

# AQUA Culture

## Asia Pacific

### Organic Shrimp in Thailand

Sustainable Shrimp Culture  
in India

Raising Industry Standards  
for Vannamee Shrimp

Tilapia in Asia

Palm Oil Based Diets  
for Red Tilapia

The Asian Seabass  
in India

A Seafood Retail Business

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# From the editor

## Where is my oil?

### WRITE TO THE EDITOR

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

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Letters may be edited prior to publication

Lipids are an essential part of the nutrient requirement of any aquaculture species. Lipids spare for protein in terms of energy requirements and as proteins sources tend to be the more expensive components of feed formulation, lipids have been used to supplement for energy values of the feed. It was not so long ago that feed conversion ratios reached a par of 1:1 for salmon culture. It fact, it was this very achievement that spurred the salmon farming industry on an exponential increase to become USD 1.6 billion export business today. The source of lipid was essentially fish oil from the fishmeal industry. However, due to the growth in the aquaculture industry, the demand for fish oil has been higher than supply leading to increasing prices of the oil. Then the perception of the aquaculture industry took a beating when the consuming public developed a negative perception due to the fact that the oil came from over fishing the seas. The NGOs do have a point arguing against the concept of feeding fish (and oil) to fish.

As the industry looked for alternatives, the immediate answer was in renewable and sustainable vegetable oils. Soya oil took the lead as the replacement. As we thought were heading in the right direction, the industry is now faced with another challenge – biodiesel which competes for and soaks up any cheap oil in the world. If anyone thought that biodiesel did not have any impact on the world except for the mineral oil and petroleum industry, then they need to look again!

Today we are aware that any lipid source can be turned into a methyl ester and hence a source for biodiesel and it is pure economics that governs its viability. Soy oil based biodiesel has been powering public buses in cities in the mid west of the USA since the mid 90s. Soy biodiesel is added into mineral oil diesel at rates of 5-15% without any negative performance of the vehicle or on the life of the engine. The problem lies in the fact that even if all of the world's 120 million tonnes of vegetable oil was added into diesel at the above rates, there would still be surplus demand.

To exacerbate the problem, corn is the major source of ethanol which is another biofuel that can be added into petrol (gasoline in the US). This has increased the price of corn and encouraged US farmers to use their land for corn instead of soybean. This reduces the production of soy and hence the availability of soy oil. The aquaculture industry is now back to square one in looking for a replacement for fish oil.

There seem to be only 2 upsides to the economics of this game. Either the price of crude mineral oil falls back to under USD 30 per barrel which makes biodiesel production unviable or that the aquaculture industry is willing to pay more for soy oil than the biodiesel industry. Will we see the day that protein is not the most expensive component of aquaculture feed but lipid? One thing is sure -the biodiesel industry has huge ramifications on the world including aquaculture.

**Zuridah Merican**

### Errata

In the March/April, Issue, there was an mistake in the email address for Dr Joachim Hertrampf on page 21. It should read Joachim Hertrampf, Email: trampf@tm.net.my  
We apologise for this and any inconveniences caused.

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# Agreements with four farms in Malaysia

In Asia, organic black tiger shrimp *Penaeus monodon* is produced in Vietnam, Indonesia and Thailand. Bangladesh also produces organic freshwater prawn *Macrobrachium rosenbergii*, while China produces a number of organic fish and shellfish species and Vietnam, organic *Pangasius* catfish. India recently signed a Memorandum of Understanding with the Swiss Import Promotion Program to go into organic tiger shrimp farming.



Signing of the documents with Dr S Subasinghe (centre).

More farms in Asia will enter this segment of aquaculture under a three year project implemented by INFOFISH, the intergovernmental Organization for Marketing Information Technical Advisory Services in Asia Pacific, based in Kuala Lumpur, Malaysia. In March, it signed agreements with four farms in Malaysia to start off production of organic products. Two farms will be involved in the production of the black tiger shrimp, one will produce freshwater prawns and the last, tilapia.

Earlier, similar agreements have been signed with farms in Myanmar and Thailand. In Myanmar, three farms will produce black tiger shrimp and one freshwater prawn. In Thailand, all four farms will produce black tiger shrimp. The initial evaluation on these farms was carried out by Naturland, the certifying body for organic aquaculture based in Germany.

This is part of the USD 1.4 million CFC (Common Fund for Commodities) project on organic aquaculture in Myanmar, Thailand and Malaysia. Funding will be from the Common Fund for Commodities (CFC), FAO and SIPPO, the Swiss Import Promotion Program organization.

At the launch of the project, Dr S Subasinghe, Director of INFOFISH, said that among the objectives are to contribute to the sustainable development of the aquaculture sector, increase the knowledge on certification and marketing of organic aquaculture products and to encourage investment in sustainable, eco-friendly friendly aquaculture, domestic marketing and export processing of organic aquaculture products.

According to Tarlochan Singh, INFOFISH, the project was conceptualized in 2004 at the conference on organic aquaculture in Ho Chi Minh City. At this meeting, it was realised that the extensive nature of several small scale farms in Asia could fit into the organic aquaculture model and that what was required was certification. In a survey conducted in India by INFOFISH in collaboration with Naturland, it was found that many extensive farms could, with minimal modifications, qualify for organic certification.

Some of the principles of organic aquaculture, such as limitation of stocking density (15 PL/ m<sup>2</sup> for shrimp) and absence of GMOs (genetically modified organisms) in stocks, can be easily met by the project partner farms. However, others such as the production of organic feed with non-GMO vegetal feed ingredients, fertiliser from certified organic agriculture and no artificial feed ingredients pose a problem. However, this problem may be almost solved as a feedmill in Thailand, in cooperation with one of the project partner farms, had already developed a shrimp feed with certified organic ingredients. If a locally produced organic feed was not available, the Malaysian farms could use the feed from Thailand, at least initially.

There will be four phases of the project: promotion and marketing, adaptation and transfer of technologies, promotion of investment and dissemination of technologies.

# CATFISH 2007 Vietnam

## A forum on the latest in the global catfish industry

This meeting will undoubtedly be the best forum to get to know the latest in the global catfish industry, not only for those who are already in the industry, but also for those who wish to enter into farming, processing or export of catfish.

To date the response have been very encouraging with many buyers from the US and Europe confirming their participation. The latest group to join is a delegation from Jiangsu Province, China and a large number of buyers from other Asian countries such as Singapore, Malaysia and Thailand. Over 150 from the Vietnamese seafood industry are expected to network at this first ever global catfish conference to be held from 13-15 June, 2007, at the Sheraton Hotel and Towers, Ho Chi Minh City, Vietnam.

Renowned speakers will share their knowledge and experiences on various issues at Catfish 2007.

- **Peter Redmayne**, President of Seafare Group (USA) will speak on the Catfish Trade War
- **Matt Fass**, President of Maritime Product International (USA) will give an update on trends and outlook of the US catfish market
- **Sherry Frey**, Vice President of Perishable Group (USA), will present the growing importance and power of the seafood retail sector.
- **Thomas Sporrer** of SIPPO (Switzerland) will talk on the fast growing market for catfish in the EU, with special reference to organic seafood products
- **Fatima Ferdouse**, INFOFISH, will discuss the latest trends and issues in the Asian markets for catfish .
- **William More**, Aquaculture Certification Council Inc. (USA) will cover certification schemes for sustainable farming practices for *Pangasius* and *Ictalurus* (Channel) catfish

### Catfish 2007 Vietnam

Dates: 13 – 15 June, 2007

Venue: 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; Web: www.infofish.org

- **Philippe Serene**, IMO, Vietnam will speak on technical aspects of developing organic farming of catfish.

In addition, speakers from NACA (Thailand) and Food Agriculture Organization (FAO) Rome will speak on industry situations in Asia and disease management respectively.

Vietnamese industry representatives, undoubtedly the 'global leaders' in catfish production and trade, will share their knowledge, experience and success stories during the conference. **Dr Nguyen Huu Dung**, VASEP, **Jie-Cheng Chuang**, Uni-President (Vietnam), **Mel T.S. Sng**, Tracetracker Asia and **Nils Kristian Sorensen**, Norwegian Institute of Fisheries will cover a wide range of topics, from industry situation, traceability, processing to quality and safety aspects.

During the field trip to a catfish farming centre and processing plant around HCMC, organized by VASEP, delegates will have the opportunity to witness and experience this dynamic and bustling industry.

## Catfish

This 'new kid on the block' is changing the traditional white meat fish industry. Vietnam exported USD 737 million of its *Pangasius* catfish (*tra/basa*) in 2006 and is targeting USD 1 billion worth of catfish exports in 2007. The EU has now become the largest market for Vietnamese catfish. In 2006, EU imports rose by 146% over that in 2005. Similarly, imports in Russia also rose by 1389%. US imports of catfish in 2006 increased markedly totaling 34 000 tonnes (USD 111 million), up 150% in volume and 225% in value over 2005.

Against this background, many countries in Asia such as China, Thailand, Malaysia, and Indonesia, are aggressively expanding the farming of catfish of different species, both for local and export markets.



Announcing ...

## CATFISH 2007 VIETNAM

International Technical & Trade Conference on Catfish

13 – 15 June 2007 • Ho Chi Minh City, Vietnam

in conjunction with VIETFISH 2007, 12 - 14 June 2007



Organised by: INFOFISH, VASEP, NACA and hosted by the Ministry of Fisheries, Vietnam

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- Production and trade trends...
- Status in various producer countries and regions...
- Recent developments and trends in major markets...
- The "catfish wars" and their effects...
- New products and marketing strategies...
- Technological developments and issues...
- Food safety and quality issues...
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- And many, many more...

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## Brief news

### CP Prima to bid for PT Dipasena

The world's biggest shrimp producer, PT Central Proteinaprima (CP Prima), announced in the Jakarta Post, that it will bid for PT Dipasena Citra Darmaja. On May 25, CP Prima, a subsidiary of the Thai agribusiness group, Charoen Pokphand Foods, will participate in the auction of PT Dipasena. The company said in the statement that the decision to acquire PT Dipasena was part of its plan to expand its network in the shrimp farming sector and to strengthen the company's position as the leader in the aquaculture business.

Under the requirements set by the PPA, investors interested in bidding must have experience of the aquaculture business and be able to invest a minimum of IDR 1.7 trillion (USD 188 million) to develop PT Dipasena's shrimp farms, which are run in collaboration with local farmers. The government took control of PT Dipasena from Gajah Tunggal Group's Sjamsul Nursalim in part settlement of his IDR 28 trillion debt to the state following the country's financial crisis in early 1998. The option to take over PT Dipasena was extended by the government to PT Recapital Advisors. However, the latter has failed to inject fresh capital into Dipasena by March 1. PT Dipasena was one of the biggest shrimp producers in the world, with an output of 19,854 tonnes in 1996.

### CPF in the Philippines

Charoen Pokphand Foods (CPF), Thailand has announced that it will set up a subsidiary company in the Philippines (CPF Philippines) with livestock and aquaculture operations. The investment will be 37 million baht (USD 1 million) and operations will be in the second quarter 2007. In the Bangkok Post, President and chief executive Adirek Sripratak said that the Philippines is 'an upcoming market'. "We chose Cebu which is one of the country's economic zones to start our shrimp fry business. It will help our shrimp feed business which currently is being imported into the Philippines".

### Mega aquaculture project in Pakistan

Pakistan has planned for a mega aquaculture and shrimp farming project worth Rs 2 billion. This will include the set up of four new as well as renovating four existing hatcheries, setting up of 11 model farms (3 in Sindh and 8 in Balochistan) and 6 model markets (2 in Punjab, 2 in Sindh and 1 in Balochistan and 1 in NWFP). There will also be cage culture in five sites. The project will also include shrimp farming on 2,000 hectares of coastal land in Sindh and Balochistan. Provincial governments will provide land for shrimp farming on lease to the private sector, according to the report in the news.com. Project implementation will be five years.

### Fish meal prices to stay up

In 2006, fishmeal prices increased steadily and this trend is likely to continue well into 2007, according to a Globefish report. Fish meal production in 2006 was down to 2.8 million tonnes from to 3.5 million tonnes in 2005. Peru's production was 1.45 million tonnes in 2006 against 1.95 million tonnes in 2005. Chile's production declined 4%. China continues to be the main market for fishmeal products, with stable or even expanding demand. In 2006, imports were mainly from Peru. These declined sharply in 2006 to only half of the volume in 2005. Germany imported 80% of its fishmeal from Peru to re-export to other European countries.

The unit value of fishmeal exported from Peru varied with the country of destination, lowest for China (USD800/tonne) and highest for Australia (USD 1,074/tonne). In years of low supply such as in 2006,

it was likely that Peru exported more fishmeal to countries which were willing to pay a higher price for the product. As a result, exports to Japan and Australia grew in 2006.

### Crustacean disease breakthrough

At Australia's James Cook University, PhD student Kerry Claydon, has closed the gap on the development of a disease-fighting tool in crustaceans with a crustacean cell line. Currently, there are no treatments available for viruses in crustaceans. This has caused devastation to the industry as virus can spread rapidly.

The development of a cell line will help scientists better understand viruses affecting crustaceans and provide a more sensitive and reliable diagnostic tool, which will not only standardize the system for disease analysis, but also minimize animal experimentation. In her research, Claydon has successfully 'transfected' (introduced foreign DNA) cells taken from the Australian red claw crayfish *Cherax quadricarinatus* with human cancer genes. In the meantime, Claydon will be with Brunei's Department of Fisheries, as Director of Shrimp Pathology with consultancy firm Integrated Aquaculture International. (Fishsite.com)

### Walmart buys TiLoveYa™ tilapia

HQ Sustainable Maritime Industries has signed an agreement with Sam's Club, a division of Wal Mart, to commence online sales of various formats of its branded TiLoveYa™ tilapia products on the latter's website. Sam Club is a large warehouse club with 47 million US members. The tilapia is a new range of "consumer driven" health-conscious, toxin-free fish produced by HQ in Hainan, China. The product was also presented to European markets for the first time at the European Seafood Exposition, in Brussels. These are freshwater tilapia products which do not contain any hormones, antibiotics or other toxins and are free of heavy metals associated with ocean-harvested products. Their fresh clean taste is due to the natural farming methods in ponds that are richly oxygenated to prevent algae growth that affects taste.

### Vietnamese catfish wins EU customers

The Association of Seafood Exporters and Producers (VASEP) reported that Vietnam's catfish has won interest from many European Union businesses. It was on display at the European Seafood Exposition, held in Brussels, Belgium, from April 24-26. The report in VietnamNet said that the EU has long been the largest market for Vietnamese 'tra' and 'basa' catfish, importing in 2006 more than 100,000 tonnes of this product from Vietnam. The country targets an earning of USD 1 billion from catfish exports in 2007, USD 300 million more than in 2006.

### Indonesian Aquaculture 2007

The Directorate of Aquaculture, Ministry of Fisheries Indonesia will organise Indonesian Aquaculture 2007 in Denpasar, Bali from July 30 to August 2, 2007. There will be a seminar, trade exhibition and business meetings. Some of the speakers lined up for the seminar include Dr. George Chamberlain, GAA, Dan Fegan, Alltech, Dr. James Wyban, HHA, USA, Dr. Chalor Limsuwan, Kasetsart University, Dr. Kevin Fitzsimmon, University of Arizona, Dr. Bernard Devresse and Dr. Mike Rimmer. Other speakers will be from Indonesia. A shrimp farmer day session will be organised by Shrimp Club Indonesia and a catfish session will be organised by the Fish Feed association. (More information: //www.perikanan-budidaya.gov.id)



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# Thailand's road map for organic aquaculture

By Lila Ruangpan

**A growing niche market for certified organic aquaculture production is attracting shrimp producers in Thailand to convert to this method of farming. The Department of Fisheries has a road map to increase production to 2,730 tonnes of organic black tiger shrimp in 2008.**

Certified organic aquaculture is a young sector of the organic food industry. It is also growing rapidly and the potential for expansion is excellent. Total global production for this niche market is unknown but was estimated at 10,000 to 20,000 tonnes per year (Lem, 2004). The organic food industry is growing at 20% per year. However, the growth rate for organic aquaculture products is unknown but estimates ranged from 20% to 30% annually. At the latter rate, it can account for 0.6% of the annual production of aquaculture in 2030, according to FAO (2002).

In Thailand, there is already a general trend in promoting a system of environmentally friendly agriculture activities. This principle of organic agriculture is in harmony with the King's philosophy on having a sufficiency economy. At the same time, it provides safe and healthy food for customers. As shrimp farming can be controversial, with criticisms on damages incurred in mangrove areas and pollution of coastal environments, organic culture methods can demonstrate the positive aspects of shrimp culture.

## A growing market

By definition, certified organic aquaculture is using the best practices, preservation of natural resources and respecting social and animal welfare. It is the delivery of non genetically modified organisms (GMOs), healthy and safe food derived through transparent processes to the consumer. These products from organic aquaculture are the choice of a growing group of customers demanding safe and high quality products.



5 months black tiger shrimp

It is also demanded by consumers who disagree with conventional methods for fish and shrimp production. These consumers are prepared to pay premiums of more than 15 - 30% for certified organic products.

The important markets are the US, Europe and Switzerland. Japan has a limited market. Within Europe, the largest market for organic aquaculture products is Germany and UK. Asian producers are also targeting their home markets in addition to the export markets. Changes in lifestyle in countries such as Singapore and higher incomes levels



## Thailand's first organic shrimp farm

The Sureerath farm located in Chantaburi Province was the first farm to produce and market certified organic black tiger shrimp. It shifted from conventional farming to organic farming two years ago. The total area occupied by the farm, set up in 1985, is 1,200 rai (168 ha) with 116 ponds.

The farm uses 113 grow out ponds, each of 0.4 ha for organic shrimp production. There are 1-1.5 crops per year and the yield is 500 kg/rai (3.1 tonnes/ha). Harvest size is 40 pieces/kg and above, although some are larger at 25 pieces/kg.

At the farm, the average stocking density of PL15 is 15/m<sup>3</sup> of water. The culture period is 5-6 months. Previously, when shrimp was produced using the conventional culture methods, production was around 1 tonne/rai (6.25 tonnes/ha). With the shift to organic shrimp production, the farm has reduced its production by half. Following the organic method of production, the savings in energy usage is almost 30-40%. To date the farm has not reported any problems with diseases.

Farm manager, Prayoon Hongrath, said, "As shrimp do not show any effects of stress, I am happy".

The Sureerath farm has the certification for marketing organic shrimp from the Germany based certifying body, Naturland. This was a result of the cooperative program between DoF Thailand and GTZ (German Technical Cooperation). Today, the farm markets the shrimp as chilled head on, frozen raw peeled tail off and/or head on, cooked chilled tail off and/or head on. The markets for the shrimp are in UK, Germany and France.

*At the Sureerath Farm. Lila Ruangpan (right) with Sureerath Hongrath (second from left)*





*Mangrove conservation. One of the principles of organic shrimp farming is the preservation of environment and natural resources*



### Animal welfare

The Naturland Standards for Organic Aquaculture indicated that, "Transport and slaughtering must be done as considerate as possible in order to avoid any unnecessary suffering of the animals. The methods, procedures and materials have to be in any case oriented towards the sensitivity of the respective animal species (e.g. to temperature or to stress).

in China and India are changing consumers' perception on aspects of quality in fish and shrimp.

The current market in UK, Germany, France and Italy for organic agriculture product was estimated at USD 6.9-7.6 billion in 2006. Demand in Europe for certified organic fish will be met with local production. Europe produced 14,000 tonnes valued at EUR 70-80 million annually. However, organic shrimp and shellfish will be from outside Europe such as Asia for black tiger shrimp and Latin America for vannamei shrimp. Two large companies in Latin America produced about 1,300 tonnes of shrimp annually.

### Organic black tiger shrimp

Presently, the production of organic black tiger shrimp is very small. Producers are in Bangladesh, Indonesia, Vietnam and Thailand. In 2006, Vietnam produced 300 tonnes from farms in the Ca Mau region. The annual production in Thailand is 350 tonnes from the Sureerath Farm (see box) and 100 tonnes from the cluster of transitional organic farms using semi-intensive methods in Samut Sakorn.

Intensive shrimp culture started in Thailand in the early 1980s with black tiger shrimp, the indigenous species. However, Thailand's

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## The organic consumer

In general the consumer falls into three categories, according to Lem (2004).

Heavy user	Young families with small children and older consumers	Occasional consumers
<b>Motivation to buy organic products</b>		
<ul style="list-style-type: none"> <li>environmental concerns</li> <li>health concerns</li> <li>ethical concerns</li> </ul>	<ul style="list-style-type: none"> <li>health</li> <li>environmental concerns</li> <li>health concerns</li> <li>consumer friendliness</li> </ul>	<ul style="list-style-type: none"> <li>life style aspects</li> <li>gourmet</li> <li>quality considerations</li> <li>health concerns</li> </ul>
<b>Where do they buy organic products</b>		
<ul style="list-style-type: none"> <li>Health stores</li> <li>traditional food stores</li> <li>local markets</li> </ul>	<ul style="list-style-type: none"> <li>traditional health stores</li> <li>conventional supermarkets</li> <li>organic supermarkets</li> <li>local markets</li> </ul>	<ul style="list-style-type: none"> <li>conventional non organic supermarkets</li> <li>organic supermarkets</li> </ul>

production of 400,000 tonnes in 2006, is now dominated by *Penaeus vannamei*. Black tiger shrimp culture is almost gone with only 1-2% of total production today. Therefore, another objective of this program is to increase black tiger shrimp production by at least 15% within 3 years. This will be through organic aquaculture.

The Department of Fisheries (DOF), Thailand wants small scale farmers using extensive culture methods to convert and certify their farms for organic shrimp production. This is seen as an opportunity for small scale producers to continue farming black tiger shrimp and receive higher prices for their produce. At the same time, it reduces the costs of production through elimination of drugs and chemical use in feed and also reduces the energy used in pond management.

### Proposed road map

There will be two approaches, intensive and semi intensive/extensive culture of the shrimp. In the context of organic shrimp farming, intensive systems use a stocking density of 15 postlarvae/m<sup>3</sup> and produces at least 40 pieces/kg size shrimp in a culture period of 5 -6 months. Semi intensive systems use stocking densities of not more than 10-15 postlarvae/m<sup>3</sup> to produce 40-20 pieces/kg size shrimp at a productivity level of 100 kg/rai. (Note: One rai =1,600m<sup>2</sup>).

The target production in 2008 will be 2,730 tonnes which will comprise 730 tonnes from 1,460 rai of intensive farms (producing 500 kg/rai) and 2,000 tonnes from 20,000 rai of semi intensive farms (producing 100 kg/rai). The planned development will be throughout the country (Figure 1).

In 2008, efforts will focus on the production of quality products of international standard, marketed under an internationally recognized

Thai Certification System. The certification covers hatchery, farm, processing plant, distributor and feed manufacturing. Product promotion will be under the label Organic Aquaculture Product of Thailand. It was developed in accordance to the international organic agriculture standards such as IFOAM and includes CODEX, ISO14001/(EMS) and FAO CoC for responsible fisheries. Shrimp farmers will be required to learn more about organic standards from advisers before they can convert their GAP or CoC Standards to that following the norms for organic certification.

Undoubtedly, the organic method of culturing shrimp has lower production yields but it has less impact on the environment as compared to conventional methods. Additional costs come in the form of organic feeds, if natural food production is not applied. Post harvest, the costs are in the inspection and certification of products by the certifying body.

Support from the DOF will be in several areas.

- Public relations and marketing will create consumer awareness on the benefits of organic products. It will help producers to understand the practices and prerequisites for certified organic aquaculture. Marketing of the products will require branding and road shows.
- R&D will focus on improving broodstock quality and breeding techniques. Another area will be the development of natural and high quality organic feed, using local raw materials. The cost and benefits of organic aquaculture will be clearly investigated and explained to farmers. R&D will also seek to implement organic methods of processing in packing and processing plants.
- Incentives will include quality seed for 3 years as well as technical support and disease monitoring services. To assist farmers, DOF has a revolving fund for semi intensive farms. This is one million baht/1,000 rai for the purchase of post larvae for stocking. It also encourages the formation of a cluster/network system of farmers.
- A national certification system is required to develop local certifier bodies and inspectors. The aim will be to develop this further into an international recognized certification for Thai organic shrimp.

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# Black tiger shrimp in India

By Zuridah Merican

## A need to be sustainable to stay in business

The coastal areas along India's Tamil Nadu state have a long history of shrimp farming. In 2005-06, it contributed 7,069 tonnes to the annual Indian production of 143,170 tonnes (Vishnu Bhat, 2007). Increasing competition from other shrimp producing states may signal a need to expand production. Except that here, expansion is limited not only by environmental constraints and but also concerns on disease control and its future sustainability.



The ponds in the 150 acre (60ha) *Bismi Prawn Farms (P) Ltd*, located in *Perunthottam, Sirkali Taluk, Nagapattinam District*, Tamil Nadu, 300 km from Chennai is relatively secluded with the nearest village some 3km away and with no other shrimp farm in the vicinity. The farm is part of the Bismi Group with interests in agriculture, shrimp farming, hatchery and feed mill.

Water is pumped directly some 500m out at sea. It is then directed into settling ponds prior to use in the culture ponds. In the reservoir ponds, Mr S. Ali Husain, Managing Director is keeping some 10,000 two year old seabass obtained from the nearby RGCA (see pages 32-33). The fish together with tilapia, mullet and other brackishwater fish are used for biofiltration in the reservoir and settling ponds which total 4 ha. "These seabass are my soldiers and prevent crustaceans from entering the pond system," said Ali Husain.

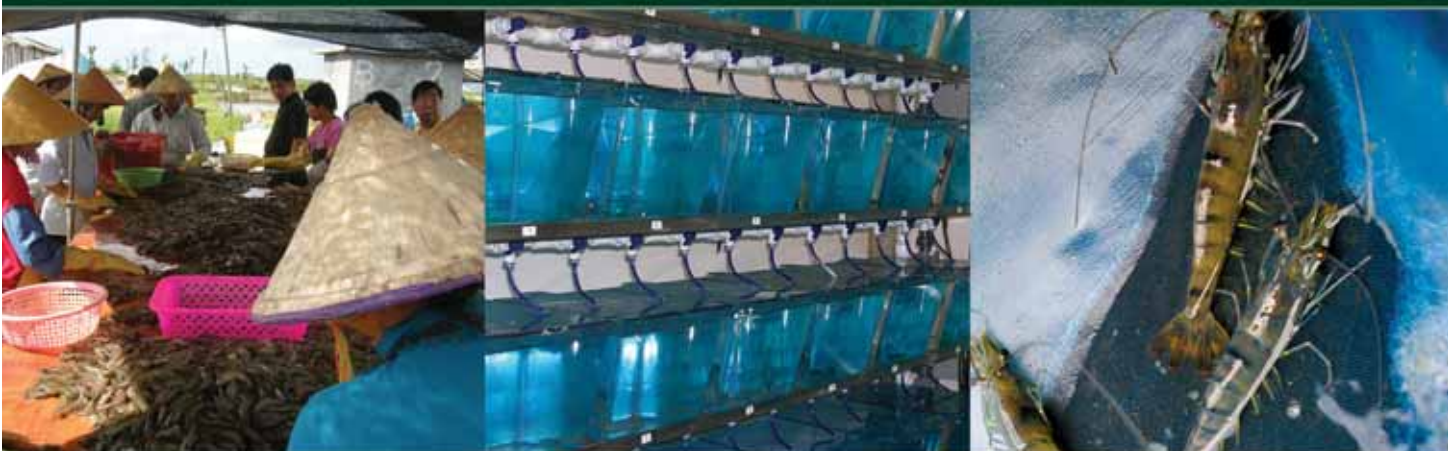
At the same time, Ali Husain is also paying a lot of attention to biosecurity to prevent occurrences of diseases. Three years ago, he had problems with WSSV (white spot virus syndrome) and MBV (Monodon baculovirus) infections which forced an immediate harvest. Today, the strategy is to prevent the entry and to eradicate crustacean hosts. The current pond structure also allows him to empty the ponds within 96 hours. "I believe that once we can control the hosts for these viruses, we can control diseases".

He has divided the pond system into three modules, two modules each containing 18 ponds and another with 12 ponds. Pond sizes range from 0.7 to 1.0 ha each. Each module is managed by a foreman and group of 20 men and women from the local community. Inlet and outlet channels are separated such there is no mixing of water from one module to another.

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*Mangroves Rhizophora sp which can withstand extended submerged periods are planted in the canals. The plants bio filters the slow moving water.*

Stocking starts early in March as water temperatures are relatively stable at 27°C. Postlarvae are stocked at a density of 8-10 PL/m<sup>2</sup>. These are obtained from the hatchery set up by Ali Husain and a group of 3 shrimp farmers. The hatchery with an annual production of 30-40 million post larvae is located along another part of the coast just 4km away in the village of Thoduvai, Thirumullaivasal in Nagapattinam District. According to Ali Husain, the group decided to start their own hatchery as they had doubts on the quality and disease status of post larvae produced by private hatcheries. Post larvae are produced mainly to supply the farms and the remaining are sold in the neighboring farms.

In pond management, there is no water exchange for the first 40 days after stocking. Water parameters such as ammonia, salinity, pH, iron, dissolved oxygen etc are checked regularly. Shrimp are fed twice a day with pelleted feeds after the initial 30 days. For the rest of the cycle, feeding is carried out four times a day at 6am, 12 noon, 6pm and midnight. The farm uses a particular brand of feed for each cycle. Several feed brands have been used including Rangen shrimp feeds imported from the US. There are no complaints on the quality of shrimp feeds available in the country. However, feed conversion ratio used to be 1:1.5 but recently this has increased to 1.9. This could be attributed to the lower survival. Nevertheless this is worrying as more feeding means higher pollution of the pond environment.

However, as a next step, the farm will be formulating its own feed with assistance from the Central Institute of Brackishwater Aquaculture (CIBA). The feed unit has been set up with a pelletiser with a production rate of one tonne per hour of shrimp feeds. There will not be any problems in obtaining good quality ingredients, according to Ali Husain. "Some 95% of the feed ingredients will be local. We have made advances in improving the quality of local ingredients. More than 60% crude protein fishmeal is available in India using technology imported from Peru. We also have fish oil, fish solubles extract from our own steam sterilized fish meal plant built in with our feed mill and wheat flour and soybean meal from Punjab & Maharashtra."

Harvesting is staggered with the first harvest when shrimp are 30g in size and the next when shrimp are 40g in size. Water is drained partially and is filled up immediately whilst shrimp are collected at the sluice gate. This is possible as the farm has a large reservoir. Each harvest is carried out with 2-3 ponds and the shrimp are chill killed, weighed and loaded in the insulated vehicles within 20-30 minutes from time of harvest and send to a processing plant. The target production is 2 tonnes/ha. Each production cycle is 180 days water

salinity is 33ppt in the sea and increased in the ponds up to 38ppt. The schedule is three crops for every two years.

## Eco restoration

"When we took over these abandoned ponds, there were no mangroves in the vicinity. We then collected plants from the forest and replanted 3,000 plants. However, only 12 survived and now these have propagated to cover the area. Through a system of canals, the mangroves filter the effluent water"

This is the outstanding nature of the farm which Ali Husain is very proud of. In 2001, the production model of these shrimp ponds was the subject of an integrated approach in farming black tiger shrimp in Perunthottam, along the Sirkali coast of Tamil Nadu.

Some of the negative perceptions associated with aquaculture in India were seepage, salination of agriculture lands and freshwater aquifers, fishermen's inaccessibility to the fishing grounds, lack of employment and displacement of the community. The project showed that mangroves planted outside the ponds and inside the effluent treatment plant and outlet canals have the added advantage of reducing the nutrient load and seepage levels. The planting of mangroves also created a permanent wind shield and helped in reducing the exposure of the Sirkali coast to storms and flash floods.

"Compared to agriculture activity like paddy and sugar cane, our aquaculture generates 3-4 fold (higher) employment opportunity in the coastal unproductive saline lands, which were kept fallow for many decades. They were not even used for grazing because of no grass due to the saline soil. Not even a single family was displaced. The accessibility to the fisher folks never been a problem in the village", said Ali Husain.



*S.Ali Husain*

"When the tsunami hit in December 2004; our farm was damaged badly as it is stood right before the Bay of Bengal. Fortunately neighbouring villages are protected by the bunds in our farm which acted as wave breakers. I myself witnessed that even a drop of water did not enter the village. We compromised our losses as we saved the village at the cost of our farm".

"In India, shrimp farming has the bad publicity of destroying the environment and I want to show that we can live together with other fishermen and farms. If I do have difficulties with neighbours, I will need to know how to tackle this. All of us have been here for the past 12-13 years and land side of this farm are padi lands", said Ali Husain.

He emphasized that what is important is to understand the interaction between the environment, ecosystems, water, soil inputs and the animal. It is also the understanding of farmers in the village and the co-operation with them. We need to understand the value of consumers and their expectations. Only then can there be sustainability in aquaculture worldwide.

***"Since private entrepreneurs own a major share of aquaculture systems in India, they should ideally be involved in afforesting or reforesting private lands and show sustainable bio culture models."... SD Oswin and S Ali Hussain, 2001.***

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# Black tiger shrimp in India

## Limited by environmental constraints

With only one culture cycle per year, production has reached 2.6 tonnes/ha and no major diseases problems have been reported in this extensive black tiger shrimp farm.

There are 15 ponds of 0.8 to one ha sizes in this farm located along the road from Chennai to Pondicherry, 60 km south of Chennai. The farm is on a joint venture basis between the local community and the Poseidon group of companies which also manages another farm in Andhra Pradesh and two hatcheries in Tamil Nadu state. It also markets a range of probiotics, immunostimulants and pond products for shrimp farming.

The production yield has been consistent at 2.6 to 2.65 tonnes/ha/crop. No diseases have been encountered, which Mr Ramesh, farm manager attributes to the use of probiotics and the restriction of only one cycle of culture per year. Culture is during the latter part of the year after the monsoon when the creek supplying water to the area is full. It dries up during the early part of the year. The farm has been in operation for the last 6 years.

The production cycle is 150 days for an average harvest size of 37g/shrimp. There are no apparent problems in farming of the shrimp according to Ramesh, except for some incidences with infections with protozoans. He has 15 full time and part time labourers to assist in pond management on a 24 hour basis. Security is essential as poaching of shrimp after 100 days of culture is common. In addition, the farm has a pond supervisor and technician. Each full time pond worker is responsible for two ponds. Parameters such as dissolved oxygen, pH etc are monitored regularly. Water salinity is 18-20 ppt.

The general stocking density is 7-8 PL/m<sup>2</sup>. Shrimp are stocked at 65,000 in each 0.8ha pond. These are supplied from the hatchery belonging to the company. Only thoroughly screened and tested post larvae are stocked in the farm. Ramesh continues to send some samples to private laboratories to cross check and to ensure that the batch is disease free.



The farm uses two types of feeds. Ramesh reported that the FCR has remained low at 1.33 to 1.38. A 38% crude protein feed costing INR 50/kg is used throughout the cycle. In addition, during the latter stages of culture (more than 90 days), a booster feed is added. This is fed to the shrimp for two out of the five feedings per day. The booster feed contains 43% crude protein as well as additives such as immunostimulants produced by the main company.

The average cost of production is INR 140/kg. Survival averages 80-90%. High costs are due to diesel (INR 38 per litre) for the running of generators to work aerators. Four aerators are allocated to each pond, placed at four corners. Aerators are only run for 5-8 hours per day during the night. Aerators are fixed only after 90 days of culture. The selling price of 30 counts shrimp was INR 300/kg in January 2007. Shrimp are sold to processors on the basis of the best quoted price.



The team at the farm. In the centre are Ramesh (centre, left) and PK Senthil Kumar, hatchery manager (centre right).



Black tiger shrimp reached 24-25g after 100 days of culture

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# Thailand's shrimp revolution

By James Wyban

Thailand is the world's leading shrimp farming nation exporting the most shrimp in terms of volume and value. It is the top supplier of farmed shrimp to the US and Japan. Traditionally, the Thai shrimp industry farmed black tiger shrimp, *Penaeus monodon*. Since 2001, the Thai industry has undergone a dramatic transformation and switched species to farming Pacific white shrimp, *P. vannamei*. It is now the world's leading supplier of white shrimp. This article describes the key factors that drove this revolution in shrimp farming in Thailand.

Thailand started farming shrimp in the 1970s, using locally available *P. monodon* broodstock captured from the sea to produce post larvae in land-based hatcheries for pond stocking. By the early 1990s, Thailand emerged as the world's leading farmed shrimp producer and exporter based on *P. monodon* production.

A combination of factors allowed the Thai shrimp industry to develop into a well-organized, fully-integrated shrimp industry. All components for successful shrimp farming are well represented including technology at all levels in shrimp hatcheries, farms, feed companies and processing plants as well as international marketing companies.

A diverse collection of entrepreneurial businesses and several multinational public companies create a competitive business climate leading to innovation and increasing productivity. Financing for the industry is substantial through several large publicly-traded companies (Charoen Pokphand Foods Ltd, Thai Union Frozen and others) as well as bank financing. Government support for the industry is through R&D and extension by Department of Fisheries and University research programs.

## A strong market focus

The Thai shrimp industry has a strong market focus with many processing and exporting companies to distribute Thai shrimp worldwide. Thailand's Mahachai shrimp auction provides an excellent outlet for independent farmers at competitive auction prices for their products. Daily auction prices are text-messaged industry-wide. Several Thai companies have well established marketing companies in major import markets (US, Japan, Europe).

## Slowing of production

In the 1990s, disease problems increased risks and slowed industry expansion. Yellow head (YHV) and white spot viruses (WSSV) severely impacted production. Government-sponsored research and extension helped the industry adjust and manage around these diseases. These viruses were most often introduced through the wild broodstock supply. Despite these problems, the Thai industry maintained its position as the number 1 shrimp producer. In 2001, Thailand's *P. monodon* production peaked at 280,000 tonnes.

Since 2001, *P. monodon* farmers faced a new disease called Monodon Slow Growth Syndrome (MSGs), characterized by slow growth leading to smaller harvest size and lower prices. The cause of MSGs is still unknown. This slow growth problem with *P. monodon* set the stage for SPF *P. vannamei* introduction. Farmers were looking for a lower risk, reliable way to make money farming shrimp.

## Testing of SPF broodstocks

Limited SPF *P. vannamei* broodstock imports were first tested in 2001. Results were impressive with stable, consistent results; high survivals and fast growth to 20 g in 100 days with uniform size distribution at harvest (2-3 size classes). The SPF shrimp were tolerant to higher densities than *P. monodon* – up to 2.5 kg/m<sup>2</sup> and there were lower incidences of mass mortalities.



The industry lobbied to allow more broodstock imports in 2002. More farm trials followed and 2002 also saw tests of 'homegrown' or 'F1 broodstock'. Farmers soon found that most growth and production advantages of true SPF *P. vannamei* were lost using 'home grown or F1 broodstock'. Slower growth and large size variation and more disease events were typically experienced with F1 stocks.

White shrimp production in 2002 jumped to 20,000 tonnes. Figure 1 illustrates the rapid increase in *P. vannamei* production (yellow bars) between 2002 and 2006 while *P. monodon* production (red bars) rapidly declined. In 2006, *P. vannamei* represented over 98% of total production entering the shrimp auction and production may reach 400,000 tonnes.

Progressive Thai farmers now produce 20-30 tonnes/ha/crop using SPF and TVR *P. vannamei*. Table 1 compares the relative production numbers and profits between species in Thai shrimp farms. These data clearly showed that the driving force of Thailand's change from farming *P. monodon* to farming *P. vannamei* is the superior production economics with *P. vannamei*. Crop value and profits (USD/ha) with *P. vannamei* are 2-3 times greater than with *P. monodon*. Reliability of production (avoidance of disease) is also higher with SPF *P. vannamei*.

**Table 1. Comparison of production parameters and profits between typical *P. monodon* and *P. vannamei* production systems in Thailand (in USD).**

Parameter	<i>P. monodon</i>	<i>P. vannamei</i>	% Difference
Density (PL/m <sup>2</sup> )	40-50	120-200	300%
Crop duration (days)	110-140	105-120	27%
Harvest size (g) (#/kg)	22-28 (40/kg)	21-25 (42/kg)	5%
Yield tonnes/ha/crop	8	24	300%
Crop value (USD/ha)	45,000	96,000	220%
Crop costs (USD/ha)	32,000	60,000	
Production profit (USD/ha)	13,000	36,000	280%

## Thailand's success

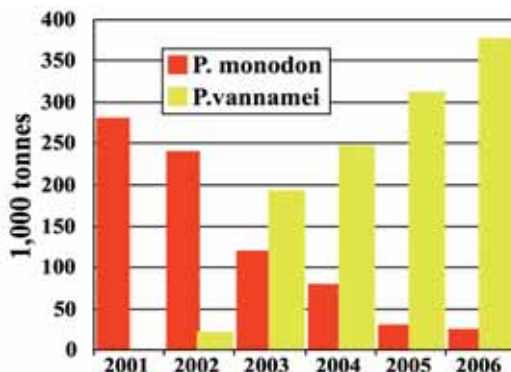
A key factor of Thailand's success with *P. vannamei* is their controlled broodstock imports to ensure sufficient supplies of true SPF *P. vannamei* broodstock. A permit to supply broodstock is required from Thai Department of Fisheries (DOF). Thai law requires that broodstock suppliers are certified SPF producers with a two-year history of SPF production and US-government certification. Based on DOF records, High Health Aquaculture is the leading supplier of SPF broodstock to

Thailand. A DOF Code of Conduct (COC) certification is required for a Thai hatchery to import SPF broodstock.

A recent trend in Thai *P. vannamei* farming is multi-cropping from high stocking densities (200/m<sup>2</sup>) leading to a local supply of small farmed-shrimp (100 pieces/kg) which is replacing a traditional fishery product. Industry consolidation is another trend with large integrators testing a contract-farming business model. Thailand's revolution in shrimp farming largely benefited from the domestication and breeding of SPF *P. vannamei* by US companies.

\* **James Wyban** is the President of High Health Aquaculture Inc. the Kona, Hawaii based broodstock production facility. Email: wyban@hawaiiintel.net

Figure 1. Thailand annual shrimp farming production by species



## Raising the bar By Zuridah Merican

### Through HHT, Dr James Wyban will bring up the quality of Thai shrimp to be the best in the industry.



In late 2005, Thai Union Feed Mill (TFM), a leading shrimp feed producer in Thailand, part of the Thai Union Frozen Foods Ltd (TUF) conglomerate and High Health Aquaculture (HHA) of Hawaii signed a joint venture agreement to develop a hatchery to produce specific pathogen-free (SPF), fast-growing, Taura-virus-resistant shrimp nauplii and post larvae in Thailand. The joint venture, named High Health Thailand (HHT) is capitalized at USD 11 million.

Land acquisition and construction of the hatchery at the site at Khao Pilai beach in Phang Nga, Southern Thailand began in 2006 and was completed in April 2007. HHT will produce and distribute the highest quality SPF post larvae available in Thailand. HHT has a production capacity of over 300 million post larvae/month using SPF GxTVR™ broodstock from HHA in Hawaii. Hatchery production will be managed by HHA personnel.

As Managing Director of HHT, Dr James Wyban (also President of HHA), oversees all aspects of technology and business at the hatchery. In this on site interview, he explains how it all started and how SPF *P. vannamei* will lead to the industrialization of the farmed marine shrimp industry in Thailand and subsequently the region.

#### AAP: Can you tell us how this joint venture came about?

**JW:** We like to think of the JV as a good marriage with both parties bringing their special assets, skills and resources to the venture. HHA brings shrimp breeding technology, shrimp production, high quality/high value products and concepts and skills. It also brings its knowledge of the Thai farmed shrimp industry. We have been active in the Thai market as the leading SPF broodstock supplier since 2001. The Thai industry has confidence in our reputation and brand. TFM brings the substantial resources and knowledge of the TUF group to the partnership. TFM has in a short time developed as a top shrimp feed producer. It has a good position and reputation in shrimp farming.



I see this as an ideal partnership of a leading feed company with TFM's strong customer base and sales force and coupled with the advanced SPF hatchery and operations protocol developed and designed by HHA. We started to structure the partnership in 2005. Land acquisition and facility design were done in early 2006 followed by start of construction in May 2006. As you can see, it has been fast. I am very pleased that in less than a year, the hatchery will be completed.

#### AAP: on your part, why a post larvae business?

**JW:** The post larvae business is a significant part of the industry, much larger than broodstock with a huge turnover. It is big business in Thailand. The broodstock business has been good for us but the demand for broodstock from Hawaii is limited. We wanted to be more integrated into the industry. In HHA strategic planning, we intended to develop a hatchery and we targeted Thailand. At the same time, TFM had decided to develop a hatchery company. Both companies had this common goal so we decided to work together.

As a listed company, TUF has a large market presence in the US, Japan and EU and needs a reliable supply of shrimp with consistent quality and results. TUF is answerable to its shareholders and it cannot gamble with

shrimp farming using traditional production methods. It has to go industrial, producing feed, seed, processing and marketing internationally. As the industry intensifies, profitability is the issue. To be competitive, it is critical to get every pond not only in production but performing well. This investment will secure the future for both HHA and TUF.

HHT will exclusively use HHA's SPF GxTVR™ broodstock from Hawaii. GxTVR™ are SPF (disease free) and selectively bred for fast growth crossed with resistance to Taura Virus Syndrome. They were developed over 10 years of work and is our most advanced *P. vannamei* stock today.

**AAP: At what stage is the project?**

**JW:** Originally we wanted to have a smaller facility and work phase by phase. Despite the higher costs, we decided on the complete facility as you see now. The scale of the facilities is tremendous. We have several rows of 'greenhouse type' buildings holding tanks for all aspects of rearing from nauplii to PL12 production. Two buildings are used for algal and live feed production. All buildings are fully enclosed for biosecurity. Biosecurity was centre stage in our designs and is now in operations. The buildings are well separated and we avoided planting grass which could attract insects. We have seawater reservoirs and effluent treatment ponds to avoid any environmental impact. Most of the materials for construction were sourced within Thailand. We invested heavily in water filtration equipment as we use super high water quality standards.

We have started production. The first experimental batch of PL12 were harvested and sent out on Songkran Festival day in April. We are happy that we could do this on such an auspicious day for Thailand. We expect full production by June 2007.

**AAP: What are your aspirations for HHT?**

**JW:** With HHT, we intend to produce the very best PL available and to raise the bar for the whole industry. We intend to put the issue of quality first in the Thai industry. This will transform the industry. The industry will need to move to an industrial level following the way of the poultry industry. It will be led by large corporate companies and independent farms.

We will be at the top of this market as a reliable supplier of quality shrimp. Our success will be clear by the end of 2007. I am very confident that what we are doing will transform the industry. We will give the producers the very best post larvae they have ever seen.

I believe that the industry in Thailand is moving towards more investment and a technical base where people need more reliable results. This is only possible when you have clean, (disease-free) post larvae

and selected for specific production traits. We do a large amount of work to make sure that the composition of our animals are the best possible.

The use of home grown broodstock reared in open ponds and usually contaminated with one or several virus, is not the way for the industry to grow. The old style culture model using whatever is available at least cost with little concern for biosecurity is always a risk and is more like gambling than an industrial process.

I believe the industry will learn that to get top performance, they will need to go to a credible source. At HHA, we believe in doing things the right way with no short cuts. This will be replicated at HHT.

**AAP: How do you see the future of farmed marine shrimp in Thailand and the region? Can there be a perfect sustainable system for all in Asia?**

**JW:** To answer this, we first need to look at the global market for marine shrimp. It is a big market and growing. However, the market for food is changing with people wanting safe and nutritious high quality food. It has to be clean and come from sustainable means of production.

Shrimp farming must fit into this scenario. We have to focus on production following the model of the poultry industry - industrialized and led by corporate companies integrating breeding, feed production, processing and marketing. We will need to develop the model based on technology which can be transferred to other locations. Shrimp production will have less and less impact on the environment as technology develops. It needs to be benign.

Thailand's lead role in shrimp production is due to its unique and intrinsic political, social and economic characteristics and how her people work together. However, I see that Thailand's future growth will be driven by vannamei shrimp production. The economics of vannamei culture is far superior to that for black tiger shrimp culture. Production volumes are 4-5 times those with black tiger shrimp. The better price obtained for black tiger (up to 50% higher) does not make up for the 5 times higher production volume that we can be achieved with vannamei. My view is that the next species to be used in Thailand will be *P. stylirostris*. Before this, we will need to build a solid foundation for this species.

The production of the black tiger shrimp will continue to be using the old style (low cost) model in countries such as Bangladesh, India and Vietnam. Producers may use SPF post larvae but from an industrial standpoint, the economics of black tiger production is still not clear. HHA owns a domesticated, SPF stock of this shrimp.

## The driving force

With a PhD in fish genetics, **James Wyban** worked as the Principal Investigator of the US Shrimp Consortium at Oceanic Institute in Hawaii. In 1991, his group discovered that SPF shrimp vastly out produced non SPF stocks. Domestication and breeding was the logical next step in the work with SPF shrimp.

"I am thrilled to be involved in this work. Until today, I find all these things incredibly interesting. We use a lot of the theories of Darwin (my hero) on domestication and selective breeding".

Deep down, I am an entrepreneur at heart. Back then, I was searching for opportunities for shrimp farming in Hawaii. I found that the most viable venture based in Hawaii is production and supply of SPF *P. vannamei* broodstock. I started HHA in 1993 supplying the industry in the US and Latin America. Today the company markets broodstock to 25 countries. We work on the domestication and breeding of 4 species of SPF marine shrimp.

"The Asian market has now become our main market and focus of my work. The key success factors for HHA are our focus on quality, customer service, applying good science with no short cuts and not doing things the cheap and easy way".

"One measure of HHA's success is how many imitators there are for our SPF broodstock. We shipped our first shipment to Asia into Taiwan in 1998 and the outstanding growth performance saw many farms producing F1 broodstock from this stock. The lessons learned was that F1 broodstock did not work as well. HHA continues to grow our business because farmers come back to us to get the great results. Most realize that we do not take short cuts. We do things the right way and this will keep HHA sustainable and will make HHT successful too. For top performing shrimp, they will come to us".



James Wyban. In the background are some of the buildings of the hatchery

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# Using natural growth promoters to improve gut health and performance in fish and shrimp

By Pedro Encarnação

The transformation of feed into a biomass gain is a process that starts in the digestive system of the animal. The health status and its functionality will correlate directly to economic results for the farmer. The article looks at how natural growth promoters can be used in modulating interactions with the environment and the development of beneficial immune responses.

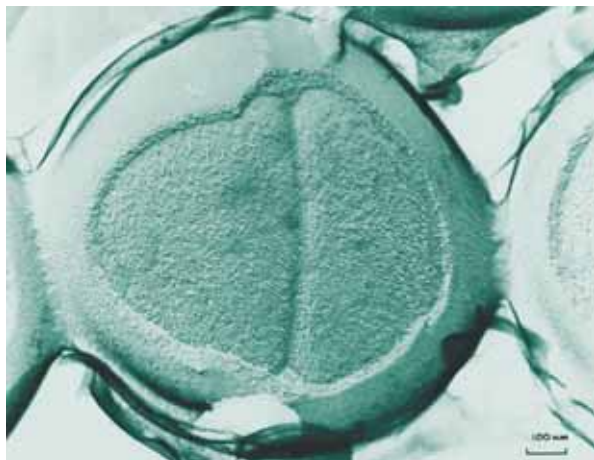
From research in mammals, it is already well known that the gastrointestinal tract is responsive and sensitive to a wide range of stressors. Some of the more common features are degeneration of the intestinal mucosa and perturbation of its barrier function and uptake mechanisms. A well balanced intestinal micro-flora helps in the digestive and absorptive process and is closely connected with the state of health of the gut. It also protects the host against invading pathogens.

Host-microbe interactions are both qualitatively and quantitatively different in aquatic and terrestrial species. The aquatic environment is rich in microorganism (up to  $10^5$  to  $10^6$  per ml), with hosts and microorganisms sharing the same ecosystem. In comparison with terrestrial animals, aquatic farmed animals are surrounded by an environment that supports their pathogens independently of the host animals.

There can be opportunistic pathogens which can reach high densities around the animal. Surrounding bacteria are continuously ingested either with the feed or when the host is drinking, causing a natural interaction between the microbiota of the ambient environment and the gut environment. If the bacterial challenge exceeds a certain level, the health of the animal is in danger, as the animal alone cannot defend itself sufficiently.

## Understanding floral health in fish

During the last decade, there have been advances in understanding the importance of intestinal microbiota in fish. Floral health is a new concept, which underlines the importance of the microbiota to the intestinal health and performance. As a result, there is increasing evidence that the complex microbial ecology of the intestinal tract provides both nutritional benefits and protection against pathogens. It is vital in modulating interactions with the environment and the development of beneficial immune responses.



Probiotic bacteria



Prebiotics

Several studies also have shown that different feed ingredients and changes in diet composition can affect gut structure. The microbiota balance influence digestive and absorptive functions. Alteration of the intestinal microbiota composition and a consequent reduction of protective gut microflora may contribute to pathogenesis in the gut. Management of the gut flora is therefore, an important issue to achieve a good feed efficiency, animal growth and animal health.

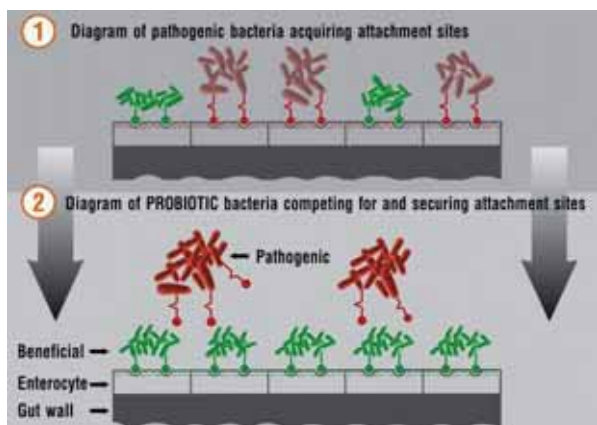
***“Management means selection of beneficial strains, control of their numbers, minimizing number of negative or potential pathogenic strains”.***

Different strategies have been used to solve problems with bacterial and viral threats. Chemotherapy using large amounts of antibiotics is the most common approach. Nonetheless, this should not be a routine method to be used in fish and shrimp culture due to the risks resulting from the increased resistance of pathogens to antimicrobials, its cost and environmental pollution risks derived from its use.

## Functional foods

Nowadays, we have learnt more about sustainable ways to manage gut microflora and fish performance using nutraceuticals or functional foods. These are to modulate the health of farmed animals. There are several natural options available to manage and regulate fish gut environment which include the use of probiotics, prebiotics, immune-stimulants, phycophytic substances, and organic acids and their respective salts, commonly known as acidifiers.

**Figure 1. Competitive exclusion for space. The high population of beneficial bacteria will limit the adhesion of the pathogenic bacteria into the adhesion sites in the intestine.**



**Probiotics** are live microbial feed supplements which beneficially affect the host animal by improving its intestinal microbial balance. The interaction of probiotics with the digestive tract and its endogenous microflora is a subject that is now being studied extensively. Its benefits on aquatic animal health are better documented and scientifically reviewed.

Several studies have shown that probiotics provide protection against pathogenic microorganisms present in the water medium and the gut of the animals by competition with pathogenic bacteria for space and nutrients (Figure 1), production of antimicrobial substances (lactoferrin, lysozyme, bacteriocins) and change of environmental conditions in the intestine (lowering of pH through increased production of volatile fatty acids and lactic acid).

**Pre-biotics** are non-digestible food ingredients (inulin, fructo-oligosaccharides) that beneficially affect the host by selectively stimulating the growth of and/or activating the metabolism of one or a limited number of beneficial bacteria in the intestinal tract, particularly *bifido* bacteria and *lactobacilli*, thus improving the intestinal balance of the host.

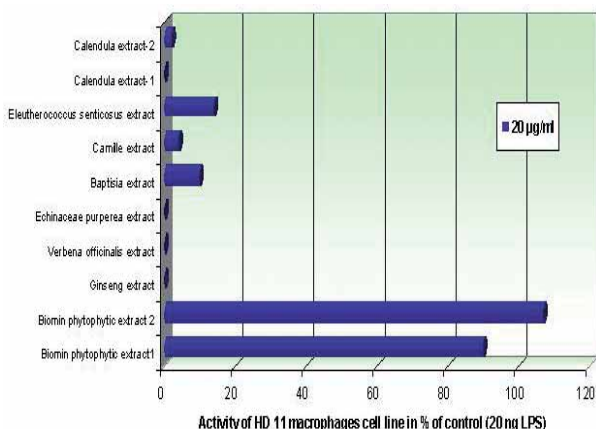
As an essential part of the immune system is associated with the intestine, its health is of particular importance. The gut associated immune system consists of unspecific and specific components. It provides a special category of antibodies (IgA-antibodies) which are a predominant antibody in body fluids and mucous membranes, responsible for defense reactions with pathogens.

**Immune-stimulants** substances have been recognized as promising supplements that potentially assist in disease prevention of several organisms including fish and shrimp. These substances increase disease resistance by regulating host defense mechanisms against opportunistic pathogens. These are always present in the environment surrounding fish.

Immune-stimulants increase resistance to infectious disease, not by enhancing specific immune responses, but by enhancing non-specific mechanisms. Therefore, there is no memory component and the response is likely to be of short duration. The use of these immune-stimulants is an effective means of increasing the immune-competency and disease resistance of fish. Research into fish immune-stimulants is developing and many agents are currently in use in the aquaculture industry such as cell wall fragments,  $\beta$ -glucans, peptidoglycans, lipopolysaccharides, and nucleotides.

**Phycophytic** substances are derived from sea algae species. They contain complex immune-stimulating carbohydrates which demonstrate

**Figure 2. Macrophage activation capability of different plant extracts tested in vitro.**



immune stimulating effects activating macrophages (Figure 2) and stimulate proliferation of lymphocytes, therefore supporting the immune system and helping fight infections.

Dietary acidification through the addition of **organic acids** is another possible alternative to improve gut health and performance. The pH decreasing action of organic acids contributes to an improved activity of digestive enzymes and creates an impaired environment for pathogens. A combination of organic acids and their salts are commonly used to modulate the gut microflora of intensively farmed animals; this is achieved by causing a shift in the dominance hierarchies of bacteria through the lysing of gram negative bacteria.

## Conclusion

The digestive system and the health status of the animal are of utmost importance to develop performance at high level. There is increasing evidence from research that several natural feed additives can have a beneficial effect on the animals by supporting a well balanced gut microflora and improving gut health and performance.

Continuous research work has been done by Biomin resulting in very efficient feed additives. These feed additives are based on natural ingredients, which are able to unlock the performance potential of our animals. These natural growth promoters (NGP's) make use of a modular system combining different substances to balance the gut microflora and boost the immune-system of the targeted species.

In this symbiotic approach, all the components act together in a well-adjusted way to compete against unfavorable dietary factors including changes of feed composition, and microbial contamination of the feed and water. They allow a better utilization of the energy deriving from the nutrients of the feed and enhance the animal immune system.



**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](mailto:pedro.encarnacao@biomin.net).

# Future challenges and strategies for sustainable health management for the Tilapia as a commodity crop

By Neil Wendover, Brian Sheehan and Cedric Komar

**Tilapia is the most popular and marketable species today. To sustain the rapid growth and intensification of the tilapia industry, further advances in farm management and animal husbandry will be required and infectious diseases must be controlled.**

The rapid expansion of the tilapia industry has been an unprecedented phenomenon: A decade ago, few people knew much about this native species from Africa and the Middle East. Today, it has emerged to become the second biggest aquatic species group after carps, with a worldwide harvest from 100 different countries of over 2.3 million tonnes and about 5% of global finfish aquaculture (FAO). Asia and Latin America are the 2 major producing regions. Of the 70 species of tilapia, nine are used in farming and, of these, the Nile tilapia (*Oreochromis niloticus*) and to a lesser extent *O. mossambicus* and *O. aureus* and their hybrids are the main cultured species responsible for the significant increase in global tilapia aquaculture production.

In view of its affordable price and increasing popularity worldwide, tilapia has been dubbed the 'aquatic chicken' and is the most important aquaculture species of the 21st century (Shelton, 2002). It can be raised in the backyard or by agro-industrial companies, grow fast on either natural grazing or formulated feeds, and is acceptable to both rich and poor consumers. More over, the nutritional characteristics of this 'green' herbivorous fish satisfy the need of the modern world: high protein content but low cholesterol and fat content.

Tilapia is a very marketable product and there is a thriving international trade at the top end of the business, that is, fresh and frozen fillets for the tables of the USA and EU consumers. Indeed, in the last 5 years, there has been an unprecedented development in the tilapia industry in terms of global production (double digit annual growth rate), international trade (26% increase per year in USA consumption), and industrialization of the farming industry (several integrated companies have

emerged in recent years, each producing over 10,000 tonnes/year).

So, tilapia has emerged from obscurity to become the number one commodity aquaculture species in the world. It has taken the USA market by storm, from 25,000 tonnes consumed in 1995 to almost 360,000 tonnes in 2006 on a live weight basis (USDA Statistics). By 2010, the global value of tilapia is forecasted to reach USD 4 billion (Intrafish, 2003).

Tilapia grows well in captivity and in a wide variety of conditions from rural subsistence farming to large-scale commercial operations. Earthen ponds are the most common culture system worldwide. Concrete tanks and raceways are commonly used in countries where temperature is seasonal and mainly for intensive and super-intensive culture of tilapia. Cage culture is mainly practiced in lakes, reservoirs, rivers and estuaries. Tilapia are farmed in different culture systems (extensive, semi-intensive, intensive, monoculture, polyculture, monosex culture, mixed sex culture) depending on the farmer's resources, site characteristics, environmental conditions, socio-economic factors, technological know-how and market demand. It is mostly farmed in



*Intensive culture of hybrid red tilapia using power waste effluent water in Qingdao, Shangdong, China*



The authors at VIV Asia 2007, Bangkok. From left: Brian Sheehan, Cedric Komar and Neil Wendover. With in-house knowledge and experience going back over 20 years, Intervet Aquatic Animal Health is a renowned pioneer, providing superior aquatic animal health products for farmed aquatic species. The authors are based in Intervet's dedicated Asia-Pacific Aquatic Animal Research and Development centre located in a purpose-built facility in Singapore. Here an experienced team of scientists and veterinarians are focused on the study of species important in the Asia-Pacific region, such as tilapia, grouper, Asian sea bass, yellowtail, amberjack and shrimp. In addition to disease epidemiology and vaccine development, investigations are well underway to develop new, high quality and safe pharmaceuticals for responsible use as part of an overall health care management plan for farms.



Transfer of tilapia from ponds to cement tanks at the PKPS fish mart farm in Malaysia



Hapas in brackishwater at a nursery in Cebu, Philippines

hot and humid environments but it can also be farmed in indoor facilities in cooler climates with the possibility of utilizing power wastewater effluent.

With the intensification of culture, the belief that tilapia are disease resistant is now a myth. Experience has shown that most intensive fish farming systems suffer from between six and eight major infectious diseases and that these must be prevented or controlled before the industry can truly become sustainable. In tilapia, we have so far identified four major bacterial diseases (*Streptococcus agalactiae*, *S. iniae*, *Flavobacterium columnare* and *Francisella spp.*), one viral disease (iridovirus) and three major parasites (*Trichodina spp.*, *Amyloodinium spp.*, and monogenean spp). Their prevalence and severity depend on many environmental factors, such as geographical location, culture system, farming intensity, salinity and water temperature, and on several biological factors, such as age, genetics, nutrition and stress.

Prerequisites for disease prevention are the identification of the etiological agents responsible for disease and the understanding of the epidemiological factors that trigger and aggravate the diseases in the farm. It is also critical to understand where the delicate balance lies between the intensity of farming and the well-being of the fish.

To sustain the rapid growth and intensification of the tilapia industry, further advances in farm management and animal husbandry will be required. Already improvements have been made in terms of various critical parameters such as stocking density, dissolved oxygen in the water, optimized diet and feeding regimen and genetic improvement through breeding schemes.

However, experience in intensive farming of other food animals has demonstrated that one key area of improvement should/will be the development and widespread application of vaccines to control the most devastating diseases. Only by combining improved husbandry with better disease management are we likely to achieve survival rates in excess of 90% which are now routine in the salmon industry.

\*Extracted from the presentation at the Aquaculture Forum, VIV Asia, 2007, March 8-10, 2007.

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# Tilapia – positive social impact as popularity grows

By David Little

The continued growth of tilapia as a commodity in Asia over the last few decades shows no sign of easing. Coming into Asia as an exotic species, it was first introduced in the urban markets in countries with a high demand for freshwater fish. Subsequently, there have been development initiatives promoting tilapia for improving rural food security. However, widespread acceptance occurred only after indigenous species were less readily available or became more expensive. In contrast, they became abundant in the suburban areas, being grown on wastes and by-products and subsequently were readily accepted by the poorer population in the cities. As Asia's boom cities has often relied on migrants from the rural areas, tilapia became a popular fish and these same migrants took their taste home with them.



*A harvest of large fingerlings of an improved strain of Nile tilapia from ricefields in North West Bangladesh. They are sold, eaten as everyday food or restocked as required*

This situation has resulted in interesting developments between Asia's 'Mega cities' and their hinterlands. Tilapia raised in East Kolkata's wastewater-fed fisheries, along with small carps is often trucked to outlying rural areas of West Bengal where they command a good price. Tilapias have long been exported on ice from Bangkok's hinterland provinces to north east Thailand. Wastewater, derived from urban sewage or intensive livestock farming that tend to be located around the cities make tilapia very cheap to produce in converted rice field in semi urban areas.

Increasing production levels and costs kept low by the characteristics of the species (herbivorous, hardy and fast growing) make the species affordable even by poorer consumers. Such trends benefit large number of people in the industry such as producers, traders and consumers and add value by recycling the waste generated by the urban centres.

The rise of intensively produced tilapia, often in cages and raised on formulated feeds is an interesting phenomenon. The large pellet fed fish appeal to middle class consumers and this market does not appear to conflict with the established trade of 'green water' produced fish. Often size (usually more than 400g) and colour (often red) differentiates the product in the market. Often, traders try to sell them live for the best price. The development of this market segment has given rise to another network of people who benefit from this supply chain. Changing culture practices has increased the demand for monosex seed. Consistent sex ratios are difficult to maintain under small backyard hatchery conditions hence large commercial outfits tend to dominate the production of monosex seed. The higher price of monosex seed and the differentiated higher priced market has created a different model which runs in parallel with the 'green water' fish.

Both models require different resources and carry different risks. While starting an intensive cage culture operation does not require ownership of land, its operating costs, especially for feed are much higher than for extensive ponds. The risk of failure is also higher especially from pollution of the public water body which is beyond the control of the farmer.

The dynamics and overall growth of tilapia production in Asia have benefited all along the supply chain as advances in technology have been developed. The market has seen an increasing demand for fish of all types which has been helped along by the Avian influenza outbreak that has hit sales of chicken. The co existence of the 2 models described above has resulted in a positive social impact through increased opportunities for employment and lower priced fish in the market.



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# Marine cage culture of Tilapia

In Singapore, the Kwee Siong Fish Farm is the only farm producing saline tilapia for the auction markets and restaurants in the city state. Tilapia is cultured in long net cages in the coastal waters off the North coast of Singapore. This farm is also among the 50 cage farms, culturing mostly marine fish such as the tiger groupers, milkfish, Asian seabass and mullet in the straits.

The three Yeo brothers have been running the farm for the past 15 years. They started by culturing mainly marine fin fish. A few years ago, they bought some hybrid red tilapia from Malaysia and began experimenting in the production of saline tilapia. Today, they market a minimum of 300kg of 500-1000g live tilapia weekly. Fish are sold at SGD 5/kg (USD 3.33) for fish of uniform size and decreasing to SGD3.00/kg (USD2.0) for fish of varying sizes.

“We found that consumers prefer black tilapia *Oreochromis niloticus* cultured in seawater. The fish does not have the muddy off flavour common in tilapia from freshwater ponds. The demand for our fish increases during festivals and at year end. We also increase the supply to restaurants. During the monsoon season, when catches of wild caught fish decrease, demand for this tilapia is higher”, said Yeo Heng Tiang.

The farm uses the long net system of cages. Here cages are usually 200 feet long and 20 feet wide (67m x 6.6m wide) and cages are aligned with the flow of the current in the straits. Fish are stocked in a 100 feet portion of the cage whilst the rest are kept above water for cleaning by sun drying. The stock is then moved to this portion of this cage after cleaning. In the case of cages holding tilapia fish, each cage contains 50,000 fish. When they started experimenting with culturing saline tilapia, the brothers stocked at 150,000 pieces/per cage but found that fish were stressed.

“We can stock tilapia at higher densities in the cages unlike the mullet, milkfish and groupers that we have here. The ideal salinity for tilapia is between 24-25 ppt and we have such conditions in these waters. Salinity ranges from 10 to 30 ppt in these waters”, said Yeo Heng Tiang.

Each culture cycle is for about 10-12 months. During the early stages of culture, fish are fed with pelleted feed for marine fish imported from Taiwan. Pellets contain 43% protein. After three months, feeding is continued with day old bread until market size. Survival during grow out averages 80% but during the fingerling stage, survival is only 30%.



A 1.5kg black tilapia from the cages.

Besides tilapia, the farm has net cages for the culture of groupers, mullet and milkfish. In a separate area, it has long lines of green mussels. It has two lift nets to capture fresh fish, mainly sprats, for the feeding of the groupers, mullets and milkfish. Yeo Heng Tiang said that it is important for them to stock several species of marine fish in the cages at one time. This is because consumer demand for any fish often changes and they have to be ready for this.

At the farm they have groupers, usually mangrove groupers *Epinephelus tauvina*, reared mainly for the recreational fishing in ponds. This is preferable as the selling price is higher than as food fish. Milkfish is another popular species. According to Yeo Heng Tiang, farms in Singapore now market some 10 tonnes of milkfish to local and markets in the Riau Islands. Milkfish are sold at SGD 1.70-2.00/kg (USD 1.13). With Singapore, demand is from Filipino workers in the shipping industry. Similar to saline tilapia, demand increases with declines in wild caught fish during the monsoon season.

The farm imports its milkfish fry from Indonesia at less 0.65 cents per piece. Better quality and uniform size fry from Taiwan are only available from May to September. To ensure a supply of tilapia fingerlings of 2 - 3cm acclimated to saline conditions, the farm has a hatchery on the farm. Broodstock are kept in freshwater in floating tanks.



Brothers Alan Yeo and Yeo Heng Tiang (right)



# Genetic development of the Tilapia

by Eric Roderick



YY broodstock in the Philippines project

Work on the genetic improvement of most aquaculture species lags behind most terrestrial farmed species. It is really only the salmon that has benefited significantly from genetic improvement. However, this is changing fast as most aquaculturists realise that there are significant yield gains to be made through genetic studies. Nowhere is this more evident than in the tilapia.

The most widespread and popular cultured species is the Nile Tilapia (*Oreochromis niloticus*) accounting for 85% of the total production of over 2 million tonnes estimated for 2006. Other species being farmed are *Oreochromis mossambicus*, *Oreochromis aureus*, *Oreochromis spiluris*, *Tilapia zilli*, *Tilapia rendalli* and a range of hybrids between some of the above especially the red tilapias which are of very mixed origins.

Most modern tilapia farming involves all male culture. This is because male tilapia grows faster and larger than the females. Traditionally this was achieved by using male hormones added to the feed to sex reverse the newly hatched fry. With new legislation regarding food additives under discussion, the industry needed a viable alternative, which has been developed by Fishgen Ltd, UK.

Through the use of Fishgen's YY-male technology, farmers can now produce their own, all male fry, without the use of hormones. The early developmental work for the YY male technology used the more superior Egyptian strains. The YY male technology results in 'super males' with two Y chromosomes instead of the normal male which has an XY combination. These have the unique property of producing progeny with average sex ratio of >97% males. Since 1995, improvements have focused on developing strains with better growth rates and higher fillet yields. The latest release shows 35% growth improvements over the earlier strains. In conjunction with the Institute of Aquaculture in Stirling, Fishgen has developed a red pure Nile tilapia, with very superior growth rates and are now marketing the YY male technology in both reds and wild type tilapia.



Eric Roderick is Executive Director of Fishgen Ltd, UK ([www.fishgen.com](http://www.fishgen.com)). He is pictured here with his wife Nia at the Fishgen booth at the recent World Aquaculture 2007 in San Antonio, Texas.

Another improved breed available in Asia is the popular GIFT strain, (Genetically Improved Farmed Tilapia) developed in the Philippines, using a comprehensive and well funded selection program using 8 strains of Nile tilapia. Others are the Chitralada strain originating from Thailand and a diverse range of red hybrid tilapia, of very mixed origins and performances. A significant disadvantage of all these other strains is that they are all mixed sex stocks. The obvious disadvantage is that these will require hormonal sex reversal for monosex culture.

## Tilapia in China

China was the leading producer of tilapia at 978,000 in 2005. Total production in 2006 is expected to reach 1.07 million tonnes, a 10% increase. The increase in tilapia production was due to farmers changing from shrimp to tilapia production when the US introduced antidumping duties on shrimp.



Vacuum packed tilapia fillets

Farming is predominantly in the southern province of Guangdong (48%) although production from Hainan and Guangxi is rapidly increasing. Local officials in Guangdong encourage tilapia culture for exports and domestic consumption by setting up breeding centres and providing subsidies of USD300-500/ha for pond construction and start up operations.

Growth in production is driven by domestic demand as well as exports. The per capita consumption is low at 0.6kg/year as compared to 1.2 kg/year in the US. Prices have dropped to USD1.6/kg in January 2006 as compared to 2.3/kg in August 2005. In 2006, exports totaled 181,831 tonnes, mainly to the US (57%) and Mexico (18%). An industry survey noted that 93% of consumers in Guangdong and 76% in Zhejiang like tilapia. Russia has emerged as the main buyer of tilapia from China in 2006.

Promoting tilapia is a priority in China. Some 120 plants are processing tilapia, of which 30 are specialised in this fish alone and most process for international food brands. Globefish reported a recent custom entry 'preserved tilapia'. This is value added such as breaded or frozen fish with addition of lemon, pimento, herbs and spices. More than half of tilapia exported in 2006 was in this category sold at US 2.70/kg.

Year 2007 is expected to see further expansion of production and the forecast is 250,000 to 300,000 tonnes of exports in 2007. This is related to the production cost which is estimated at 0.7/kg as compared to USD 2.00 in the US. (Globefish, 2007; USDA Gain report 2006; Eurofish, 2006).

# Tilapia 2007 Kuala Lumpur

## The Second International Technical and Trade Conference and Exposition on Tilapia

TILAPIA 2007 is the much awaited follow-up to the highly acclaimed TILAPIA 2001, dubbed as the first comprehensive, business-oriented, international technical and trade conference on tilapia. Once again it will be held in Kuala Lumpur, Malaysia from 23 - 25 August 2007 at the Crowne Plaza Hotel.

TILAPIA 2007 will take a close look at developments in the tilapia industry in recent years. A panel of renowned speakers will address issues of relevance to the industry. These include

- industry situation and outlook
- production and processing
- markets and marketing
- technological developments

Some 400 delegates from industry, government, academia, as well as potential investors and marketers, are expected to attend the conference. A trade show will feature buyers and sellers of seafood, suppliers of aquaculture equipment, goods and services, processing equipment, and transport and distribution services. Judging by the feedback received so far, TILAPIA 2007 is an event not to be missed!

More information: contact INFOFISH at P.O. Box 10899, 50728 Kuala Lumpur, Malaysia.

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### Tilapia

International trade in tilapia is growing rapidly with an estimated 15% of the global production of 2.3 million tonnes (345,000 tonnes). This is significantly higher than the FAO estimate of 133,504 tonnes of exports valued at USD 223.4 million in 2004. Reasons are that many countries lump tilapia exports together with other freshwater fish products and there is a substantial unrecorded trade in live tilapia among neighbouring countries.

PR China is the largest producer at one million tonnes in 2005. It is also the largest exporter of tilapia products. In 2005, exports of 92,676 tonnes, valued at USD 203.4 million, was a three fold increase of that 2002. Taiwan is the second largest tilapia exporter with 42,078 tonnes in 2005. Exports of tilapia products to the global markets are for markets in North America, Western Europe and the Middle East.

The USA is the single largest importer. Tilapia is the sixth preferred species in the country. US tilapia consumption increased from 0.28 lb/caput in 2000 to 0.60 lb/caput in 2004 and is predicted to increase further. Imports of tilapia into the USA have increased tremendously over the years, from only 24,444 tonnes valued at USD 49.5 million in 1997 to 134,869 tonnes valued at USD 393 million in 2005. This is an average yearly increase of 56% and 87% in terms of quantity and value respectively.

The common tilapia products are whole fish and fillets. There is also a growing market for high value convenience products such as skin-on, skin-off, deep-skinned, ozone-dipped, CO<sub>2</sub>-treated, IQF, smoked, and sashimi grade tilapia products in various types of packaging. There is also potential demand for organic tilapia, especially in the USA and Europe. Value addition in the tilapia industry is towards maximising by-product utilization to for surimi based products, skin for producing leather, snacks and pharmaceutical products. Tilapia scales can also be used to make handicraft items.

Tilapia culture technology is well developed, especially for the two main species *Oreochromis niloticus* and *O. aureus*. The red and golden strains of tilapia are becoming increasingly popular. Yields are increased with all-male seed for grow-out. These are produced by manual sexing, hormonal sex reversal, hybridisation and through genetically male tilapia (GMT) or YY technology. GIFT (Genetically Improved Farmed) tilapia is a result of genetic selection. A variety of culture systems is used including cages, pens, ponds and tanks. Tilapia can also be cultured in polyculture with other species, or integrated with agriculture, including livestock rearing.



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# Effects of palm oil-based diets on fillet composition of red hybrid tilapia

By Osan Maroof Bahurmiz and Wing-Keong Ng\*

A 100% substitution of marine fish oils with crude palm oil, palm fatty acid distillate (PFAD) or refined, bleached and deodorized palm olein, into diets with 30% crude protein and 8% lipid, did not significantly influence ( $P>0.05$ ) final body weight, specific growth rate, feed conversion ratio, survival and production yield of tilapia. There was no significant difference in the fillet proximate composition of fish fed the various diets, except that fish fed the PFAD diet showed lower lipid deposition. Fatty acid composition of the fish fillets were altered by the dietary lipid source.



In commercial aquafeeds, marine fish oils are commonly used to provide essential n-3 fatty acids. It is also commonly used to coat the extruded

pellets to improve palatability. Recent hikes in fish oil prices and the fact that 60% of the global fish oil production is being used in aqua feed production, may mean that within a decade or so, the demand for fish oil for aquafeeds would exceed total available supplies (New and Wijkstrom, 2002). The rapidly expanding global aquaculture industry cannot continue to rely solely on this limited supply of dietary oil.

Several plant oils have been shown to be suitable replacements for fish oil in fish diets, either by partial or total substitution. Of these, soybean oil, linseed oil, rapeseed oil and sunflower oil evaluated in diets for temperate fish species did not reduce growth performance or feed utilization. Their use affected the tissue lipid composition, which clearly reflected that of the dietary oils used (Greene and Selivonchick, 1990; Izquierdo et al., 2005; Montero et al., 2005; Francis et al., 2006).

## Palm oil in fish feeds

Palm oil as the world's most produced oil, accounting for about 28.3% and 23.4% of the total global production of vegetable and all commercial oils and fats, respectively, could potentially be an alternative to fish oil in aquafeeds (Ng, 2006). Crude palm oil (CPO) is dark orange in colour due to the presence of various carotenoids. It is bleached during the refining process to produce refined, bleached, deodorized palm olein (RBDPO). Palm fatty acid distillate (PFAD) is a by-product from the physical refining of CPO and contains mainly free fatty acids. Vitamin E tends to concentrate in the PFAD fraction during the refining process.

In a previous trial, we showed the short-term effects of feeding tilapia using CPO-based semipurified diets (Ng et al., 2001) but the long-term effects of dietary palm oil on tilapia growth and fillet quality is currently not known. In the present study, we show the response of red hybrid tilapia (*Oreochromis* sp.) fed practical diets with fish oil (FO) completely replaced by CPO, RBDPO or PFAD from stocking to marketable commercial size.

**Table 1** Ingredient and proximate composition of experimental diets (g/ 100g dry diet)

	Diet <sup>1</sup>			
	FO	CPO	PFAD	RBDPO
<i>Ingredient</i>				
Peruvian fish oil	8.0	-	-	-
CPO	-	8.0	-	-
PFAD	-	-	8.0	-
RBDPO	-	-	-	8.0
Danish fish meal	20.4	20.4	20.4	20.4
Soybean meal	30.5	30.5	30.5	30.5
Others <sup>2</sup>	41.1	41.1	41.1	41.1
<i>Proximate composition</i>				
Moisture	9.8	8.9	11.6	9.5
Crude protein	30.0	29.7	29.9	30.1
Crude lipid	11.4	11.4	11.4	11.4
Ash	6.6	6.4	6.5	6.5
Crude fiber	3.3	3.3	3.6	3.6
NFE <sup>3</sup>	48.7	49.2	48.6	48.4

<sup>1</sup>Crude palm oil (CPO), palm fatty acid distillate (PFAD) and refined, bleached, deodorized palm olein (RBDPO) were obtained from a local palm oil refinery.

<sup>2</sup>Incl. corn starch (21.0%), 3% vitamin mix and 2.0% mineral mix (Ng et al., 2003b), (, dicalcium phosphate (1.0%), carboxymethyl cellulose (1.5%), --cellulose (11.6%) and chromic oxide (1.0%).

<sup>3</sup>Nitrogen- free extract = 100 - (protein + lipid + ash + fiber).

## Feeding trials

This 20-week feeding trial was carried out to investigate the influence of three palm oil products as the principal dietary lipid source on the growth performance, proximate composition, tissue fatty acid composition and nutrient digestibility of red hybrid tilapia fed these diets from stocking to marketable size. (Also see box on experimental details).

## Growth performance

The growth performance and feed utilization efficiency of red hybrid tilapia fed the FO or the three palm oil-based diets were not significantly different ( $P>0.05$ ) (Table 2). Specific growth rate, feed conversion ratio and protein efficiency ratio did not differ statistically among dietary groups. Fish mortality was around 10% for all treatments, mainly as a result from stress during weighing, and was not diet related.

Biological indices did not show significant differences ( $P>0.05$ ) among fish fed with the various diets (Table 1). However, GSI for both male and female tilapia showed higher values in fish fed the palm oil-based diets (especially the CPO diet) compared with fish fed the FO diet. Carcass and fillet yield did not vary among dietary treatments with an average of 95% and 30% of fish body weight, respectively.

## Fillet composition

Moisture, protein and ash content of tilapia fillets were not significantly ( $P>0.05$ ) affected by dietary lipid source after 20 weeks on the diets (Table 3). Tilapia fed the PFAD diet recorded statistically lower content of fillet lipid at 1.33%, compared with 1.74, 1.71, and 1.70% in fillets of fish fed the FO, CPO or RBDPO diets, respectively.

The range (24.9–33.3%) of total saturated fatty acids content (Figure 2) determined in the fillets of red hybrid tilapia was lower compared to that found in the experimental diets (Figure 1). This ranged from 20.9 to 44.2%. Palmitic acid (16:0) concentrations were generally high in the fillet regardless of dietary treatments. It was the highest fatty acid concentration detected in fillets of fish fed the FO diet at 18.2%. However, this value was significantly lower compared with the values in fillets of fish fed the palm oil-based diets.

Total monounsaturated fatty acids in all fillets were somewhat constant at 33.0–37.5%. Oleic acid (18:1n-9) in the fillet lipids of fish fed the palm oil-based diets was significantly higher compared to a concentration of 15.7% found in fish fed the FO diet. Nevertheless, levels of the longer chain monoenes, 20:1n-9 and 22:1n-11, were markedly higher in fish fed the FO diet compared to fish fed the palm oil diets.

Significantly higher concentrations of total n-6 PUFAs were deposited in the fillet lipids of fish fed palm oil-based compared to fish fed with the diet FO. Tilapia fed palm oil-based diets had a balanced n-3/n-6 ratio of about 1.0. The fatty acid composition of the fillet lipid in fish fed the three different palm oil sources was not significantly different.

Linoleic acid (18:2n-6) was the most abundant n-6 fatty acid, amounting to 61.8–68.5% of the total n-6 PUFA detected (Figure 2). Arachidonic fatty acid (20:4n-6) was the second most abundant n-6 fatty acid in the fillets of fish fed the various diets. Fillet of fish fed the FO diet had significantly higher concentrations of eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) compared to fish fed palm oil-based diets. EPA values ranged from 0.4% for fish fed the CPO diet to 1.7% for fish fed the FO diet. However, DHA was recorded in high percentages in all fillets irrespective of dietary treatment, varying from 17.2% in fish fed the FO diet to 9.5% in fish fed the CPO diet. Fillet n-3/n-6 ratio was highest in tilapia fed the FO diet at 3.22.

## Feasibility of using palm oil

These results further confirmed the feasibility of using palm oil products in the commercial feeds of tilapia. This concurs with the results of a previous short term study (Ng et al. 2001) which showed no reduction in growth of red hybrid tilapia when dietary cod liver oil was totally replaced by CPO or crude palm kernel oil (CPKO), or 50% replaced by PFAD in semipurified diets. Up to 100% substitution of FO with PFAD was possible in African catfish fed fish meal-based diets (Ng et al. 2004b). In the present study, red hybrid tilapia fed diets containing high levels of free fatty acids (FFA >70%) found in PFAD grew as well as fish fed the other oils whose main lipid class was in the form of triacylglycerols (TAG).

Tilapia seems to have the ability to utilize lipids with high levels

**Table 2** Growth performance, feed utilization efficiency and biological indices of tilapia fed diets with various lipid

	Diet			
	FO	CPO	PFAD	RBDPO
Initial weight (g)	31.3 ± 0.1	31.3 ± 0.2	31.1 ± 0.1	31.3 ± 0.1
Final weight (g)	468.6 ± 7.74	436.6 ± 26.0	423.5 ± 17.6	414.3 ± 21.4
SGR (%/day) Specific growth rate = [(ln final mean wt - ln initial mean wt)/days x 100]	1.93 ± 0.01	1.88 ± 0.04	1.86 ± 0.03	1.84 ± 0.04
FCR Feed conversion ratio = total dry feed fed (g) / wet weight gain (g).	1.31 ± 0.03	1.45 ± 0.08	1.35 ± 0.01	1.44 ± 0.08
PER Protein efficiency ratio = wet weight gain (g)/total protein intake (g).	2.54 ± 0.06	2.33 ± 0.14	2.48 ± 0.02	2.32 ± 0.13
Survival (%)	90.0 ± 5.1	85.6 ± 8.0	91.1 ± 4.8	93.1 ± 3.3
Carcass yield (%) = [carcass weight/whole body weight] x 100.	95.1 ± 0.3	95.1 ± 0.1	95.2 ± 0.2	95.1 ± 0.2
Fillet yield (%) = [fillet weight/whole body weight] x 100.	31.0 ± 0.8	29.1 ± 1.1	30.1 ± 0.4	29.2 ± 0.8

\* Values are means ± S.E. of triplicate groups of fish. All values were not significantly different ( $P>0.05$ ).

of FFA. PFAD is a by-product of palm oil refining and is cheaper compared to CPO or RBDPO. Its use in commercial tilapia feeds will contribute to cost savings. Another benefit of using PFAD in fish feeds is the high vitamin E content which had been shown to be readily deposited in fish tissues enhancing oxidative stability (Ng et al., 2004b).

The fillet fatty acid composition of red hybrid tilapia was influenced by the fatty acid profile of the dietary lipid source; similar to studies with other fish species (Bell et al., 2002; Caballero et al., 2002; Francis et al., 2006). Feeding tilapia the FO diet rich in n-3 fatty acids, resulted in significantly higher deposition of these fatty acids in fish tissues compared to fish fed palm oil-based diets.

Nevertheless, the deposition of EPA was low as similarly reported in hybrid tilapia fed 5% dietary cod liver oil (Chou et al., 2001) and in channel catfish (Stickney and Andrews, 1972). Feeding tilapia palm oil-based diets led to increased levels of n-6 fatty acids (especially 18:2n-6) in tilapia tissues due to dietary influence. It was interesting to note that despite a wide variation in dietary levels of palmitic acid (16:0) from 14 to 39%, this saturated fatty acid was deposited in tilapia tissues at a relatively uniform concentration of 18 to 25%. The observation that fish might maintain a constant level of saturated fatty acids regardless of the amount in the diet had also been reported in other studies (Greene and Selivonchich, 1990; Ng et al., 2001; Bell et al., 2002).

Even when palm oil replaced 100% of the added fish oil in tilapia

**Table 3** Fillet proximate composition of tilapia fed diets with various lipid sources<sup>1</sup>

Diet <sup>2</sup>	Moisture	Protein	Lipid	Ash
FO	79.5 ± 0.2	17.9 ± 0.2	1.7 ± 0.1 a	1.1 ± 0.1
CPO	80.5 ± 1.0	16.9 ± 1.2	1.7 ± 0.2 a	1.1 ± 0.1
PFAD	80.0 ± 0.1	17.7 ± 0.1	1.3 ± 0.1 b	1.1 ± 0.1
RBPO	79.6 ± 0.1	17.6 ± 0.1	1.7 ± 0.1 a	1.1 ± 0.1

<sup>1</sup> Values are means ± S.E. of triplicate groups of 3 fish. Mean values in columns with different superscripts were significantly different (P<0.05). Initial fillet composition was 78.5 ± 0.1% moisture, 17.8 ± 0.2% protein, 1.6 ± 0.1% lipid and 1.2 ± 0.1% ash.

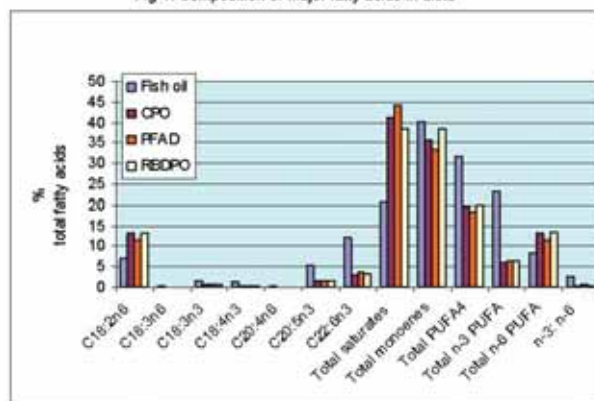
diets, significant amounts of C20 and C22 fatty acids, including DHA, were still deposited in fillets of fish fed the CPO, PFAD or RBDPO diets. This was probably due to the presence of residual fish oil from fish meal and also to the fact that tilapia has the ability to bio-convert C18 fatty acids to highly unsaturated fatty acids (Olsen et al., 1990). The present study also showed that the level of dietary FFA in palm oil did not affect the fatty acid composition of tilapia tissues.

### Bottom line

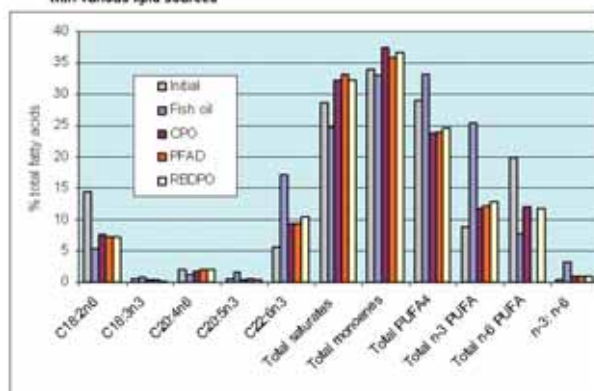
The possibility of using palm-origin oils, CPO, PFAD and RBDPO, to replace fish oil in fish meal-based diets for red hybrid tilapia without negative effects on growth performance, feed utilization efficiency or body-organ indices has been shown. Despite the high FFA content of PFAD, dietary palm oil source did not influence tissue fatty acid profile or nutrient digestibility. The cost of PFAD is about 15% and 21% cheaper compared to CPO and RBDPO, respectively.

\*Extracted from Osan Maroof Bahurmiz & Wing-Keong Ng, 2006. 'Effects of dietary palm oil source on growth, tissue fatty acid composition and nutrient digestibility of red hybrid tilapia, *Oreochromis sp.*, raised from stocking to marketable size', *Aquaculture* 262, pp 382-392. References are available on request.

**Fig 1.** Composition of major fatty acids in diets



**Fig. 2** Fillet fatty acid composition (% of total fatty acids) of tilapia fed diets with various lipid sources



### Experimental details

**Fish:** Red hybrid tilapia (*Oreochromis sp.*) fingerlings from a local fish hatchery, acclimated to laboratory conditions in two 1,000 litre fiberglass tanks, fed a commercial tilapia diet for a week.

**Treatments:** Four treatments in triplicate, each with 30 fish, mean body weight 31.24 ± 0.05g, in 12 round fiberglass tanks (1.12m<sup>3</sup>). Water parameters: Temperature-28.9°C; pH= 6.4, D<sup>02</sup>= 5.2 mg/l.

**Experimental diets:** Four isonitrogenous (30% crude protein) and isoenergetic (16.50 kJ/g) practical diets (Table 1), prepared according to Ng et al. (2000). Diets were supplemented with 8% lipid from either FO, CPO, PFAD or RBDPO, in addition to a 3.2% contribution from residual oil in fish meal (2.3%) and soybean meal (0.9%). Feeding was to apparent satiation twice a day between 0930 to 1030h and 1730 to 1830h. Feeding trial was 20 weeks.

**Sampling:** Fish were weighed every four weeks. Samples were collected for proximate composition and fatty acid analyses on fish fillets at the beginning of the trial and after 20 weeks. Liver, viscera and gonads were excised and weighed for the determination of hepatosomatic index (HSI), viscerosomatic index (VSI), and gonadosomatic index (GSI), respectively. Fish carcasses were skinned and filleted to determine the fillet yield.

**Analyses:** The free fatty acid (FFA) concentrations of lipid sources and diets were determined following Krik and Sawyer (1991) and PORIM (1995). Proximate analyses followed by AOAC (1997) methods. Lipids extraction followed Bligh and Dyer (1959) and were prepared for GC analysis according to AOAC, (1997). Fatty acid methyl esters were measured as previously described in Ng et al. (2003b)

\*Mr Osan Maroof Bahurmiz is now with the Faculty of Environmental Sciences and Marine Biology, Hadhramout University of Science and Technology, Mukalla, Yemen. Dr Wing-Keong Ng (right) is Associate Professor in Universiti Sains Malaysia and heads the Fish Nutrition Laboratory at the School of Biological Sciences. Email: wkng@usm.my



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## Asian seabass culture in India



Outdoor nursery tanks

**The Rajiv Gandhi Centre for Aquaculture (RGCA) wants to commercialise the culture of the Asian seabass *Lates calcarifer* as part of its plan to diversify aquaculture in India.**

In nearly every corner of the Asian Pacific region, one finds culture of the Asian seabass either in coastal cages, freshwater or brackishwater ponds. The exception is in India where its culture is incidental with carp in traditional ponds, even though the species is endemic in the Indian subcontinent. In India, the fish is known as bhetki in the Bengali and koduva in the Tamil languages. This is will soon change if the RGCA, part of the Marine Products Export Development Authority (MPEDA) has its way to develop seabass culture. The centre has started the hatchery production of fingerling to supply to farmers. It is also carrying out the required extension work to ensure success in its culture particularly by popularizing culture of seabass in cages in freshwater and brackishwater ponds.

### A domestic market

“One of the important roles of the RGCA based in Nagapattinam District, Tamil Nadu, India is to diversify aquaculture species and we are interested to promote aquaculture of indigenous species. Seabass is naturally available from the west to the east coast. It is a delicacy of

the coastal populations and has a domestic market. Farmers are already acquainted with the species and thus, when we propose the species, farmers are enthusiastic on its culture”, said Y.C Thampi Sam Raj, Project Director of RGCA.

At the moment, fish are usually sold fresh in retails markets. Prices are from Rs 120/kg (USD2.8) for 800g to 1 kg fish.

“According to marine fish exporters, the fish also has a good demand internationally”, said Y.C Thampi Sam Raj.

“Once the culture is well developed, we foresee that a live fish market for the fish will follow. We expect demand for live fish to increase with the tourist trade in areas such as Pondicherry, Kerala and with the developing middle class in other parts of India.”

“However, there are several problems that we need to overcome. Farmers are not interested in using trash fish to feed the fish as this is not available throughout the year, fluctuating costs and procurement is difficult. They have asked for extruded feed. We want to get companies already producing shrimp feeds to start producing extruded feeds for the seabass. They have shown interest in the proposal but want to know more on the feed demand”.



Seabass fingerlings



3 to 5 year old seabass broodstock



crab of 40 to 45 days

## Culture methodology and feeding

A two prong approach to encourage its culture has been adopted. An initial step is to develop culture methodology and feeds for the species. Thampi Sam Raj explained that in India, most ponds culturing carps are large ponds with at least two meters of water. For the culture of seabass in inland areas, they recommend the use of floating net cages in these ponds. This is preferable as they are less capital intensive than in nets cages placed in reservoirs. Other options will be brackishwater culture in net cages in lagoons and creeks or in marine waters in open seas.

In feeding the fish, the project team will soon assess the use of pelleted feeds in such cage systems. In the next few months, they will carry out demonstration trials using imported feeds. These will be those manufactured by Charoen Pokphand Foods (CPF) in Thailand and Skretting feeds in Australia. The feeds will be used for the feeding of fish kept in cages in ponds in Andhra Pradesh, Kerala and Pondicherry.

## Supply of seedstock

The initial technology for the production of seabass fry was started by the Central Institute for Brackishwater Aquaculture which managed to produce 1 million fry/year. These were sold at Rs1/fry (US 2.3 cents) to farmers. RGCA has taken this further by establishing its own hatchery in 2002. According to Project manager, Dr S. Kandan the objective was to produce sufficient seed stocks to supply to farmers to encourage them to diversify culture to this species. The production is 10 million of 1cm fry/year.

The RGCA hatchery in Thirumullaivasal village in the southern part of Tamil Nadu, occupies 13 acres. The site was chosen because it is located in a biosecure area with availability of clean sea water. The two main activities at the centre are in the hatchery production of seabass and mud crab *Scylla serrata* seeds. Work on the hatchery production of seabass began in 2002 with the collection of broodstock. Unfortunately, the hatchery was badly affected by the tsunami of 2004. It lost 69 seabass broodstock, several tonnes of live feed and few million fish larvae as well as demonstration cages located at its demonstration farm at Karaikkal, Pondicherry. However, the operations were restored in 2005.

Production of fish seed resumed in 2006 and the initial batch of 1cm fingerlings were produced in July 2006. Fingerlings of size 7 cm are distributed for culture in ponds throughout the country, according to Kandan. In many shrimp farms, the farmers are interested to stock sea bass in their reservoirs as they believe that seabass can control

populations of unwanted shrimp and crustaceans (which are carriers of virus) entering the reservoir ponds during the pumping process. Now the challenge for the team is to produce to meet the demand from farmers, said Kandan.

## R&D in larval feeding

At RGCA, a major research program is to develop feeding protocols for the various developmental stages of the seabass and mud crab. Pure cultures of *Nanochloropsis*, *Isochrysis* and *Chlorella* are maintained. These are used for the maintenance of live feed particularly SS Rotifers, *Brachionus rotundiformis* for feeding crab and fish larvae at various stages of development. Rotifers are fed to fish at day 2-11 and for the crab zoea stage 1 to 3.

Following this, smaller artemia is used for feeding fish larval on day 8 to 20 day and zoea 3 to 5 for the crab. Artemia biomass is used to feed the crab at zoea 5. At day 20, seabass are fed with microencapsulated diets, imported from the US. The crab instars (0.5 cm. CW) and crablets are fed with minced and chopped fish. The project team is also investigating the cost benefits of feeding various microencapsulated and microparticulate diets to seabass as a means of reducing feed costs.



The RGCA team around a crab larval tank. From left: Arul Raj, Dr. S. Kandan, Mr Y.C Thampi Sam Raj and Ganesh K

## Seed stock of the mud and blue crab

At RGCA, a major breakthrough was achieved in 2005 when its hatchery produced about 50,000 crablets and its ponds produced marketable crabs from hatchery-reared seedstock. In addition, crablets of blue crab *Portunus pelagicus* were also produced using the mud crab technology developed by RGCA under the guidance of Dr Emilia T Quinito, of Philippines. Today, the annual production has reached around 0.1 million crablets for distribution to farmers.

In their demonstration ponds, RGCA has recommended that crab instars from 6mm width are reared in nylon hapa nurseries for a month to produce crablets of 2cm carapace size. These are then grown out in ponds at a recommended stocking rate of 1/m<sup>2</sup> and fed with chopped fish for a period of 6-7 months to a marketable size of 500g each.

The work at the RGCA has paved the way for a development of a mud crab industry in India. Currently, the fattening of mud crabs is being carried out by shrimp farmers affected by regular occurrences of diseases in their shrimp ponds. Crabs are fattened by feeding on trash fish, dried fish and clam meat. These are conducted in Orissa, Andhra Pradesh, Kerala and Tamil Nadu usually in earthen ponds. The live crab export market totals 1,500 tonnes annually (Kathirvel, 2007).

In a presentation at Indaqua (January 11-13,2007), Emilia T Quinito reported that some issues and challenges in crab seed production still remain. She categorized these as the cost effectiveness of seed production, cannibalism at the megalopa stages, reduction in the use of fish as feed and acceptance of hatchery produced seed stock. According to Emilia, the rearing of megalopa in controlled conditions in hatchery is not cost effective. A cheaper alternative is the use of net cages with mesh sizes of 1mm and in cages of sizes larger than 20m<sup>2</sup>. Cannibalism can be reduced with the cutting of claws, size grading and providing more shelters. Biosecurity is important to prevent incidences of WSSV and bacterial diseases.

# Marketing seafood for India's tomorrow



As spending habits change, India's The Waterbase Ltd (TWL) is ready to launch its seafood retail business. In 2003, it started with the first of its proposed chain of fine dining seafood restaurants and subsequently it moved into the fast food model. At the Indaqua 2007 trade show, PK Ramachandran, President explains to AAP these moves for a diversified seafood company

*PK Ramachandran*

**AAP: In 2003, TWL went into seafood retailing for India's domestic market. Why this move?**

**PK:** The Indian market for seafood is opening up fast as spending habits are changing and we want to be there when this happens. In fact it is already happening. We started our first restaurant in Bangalore some years ago. We may have been perhaps a little early as the early years were difficult.

Unlike Chinese cuisine or traditional Indian cuisines, seafood in India is really a niche market. Except perhaps for the population in Kerala and West Bengal, most Indians are not familiar with seafood and fish. They prefer lamb, chicken and mutton. The challenge in India is that most of the population is not only unfamiliar with seafood but also the preparation of seafood.

**AAP: How is the progress and what have been the challenges in retailing seafood in India?**

It has only recently that we are seeing some progress in retailing seafood. As part of the economic boom in India, the malls and multiplexes are opening up. We decided that this was the time to expand and so we opened two fast food restaurants in the malls in Bangalore. This was a drastic change as we moved from high-end fine dining seafood restaurants to this fast food, food-court type of model.

We have also learnt a few things. The price ceiling for a typical fast food food-court customer is about Rs 100 (around USD2) and prices any higher than this is not acceptable to the Indian consumer. This is important if we want to bring seafood to the mass consumer. This is also the way to get consumers familiar with seafood. We have

found that products like fish and chips and breaded prawns are well accepted. Slowly we are introducing other breaded products as well such as squid and crabs. Price is a major element but fortunately, we are involved right from sourcing of raw material to retailing it in the finished form without any additional costs required for intermediaries. As such, we can afford to be aggressive in terms of prices.

**AAP: Will this be the business model for all regions in India?**

We have opened additional outlets in IT parks in Bangalore. Again we have had to restructure our model to suit the needs of the clients that we service in an IT Park. Our fifth outlet in Bangalore Club uses another business model. Hence there is no such thing as one fixed model to suit all market conditions or clientele. It has to be on the principle of horses for the courses.

Our aim is that the moment people think of Seafood in India they should think Waterbase.

In all, we have used our brands 'Tiger Bay' and 'Tiger Craze' as well as "Seafood Bay". These are our seafood brands which we pack for the Japanese and the US markets.

Our latest foray is into the malls in Delhi and again, we know that we have to change the model as eating habits are different. In India, each region has its own preferences.

Overall, we now know that seafood retailing is important for us and the seafood restaurant concept is one way of building a national brand. However, we needed to fine-tune this to each region. Down the line, we have also learnt that brand building will help us become a national chain.



*Tiger Bay Restaurants*

## On TWL

The Water base Ltd is part of the large India business house—the Thapar Group with interests in paper, chemicals and electronics. In the early 1990s, it entered the aquaculture business in India answering calls by the government for investments in shrimp farming. It started the first large scale private hatchery in India in 1993 and a feed mill with technology from Luxe enterprises of Taiwan was started in 1994.

The ISO 9001 certified feed mill has a capacity of 40,000 tpy of feeds for the marine shrimp and freshwater prawn. The capacity of the hatchery is 200 million post larvae of monodon shrimp and 40 million post larvae of freshwater prawn (scampi). The grow out farm covers 100 ha.

It started the Tiger Bay seafood restaurant in 2003 to offer fine dining of international quality products to India's domestic markets. This was also to leverage TWL's strengths in procurement and of production of high quality seafood products. The Handy Waterbase joint venture in Tuticorin is for the production of pasteurized crab meat for direct retails to US and other markets. The soft shell crab project is unique to India with a promise of complete traceability from 'farm to fork'. It has an exclusive marketing arrangement with M/s Handy International, USA. The seafood processing plant has a processing capacity of 20 tonnes/day and cold storage of 400 tonnes/day. It is equipped with conveyor washing and grading lines, plate and IQF freezers, liquid nitrogen freezers as well as breading, battering and forming lines. It is EU approved and FDA listed. Shrimp product ranges are head on and headless block frozen, IQF, peeled deveined tail (PDTO) and raw breaded butterfly shrimp as well as crab cakes

In 2006, the feed and seafood business provided 60% and 40% of revenues respectively for the company.

**AAP: What can you tell us about the other segments of the business?**

Waterbase is really a diversified company and the feed business is just one of them. Most of our activities are concentrated within our complex of 500 acres (300ha) in Nellore. Here we have the 200 million PL capacity hatchery, feed mill, a 100 ha grow out farm and a state-of-the-art processing unit. We have been working on shrimp and crab nutrition with our consultant Dr Joachim Hertrampf and with INVE at the R&D facilities. Our hatchery produces post larvae of marine shrimp and scampi. Recently, we stopped the production of scampi seeds as the demand is price rather than quality driven. We will resume this when farmers are willing to pay for quality seed as we do not wish to compete in the low price/low quality segment.

In India, we are the only producer of soft shell crabs. We do this in Nellore, Andhra Pradesh where we fatten them up in 1.5 months and package them for markets in the US. Our next step is to complete the life cycle. We are ready with all aspects in the grow out of the mud crab and are in discussions with the Rajiv Gandhi Centre for Aquaculture (RGCA-MPEDA) to commercialise their breeding of mud crab. At RGCA, they have successfully bred mud crab.

If you look at it, our aim is to be a complete seafood company. We have been in the processing business for a long time and have been marketing our products to companies like Darden, SYSCO in the US.

We also have a JV unit in Tuticorin, Tamil Nadu in collaboration with M/s Handy International Inc, US a 100 year old crab company in US to produce pasteurized crab meat from wild caught marine crabs.

On the processing side, we have always focused on value addition. As early as 1993-94 we were processing and exporting to US cooked shrimps. We are also looking at the European market for head on products with shrimp produced in our 100 ha shrimp farm. We presently produce crab cakes for the US retail market.

**AAP: Many in the industry have said that the last few years have been turbulent for the shrimp farming and seafood industry in India. Do you see better years ahead?**

From 2004 to mid 2006, we suffered with the US antidumping action which was followed by the tsunami which created huge problems on seed quality. Added to this, Japan which used to be large market for Indian shrimp did not show the kind of recovery that we had expected. Shrimp prices declined by almost 40% to Rs 230 per kg from Rs 300 per kg for 30 counts. The low shrimp prices for farmers, the various problems being faced by Indian exporters to US and other markets, the Bond issue for exports to US compounded by poor post larvae quality and diseases have had a major impact on shrimp farming in India. The trickle down effect of this was reduced culture areas.

However since mid 2006, shrimp prices have remained stable at Rs 300/kg for 30 counts giving a lot of confidence to the farmers. Considering this, I am confident that 2007 will be a much better year but I have cautionary note here.

***"The positive aspects are increased awareness on post larvae quality and testing with PCR for diseases but at the same time the rush to stock early to take advantage of better prices while being not careful in choosing proper seed can pull down the industry".***

In the feed segment, it will continue to be tough. This is especially because of the steep increase in raw material prices especially fish meal besides the increases of wheat and soybean meal prices. As all these commodities are in short supply and have increasing demands, we cannot expect any price correction in the near future. Our ability to pass these costs to the farmer was limited and in 2006 we managed an intermediate increase in prices which hardly covered 25-30% of our cost increases. The balance had to be absorbed by the feed company. Further with demand being highly seasonal and disease problem continuing, the industry is indeed passing through tough times.

**Shanghai International Fisheries & Seafood Expo (SIFSE) 2007**  
**2007 上海国际渔业博览会**

**Jun 22-24, 2007** **Shanghai Mart**  
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## Asian Pacific Aquaculture 2007

# Prospering from dynamic growth

As this biennial meeting and conference for the Asian Pacific Chapter of the World Aquaculture Society (APC-WAS) moves to Hanoi, Vietnam, it will also be the first major international aquaculture conference for the country. The event is co-hosted by the Vietnamese Ministry of Fisheries.



Asian Pacific Aquaculture 2007 will also be the venue for industry to find out more on developments in aquaculture not only in Vietnam but also of the region. Participants will see firsthand the rapidly expanding aquaculture industry in Vietnam, which within a few years developed to a major player.

### Special Producer Program

This will be on Tuesday, August 7. The main aim is to convey the latest in practical knowledge for Vietnam's aquaculture producers. Topics will cover various aspects of interest for local and regional producers which the organizer, Uni-President Vietnam has identified as nutrition, culture technologies, shrimp health management and shrimp diseases. Vietnamese producers can attend at a special rate USD 40. Simultaneous translation into Vietnamese will be available.

The morning session will be dedicated to the production of vannamei shrimp. Presentations will be by regional and international experts. The sessions will be chaired by Dr Shi-Yen Shiau, Taiwan's Ocean University and Dr Le Thanh Hung from the University of Fisheries and Forestry, Vietnam.

At print time, the tentative program for the producer session is as below.

- Dr Sergio Nantes, Fats and Proteins Research Foundation, Inc, USA on *Penaeus vannamei* nutrition & their impact under different culture conditions
- Oscar Hennig, Kona Bay Marine Resources, Hawaii, USA
- Prof Donald Lightner, University of Arizona, USA with a review of the diseases of *P. vannamei* in the Americas
- Prof Chalor Limsuwan, Kasetsart University, Thailand on farm management of vannamei culture in Southeast Asia
- Dr Jacques Gabaudan, DSM Nutrition Products, Bangkok, Thailand on the global shrimp trade and marketing status and prospects of *P. vannamei* culture in Vietnam

### The trade show

A broad section of industry from Asia and elsewhere are expected at the trade show. These will feature products and services such as complete feeds, feed ingredients, micro nutrients to pond equipment and health management. At press time, organizer have indicated that 50% of the 120 booths available have been taken up. New developments in the industry will be the focus of some exhibitors. Below we feature information from some early bird exhibitors.

### Technical Program

The sessions and workshops at Asian-Pacific Aquaculture 2007 will cover

#### Marine Shrimp

- Production
- Nutrition
- Breeding and Genetics
- Health

#### Freshwater Fish Culture

- Tilapia
- Integrated Culture Systems
- Cyprinids
- Reservoir-based Aquaculture

#### Catfish

- Production
- Health
- Nutrition

#### Marine Finfish

- Culture Systems
- Seed Supply
- Nutrition

#### Others

- Freshwater Prawn
- General Aquaculture
- Ornamentals
- Aquatic Animal Health
- Genetics in Aquaculture
- Aquaponics
- Crabs and Lobsters
- Seaweeds and Algae
- Mollusc Culture
- Education and Training
- Post-tsunami Recovery

#### Special sessions

- VIFINET session (including EU programmes)
- Proteins in aquafeeds: meeting the need of markets and trade (incl. food safety, traceability, etc.)
- Aquaculture and integrated coastal zone
- Management (AICZM)
- Managing dynamic growth in aquaculture:
- Market vs policy

For updates, go to [www.was.org](http://www.was.org)

For more information on how to participate in this show, contact Conference Manager PO Box 2302, Valley Center CA 92082 USA

Tel: +1 760 751 5005 Fax: +1 760 751 5003, Email: [worldaqua@aol.com](mailto:worldaqua@aol.com), Web: [www.was.org](http://www.was.org)

TRADE SHOW SCHEDULE			
SUNDAY, 5 August 2007	MONDAY, 6 August 2007	TUESDAY, 7 August 2007	WEDNESDAY, 8 August 2007
Move-in Noon-18:00	Move-in 8:00-10:00 Exhibits Open 10:00-18:30	Exhibits Open 10:00-17:30	Exhibits Open 10:00-16:00
Welcome Reception 18:00-20:00	Happy Hour 17:20-18:30	Reception 18:30-20:30	Move-out 16:00-20:00

## Breeding of black tiger shrimp

**MOANA** will have a large presence the event, according to Yuan Wang, CEO. It will introduce its "New Generation of Black Tiger" and its services to the aquaculture community. At the conference, they will present three research papers in the area of genetics, disease and farm biosecurity.

The Group is active in the development and supply of genetically improved seed of black tiger shrimp through pedigree-based selective breeding technologies (non-GMO). The nucleus breeding center, located in Kona, Hawaii, started operations in 2000. Through its breeding program, the group will bring sustainability and full traceability in the supply chain of black tiger shrimp. The traits that will characterize and differentiate the MOANA breeds include absence of specific diseases, hardness to aquaculture conditions, improved growth rate and FCR, disease resistance. Other traits will be considered at later stages.

The company has now started with the operation of Multiplication Centers in selected markets in Asia through which first high quality SPF and later genetically improved seed will be made available to shrimp farmers. Experts will provide information on the values and black tiger shrimp, with solid data on health status, performance and profitability.

It will also kick-start the activities of the Multiplication Center in Vietnam (a JV with the Government of Vietnam). The MOANA certificate will be launched as the highest standard in quality and reliability in shrimp breeding.

### **MOANA Asia Ltd (Regional Office in Asia)**

218/47-48, 4th Floor Geneva Building, Bond Street, Muang Thong Thani, Bangpoo, Pakkred, Nonthaburi 11120, Thailand  
Tel: +66 (0)2 961 0207, Fax: + 66 (0)2 961 0208, Email: aor@moanathai.co.th  
**Booth No: 28-29-30-31-32-33**

### **MOANA Mekong Ltd**

3 HQ Ton Duc Thang St., Ben Nghe Ward, District 1, Ho Chi Minh City, Vietnam  
Tel: +84 917 56 57 50, Fax: +84 8 829 32 53, Email: linh@moanatech.com

## Health Management

At the show, Aries Madethen said that **Schering Plough Aquaculture**, a prominent company engaged in aquaculture health management will show the latest technology approach i.e.: vaccines and Immunomodulator for finfish and shrimp. These are Aquafen, an antibacteria against all finfish, Garvetil, a vaccine against Streptococcus in Tilapia, Ergosan an immunomodulator for fish and shrimp, and Vibromax, a feed additive to boost immune system for shrimp. These have the result of technology approach in research by the company.

### **Schering Plough Aquaculture**

Web: [www.spaaquaculture.com](http://www.spaaquaculture.com)  
**Booth No. : 115 - 117**

## Health and Nutrition

**DSM Nutritional Products** is the world's leading supplier of vitamins, carotenoids, enzymes and other fine chemicals to the feed industry. These products are highly developed feed additives allowing the aquaculture industry to optimize feed production through the guaranteed content of active substance and product formulation.

### **DSM Nutritional Products**

17/1 Maleenont Tower, 3199 Rama IV Road, Klongton, Klongtoey, Bangkok 10110, Thailand  
Web: [www.dsmnutritionalproducts.com](http://www.dsmnutritionalproducts.com)  
Contact :Dr. Jacques Gabaudan  
Email: [jacques.gabaudan@dsm.com](mailto:jacques.gabaudan@dsm.com)  
**Booth No: 19**

According to Anawat Sangkhasap, **Alltech Aquaculture** sees this Asian Pacific Aquaculture 2007 as the first major international aquaculture show to be held in Vietnam, one of the fastest growing aquaculture producers in the world. The rapid development of shrimp and fish production in Vietnam over the past few years has made this an important market for Alltech's range of products.

"In addition, Alltech's commitment to product quality, safety and traceability, our understanding of the needs of the global industry and our strong partnership with our customers in the Asian region, makes this an important opportunity to demonstrate our support of aquaculture in the region"

Alltech® is one of the world leaders in providing natural solutions for today's animal feed and animal health industries. Over the past 27 years, the company has focused its research efforts on developing innovative products to improve animal production, performance and profitability. These innovative solutions have been equally successful for a wide range of fish and shrimp species. Bio-Mos® and Aqua-Mos® support animal health without antibiotics by helping to maintain intestinal condition. NuPro™ provides "functional nutrition" in a protein-rich additive designed to improve feed conversion and save on feed costs. De-Odorase® supports shrimp and fish production by decreasing ammonia and nitrite levels, whether used in feed or as a pond additive. The Alltech® range of Bioplex® organic minerals redefine mineral nutrition by increasing mineral uptake and function while Sel-Plex®, selenium yeast, ensures optimum selenium levels in tissues without harmful toxicity issues. Alltech customers are also assured of top class professional technical and marketing support from our team of aquaculture and product specialists.

### **Alltech Biotechnology Corp., Ltd.**

Contact: Anawat Sangkhasap  
Tel: +66 2 260 0888 Fax: +66 2260 0866  
Email: [asangkhasap@alltech.com](mailto:asangkhasap@alltech.com)  
**Booth No: 10 & 21**

**INVE** is a family holding active in agri-and aquaculture. The business unit INVE Aquaculture provides nutritional and health products in marine/freshwater fish and shrimp rearing. A leader in the development, production and commercialisation of a.o. artemia cysts, the company has the Selco range of enrichment products, Frippak and Lansy range of dry diets, standard and specialty premixes & concentrates and a health line.

During this show in Hanoi, INVE Aquaculture will display its complete product portfolio both in nutrition and health for shrimp and fish. Experts will be available during the course of the show to answer all technical questions, give support and introduce the new innovative solutions proposed by the company. The focus of our booth will be on the health concept for shrimp and fish production.

It will also take the opportunity to launch its newly developed INVE specialty premix portfolio for aquaculture feed mills and farmers. A workshop will be held during the course of the show to discuss the current constraints of the aqua feed mill and highlight the launch of the services in Asia.

### **INVE Asia Service Ltd. (Regional Office in Asia)**

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Email: [iass@inveasia.co.th](mailto:iass@inveasia.co.th), Web: [www.inve.com](http://www.inve.com)  
**Booth No: 35-36-37-38-39**

### **INVE (Thailand) Ltd**

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## Industry supplies

**CATVIS B.V.**, Netherlands supplies a wide range of products to the aquaculture industry. At the show, they will feature products in three areas. In larval feeds, there will be high HUFA and premium artemia cysts, rich enrichment diets, algae concentrates, Lucky Star larval feeds, Lucky Star broodstock diets. The products in the land based equipment category include Hydrotech drumfilters, Berson UV systems, OxyGuard and YSI oxygen measurement and control systems, oxygenation and aeration equipment, Arvotec automatic feeders and feeding robots, CJ-feeders, Arena centralised feeders, Matsusaka and Aqua-Life fry pumps, graders and fry counters (Vak, Impex and others), recirculation equipment and various other products. Offshore equipment include Aqualine cages and mooring systems, Mø'bfrenot nets, Netwax anti fouling, Scanbio cannon feeders, Arena compact feeders and feeding barges, Aqua-Life fishpumps and shrimp harvesters, Idema netcleaners and underwater cameras.

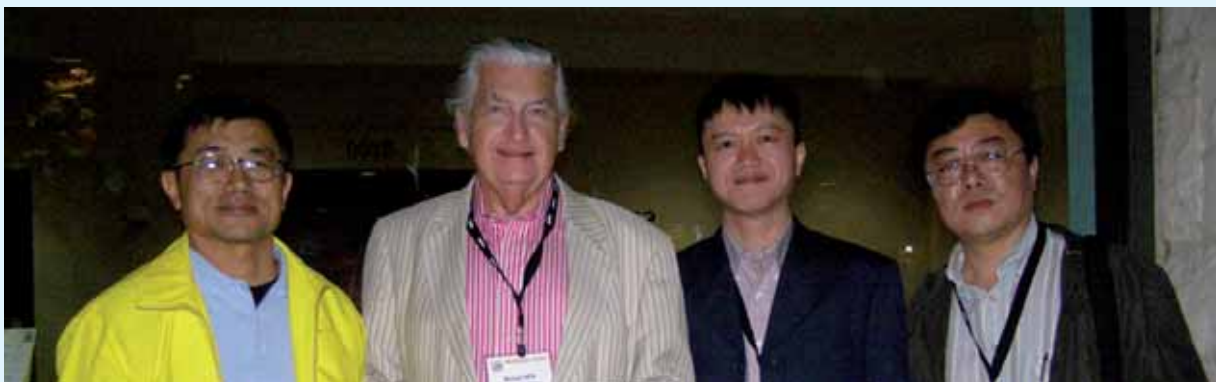
### **CATVIS B.V.**

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Mr. Gerry McGuire: [gerry.catvis@yahoo.com](mailto:gerry.catvis@yahoo.com)

World Aquaculture 2007, San Antonio, Texas, USA

## Research supporting 'science for sustainable aquaculture'

The theme of the meeting 'science for sustainable aquaculture' followed that of an earlier meeting in Hawaii which focused on aquaculture as an ecological and profitable venture. The rise in aquaculture will generate about 600 million to one billion pounds just for the US markets. With this comes the responsibility to ensure that all is done in an environmentally and socio economically sustainable way. The message at the meeting and trade show is that aquaculturists should be good environmental stewards.



At the welcome reception, Michael New, OBE, Chairman, AwF (second from left) with Dr Chen Ming Dang, CPF, Bangkok (left), Dr Fuci Guo, Novartis, Canada and Dr Yang Yi, AIT, Thailand

The figures at this show were impressive. There were 1,000 abstracts presented by participant from 60 countries with 16 concurrent sessions over 4 days. The poster session featured 250 posters and the trade show attracted 250 exhibitors.

At this **shrimp** session, the emphasis was on the evolution of R&D in shrimp breeding and the follow up work on super intensive production systems. Scientists in various US institutions made several presentations in this area. Anthony C Ostrowski, Oceanic Institute, Hawaii said that the industry in the US cannot compete with low prices from producers in other countries. Thus in the US, producers are investing into niche markets for fresh, 'eco best' and organic as alternative to imports. The future is also in environmental control.

Industry is also looking at the culture of other species such as *Penaeus setiferus* where there is an ongoing breeding program. The strategy is broodstock development as a competitive advantage. The US has a 20 year investment in the best marine shrimp breeding program. Some of the progress are with super intensive recirculation raceways systems with 400 PL/m<sup>2</sup> stocking density which can produce 7-9kg/m<sup>2</sup>. Costs of production have improved from 5.92 /lb in 1999 to 1.06/lb in 2006. With partial harvest, sizes of 30g are achievable.

Dr Shaun Moss said that the global industry has benefited from the research on **selective breeding** at Oceanic Institute (OI). Further to this OI researchers have developed super intensive culture systems to evaluate the performance of selective bred shrimp. The OI growth line was evaluated in indoor raceways systems of 75m<sup>2</sup> with complete bio-security. The stocking density tested was 401 PL/m<sup>3</sup> using 0.8g shrimp. In 14 weeks, results were 20 tonnes of shrimp (7.5kg/m<sup>3</sup>) with an FCR of 1.5. The system used 160 litres of water to produce 1 kg of shrimp in comparison with 186,000 litres in traditional pond systems in Latin America. The final weight of shrimp was 21g

with 89% survival. Growth rate was 1.4g/week.

Recent data also showed that TSV-R (Taura syndrome resistance) do not have a reverse relationship with growth and performed as well as shrimp from the growth line in terms of growth rate (1.5g/week), raceway survival (80%) and harvest weight (6.4 kg/m<sup>3</sup> at a stocking density of SD of 400PL/m<sup>3</sup>). Shaun said that more importantly the focus is on bio-secure systems as selective breeding is not the panacea for all. In bio-secure systems, it is also to reduce cost of production.

In **shrimp diseases**, Dr Donald Lightner, University of Arizona, said that IMN-Infectious myonecrosis disease is a global problem although currently the impact is on industry in Indonesia. In 2003, the farmed shrimp industry in Brazil suffered with declines of production to 65,000 from 90,190 tonnes and losses reached USD 20 million by 2004. The possible consequences of IMN to the industry in Indonesia are 30-40% and a possible spread to other countries. The disease is listed with OIE. However, the impact of adding this disease to the many already present in farms in South East Asia may have negative consequence such as trade restrictions. The worst impacts on the local industry are social and political ramifications for the industry in S E Asia.

He added that the spread outlines the importance of following OIE rules on regional movement of live. However, while the occurrence of IMN in SE Asia may be a catastrophe for some shrimp farming regions in SE Asia, it nonetheless also presents an opportunity for US breeders

of SPF broodstock to further demonstrate the inherent value of farming domesticated SPF shrimp, and thereby assist in the recovery of the industry in the affected regions.

Interest was in **bio flocs** which have beneficial effects on shrimp growth in intensive recirculation systems. David Kuhn, Virginia Tech, USA showed the use of tilapia effluents to generate beneficial microbial flocs for shrimp culture. In a 40 day feeding trial in the laboratory, the nutrients in



At the Cargill reception with the Alamo in the background, from left Nattaporn Wongweerachotkit, Mani Farm, Thailand; Clemens Tan, Cargill Indonesia; Ng Siow Leng, Cargill Malaysia; and Zuridah Merican.

wastewater effluents were offered as supplementary feed to white shrimp. The results showed improved shrimp growth. He obtained best results by using microbial flocs with nutrient composition similar to that of 100% shrimp feed. There were no significant differences when combination of 50% feed & 50% biomass and 50% feed & 50% untreated solids. It was concluded that bio flocs, high in crude protein, are viable as feed source and is a sustainable method for shrimp culture. He added that this is a feasible method for fish producers to mitigate the environmental impacts of their effluents.

Eric Muylder, Crevetec suggested that bacterial floc single cell protein (BSCP) can be used as raw material as there are nutritional and probiotics advantages. In trials with *Clarias gariepinus*, he said that 14% of BSCP containing 30% CP is optimal. In the case of tilapia, he suggested an optimal 20% inclusion rate. The low pH in the stomach of tilapia was possibly the reason for better digestibility. However, as BSCP is deficient in methionine, supplementation will be required. An adequate processing method is required to make the material more digestible. This can be a good source of protein depending on the species.

According to John Hargreaves from Louisiana State University, the main disadvantages of a biofloc system for tilapia are the loading limits and its effects on water quality. This is because the concentration of solid fluctuates and its retention increases with time. In their trial, fish stopped feeding after 11 weeks. The hypotheses included combined metal toxicity related to low water hardness, nitrate toxicity and a factor associate with accumulation of dissolve organic matter. He concluded that 200 g/m<sup>2</sup> is the maximum feeding rate. Beyond this, the control of solids becomes difficult and water quality variable.

In indoors tanks for tilapia, Ekram Azim from Stirling University, Scotland showed the activated suspension technique (AST). Aeration agitated the water column and allows for the aerobic decomposition of bacteria and maintain high levels of microbial protein in suspension. The dense microorganism becomes a protein food source for fish. In three treatments; AST with 35% CP, AST with 24% CP and clean water recirculation system with 35% CP feed. He concluded that tilapia fish used biofloc as food, contributing 43% to the production. Survival was 100% but fish growth was poor. He also compared welfare indicators such as fin condition.

In South Carolina, Wilson Wasielesky, Waddell Mariculture showed how shrimp can be cultured indoors at high densities in enclosed raceways. Populations have reached 6.8kg/m<sup>2</sup> with no water exchange. Results suggested that pH reductions associated with build up of CO<sub>2</sub> in intensive systems reduce growth and production but with proper husbandry, survival may not be effected. He added pH of 5.1 affected FCR.

## Trade show

Some products launches at the show followed the theme of sustainable aquaculture. Diamond V launched DV Aqua at the show. This is an all natural ingredient for shrimp feeds. (More details in Aqua Culture Asia Pacific, Vol 3 (2)).

Advanced BioNutrition Corp. (ABN) launched a sustainable solution



Ben Williams (left) and Henry Clifford, Aqua Bounty Technologies, USA



At USSEC, Booth, from right, Dr Farshad Shishehchian, Novus Aqua, Singapore and Jim Zhang, ASA International Marketing, Shanghai, China and Andy Pei, Purdue, University

for shrimp production (see page 42).

Wales based Dragon Feeds has now developed complete maturation dry feeds for shrimp (Dragon Feeds Supreme) based on farmed polychaetes. In fields trials these replaced 100% of the traditional use of fresh/frozen foods to ensure successful maturation, spawning and offspring quality under commercial operating conditions. This is result of an exhaustive evaluation of different ingredient types that includes farmed polychaetes and special processing methods. The research was also focused on requirements and evaluating ideal balance nutrients in diets to achieve maturation, spawning and a high nauplii production.

Keeping to the environment issues are products from Mcopa, Brazil. The soy processing company runs a non GMO production program. In addition, it said that it uses natural gas as energy and has an effective recycling of solid waste. It also controls water usage through system that treats water and recycles the most of the volume collected.

USSEC, the Soybean Export Council is currently working on ecological challenges in aquaculture. These include the replacement of direct feeding of trash fish to marine fish in China and other parts of Asia with more sustainable feed ingredients with renewable resources such as soybean meals. Although soybeans are nutritional sources, application of new soy based feed technologies is still an emerging science. Nevertheless, they have achieved success. In India, the rohu *Labeo rohita* can be fed with up to 52% soybean meal in the diets. The production was three times the yield compared to that with traditional farm made feeds. In Vietnam soy fed red drum had 85% better growth as compared to fish fed trash fish.

## Next meeting

The next meeting- World Aquaculture 2008 will be held in Busan, South Korea from May 19-23, 2008. The venue will be Busan Exhibition and Convention Centre. It will be hosted by the Korean Aquaculture Society. More information: [www.was.org](http://www.was.org).



Participants from Brunei Department of Fisheries, Hj Rajid Hj Metali (right) and Sabri Md Taha

VIV Asia 07

# First with a focus on Aquaculture in Asia



The three day show for the livestock and aquaculture industry in Asia was a change from previous meetings where the concentration was only on feeds and additives for the poultry and swine industry.

Overall, the show was a success with 518 exhibitors from 37 countries. It registered 21,726 visitors from 92 countries with 53% from Thailand itself. According to a survey carried out during the show, 70% of the visitors had investment plans.

The special focus on aquaculture in this year's edition led to an increase in visitors from this sector, from 16% to 26%. VIV Asia was further internationalised with visitors from 92 countries compared to 87 in 2005. The most remarkable growth in visitor numbers came from The Philippines, Malaysia, Indonesia, Korea, Taiwan, Sri Lanka and Pakistan.

## Aquaculture Forum

What drew the interest of professionals in the aquaculture industry was the introduction of an aquaculture forum. The organisers dedicated a partially enclosed space in the middle of the main hall. Over three days, representatives of some ten companies, selected to participate in the Aquaculture Forum, continuously gave presentations covering the various fields in aquaculture. In contrast, the Aqua Walk, where 196 companies with products for the aquaculture industry were given symbols to identify them, was less effective as a marketing tool, according to an exhibitor.

## Presentations at the Aqua Forum

It was a who's who from regional companies presenting technical information within a back drop of product information at this forum. According to Farshad Shishenchian, Novus Aqua, the industry continues to find ways to replace fish meal with plant meals and obtain the same performance in growth. However, as meals such as soybean has levels of methionine below that required by most fish and shrimp, the addition of a source of methionine such as the Mera-Met, the calcium salt of the hydroxyl analogue of methionine is a solution. Addition of Met to 25% soybean meal can reduce fishmeal to 20% in marine shrimp diets, without affecting survival and growth.

The team from Alltech covered several areas in fish and shrimp culture. Dan Fegan talked on the efficacy of using yeast based products to improve health of aquatic species. The application of NuPro containing nucleotides showed improvements in shrimp survival of 93% as compared to 86% in the control group in shrimp stocked at 90pl/m<sup>2</sup>. Porpun Yutharasanukul, Business Development Manager discussed the benefits of adding Bio-Mos in the culture of tilapia and shrimp in lieu of antibiotics in a shrimp and tilapia farm in Thailand. He said that with tilapia, Bio-



from left, Meinrad Schmid, Tan Meng Kiang and Dr Thanit Yoonasil, Thailand (right) at the Chemoforma booth.

Moss improved growth and survival leading to better yields and returns. In the case of shrimp, survival was better but growth was not higher. Nevertheless, yields were higher. In another presentation, John Sweetman looked at the markets for aquaculture products and the opportunities and threats for the Asian producer.

Jacques Gabaudan, DSM discussed the use of phytase to increase phosphorus (P) availability from diets with soybean meal as well as its role in reducing the loading of P into the environment. The effects of Ronozyme have been tested in channel, pangasiid and African catfish, carp, tilapia and white shrimp. It has a role in protein digestibility, cation availability and water quality. In addition, they are looking at the health benefits of phytase based on the hypothesis that phytase improves the absorption of iron, important in the synthesis of haemoglobin. Jacques also presented results of a survey on the preferences of Japanese consumers for shrimp.

In tilapia culture, Neil Wendover, Aquatic Animal Health, Intervet Norbio Singapore gave an overview of the challenges faced by the rapidly developing industry and the future requirements for a sustainable health management program (See page 22). The development of vaccines is important for this rapidly developing segment, especially as culture is being intensified. Also from Intervet, Cedric Komar explained the development and health management program for Norvax Strep, the vaccine for the marine fish. Pedro Encarnacao, Biomin, Singapore discussed the role of natural growth promoters in ensuring gut health



Supornchai Sri Nhonghang



Dan Fegan



Jacques Gabaudan



At the Aqua forum - Anawat Sangkhasap, Alltech and Jacques Gabaudan, DSM

for the shrimp and fish (see page 20).

Supornchai Sri Nhonghang, Dupont presented the web of WSSV causative agents in the pond environment. Crab and other crustaceans are carriers. To allay concerns on the use of chemicals, he said that the product Virkon has been tested and does not leave any residues of concern. It has been endorsed for organic farming in the UK.

At the forum, Bayer Vietnam presented information on in-feed treatment for parasites of tra catfish. These work against tapeworms, flukes and skin flukes. Bayer is also cooperating with Pharmaq, a leader in fish vaccine development in Europe, for the distribution of products. In Asia, it will have products for the treatment for fish parasites in marine and freshwater. Other products such as Aquaguard offer solutions for the eradication of virus in shrimp and ectoparasites in fish. At the forum, Kjersti Gravingen, Pharmaq AS showed the impact of fish vaccination on fish production. She also covered the challenges in the development of vaccines based on experiences in the salmonid industry in Norway.

### Highlights from aquaculture conference

Novus Aqua organized a one day aquaculture conference with the theme "Aquaculture Today and Tomorrow". Dr Yont Musig, Dean of the Faculty of Fisheries at Kasetsart University outlined the opportunities and challenges of aquaculture in Thailand. In the shrimp industry, he said that 50% of ponds are not utilised because viral diseases are still a major problem for the industry. However, as aquaculture is a substantial part of the economy, efforts must continue to develop solutions to cope with the ongoing problems. In mariculture, the coastal areas are not fully utilised either. Several potential species can be promoted for freshwater and coastal aquaculture. The continued growth of the industry in Thailand will depend on how threats such as trade barriers can be overcome.

As shrimp culture is one of the fastest growing sectors in agriculture, it has been associated with the destruction of habitats. In her presentation on shrimp farming for sustainable production, Dr Fatimah Md Yusoff, University Putra Malaysia said that the sector must find solutions that are environmentally friendly and health promoting but



From left M A Nazeer, Aqua International, Herbert Altherr, Thailand, John Lee, Kemine, Singapore.

at the same time economically viable. She discussed several approaches which the industry can use to improve its image and increase yields yet continue to be sustainable.

Dr Jiaxin Chen, Yellow Sea Fisheries Research Institute, Qingdao, China presented information of the industry in China which produced 51.01 million tonnes in 2005 and increasing to 52.60 million tonnes in 2006. It is the force behind the rapid increase of seafood exports from China. However, the rapid expansion has led to problems with pollution, disease outbreaks, genetic deterioration of species and seasonal oversupply. On the other hand it also faces threats such as effluents from industries and agriculture. To cope with these threats, authorities in China have issued rules and regulations to guide aquaculture to be a more sustainable and responsible production of seafood.



From left; Dr Claire Yew, Dr Maximillian Sim, Helen Walker and Dr Justin Tan at VIV Asia

## Meriden Animal Health Limited launches phytobiotic feed additive for aquaculture

UK based Meriden Animal Health Limited launched their product Orego-Stim® Aqua at this VIV Asia 2007 in Bangkok, Thailand. Orego-Stim®, the bench mark product for phytobiotics developed after 20 years of research, was initially launched in 2000 for use in livestock animals such as pigs and poultry. Since then it has achieved global success and is now used for other species such as cows, pigeons and caged birds.

The product has now been developed for aquatic animals. It is 100% natural and is derived from a plantation-grown hybrid oregano plant and acts as a feed enhancer with a number of unique properties including antibacterial properties. In commercial trials in shrimps, Orego-Stim® Aqua has been proven to improve feed conversion, survival and harvest weight, all of which will mean additional profits to the shrimp producer. Trials conducted in hybrid catfish showed that Orego-Stim® Aqua not only improves feed conversion ratio, but also maintained a healthy lactic bacteria count, beneficial for gut health.

The product is available in three forms: Orego-Stim® Aqua liquid and powder, both designed for coating the fish food after the pelleting procedure and as topical dressing applied with fish oil. Orego-Stim® Aqua powder can also be mixed with other micro ingredients in the feed mill prior to pelleting.

(More information, [www.meriden-ah.com](http://www.meriden-ah.com))

## Advanced BioNutrition

# Launches sustainable solution for shrimp culture

Aiming for the USD 4 billion shrimp industry, US based Advanced BioNutrition Corp. (ABN) has launched a sustainable solution for shrimp production. The product called AquaGrow® allows feed manufacturers to produce feeds for the first time that comprise of ingredients that are 100 percent sustainable in origin. This premix for shrimp grow out feeds has a balance of key omega-3 fatty acids from natural sources, including microalgae.

According to Robert A. Bullis, Director of Animal Health and Regulatory Affairs, "AquaGrow® for shrimp has been developed and field-tested over several years under a number of different conditions in tanks and ponds, both in the United States and Thailand. We have now developed the correct blend of natural components that, in combination with lower cost vegetable proteins, enables the total replacement of fishmeal and fish oil in shrimp feeds, while providing equivalent growth and health in the farm-raised shrimp."

Dr. David Kyle, President, said, "Because the micro algae are grown in a clean, traceable, and sustainable fashion using conventional fermentation, AquaGrow® for shrimp can be produced at a scale that meets the needs of the entire world's shrimp farming industry and farmers and manufacturers who are focusing on the sustainable seafood market now have a tool that enables them to meet market demands".

The products and its benefits were highlighted at the recent World Aquaculture 2007 in San Antonio, Texas. Advanced BioNutrition is a leader in developing technology to improve animal health and functional nutrition. (More information: [www.abn-corp.com](http://www.abn-corp.com))



ABN's Larry Giessinger (right) with guest at World Aquaculture 2007, Texas, USA

## Dragon Feeds Ltd

# Deal to expand polychaete production

**At the World Aquaculture 2007 in Texas, USA, sustainable fish feed producer Dragon Feeds Ltd signed an international distribution deal with Peruvian firm Alicorp S.A.A. This will see the two companies working together to significantly expand polychaete farming in Peru and accelerate the availability of polychaete-enhanced feed products. At the show, Dragon Feeds showcased its unique worm-based (polychaete) products with support from International Business Wales, the overseas trade and investment arm of the Welsh Assembly Government.**

Tony Smith, founder and managing director of Dragon Feeds, said: "The deal with Alicorp is a very important step forward for us and reflects the worldwide reputation which Welsh companies have developed within the sustainable aquaculture industry. As natural fish stocks deplete, sustainable feed is seen as essential to ensure future growth in the industry. This deal enables us to reach a much wider customer base."



From left; Tony Smith, managing director of Dragon Feeds and Leslie Pierce, managing director at Alicorp

"Polychaete feed offers a 100 per cent alternative to fishmeal and addresses the increasing cost and limited availability of conventional food sources. We are able to produce polychaetes in large volumes and, as they are near the

bottom of the marine food pyramid and can be fed on land-based protein and oil sources, they can be converted into forms that are readily accepted to cultured species in aquaculture."

Dragon Feeds, which is supported by the Welsh Assembly Government's Knowledge Bank for Business Initiative, developed its polychaete products through an intensive R&D programme and the company opened a £3 million test facility towards the end of last year. In response to its success it is also scheduled to open

a new mill at the end of 2008, which will be able to produce 500,000 tpy of polychaete-based feed. (More information: Email: [samantha.morgan@trimediahc.com](mailto:samantha.morgan@trimediahc.com) / [abi.dare@trimediahc.com](mailto:abi.dare@trimediahc.com))

MLH

## Full mortality insurance in aquaculture

The rapidly changing aquaculture production processes in aquaculture in Asia and worldwide such as offshore cage culture, intensification of culture systems, aquaponics and recirculation systems have generally increased demand for insurance to share and cover the risks involved. Risk management is gaining attention within the aquaculture sector, which is reflected in the development and increasing implementation of Better Management Practices (BMPs), Codes of Conduct and Codes of Good Practice, Standard Operational Procedures, certification and traceability. (FAO, 2006).

For aquaculture, MLH has access to full mortality insurance cover from any cause or for specified perils. It sees aquaculture as an exciting area for its insurance business. The company is privately owned and specialises in providing insurance solutions in aquaculture to medium to large commercial/corporate entities. Based in Adelaide, South Australia, MLH was founded in 2000 and is led by its two Directors, Graham Gulliford and Grant Goldner. Graham who started his career as a Lloyds of London insurance broker over 20 years ago specializes in the provision of risk managed insurance solutions for specialist areas of risk including marine, aquaculture, property and liability.

"We have been building insurance solutions for aquaculture association members and individuals alike for many years now. We understand that the aquaculture Industry needs value for money, comprehensive insurance protections. The industry is unique in that it needs the very best insurance professionals to understand and empathise with the unique exposures that an aquaculture business encounters", said Graham

"Stock losses do happen and businesses may never recover. Our role is to help companies protect their stock and business".

The company says that it has competitive and comprehensive insurance covers available for the insurance of valuable Aquaculture stock. It has experience in all types of stock including offshore marine

culture of tuna, land and sea based abalone operations, mussel farms, oysters (including pearls), prawn and even sea horses.

Aquaculture is one of the niche products that the company provides aside from distribution systems specific to marine insurance, freight forwarders, professional liabilities, telecommunications industry products, telemarketing industry compliance, corporate insurance distribution models and designing new and unique insurance products.

The company says that it can design industry specific insurance products, insurance distribution solutions, and source underwriting markets anywhere in the world to suit demands and opportunities of business partners. This includes designing and implementing innovative insurance solutions to progressive minded companies, affinity groups and associations throughout the world.

"Our approach to business is simple. We listen to our clients, we employ experts to help us understand and minimize our client's exposures, we discuss our proposed solutions with our clients and then we back up our proposals with results".

More information: [www.mlh.com.au](http://www.mlh.com.au) Email: [grahamg@mlh.com.au](mailto:grahamg@mlh.com.au)



Graham Gulliford

## Bio Solutions and Virbac SA

# A synergy in aquaculture

Thailand based premier biological solution provider for aquaculture, Bio Solutions Co., Ltd. announced in January a new joint venture with Virbac S.A to form a specialized aquaculture product and service company.

The resulting joint-venture firm, Bio Solution International Co. Ltd., seeks to provide innovative approaches to aquaculture by focusing totally on environmental-friendly solutions, premium products and customer service. Together the focus will be on continuous research to meet industry needs for innovative solutions. At the initial stage, the companies will seek to explore synergies with Virbac's existing patented technologies to improve products efficacies and effectiveness.

Bio Solutions, founded in 1997 by a team of doctors, engineers and pharmacists, is an industry leader in the aquaculture market. Virbac S.A is renowned globally in animal health and is the animal health, is ranked ninth as a veterinary laboratory worldwide. It has a commercial presence in more than 100 countries. This pharmaceutical group has proven technical knowledge, innovation in combining quality and efficacy to bring solutions and convenience to animal health care.



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Singapore  
Email: [aquarama@cmpasia.com](mailto:aquarama@cmpasia.com)  
Web: [www.aquarama.com.sg](http://www.aquarama.com.sg)

### June 4-7

**Aquaculture Indonesia 2007**  
Surabaya, Indonesia  
Email: [daftar@aquaculture-mai.org](mailto: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, June 12-14)  
Email: [infish@po.jaring.my](mailto:infish@po.jaring.my)  
Web: [www.infofish.org](http://www.infofish.org) (p5)

### June 18-22

**7th International Symposium on Fish Immunology**  
Stirling, Scotland  
Web: [www.noffi.org](http://www.noffi.org)

### June 22-24

**Shanghai International Fisheries and Seafood Expo**  
Shanghai, China  
Email: [kim.yang@sifse.com](mailto:kim.yang@sifse.com) (p35)  
Web: [www.sisfe.com](http://www.sisfe.com)

### July 29-August 2

**Indonesian Aquaculture 2007**  
Bali, Indonesia  
Email: [indoaqua-07@hotmail.com](mailto:indoaqua-07@hotmail.com)  
Web: [www.perikanan-budidaya.go.id](http://www.perikanan-budidaya.go.id)

### August 5-8

**Asian Pacific Aquaculture 2007**  
Hanoi, Vietnam  
Tel: +1 760 432 4275  
Email: [worldaqua@aol.com](mailto:worldaqua@aol.com)  
Web: [www.was.org](http://www.was.org) (IBC)

### August 23-25

**Tilapia 2007**  
Kuala Lumpur, Malaysia  
Email: [infish@po.jaring.my](mailto:infish@po.jaring.my)  
Web: [www.infofish.org](http://www.infofish.org) (p27)

### September 25-28

**IAFI World Seafood Congress**  
Dublin, Ireland  
Web: [www.worldseafoodcongress07.com/](http://www.worldseafoodcongress07.com/)

### October 23-25

**Livestock Asia 2007**  
Kuala Lumpur, Malaysia  
Web: [www.livestockasi.com](http://www.livestockasi.com)  
Email: [mha@ambexpo.com](mailto:mha@ambexpo.com)

### October 24-26

**Fish Africa & Aquaculture Africa**  
Capetown, South Africa  
Web: [www.fishafrica.net/](http://www.fishafrica.net/)

### October 24-27

**Aquaculture Europe**  
Istanbul, Turkey  
Tel: +32 923 34 912  
Email: [ae2007@aquaculture.cc](mailto:ae2007@aquaculture.cc)  
Web: <http://www.easonline.org> (P31)

### November 6-9

**Caribbean and Latin American Aquaculture**  
San Juan, Puerto Rico  
Tel: +1 760 432 4275  
Email: [worldaqua@aol.com](mailto:worldaqua@aol.com)  
Web: [www.was.org](http://www.was.org)

### November 6-8

**China Fisheries & Seafood and China Aquaculture**  
Dalian, China  
Web: [www.seafare.com](http://www.seafare.com)

### November 20-23

**8th Asian Fisheries Forum**  
Kochi, India  
Tel: +91 484 2394798  
Email: [8aff2007@gmail.com](mailto:8aff2007@gmail.com)  
Web: [www.8aff2007.org/](http://www.8aff2007.org/)

### November 27-30

**Iran 5th International Fisheries and Aquaculture Exhibition**  
Kish Island, Iran  
Email: [iranseafoodexpo@cororg.com](mailto:iranseafoodexpo@cororg.com)  
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## New dates for VICTAM ASIA 2008

Once again, the show will be held at the Queen Sirikit National Convention Centre in Bangkok, Thailand from 5 – 7 March 2008.

Companies at Victam Asia 2008 will display the latest equipment, technology and additives for animal, aquatic feeds, petfood production, as well as, for the rice, flour milling and grain processing sectors.



The 2006 show was the largest dedicated event for the animal feed and grain processing industries in South East Asia, with over 120 exhibitors from all over the world. Nearly 4000 senior executives from feed compounding companies, integrators, rice and grain processors and flour millers from throughout the Asia/Pacific region and beyond attended this major international event in Bangkok in 2006.

After the success of the 2006 show, Victam Asia 2008 will again include Thai and PR China exhibition pavilions. This show will not just be a comprehensive exhibition for these industries, it will also be the meeting place for many industry executives from these industries from throughout South East Asia and beyond as the event is supported by

a major series of industry related seminars and workshops. These will include:

- Petfood Forum
- Aquafeed Workshop
- Thai Ministry of Agriculture

New for 2008 will be a specialist co-located exhibition and conference – FIAAP 2008. Feed Ingredients and Additives Asia Pacific 2008 is a separate event where integrators, feed formulators, veterinarians and feed formulators will find international companies exhibiting the latest innovations within ingredients and additives necessary for the processing of feed. (More information: [www.victam.com](http://www.victam.com))



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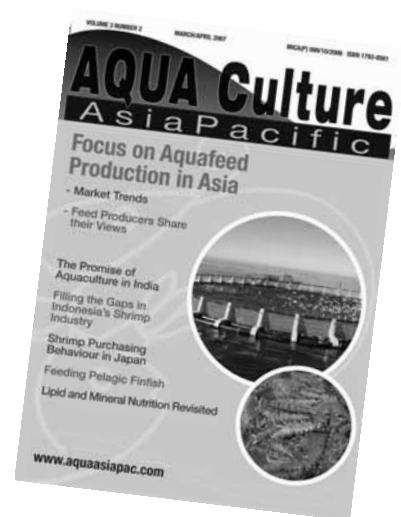
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