp feed demand increased 24% in Vietnam from the estimate of 250,000 tonnes in 2005.

The increase in fish feeds production in 2006 was most significant in Vietnam (Table 1). The estimated production of fish feeds was only 500,000 tonnes in 2005. In 2006, 500,000 tonnes of catfish was produced. Industry reported that there is a general trend towards the use of commercial feeds in marine fish culture in China, Malaysia, Vietnam and Indonesia, although estimates of demand are not available.

Table 1. Available estimates on aquafeed demand for 2006 and 2007*

Country		2006	2007
Thailand	Marine shrimp	680,000 to 750,000	750,000
	Freshwater fish	416,000	438,000
China	Marine shrimp	600,000	na
	Marine fish	600,000	na
Indonesia	Marine shrimp	312,000	312,000
	Freshwater fish	420,000	460,000
Vietnam	Marine shrimp	310,000	320,000
	Catfish and tilapia	840,000	960,000
India	Marine shrimp	165-200,000	200-230,000
Malaysia	Marine fish	80,000	100,000
	Freshwater fish	28,000	30,000
	Marine fish	6,000	8,000
Philippines	Marine shrimp	30,000	40,000

**Estimates were given by industry in each country*

Shrimp feed markets

Segmenting markets

Although culture is predominantly *vannamei* shrimp (95%) in **Thailand**, the feed market may comprise only 60% of feeds specifically formulated for this shrimp. The feed market is showing segmentation according to shrimp harvest size, said Dr Thomas Wilson, Thailuxe Feed Co Ltd. Risk-averse farmers in the inland coastal provinces in Eastern Thailand prefer to have minimal investments in feeds. Shrimp is cultured to 80-100pcs/kg and sold at THB 100/kg. Margins are low. In these areas, 70% of the feeds are low cost supplementary feeds, costing around THB 19/kg.

The more attractive feed market is in the southern provinces. Farmers in Suratthani, use high quality feeds costing THB35/kg for the production of larger shrimp of 50 pcs/kg, generally sold at THB 170/kg with high margins. Farm management is good with stocking density ranging from 60 to 160 pl/m^2. Here the challenge lies not only in producing 'big size' shrimp but also shrimp with the right colouration. Colour is affected by mineral content and type of soil, and is less pronounced in shrimp farmed in the south of Thailand.

The choice of either using feeds formulated for the *vannamei* or *monodon* shrimp depends on the farmer. Usually, feeds for *vannamei* shrimp containing a minimum of 32-33% crude protein costs 30% less at USD 0.8 to 0.9/kg than those for *monodon* shrimp with 38-40% crude protein.

"In *vannamei* shrimp culture, we can see that farmers may use feeds for the *monodon* shrimp during the early culture stages for 1-2 months. Later they may change and use *vannamei* feeds. This is especially so when stocking density is high," said Mr Bunleusak Sorajjakit, Managing Director, Thai Union Feed Co, Thailand (TUF).

Bunleusak Sorajjakit

Too many brands

There are too many brands competing for the small feed market in **India**, according to Mr Udayakumar of Higashimaru Feeds (India). Prices range from INR 50-63 (USD 1.13-1.43) from economy to premium grade. On top of these there are special feeds for use during stress periods. Shrimp feeds from CP Aquaculture (India) have brand recognition and the company has 60% of the feed market. It has also expanded with two feed mills. Competition is intense between the other large producers in India. Most are located in Andhra Pradesh and Tamil Nadu. (see page 38 for more information on shrimp feed in India).

New market segments

With *vannamei* culture, feed demand is increasing in **Vietnam**. Jeff Chuang, Uni President, Vietnam (UPV) said that he does not expect significant increases in demand for *monodon* feeds but is prepared for the increased demand for *vannamei* feeds. In **Malaysia**, *vannamei* culture pushed up demand to 80,000 tonnes of feed. Production is for the 70 pcs/kg range. Local production of shrimp and fish feeds from Star Feedmills began in 2006.

In anticipation of the removal of the ban in the culture of this shrimp in the **Philippines**, Tateh Aquafeeds (Santeh Feeds Corp) unveiled feeds for the *vannamei* shrimp in June 2006. These are produced by partial extrusion. Ocean Feedmill in Bacolod expanded operations to shrimp feed aside from that of fish feeds which began in 1990.

Choice of post larvae

It is the quality of post larvae that is influencing farmers' decision for feed purchase. This is apparent in most countries and came about because of doubts on the quality and SPF (specific pathogen free) status of broodstock. To retain customers and gain market share, feed producers work at ensuring that customers have access to the best quality post larvae. The trend is to link with reputable hatcheries or establish their own.

It is the buyers market for feeds as farmers are quick to react to poor quality post larvae. In Thailand, if growth is poor within the 70 days of culture, the crop might be discarded. In Indonesia, total feed costs have been related to the quality of post larvae. The choice is first generation post larvae from imported broodstock. Although FCR is poorer at 1.8 instead of 1.5, shrimp reach larger sizes (40 pcs/kg) in 130 days as compared to 70 pcs/kg in 120 days. (see page 11).

Higher prices in 2006

In **Indonesia**, escalating prices of fish meal to USD 1,600/tonne forced a general increase in shrimp feed prices of 15-20%. Price adjustments were also made in the **Philippines** despite low shrimp prices, according to Christopher Co of Overseas Feed Co (OFC), Philippines.

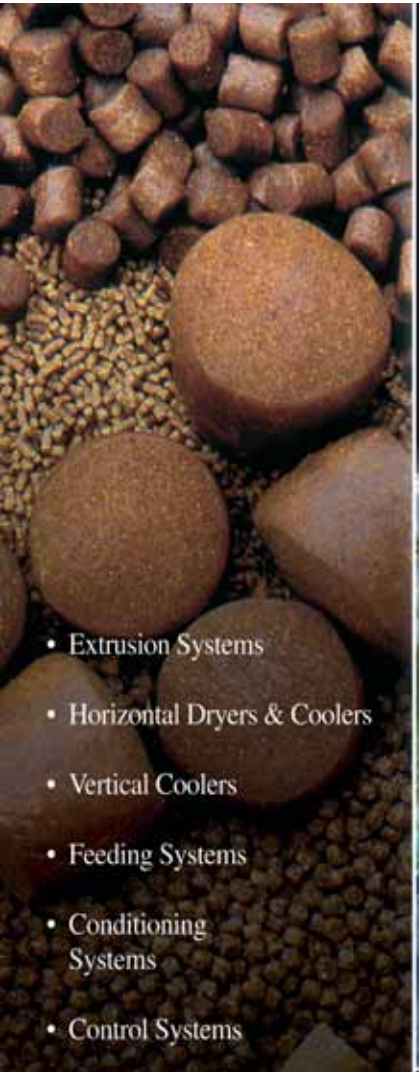
"From the point of view of the feed industry, we in **Thailand** will continue to be caught between high prices of raw materials and low selling prices for finished feed. Poor weather conditions in many parts of the country, is reducing domestic production of many raw materials. If the value of the Thai Baht remains strong we will not be able to increase the price of feed as farmers cannot tolerate this", said Thomas Wilson.

Christopher Co

Gina Regaldo

Cost of feeds

The contribution of feeds to the total costs of production has changed in recent years. This is because power and fuel cost have increased. Gina Regaldo, Intaq Feeds, **Philippines** in her



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presentation at the Shrimp Congress (June 2006) said that the proportion of feed cost declined to 45% whilst power and fuel costs increased to 17% and 9% respectively. In 2004, feed costs accounted for 55% of costs of production. However, she noted that costs of chemicals and additives also reached 10% in 2006.

Fish Feeds

Expanding markets

After a slow start, local production of feeds for the grouper, seabass and cobia is increasing in some countries. During grow-out, **Malaysian** farmers have the choice of expensive imported feeds versus local feeds manufactured by Cargill, Grobest, Uni Best and CP Malaysia. Most larval feeds are imported. Locally made feeds contain around 42% crude protein and retail from MYR 2.50 to 3.50 (USD 0.6-1). Demand is seasonal and is estimated at less than 8,400 tpy.

In **Indonesia**, extruded feeds are used for grouper fish until 300g. Farmers believe that locally produced commercial feeds are below expectations and want the crude protein level to be raised from 45% to 52%. In the **Philippines**, industry said that it needs to create domestic markets for marine fish to expand feed production. Consumption of marine fish other than milkfish is low.

Contrary to reports, Christopher Co, OFC does not see any bottleneck in feeding marine fish with pellets. In some trials at their cage farms, they have managed to wean 60-80% of 3-4 cm tiger and green grouper easily. They have also trained 3,000 to 5,000 fingerlings per batch of coral trout. *Epinephelus bleekeri*. He added that even wild grouper of 200g can be feed trained easily.

China with the largest marine fish culture industry presents a large market for commercial feeds. There are already several local feed companies producing marine fish of varying quality. Imports from Japan (Skretting) and Biomar are popular. Nosan, the third largest aqua feed producer in **Japan** wants to expand into North China. Feeds are for the red seabream and yellowtail. The marketing strategy is that the company does not only market feed but wants to address food safety issues. Some of the products available include feeds to suppress flesh discolouration, allowing for longer shelf life. Feeds containing banana powder improve fish resistance and activate the immune system.

Cobia culture is expanding in **China** and **Vietnam**. Small scale producers use trash fish as feed in Vietnam. In an experiment carried out using wood frame cages, the clear advantage of using pelleted feeds was shown. Imported feeds (EWOS) with CP/CF 42/27 gave FCRs of 1.95 and survival of 97.5. In comparison, it was 1:7 and 54% with trash fish. The feed cost was 16% less at USD 2.02/kg. The conclusion was that it is the availability of trash that will still determine whether farmers will use pelleted feed, despite the much faster growth achieved with pellets feed (Nyugen et.al., 2006).

Extrusion of fish feeds

Some 420,000 tonnes of feeds for various freshwater fish was used in Indonesia in 2006. PT Sinta Prima has 60% of this feed market, mainly pelleted and sinking feeds. In 2006, the company started to produce floating and slow sinking fish feeds, joining PT Matahari Sakti (see page 18) which started a new plant in September 2006. With this, PT Sinta Prima will be the newest player in this market segment. Prices of extruded feeds are generally 20% higher than pelleted feeds in Indonesia and cost IDR 4,750/kg (USD 0.50) for 32% crude protein feed.

Candra Yanuartin

Candra Yanuartin, Vice President said, "We have invested in machinery which will allow us to use local ingredients to produce quality feeds. We have tested the feeds at our demonstration and farmer ponds. We want to retain a leading position in the market for pelleted feeds and also gain more market share in the market for floating feeds. We will do this by cooperating with our customers and maintaining their trust in us to produce quality feeds and ensure their profit levels".

"Our feeds have been developed for the different culture systems and for the various species. For the milkfish, we will begin with natural food and will feed floating pellets at later stages. For the carp, cultured in cages and running water, we will still encourage the farmer to use sinking feeds".

Expansion and diversification

Ir Arianto

In **Indonesia**, the culture of vannamei shrimp has increased feed demand. PT Suri Tani Pemuka (STP) now has four feed mills across Indonesia for the production of both fish feeds and marine shrimp. In May 2006, the feed mill in Lampung started producing pelleted freshwater fish feeds and shrimp feeds. According to Ir Arianto, Head of Aquafeed Operations in Banyuwangi, East Jawa, further expansion will only be likely in 2008.

CJ Feed from Korea has started construction of a shrimp feed mill in Jombang, East Java with a capacity of 12,000 tpy. Operations is planned for June 2007 and target markets will be intensive vannamei farms, in East Java, Bali, Lombok, Sumbawa, Lampung and Pontianak.

New to the industry in **India** is Bharat Luxindo Agrifeeds Pvt Ltd. Also in 2006, Cargill, USA purchased controlling interest in Matrix Biosciences. The venture is Cargill Animal Nutrition's first fully dedicated shrimp mill in Asia and also its first operation in India.

In **Vietnam**, Uni-President Vietnam expanded with a new feed mill producing both fish and shrimp feeds. In a news report, the company said that it sold 75,000 tonnes of fish feeds in 2005. The new mill will be able to produce 100,000 tpy. Also in 2006, Cargill opened a new mill which will add another 60,000 tpy fish feed to its current capacity. When these and smaller producers expand, capacity for fish feeds will be more than 700,000 tpy in Vietnam.

In **Thailand**, the diversification was apparent with Inteqc Feeds and Thai Union launching fish feeds for freshwater fish in 2006. Both have set up new plants for production of extruded feeds for the tilapia and other freshwater fish species. Earlier in 2005, Thailuxe Feeds expanded with a new plant. All three companies have plans for the production of marine fish feeds as the next stage.

Technology

Extrusion or pelleting for grow out shrimp feeds

Now that the shrimp feed sector in seeing escalating prices for fish meal as well as low supplies, attention is on extrusion which may allow them to reduce the proportion of fish meal, use alternative ingredients, improve pellet stability through gelatinization and reduce use of binders. Many producers use single/twin screw extruder easily to produce crumbles for the starter stages. Larger pellets are commonly produced with pelletisers. It was reported that extruded grow-out feeds are being marketed in Brazil for the vannamei shrimp.

The most common problem faced by companies experimenting with extrusion technology for grow out feeds, both in Asia and South America, was that some feeds floated. It could be only 2-3% but any feeds floating created doubts by the shrimp farmer. There are also questions on the palatability presumably due to texture.

According to Joseph Kearns of Wenger, USA, as far back as the early1980's producers looked at extrusion technology for shrimp feeds. "Even at the much lower prices of fish meal in those early years, the cost benefits of extrusion technology far out weigh that of pelleted feeds. However, pelleting methods improved with advances in pelleting technology including pre and post conditioning, resulting in improved pellet stability. Pelleting is also a less exigent method of producing shrimp feeds. Interest disappeared and feed producers stopped looking at cost effectiveness of extrusion technology again until recently".

Joseph said, "Processing shrimp feeds may require twin screw extruders rather than single screws based on formulation adjustments for lack of fishmeal availability. This will give more ingredient flexibility as well as product shape and density control. To ensure sinking pellets, density control is possible with the External Density Management Systems as manufactured by Wenger or the highest capacity option of using a Product Densification Unit for major shrimp feed producers".

"Once the industry realises that extrusion methods have again overtaken pelleting technology they will see the results in the production of more cost effective feeds".

Betagro has constructed a new feed mill in North East Thailand to produce slow sinking and floating feeds for freshwater fish, aquarium fish and pet foods. Next will be feeds for the grouper and abalone. Aqua feed production is an attractive business for the conglomerate with margins of 13-15% which the company said is due to its lower overhead costs (Feeds and Livestock, 2007, Vol. 4 (1)). CP is building a new fish feed mill in Saraburi, reported with 10,000 tpm capacity. With high raw material prices and low margins, stiff competition is expected among the top 6 players in fish feed production (CP, Thailuxe, Krungthai, Lee Feedmill, Betagro and Cargill) in the next few years.

Consolidation

Udayakumar

Higashimaru Feeds (India) Ltd based in Kerala divested its shrimp feed business to Godrej Agrovet. The latter then became the second top producer in India. Higashimaru's Udayakumar, said, "We had eight brands of shrimp feed and Godrej, has five. The move was to consolidate our position in India. Marketing of the feeds will be more efficient under one umbrella. We are now concentrating on the marketing and production of larval feeds and specialty ingredients such as fish extracts".

In 2006, Godrej Agrovet and PT Gold Coin formed a joint venture company called Godrej Gold Coin Aquafeed Ltd. In India since 1996, PT Gold Coin marketed imported feeds from its factory in Indonesia and Malaysia. New feeds under the JV company will be produced at the Godrej's plants in Chennai and Vijaywada.

Outlook for 2007

Thailand

At the recent meeting for the shrimp industry in Thailand, industry was pessimistic and said that achieving better farmed shrimp production in 2007 as compared to that in 2006 would be difficult. The reason cited was the increasing value of the Thai baht and floods experienced during the early part of the year. The currency reached THB 33 to one USD in mid March 2007. Prior to this, feed producers expect a 30% increase in feed volumes. However, producers look forward to the rapidly expanding market for freshwater and marine fish feeds.

Indonesia

Another damper on the industry came with recent rejections by Japan as some export consignments of shrimp contained metabolites of the antibiotics nitrofuran. Japan is Indonesia's largest market. This affected mainly East Java where production is mainly targeted for Japan. Shrimp prices declined by 10%.

"In 2006, we faced similar problems. Shrimp demand only picked up from March when processors began to buy significant amounts of shrimp. Shrimp prices improved to IDR 39,000 for 50 pcs/kg. This benefited feed producers. Now we have this problem again and everyone in the industry must work to prevent such setbacks in the market", said Haris Muhtadi, the new general manager for CJ Aquafeeds.

Haris Muhtadi

"Nevertheless, we can expect feed demand to increase substantially for shrimp culture in North Sumatra, West Kalimantan and other new production areas in Bengkulu, South West Sumatra. Marginal increases can be expected in East Java whereas production may be stable in other areas where culture activities are already intensive", added Haris.

Malaysia and Philippines

The feed market in Malaysia has benefited from the start of *vannamei* culture since 2005. Shrimp production may have increased to 50,000 tonnes but industry is concerned that progress in the industry is slow to meet targets. Production costs are high but the comparative advantage in Malaysia is the low fuel prices and interest by governments and large companies to invest in the industry. Industry in the Philippines estimates that shrimp feed demand may increase 30% with *vannamei* culture.

Vietnam

Industry has predicted that Vietnam's feed market will continue to grow. The demand for catfish and tilapia feeds will grow by 15% to 960,000 tonnes. The use of commercial feeds, priced at USD 0.40/kg is increasing.

However, as culture expands, the focus will also be on feeds for the *vannamei* shrimp in areas north of the Mekong Delta. Jeff Chuang, Uni President Feeds, Vietnam said, "We can expect increase of 50,000 tonnes in 2007 but how well the farming sector does will depend on post-larvae quality. Our attention must focus on broodstock quality. At the moment, stocking density of *vannamei* shrimp is ideal for industry", said Jeff.

India and Bangladesh

PK Ramachandran

In India, as farms were already into the first crop in January, industry expects shrimp feed demand to stabilize or increase marginally in 2007. The problem of seed quality which presumably brought down the industry in 2006 has been settled. However, PK Ramachandran, the Waterbase, India said, "It will still be tough for feed producers as we are challenged by costs of production but demand is expected to increase, helped by better prices for shrimp".

The future may be in feeds for carp. India produced 2.1 million tonnes in 2004, followed by Bangladesh with 616,151 tonnes (FAO, 2006). Methods are traditional using farm made feeds. In 2004 and 2005, ASA-IM/USSEC (American Soybean Association) helped to develop feeds for the Indian carps. The formulation and technology was taken up by several feed companies to produce extruded feeds for carps. An intensification of 10% of current farms will need at least 360,000 tonnes of feeds. The potential market is large. Based on the 3 million tonnes of ingredients used for farm made feeds, it has been estimated that feed demand may reach 1.7 million tonnes (Anand, 2006).

** References are available on request*

What aqua feed producers say

Philippines

...On high costs of feed production and low product prices

"In 2005 to 2006, prices for fish (tilapia and milkfish) continued on its downward trend and naturally this has affected our aqua feed sector. Some farmers, discouraged by the low prices, have stopped culture activities. In the case of the black tiger shrimp, prices were not too encouraging either".

"With regards to high prices of fishmeal, the Philippines is no different from other countries. Most of our fish meal is imported. There is little that the government can do as raw material costs are beyond their control. The situation has been aggravated with the devaluation of the Philippine Peso to PHP 53 to one USD in June 2006. (Note: It has, however, strengthened to 48 PHP in Feb 2007)".

"With the current situation for black tiger shrimp production, where productivity has been low due to diseases, it has been difficult to pass on the added costs to the farmers. What we have been doing is to upgrade and streamline our production process. We are working harder at being more cost efficient. The goal is to have energy saving measures so that we can maintain operational costs (i.e. excluding raw material costs), as two years back. This means that any increase in cost of production will only be due to raw material costs".

"In such a competitive industry, we realise that vertical integration from pond to port is now the norm for many companies. At present our integration has been limited to grow out farms. We will need to look at this to remain competitive. Traceability will be requirement for products and it is only possible when there is absolute control of each stage of the supply chain".

"We are optimistic on the industry. By the end 2007, we will have a HACCP certificate and by 2008, we hope to have an ISO certification. Our next step will be to go regional".

Philip Young is currently the COO of Hoc Po Feeds Corp (HPFC), a leading shrimp and fish feed producer in the Philippines. Production facilities are in Bulacan Province. Markets are nationwide. Before joining the aquaculture industry, Philip was involved in the food manufacturing and export industry. He has been awarded by the Philippine Government Department of Trade and Industry the very prestigious (national award) Golden Shell Award. The Philippine Marketing Association has also awarded him the Agora award for excellence in export marketing.

Indonesia

...On managing costs

"Fish meal prices are going up and we are challenged with matching costs with fish prices. I still feel that the future is still good with the increasing demand of seafood. This situation with fish meal as well as increasing prices of wheat flour etc is teaching us how to manage costs. This is in optimising and developing formulations based on culture density and demands by farmers".

Our strategy for reducing costs is by minimizing labour costs with efficient control on production utility cost. We conduct R&D to find substitute ingredients that can reduce production cost and meet quality criteria.

"In 2006, we had to increase prices from 900 to 1,000 IDR/kg for our shrimp feed, depending on the grade. This added about 12% of the feed cost to farmers. In fish feed, the increase was 10% with 300 to 450 IDR/kg. This was below the increases in our production costs but we had to absorb the difference. The dilemma was if we increase feed prices to reflect costs, the farmer will most probably reduce culture density, operate some ponds or even stop culture totally".

"The situation in 2006 was not good for the fish feed industry, but we still have a good vision for the future for the aquaculture industry and is expanding production of fish feed. Cage farmers are learning to use floating feeds. They now realize that most of the pelleted (sinking) feed, though cheaper by IDR 500, is lost to the water."

PT Matahari Sakti goes into fish feed production

Puspita Dewi Prijadi is President Director, PT Matahari Sakti.

"In September 2006, we began operations at a new plant 30 km from Surabaya. This is mainly for the production of fish feed. This increased the total capacity of our feed production from 6,000 tpm to 8,000 tpm. Production at the new plant will comprise of 60-70% fish feeds".

"Our focus will remain in the aqua feed production business with the good quality. The opportunity is also in marine fish feeds. We have started some trials to develop feeds for the marine fish."

The company started the production of shrimp feed in 1988 and also expanded into floating feeds for freshwater fish in 1999. Markets for its feed are throughout Indonesia. The company has three brands of shrimp feed. Fengli is the premium brand, followed by Zaigen and Good Harvest. They have two brands of fish feed, Primafeed and Sinar Intan. All brands have achieved trust and recognition by industry in Indonesia.

Thailand

Good years for Thailuxe Feeds

Thomas Wilson is Vice President of Thailuxe Feeds, Thailand.

"Thailuxe started with shrimp feed some 20 years ago and started fish feeds in 1993. We can clearly say that we have achieved considerable progress in fish feed production. When I started with Thailuxe in 1997, our fish feed production was 5,000 tpy. Over the years production increased. We started running our new fish feed mill in July 2005, because we needed more capacity. For example, in 2006, production was 58,000 tpy and in 2007, we will target 80,000 tpy. We do not have any aspiration to go regional; the domestic fish feed market, especially if marine fish farming develops, is large enough".

"We also expect to launch feeds for the seabass in 2007. The reason for this is that seedstock for this fish is readily available and its culture can be easily expanded. In contrast, that for the grouper needs to be imported. We have also started producing starter feeds and in this way, we introduce our feeds to the customers from early culture periods and get them to continue with our feeds at grow out. Other product lines will be feeds for the aquarium feed industry. The machinery at a new line will allow me to produce feeds for crab and lobster".

"2007 may be a difficult year as far as raw material costs are concerned. The price of nile tilapia will most probably remain around THB 36 to 45 baht depending on location. In feeds we will face increases in costs from higher prices for most raw material except perhaps for cassava. Since we may not be in a position to raise prices of feeds, we will have to manage somehow. Whatever we do, the high feed quality expected from Thailuxe will have to be maintained".

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Internal physical properties of shrimp feed

By Joachim W. Hertrampf

Water durability of feed pellets is an important internal physical property. A subjective method which is not time consuming and suitable for routine water durability testing in feed mill, has demonstrated that accurate and reproducible results can be obtained.

The physical properties of pelleted shrimp feed can be classified as "external physical properties" and "internal physical properties". The former includes the appearance of the feed, such as crumbles, diameter and length of pellets. The latter considers the behaviour of feed pellets in water. In this article, only the internal physical properties of shrimp feed are discussed.

Water durability

This is the time feed pellets sustain in water before falling apart. This is a significant property of commercial shrimp feed. Pellets with insufficient water durability not only remain in water unconsumed but also contribute substantially to the water pollution of ponds. The deteriorating feed is hazardous to shrimp.

Producing shrimp feed of the highest water durability is therefore important. This, however, is not an easy task because many factors contribute to the water durability – negatively as well as positively. Water durability depends on the following.

Raw materials

There are raw materials that have a high pelletising ability. These include soybean meal while others with high crude fibre content such as rice bran have low pelletising ability. Fish meal and wheat flour, normally used at a higher level in shrimp feed, have a medium pelletising ability (Hertrampf, 1992).

Another important quality parameter is the abrasiveness of feed pellets. High abrasiveness of pellets is responsible for unwanted dust development that usually occurs during the transport of feed. The abrasiveness properties of raw materials range from high and low.

In many cases a low pelletising ability corresponds with a high abrasiveness and vice versa (Table 1). There is, of course, a wide variation in the physical properties of raw materials. The pellet quality of feed, therefore, may vary with raw materials used. (Hertrampf, 1984).

Table 1. Pelletising ability and abrasiveness of selected raw material used for aquaculture feed

	Crude protein	Crude fat	Crude fibre	Pelletising ability	Abrasiveness
Blood meal	80.0	1.0	1.0	low	low
Cottonseed meal	41.0	1.5	13.0	low	medium
Fish meal	66.0	8.0	1.5	medium	medium
Ground nut meal	48.0	5.0	7.0	high	low
Rice bran	14.0	0.6	15.5	low	high
Soybean meal	45.0	0.5	5.0	high	low
Wheat flour	14.0	2.0	1.0	medium	low
Wheat bran	14.0	3.5	11.0	low	low

Source: Hertrampf, J.W. (1992). On the water durability of aquaculture feed pellets. Advances in Feed Techn., (7), 18-38

Technical measures

The pelletising machine is most influential in producing the required water durability. The best pellet binding agent will not result in high quality feed pellets, if technical measures are improperly applied. The application of steam and temperature to the conditioning process has to be right so that the starch components gelatinize properly. To choose the correct thickness of the pellet die and the use of not worn-out pellet dies are of importance contributing to water durable feed pellets. These are only some of the technical applications in the manufacture of feed pellets.

Pellet binders

Pelleted feed for terrestrial farm animals can be manufactured without applying a pellet binding aid. However, producing feed pellets for aquatic animals that are immersed into the water, the use of a pelletising aid is a "must".

The range of pelletising agents and products is rather wide. They can be classified as the following (*Hertrampf*, 1992):

- Natural minerals
- Wood-processing by-products
- Plant products with pellet binding properties
- Synthetic compounds.

Here we will refrain from discussing "pros" and "cons" of individual pelletising agents. However, an "Efficiency Index" may help to select the most suitable pellet binder (see box, Hertrampf and Piedad-Pascual, 2000). The lower the Efficiency Index, the more cost and performance efficient is the pellet binder. However, in practical feed manufacture it is common to use a combination of various pellet binding agents.

Judging water durability

Water durability requirements

Gaus (1985) reported that shrimp farmers in Central America in the past requested a water durability of six hours. This, of course, is an 'overkill'. It is impossible to produce a pellet that disintegrates only after six hours and still is in shape that will be found and eaten by the animals.

Today's water durability of shrimp pellets is in the range of two to three hours. This time is absolutely sufficient. Mishra (1999) observed in his trials in juvenile black tiger shrimp *Penaeus monodon* that the pellets were consumed within 30 to 60 minutes.

Although pellets immersed in water should not fall apart, a certain amount of chemo-attractants have to leach from the pellets so that the shrimp get the signal to find the feed. Lemm (1983) demonstrated that 50% of a salmon population died in the presence of feed that was free of any chemoattractant.

Measuring water durability

Although the water durability of aquaculture feed is very important, there is still no standardized method or generally accepted procedure available for testing it (Heidenreich, 2000).

Putting some pellets in a glass beaker filled with water is a very common procedure to test the water durability of industrial shrimp feed. Uncontrolled stirring of the contents of the beaker from time to time is similar to a hurricane gust. Such tests have no value, and they do not provide acceptable and reproducible information on the feed pellet quality. However, more accurate and precise methods have been developed for evaluating the water durability of feed pellets.

In her trials, Boonyaratpalin (1984) in Thailand measured the disintegration of pellets by weight loss in water after determined time. The weight loss is used as a parameter for judging the water durability. This test has been used by other research workers, too (Anonymous, 1987; Pascual, 1990; Dominy and Lim, 1991). The results of this test are reliable. However, the procedure is very time consuming and, therefore, not applicable for routine tests in a feedmill.

Löwe and Appelt (1985) estimated the water durability of feed pellets by applying the following parameters:

- The floating and sinking behaviour of pellets;
- The swelling of pellets in water and in humid air;
- The turbidity of the water.

This procedure requires more time for obtaining results than the method developed by Boonyaratpalin (1984) and is not suitable for practical conditions.

The "leaching rate" which measured the visible light absorption after determined time was used by Lee and Tsay (1991). The results

Table 2. Chart to judge water durability of shrimp feed pellets using rating points from 1 to 10 (Waterbase method)

Swelling	Cracks[1] in pellets	Disintegration	Rating points
Little to-normal	none	none	10
normal	less than one third	none	9
normal	a third to half	about 15% 2	8
normal to full	half to two-thirds	about 25%	7
normal to full	Two-thirds and more	about 50%	6
full	total	about 75%	5
full	total	almost total (90%)	4
full	total	total	3
full -within few minutes	-	total-within few minutes	2
full -immediate	-	total -immediate	1

[1] Means number of pellets actually developed cracks but have not fallen apart.
[2] Visual estimation of fallen-off particles in comparison to the volume of feed present.
Source: Farooq, M.A. (1998): Report on water durability rating system to be followed at TWL. TWL-Report 06.11.

obtained were not particularly encouraging. In this context, Meyers (1991) remarked that the leaching of water soluble nutrients is only significant during the first several minutes of immersion.

The Waterbase method

Due to the lack of generally acceptable methods for testing the water durability of aquaculture feed pellets, the quality control department of The Waterbase Ltd., Nellore, India, developed a method for routine testing. Although it is a subjective test, the results were very satisfactory for practical purposes (Farooq, 1998; Divakaran, 2000a).

The measurement of water durability is based on three parameters:

- Swelling of the pellets
- Cracks in the pellets, and
- Disintegration of pellets.

In rating water durability a "judgement chart" ranging from 1 to 10 has been designed (Table 2).

For the best water durability, a maximum of 10 rating points can be applied and a minimum of eight points are required for passing the test.

Feed samples of 5.0g in a glass beaker full of water are mechanically stirred at five minutes intervals. Each stirring lasted for 20 seconds at a speed of 300 rpm to simulate the water movement in the pond. Reading was done after an hour and 2 hours by one person and after 2.5 hours by three persons. The average of the last reading by three persons was the deciding value.

All tests were conducted in fresh water. However, it was suspected that feed pellets may react differently in seawater, particularly with regard to the disintegration of pellets. The correlation between point rating in fresh water and seawater, respectively, revealed no difference whether fresh water or sea water was used for the test. The correlation coefficient was r = 0.88 (Farooq, 1999a).

This test still requires 2.5 hours which can be too long for routine control. By exchanging the test medium water by an alkaline solution, the testing time could be reduced to 1.25 hours. In addition, the preparation time of samples could be reduced. The results are accurate as the comparison of 112 samples, tested in water and alkaline solution, respectively, had demonstrated. The correlation coefficient is r = 0.91.

Efficiency Index for selection of a suitable pellet binding agent (*Hertrampf*, 1992)

$$\text{Efficiency Index} = \frac{(X \times 5) \times (Y \times 2) \times Z}{3 \times W}$$

Where
X = Water durability
Y = Inclusion rate of the pellet binder
Z = Cost of pellet agent per tonne of feed
W = Any divisor for reducing the index (otherwise it may be to high for practical purposes)
5 & 2 Factors expressing the importance of the criteria
3 = Number of criteria

The results of exchanging water by an alkaline solution, therefore, are reliable. (Krishna and Venu Gopalkrishna, 2003).

Comparison

For testing the reliability of the subjective Waterbase Method, it was compared with objective water durability tests, in particular with the dry-matter-loss test. This test can be considered as the most reliable procedure for evaluating the water durability of feed pellets. A comparison with 94 samples was conducted. The correlation coefficient is r = -0.81 (Farooq,1999a). This high statistical correlation means that the Waterbase Method's subjective rating was satisfactorily accurate.

On the other hand, the correlations between the rating by points and the turbidity of the water were less convincing. They were as follows (Divakaran, 2000b):

- After 1 hour: r = 0.56
- After 2.5 hours r = 0.58

This relationship between point rating and turbidity was insufficient for the determination of the accuracy of the Waterbase method. The results also indicate that the turbidity after one hour and 2½hours were almost the same. This corroborated with the findings by Meyers (1991) that leaching of water-soluble nutrients during the first minutes after immersion of pellets was significant.

References are available on request.

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Practical nutrition of farmed tuna and pelagic finfish

By R.J. van Barneveld and M.E.Vandepeer

Research continues to fine tune moist feeds for marine fish. Though easily weaned on to pellets, these will become routine only when sources of fresh feeds become depleted.

The nutritional requirements and feeding regimes for pelagic finfish vary significantly between species. Carnivorous species of fish, such as tuna, seabass, seabream and cod, require a protein rich, high-energy diet. Research has shown that optimal protein content of diets for these fish range from 40-55% (Table 1). However, the needs for indispensable amino acids (IAA) do not appear to vary significantly between different species of teleosts. Emerging aquaculture species such as Southern and Northern Bluefin Tuna are predominantly fed baitfish and to date, it has been difficult to develop suitable manufactured diets for use in these production systems. As these systems evolve, it is likely that manufactured diets will become more commonplace given mature aquaculture systems farming pelagic finfish species such as Atlantic salmon commenced from a similar base.

Table 1. Optimal crude protein levels for some fish (Guillaume et al., 1999)

Species	Optimal content (% DM)	Species	Optimal content (% DM)
Atlantic salmon	45	Gilthead sea bream	40
Chinook salmon	40	Japanese sea bream	45-55
Coho salmon	40	Striped bass	47
Sockeye salmon	45	Sea bass	45-50
Yellowtail	55		

Southern Bluefin Tuna

Current Southern Bluefin Tuna (SBT) aquaculture systems predominantly rely on the supply of nutrients via baitfish. In addition, an increasing proportion of this baitfish is from locally caught pilchards due to an increase in the number of tuna farm proprietors who concurrently hold pilchard trawl licences. For farmed southern bluefin tuna, potential exists to improve production efficiency by reducing the absolute cost of the feed and/or improving the feed conversion efficiency.

Nutrient requirements – Feeding baitfish

Anecdotal evidence suggests that farmers have been blending baitfish supplies for some time in an attempt to improve the growth of their fish and the resulting product quality. It is known that intake changes significantly as water temperatures drop and as SBT gain condition. Hence opportunities exist to match nutrient supply from available baitfish to this intake pattern. Results from recent research suggest that varying baitfish combinations and subsequent nutrient supply can affect the relative growth efficiency of SBT over the course of the growing season.

Maintaining a constant and balanced supply of protein and fat appears to be the most desirable feeding strategy for SBT. SBT fed a diet containing medium levels of protein and medium levels of fat for the entire experimental period had the greatest length increase, the greatest weight gain and the lowest feed conversion ratios. In particular, feed conversion ratios were maintained during the final trimester of growth compared to all other treatments. There does not appear to be any advantage to supplying either high protein/low fat or low protein/high fat diets at the beginning of the season to exploit higher intakes and potential growth potential of the SBT. There is certainly little to be gained through feeding more expensive high fat baitfish at the commencement of the season.

Manufactured feeds

Manufactured feeds for SBT have been developed to support acceptable growth rates and resulting product quality. A review of research results from 1994 to 1998 (when the bulk of this research was completed) demonstrates the significant progress that has been made towards the production of a commercially viable manufactured feed for SBT (Figure 1). The feed conversion ratio of SBT fed manufactured diets is approximately 9:1 compared to an FCR of 12:1 for SBT fed baitfish.

Baitfish supplies are currently USD 1000/tonne compared with manufactured feed costs in the vicinity of USD 2,000-3,000 per tonne (however, this could be significantly reduced if production volumes were increased). With this in mind, the FCR of SBT fed manufactured feeds need to be improved to less than 6:1 to be financially desirable. Having said that, manufactured feeds are currently offered in the same way as bait fish, and this may be compromising feeding efficiency. It should also be noted that until the use of baitfish as a nutrient source is no longer permitted, it is unlikely that there will be a significant uptake of manufactured feeds by commercial producers.

Research continues to fine tune the production of semi-moist feeds for SBT, and the management of pellet feeding has progressed to a point where SBT can be easily weaned onto a diet consisting entirely of manufactured pellets. Previous research has shown that SBT prefer 30 mm pellets over 60 mm pellets (however, this experiment may have been influenced by the previous feeding regime), and further preference experiments have allowed us to further fine tune pellet specifications.

Iat pellets have been compared with round pellets to reveal that farmed SBT have a preference for flat, 30 mm pellets (Figure 2). It appears the flat pellets result in greater surface disruption when fed, and have a slower sink rate resulting in greater consumption by SBT when offered as part of a paired feeding experiment.

Figure 1. Progress in the development of manufactured feeds for SBT. (P ADG, pellet average daily gain; M ADG, manufactured diet average daily gain; P FCR, pellet feed conversion ratio; M FCR, manufactured diet feed conversion ratio).

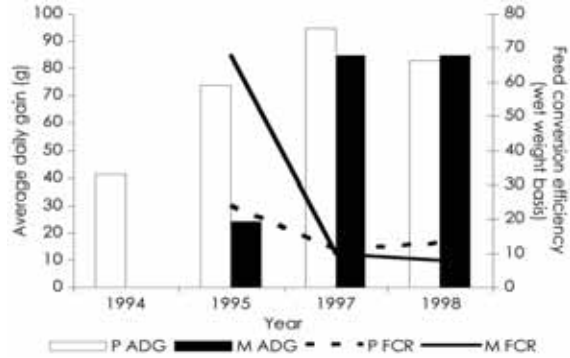
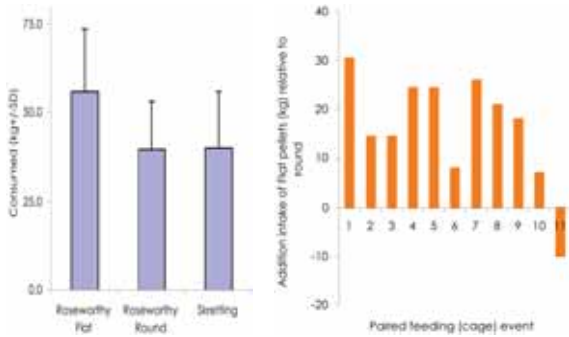


Figure 2. Consumption of flat pellets vs round pellets when offered as part of a paired feeding experiment.



Striped Bass and Hybrid Bass

Striped bass and hybrids are voracious feeders. They respond to multiple daily feeding and can grow rapidly (Hodson et al., 1987). They respond to diets high in crude protein (36 to 45 %) that contain a high percentage of fishmeal (Klar and Parker, 1989). Young striped bass and hybrid bass require eicosapentaenoic or docosahenaenoic acid in the diet for normal growth (Clawson, 1990; Webster and Lovell, 1990). Commercial trout and salmon diets can be successfully used for the rearing of these fish from juveniles to marketable size.

Protein and Amino Acids

In seabass, the protein requirements as well as the relative potential of non-protein energy sources were identified through a series of original studies (Alliot et al. 1979b; Hidalgo et al. 1987; Hidalgo and Alliot, 1988). The protein requirements have been determined to be around 50 % and an optimal dietary fat level of 12 % has been proposed. Data of Hidalgo et al. (1987) also show that the daily protein needs of juvenile seabass would range between 5 g/kg/day at 15°C to 8 g/kg/d at 20°C.

Data on the IAA needs of European and other seabass (Thebault et al. 1985; Tibaldi and Lanari, 1991; Tibaldi et al. 1993; 1994) have confirmed requirements for amino acids such as methionine, lysine, arginine and tryptophan as being similar to those for salmonids.

DP/DE ratio

Earlier data on the DP/DE ratios for the European seabass range from 25 to 30 mg/kJ (Alliot et al. 1979b; Métailler et al., 1981). These studies appear to indicate that dietary crude starch to be a poor non-protein energy source in seabass with increased liver size and decreased feed efficiency when fed diets containing high levels (>20%) of carbohydrates.

Data from Dias et al. (1997) on protein utilisation confirm the existence of a protein-sparing effect of lipids and treated carbohydrates in European seabass. The optimal DP/DE ratio (19-20 mg DP/ kJ DE) found in this study for juvenile European seabass was lower than the values found in the literature and is slightly higher than the recommended values for salmonids. Both fats and gelatinised starch were found to additively increase dietary DE levels for juvenile seabass. Compared to native starch, incorporation of gelatinised starch increased starch availability in this species, much like what has been observed in the salmonids. However, such beneficial effects of a rise in dietary DE were only significant in those fed a low dietary protein level.

Dietary protein quality and replacement of fishmeal

Besides protein sparing through optimised DE supply, to bring down dietary protein cost, substitution of fishmeal as the major protein source in aqua feeds remains a major issue. Very early, Alliot et al. (1978) stressed the importance of fishmeal quality in the diets of seabass. Subsequently, they found that up to 20-25% of alternate protein sources such as corn-gluten meal, soybean meal or single cell proteins can be incorporated in the diets of seabass (Alliot et al. 1979a). Recent work shows that a total substitution of fishmeal by plant proteins such as soy protein concentrates or corn-gluten meal reduce growth, but also have repercussions on lipid metabolism. In both trout and seabass, levels of plasma triglycerides and cholesterol are reduced when fed soy protein diets (Dias et al. 1997). Besides, the activities of hepatic lipogenic enzymes were found to be affected by dietary protein quality in both species.

Conclusion

Despite similarities between various pelagic finfish production systems, the nutritional requirements and feeding regimes can vary significantly. In emerging systems such as tuna, diets are still predominantly baitfish, and manufactured feeds must be fed as semi-moist pellets. Significant opportunities exist to further improve the efficiency of feeding these species.

References are available on request

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12th DSM Aquaculture conference Asia Pacific, Bangkok

The DSM team with David Smith, CSIRO (right). From left, Fred Schwenke, Jacques Gabaudan and Robert Redman

From left, Nuanpa Ariyapinyo, DSM, Supis Thongrod, DOF, Prof Alice Thienprasert and Dr Marisol Izquierdo

From left, Dr Chutima Tantikitti, Songkhla University, Rutchanee Chotikachinda, Inteqc Feed, Dr Juadee Pongmaneerat, DOF, Supamat Tantipaswasin, DSM, Dhanapong Sangsue, Inteqc Feed and Dr Chen Chen Ming Dang, CPF, Thailand

Revisits lipid and mineral nutrition in fish and shrimp

Increasing prices and decreasing supplies of fish oil and fish meal amidst low prices of farmed shrimp and fish continue to be a major issue for the aquafeed sector in the region. Last year, organisers of the annual DSM aquaculture conference looked at plant meals as substitutes for fish meal. Next is to endeavour to replace fish oils with the more sustainable plant oils.

During this conference, held on November 24 2006, lipid nutrition in fish and shrimp and the protection of lipids in fish meal and fish oils were the primary subjects. Complimenting these were presentations on the health benefits of n-3 fatty acids in seafood which industry can take advantage of to encourage consumption. Then there were other subjects such as in mineral and larval fish nutrition where lipids also play important roles.

Since 2005, market trends have always been included in the conference agenda and at this conference, Dr Jacques Gabaudan, Aquaculture Centre Asia Pacific, presented findings of a market survey of preferences for shrimp by Japanese consumers. He concluded that the purchasing of shrimp was based on colour more than anything else. This presentation is given in pages 30-31.

Aquaculture no longer a marginal business by 2030

This was the opening statement of Dr Ian Partridge, Director of New Business Development, Animal Nutrition DSM based in Singapore. At the current rate of growth, 8.7 %/annum since 1970, (FAO, 2003), aquaculture output in 2030, will overtake that from capture fisheries. Recently, some experts have predicted that by 2048, there will no longer be fish in the seas. So it leaves aquaculture with the role to supply

Dr Ian Partridge, DSM

(cont'd page 26)

Lipid nutrition in aquafeeds revisited

An often overlooked area is lipid nutrition. During his presentation Dr David Smith said that aqua feeds are already using 90% of the global fish oil production. The focus is now on lipids as the pressure is on alternatives to marine fish oils, an expensive source of lipid which is non renewable and supplies are declining. Knowing how to protect the oils in feeds is the next step as explained by Tom Verleyen.

Understanding lipid nutrition by David M Smith, CSIRO, Queensland, Australia

"If and when, there is a need to use less of fish oil, it is essential that we understand more the role of n-3 HUFAs (highly unsaturated fatty acids) and phospholipids. Ultimately, it is the cost factor which will affect decisions".

One of the reasons for the poor understanding of lipid nutrition is the complexity of the nutrient. It contains many classes of compounds, some of them essential. Current information on the requirement for the various components in marine and freshwater species vary greatly. Information is sufficient for feed formulation of marine shrimp, *Penaeus monodon* and *P.vannamei* but not for the lobster and mud crab. In fish, knowledge is available for the grouper and Asian seabass, catfish, tilapia and milkfish only.

Lipids in shrimp nutrition

An important factor is that recommended specifications for lipids are linked to the protein content, i.e the protein:energy (P:E) ratio. It is also linked to the quality of lipid. In general, this should be between 6-8% but not exceeding 10%. In the case of *P. japonicus*, the requirement is 6-8% with crude protein (% CP as fed) under 50% but increases to 12% at 55-58% CP. Growth is however inhibited at 16% lipid notwithstanding the level of protein. In *P. monodon*, the requirement is 7.5% with 44% CP and is reduced to 6% with 36% CP. CSIRO has found that growth of *P. monodon* declines progressively as the lipid content increases from 6 through to 11%. Information is not clear in *P. vannamei* but this is likely in the 6-8% range.

The role of phospholipids (PL) has usually been underestimated by most nutritionists. These may be synthesized in the animal but at a slow rate. Supplementation is essential. Levels proposed have varied from a minimum of 1.6% in feeds for *P. japonicus* and 1.35% in *P.monodon*. A recent recommendation for *P. vannamei* feeds was 3-5% of dry weight of the feed. However, this might add too much lipid to the feed and adversely change the fatty acid profile.

It is not only the total amount that is important. Nutritionists must look at the purity of PL and be aware of the type in the raw material. A mixture is better than just one type. The common source of PL is lecithin from SBM. PL containing the essential fatty acids is best but these are expensive and are marine organism based. The recommendation is 1.25% for *P. monodon* and at least 1.25% for *P. vannamei*.

PL are required for the efficient absorption and transport of cholesterol. Again, the animal cannot synthesise cholesterol and supplementation is essential. Less cholesterol will require higher amounts of PL. However, it is not recommended to reduce the levels of cholesterol to 0.05% (Table 1) and increase PL to 5%, because there would be too much PL in lecithin form. This may affect fatty acid balance, pellet quality and certainly increase costs.

In the case of the essential fatty acids, balance is the key issue. Glencross (2002) showed that when there are adequate levels of EPA (eicosapentaenoic)/DHA (docosahexaenoic) acids, we may not need LOA/LNA (linoleic/linolenic) in *P. monodon* with 7% lipids in the feed. An excess of EPA/DHA will also lead to reduction in growth and increasing ARA (arachidonic) to 0.3% will also lead to decreased growth. Ideally the n-3: n-6 ratio should be between 2:1 to 3:1.

Table 1. Cholesterol and phospholipids specifications for shrimp diets

	Cholesterol +	Phospholipids
P. monodon	0.17%	1.7%
P. japonicus	0.5%	2.0%
P. vannamei	0.35%	None
	0.14%	1.5%
	0.13%	3.0%
	0.05%	5.0%

In the case of astaxanthin, there is no apparent requirement for growth but dietary levels less than 10 mg/kg result in the blue shrimp syndrome. Recommendations for finisher diets are 80 ppm in the 4 weeks prior to harvest. A new technology incorporating astaxanthin in feed has reduced this to 50ppm.

Lipid specifications for fish

What is known is that high total lipids will reduce the capacity of fish to use protein effectively. Excess TL in the feed resulted in increased deposition of body fat. Whether there is a similar requirement for all species of tropical marine fish is still unknown. Some recent work showed the following.

Asian seabass fed an improved diet of 55% CP and 20% TL achieved 500 g in 100 days as compared to 375g for fish fed a diet with 45% CP and 10% TL (Williams et al., 2000). In the grouper *Epinephelus malabaricus* in Vietnam, Tuan and Williams (2006) have determined that the optimal level for growth was 12% total lipids and 55% CP. In smaller fish, the optimal TL level was 10%. In 12g humpback grouper, a 1.5% of dietary HUFA is appropriate for a total lipid level of 9% (Suwirya et al., 2004).

It has been determined that smaller tilapia need higher levels of n-6 PUFAs and larger fish (30-35g) will require 7-12% of TL. In contrast, Shiau postulated that younger fish should require more n-3 PUFAs and that the ratio (n-3:n-6) should be > 0.5:1.

The issue of fat deposition is important and Williams and Barlow (1999) showed that in 80g seabass, the optimum TL was 15%. In fish, growth rate was not shown to be influenced by n-3/n-6 ratios. When the n-3 composition was maintained and TL was 12%, optimal crude protein was from 45% to 55%. The deposition of fat in cold water species, such as salmonids is desirable, and with 35% TL in feeds the fat ended up in layers within the muscle. However, with tropical species excess fat is deposited in the viscera, which reduces the value of the product in most markets.

Sources of lipids

The nutritionist is very concerned about sources of lipids. The key factor is the fatty acid profile. ARA, EPA and DHA are missing in lecithin and meat and bone meals but high in fish and squid meals. Soybean, flaxseed and tallow are high in LNA and moderate in LOA. Caution is on the use of coconut oil which may contain 0.2% of LNA but also high amounts of medium chain saturated fatty acids which can reduce fish appetite.

The future may possibly be with new sources, such as from krill. The question here will be the cost of harvesting the material. Another possibility is the plant *Echium plantagineum* which is rich in steridonic acid (18:4n-3) which can be converted to EPA/DHA. Other possibilities are microbial oils from thraustochytrids which are marine single cell heterotropic protists and yeast, and vegetable oils containing DHA from genetically modified oilseeds.

Lipid oxidation and antioxidants – by Tom Verleyen, Kemin Agrifoods, Belgium

"Oxidation of lipids is a one way cycle and cannot be reversed. Only antioxidants can slow down the process. However, it is important to start with good raw material. We also need to go back to the origins of fish meal and its storage conditions too".

The autoxidation of fish meal, oil, carotenoids and vitamins undermines feed quality. With an oxidized feeds, the animal has a lower feed intake and oxidative stress. The loss in metablisable energy has been reported as 5-20% (ref). In the sturgeon, feeding 8% oxidized oil in feed has its side effects such as reduced survival to 39% and increasing the percentage of deformed fish to 15% from 3%.

The measure of the primary products of oxidation is the peroxide value in meq/kg. The TBA value is indicative of secondary oxidative products (aldehydes and ketones) and which gives the off flavour characteristics. In the salmon, oxidized oil of 200 Meq/kg in feed, results in high TBA in the liver and a lower feed intake. More critically, this undermines the stability of lipid in the fillet and its organoleptic properties.

The cycle of reactions in lipid oxidation comprising three stages is further complicated by factors such as the degree of unsaturation of the lipid, presence of metal ions and temperature. Even at low temperatures of -20°C, oxidation continues. Metal ions which are pro oxidants are Cu^{2+} and Fe^{3+}, present in fish oil at 0.07-10ppm and 0.06-0.7 ppm, respectively. They are present in fish meal at 70-200 ppm and 2-5 ppm, respectively. Extra premixes which are sources of copper and iron ions, may effect oxidation.

The various antioxidants act at different stages in the cycle and in varying ways. Metal chelators such as citric acid and phosphoric acid act at the early stage and inhibit free radical formation. The commonly used synthetic antioxidants such as ethoxyquin, BHT/BHA are radical scavengers and act by breaking the oxidative chain. Current interest is also in natural antioxidants substances such as gallic acid.

As for fish meal, the supplier usually stabilizes it with ethoxyquin added at 300 ppm. A 5 year survey on fishmeal from various sources showed 38% of supplies have less than 5% TBA. As an added precaution, feed producers add antioxidants to the mix. The goal is how to have a good equilibrium so that the species is not under oxidative stress which affects growth performance.

In shrimp feed with antioxidant at 500g/tonne, TBA values are lower and shrimp showed 25% higher weight gain, according to Bautista-Teruel (1999). In salmon feed where astaxanthin is added for colouration, antioxidants are required to improve pigment retention. Ethoxyquin added at 100ppm gave a pigment recovery of 92% whereas an antioxidant blend gave 97% recovery.

In the future, the focus will be on ethoxyquin, traditionally used to stabilize fish meal but can be transferred to the tissue. As ethoxyquin is not allowed in human food, the search is for cost effective alternatives. In organic aquaculture the focus is on the use of natural antioxidants. There are now initiatives by certification bodies to include natural antioxidants such as the tocopherols.

Larval nutrition and feeds by Marisol Izquierdo, ULPGC, Spain

"As lipids are the most important factor in nutritional quality of live prey, investigations have focused on the essential highly unsaturated fatty acids and phospholipids. These play a role as an energy source, in biomembranes and cell structure maintenance, immuno and stress regulators, transport of fat soluble vitamins and hormones".

During larval stages of fish and shrimp, nutrient utilization is related to morphological and physiological changes during larval development. Requirements for nutrients would be related to a complex mix of parameters such as broodstock feeding to nutrient interactions and conditions of culture.

Digestive enzymes are present in shrimp and fish from first feeding. There is a progressive increase in activity with age for the phospholipase A2 in turbot and with lipase for the gilthead bream. Activity is related to diet composition. However, the question remains whether the larva has the required amounts of digestive enzymes.

Up to 2.89% EPA (eicosapentaenoic acid) in diet was found effective in several stress situations such as salinity and temperature. Cortisol production, which control stress, also increased with EPA and ARA additions. However, the lack of essential fatty acids will alter the tissue composition. Some negative effects are reductions in growth, poor feeding and swimming activities. Recently, the Δ6 deshydrogenase gene was isolated from sea bream which indicate chain elongation capabilities of the species. This may not be sufficient and dietary EPA will still be necessary.

More n-3 HUFAs are required by larval fish as compared to juveniles. It is 3.5% in larval *Pagrus major* and 0.5% in juvenile fish. More importantly is DHA which in larva, the higher the better. If ARA is low and DHA is high, growth is also improved. It is important to know the balance because these fatty acids compete in digestive enzymes. The requirement is affected by the ratio of EPA:DHA. A 1.5 ratio gives a requirement of more than 2% of HUFA in dry diets whereas, at a ratio of 5.5, the requirement will increase to 4.5% in gilthead bream. The optimal dietary levels of EPA/DHA are determined by salinity.

From Right, Ng Siow Leng, Cargill Malaysia and Charles Nam, PT Japfa Comfeed, Indonesia.

fish but the issue is whether aquaculture can close the gap between demand and supply. With this responsibility, aquaculture can no longer be a marginal business.

The challenges faced by the industry ranged from the supply of raw materials, environmental sustainability, and commercial viability to consumer confidence. Added to this, is food safety and traceability. Any failure at any part of the production chain has its own consequences.

"Our global consumption of fish oil in aqua feeds at inclusion rates of 0.5% in the carp feeds to 12% for marine fish means that consumption will increase by 68% in 2010. This will exceed projected supply".

He added that through science, the industry has made advances in domestication of the shrimp and cell lines for the blue fin tuna. "In the future, science will again lead us".

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More on mineral nutrition in fish and shrimp by Dr Santosh Lall, NRC, Canada

"Unlike many other nutrients, minerals show toxicity and deficiency signs. An excessive intake of minerals from diets or gill uptake causes toxicity. Thus a fine balance between surplus and deficiency is vital. It is important to minimize outputs to the environment. Our goal is for better fish performance and product quality, disease prevention and low mineral excretion".

Dr Santosh Lall, NRC, Canada

In mineral nutrition studies, we have confirmed the essentiality of several minerals for various species of fish and shrimp. We know that copper (Cu) is important in shrimp for haemocyanin production and the levels are higher than in other animals. Mineral metabolism depends on the water environment. In freshwater, the rainbow trout takes in mineral through the gills but in saltwater, it is through continuous drinking. There are also toxicants from the environment and feeds. Cu and molybdenum are essential yet toxic in larger quantities. In recirculation systems, more soluble mineral will be required.

Research and development in mineral nutrition has been rather slow. Requirements have been determined for several species but these have been on small fish. Calcium (Ca), potassium (K) and selenium (Se) is required in tilapia but we do not know the quantity. In marine shrimp, information is only available for *P. japonicus* and requirements levels for Ca and Phosphorus (P) are known for *P. monodon* and for Ca, P and Magnesium (Mg) in *P. merguensis*. In 2002, Kaushik showed that there was a large variability of mineral and trace mineral composition in salmonid feeds. Today we are also looking at some 20-30 trace elements and the question is whether these are essential or contaminants.

The main functions of minerals include skeletal maintenance, cellular respiration and acid base equilibrium. They are also important as components of hormones, enzymes and activator of enzymes. Mineral deficiencies affect all stages and deficiency in the broodstock is carried to the egg stage.

Skeletal deformities are linked to deficiencies in P, manganese (Mn), zinc (Zn), Cu, fluoride (Fl), Se and iodine (I).There could however be more to this. For example, nephrocalcinosis appears in fish fed with 10 mg/kg of Se whereas the requirement is only 0.3mg/kg. Are certain skeletal deformities the result of toxicity of deficiency? In the bone remodeling process, vitamins such as Vitamin C, E, A and phosphorus and hormones are involved.

The problems with mineral imbalance, bioavailability and toxicity are widely recognised but information is still limited. Answers to some questions such as is Ca and P absorption under the control of hormones and the how micronutrients (Fe and Cu) are utilized in the shrimp will require more sensitive methods. Techniques such as genomics and genotyping are now available to look at nutrient deficiency and toxicity at the cellular level and explain some of the effects as well as the pathogenesis of deformities and the role of minerals in diseases.

Fishmeal is considered a source of minerals but its supplementation with certain trace elements is required for optimal growth. Selenium in fish meal has a low digestibility at 30 to 40%. The bioavailability of elements may vary when supplied from different sources. In substituting fish meal with plant meals, the nutritionist needs to be aware of the low mineral concentration of Ca, P and Fe in the latter. There is also the heavy metal contamination from soil. Fibre, high in plant meals, may interfere with availability. The availability of phosphorus is low. (Extracted from Mineral nutrition of aquatic animals by Santosh P. Lall)

Dr Mali Boonyaratpalin, DOF(right) and Sirirat Rengpipat, Chulalongkorn University, Thailand

The PUFA story in seafood

It is the polyunsaturated fatty acids (PUFAs) and its health benefits that can bestow seafood an advantage over pork and poultry. Prof Alice Thienprasert, Unit of Nuritional Biochemistry, Silpakorn University in her presentation said that it is the through the n-3 fatty acids that anti inflammatory n-3 eicasanoids are derived. Studies also showed that diets with high levels of n-3 fatty acids have reduced ADHD (Attention Deficit Hyperactivity Disorder) and the level of absenteeism in Thai children.

In events linking diets to diseases, Dr Alice showed that the production of n-6 eicosanoids, precursors of inflammatory cytokines from high levels of n-6 HUFAs (highly unsaturated fatty acids) ultimately leads to thrombosis and mortality. She added that it will be the balance of dietary n-3 and n-6 fatty acids that will affect the amounts in the tissue. The grim view is that excessive n-6 eicosanoids promotes heart attacks, strokes and a long list of ailments. This is evidenced by over 300 deaths per 100,000 from heart attacks in American populations, where 84% of diet is n-6 fatty acids. In contrast, in the Japanese population with only 47% of diet comprising these n-6 fatty acids, 100 deaths per 100,000 was reported. Her take away message was that it is "the choice of food that will give the right balance of n-6 and n-3 in the body".

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A promising approach to stress reduction in aquaculture with natural feed supplements

By Sjoerd Wendelaar Bonga and John Sweetman

Stress is a major problem in intensive fish production systems, leading to growth reduction and increased susceptibility to infectious diseases. The goal of a successful aquaculture enterprise is to avoid a disease outbreak and significant economic losses. Although preventive measures through good management practices are still most effective, the correct application of natural feed supplements can help to promote stress resistance.

Stress and aquaculture

Many potential fish pathogens are ubiquitous. In nature fish are able to resist these these pathogens well as they are able to seek out the best environmental conditions through freedom of movement. Fish in an aquaculture environment, however, are confined to the production unit and are often exposed to a regime of stressors including high fish density, reduced water quality, handling and sub-optimal nutrition.

A stressor can be defined as 'an adverse stimulus acting on a biological system which results in the system reacting to that stimulus'. Stress often changes a biological system from one that acquires energy to one that uses it, affecting the fish' behaviour and feeding. Stressors may have extensive adverse effects on growth, reproduction and flesh quality, changing the body to one that starts using energy, rather than storing or investing it. Furthermore, stressors may also suppress the immune system leaving the animal at greater risk of disease.

In intensive aquaculture, stressors are common and as fish cannot escape these, stress is therefore an intrinsic problem which results in reduced fish performance and threatens fish health. In addition, stress is cumulative, a fish that is suffering from low dissolved oxygen will show a further increased stress response if it is then handled for example. Stressors have considerable adverse consequences for the profitability of the fish farmer, therefore, stress reduction is of paramount importance for a successful aquaculture system.

Stress response in fish

Two types of stressors can be distinguished; acute (e.g. handling) and chronic (e.g. continuous poor water- or feed quality). The stress response is essentially similar in all vertebrates and involves physiological and behavioural responses directed at restoring the disturbance of, or protecting, the physiological equilibrium of an organism.

Fish are able to adapt to stress for a short period of time. They may look and act normal but under chronic, unavoidable stressor exposure, the stress response can become maladaptive. The energy reserves are eventually depleted and hormone imbalances occur. This is then responsible for damage to the cardiovascular system, loss of appetite and reduced growth or weight loss, as well as reduced reproduction. Furthermore, the immune system of the fish is suppressed and the susceptibility to infectious diseases is increased.

Fish are relatively sensitive to stressors when compared to terrestrial vertebrates and the main reasons for this are the presence and importance of the gills and the structure of the skin.

Stress signalling by gills and skin

The gills consist of very delicate and extensive structures with epithelial layers forming a barrier of only a few micrometers between the blood and the ambient water. Furthermore, the structure of the skin of fish is very thin compared to that of terrestrial vertebrates, and only covered by a mucus layer instead of well protected by keratinised layers and structures such as feathers and hairs. The advantage of the skin , with its complicated structure and many different cell types, is its role as an important interface between the fish and its environment. The skin contains many sensory cells and organs, with fine sensitivity for the detection of water movements, chemicals and signals from other fish, prey animals or predators. However, the skin is also easily damaged, mechanically and through infection, leading to epithelial ulcers which arise rapidly.

Acute stress, as well as chronic stress, is usually associated with marked structural changes of the skin and gills and structural damage to the gills. The latter effect is mainly due to the high blood pressure and increased blood circulation as a result of the stimulated heart rate and ventilatory movements. This may lead to swelling of the lamellae and even to disruption of the vascular tissue of the gills. It may also lead to increased permeability of the branchial and, most likely, the skin epithelia to water and ions which causes severe disturbance of the hydro-mineral balance, a typical phenomenon of stressed fish. Skin and gills are also primary targets for infectious agents, from viruses to crustacean ectoparasites.

Improve performance by stress reduction

Selection of fish

When compared to the farming of most other animals, intensive aquaculture is a relatively new innovation. The process of domestication has only just begun and considerable effort is devoted to selecting for and defining the heritability of economically important traits in these fish. These are for growth rate, age at maturity, fillet composition and disease resistance. Selection could be performed by selective breeding from desirable phenotypes or by more recent techniques such as application of biochemical/molecular techniques in genetic engineering. However, the selection of strains of fish with a low stress response and the propagation of stress-resistant strains is still in its infancy and only few successes have been reported.

Management

Preventive measures through good management practices are still most effective in stress reduction. In this way disease problems and mortalities are minimised while economic benefits are maximised. Good management involves maintaining good water quality, preventing injury and limiting stress during handling, providing well-balanced nutrition at a proper rate and using appropriate sanitation procedures. The use of common sense of the farmer plays a vital role here.

Feed supplements, additives and nutraceuticals

The potential for reducing stress and enhancing immunity and disease resistance by a wide range of nutritional factors/feed additives has been clearly demonstrated in warm-blooded animals, while relatively little work in this area has been conducted in fish. However, the positive effects of dietary nutrients and additives in terrestrial animal production together with the encouraging results of those ingredients and additives that have been tested in fish show great promise for some stress resistance in aquaculture.

To reduce the impact of stressors and to facilitate the compensatory adjustments of fish in aquaculture, several feed supplements have been advocated. Substances derived from yeasts, bacteria, algae and fungi, or lyophilised preparations of these organisms, have been introduced to activate the innate defence mechanisms. Also nucleotides

as a diet supplement have been shown to stimulate the immune system and to counteract the suppressive effects of stressors.

Feed supplements and additives

Commercial aquaculture feeds have initially been developed to meet the basic nutritional requirements of a few farmed species. Raw materials and 'least-cost' formulations should meet basic nutritional demands and support adequate, economic growth in healthy farming conditions. Nowadays there is an increased pressure on feed companies to deliver high quality feeds that preferably have a beneficial effect on animal performance. In addition, greater traceability and changing consumer demands ask for alternatives for specific feed additives such as e.g. antibiotics. Finally, there is, because of the dramatically declining natural fish stocks, an urgent demand for alternatives for fish meal as a protein source. A wide variety of feed supplements is nowadays available to meet those demands.

Feed supplements are nutrients or additives added to a diet or feed ingredient either to;

- preserve its nutritional characteristics prior to feeding (antioxidants, mould inhibitors, mycotoxin binders)
- facilitate ingredient dispersion or feed pelleting (emulsifiers, stabilisers and binders)
- facilitate feed ingestion and digestion (attractants, feeding stimulants, digestive stimulants)
- increase consumer acceptance (food colourants) or improve meat quality
- positively affect the immune system (immunostimulants)
- balance gut microflora (prebiotic and probiotics)
- supply essential nutrients (vitamins, minerals, amino acids, cholesterol and phospholipids)
- increase nutrient and/or trace mineral availability.

Stress reduction by feed supplementation

Feed supplements gained wide acceptance in livestock production and they are very applicable in aquaculture production systems. Feed supplements have been shown to improve performance, health and reproduction. However, still little information is available on the specific role of supplements in stress resistance, however this area is very promising and deserves more attention.

Knowledge in this field is growing rapidly and the challenges of modern feed formulations play an important role in the selective use of feed supplements. Further as selected fish stocks show higher performance capabilities so their nutritional requirements become more demanding. The challenges we face today require the careful application of this developing information pool and these must be backed by positive benefit in terms of growth performance and survivability of aquaculture stocks.

Evaluating feed supplements and additives

Many different types of feed supplements are being marketed. Profitability is a key factor when deciding if an additive should be used on a farm or not. Specific rearing conditions and health issues unique to that site will also play an important role in the strategy developed to reduce the negative impact of stress and disease.

In general it can be stated that natural feed (and also food) supplements perform better than synthetic products. Furthermore, the products should be developed after appropriate scientific research and should be marketed after thorough evaluation by the manufacturer.

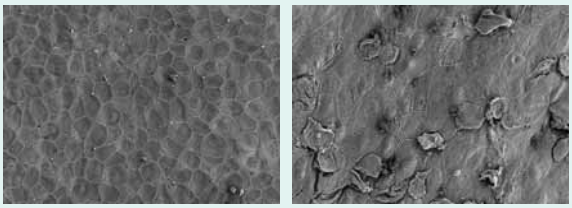
In evaluating the usefulness, the following points should be considered;

- their role should be defined and demonstrated
- they should be included in the feed at an optimal level or ratio
- they should be positioned properly in the feeding programme
- inclusion rates or application strategy may need to be adjusted to individual farm requirements
- cost effectiveness should be evaluated in the different production environments or at the specific farm (level).

Fish living in their natural environment eating their natural food is the core of the approach to health and well being, however, this idyllic situation can never be achieved in aquaculture. It is necessary to address the challenges associated with intensive aquaculture practises on the nutritional, environmental and management sides. Fortunately, it has been shown that certain high quality feed supplements and additives can play a critical role in optimising health and performance in culture situations. Properly understood and applied, these supplements may complement even the best diets.

Alltech Inc produces natural and effective products for aquaculture. These products have shown efficacy in reducing the negative impact of stress and disease on fish and shrimp stock performance. Bio-Mos®, NuPro® , Bioplex® minerals and Sel-Plex® have been shown to improve gut health and morphology, immune status and disease resistance, play an important role in antioxidative protection and mineral nutrition.

Figure 1. Scanning electron micrographs of carp skin.



The left picture shows the skin of a control fish, with the typical fingerprint pattern dominating on the surface of the upper layer of skin cells. The right picture shows the irregular surface of the upper layer of skin cells of a stressed carp. Several cells have lost the fingerprint pattern and some are being sloughed off, indicating increased cell death (by apoptosis) in stressed fish. These cells, like many other cell types in stressed fish, also show enhanced cell division and differentiation, which in combination with the increased cell death points to accelerated ageing of the stressed animals.

Figure 2. High density aquaculture (left), including the necessary handling procedures like grading (right), is very demanding for the cultured animal. Practice has shown that certain high quality feed supplements could optimize health and performance under these conditions.

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John Sweetman has over 25 years worldwide experience in aquaculture. His consultancy company Ecomarine Ltd is involved in all aspects of aquaculture production, product use and marketing, research and development and management. Currently he is working as European Technical Manager of Alltech Inc.

Mycotoxins, the often overlooked threat in shrimp farming!

By Pedro Encarnação

Most of the problems currently confronting the shrimp farming industry are related to the widespread occurrence of disease, be it parasitic, bacterial and/or viral infections. As these usually lead to heavy losses, the industry has focused most of its attention to deal with such threats. This is in particular with those associated with viral diseases. However, disregarded by the industry are other disease causing factors such as in the culture environment and in feed.

One such factor is the presence of mycotoxins in shrimp feed. Contamination of aqua feed is common in humid tropical regions, such as all of South East Asia. The problem can be caused by many factors, such as low quality feed ingredients to inappropriate methods of feed storage.

Mycotoxins in aqua feeds

These are secondary metabolites produced by fungi, commonly referred as molds. They are produced by these organisms when they grow on agricultural products before or after harvest or during transportation or storage. Most of the mycotoxins that have the potential to reduce growth and health status of shrimp and other farmed animals consuming contaminated feed are produced by *Aspergillus*, *Penicillium* and *Fusarium* sp. (CAST, 2003). These toxic substances are known to be either carcinogenic (e.g. aflatoxin B1, ochratoxin A, fumonisin B1), estrogenic (zearalenone), neurotoxic (fumonisin B1), nephrotoxic (ochratoxin), dermatotoxic (trichothecenes) or immunosuppressive (aflatoxin B1, ochratoxin A and T-2 toxin).

Given the trend and the economical need to replace expensive animal-derived proteins, such as fish meal, with less expensive plant proteins sources, the impact of mycotoxin contamination in aqua feeds will have a tendency to increase. This is related to the higher susceptibility for mycotoxin contamination in the feed ingredients of plant origin.

Toxicity for aquatic species

Mould toxins vary in their toxicity toward different animals species. While the effect of mycotoxins is relatively well known in most terrestrial farm animals, the effect of mycotoxins on aquaculture species has not been studied extensively.

Nevertheless, several studies have reported pathological signs of mycotoxin poisoning in fish and shrimp species, sufficient to cause economic damage. These are either through unfavorable effects on the animal themselves, caused by exposure to high contamination levels, or by detrimental health effects in animals consuming low or moderate contaminated products.

This general disregard regarding the consequence of mycotoxin contamination in shrimp feeds is probably directly related to the lack of information on the impact of the different mycotoxins in crustaceans.

Effects of AFB_1

Several studies have focused mainly on aflatoxins. It has been reported that dietary aflatoxin B1 (AFB_1) adversely affected growth performance, feed conversion and apparent digestibility coefficients. It caused physiological disorders and histological changes, in particular on hepatopancreatic tissue.

Nevertheless, these reports have shown inconsistent results regarding the sensitivity of shrimp to AFB_1. According to Bintvihok et al. (2003) AFB_1 levels below 20 ppb (20μg/kg) can already cause reduction in weight gain and slight increase in mortality, after only 10 days. Histopathological findings indicated hepatopancreatic damage by AFB_1 with biochemical changes of the haemolymph. Similarly, Bautista et al., (1994) observed histopathological changes in the hepatopancreas of shrimp at levels of 25 ppb AFB_1. These effects were then aggravated with increasing toxin concentration. However, reduction in weight gain was only observed for AFB_1 concentrations above 75 ppb during the 60 day study with juvenile black tiger shrimp *Penaeus monodon*.

Conversely, AFB1 levels between 50–100 ppb showed no effect on growth in juvenile black tiger shrimp *Penaeus monodon*, according to Boonyaratpalin et al. (2001). Nevertheless, growth was reduced when AFB1 concentrations were elevated to 500–2,500 ppb. Survival dropped to 26.32% when 2,500 ppb AFB_1 was given, whereas concentrations of 50–1000 ppb had no effect on survival (Boonyaratpalin et al., 2001).

They also showed marked histological changes in the hepatopancreas of shrimp fed diet containing AFB_1 at a concentration of 100–2500 ppb for 8 weeks, as noted by atrophic changes, followed by necrosis of the tubular epithelial cells. Severe degeneration of hepatopancreatic tubules was common in shrimp fed high concentrations of AFB_1 (Boonyaratpalin et al., 2001).

Abnormal hepatopancreas and antennal gland tissues were also reported by Ostrowski-Meissner, et al., 1995 in shrimp fed 50 ppb AFB_1/kg after only 2 weeks. Feed conversion efficiency and growth were significantly affected, but only at AFB_1 levels of 400 ppb. Apparent digestibility coefficients decreased significantly at AFB_1 900 ppb (Ostrowski-Meissner, et al., 1995). According to Burgos-Hernadez et al. (2005), the effect of AFB_1 toxicity to shrimp results in the modification of digestive processes and abnormal development of the hepatopancreas due to exposure to mycotoxins.

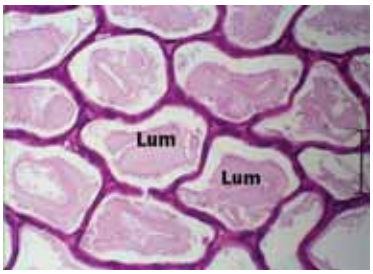
Effects of other mycotoxins

Information on the effects of other possible harmful mycotoxins on shrimp and other crustacean species are scarce. Only a few studies have been conducted to access the effects of deoxynivalenol (DON), ochratoxin A (OTA), zearelenone (ZON) and T-2 in shrimp.. Deoxynivalenol, also known as vomitoxin, and other type B trichothecenes are produced by *Fusarium* sp. and can be an important contaminant of wheat.

Deoxynivalenol levels of 200, 500, and 1,000 ppb in the diet significantly reduced body weight and growth rate in white shrimp *Litopenaeus vannamei*. However, the effects of 200 and 500 ppb DON were manifested at later stages of growth and 200 ppb DON affected only growth rate and not body weight. Feed conversion ratio and survival of shrimp fed diets containing 200, 500, and 1000 ppm DON were not significantly different from those of shrimp fed the control diet (0.0 ppm DON) (Trigo-Stockli et al., 2000).

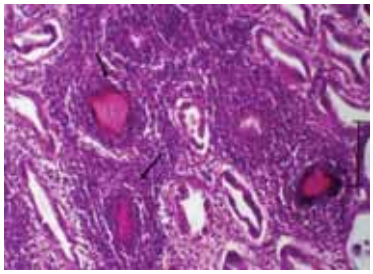
In *Penaeus monodon*, feed supplemented with DON to levels up to 2,000 ppb caused no effect on growth (Suppamataya et al., 2005). Supamattaya et al. (2006) reported that in white shrimp growth was significantly reduced by T-2 toxin at 0.1 ppm while for black tiger shrimp reduced growth was observed at levels of 2.0 ppm. The presence of T-2 toxin at 1.0-2.0 ppm produced atrophic changes and severe degeneration of hepatopancreas tissue, inflamation and loose contact of hemopoietic tissue and lymphoid organ on black tiger and white shrimp after feeding for 10 weeks and 8 week respectively (Fig 1). The same pathology was found in shrimp receiving 1.0 ppm zearalenone (Supamattaya et al., 2006). It was concluded by the authors that white shrimp are more sensitive to mycotoxins then black tiger shrimp.

Figure 1A.



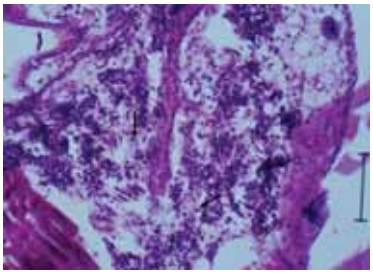
Atrophic changes of hepatopancreatic tubule produced by T-2 toxin at 1.0 ppm for 8 weeks.

Figure 1B.



Tubular degeneration and encapsulation were observed in white shrimp fed zearalenone at 1.0 ppm for 8 weeks.

Figure 1C.



Loose contact and necrosis of hemopoietic tissue affected by T-2 toxin at 2.0 ppm in white shrimp (source Supamattaya et al., 2006).

Mycotoxins and the immune system

There is evidence to suggest that consumption of diets contaminated with mycotoxins suppresses the immune system and decreases disease resistance. This can occur even when animals are consuming low or moderate contaminated products. The effects can pass unnoticed and the economical losses are normally just associated with the disease outbreak causing the damage.

Mycotoxins that impair the immune system include AFB_1, T-2 toxin, OTA, DON and fumonisin. Most of this toxins cause impairment of the immune system by inhibiting the synthesis of key proteins associated with the immune function. In the shrimp immune system, haemocytes, in conjunction with fixed phagocytes form the immunocompetent components and their reduction in numbers can result in a decreased disease resistance. Shrimp becomes more susceptible to infections.

A consumption of trichotecene mycotoxins causes suppression of immune response by reducing both phagocytic activity and chemotaxis by macrophages (Maning, 2001).

According to Supamattaya et al. (2006), total haemocyte, granulocyte and phenoloxidase activity were reduced in shrimp fed with T-2 toxin and zearalenone. Conversely, no difference in numbers of haemocytes in blood circulation was observed between shrimp fed various concentrations of OTA and DON (0 – 2000 ppb) after 8 weeks period. The results of phenoloxidase (PO) activity however, showed that feeding with high level of OTA (1,000 ppb) caused significant decreasing of PO activity (Supamattaya et al., 2005).

A negative correlation between the number of haemocytes and dietary concentration of AFB1 was reported by Boonyaratpalin et al. (2001) when feeding shrimp diets ranging from 0-2,500 ppb AFB_1 during a 8 week period. A biochemical change of the haemolymph by AFB1 was also reported by Bintvihok et al. (2003). A decline in the activity of such immuno-competent cells causes a decline in shrimp's immune response (Boonyaratpalin et al., 2001).

Combating mycotoxins

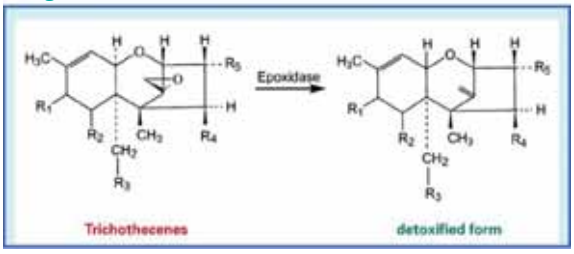
The contamination of feeds and raw materials by mycotoxins is now a reality. It is increasingly likely that any given feedstuff could contain one or, more likely, several mycotoxins. They are invisible, odorless and tasteless toxins with a major impact on animal health.

Although the presence of mycotoxins in feed represents an increase threat to aquaculture operations, there are a number of options available to feed manufacturers and farmers to prevent or reduce the risk of mycotoxicosis associated with mycotoxin contamination. These range from careful selection of raw materials, maintaining good storage conditions for feeds and raw materials, and using an effective mycotoxin deactivator product to combat the widest possible range of different mycotoxins that may be present.

Binders or adsorbents have been used to neutralize the effects of mycotoxins by preventing their absorption from the animal's digestive tract. The most common binders are clays, bentonites, zeolites silicas and alumino silicates. Unfortunately, different mycotoxin groups are completely different in their chemical structure and therefore it is impossible to equally deactivate all mycotoxins by using only one single strategy.

Adsorption works perfectly for aflatoxin but less, or non-absorbable mycotoxins (like ochratoxins, zearalenone and the whole group of trichothecenes) have to be deactivated by using a different approach. Biotransformation is defined as detoxification of mycotoxins using microorganisms or enzymes which specifically degrade the toxic structures to non-toxic metabolites (Fig. 2).

Figure 2. Detoxification of trichotecenes by microbial enzymes. The change of structure deactivates its toxic effects.



Mycofix®Plus is a mycotoxin deactivator which combines adsorption and bio-inactivation to break functional groups of mycotoxins such as trichothecenes, ochratoxin A and zearalenone, and also includes immune-stimulation with addition of selected plant extracts. Mycofix®Plus combines different micro-organisms, live bacteria and yeast strains, expressing specific mycotoxin-degrading enzymes to successfully counteract all agriculturally relevant mycotoxins in a biological way. *BBSH 797*, a *Eubacterium* species, patented by Biomin®, produces enzymes, so-called de-epoxidases, which degrade the toxic epoxide ring of trichothecenes, *T. mycotoxinivorans*, a yeast strain, successfully counteracts ochratoxin A and zearalenone by enzymatic cleavage.

Furthermore, all mycotoxins are detrimental to the liver and cause immune-suppression in animals. The addition of plant and algae extracts to the animal's diet helps to overcome these negative influences. Special algae extracts with proven immune enhancing properties, can overcome the immune-suppressive effect of all mycotoxins.

References are available on request

Dr Pedro Encarnação is aquaculture specialist for Biomin. Based in Singapore and responsible for the Asia, Pedro has an extensive background in aquaculture and nutrition and has conducted several research projects focusing on the improvement of feed formulations for aquaculture species. He obtained his PhD in Animal Nutrition from the University of Guelph, Canada. Email: pedro.encarnacao@biomin.net

The choice of the typical Japanese shrimp consumer is guided by the price, freshness, size and color of the product

Shrimp purchasing behaviour in Japan: a consumer survey

By Jacques Gabaudan and Taro Saitoh

Japan is currently the second most important market for shrimp worldwide, and has previously been the most important market. With recent USA trade restrictions still in place for Thailand, Vietnam, India and China, Japan offers an advantageous market for some Asian shrimp producers.

A professional preference survey was conducted among Japanese consumers in four geographical regions. It assessed their shrimp buying patterns, preferences, and perceptions through a mail survey of 432 pre-qualified respondents. The emphasis was on the relevance of the coloration of both fresh and boiled shrimp as a value criterion.

The objectives of the survey were to provide information on the Japanese shrimp market which could be used to better position farmed shrimp from Asia. It was also to investigate what efforts might be made to improve the perception, sales price and volume of sales of farmed Asian shrimp in Japan.

A significant portion of the questionnaire addressed species preferences, particularly between black tiger shrimp (*Penaeus monodon*) and white shrimp (*Litopenaeus vannamei*). This topic is especially important now that many Asian producers have shifted their production from the black tiger to white shrimp. Another emphasis of the study was placed on the Japanese consumer perception of shrimp quality and value.

Summary of results

Japan as a consumer market for shrimp

Black tiger shrimp occupies a central position in the market. Ninety percent of the respondents knew the name and appearance of this species. On the other hand, awareness of white shrimp remains at a low level (18%) and over 40% of the respondents did not even recognize the species name.

Purchase frequency of at least once a month was indicated by more than 80% of respondents who were aware of the species black tiger shrimp. More than 50% of those aware of white shrimp indicated that they did not purchase them.

Shrimp are most commonly purchased as frozen and headless>frozen headless and peeled >fresh and headless forms. The most frequent cooking method is deep frying followed by stir frying and boiling/steaming.

Ninety three percent of the respondents prefer to purchase shrimp at the supermarket and 97% mostly serve it at ordinary dinners rather than on any other occasion.

Perceptions to color

The top five purchasing criteria are price, freshness, size, color and safety. The fresh 'dark' shrimp was very appealing to 86%. For the boiled shrimp, 84% and 51% of respondents were for the 'dark' and 'pale' shrimp, respectively.

Defining the Japanese retail shrimp market

Where	The typical Japanese shrimp consumer buys her shrimp at a supermarket. Over 96% of respondents bought shrimp at supermarkets, followed by fish stores (26.9%), co operatives (26.6%), and department stores (22.7%).
When	She buys shrimp once to three times a month. Some 51.2% responded once per month and 37.3% responded 2-3 times per month.
What	The most frequently purchased product forms are frozen and headless (64.6), frozen peeled (56.7%) and fresh headless (56.4%).
Why	The occasion for a shrimp purchase was most frequently for an ordinary dinner (97.9%), followed by a box lunch (61.9%) and a special dinner (48%).
How	Shrimp were most frequently deep fried (90.7%), followed by stir fried (78.4%).

The most frequently mentioned price range for the 'dark' fresh shrimp was JPY500–599. The most frequently mentioned price range for the 'pale' fresh shrimp was JPY400–499. Nevertheless, purchase intentions were clearly higher for the shrimp expected to be higher in price.

Survey methodology

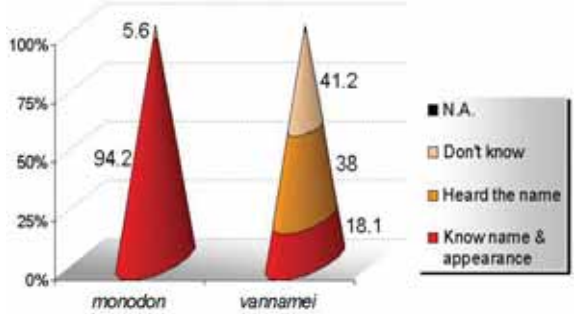
The two part mail survey on shrimp purchasing behavior and perceptions was conducted in four geographical regions in Japan in October and November of 2005. The study was conducted by Intage, Inc. (Tokyo). Four geographical regions were tested: Greater Tokyo, Tokai, Greater Osaka, and 'other areas' (remainder of the country).

The survey included a screening phase to select the respondents for the second phase which consisted of the study questionnaire and accompanying visuals. In phase 1, 1490 questionnaires were mailed to a representative panel of consumers. These were to identify respondents who were

- married women age 21-59 living in the selected areas
- people who purchase medium to large shrimp at least once every two to three months

Some 924 responses were received which equaled a 62% response rate. This was followed by the main survey conducted in which 450 questionnaires with visuals were mailed to consumers who meet the above qualifications. The response rate was 96% (432 responded). Sample size used for analyses was 400 respondents, with an equal allocation of 100 responses from each area. The first part of the survey looked at Japan as a consumer market for shrimp. The second part of the survey focused on perceptions and attitudes toward fresh and boiled shrimp colour.

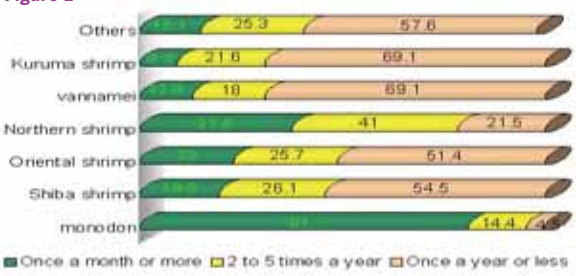
Figure 1.



The preferences and quality perceptions of Japanese consumers

Japanese consumer awareness was highest for Northern Shrimp (94.9%) and black tiger shrimp (94.9%), followed by Shiba shrimp (59.3%) and Oriental Shrimp (57.6%). Only 18.1% of the respondents said that they knew the name and appearance of white shrimp. White shrimp was the least known shrimp among the 6 species surveyed. Awareness of white shrimp was greatest in urban areas (25.5% in Greater Tokyo) compared to rural areas (12.7% in the Other Area). Note Shiba shrimp is Metapenaeus joyneri, Oriental shrimp is Fenneropenaeus chinensis

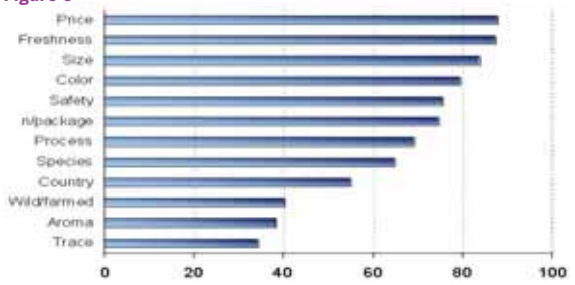
Figure 2



Purchasing frequency

The most frequently eaten shrimp (once a month or more) were black tiger (81.2%), Northern shrimp (37.5% of respondents), Oriental shrimp (23.3% of respondents), and Shiba shrimp (19.5% of respondents). On the other hand, white shrimp was consumed once a month or more by a mere 12.9% of respondents.

Figure 3

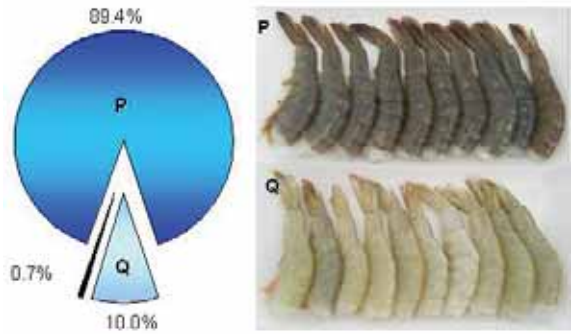


Price is most important

The importance of various characteristics of shrimp to the respondents at the time of purchase was assessed. The three-stage question asked if the specific characteristic 'was important', 'had no opinion', or ' not important'.

Price was the most important purchasing aspect (88% of respondents) closely followed by freshness, size and color (87.5, 83.8, and 79.6%, respectively. Other important factors were safety, package size, product form, and species. Country of origin was less important (55%). Source of shrimp (wild or farmed) was even less important, 40.3%.

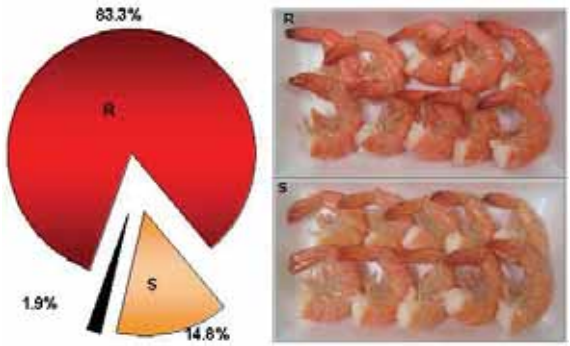
Figure 4



Darker raw shrimp was preferred

Respondents were asked to compare photographs of dark raw shrimp tails and pale raw shrimp tails. Eighty-nine percent of respondents expressed purchase intention for the darker shrimp (photograph P), while only 10% expressed purchase intention for the paler shrimp (photograph Q).

Figure 5



Deep colored cooked shrimp was preferred

Similar results were obtained when respondents were asked to compare deep and pale colored boiled shrimp. Eighty-three percent of respondents expressed purchase intention for the darker boiled shrimp (photograph R) versus only 14.8% expressing purchase intention for the pale boiled shrimp (photograph S).

Dark colored raw and boiled shrimp also had higher perceived value than pale color raw and boiled shrimp. For pale raw shrimp, the most frequent price expectation was JPY400-499 /kg, while for dark raw shrimp the most frequent price expectation was JPY 500-599 /kg. Similarly, the respondents valued pale boiled shrimp lower (most frequent response JPY 300-399 /kg) compared to JPY 400-499 /kg for the dark color boiled shrimp. (Note: One USD averaged JPY 118 at the time of the survey).

Implications for Asian shrimp producers and exporters

The striking finding of the survey was the low Japanese knowledge and therefore acceptance of white shrimp. With hundreds of thousands of tonnes of white shrimp being farmed in Asian countries, only 18.1% of Japanese consumers in the study knew the name and appearance of white shrimp.

This situation offers an opportunity to expand sales of cultured white shrimp in Japan, perhaps through a generic marketing campaign, or a marketing campaign by large individual exporters.

Another finding with potential significance to shrimp producers and exporters of white shrimp is the importance of appearance, and especially color to Japanese consumers in making purchasing decisions. Only price, freshness, and size were considered more important than color.

Color was more important than safety aspects, product form, and package size, farmed or wild, and species. Considering that dark colored raw and cooked shrimp were valued about ¥ 100 /kg more than corresponding pale shrimp, production of darker colored white shrimp could play a role in expanding white shrimp retail sales in Japan, and help the product command a higher price.

Other findings from this study that may be useful to shrimp cold-storage and export companies include product form preferences expressed as most frequently purchased product form. Frozen headless was clearly the preferred form but ready to serve and ready to cook shrimp meals were also important. Package size was also mentioned as a choice criterion, with respondents requesting smaller package size.

**Presented at the 11th DSM Nutrional Products Conference, 24 November, 2006, Bangkok, Thailand.*

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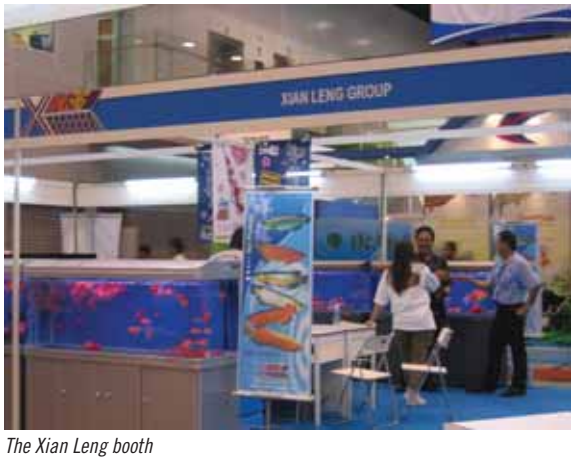
Aquafair 2007

An inaugural show for Malaysia's ornamental fish industry

In 2005, exports of ornamental fish increased by 266% to MYR 300 million (USD 85 million) as compared to MYR 82 million (USD 23.4 million) in 2004. High returns continue to attract investments to the industry. In the region, Malaysia is the top producer but second in terms of exports to Singapore. Aptly, the Department of Fisheries, wanted a show for local industry to highlight developments. It was also for local breeders to seek opportunities and network directly with importers.

The Bukit Merah Aquaculture Group

Connie Tay (third from left) with the team at the Hikari booth



The Xian Leng booth

The exhibition and technical conference was held from November 16-19 in Kuala Lumpur. Jointly organized by Department of Fisheries with Fairs and Events Management, the show attracted 123 companies from 13 countries. Some 60% of exhibitors were local breeders, importers and exporters of ornamental fish.

Positioning Malaysia

Dato' Junaidi Ayub

Dato' Junaidi Ayub, Director General of DOF said that as a large player in the global industry, Malaysia needs to expand markets and showcase its capabilities as a producer of quality fish. The country already produces 550 million pieces, 70% is exported and the target is to increase this to 800 pieces by 2010. Major markets are US, EU, Singapore and Japan but it needs to tap new export markets such as the Middle East and China.

"Ultimately, we want to position the country as the world's leading producer. Our global exports are MYR 180 million (USD 51.4 million) which is 7% of the global market of USD 8 billion. We have 456 farms mainly in the southern part of the country employing 5,000 people. More than 50% of these farms are small scale farms. The target will be to develop these into larger entities. Over the next few years, the Department will invest MYR 92 million (USD 26.2 million) in infrastructure and technical services for the industry."

At the technical conference, Gerald Bassler, President of the World Ornamental Fish Association said that the top exporter in 2002 was Singapore with USD 41 million, followed by Malaysia with USD 17 million. Indonesia is producing several special breeds whereas Malaysia produces the more common varieties. A new entrant is the Czech Republic which imports from countries such as Malaysia and re exports to the European Union. The larger importing countries are in Europe (53%) and North America (21%). The total turnover of the total trade in ornamental fish and accessories was USD 15 billion in 2002. However, negative fish welfare practices in the industry are being monitored by campaign groups. These are practices such as injecting fish with colour, transgenic and genetically modified fish.

Major players

At the trade show, the two listed companies in the region, Malaysia's Xian Leng and Singapores's Qian Hu were prominent with large booths. There was a significant presence of producers of arowana fish or dragon fish. Most companies have CITES certification (www.cites.org) which allows them to breed and market the fish. The Bukit Merah Aquaculture Group is a cluster of six arowana fish producers. Production has been increasing from an annual production of around 1,700 fish in 2005 to 2,500 in 2006. The group expects production to increase to 3,000 to 4,000 pieces in 2007.

KTN Aquaculture started in 2004 to capitalize on opportunities in the production of Arowana fish. The company has three farms with a total area of 9ha in three locations. These are close to the original

habitats of the fish. Another company is the Bukit Merah Aquaculture Breeding Farm which specializes in the production of the golden arowana. Aside from displaying varieties of the fish, the group is keen to build up a brand image as well as network with other producers at the show. The company said that in general, production of this species is a risky business but nevertheless a lucrative business with high demand. They are also seeking investments for their expansion plans.

Supporting industry

According to Connie Tay, Hikari Sdn Bhd., most arowana fish breeders use the worm shaped extruded floating pellets called food sticks made from white fish meal. Previously, arowana was fed with live food such as cockroaches. Breeders wean the fish onto pellets by co feeding them with shrimp. Breeders also wean fish on to pellets at the request of buyers. Hikari introduced the feed into Malaysia 8 years ago. The company has a large share of the local ornamental fish market. Their latest product is feed for the koi fish containing white fish meal and carotenoids to increase fish colouration. Other products include feeds for the marine fish, algal wafers and micro pellets for the small fish.

At the Glomedic booth, Ng Yan Peng introduced pond liners, mainly for ornamental fish ponds. The liners are also suitable for use in shrimp and food fish ponds. The Oase pond liners are German in origin and have been marketed in US and China. The unique aspects, are that the 0.5 to 1mm thickness liners that can be customized and joined together in the factory for large ponds, according to Ng. The range of liners includes rubberized liners which are relatively expensive for small ponds of hobbyists and have a guarantee for 15 years with correct laying. PVC liners are for commercial use. An interesting feature of the liner is the rough texture for the attachment of microorganisms. Liners have a fleece underlay to protect from rocks and root penetration. Other products from the company include preformed pools, modular filter systems, pumps and algaecides.

The next Aquafair 2008 is planned for November 20 to 23, 2008.

The wonderful world of the arowana fish

Kao Heng Soon

Some 50% of the arowana fish breeders in Malaysia are members of the Arowana Society of Malaysia. The association encourages cooperation among members and online discussion are available at its web site (www.myarowanas.com). According to Kao Heng Soon, some 5,000 pieces of arowana fish are produced annually, valued at MYR 2,000/fish (USD 571). He estimated a 20% annual growth in the next five years.

The arowana has its origins in Malaysia and Indonesia. However, Malaysia is a leading producer as most companies are CITES certified to breed and export. Trade in the fish began in the 1960 with wild caught fish. Kao said that the external morphology of the fish denotes its origins. The high back variety is from the northern part of the Peninsula Malaysia and Sumatra in Indonesia. The cross back variety originated from the southern part of the Peninsula. The production technology is well developed. All aspects of culture are controlled and survival is usually 90%. Currently it takes a year from the egg stage to a 10 cm fish.

The marketing strategy of the association as well as other producers in the country is based on the Chinese belief that the fish has a high status in society and that one must have one in the home. Markets are divided into three levels. It is lead by markets in China, Japan, Korea, Taiwan and Hong Kong where the 'mythical dragon' is omnipresent in the culture. This is followed by markets with large Chinese populations such as Thailand, Cambodia, Riau, Singapore, Myanmar and Indonesia. Last are markets for the oriental diaspora in Europe. With increases in disposal incomes, the market in China is expanding fast. Kao said that their competitors are the new producers from Indonesia.

Trade at Indaqua 2007

Targeting quality shrimp with stress management to feeds

At the Godrej Gold Coin Aquafeed Ltd booth, Viney Vatal (right) with his new team. Standing from left, Mathi, Ridzwan, Venkat, Ravinthar and Martin Guerin. In front, from left, Janardthan and Twinkle

More than 90 exhibitors comprising local and foreign companies with distributors presented their services and products at the trade show. The range of products reflected the needs of the shrimp farming industry ranging from quality post larvae, prevention and control of diseases to production of quality and traceable products.

Shrimp seed stock

Oceanic Shrimping Ltd started commercial production of post larvae in 1986. Since then, it has expanded from an annual production of 80 million post larvae (PL) to 500 million. Production is from three hatcheries in Tamil Nadu. They carry out biosecurity at every level. Post larvae are PCR (polymerase chain reaction) checked in-house to be white spot syndrome virus (WSSV) and Monodon baculovirus (MBV) free. It has supporting nauplii centres at Port Blair and the Nicobar Islands with an annual production of 2 billion and centres at Vishakapattinam and Kanyakumari with producing 5 billion nauplii/year.

Vaisakhi Shrimp Fry is produced by the two hatcheries of Vaisakhi Bio Resources in Andhra Pradesh and Vaisakhi Bio- Marine in Tamilnadu. They accredit their success to a robust disease surveillance program and biosecure operating procedures. The company said that although by definition the PL are not SPF, it is however, of 'high health'. One of the early entrants to aquaculture in India is the **BMR** group, established in the 1990s. It has shrimp farming and shrimp hatchery businesses. Post larvae are produced from six hatcheries located across the east coast of India. A subsidiary, Claswin offers technology transfer to overseas clients.

Raj Hatcheries was established by J. A. Samy who started with the Orissa shrimp seed production Centre (OSSPARC), a pioneering post larvae production centre established by MPEDA. The company has two shrimp production units with an annual capacity of more than 200 million post larvae. It also has a nauplii production unit at Vishakapatnam. To avoid cross contamination, the PCR lab is divided into pre PCR, OCR, post PCR and sterilization rooms. New to the industry is **Sona Shrimps Hatchery**, established in 2004 in Villupuram District in Tamil Nadu. Production is 300 million/year. Spawners are used only once after rigorous checks for bacterial and viral infections. In India, farmers send several samples of PL to independent laboratories for PCR testing prior to purchase. **Ram Aqua Shrimp Diagnostic Lab** provides these tests on a 24/7 basis.

S. Chandrasekar and team at the INVE booth

Larval feeds

The larval feed market is estimated at 120 tonnes/year and if vannamei culture is introduced the market may increase by 50 tonnes. Gold Coin Specialities and INVE (India) have the large portion of the hatchery feed market as well as **Higashimaru Feeds** (India) which markets the Higashi brand of larval feeds. Higashi feeds are microparticulate feeds for the black tiger shrimp which are imported from Japan. The feed has a new stable form of vitamin C which is used to overcome the problem of deterioration and instability of vitamin C during storage. In addition, the company markets fish feed ingredients such as fish extract with 50% moisture and 28% crude protein (CP), dehydrated clam meal with 55% CP, cod liver oil and shrimp head meal with 31% CP.

At the booth of **Epicore Bionetworks**, **USA** and **Nurture Aqua Technologies (India)**, the team introduced an emulsion form of liquid

feed (Epilite) which is less concentrated and thus costs less than the original version. The advantage of this emulsion, according to Matthew Briggs, is that it has natural buoyancy and particles remain suspended. The feed is popular in Bangladesh and India. Both companies also market several ranges of probiotics for use in the hatchery as well as water conditioning products.

Probiotics and pond products

Poseidon Biotech, based in Chennai presented several products, including Thionil and Mega PS, containing a mixture of live bacterial culture for soil remediation. Another preparation establishes itself in the pond and suppresses growth of harmful bacteria such as Vibrio sp by competitive inhibition. Products such as Plankton plus stimulate the growth of plankton. Similarly, **SDC Agro Vet (India)** markets a water and soil probiotics called Superzyme-AT. It contains multi strains of Bacillus, enzymes and nutrients. An extract of yucca in Odoban-A30 reduces ammonia in pond water. **Devee Biologicals** has a natural probiotics product called Oxydol which contains a listed blend of bifidobacterium spp and enzymes.

Also at the show, **Novozymes**, USA and distributor **TIL Bioscience**, presented their microbial challenge program. Three products were presented. Pond Plus, a consortium of 7 selected bacterial strains with anti-microbial and stress reduction effects. Pond Protect which comes in a dry and stable form has strong ammonia and nitrite removal characteristics. PondDtox is a hydrogen sulphide oxidizing bacteria. In stress management, **Bentoli** has the Effinol Program comprising combinations of bacteria and yeasts which work by competitive exclusion to control pathogenic microorganisms in the pond and gut microflora. In hatcheries, there is the Effinol EL for zoea to mysis stages and Effinol L for postlarvae.

Feeds

India's top shrimp feed producers were there. Viney Vatal, General Manager introduced his new team and products manufactured under the new joint venture **Godrej Gold Coin Aquafeed**. These were the JV brands, Super Tigris and Hositho as well as Gold Coin's. Gold Classic, Gold Supreme and Gold Essence shrimp feed. **CP Aquaculture (India)** Ltd had a display unit of its modular hatchery system as well as aquatic animal health care products. **Avanti Feeds** Ltd has 7 product ranges of shrimp feed. At the booth, it showed the Profeed produced together with Thai Union of Thailand and those produced together with Pingtai Enterprises of Taiwan.

Cargill Matrix introduced Legend, its next generation feed with 39-41% crude protein. This is the premium shrimp feed from the company. It also introduced the Ultimate feed with crude protein from 34-37% to meet the needs of farmers for lower cost economy feeds. The company said that it will launch a new product if vannamei shrimp culture is allowed. The **Waterbase Ltd (TWL)** is well integrated with hatcheries as well as seafood restaurants. In feeds it markets 3 ranges of shrimp feed with minimum crude protein of 41% in starter feed of the Wave to a 38-39% crude protein for the Tiger bay. There is also its Ultra –XL incorporating nucleotides and nutraceuticals. The Hi gain Booster feed with 43% crude protein is recommended during periods of stress. TWL and other feed producers also have 1-2 products for the scampi (freshwater prawn) farming).

Certification companies

Organic aquaculture certification is through **Indocert**, the Indian Organic Certification Agency based in Kerala. This is non profit organization with a mission to render affordable inspection and certification services in food production. Another company, **SGS** has a network of independent food testing laboratories situated in many locations. It provides chemical and microbiological testing and sensory physical examination. **Det Norske Veritas As**, provides certification services to industry through 8 offices (including Chennai and Hyderabad). In certification such as (HACCP, it offers training customized to the needs of an enterprise.

R&D for commercial uptake

The **Rajiv Gandhi Centre for Aquaculture (RGCA)** is one of the institutions established to develop and disseminate appropriate technology in India. At their booth, researchers and staff explained the results of some recent activities. At Kodiyaghat, Andaman and Nicobar Islands, it has established facilities to domesticate the black tiger shrimp and SPF shrimp. Also in the Andaman, is a project to reproduce tiger and other groupers. At Neelankarai, they are developing high health shrimp. The highly successful mud crab and sea bass production is carried out in the centre in Sirkali Taluk in Tamil Nadu.

Matthew Briggs, Epicore BioNetworks (left) with D.K Gulati and R. R.Balaraman, Nurture Aqua Technology, India

At the RGCA booth, M. Shaji (middle) and Pandiarajan (right) show the layout of the complex in Sirkali Taluk, Tamil Nadu

At the Novozymes booth, from left, Bruce Banyani, Sameera Gujarathi and Dr Pornlerd Chanratchakool

S. Ravindran (left), Oceanic Shrimping Ltd, Chennai

Udayakumar (left), Higashimaru Feeds

Shery Kurian and the Alltech team with customers

CATFISH 2007 VIETNAM

An International Technical & Trade Conference

Catch CATFISH 2007, an event not to be missed by any global seafood industry player!

The catfish is now the new 'tiger' in the global seafood market. Five years ago, it was considered fit only for the local market. Today, it has stormed into prominence and is now traded internationally.

In the USA, the catfish is ranked as the fifth most popular seafood after shrimp, tuna, salmon and pollock. In the European markets, in particular Russia and Poland, Vietnamese tra and basa catfish have become a new phenomenon over the past two years. In recent years, there has been a new wave of frozen catfish fillet from Vietnam, sold in supermarket chains and seafood restaurants in major cities in Asia. Judging from this rapid growth in demand for catfish in the international markets, it is speculated that the fish could be a potential solution to declining stocks of other popular whitefish such as pollock, cod and haddock.

The fast growth of the industry, however, has also raised some concerns and created new problems and challenges. Oversupply, declining prices, sustainability of the industry and market, environmental related issues, quality and safety problems, mislabeling, new trade barriers imposed by importing countries, eco-labeling, increasing production costs, rising number of unscrupulous players etc are among the concerns and challenges faced by the industry.

Catfish 2007 will be held for the first time in Vietnam where the industry has rapidly risen to be among the top. It is jointly organised by INFOFISH, Vietnam Association of Seafood Exporters & Producers (VASEP), and Network of Aquaculture Centres in Asia-Pacific (NACA) and will be hosted by the Ministry of Fisheries, Vietnam.

It is an event to be watched closely for current developments and future prospects of the industry in the global scenario. Jointly chaired by prominent industry representatives from the US, Europe and Vietnam, it will discuss production, market and demand trends, issues and challenges faced by the industry and also present the latest technology available for more sustainable and productive farming and processing techniques.

Catfish 2007 Vietnam
13 – 15 June, 2007 • Sheraton Saigon Hotel and Towers, Ho Chi Minh City, Vietnam
Contact: Infofish for more information, Tel:+603 26914466; Fax: +603 26916804;
Email: infish@po.jaring.my; infish@tm.net.my Web: www.infofish.org

Issues to be addressed at Catfish 2007

- How should industry respond to increasing technical barriers to trade such as new requirements on traceability, eco-labeling and stricter safety standards imposed by importing countries?
- Is the current rapid growth of catfish sustainable?
- Will there be an end to the catfish war and lasting 'peace' between US and Vietnam producers?
- What are the prospects of marketing organic catfish and other value-added products in the global market?
- What are the demand trends for catfish in major and emerging markets?
- What are the seafood sales trends in the retail/supermarket sector?

All the above and other doubts will be answered by an international panel of experts.

Cargill

New manager for global aqua feed business

Cargill Animal Nutrition has named Ryan Lane as technology deployment manager for its aquaculture group. Ryan's responsibilities include innovation and deployment of new and existing technologies to support and further develop the unit's global aqua feed business.

Ryan joined Cargill in June 2006 after serving as a research assistant professor at Southern Illinois University in Carbondale. His basic and applied research activities covered a range of finfish and shellfish species, garnering recognition for him as a nutritional physiologist in aquatic animal husbandry. While at Southern Illinois, Ryan received federal funding from the National Research Initiative of the U.S. Department of Agriculture for his work with lipid biochemistry, nutrition and reproduction. Contact: Ryan Tel: +1 952 9841869

Ryan (centre) and team at aquaculture centre

Opens new aquaculture research facility

Cargill Animal Nutrition has recently completed construction of a new aqua research facility in Elk River, Minnesota. The environmentally controlled facility consists of multiple research systems capable of handling a wide range of research objectives, including feeding trials using either freshwater or saltwater animals of various sizes and at a range of salinities and temperatures. Initial feeding trials will use tilapia and hybrid striped bass; however, longer-term projects will include catfish as well as shrimp and other saltwater species.

It is anticipated that the facility will be able to host up to a dozen major aquaculture studies annually. The facility's first trials will involve benchmarking Cargill's current nutrient systems and defining additional nutrients to provide nutrient-driven solutions to the feed industry. Ryan Lane, said , "The new facility allows us to increase and centralise our research efforts and work more effectively when we need to conduct research in other parts of the world. We will work with technical and sales teams in Asia and Latin America, to define and prioritise research needs and to share technologies".

All these are part of Cargill Animal Nutrition's commitment to creating innovative solutions to improve aquaculture production, according to the press release. Based on specific customer needs, consultants develop nutrition solutions that include both products and processes. Products deliver nutrient technology designed specifically for a customer's requirements, such as the needs of individual species, production systems and animal life stages. Understanding nutrients, including its supply and demand translates into precise diet formulation and consistent animal performance. Processes may be used to value ingredients, design diets or set animal performance using key systems and nutrient-driven feeding programs.

Clextral

Now division of Legris

The acquisition of Clextral by the diversified industrial group was announced by its Chairman Georges Jobard in March. The Clextral Group develops technologies and designs processing plants on a turnkey basis for the food and feed industry as well as for specific "high technology" niche markets.

It recently celebrated its 50th anniversary with a scientific seminar on the broad applications of twin screw machines, from reactive extrusion to aquatic feed as well as drying expertise and latest innovations.

Set up in 1986, the Legris Industries Group is a major player in the fields of fluid connectors and process engineering. It has a track record of 20 years. Integrating with Legris Industries, will give Clextral the benefit of the group's know-how, resources and experience for international expansion and business performance in the long term, according to the press release. With this, Clextral becomes a new division of the Legris Industries Group. Together, the activities will represent a worldwide workforce of 4,100 and annual sales of Euros 670 million. More information: www.clextrusion.com

DSM Dyneema

Partnership for offshore cage systems

DSM Dyneema has announced that it will work with Open Ocean Systems Inc. (OOSI) of Canada for joint development of innovative technologies for offshore fish farming. Under this three year old partnership, OOSI will develop a total system for aquaculture operations further offshore.

The new venture will use ultra-strong, lightweight Dyneema® fiber which can offer great potential for designing new cages that can meet the challenges of the open ocean environment, such as stronger currents and higher waves.

The current in-shore locations available for aquaculture are not sufficient to accommodate expected volumes, as projected by the United Nations Food and Agriculture Organization (FAO). That means there is strong interest in expanding into more exposed areas. In 2007, the two companies will conduct worldwide tests of OOSI's new cage design featuring netting made with Dyneema® fiber. Commercialisation is expected in 2008.

André van Wageningen, Market Segment Manager, Commercial fishing for DSM Dyneema said, "We see OOSI's farming system as a solution that will help the open ocean aquaculture sector meet future world demand for farmed fish. We are pleased that our innovative materials technology and knowledge is playing a key role in turning this market potential into a reality."

Diamond V
Enters aquaculture

At World Aqua 2007 and VIV Asia held in March in San Antonio, USA and Bangkok, Thailand, respectively, Diamond V announced its entry into the aquaculture industry.

The company is the world's leading manufacturer of fermentation products for the livestock industry. At the show, it introduced DVAQUA, a complete fermentation product specifically designed for aquatic diets. The product took six years to develop and is different from that marketed for the animal feed industry.

"We believe that DVAQUA will have a huge impact on the international aquaculture market, especially in terms of improving survival. However, we see the product as a basic ingredient for the diet rather than a specialty product," said Dr. Mark Kujawa, VP, International Business Development. "The aquaculture market offers us tremendous potential and we are excited on the further expansion of our global presence. We want to be an integral part of the industry. Similar to our activities in the animal feed industry, we will be active with and in seminars and conferences. Our contribution to aquaculture will be our science-based approach to product development and application."

At the launch at World Aquaculture 2007, Diamond V team with 'John Wayne' impersonator, Dr Gene Howard. From left, Bruce Hageman, Kim Jones, Brian Hunter and Mark Kujawa

DVAQUA is a 300 micron particle product which has been shown to be effective in improving fish/shrimp immunity and optimising survival. It is the result of DiaMatrix Technology, a proprietary fermentation process and formula which produces metabolites specific for aquaculture diets. This is significant as at low inclusion rates (1.25kg/tonne) it has not shown an immune fatigue affect. Research also indicated that the product is extrusion stable and will not require post pellet applications.

Laboratory based nutrition trials in the US with *Litopeneaus vannamei* have demonstrated that dietary administration of the product can protect the shrimp against a decline in resistance. Other studies in China also showed improvements in shrimp immunity. Similar results are for the catfish and Japanese flounder. Further research is planned for catfish in Vietnam where stocking densities are high. DVAQUA is now available worldwide. It is already on sale in China and Vietnam but registration is pending in the Philippines, India, and Thailand.

Lallemand
Organic selenium yeast

Lallemand announced today that Alkosel® has received a favourable opinion for use in all animal species from the European Food Safety Authority's (EFSA) Scientific Panel on Additives and Products or Substances used in Animal Feed.

EFSA's opinion was based on a thorough examination of the safety and efficacy of Alkosel®. The production and quality control is performed in Lallemand's specialized yeast plants, where selenium enriched yeast is also produced as a food supplement for human nutrition. It is already authorized for use in all animal species in the USA and Canada. This notification concerns an application filed in the EU for use of Alkosel®as a nutritional feed additive for all animal species. Earlier this month, the company announced the adoption by the Canadian National Research Council of a Certified Reference Material for the analysis of organic selenium yeast based on this ingredient. Alkosel is a source of organic selenium based on a specific yeast strain of *Saccharomyces cerevisiae* - NCYC R397.

More information: brochet@lallemand.com

Rotomas Technology
RAS on trial

To show the efficacy of its recirculating aquaculture system, Rotomas Technology Malaysia, has set up a demonstration model at the agriculture exposition site in Serdang, Malaysia. This is a 4 rearing tank module for freshwater fish culture. Each rearing tank can hold 50 kg of fish per tonne of water.

Bluey Chew, Director said, "Soon the use of recirculation technology will be necessary for the efficient use of our water resources. It is also to ensure that pathogen free water is used in fish/shrimp culture and that affluent water is also treated before discharge. The purpose of sitting this demonstration unit here is to show the technical features of the system. The whole system has a small footprint of 120m^2 such that high volumes of production can be achieved in a small area."

In this system, incoming water is pre-treated to remove chlorine by storage and aeration. During culture, faecal waste and uneaten feed are passed through the swirl separator to remove larger solids, the drum filter to remove solids up to 60 microns and the bio filter to convert toxic ammonia to nitrite and then to nitrate. In the 4 module system of 200 tonne production, the filtration system is calculated based on the total ammonia nitrite production and dissolved oxygen requirement of the animals. The whole system was designed and built in Malaysia and costs MYR150,000 (USD 41,000).

In addition to this basic module, Bluey added that options include foam fractionators and UV sterilisation units, if it is considered for marine shrimp/fish culture. The system is ideal for the use in marine shrimp hatcheries and shrimp grow out as well as freshwater fish culture. It works well with ambient temperatures. In the ongoing trials, he has stocked 1,000 fish of 200g. At harvest, fish grew to 500g, survival is 85% and FCR was 1.2. No diseases were recorded.

More information: email: blueychew@gmail.com; www.rotomas.com

Eurotier 2006, Hanover, November 14-17

Insight into European fish production

By Erik Roderick

With over 118,000 visitors, the 4-day Eurotier 2006, Europe's largest agricultural exhibition was a great success. This was the 7th International German Agricultural Society exhibition, and Dr Jochen Kochler, Eurotier's project manager reported a 7% rise in visitors this year, with 23% from outside Germany.

For the third time, Eurotier gave a special platform for aquaculture, recognising that overfishing and declining stocks meant that aquaculture must expand to meet the predicted shortfall in available fish for consumers. Aquaculture is the only sector in agriculture that is currently expanding. Germans consumed 13.3 kg per capita of fish or fish products in 2005, an increase of 14% from the previous year, despite rising fish prices. Market research suggests that 1 million new customers tried fish or fish products for the first time.

Exhibitors at Eurotier totalled 1485, representing 39 countries, including 495 exhibitors from outside Germany. Although aquaculture exhibitors only totalled 32, they put on some excellent displays, and generated brisk business throughout the even. These include leading technology and equipment companies from the areas of aquaculture, mariculture, inland fisheries, certification and environmental technology. Many university groups specialising in aquaculture research, and were offering consultancy services to the industry. Other products involved new technologies, feed, processing and added value and environmental controls, especially to cater for a rapid expansion of recirculation systems predicted.

Aquaculture at Eurotier served as a joint platform of presentation and information, with many experts available to answer questions. The presentations (Forum Aquaculture) were located in the middle of the aquaculture exhibition space. There were 4 days of lectures, all well attended, and with over 50 speakers, most aspects of aquaculture were discussed. Some presentations of interest to the Asian aquaculture industry are detailed below.

Biogas

The bioenergy and biogas in agriculture/aquaculture session discussed biogas technology, which has major potential for use in warmwater recirculation throughout Europe. This has enabled European producers to compete effectively with tropical producers. This makes aquaculture an attractive proposition for investors interested in bioenergy. IBAU (Ingenieuburo fur Aquakultur) a German recirculation company is focusing on the combination of biogas and recirculation for catfish production units throughout Germany.

Aquaculture imports regulations

Speakers covered certification, organic fish, and quality testing. The session closed with a roundtable discussion hosted by Fischmagazin "quality control- from pond to plate" where retailers, producers, international certification bodies, and consumer protection organisations raised the important issues. A lot of the discussion here emphasised the need to standardise the certification issues, and have fewer organisations offering certification, which generally confuses the consumer. Euregap, a certification and quality assessment body discussed the forthcoming European standards on recirculation systems.

Current aquaculture production in Germany comprise 30,000 tonnes of rainbow trout, (with another 20,000 tonnes being imported) and 20,000 tonnes of carp (with another 10,000 tonnes being imported from Eastern Europe, mainly Czech Republic). In the EU, production is around 1.5 million tonnes, made up of salmon (48%) trout and other salmonids (26%), cyprinids (15%) sea breams (5%) and sea bass (4%). Other species farmed are catfish, flatfish, eels, sturgeon and tilapia. Norway is by far the largest producer with 38% of the total followed by the UK with 11%.

In the country overviews, an insight covered the perspectives and problems of tilapia farming in Holland. There are currently 80 fish growers in Holland, who between them produce 4,500 tonnes of eel, nearly 4,500 tonnes of catfish, and around 600 tonnes of trout, flatfish sea bass tilapia and pike-perch (zander). This totals only 1% of European production, which in turn is only between 4-5 % of world production.

From product to market driven

Traditionally Holland's aquaculture industry was product driven, the producer would grow a fish that the public would be enticed to buy, but it is changing to a market driven industry, where the consumer is demanding a product which the retailer must source from a grower, willing to produce it. This concept called "Fishion" is strongly market driven, and is chain of production, processing and marketing and sales companies. It focuses on sustainability, transparency, traceability and freshness, and is seeking Greenpeace and WWF approval. Fishion plans to develop markets for 10,000 tons of tilapia Catfish and possibly other new species in Europe by 2010.

Harri Rudgers Barramundi Farming Company BV Holland gave a presentation on barramundi (Asian sea bass *Lates calcarifer*) farming in closed recirculation systems (using Cell Aquaculture modular systems) in Holland. The fish is gaining popularity in Europe and with high prices, a new farm (Aquabella) is producing in the UK too. The fry are currently imported from Australia or Israel but local breeding centres are being considered.

Tilapia is one of the biggest growth areas throughout aquaculture, with the USA in particular consuming a steadily increasing amount of tilapia. Current imports into the USA are valued at USD 393 million (2005) 32% higher than the previous year. Eric Roderick of Fishgen Ltd. the British company that developed the YY supermale tilapia technology, gave a presentation on "Successful tilapia farming with genetically improved all male stock". He focused on the global expansion of the company, its work with local partners and also the latest improvements in the stocks.

Peder Nielsen talked on Danish trout farming in recirculated systems, where the main problem was the image of fish farming, and the lack of communication between the regulatory bodies, the environmentalists and the farmers. Farm gate prices are also currently low. Current production in Denmark is over 30,000 tonnes of rainbow trout in freshwater and another 8000 tonnes in seawater. They also produce around 3,000 tonnes of eel.

It seems that in Denmark, and more widely throughout Europe, the solution to increased production probably lies with large scale high-tech closed recirculation systems to minimise environmental impacts and conserve water resources. The very hot summer of 2006 gave a lot of added problems to Danish trout farmers. The cost efficiency of generating more water flow rather than more aeration or the addition of liquid oxygen was discussed.

The next meeting will be Eurotier in 2008. For more information on the talks, www.eurotier.de/aquakultur

May 8-10
Victam International 2007
Utrecht, Netherlands
Email: expo@victam.com
Web: www. victam.com (p29)

May 9-10
Aquafeed Horizons
Utrecht, Netherlands
Email: editor@aquafeed.com
Web: www.aquafeed.info

May 24-27
Aquarama 2007
Singapore
Email:aquarama@cmpasia.com
Web: www.aquarama.com.sg

June 4-7
Aquaculture Indonesia 2007
Surabaya, Indonesia
Email: daftar@aquaculture-mai.org
Tel: +62 24 70194598
Fax : +62 24 7460049

June 13-15
Catfish 2007 Vietnam
Ho Chi Minh City (in conjunction with Viefish 2007)
Email: infish@po.jaring.my
Web: www.infofish.org (p 40)

June 18-22
7th International Symposium On Fish Immunology
Stirling, Scotland
Web: www.noffi.org

June 22-24
Shanghai International Fisheries and Seafood Expo
Shanghai, China
Web: www.sisfe.com
Email: kim.yang@sifse.com (p37)

August 5-8
Asian Pacific Aquaculture 2007
Hanoi, Vietnam
Tel: +1 760 432 4275
Email: worldaqua@aol.com
Web: www.was.org (IBC)

August 23-25
Tilapia 2007
Kuala Lumpur, Malaysia
Email: infish@po.jaring.my
Web: www.infofish.org

September 25-28
IAFI World Seafood Congress
Dublin, Ireland
Web: www.worldseafoodcongress07.com/

October 24-26
Fish Africa & Aquaculture Africa
Capetown, South Africa
Web: www.fishafrica.net/

October 24-27
Aquaculture Europe
Istanbul, Turkey
Tel: +32 923 34 912
Email: ae2007@aquaculture.cc
Web: http:www.easonline.org

November 6- 9
Caribbean and Latin American Aquaculture
San Juan, Puerto Rico
Tel: +1 760 432 4275
Email: worldaqua@aol.com
Web: www.was.org

November 6-8
China Fisheries & Seafood and China Aquaculture
Dalian, China
Web: www.seafare.com

November 20-23
8th Asian Fisheries Forum
Kochi, India
Tel:+91 484 2394798
Email: 8aff2007@gmail.com
Web: www.8aff2007.org/

November 27-30
Iran 5th International Fisheries and Aquaculture Exhibition
Kish Island, Iran
Email: iranseafoodexpo@cororg.com
Web: www.iranseafoodexpo.ir/

2007

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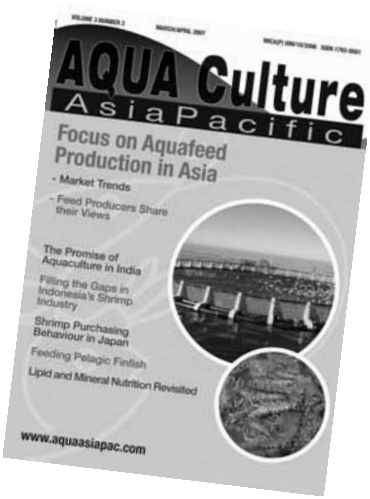

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