

MAY/JUNE 2009

Volume 5 Number 3

# AQUA CULTURE

A s i a P a c i f i c

**R**eview on tra catfish in Vietnam

**S**hrimp choices in Vietnam/Malaysia

**O**ptimising ingredient evaluation

**I**nnovating for sustainable aquaculture

**M**anaging WSSV in India



# Grow with Gold Coin



Since 1984, GOLD COIN is committed to research, sustainability and good customer service.

visit our website [www.goldcoin.com.hk](http://www.goldcoin.com.hk)

At **GOLD COIN**, we are committed to provide superior shrimp feeds to ensure your business success. Using only the highest quality raw materials and manufactured under strict quality controls, we offer a range of feeds\* to consistently meet the various levels of production systems. Our strict policy of opposing the use of antibiotics in our feed is congruent with the growing demand by consumers for traceability.

- **GOLD SUPREME** for superior growth and feed efficiency. Health enhancement with proprietary ENCAP® Immune enhancer
- **GOLD FORTE/GOLD VERTEX** are specially formulated for the intensive culture of white shrimp *Penaeus vannamei* in Asian conditions
- **GOLD CLASSIC/GOLD ELITE** are our flagship products that meet all nutrient requirements of *Penaeus monodon* shrimp under normal conditions
- **GOLD ROYALE** is used in highly intensive conditions by the most discerning farmer
- **ENCAP®** Hatchery Feeds have prime quality ingredients micro-encapsulated within a digestible yet water stable membrane

\*Some products may not be available in your country. For details on Gold Coin range of shrimp feed and other Gold Coin Aquaculture products, please contact our regional offices.



## 2 From the editor

The end of road for BT shrimp?

## 4 News

Barramundi from Malaysia, organic shrimp, Pangasius in Indonesia

## 6 News in brief

## Marine Shrimp

### 8 Choosing vannamei shrimp

A shift to vannamei shrimp farming assures continuity in Bagan Lallang, Malaysia. By Zuridah Merican and Khoo Eng Wah



### 10 Biofloc technology in shrimp nursery systems in India

This reduces feed and filtration costs in recirculated systems, says Anil Ghanekar

### 12 Semi intensive monodon shrimp culture in Vietnam

A key success for consistent and sustainable shrimp farming is quality and disease free post larvae.

## Feed Technology

### 14 A feed is only as good as its ingredients

Brett Glencross looks at optimising ingredient evaluation technology for aquaculture diets. Part 1: Ingredient characterisation and digestibility

### 18 Yeast as immune-modulating agents in aquaculture: background and in vitro evaluation

By Anja Ganner and Pedro Encarnaçao

## Industry Review- Catfish in Asia

### 20 Industry analyses tra and other catfish farming

In December 2008, industry and researchers discussed production, seed production, threats from diseases and the future of catfish culture vis-à-vis environmental concerns. By Zuridah Merican

### 27 The catfish in India and China

These are Pangasiids in India; Ictaluriids and Siluriids in China.

## Focus on Sustainable Aquaculture

### 29 Innovations for sustainability of seafood supply

Jan Koesling looks at the innovations in aquatic health and culture management to ensure long term sustainable production in Asia.

### 33 Aqua probiotic products for both shrimp and fish.

These help to alleviate problems with changing environmental conditions. By Angelito O. Abaoag and Seah Choon Meng

## Health Management

### 35 Host-targeted antibody has positive impact on tilapia survival and performance

A novel approach directly tackles the problem of excess gut inflammation. By Carrie L Cook, John S Clark, Kyle Montgomery and M. D. Yang

### 36 Organic selenium in stress and disease management

Field trials show how selenium may be a tool to overcome viral infections in marine shrimp. By Shery Kurian and Chris King

## Developments

### 39 Intensive farming of the goby fish in the Mekong Delta, Vietnam

The potential of the euryhaline goby fish in alternate culture with marine shrimp. By Tran Ngoc Hai, Nguyen Thanh Phuong and Nguyen Tan Nhon

## Company News

### 41 Inve NutriAd

### 42 Nutreco 's forum at VIV Asia 2009

## Show Reviews

### 44 Aqua seminars, Novus, Biomin and Delacon at Aqua VIVAsia 2009, 11-13 March, Bangkok

### 50 Aqua India 2008 focused on new technologies and initiatives, 16-17 February, Chennai

## Forthcoming Events

### 51 Asian Pacific Aquaculture 2009 and events in 2009

#### Editor/Publisher

**Zuridah Merican, PhD**

Tel: +603 2096 2275 Fax: +603 2096 2276

Email: zuridah@aquaaasiapac.com

#### Editorial Coordination

**Corporate Media Services P L**

Tel: +65 6327 8825/6327 8824

Fax: +65 6223 7314

Email: irene@corpmediapl.com

Web: www.corpmediapl.com

#### Design and Layout

**Words Worth Media Management Pte Ltd**

Email: sales@wordsworth.com.sg

Web: www.wworthmedia.com

AQUA Culture AsiaPacific is published bimonthly by **Aqua Research Pte Ltd**

3 Pickering Street, #02-36 Nankin Row, China Square Central, Singapore 048660

Web: www.aquaasiapac.com

#### Editorial and advertising enquiries

Request for reprints and articles

Email: zuridah@aquaaasiapac.com

Tel: +603 2096 2275 Fax: +603 2096 2276

#### Subscriptions

**Online: www.aquaasiapac.com**

Email: subscribe@aquaaasiapac.com

Tel: +65 9151 2420 Fax: +65 6223 7314

Annual Subscription by airmail (6 issues a year) Asia: SGD70

Other zones: SGD100

Copyright © 2009 Aqua Research Pte Ltd. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of the copyright owners.



# From the editor

## End of the road for BT?

The 1990s saw a boom in shrimp production in SE Asia as a result of intensive black tiger *Penaeus monodon* culture. Perhaps it was the Japanese who solicited and encouraged its growth with the strong JPY and an apparent bottomless market. It spurred the expansion of farms from Thailand to Indonesia and the Philippines. Taiwanese culture and feed technology was sought after to support this industry and for a while the black tiger was king of the aquaculture industry which in the past only saw backyard freshwater fish farm operations. This industry created the growth of many enterprises and later failures as the rush to increase output of the undomesticated species with higher stocking density invited diseases such as WSSV. Then in 2002/2003, it seemed as if the black plague had hit and soon decimated the industry.

The industry was dumbfounded for a period but then started to experiment with a replacement species – *P. vannamei* – but fully domesticated from the Americas. Asian producers pushed the limits of production, albeit in open ponds and stocked at 4 to 8 times that of monodon making up for the smaller average body weight at harvest and are now looking at more than 10 tonnes/ha as if it was the norm. The bonus is that this species can be cultured in the entire volume of the water body as opposed to just the bottom surface area. The success of *P. vannamei* can be seen in Thailand where it comprises more than 95% of the shrimp cultured in the country. Today, even 40g harvest weight can be achieved with partial harvesting. This encroaches into the body weights and market sizes which were once the domain of monodon shrimp only. In the EU for head-on /shell –on segment, monodon is still the sought after species but with smaller sizes and in the peeled and cooked segment, the markets do not distinguish between species. In the local markets of Malaysia and Singapore, the local chilled market for smaller sizes offer better prices than the frozen market and this favours the vannamei shrimp.

## No not yet!

Does this mean the end of the road for *P. monodon*? It is said that vannamei not only saved the SE Asian shrimp industry in 2004 but revolutionised it. Specifically, it was the availability of vannamei post larvae from specific pathogen free brood stock that provided the competitive edge. Today the supply of similar monodon post larvae is available. However, uptake has been limited mainly because vannamei shrimp producers cannot back track to lower stocking density and output, as is perceived with the monodon. For Thailand, it does take time to turn this ‘vannamei based juggernaut’ around. We should not write off monodon at all.

In order to be sustainable, we strongly believe that the industry should not rely solely on one species. If a yet to be discovered disease (or WSSV for that matter) were to hit, this industry will be left without a leg to stand on. Monodon shrimp is a credible complement and should be promoted as such. The determining factor is the bottomline – contribution from more than 10 tonnes/ ha of vannamei is certainly more interesting than 5 tonnes/ha of monodon shrimp over the same culture period and at closely similar prices.

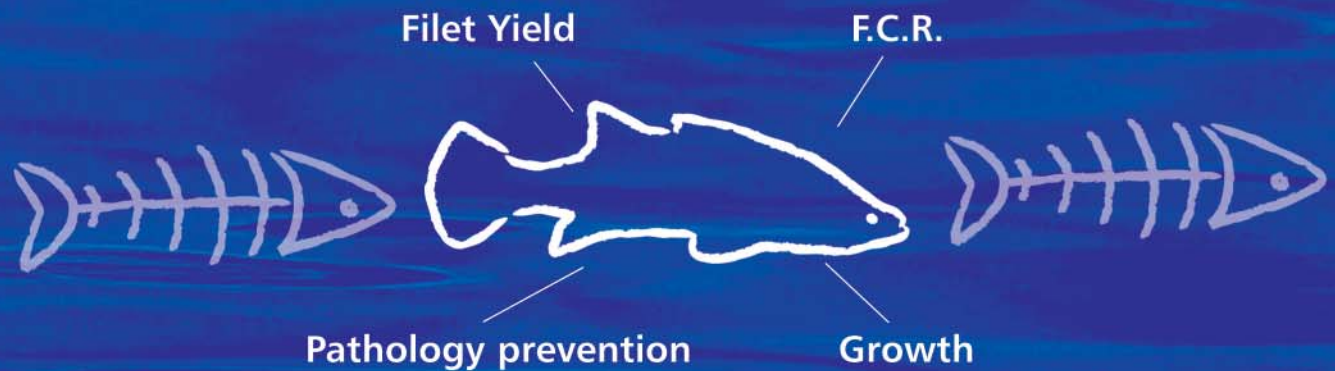
For monodon to be successful, we see 3 options. Firstly, to culture at higher densities now that we have post larvae from SPF brood stock but be cognisant that we could be testing the boundaries and inviting new diseases. Should we think out of box and change culture technology to controllable indoor high density culture systems as we see with vannamei in the US (see p47)? Secondly, to differentiate it with larger sizes and premium prices since it is easier to grow monodon above 40g sizes. Although this high end segment seems to be prepared to pay higher prices to keep monodon culture viable, price elasticity should be considered. Thirdly, to use only domesticated stocks genetically selected for faster growth. This is exactly how the industry evolved with poultry and livestock so let us use this tried and tested strategy on monodon. Putting all our resources in the vannamei shrimp is dangerous and could just prove that the industry has not learnt its lesson.

Zuridah Merican

### Corrections

In the article ‘Fighting the muddy off-flavour in the tilapia’, Vol 5 (1), 2009, January/February, the last para, column 1 on page 33 should read “In microbial management, the farm applied a series of Sanolife probiotics such as PRO-W (a product at a concentration of  $5 \times 10^{10}$  cfu/g) at 10mg/tonne water/week in the grow-out pond water”. The error is regretted.

In a news report in issue January/February 2009, page 49, we referred to USSEC-India. The correct organisation name should be ASA-IM / American Soybean Association - International Marketing. We apologise for this error.



# RESEARCH MAKES THE DIFFERENCE



**OCIALIS : Our best publicity is your improved results !**

OCIALIS has developed its own Aqua Feed Research Centres in Vietnam, Brazil, Mexico and Indonesia.

WHY ? Because we believe that our innovation must be developed as close as possible to our partners to best respond to their needs.

OCIALIS commercial and research teams are working day-to-day with farmers to optimise their results.

Our 12 world wide Aqua feed plants manufacture feeds for **Pangasius, Cobia, Barramundi, Grouper, Tilapia, Monodon, Vanamei, etc ...**

Do you have specific requirements ?

Contact us !



**Ocialis**

# First barramundi harvest from Malaysian operations



**After 12 months in operation, TRG Cell Sdn Bhd has harvested its first batch of 800-900g barramundi *Lates calcarifer* in March. The bulk of the harvest air freighted directly to Melbourne to some of Australia's top chefs, arrived 18 hours after harvesting.**



*Pictures courtesy of TRG Cell*

Exporting to Australia required considerable documentation but was worth the effort as feedback from Melbourne's executive chefs and distributors was that the fish was 'equal to or better than' any wild or farmed barramundi product which can be sourced in Australia. With the help of the Australian Embassy, the fish was also distributed to a number of five star executive chefs in Kuala Lumpur, familiar with Australian barramundi. The feedback was positive, with all chefs wishing to commence immediate ordering of this premium barramundi.

This state of the art production facility in Tanjong Demong, Besut, Terengganu was set up in 2007 under a joint venture company with the Terengganu State Government, Malaysia and Cell Aquaculture Limited (Cell), publicly listed on the Australian Securities Exchange. In this joint venture, Cell supplies and installs the growing systems, the Cell™ proprietary production modules for a vertically integrated production process. It also manages the operations as well as sales and marketing of finished product. Production began in February 2008.

Cell's high tech, clean and green recirculating aquaculture technology has been developed over 10 years with custom designed operating and monitoring software. The target is to ensure that fish is traceable and do not move from one module to another. Besides foam fractionators, filter beds, bioreactors, degassing, the unique features are conveyer micro screens which takes the load off tanks and contact chamber for oxygen exchange, a patented technology developed by the company in Perth.

"Maintenance is relatively simple and microfilters are sprayed cleaned daily and a thorough cleaning is required once in two months", said Peter Burns at the Besut facility. "The strong point of our modular system is the computerized monitoring of all essential parameters and which alerts us when there is a hitch. We also emphasise strongly on biosecurity to prevent any crop failures. With local staff and of different cultures, we have to go through a learning process in management. We also faced a different set of parameters such as temperatures and salinity".

This harvest is of barramundi fry (20mm) shipped to Malaysia from its hatchery operations for Australian barramundi at James Cook University, Queensland. These were kept in nursery tanks, fed specialised starter diets and are frequently graded. Fingerlings of 100g are transferred to larger 10 tonne tanks for grow out in 8ppt salinity. Currently the production target is 120 tonnes per year. This success with the first harvest will open the way for projected expansion of the facility to increase production to more than 1,100 tonnes by year 2011 and will also include a multi-species hatchery for 8 million fingerlings, processing and value adding and aqua feed development.

The acceptance of the fish in Australia is endorsement for a 'Malaysian Produced' fish, as barramundi is a native Australian fish. The success of the first stage grow-out facility places the company closer to realising its vision to establish Terengganu as the 'hub' of premium finfish production.

## Good start for organic shrimp

**Sureerath Farm, Thailand has sent its first shipment of 40 tonnes of organic shrimp to Switzerland and Germany for 2009. This marks Thailand's first foray into the organic shrimp market of Switzerland.**

The farm located in Chanthaburi province is a pioneer in organic shrimp farming in Thailand. It had a 30 year history in conventional shrimp farming before shifting to organic black tiger shrimp farming in 2004. The farm has 100 ponds of 6,000 to 7,000 m<sup>2</sup> and stocks them with 15 post larvae/m<sup>2</sup>. Harvest size is 40pcs/kg after 5-6 months of culture.

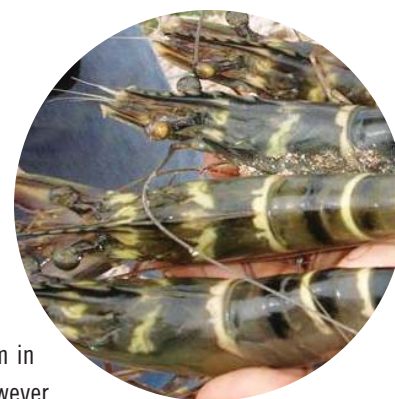
With the conversion of ponds to organic farming, Prayoon Hongrath, President of Sureerath said that he had to have settling ponds for effluent water treatment, large water storage ponds and replanted mangrove trees. The cost of production has increased by 30%. He added, "I feel good that by not using any chemicals, I am supplying shrimp which are healthier and wholesome".

In Thailand, the Department of Fisheries, encouraged organic shrimp farming with the establishment of the Thai organic standards in 2005, according to Dr Lila Ruangpan who is in charge of the organic shrimp program. Since then, there are now 19 organic shrimp farms in Thailand. These are mainly located in Chanthaburi Province

and one is an extensive farm in Samutprakarn province. However, Sureerath Farm is the first and only to receive certification from Naturland, Germany, for meeting standards in the production and in ensuring product quality. This certification had paved the way for the farm to secure orders this year from Switzerland's Co-op retailer and Germany's Deutsche See, an organic sea food distributor.

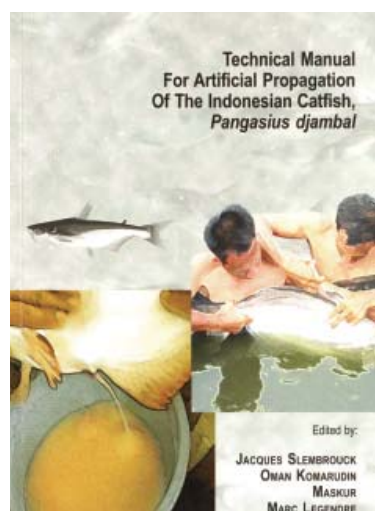
Despite this success, Prayoon expects that demand will decrease due to the global crisis. He is optimistic that organic farming in Thailand will grow, albeit at a much slower pace. During the next five years, Sureerath farm will focus on production within its current infrastructure.

"We will have to wait and see, but I foresee the future of organic and healthy food will still be good as more people are health conscious, not only in Europe but also closer to home in Thailand and the rest of Asia".



## Pressure to increase catfish production

**In the past three years, the government in Indonesia has been encouraging the production of the silver catfish *Pangasius djambal* or ikan patin in Indonesian. This is to compete with catfish fillet from Vietnam in both domestic and export markets.**



The fish is common in Kalimantan, Jambi, Riau and South Sumatran provinces. It has soft white flesh and is easy to culture. Indonesia has 14 pangasiid species but culture began with the *Pangasius hypophthalmus* (or tra catfish from Vietnam) with imported seed stock from Thailand. Production of the pangasiid catfish totalled

51,000 tonnes in 2008 and the estimated production in 2009 is 75,000 tonnes. Production in 2008 was 40% higher than that in 2007.

In 1996, the Central Research Institute (CRIIA) and the French Institute of Research for Development started a program 'Catfish Asia' which carried out basic and applied research on this species. One of

the outputs is a manual on its artificial propagation (see picture). Researchers at various centres in Indonesia showed that *P. djambal* can grow to 1.0 kg in ponds and 1.9kg in floating cages. FCR ranged from 1.27 to 1.57 for 6 months of culture. In contrast, the *P. hypophthalmus* grow to 800g in six months in cages.

However, despite local production, market preferences are for the catfish fillet from Vietnam. CP Prima launched its first catfish culture project in Sukamandi, West Java but used *P. hypophthalmus*. However, industry says it is difficult to compete with imports from Vietnam, as cost of production for domestic catfish is much higher. The fish is sold at IDR 11,000 to 17,000/kg whereas the Vietnamese imports are sold at IDR 9,000/kg. The major cost is feeds at 80% of costs and industry says that feeds in Indonesia have a 5% duty. Denny D Indradjaja, Head of the fish feed division of Indonesian Fish Feed Association (GPMT) said that feed costs are higher in Indonesia than in Vietnam. Gunandi, PT Muara Manggalindo, a major catfish producer said that culture technology lags behind that of Vietnam. It takes 9-10 months to harvest the catfish in Indonesia but only 5-6 months in Vietnam. (Source: Jambi Express, Jakarta Globe, Abstracts from Indonesian Aquaculture 2007)

# News in Brief

## Thai shrimp exports thriving

Thailand's exports of frozen shrimp have increased 8.17% over the same period in 2008. The value of exports was USD 290 million, up 4.06% from that in 2008. Poj Aramwattananond, president of Thai Frozen Foods Association said in the Bangkok Post that if the two-month trend continues, Thailand's shrimp production will be 10% higher. However, there are concerns over the domestic politics affecting orders and financial liquidity. Most commercial banks have tightened their credit lines to local exporters.

In the same report, Thai Eastern Shrimp Farmers Association president, Banchong Nisapavanich said that production in the first quarter was 96,000 tonnes of shrimp, a 15% drop from the same period in 2008. Local producers are cutting output by 20%, in a bid to keep prices high. Production is now forecast at 392,000 tonnes this year, significantly lower than the 530,000 tonnes produced in 2007 and 500,000 tonnes in 2006. Ex farm prices have increased to THB 140/kg for 50 pcs/kg, 10-15% higher than prices in 2008. The concern is that with higher shrimp prices, more farmers may resume shrimp farming, making the production cut ineffective.

## Cell Aquaculture goes to South Africa

Australia's Cell Aquaculture Limited (CAQ) will establish an AUD20 million land-based seafood production facility in the Eastern Cape region of South Africa, reported wabusinessnews.com. This will be one of the world's largest, fully integrated, recirculating land-based seafood production facilities with an annual production of more than 2,000 tonnes of premium fin-fish. The partner is a consortium of entrepreneurs in South Africa. The new facility will be a licensed Cell™ proprietary design, incorporating CAQ's tried and proven proprietary seafood production technologies and operating procedures. In the plan, 50% of the production will be sold domestically within South Africa and the rest exported to European and Middle Eastern markets. This is to ensure no cannibalism of CAQ's existing markets for the Malaysian production (see p4).

## Tra exports resume to Russia and Egypt

In April, Vietnam can resume exports to Russia. In 2008, exports to Russia totaled 118,155 tonnes valued at USD 188 million. However, Russia stopped importing catfish from Vietnam in December citing 'unhealthy competition between local breeders and exporters, leading to unstable prices and poor quality, unhygienic produce'. The first consignment of 20,000 tonnes will begin at an export price of USD2/kg. In March, Egypt temporarily halted imports of catfish from Vietnam citing the production was from the heavily polluted Mekong River. Egypt has resumed imports. Vietnam exported 26,630 tonnes valued at USD 54,918 to Egypt in 2008. (www.saigon-gpdaily.com; Vietfish International, Jan/Feb 2009).

## Food Safety Law passed in China

The new Food Safety Law provides a legal basis for the government to strengthen food safety control 'from the production line to the

dining table'. This goes into effect on June 1, 2009 and is a push to improve food safety in the country through stricter monitoring and supervision, tougher safety standards, recall of substandard products and severe punishment for offenders. A recent spate of food scandals had triggered calls for overhauling China's current monitoring system. This law requires the State Council, or Cabinet, to set up a state-level food safety commission to oversee the entire food monitoring system. (source: Tongwei Aquanews)

## EU alert on Indian shrimp

The EU has imposed emergency measures on crustaceans imported from India after rapid alerts showed the presence of nitrofurans in two consignments of the freshwater prawn and presence of furazolidone in one consignment of black tiger shrimp in February and March. This will require all crustacean imports from India to be accompanied by an analytical test result showing that the exported product is free from nitrofurans residues. The immediate reaction of MPEDA is to set six new testing laboratories and it will only allow tested consignments for export, said G Mohan Kumar, chairman. As over 90% of the rejections came from Andhra Pradesh, strict screening measures could be implemented over a smaller territory.

## Push for Korean corporate aquaculture

The Ministry of Food, Agriculture, Forestry and Fisheries (MIFAFF) has announced a five year plan until 2013 to develop industry in Korea. The aim is to orient Korean aquaculture to meet global competition. Projects identified include offshore cage culture, hatcheries, feed development, insurance for natural disasters and adoption of HACCP and traceability. It will support aqua ventures outside the country which will use Korean technologies, either through private sector or intergovernmental action. The ban on companies with more than USD 3.7 billion from investing in aquaculture will be removed to have global scale enterprises investing in high value fish production such as cod and tuna farming. An offshore underwater AQUAPOD cage project in Gang won was started for the rearing of yellow tail, sea bream and cod (AquaInfo Newsletter 2, 2009).

## End to EBR for Thailand and Indian shrimp imports

The US Customs and Border Protection (CBP) has published a notice that from April 1, 2009, the enhanced bonding requirement (EBR) is not required for shrimp imports subject to antidumping. This followed a WTO ruling in favour of industry in India and Thailand that its application contravene WTO regulations. During the first week of March, the US Department of Commerce (DoC) had reduced the anti-dumping duty on Indian shrimp to 0.79% and to 4.51-4.64% for shrimp from Thailand.

# INVE Aquaculture Health Solutions covering all the fields of good health management



Sanocare®



## Products for maximum hygiene and disinfection

- **HC** : for clean and vital *Artemia*
- **PUR** : highly effective disinfectant & virucide before, during & after culture

Sanolife®



## Products for effective microbial and environment management

- **MIC** : high-tech hatchery probiotics controlling pathogens and water quality
- **PRO** : high-tech grow-out probiotics controlling pathogens and waste
- **AFM** : fixates ammonia in ponds
- **NutriLake** : specialty enhancer for the natural food web

Sanoguard®



## Products for optimum stress resistance & immune enhancement and diagnostics

- **S-PAK** : specific health boost for postlarvae
- **TOP** (dressing) : Immunostimulant & nutritional supplement



[www.inve.com](http://www.inve.com)



For more information, please contact: [sales@invethailand.com](mailto:sales@invethailand.com)

## Choosing vannamei shrimp

By Zuridah Merican and Khoo Eng Wah

A shift to vannamei shrimp farming assures continuity in a farm in Bagan Lallang, Malaysia.



Black tiger shrimp was the species of choice for this farm, but after frequent outbreaks of the white spot syndrome virus for three consecutive years, followed by slow growth of the shrimp, Leow Chuan Huat said that there was no choice but to shift to the white shrimp, *Penaeus vannamei* at this farm in Bagan Lallang, Selangor.

When the farm started 6 years ago, they usually stocked 180,000 post larvae/ha of the black tiger shrimp and production was good at 7 tonnes/ha for this shrimp. Gradually production began to decline to as low as 2.5 to 2.6 tonnes/ha. The problem was not only diseases but also the slow growth of shrimp.

There are 15 ponds at this farm in Bagan Lallang used for the culture of vannamei shrimp, tiger grouper *Epinephelus fuscoguttatus* and green grouper *E. coioides*. Some ponds at the farm have HDPE liners. Currently, the stocking density for the vannamei shrimp is capped at 80 PL/m<sup>2</sup>. The farm gets its supply of specific pathogen free (SPF) post larvae as part of the feed package. Survival is good at 80-93%. In a 0.7ha pond, stocking 600,000 post larvae, the final output can reach 9.3 tonnes/ha after 110-120 days of culture. The benchmark that Leow uses is for each 100,000 PL stocked, the maximum output is about 1.5 tonnes with size of 50 pcs/kg after 110 to 120 days. He added growth can be good at 45 pcs/kg or slow at 60 pcs/kg after 120 days.

Three partial harvestings are usually carried out. The time for harvesting is determined by the size of the shrimp. The first harvest of 30% of stock is when shrimp reach 70-75 pcs/kg, followed by a second at 60 pcs/kg and a third at 55 pcs/kg. The interval between harvests is 2-3 weeks. However, all these will depend on the market situation. Leow will observe the average daily growth (ADG) before he decides on

the harvest. He also takes into account what is required by the local market and that of the Singaporean market. The local market will only buy shrimp of 60-80 pcs/kg. When there is demand from the Singapore market for larger shrimp of <50 pcs/kg such as 40 pcs/kg, he will harvest this size after 150 days of culture.

The current situation is favourable for some farms as prices are higher than during the early part of the year. Current prices (April 2009) are MYR 12.70 for 70 pcs/kg as compared to MYR 11.50 in February. The low supply of small size vannamei is because production in several locations is affected by diseases.

### All is not lost for black tiger shrimp

Asked whether he will return to farming the black tiger shrimp, Leow said that even before the advent of SPF vannamei post larvae





into the country, farming of the black tiger shrimp was less than optimum at this farm as pond water salinity ranged between 26-32ppt and affected growth of the shrimp. These conditions are more conducive for vannamei shrimp and shell recovery after molting is good. At another farm in Sg Molek, 40% of production is black tiger shrimp. At an associate farm on Pulau Carey, it is still 100% black tiger shrimp culture.

However, there is still a market for the live black tiger shrimp in Malaysia and Singapore. Under optimum conditions, the shrimp grow faster than the vannamei shrimp, said Leow. There is a general shortage of post larvae for the black tiger shrimp, in particular of the high health post larvae produced by a hatchery in the south. When buyers ask for this shrimp, he will always culture the shrimp at his other farm. Demand is from restaurants in Malaysia and Singapore.

A new and increasing demand is also from recreational fishing shops situated all over the Klang Valley, which requires 600-800kg/day, only of the black tiger shrimp.



**Khoo Eng Wah**, consultant, operates an aqua farming training center in Sepang, Selangor, Malaysia. Since 1997, the centre has trained managers in aquaculture as well as upgraded pond, farm and hatchery operators with culture and practical

skills. His experience in aquaculture spans 35 years. He has B.Sc. in Biology and Post-graduate Diploma in Fisheries from University of Singapore 1970. Previously, he was with the Fisheries Development Authority of Malaysian (LKIM).



*A surprise at the farm, 3 pieces of 75g vannamei shrimp in one pond after 120 days of culture.*



## RAJIV GANDHI CENTRE FOR AQUACULTURE GLOBAL EXPRESSION OF INTEREST

The Rajiv Gandhi Centre for Aquaculture (RGCA), MPEDA, Ministry of Commerce & Industry, Government of India is inviting expression of interest from suppliers and manufacturers of aquaculture equipment & materials for its Bio-secure *Penaeus monodon* Nucleus Breeding Centre and Multiplication Centre located in the Andaman & Nicobar Islands and Tamil Nadu, India. The criteria of all equipment components, materials & supplies must be of the highest quality supplied by world renowned sources with proven track record of service and dependability and include warranties for their products.

The basic general descriptions of the equipment/materials and other particulars to be furnished by the prospective vendors are published at the website of Marine Products Export Development Authority, India - [www.mpeda.com](http://www.mpeda.com) and the information should reach on or before 31st May 2009 at the address given in the website.

# How biofloc technology reduces feed and filtration costs in recirculated shrimp nursery systems

By Anil Ghanekar

**Trials in India show the potential use of heterotrophic bacterial floc to increase efficiency and reduce operational costs in marine shrimp nursery systems.**

Increasing biosecurity risks, adverse weather conditions and the need to maximise farm output, are some of the major reasons for the use of closed, water recirculating systems for shrimp nurseries. Typically such a nursery consists of grow out raceways or circular tanks connected to a recirculating filtration system enclosed in an indoor facility. The filtration system has its own raw water treatment and storage and a small effluent treatment plant. Located near the farms these nurseries serve as an excellent link between the hatchery and the farm providing biosecurity to and from the farming area as well as allowing for continuous operations despite adverse weather conditions.

A number of trials were conducted in recent years to develop operating protocols for recirculated shrimp nursery systems in India. Trials were conducted in systems set up at G.M. Hatchery in 2005 and at Aqua Nova Hatchery in 2006. Both hatcheries are located near Chennai in India. The systems were stocked with black tiger shrimp *Penaeus monodon* or Indian white shrimp *Fenneropenaeus indicus* (formerly *P. indicus*). Five m<sup>3</sup> rectangular tanks in the hatchery were connected to a common recirculating system which used a cyclone settler, bead filter, ozonizer, foam fractionators and a gas exchanger. The system was seeded with commercial products containing ammonia and nitrite oxidizing bacteria.

In the trials, the shrimp post larvae/juveniles were in the growth phase of between 15 to 250 mg each. Rearing densities ranged from 10 to 18,000 post larvae/m<sup>3</sup>. The food conversion ratios (FCRs) achieved in these clear water systems are shown in Table 1.

**Table 1: FCR achieved in clear water recirculated water nursery trials**

Species	Individual weight (mg)	FCR range
<i>P. monodon</i>	15 to 250	1.7 to 2.4
<i>F. indicus</i>	15 to 250	1.4 to 1.8

## Using BFT to reduce costs

As a continuation of efforts to make these nursery systems more efficient and cheaper to operate, the potential use of heterotrophic bacterial floc was considered. Biofloc refers to the bloom of bacterial biomass that is encouraged to grow in water by adding a source of carbon as a nutrient for the bacteria. Using the nitrogen in the nitrogenous waste produced by shrimp, and the added carbon, the biomass offers two major benefits: the removal of nitrogenous waste in the water and a source of food for the shrimp. The biofloc provides a brownish appearance to the tank water.

In a recirculation system, the use of biofloc to control ammonia is a way to reduce the size of the filtration system. The various types of biofilters employed in recirculation systems provide large surface area for bacteria to attach and grow. If the bacteria are encouraged to grow in the grow-out tank itself, the size of the filtration unit can be reduced to remove sludge and control bacterial blooms alone. Building and operating the system would therefore cost less.

## Trials with biofloc

The trial was conducted at Aqua Nova Hatchery in July 2007. The objective of the trial was to determine if biofloc production in recirculated nurseries reduces feed and filtration costs. Three tanks were stocked with *F. indicus* in two tanks at two different densities and *P. monodon* in the third tank (Table 2).

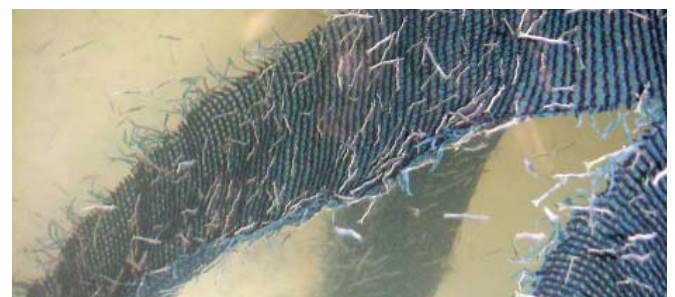
**Table 2: Shrimp stocking details in biofloc testing tanks.**

Tank	Species	Individual weight (mg)	Total no stocked	Stocking density, (shrimp/m <sup>3</sup> )
A	<i>F. indicus</i>	16.5	90,000	18,000
B	<i>F. indicus</i>	16.5	60,000	12,000
C	<i>P. monodon</i>	15.5	55,000	11,000

Shrimp in all three tanks were fed to satiation, 8 times per day, during the trial period using starter feed pellets. A probiotic containing *Bacillus spp.* was added along with molasses, at 50% of feed weight to the tank water, until a brown coloured bacterial bloom was achieved. This bloom was maintained at a Sechii's disk reading of about 50 cm by regularly adjusting the daily addition of molasses and regulating the flow rate of the recirculating system during the trial period. The flow rate was scaled up from 600% to 800% per day during the 16 day trial. About 3.5% water was removed as sludge during filter cleaning every day. Table 3 shows harvest data in nursery tanks, after 16 days of rearing. During previous trials in clear water recirculated nursery systems the FCR for *F. indicus* was in the range of 1.4 to 1.8 and for *P. monodon*, it was 1.7 to 2.4.



The column swimming habit of *F. indicus* may allow for higher densities.



Increasing surface areas as in this picture, may allow for an increase in density of *P. monodon* post larvae in the nursery tank.

**Table 3: Performance of shrimp in nursery tanks with biofloc**

Tank	A	B	C
Species	<i>F. indicus</i>	<i>F. indicus</i>	<i>P. monodon</i>
Stocking density/m <sup>3</sup>	18,000	12,000	11,000
% Survival	83	73	91
FCR	0.68	0.89	1.25
Harvest weight / shrimp (mg)	0.225mg	0.225mg	0.125mg

**Table 4: Comparative FCR with or without biofloc in the recirculated shrimp nursery.**

Species	<i>F. indicus</i>	<i>P. monodon</i>
Without biofloc	1.4 to 1.8	1.7 to 2.4
With biofloc	0.68 to 0.89	1.25

**Table 5: Water quality data**

Parameter	Total ammonia nitrogen	Nitrite	DO	Temperature
Range	0 to 0.3 ppm	0 to 1 ppm	4 to 5 ppm	27.5 to 30 °C

## Precautions

It was observed that the incidence of appendage necrosis and ciliate infestation increased tremendously when the Secchi disk reading went below 40 cm. The thickness of the biofloc was accordingly adjusted to be in the range of Secchi disk reading of 50 to 60 cm by regulating the recirculation flow rates as well as controlling the addition of molasses. The flow rates went up from 600% to 800% per day as the biomass and feed content rose during the trial. The molasses addition was in the range of 30% to 50% of the pellet feed weight.

## Conclusions

With data available from these closed recirculating nursery trials during the 2005, 2006 and 2007 periods, the following conclusions have been made:

- Pellet feed input was less when biofloc was used in both species. In *F. indicus* the average FCR improved from 1.6 to 0.8. This would reduce the average feed input by nearly 50%. In *P. monodon* the reduction in FCR was from 2 to 1.25, implying a reduction in the feed input by about 37.5%. A substantial reduction in feed costs is indicated in both species when cultured with biofloc. This can be achieved by using regular farm starter feeds instead of expensive raceway or nursery diets, without compromising on the growth rates, overall health and survival rates of the animals.
- *F. indicus* grew from 16.5 mg to 225 mg in both densities, while *P. monodon* grew from 15.5 mg to 125 mg. Results indicated that higher densities may be possible, especially with the column swimming habit of this species. *P. monodon* requires a surface area to sit on and further increase in density as well as reduction in FCR may be possible by increasing the surface area inside the nursery tank.
- The same filtration components were used to maintain the uniformity between previous trials without biofloc and during this trial with biofloc. In the same nursery system, shrimp biomass maintained with biofloc was more than double that of the biomass maintained without biofloc.
- With the above increase in density, it will be possible to reduce the nursery infrastructure cost by more than 50%. The running cost too would be substantially reduced due the reduced feed input costs.
- With the use of biofloc, it is possible that some components of the filtration system can be excluded. However, this possibility needs further investigations.

## Acknowledgements

The author would like to thank the respective managements of G.M. Hatchery, Aqua Nova Hatchery and Raceway Marine technologies for their support during the trials.



**Anil Ghanekar** is Systems Designer for Ecosecure Systems which designs Recirculating Aquaculture Systems and water treatment equipment. He is also the Coordinator BFT working group Asia and an Evaluator with ACC. Email: anilghanekar@yahoo.com

# The Best Source for Maturation Feeds



**ServiceAqua**  
www.serviceaqua.com



**TOPSY  
BAITS**  
PRODUCT OF HOLLAND

*Cultured Polychaetes*

**artemia  
biomass**

*Artemia Biomass*



Phone: +1 772 408 6133  
Fax: +1 772 264 8076  
sales@serviceaqua.com

# Semi intensive monodon shrimp culture with disease free post larvae in Vietnam

A key success for consistent and sustainable shrimp farming is quality and disease free post larvae. In Vietnam, success at a farm in Kien Giang Province is paving the way for the use of disease free post larvae from domesticated and genetically improved *Penaeus monodon* brood stock.



Dong Thai Commune is a brackish water area located in An Bien District, Kien Giang Province. For ten years, farmers in this commune have been culturing the black tiger shrimp *Penaeus monodon* in extensive culture systems with yields of 100- 250 kg/ha. Recently, one of them, Le Quoc Thang decided to shift to semi-intensive monodon shrimp culture at a density of 10 PL/m<sup>2</sup> and has harvested 1.5 to 2.5 tonnes/ha).

Farmers in the district are well aware that higher profits and a more stable income comes with improve quality, quantity and consistency of their production which in turn arises from increased survival and improved growth rates during the production cycle. This opportunity came with the availability of 100% specific pathogen free post larvae produced by Moana Vietnam. This post larvae produced from domesticated, genetically improved and disease free brood stock from Moana was available in the market in the Mekong Delta since March 2008.

Moana Technologies started the domestication of the black tiger shrimp in 2003 in its bio-secure facility in Kona, Hawaii. The domesticated line or stock of shrimp have been subjected to a routine health monitoring program carried out under the supervision of an approved diagnostic laboratory for at least two years. They have been demonstrated to be free of OIE (World Organization for Animal Health) and USMSFP (US Marine Shrimp Farming Program) listed pathogens namely Taura Syndrome virus (TSV), white spot syndrome virus (WSSV), Yellow Head virus (YHV), *Penaeus monodon*-type baculovirus (MBV)

and Hepatoparvovirus (HPV). The company is also improving shrimp performance with genetic selection programs.

Le Quoc Thang decided to stock these post larvae on April 11, 2008. Shrimp were harvested in September 2008. Throughout the culture period, he had the support of staff from the company to prepare culture ponds to meet the general requirements on biosecurity and culture for a successful culture of SPF shrimp. These included biosecurity, environment control, feeding and harvesting. He was also trained in data base building. Diligently, he followed all the protocols to gain the best result in Dong Thanh, Dong Thai area. In detail, these components included the following.

## Getting ready

Pond rehabilitation involved that of the four ponds of 16,900m<sup>2</sup>. Each pond size ranged from 2,900 to 5,000m<sup>2</sup>. Pond preparation included removing sludge, fixing dykes, fences and cleaning drainage systems. However, because of the old pond conditions with high organic load, it was not possible to achieve the ideal soil conditions. Water treatment involved the pumping of water from the canal to reservoirs ponds, treatment with chlorine, adding probiotics and fertilisation. The salinity was kept at 10- 15 ppt.

Post larvae, priced at VND 241(15 USD/1000PL) were stocked at a density 13-14 PL15/m<sup>2</sup>. The total stocking amount for the four ponds was 230,000 post larvae. Shrimp were fed commercial feed costing VND 19,000/kg (USD 1.18/kg). Feed trays were used to monitor feeding and to adjust the feeding rate daily. The feed conversion ratio was calculated at 1.3- 1.74.

Management involved regular visits to ponds with Moana staff monitoring and providing technical support to ensure a stable environment for shrimp. There was no water exchange during the first two months. Only top up water was added. During July and August, with heavy rains, pond water salinity was reduced to 3- 5 ppt. This resulted in algae attachment to the shrimp and slow growth. Probiotics were used to alleviate the problem.



Le Quoc Thang (left) discussing with the newspaper editors Nguyen Bang, and Mr Le Hoang Vu.

The usual culture period is 5 months but at the time of the planned harvest, Thang discovered that the price of 30pcs/kg shrimp was low, so he prolonged the culture period to reach to the size of 20pcs/kg.

All four ponds were harvested with shrimp of uniform size with an average weight of 38.5 – 43.5 gm/pc (24- 28 pcs/kg). The survival rate was 78.9 – 86.4%. The total yield from all ponds was 7.85 tonnes which translated to a production of 4.5 – 4.8 tonnes/ha. The income from sales was VND 730,850,000 (VND 75,000 – 105,000/kg). With a production cost of VND 535,423,000, the profit margin was VND 195,427,000 (USD 12, 214).

### Potential

During the period, a data base was setup which included environment, technical, and economical data. Based on this, the following conclusions were drawn up.

Under less than ideal conditions such as in the above case, difficulties in management of pond, water and soil conditions, unstable environmental and weather conditions and poor selling prices, using these post larvae can provide a profit of VND 97-127 million/ha (USD 6,062-7,937/ha). Under these conditions, post larvae grew well in the first 2 months. Cost of post larvae is 6.2- 9.3% of selling price. The large range of FCR from 1.3-1.74 was due to the high silt conditions in the ponds.

This industrial culture of SPF PL has shown the advantages of good survival rate, growth rate, productivity and profit. With a good system of ponds, technique, and environment, the SPF post larvae have the potential for consistent and higher yields. *(Adapted from an article in Vietnamese by Nguyen Bang, Con Tom magazine, translated by Le Quoc Thang, distributing agent for Moana in An Bien District, Kien Giang Province).*



Nguyen Thi Ngoc, farmer with a harvest

The natural way.

**Biomin®**

## BIOMIN AQUA Product Line

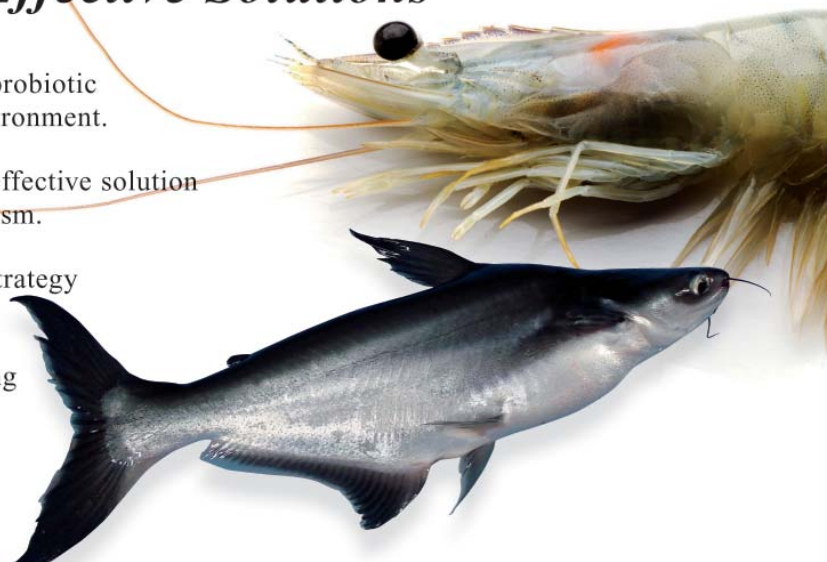
### *Specific Action – Effective Solutions*

**AquaStar**, high performance probiotic strains to enhance gut and pond environment.

**HepaProtect Aqua**, an effective solution to support and protect liver metabolism.

**Mycofix®**, the most complete strategy for counteracting mycotoxins.

**Biomin® P.E.P.** for improving digestion and feed conversion.



For enquiry, please e-mail

[aqua@biomin.net](mailto:aqua@biomin.net)

[www.aqua.biomin.net](http://www.aqua.biomin.net)

# A feed is only as good as its ingredients

## – Optimising ingredient evaluation technology for aquaculture diets

By Brett Glencross

The wide variety of alternative ingredients to fishmeal will require thorough evaluation to determine their nutritional value and appropriate levels in commercial diets. This ingredient evaluation process includes information on the ingredient digestibility, ingredient palatability and nutrient utilisation and interference. This series of three articles detail the key steps as well as problems to be wary of during the evaluation process.

### Part 1: Ingredient characterisation and digestibility

To improve the sustainability of diets for aquaculture species there is a need to be able to use a wide range of alternative ingredients, which can satisfy formulation constraints for the specific nutrient, energy and processing requirements of each intended diet. However, prior to the use of any particular ingredient it is critical for that ingredient to undergo evaluation so some consideration can be made of its potential limitations. This nutritional evaluation process has several key facets that need to be considered to be able to provide a clear indication of the potential that any ingredient may have for use in an aquaculture feed.

Details on the ingredient evaluation process have been reviewed in Glencross, B.D., Booth, M. and Allan, G.L. 2007. *A feed is only as good as its ingredients – A review of ingredient evaluation for aquaculture feeds. Aquaculture Nutrition 13, 17 – 34.* This and the subsequent articles are largely abridged versions of that review. For further details and references, readers should refer to that article.

In this first part of a series of articles the key steps of ingredient evaluation will be defined and then the initial steps of ingredient characterisation and digestibility assessment will be examined.

### Introduction to ingredient evaluation

There are three essential components to ingredient evaluation that needs to be completed to provide a basis to use a specific ingredient. These include assessments on the digestibility, palatability and nutrient utilisation (growth) responses of the animal to an ingredient (Glencross et al., 2007). There are several other aspects that can also be examined to improve the confidence in the potential applicability of an ingredient, but these three primary components provide the foundation.

**Ingredient digestibility** is the measurement of the proportion



Feed grains have made a significant impact on reducing the reliance of aqua feeds on fishmeal.



Crop species, cultivar, source and season effects are all critical factors having nutritional implications on ingredient quality of feed grains

of energy and nutrients that an animal can obtain from a particular ingredient through its digestive and absorptive processes. The determination of **ingredient palatability** is an assessment of the willingness of the animal to consume a particular ingredient. Irrespective of how digestible the nutrients and energy from an ingredient might be, if the ingredient reduces feed intake then it may have limited value.

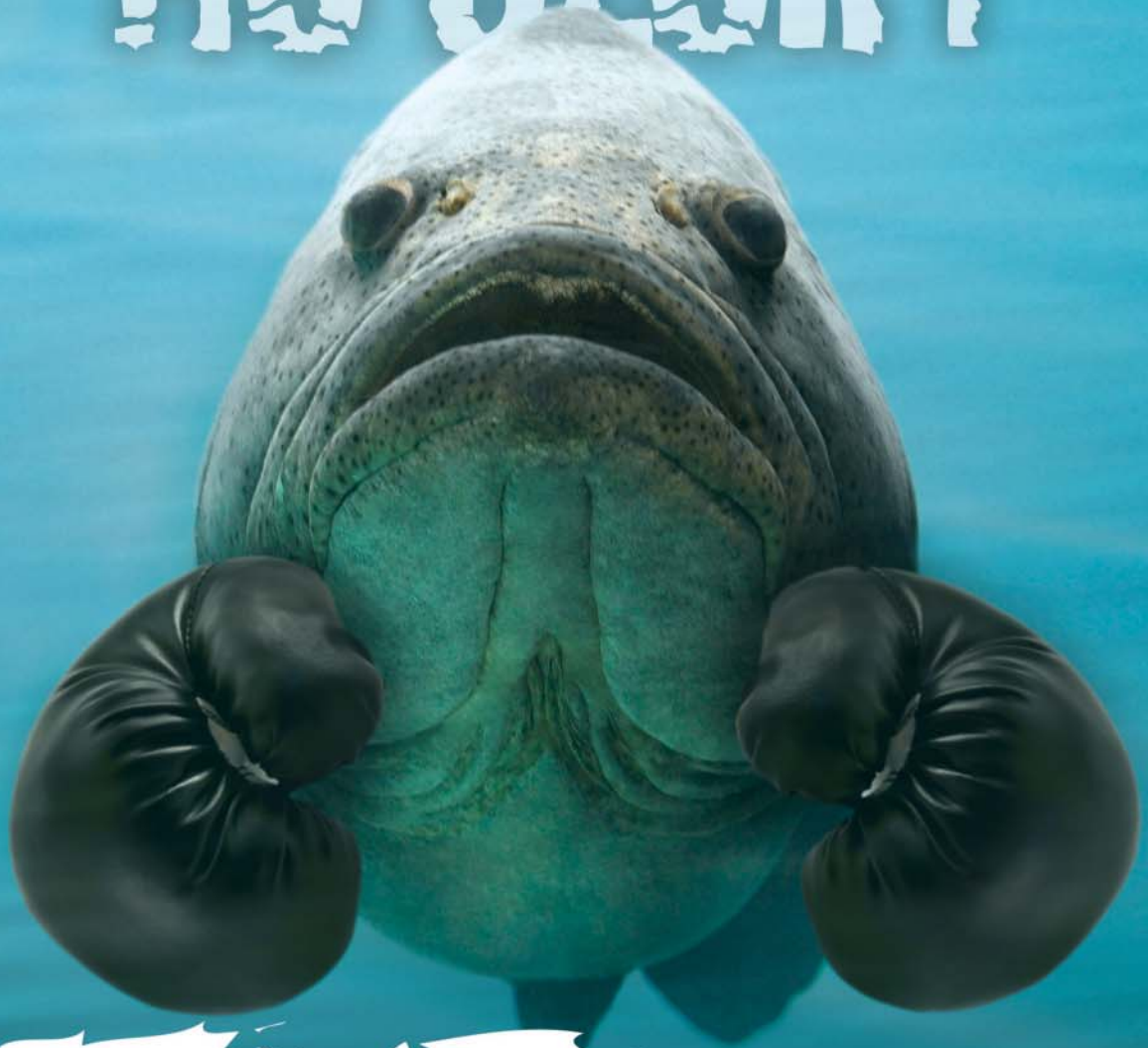
The determination of **growth and nutrient utilisation** as a function of the incorporation of any specific ingredient is perhaps the most complex step in the ingredient evaluation process. This complexity is largely related to the wide variety of factors that may impact on growth and nutrient utilisation by an animal. While studies examining the weight gain associated with different diets form the basis of most assessments, there are additional methods that can be employed to examine issues relating to nutrient utilisation.

### Characterisation of ingredients

One of the key reasons for comprehensively characterising ingredients is so that the findings from the study can be used by others. Identification of factors such as the species of the ingredient, its genotype or cultivar classification (if relevant) and source, should be all be detailed where possible. Variability, even among ingredients from a single species can be substantial. Identification of the origin of the ingredient being studied at least to country should also be considered mandatory.

The processing of an ingredient sample prior to addition to the experimental diets also has important implications on its characterisation and the nutritional value likely to be attributed to it. Booth et al. (2001) noted clear differences in the chemical composition and also the nutritional value of a range of grain legume meals

# NO GUTS NO GLORY



## BIGGER, STRONGER, HEALTHIER

grouper | catfish | shrimp | tilapia | carp | salmon | trout | seabream | yellow perch

natural micro feed ingredient  
host-targeted immunoglobulin  
improved FCR

supports gut health in challenged environments  
big performance, big return on investment



**aova technologies**  
powering animal agriculture®

[www.usebigfish.com](http://www.usebigfish.com)



Lipid source quality is an area of high priority in ingredient evaluation research

produced from either whole-seed or seed kernels. Accordingly, some details of what processing has been undertaken on the ingredient from its raw state are also useful.

In addition to the clear classification of the ingredient of concern, its origins and processing, it is imperative that a detailed analysis of the compositional characteristics of the ingredient is also provided. Ideally this analysis should be as comprehensive as possible, but key variables such as crude protein (nitrogen x 6.25), total lipids, ash, moisture and gross energy should be considered mandatory for all test ingredients (Pettersen et al., 1999).

For studies examining lipid nutrition and/or fish oil replacement issues it is imperative that the fatty acid content of the diets and preferably the ingredients also be detailed. In the absence of specific details on the ingredient species, cultivar, origin and degree of processing, then the importance of the compositional analysis increases.

### Defining ingredient digestibility

Modern aquaculture diets are routinely formulated based on digestible nutrient and energy specifications. Because of this, it is important to measure the digestible energy and nutrient content of prospective ingredients. Essentially this means measuring the amount of the energy or nutrient from a diet that is not excreted in faeces. In assessing diet digestibility there are two key methodological approaches used; the

direct and in-direct assessment methods.

In the direct assessment method a complete account of both feed inputs and faecal outputs is required. The digestible value of the feeds is then determined on a mass-balance basis. However, this method is fraught with problems, largely because of the difficulty and errors involved with collection of accurate data on feed intake and faecal production.

The alternative method is via indirect assessment, where a representative sample of both the feed and faeces is required and an indigestible marker is included in the diet. This method works primarily based on measuring the ratio of the marker between the feed and faeces determines which dry matter digestibility and from this can be extrapolated to calculate digestibility of energy and other nutrients. This indirect assessment produces data that is referred to as 'apparent digestibility'.

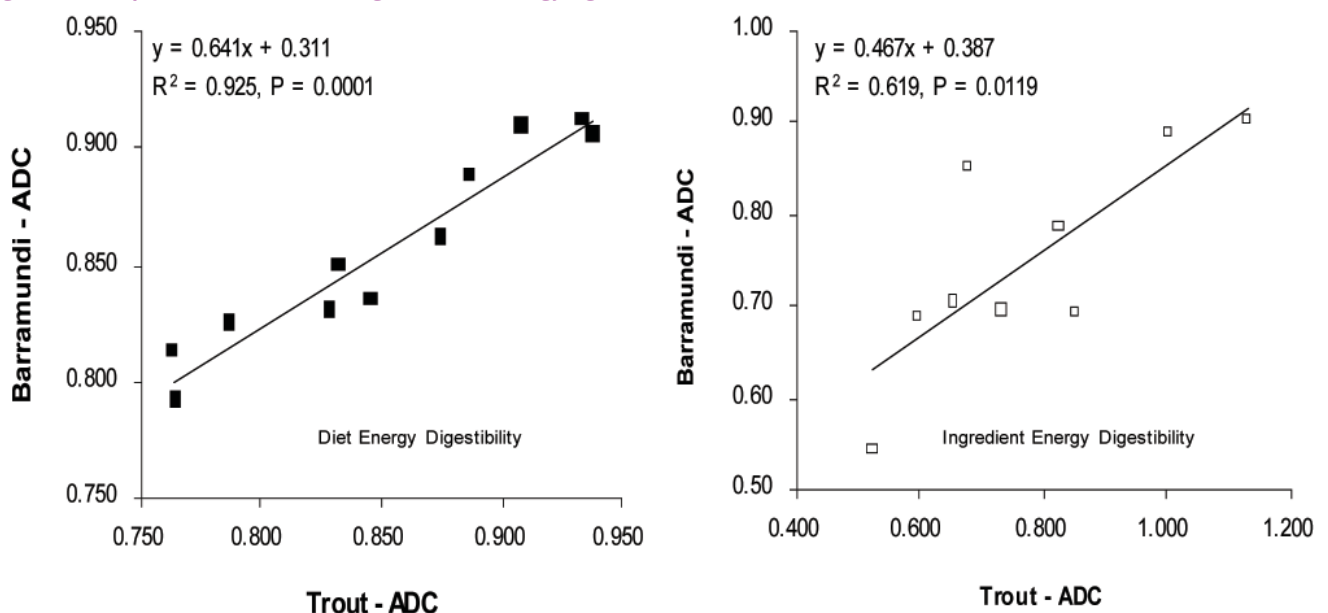
### Feed issues in ingredient digestibility assessment

Generally diets for digestibility assessments use an ingredient substitution approach, where test diets comprise the test ingredient plus a reference diet component. The reference diets used for digestibility studies with most aquaculture species have usually been practical diet formulations. The amount of the test ingredient that is included into a test diet usually varies from 20% to 50%, with 30% being the most typical of digestibility studies.

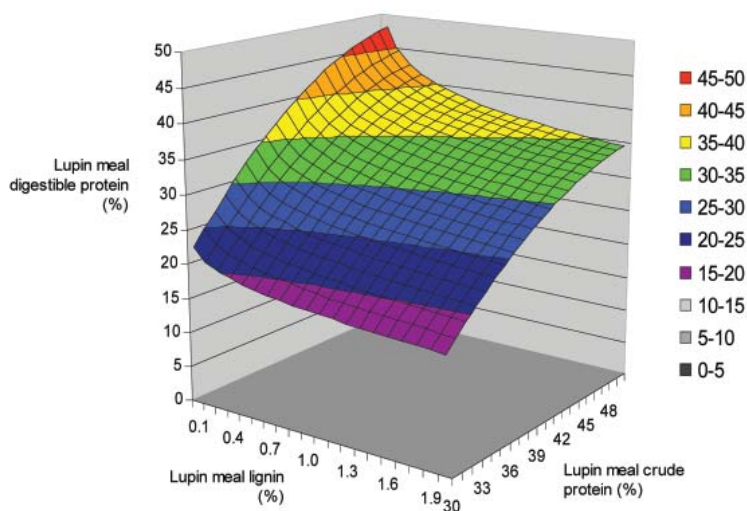
There are also potential benefits from examining the inclusion of a particular ingredient at more than one inclusion level as it allows the examination of potential interactive effects of ingredients within a feed formulation. This is especially important for plant protein sources where certain carbohydrates have been shown to exert some effects on the digestibility of other dietary nutrients.

A wide variety of marker types have been used in digestibility studies. While chromic oxide is perhaps the most commonly used marker, rare earth metal oxides such as ytterbium oxide, yttrium oxide and other rare earth metal oxides are gaining favour. Studies focusing on lipid utilisation have found favour with the use of hydrocarbon markers such as cholestane. Other endogenous markers such as acid-insoluble-ash and crude fibre have also been used, though they are somewhat less reliable and more prone to producing data with larger variance.

Figure 1: A comparison of diet (■) and ingredient (□) energy digestibilities when fed to either rainbow trout or barramundi (Asian seabass).



The modelled relationship between lupin kernel meal protein content and lignin content as it affects the digestible protein content of lupin kernel meals. Figure reproduced from Glencross et al. (2008a)



### Collecting faeces for digestibility assessment

There are basically three methods adopted by most researchers for faecal collection in aquaculture nutrition research; dissection, stripping and collection of voided faeces. Where faeces are collected by dissection or stripping, there is arguably the potential to underestimate digestibility because of incomplete digestion and potential contamination of faeces with endogenous material. In contrast, when faeces are collected from the water column or following settlement, there is the potential to overestimate digestibility because of leaching losses of organic matter. Generally it can be regarded that faecal stripping provides a more conservative estimate of both diet and ingredient digestibility than that provided using settlement techniques.

### Experiment management and species effects on ingredient digestibility assessment

Experimental conditions can also have important effects on the determination of diet digestibility and need to be managed accordingly. Key considerations include environmental conditions, fish size and feeding ration structure. For a more complete review of those considerations see the full review by Glencross et al. (2007).

The comparability of digestibility data across species has shown contrasting results. A study comparing the diet and ingredient digestibility of a series of diets and ingredients fed to rainbow trout and Atlantic salmon found a high degree of correlation between energy digestibility, and somewhat less correlation between protein digestibilities. Strong correlation has also been observed between diet and ingredient digestibilities from rainbow trout and Asian sea bass (Figure 1). It was suggested that the diet and ingredient digestibilities of a species such as rainbow trout could be reasonably applied to other carnivorous species like Atlantic salmon and Asian sea bass. However, how broadly this could be applied to other fish species (including other carnivores or even omnivores), or even the same species but comparing fresh and salt water remains to be tested.

**It is clear that the apparently simple process of ingredient evaluation is actually far from that. While this article briefly covers some of the elements to consider for ingredient characterisation and ingredient digestibility assessment, the next article will consider ingredient palatability, growth and utilisation assessments.**

### References

- Booth, M.A., Allan, G.L., Frances, J. and Parkinson, S. (2001) Replacement of fishmeal in diets of silver perch: VI. Effects of dehulling and protein concentration on the digestibility of four Australian grain legumes in diets for silver perch (*Bidyanus bidyanus*). *Aquaculture* 196: 67-85.
- Glencross, B.D., Booth, M. and Allan, G.L. (2007). A feed is only as good as its ingredients – A review of ingredient evaluation for aquaculture feeds. *Aquaculture Nutrition* 13, 17 – 34.
- Petterson, D.S., Harris, D.J., Rayner, C.J., Blakeney, A.B. and Choct, M. (1999) Methods for the analysis of premium livestock grains. *Australian Journal of Agricultural Research* 50, 775-787.



**Dr Brett Glencross** has a PhD in Aquaculture Nutrition and is the Principal Research Scientist for Aquaculture Nutrition at the CSIRO Division of Marine and Atmospheric Research in Australia. He has 15 years of experience in a broad range of aspects of aquaculture nutrition R&D in Australia, Asia and Europe. Email: Brett.Glencross@csiro.au.

VANNAGEN®

naturally supports...

- ... Performance
- ... Health
- ... Stress management

We have your performance in mind

Chemoforma Ltd. CH-4302 Augst Switzerland  
Tel +41 61 811 33 55 Fax +41 61 811 28 03

www.chemoforma.com

Are you sure I'm not missing a key essential nutrient?

# Yeast as immune-modulating agents in aquaculture: background and *in vitro* evaluation

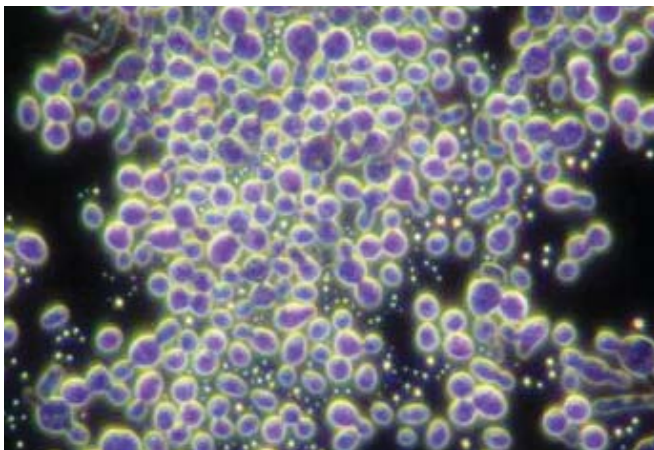
By Anja Ganner and Pedro Encarnação

**Work on the role of the yeast cell in immunostimulation in fish shows that different immune responses depend on the yeast fraction or purity of these products. However, the reason for the decrease in immune responses in fish with long-term oral administration of immune stimulants is still unknown.**

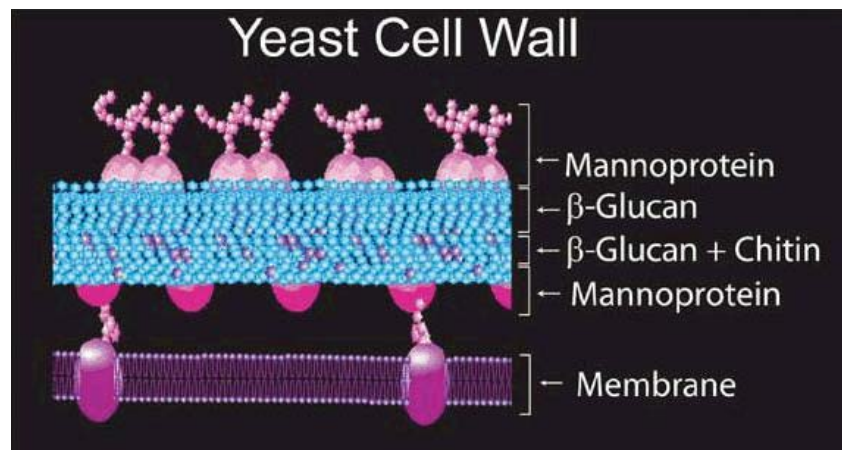
Worldwide, aquaculture production has expanded, intensified and diversified. Farmed fish and shrimp are normally cultured in enclosed spaces such as ponds or net cages and efforts have been made to increase productivity per unit space. Overcrowding along with environmental fluctuations, handling and poor water conditions tends to adversely affect the health of cultured fish. These conditions tend to produce poor physiological environment for fish and increase susceptibility to infections.

Various chemotherapeutics have been used to treat bacterial infections in aquaculture operations since the beginning of this new industry. However, the incidence of drug-resistant bacteria is becoming major problem. Vaccination may be probably the most effective method of controlling fish diseases. However, the immediate control of all fish diseases using only vaccines is impossible. As such, discovery, development, marketing and evaluation of animal health anti-infective products are at an important crossroad. From a clinical perspective, the emergence of drug-resistant pathogens makes the identification of novel and high quality antimicrobials even more important. Research in this area is becoming increasingly important for industry and science.

Immune stimulants have been recognised as promising supplements that potentially aid in disease prevention of farmed aquatic species. These substances increase disease resistance by regulating host defence mechanism against opportunistic pathogens present in the surrounding environment. Immune stimulants increase resistance to infectious disease, not by enhancing specific immune responses, but by enhancing non-specific defense mechanisms. Therefore, there is no memory component and the response is likely to be of short duration.



Yeast cells



Use of these immunestimulants is an effective means of increasing the immunocompetency and disease resistance of fish. Research into fish immunestimulants is developing and many agents are currently in use in the aquaculture industry.

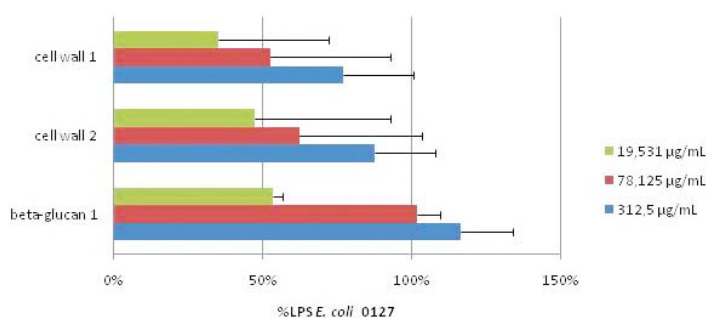
## β-glucans

Yeast products and in particular β-glucans are seen as the most popular source of immunestimulant substances (Sakai, 1999, Gatesupe, 2007). These substances have been described to have immunomodulatory properties enhancing antimicrobial resistance by activating various points of host defense mechanisms. Activated macrophages secrete reactive oxygen and the bactericidal nitrogen metabolite NO and O<sub>2</sub> radicals, which are able to attack extracellular pathogens such as bacteria, parasitic worms or intracellular pathogens that survive phagolysosome fusion.

Macrophages and phagocytic cells have a vital role in many aspects of the immune response in fish. There are two killing mechanisms in fish phagocytes: the oxygen dependent and oxygen independent system, both of which lead to digestion of the phagolysosomal content and elimination by exocytosis. The oxygen dependent system consists of several oxygen and nitrogen free radicals, which are produced during the process known as respiratory burst. These compounds are extremely microbicidal because they are powerful oxidizing agents which oxidize most of the chemical groups found in microbial proteins, enzymes, carbohydrates, DNA and lipids.

However, as the role of various components of the yeast cell (see photo) is increasingly understood, interest in yeast extracts and the whole yeast cell has increased. This interest is from new findings that whole cells or extracts contain other potential immune stimulant substances such as chitin, chitinase, nucleotides, mannan-sugars and

**Figure 1 – Changes on NO production in macrophages cell line (HD11) following *in vitro* incubation with increasing dosages of different immune-stimulants.**



manno-proteins rather than only the well recognized immunostimulant  $\beta$ -glucan (Sakai, 1999, Gatesupe, 2007). Concomitant, increases in performance and stress tolerance, increased diet palatability and reduction of mortality have also been described.

## NO-production and immune modulators

Recently, Biomin's R&D department conducted several studies to investigate yeast derivatives as immune-modulators, in particular for their ability to activate macrophages.

Different yeast extract products have been evaluated (beta-glucans, cell wall, nucleotides). Initially, an *in vitro* assay using a chicken bone marrow-derived macrophage cell line (HD11) transformed by a retrovirus (MC29, v-myc oncogene) was used to test macrophage activity by measuring their NO-production. From the initial tests it could be shown that 3 of 6 beta-glucan products and 8 of 13 yeast cell wall samples stimulated HD11 up to 100% of the positive control; the other 3 beta-glucan products and 4 yeast cell wall samples up to 50% of the positive control. Three out of 6 yeast nucleotide products also stimulated HD11 up to 100% and another nucleotide product showed a stimulation of 50% of the positive control.

These results highlighted the fact that not all yeast extracts or derivatives have similar performance regarding immune modulation functions (Figure 1). A well documented class of immunostimulants currently in use in the aquaculture industry is the  $\beta$ -(1,3)-glucans, and the common structural trait for these is a  $\beta$ -(1,3)-linked chain of glucose units (Sakai, 1999). The main chain has  $\beta$ -(1,6)-branched glucose units. The length and frequency of these branches vary depending on the different sources, as does the length of the main chain (Bohn and BeMiller, 1995). As such it is comprehensible to see different immune response depending on the yeast fraction or purity of these products and this should be considered by the manufacturer and user of such products.

A posterior study in cooperation with Dr. Galina Jeney (HAKI Institute in Hungary) focused on the *in vitro* effect of several immune-substances on non-specific immune system activity of common carp (*Cyprinus carpio*). Target were the burst activities (oxygen burst and nitrogen burst activities) in immune cells (macrophages) from blood and head kidney. All of the tested substances modulated the nitric oxide in macrophages isolated from head kidney except nucleotides. In the case of cells isolated from blood we could not detect any positive changes neither in NO nor in toxic oxygen production.

These studies revealed that yeast derivatives are potent NO-inducers in macrophages. This might improve animal and aquaculture health by alerting the immune system and to prepare it to respond quickly

to infections and to counteract the effects of weakened immunity, especially in critical transition and stress periods.

*Use of immune stimulants, in addition to chemotherapeutic agents and vaccines, has been widely accepted by fish farmers. However, many questions about the efficacy of immune-stimulants from users still remain for example, whether immunostimulants can protect against all major infectious diseases is one of the most pertinent that still has no specific answer.*

## Long term effects

In addition strategic use and application methods are another important issue. Oral administration is the most practical method for delivery of immunostimulants. However, the effects of long-term oral administration of immunostimulants are still unclear. Many authors have reported declined immune-response after long-term application of different type of immunostimulants. Matsuo and Miyazano (1993) reported that rainbow trout treated with peptidoglycan orally for 56 days did not show protection after a challenge with *V. anguillarum*, although fish treated for 28 days showed increased protection.

Yoshida et al.1995 also demonstrated that the number of NBT-positive cells in African catfish increased following oral administration of glucan or oligosaccharide over 30 days, but not over 45 days. Similar findings were obtained in our research tests at the Aquaculture Center for Applied Nutrition (ACAN) in Bangkok when testing the effects of different immunostimulant substances on growth performance of Asian seabass (*Lates calcarifer*) and white shrimp (*Litopenaeus vannamei*). Galindo-Viegas (2005) reported that intermittent application (15/15) is preferred to long-term, continuous application. Our in house research also seems to indicate that intermittent application of such substances could be more appropriate than long term application.

Although the reason for these decreases in immune responses in fish by long-term oral administration of immunostimulants is still unknown, negative feedback systems against immunostimulation may function in fish, and the immune response may revert to a previous state. Thus, the effective administration period should be investigated for each immune stimulant.

*References are available on request from the authors*



**Anja Ganner** is R&D Manager in the Biomin Research Center in Austria. Since 2007, her main research areas are *in vitro* and *in vivo* evaluation of yeasts and yeast derivatives, feed supplements, animal nutrition, microbiology and immunological cell culture assays.

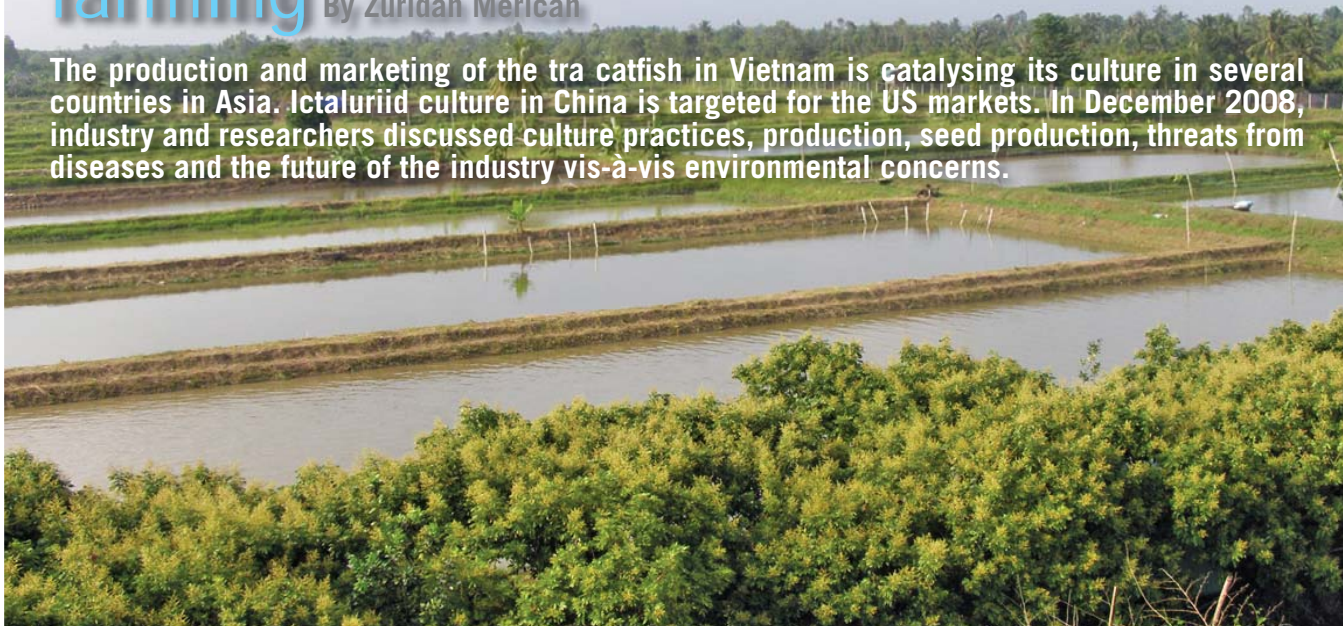


**Dr. Pedro Encarnação** is Aquaculture Specialist for Biomin. Based in Singapore and responsible for Asia, Pedro has an extensive background in aquaculture and nutrition and has conducted several research projects focusing on the improvement of feed formulations for aquaculture species. Email: pedro.encarnacao@biomin.net

# Industry analyses tra and other catfish farming

By Zuridah Merican

The production and marketing of the tra catfish in Vietnam is catalysing its culture in several countries in Asia. Ictaluriid culture in China is targeted for the US markets. In December 2008, industry and researchers discussed culture practices, production, seed production, threats from diseases and the future of the industry vis-à-vis environmental concerns.



Nursery and broodstock ponds at the Caseamex farm in Vinh Long

The rapid access to global markets of the tra catfish *Pangasius hypophthalmus* from Vietnam since 2003 is creating waves and this led to the rapid expansion in production with intensive culture methods. How it has reached numerous markets is catching the attention of several countries where the species or related *Pangasiids* is farmed, albeit at lower levels of intensity. Industry in the Phillipines, Malaysia and Indonesia wants to emulate Vietnam's success but wants to avoid the negative perceptions, that Vietnam has received from international markets. These are not only on quality, food safety, traceability but also its impact on the ecosystem of the Mekong. Nevertheless, the catfish family is a now a 'hot' group of freshwater fish comprising of the *Pangasiids* mainly in Vietnam, India, Bangladesh, Malaysia, Indonesia, Cambodia and Myanmar, *Clariids* in Malaysia, Thailand and Indonesia (*Clarias macrocephalus* and its hybrid *Clarias macrocephalus* x *C. gariepinus* and the *Siluriformes* and *Ictaluriids* in China.

In early December 2008, 195 participants of the International Symposium on Catfish Aquaculture in Asia gathered in Cantho City, the heart of catfish farming in Vietnam to review culture practices, seed production, health management, genetics and biodiversity, physiology and nutrition, certification, standards and environment impacts in the catfish industry of countries in Asia. A considerable amount of the research output was from Can Tho University (CTU). The status of catfish farming in Vietnam, India, China and Nepal were given. In the keynote speech, **Prof. Sena de Silva**, Director General of the Network of Aquaculture Centres in Asia and Pacific (NACA) said that public perception on the environmental impact of aquaculture has focused on farming salmonids and the marine shrimp. All farming systems to produce food have an impact on the environment and tra farming is no exception. The yield from tra farming is 64% of total European aquaculture production and is the highest yield/area for any

aquaculture system. At the FCR of 1.4, the nitrogen input into the water is substantial. The message is that there should be an ecosystem approach in farming. The meeting was organized by CTU, together with NACA and ASEM Aquaculture.

## The tra today

In 2007, during the Catfish Symposium in Ho Chi Minh City, **Dr Nguyen Huu Dung**, Vietnam Association of Seafood Exporters and Producers (VASEP) said that this fish is the 'Cinderella' of industry in Vietnam which catapulted freshwater fish production and brought social and economic changes to the community in the Mekong Delta. Increasing volumes with intensification of culture has had the effect of haphazard farm gate prices, often below costs of production especially when costs of production increased in 2008 with high feed costs. Some 640,829 tonnes of fillet was exported from 1.3 million tonnes of fish in 2008.



Participants after the tour to Caseamex's catfish farm, hatchery and processing plant.

The catfish export was valued at USD 1.45 billion, second in value to that for the marine shrimp at USD 1.61 billion (Vietfish International, February 2009).

Three situations led to the current status of industry in Vietnam, the establishment of seed production facilities following success in artificial propagation techniques in 2000, development of export markets and development of feed processing facilities. Industry was also helped by supportive policies of the government, said **Nguyen Thanh Phuong** of CTU. Overall, the progress of the industry has been gigantic but this came with doubts on its sustainability. The world's catfish aquaculture trend is to guarantee food safety and sustainable aquaculture and this is also the aim of industry in Vietnam.

### Seed production

The capacity of 93 hatcheries was 52 billion fry in 2008, increasing from only 28 billion in 2007. Demand is high in mid year and production stops from October to December. **Le Xuan Sinh**, CTU, reported on a survey carried out with 33 farms in the Mekong Delta conducted from June 2007 to June 2008. The factors affecting seed production were frequency of breeding, tank capacity and costs of chemicals. Some 21% of grow out farms have nursery facilities. With the increased demand, hatcheries used four breeders instead of two at a time. The average survival from fry to market size fish was 76.2% using an average stocking density of 43.5 pcs/m<sup>2</sup> (instead of the recommended 25 pcs/m<sup>2</sup>). Seed costs ranged from VND 670 to 829 each (USD 41-51/1000) and represented only 7% of costs of production. Farmers prefer 2cm fry which gives them a lower yield but better profits.

With the intensity of production, improvements in seed quality and production efficiency are required, said **Duong Nhut Long**, CTU.

The feasibility of using wild brood stock matured in ponds and fed commercial diets containing 32-36% protein was demonstrated. With induced spawning, fish spawned completely and hatching rates were 83.4 to 85%. Survival from larval to fingerling (1.2cm) ranged from 18-25% after 45 days. Overall there is need to develop a more scientific basis in hatchery management as factors affecting seed performance are temperature, turbidity and pesticides from rice fields, said **Ben Belton**, Stirling University, Scotland. Farmers perceived that seed produced by public hatcheries are better than those of private hatcheries. Business relationship is important and there is a preference for local seed stock from reputable hatcheries. He added that the use of brood stock is seasonal and it can range from a ratio of 1:1 (male:female) to 1:9 or an average of 1:3. Spawning is 9 times over a 3 year period or 5-6 times/female/year.

### Changing grow-out methods

Since 2000, there have been changes in the culture of catfish, said **Nguyen Thanh Phuong**, CTU. Grow-out in production ponds start either with 1-1.5 month old fry or 3 month old fingerlings. The rearing period is 6-7 months for the former and 5-6 months for the latter. Culture is mainly in ponds which allows for better management of water quality and culture environment. Large farms use only commercially extruded pellets throughout the production cycle and smaller farms use a combination of pellets and farm made feeds.

The critical aspect in catfish farming is the low profit margin (USD 0.134/kg) which is extremely price sensitive and is linked to the price of feed which is 72.6% of total production cost of USD 0.70/kg. Overall, the progress of the industry has been gigantic but there are doubts on its sustainability. Too high stocking density has led to risks with



# FISH FORM<sup>®</sup>

## for high quality fish meal



### Studies with FISHFORM show:

- effective preservation of fish and offal
- strong antimicrobial effects
- high quality fish meal & optimized nutrient contents

[www.addcon.net](http://www.addcon.net)

**Distributors wanted!**

For further information please contact:

**ADDCON GROUP GmbH**  
Kaiserstr. 1a • D-53113 Bonn • Germany  
Tel.: +49 228 91910-0, Fax: +49 228 91910-60  
eMail: [info@addcon.net](mailto:info@addcon.net)



the environment. Nguyen Thanh Phuong said in Vietfish International (February, 2009) that a feasible solution is to adjust stocking density and followed by solutions to cut down on production costs, especially feed costs.

### Feeds and nutrition

Improvement of the nutrition and feed management of the tra catfish is a key priority to improving production efficiency, said **Brett Glencross**. The main aim of the ACIAR (Australian Centre for International Agricultural Research) project at CTU has been to develop and improve diets based on locally-available ingredients. The project comprised collection of >1000 samples for a database of ingredients and determination of digestible value of key ingredients. Results showed that the fish can derive digestible energy well from starch and thus can use low cost, low-energy density diets. The project showed that using a bioenergetic approach the demands for dietary energy and protein can be defined. A model was developed to estimate optimal feed designs and feed rations and significantly improve production efficiency.

Usually, the crude protein content in locally produced commercial grow-out pellet for the tra catfish is 22-26%. When the farmer looks for less expensive feed, this means a lower protein diet. **Nina Meilisza**, IRD LR-BIHAT, Depok, Indonesia said that this is often equal to lower protein-energy (PE) ratio in the diet. A previous finding (Moreau et al. 2008) showed that growth of *P. hypophthalmus* juveniles was similar at two different PE ratios as long as protein supply is the same. In an experiment with six diets of increasing PE ratio, 17 to 28 mg CP/kJ, fed to juveniles ( $1.13 \pm 0.04$  g) at a rate of 23.8g CP/kg for 35 days, growth rate did differ among treatments. However, FCR was negatively correlated to dietary PE ratio. Body fat increased with lower feed protein content. It was concluded that utilisation of such diets may be justified if their price can compensate the higher cost associated to a higher FCR. However, the fish farmer must be aware of the effects on quality of flesh with changes in diet.

On the effect of feeding levels, **Ediwarman**, BBAT, Jambi, Indonesia showed that final body mass and growth rate were significantly affected by feeding levels and reached a maximum for 60g/kg/day or higher feeding level. During grow-out from 20g to 90g in hapas, fish were fed for 70 days, two equal meals five days a week. FCR increased more or less linearly with feeding level and did not plateau. The fillet yield was

maximum at 45-60g/kg/day but feeding level had a less pronounced effect on abdominal fat. The optimal daily protein calculated from the study was 19-19.9g protein per day. **Dr Nguyen Nhu Tri**, Nong Lam University showed that feeding frequency had an effect on FCR. Feeding fish 4 times a day significantly improved FCR to 1.80, as well as the growth rate in comparison to feeding twice a day.

Despite the availability of extruded feeds, some farmers alternate with farm made feeds containing rice bran. **Le Thanh Hung**, Nong Lam University, reported that oxidation of the lipid in rice bran is a problem in Vietnam with its high temperatures and humidity. Peroxide levels increased with the inclusion rate of preserved rice bran, as it replaces fresh rice bran in diets. The increased peroxide did not have any effect on fish growth and survival rates but effected fish intake and feed efficiency. A high level of peroxide in the diets resulted in increased adipose fat and liver weight. The colour of fish fillet and liver at the end of the experiment was yellow with diets with high peroxide levels. Rice bran and plant meals such as soybean and cassava meal comprise 80-90% of the feed ingredients in feeds for the catfish. In experiments with phytase supplementation, Dr Hung showed that 1500 PYT increase growth performance and feed utilization and also increased mineral, calcium and phosphorus content of bone.

The lack of information on the nutrition of the catfish requires more research. **Philippe Serene**, Proconco said that the best FCR of 1.2 is still relatively high as compared to that reported for the American catfish. Further work in this area is required to bring down production cost. To reduce feed costs, **Dr Yann Moreau**, IRD, Indonesia showed results on trials with maggots and palm kernel meal in semi moist feeds for *P. djambal*. Palm kernel meal can replace 13-16% of fish meal. It will provide 22% protein without any affect on growth.

## The tra in future

### Markets expansion

**Dr. Nguyen Huu Dzung**, VASEP, in his review said that the production of tra has increased to 1.3 million tonnes from a farming area of 6,000 ha. There are 80 processing plants to support the industry. Markets have been expanded to match increases in production. Pangasius fillet exports have been increasing because of competitive prices and as an alternative to depleting supplies of white fish from capture fisheries. The European Union is the single largest market at 30% of volume

# Reveal the Hidden Potential



## **NUPRO**<sup>®</sup>

In today's world of uncertainty and rising feed costs, maximizing aquaculture lifetime performance is vital.

NuPro<sup>®</sup> can help reveal the hidden potential of your shrimp and fish, leading to improved performance and profitability  
*...naturally*

For more information on NuPro, e-mail: [aquasolutions@alltech.com](mailto:aquasolutions@alltech.com),  
log on to [www.alltech.com](http://www.alltech.com) or contact your local Alltech representative.

**Alltech**<sup>®</sup>  
*...naturally*

Proud sponsor of the



**Alltech FEI** World Equestrian Games 2010™

[www.alltech.com](http://www.alltech.com)

and Russia absorbs 18% of the exports. Newer markets are China and Hong Kong.

Year 2008 was a difficult year for the industry which faced issues mainly in food safety, labeling and trade frauds, traceability requirements and the declining prices for the product in importing countries. It also had to overcome higher requirements of importing countries on environmental issues and social responsibility. In trade, there were the trade name issue and the US antidumping tariffs, imposed in 2003 and which remains in force. Glazing of up to 30%, sometimes at the request of importers, has damaged the image of the industry. During production and processing, the industry had to deal with differences in processing requirements depending on markets, unstable quality and rejections, food quality assurances, competitiveness in the industry, use of antibiotics to combat diseases, high feed prices, low seed quality and breach of contracts between processor and farmers.

“Vertical integration is increasing where the processor has hatchery, feed facility and farms. However, in general, the requirement for farm to fork traceability in the majority of small farms is not easy to achieve but has to be implemented during the next five years. Improving product safety and quality with enriched omega 3 fatty acids, branding, environmental management policies and increasing social responsibility of enterprises will be required”, said Dr Dung.

**Disease management**

High levels of bacterial infection is common because of the high density (40-50 fish/m<sup>2</sup>) and bad water quality from waste feed, according to **Truong Thy Ho**, Kasetsart University, Thailand. In the Mekong Delta,

*Edwardsiella ictaluri* is the major cause of bacterial diseases. The bacterial isolation conducted from pond cultured tra catfish consisted of *Edwardsiella ictaluri*, *Aeromonas hydrophila* and unidentified pathogens. Tests showed that the effective antibiotics against *E. ictaluri* were ciprofloxacin, amoxicillin, ampicillin, florfenicol, doxycycline and oxytetracycline. Some degree of resistance was with licensed drugs such as OTC and FFC.

Until 2006, chloramphenicol was used for treatment of diseases but since 2007, this has dropped to 20% said **M. Crumblish**, Stirling University, Scotland. This was the result of the rapid decrease in antibiotic sensitivity and the encouragement given to farmers to test for antibiotic sensitivity. Farmers are also encouraged to use therapeutic doses at the right time. They are trained to realize that without this practice, resistance will develop.

In the Mekong Delta, increasing severity of bacterial infections such as white spot disease is a major concern. Fish were emancipated with hemorrhages on the tail, fins and rest of body. Internally, there were white spots on swelling liver, kidneys and spleen. Biochemical tests and PCR analyses showed that the bacterial pathogen *Edwardsiella ictaluri* is a major causative due to this WSD, said **Dang Thi Hoang Oanh**, CTU. The next step in her study is molecular characteristics of the bacterium to develop antibacterial therapeutics. One of the reasons for ineffective treatment is the slow conventional bacterial culture to diagnose the pathogens. The polymerase chain reaction (PCR) technique takes only a quarter of the normal time to detect *E. ictaluri* as compared to the biochemical test. It is less expensive and more accurate. Thus these protocols can be very useful for diagnostic purposes and subsequently for effective prevention and treatment of the disease.



The Caseamex Hatchery, located in Phu Thanh Commune, in Vinh Long was set up in 2008 and has a production capacity of 500 million fry. Some 50% are sold and the rest are reared in the 23 nursing ponds of 2,000m<sup>2</sup>/pond for the company's farm. The farm uses 30-60 million of 15-20g fingerlings for its farms. It has 6 brood stock ponds totally 9,000 m<sup>2</sup>. The seed production season is from February to October The hatchery employs 9 technical and 100 workers.



From Left, Tran Doc Dinh, Tran Thi Thanh Hien and Nguyen Thanh Phuong, Can Tho University

In a study to develop vaccines for WSD in the tra, **Nguyen D. Thu**, RIA 2, reported that Ictaluri vaccine from formalin-killed cells in alum adjuvant were suitable and effective for tra catfish. However, more experiments should be done such as the determination of vaccine safety and efficacy of vaccine on a farm level to ensure that his kind of vaccine can be used for preventing WSD. Studies on immune responses showed that the catfish can specifically respond against inactivated *E. ictaluri* and injections of two bacterin result in higher and longer production compared with one injection. The effective dose was determined.

The yellow flesh syndrome also causes economic losses as fish have yellow flesh as well as bright yellow gills, yellow to green liver and dark spleen. A study showed that the characteristics of the disease in 20 farms identified no bacteria or parasite as causative agent but it did indicate a reduction in erythrocytes, said **Tu Thanh Dung**, CTU. In humans, the liver and blood status is a measure of the presence of pathogens. Similarly, **Xavier Bocquillet**, Quali Service applied this to the catfish and showed a clear correlation between certain white blood cells and liver status. Neutrophils show liver disorder and this information can be used in future to advise farmers and improve productivity.

**Environmental integrity and sustainability**

As the industry employs 100,000 persons with considerable investments by the private sector, it does need to address issues of environmental integrity according to **Phan Thanh Lam**, Research Institute for Aquaculture No 2. The current practices in culture need to be improved in Vietnam and risks factors identified for sustainable development of the catfish farming. In preparation for a development of best management practices (BMPs) in seed supply, water and disease management and technical skills, a study covering 50 farms in Dong Thap and Vinh Long showed that the basic skills of farmers are either inherited, procured at training centres or through self learning. Majority of farms (52%) are small farms and 38% are less than one hectare in size. Fluctuating prices have stopped operations of 30-40% of these farms. Most farms exchange water regularly without treatment and 83% of farmers believe that diseases occurrences are associated with this practice.

The impact of water quality in production systems and on the environment was covered in a study by **Vu Ngoc Ut**, CTU. Three culture



From Left, Tran Ngoc Hai and Dang Thi Hoang Oanh, Cantho University and Dirk Lorenz-Meyer, Thailand.

systems in An Giang, Can Tho and Hau Giang were categorised by the production scales based on the number of culture ponds and with and without discharge areas. The big scale system with discharged area was system 1, the big scale system without discharge area was system 2 and the small scale system without discharge area was system 3. Big scale systems had many ponds with the area of 1,500- 9,000m<sup>2</sup> each. The small scale system contained only 1-2 ponds of 2,500m<sup>2</sup> each. Sampling of water three times during the production period showed that most parameters were within the acceptable range with the exception of total nitrogen and total phosphorus. Dissolved oxygen did not drop below 5mg/l. High levels of BOD were often measured at certain periods. Treatment measures to reduce nitrogen are essential.



Three decades old GMP, ISO & HACCP certified Group engaged in the manufacture of nutritional and healthcare supplements for Aquaculture is looking for business associates in the Asia Pacific Region on attractive terms.

The range of products include :

- Immunostimulants
- Feed & Pond Probiotics
- All natural antibacterials
- Nucleotides,
- Enzyme complexes etc.

**ZYMONUTRIENTS PRIVATE LIMITED**  
 A-114, Industrial Estate, Hebbal, Mysore – 570 016, India.  
 Tel : +91-821-2540144, 2512686  
 Fax : +91-821-2516819, 4289609  
 E-Mail : zymo@zeusindia.net



Dr Mohd Azmi Ambak (left) and Dr Annuar Hasan (right), University Terengganu Malaysia and Ediwarman, Indonesia (centre).

Reduction of concentration of ammonia, nitrite, nitrate and total nitrogen was possible with isolates of *Pseudomonas stutzeri*, said **Dang Thi Be**, CTU.

Catfish farming also generates vast amounts of effluent including nutrient enriched waste water and sediment. These are discharged into the natural ecosystem without treatment. **Phan Quoc Nguyen** said that a survey indicated sediment thickness was 10cm per month and is rich in nutrients. Using the sediment as a natural agricultural substrate will reduce the environmental impact from the discharge of waste

sediments into the environment. The sediment produced twice the yield of spinach in comparison with using local agricultural soil.

Probably the greatest impact of climate change will be in deltaic regions and in areas with a high level of aquaculture activity such as the Mekong Delta. Dr Sena de Silva said that the impact will be through the sea level rise in the delta, at 1 cm/year, reduced river flows and degree of salinity intrusion. Global warming effects in the delta will be water flow reductions by 2-24% in the dry season and 7-15% in the flooding season. Vietnam has launched irrigation projects to prepare for these changes as well as civil society projects with the Government of Finland to reduce risks and adapt to climate change.

### Certification and standards

The discussions centered on the World Wide Fund (WWF) pangasius dialogue on developing certification standards to minimize or eliminate the impacts of its aquaculture. At the first Pangasius Dialogue in September 2007, 8 main issues were identified. These were: legal compliance, land and water use, water pollution, escapes (later renamed genetics and biodiversity), feed management, health management, antibiotics and chemical use, social responsibility and social conflicts. Principles to address each issue were identified and criteria on which the standards were to focus were drafted and discussed at the second meeting of the dialogue held prior to the meeting.

### Integrating seed production to processing

*A full control of the production chain from seed production to processing allows Caseamex to comply with market demand for food safety and environmental issues. This is a step to be a responsible catfish producer.*

Cantho Import-Export (Caseamex) became a joint stock enterprise in 2006. Formerly, it was CATACO (Cantho Import Export Animal Husbandry Company). It started with a plant for the processing of tra catfish into frozen and fresh fillet, black tiger shrimp and freshwater shrimp in Cantho City in the Mekong Delta. In 2007, a new processing plant with a capacity of 300 tonnes/day was added. Products are exported to the US, EU, China, Malaysia, Singapore, Middle East, Russia and Australia.

Caseamex has four grow-out farms in various locations in the Delta to supply raw material for its processing plants. In 2007, these totalled 60 ha and in 2008, this was increased to 120 ha. The total production is 30,000 tonnes/year. The goal is to expand the farm area to 200ha in the future. In ponds of 7,000 to 10,000m<sup>2</sup>, production is 300 tonnes/ha/crop of 1 to 1.2 kg fish. The stocking density of 15-20g fingerlings is 30-35/m<sup>2</sup>. Survival rate is 75-80% and FCR range from 1.50 to 1.65. Vo Dong Duc, Director said that these supply a small part of the total requirement for raw material. The company participates in the Clean Fish program to keep records during production. This is important as producers now have to supply to authorities in importing countries documents indicating traceability.



Filleting fish at the new processing plant

# The catfish in India and China

## Catfish in India

India is the next largest producer of the catfish *Pangasius hypophthalmus* in Asia. In 2008, production was between 180,000 to 220,000 tonnes. Culture is mainly in Andhra Pradesh and West Bengal. The fish is seen as an alternative to farming the Indian major carps and is favoured because of its hardiness and fast growth, said **Flavio Corsin**, World Wild Life Fund, Vietnam in the presentation 'Present and Future of Pangasius farming in India'. The present system of culture appears to be eco friendly and sustainable.

Farming is mainly in three districts in Andhra Pradesh and in carp ponds, without any modification. Ponds are large at 2ha each and deep at 2-2.5m. In general, stocking density is low at 1-2 fingerlings of 100-200g each but some farmers have been successful with stocking 10 fingerlings/m<sup>2</sup>. The culture period is 8 months and above. The preferable market size is 1-1.5kg. Whole fish is usually gutted and sold fresh in the northern and north-eastern markets. Fish are fed farm made feeds comprising a mixture of de-oiled rice bran, broken rice and maize, placed in perforated bags in a line along the middle of ponds. Water exchange is low and survival is high. Industry said that whilst these practices resulted in good harvests, FCRs were high leading to deteriorating pond bottom and increased occurrences of parasites and disease. Culture periods became longer and the risk of crop losses more common.

Opportunity to increase the present production in 40,000ha of



All photos courtesy of Bharat Luxindo, India

# AQUA FARMING INTERNATIONAL

## VIGO 2009 · 16-19 SEPT · SPAIN

AQA 2009: innovation, research and development and the latest technology, products and services

[www.aquafarminginternational.com](http://www.aquafarminginternational.com)



From September 16th-19th, Vigo will play host to the first AQA 2009 - Aqua Farming International Exhibition - at the IFEVI Exhibition Centre, Vigo, Spain.

AQA 2009 will be co-located with the World Fishing Exhibition and a range of international conferences and seminars including the Fifth Fisheries Ministers Conference, a Sustainability Summit and an Aquaculture Conference supported by the European Aquaculture Society.

No other event will attract such a quality audience that spans from ministerial level to manufacturers to local farmers.

If you are involved with aquaculture, you must be at AQA 2009.

The international meeting point for the global aquaculture industry

For more information or to register online visit [www.aquafarminginternational.com](http://www.aquafarminginternational.com)

**Maria Rybak-Rendell**/International Sales Manager  
 mrybak-rendell@worldtradeexhibitions.com  
 Direct Line: +44 (0)1329 820495  
 Mobile: +44 (0)7717 376152  
 The Old Mill, Lower Quay, Fareham,  
 Hampshire PO16 0RA, United Kingdom

**José Francisco Alfaya**/Sales Manager Spain/Portugal  
 jfa@worldfishingexhibition.com  
 Tel. +34 986 447 485 (ext. 1009)  
 Mobile: +34 637 817 925  
 Poiccarpo Sarz 22, 3º Dcha. 36202 Vigo, Pontevedra, Spain





ponds to 500,000 tonnes is with improved and standardised culture methods and development of hatchery technology to meet the demand for seed stock. The catfish could play a role in increasing supply to meet the demand for fin-fish domestically and for potential export markets. However, issues in the industry are the variation in size at harvest which is unsuitable for fillet processing.

Pelleted or extruded feed is essential with intensification. With the recent introduction of pelleted feeds, farmers have noticed an overall improvement in the health and appearance of the fish within the first two weeks of using the feeds. Pond conditions have also begun to improve due to better FCRs. Little by little, the farmers here are beginning to see and acknowledge the benefits of using pelleted feeds and this bodes well for the future of the industry.

Farmers also need to adopt the suggested best management practices and certification to be able to market internationally. The vision is to build an Indian brand that is eco-friendly and sustainable. The export potential is USD 450 million with 150,000 tonnes of fillet valued at US 3.0/kg.

### Ictaluriids and Siluriids in China

The channel catfish *Ictalurus punctatus* was introduced several times into China since 1978. The latest introduction was in 2007 with one million yolk sac eggs, said **Wang Wei Min**, Fisheries College of Huazhong Agricultural University Wuhan, China. Artificial propagation was successful in 1987 with 500,000 fingerlings. The major areas of production are Sichuan, Hunan, Anhui, Jiangsu, Hubei and Jiangxi. Production has been increasing in the last five years. The annual production was estimated at 150,000 tonnes in 2008, up from 120,000 tonnes in 2006 (Infoyu, 2007). This was closely related to rising exports to the US with the exception of 2007, when the US imposed a ban on catfish imports following reports of contamination with banned chemicals. Its domestic consumption was reported to be increasing in December 2008 with rising incomes to more than 30% of production.

Production is mainly from polyculture in ponds with grass carp, big head carp and black carp and monoculture in cages. Serious problems with diseases ranged from CCV (channel catfish virus), ESC, columnaris diseases to intestinal intussusceptions, sometimes with losses of 50% of the stock. Although research is ongoing on catfish

diseases, an improved and standard culture technology is more helpful to the effective prevention against fish diseases, said Wang.

China has exported 12,000 tonnes of the catfish to the US in 2008, which is 30% of the latter's imports of catfish. Ictalurus exports to the US were 7606 tonnes in 2006 (Infoyu, 2007). Wang said that the international market, in particular the US market is attractive but the family oriented farming must move to a higher corporate level to produce catfish of higher quality and adhering to food safety requirements.

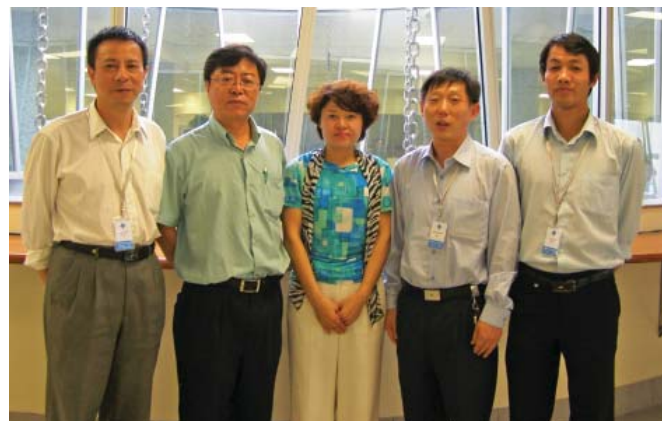
The small sized yellow catfish *Pelteobagrus fulvidraco* is commercially cultured for its high dress-out weight, few intramuscular bones and taste. The domestic demand is rising and prices have been on the increase too. The fish is also exported to Japan and Korea and currently supply does not meet demand, said Wang. Usually 20-day old fry are kept in nursery ponds at a density of 450,000~750,000 fry/ha. Fingerlings of 20g are stocked into grow out ponds after 6 months and are harvested at 100–200 g for females and 50–100 g for males after a year of farming. The market size for yellow catfish is above 50g per fish.

The carnivorous southern catfish *Silurus meridionalis* is cultured in the Sichuan, Guangdong and Jiangxi Provinces, because of the environmental requirements for 25-28°C, said **Dr Yang Yi**, Shanghai Ocean University, China. The annual total production of southern catfish reached about 300,000 tonnes in 2007. Larval rearing is in earthen ponds, cement tanks and cages with varying stocking densities from 100/m<sup>2</sup> in the 300-1600m<sup>2</sup> ponds to 2,000 to 2,500/m<sup>2</sup> in 3mX1mX1m cages. Fingerlings are weaned onto artificial diets at 5cm. Grow-out production is in ponds, cages, flow-through culture and in integrated rice-fish culture systems. Prices are USD 1.83 to 1.98/kg. Issues in its culture are quality of seed due to limited genetic pool.

**Gao Qiping**, Sichuan Aquacultural Engineering and Technology Research Center, Tongwei Co. Ltd, China said that 90% of production is with feeding trash fish and 10% with pellet feeds. Efforts are ongoing to use floating pelleted feed. Trash fish at USD 0.44/kg is preferred to the 40% crude protein pellets (USD 1.26/kg). With a final size of 150g, Gao reported no difference in growth when either type of feed is used. The next step is to conduct tests on flesh quality in fish fed pelleted feeds.

### Reference:

*Catfish Aquaculture in Asia: Present status and challenges for sustainable development. Handbook and Abstracts, Can Tho University, Can Tho City, Viet Nam. 138p.*



From left: Wang Weimin, Huazhong Agricultural University, Yang Yi, Shanghai Ocean University, Gao Qiping, Tongwei Co Ltd and Miao Weimin, FAO and Jinniao Zha, Chinese Academy of Sciences

# Innovations for sustainability of seafood supply

by Jan Koestling



*A seabream hatchery in the Mediterranean*

**As aquaculture fills the gap in the global fish supply, there is a need to develop cost-effective, intensive production methods with high yields of healthy fish and shrimp. The vital link is innovations in aquatic health and culture management to ensure long term sustainable production in Asia.**

Those in seafood production often quote the management guru Peter Drucker, who predicted “Aquaculture, not the Internet, represents the most promising investment opportunity of the 21st Century.” Aquaculture is one of the fastest growing and increasingly important sectors in the food industry. The 2009 State of World Fisheries and Aquaculture report released by the FAO states that aquaculture produces 47% of seafood consumed by humans, providing more than 2.9 billion people with at least 15% of their average per capita animal protein intake.

The growth potential for aquaculture is staggering and as wild catch dwindles and consumer demand for fish as protein source increases. Europe and North America are major consumers of seafood, with up to 78% of seafood consumed in the US imported. Rapid intensification of aquaculture is needed to fill the gap.

With challenges come opportunities. On one side, there is a need to develop cost-effective, intensive production methods with high yields of healthy fish and shrimp that is acceptable by markets. Few aquaculture operations have veterinarians on site with research-based perspective of the role of aquatic health in production management. Conversely, aqua farmers have to deal with sustainability issues and consumer demands. Importing countries require high quality seafood with emphasis on safety. Consumers in the main markets, along with NGOs, have successfully pushed their agenda for increased quality assurance of imported seafood. As a consequence, seafood exported to these regions is subject to stringent controls to meet local regulatory and legislative guidelines.

How industry in Asia can learn from experiences in other regions and meet market requirements were the focus of a conference and forum held in March by Bayer HealthCare’s Animal Health Division during VIV Asia 2009, Bangkok, Thailand. The company invited industry experts from within the Asia Pacific and Mediterranean regions to debate these issues. The company develops, along with partners, novel aquaculture pharmaceuticals to meet elevated safety requirements for products users, the seafood consumers and the environment.

## Safer seafood

Bayer’s Division Head of R&D, Prof Michael Londershausen, pointed out the pressures on industry suppliers and producers created by rigorous European regulatory requirements. To ensure the safety of seafood sold

to the EU, the Food and Veterinary Office (FVO) conducts strict audits and inspection of plants, storage and processing facilities in seafood producing countries. This forces seafood producers to be cautious in exporting to the region.

The FVO additionally inspects all seafood consignments entering the EU and those crossing borders within the region for health certification, physical characteristics and various chemical residues. Through the Rapid Alert System for Food and Feed (RASFF), non-compliant seafood imports are immediately flagged for return to origin or for destruction. In principle, FVO also tests against the use of chemicals in seafood, which are not regulated in the EU for use in aquaculture. At present most border cases involve crustacean and fish with nitrofurans and malachite green residues. In cases where the MRLs have been exceeded, the products are often destroyed and the financial consequences severely impact the producers’ return on investment.

Prof Londershausen also highlighted the impact of public opinion on the reputation of seafood exporting countries. Food distributors and similar businesses are playing an important role in shaping the opinion of consumers and the general public. In response to the food scares of the last decade, some of Europe’s largest food retailers, later followed by those in the US, have enforced tougher guidelines on seafood quality and actively uses business-to-business labels (GlobalGAP) and NGO labels (Marine Stewardship Council) to reassure consumers.

He concluded that innovation is required to respond to the needs of seafood producers while ensuring that consumer safety needs are met and cautions, “Reputation and innovation in terms of efficacy safety and quality are important. Especially as the markets spiral downwards, quality labels for export need to be implemented and producers also need to have their own quality labels which go beyond those exclusive of the regulatory authorities.”



*Mouse grouper *Cromileptes altivelis* showing two common types of deformities: skeletal deformity and missing gill operculum. Picture courtesy of Mike Rimmer.*



*Tilapia with typical blistering with *Streptococcus* infections on caudal region (bottom) and under jaw (top). A vaccine is available for *S. agalactiae*. Picture courtesy of John Clark.*

## Thailand's lead

Government regulations, food retailer guidelines and consumer demand together create a trend towards safer and more sustainable seafood production. All industry stakeholders are dealing with these issues on all fronts. Asia is the top source of seafood for global markets, and Thailand's Department of Fisheries (DOF) is at the forefront of production and export regulations in the region.

According to Dr Nanthiya Unprasert, Director of Fish Inspections & Quality Control at the DOF, frozen shrimp and canned tuna are Thailand's top exports and the inspection and control of these products is the responsibility of the Department. Since the 1947 Fisheries Act, Thailand has proactively set strict conditions and guidelines for licensing of all aquaculture farms and processing plants. DOF undertakes approval, surveillance, chemical monitoring and production and sanitation control at every step, from feed manufacturing to hatchery and farm productions, to collection/pre-processing and final product processing. DOF ensures compliance of product quality and quality with its own criteria and that of importing countries. At present there are 100% checks on oxolinic acid and oxytetracycline for shrimp exported to Japan, nitrofurans for shrimp shipped to the EU and malachite green for shrimp sold to Korea.

Traceability is an important aspect of the DOF's monitoring program. 'Movement Documents' are required from hatcheries, farms, middlemen, to processing plants. Currently, 16,500 Thai farms are GAP certified and 320 are CoC certified. Thailand also has a Rapid Alert for Food and Feed system patterned after that of the EU. In cases of rejections, DOF will investigate and demand remedial action from the processing plant, followed by an audit and reporting to the importing country. The recent Animal Epidemic Act of 2005 has further assigned the Thai DOF to control diseases for imported and exported fish, and the Department will be more focused on biosecurity and the propagation of disease-free fry and fingerlings.

## Innovation for intensive culture systems

The burgeoning world-wide demand for seafood must be met with significant expansion and intensification in aquaculture production. In industry segments such as salmon or shrimp, application of fundamental reproduction, feeding and pharmaceutical innovation

have proven to be pivotal as shown by substantial production growth over the past years. To help avoid intensification pitfalls, seafood producers have valuable lessons to learn from other regions, as well as from recent technology developments.

According to Dr Ra'anah Ariav, Director of Aquavet Technologies in Israel, as demand for seafood increased, farms in the Mediterranean turned to rapid intensification of production. Upcoming culture systems were characterised by higher densities of fish (such as from 15 pcs/m<sup>2</sup> to 25 pcs/m<sup>2</sup> for tilapia). An accumulation of pathogens in the culture systems or in the environment, poor water quality, feeding management, and over-treating resulted in rearing environments that imposed chronic levels of stress on the fish. This in turn gave rise to numerous infectious disease agents that potentially compromise both productivity and commercial acceptance of the seafood products.

Health management is one of the most pressing concerns in intensive aquaculture. Dr Ariav identified four health problems often seen in intensively cultured species: non-infectious deformities, parasitic infestation, bacterial infections and viral diseases. One common problem in fin-fish reared within intensive and super-intensive hatcheries are non-infectious anatomical deformities and fatty liver degeneration. Diagnosis for deformities is often performed by exclusion after random inspection of the fry by stereoscope and X-ray. The causes are usually multi-factorial, but critically evaluating the feeding program is a prudent way to manage the problem. High density of stock in culture systems also lead to widespread infestation of both internal (*Myxosporidium*) and external parasitic diseases (*Isopoda* and *Copepoda*). Both have serious adverse effects on growth, survival and sustainability and needs to be managed and treated to prevent secondary infections. Anti-parasitic agents with documented safety and efficacy are not always available in the various markets.

The most prevalent problem of intensive fish farming is bacterial contagion. Secondary to stress, poor feeding and water quality and parasitic infestation, opportunistic bacterial attacks can cause severe losses. Some of the most damaging are: *Mycobacterium marinum* which can cross species and manifest as granuloma in infected humans; Pasteurellosis that in general affects fish at the hatchery/ nursery face and becomes a problem during the first months in the grow-out facilities; Vibriosis that turns fish inactive, lethargic, dark in colour and results in scale loss and skin lesion that finally become entry point for other disease agents such as ulcerative *Aeromonas*. Farm site diagnosis requires the availability of the production history, clinical symptoms, necropsy findings, ELISA based rapid diagnostic kits, isolation of the bacterium on agar plates (usually TSA or BHI agar). The final microbial identification is normally done by biochemical identification or serologically by means of rapid agglutination test kits.

Viral diseases are more difficult to manage as expert laboratory testing is required to diagnose. Mortality often results from secondary infections. Aside from available anti-microbial treatment regimen, vaccination can be effective against both bacterial and viral diseases. As part of an overall health management program, there is an urgent need for better vaccines against more viral types.



*Snapper with skin parasite. Picture courtesy of John Clark*

Finally, sustainable increase of productivity in marine aquaculture requires the effective implementation of biosecurity measures in planning and management, specialized veterinary services and fish health management programs, utilization of new diagnostic methods, effective feed additives, and preventive medications and vaccination programs, said Dr Ra'anana Ariav.

Dr Ariav further discussed the Israel experience in recirculating aquaculture systems (RAS) which offer fish producers a variety of important advantages over open pond culture. RAS allow producers to build aquaculture facilities of various sizes near large markets. They can even be built in locations where there is a limited supply of water and land. On one hand, RAS provide complete environmental control to maximize fish growth and disease control, along with full and convenient harvesting. However, this type of system has higher cost of production and all animal health risk factors associated with intensive farming systems.

## Adopting technology in Asia

Aquaculture farmers can turn to new technology and innovation on old processes to increase production. The tools to meet safety and sustainability goals range from improvements in hatchery systems, to advances in biological methods, new milestones in feed technology seafood and anti-parasitic and anti-viral products.

Dr Michael Rimmer of James Cook University in Australia described the quality problems of seedstock production where urgent improvement is required to produce better quality fingerling to meet increasing demand. There are key differences between Asian and European seedstock production. Europe has well-developed hatchery technologies including water quality control, RAS and filtration via physical, UV, or ozone. Fingerlings are also fed on tailor made grow-out diets and these results in high growth and survival rates. The method, however, is applicable to only a few species leading to low-diversity of cultured species.

In Asia, hatcheries are small technology-constrained "backyard" operations. The low-cost approach allows for greater diversity of cultured species but results in poor quality and survival as the fingerlings are reared in static micro algae-enriched 'green water' and fed on generic grow-out diet. Asian hatcheries are also labour intensive, and as such are an important source of livelihood for the community.

Understandably, the introduction of European hatchery technology, usually capital-intensive and often automated, is limited in scope and success. Dr Rimmer believes that in Asia only a targeted and well



Small scale hatchery in Indonesia. Picture courtesy of Mike Rimmer.

adapted introduction of European technology can lead to sustainable production. In particular, he believes there will be great advantage to introducing nutritional enhancement of rotifers and brine shrimp with HUFA to improve survival and quality of fingerlings. There is a need to adopt specific interventions but Dr Rimmer cautioned that further research and development in seedstock production should be undertaken with the commercial sector to ensure that the technologies developed are readily adopted by the private industry in Asia.

Advances in feed manufacturing technology also contribute to increasing aquaculture productivity. Skretting's Regional Business Development Manager, Dr Arjen Roem said extrusion production already allows for a more optimal nutritional balance between protein, lipid and carbohydrates, improved starch digestibility, use of high energy feeds, sinking, semi-sinking and floating feeds. Growth and feed utilisation is better with superior feed intake, lower leaching rates, less dust and broken pellets. In salmonids, feed conversion ratio (FCR) is reduced in a linear relationship with increasing digestible energy in the diet. Research showed that FCR improves with digestible energy in 1 to 2 kg Asian sea bass and 10g *Cromileptes altivelis* grouper. However, optimal energy levels require more verification in Asian fish species and beyond the juvenile stage. Recent advances in low temperature extrusion offers more advantages with particles which are soft and uniform in size and seabass larval accept these diet more readily. Phospholipids vital in larval development can be increased to more than 10%. These lead the way in managing feeds for a sustainable marine finfish industry.

## Managing feeding behaviour and fish welfare

Dr Andrew Moore from the Centre for Environment, Fisheries and Aquaculture Science (Cefas) related research which showed a strong link between fish behaviour and sustainable aquaculture. The research

**Bayer HealthCare**  
Animal Health

Partner of choice for  
innovation in aquaculture

[www.bayerhealthcare.com](http://www.bayerhealthcare.com)

**AQUATIC HEALTH**



Bayer HealthCare's Animal Health Division at Aqua VIV Asia. With partners, the company develops novel aquaculture pharmaceuticals to meet the safety requirements for users, consumers, and the environment. Bayer offers anti-parasite solutions such as Hadaclean® A, an early virus detection tool, I-screen® from GeneReach and full range of microbial pond water and soil treatment solution from Novozymes.

concluded that intensive aquaculture needs to find more sustainable forms of feed protein in farmed fish to reduce reliance on wild fish stocks. In the short term, this may be achieved by modification of fish feeding behavior by the application of new and novel attractants, which will maximize the uptake of conventional feeds.

Another area that requires innovation is in fish welfare. It is commonly accepted that disease outbreaks are triggered by acute chronic stressors and cortisol is the classic indicator of stress in fish. Free cortisol is released into water through passive leakage via the gills and a non-invasive cortisol assay could serve as an early warning system. The development of a "dip-stick" for cortisol could be a step towards ensuring fish welfare and prevention of disease outbreak in aquaculture. Dr Moore also sees the need for 'Invasiveness Screening Tools' for non-native aquaculture species to increase biosecurity and reduce any potential damage to the ecosystem

### Pond water environment and biosecurity tools

One focus of innovation featured at the conference was in biosecurity at pond level. Novel and effective products for detection and prevention of disease outbreaks are available for seafood producers interested in tackling production problems from a health management perspective.

Aquaculture farmers are well aware of the animal health problems associated with poor water and soil quality in pond culture systems. Dr Pornlerd Chanratchakool, Technical Director of Novozymes Biologicals advised a proactive management of these problems as part of disease prevention in shrimp farms. He suggested the routine monitoring of toxic condition i.e. ammonia, nitrite, hydrogen sulphide and use of intervention tools to keep these as low as possible. A healthy pond environment will

decrease disease risks and will produce larger size shrimps within a shorter period.

Dr Chanratchakool pointed out to recent scientifically proven advances in the use of biological methods to prevent toxic conditions in the water and soil of culture systems. He recommends the use of microbial applications as tools for profitable and sustainable aquaculture. Farmers now have the option to apply selected natural, microbes with specific metabolic activities that will help them to sustain optimal performance in their culture systems while decreasing the need for other chemical and antibiotic remedies.

Aquaculture farmers face huge losses caused by virus outbreaks, particularly in intensive culture systems. Undiagnosed and untreated, diseases spread within days through vertical and horizontal transmission resulting in high mortality. Whilst viral diseases are difficult to manage, Mr Simon Chung of GeneReach, Taiwan pointed out the benefits of early detection to prevent production losses. He explained the advantages of an on-site virus detection system as part of an effective biosecurity and disease management program. Mr Chung outlined the criteria of a good detection system, the most important of which are technical efficiency, accessibility, and mobility. As part of what he calls "innovation for a dream system", he described the pond-side real-time PCR testing as break-through that will allow on-site detection at less than one-third the cost of lab-based tests. Chung believes that such innovative technology will significantly contribute to raise safety and sustainability standards in the field.

With the increasing demand for greater quantity and quality of seafood, all these proposed solutions point towards an aquaculture sector focused on sustainable expansion that will produce safer products. Whilst there are difficulties to adopt some of the proposed innovations in Asia's aquatic health field that requires consensus and co-ordination, there is also an increased interest in the industry for the uptake of new products and approaches that could immediately increase production.

Those involved in the conference are committed to continued education, and the introduction of novel technology applications for sustainable intensified operations. Asia's aquaculture industry is poised for rapid growth, and there is great hope that the conference marks the beginning of a period of innovation and sustainability.



Dr Jan Koesling is the Regional Business Development Manager Aquaculture & Animal Nutrition Asia-Pacific for Bayer HealthCare Animal Health. His responsibility is to expand Bayer's product line in the aquatic animal pharmaceutical segment and in feed additives. Email: jan.koesling@bayerhealthcare.com



Conference presenters from left: Dr Jan Koesling, Simon Chung, Prof Michael Londershausen, Dr Pornlerd Chanratchakool, Dr Ra'anan Ariav, Dr Andrew Moore, Dr Michael Rimmer and Dr Arjen Roem.

# Aqua probiotics effective for farming both shrimp and fish helps to alleviate problems with changing environmental conditions.

By Angelito O. Abaoag and Seah Choon Meng

Environmental and economic factors are drastically transforming the aquaculture industry. The continuous damage inflicted by fish and shrimp pathogens and viruses is taking a heavy toll on aquaculture. Environmental degradation brought about by contamination of water source, acidic soil conditions and uncontrolled use of chemical inputs has an overall negative impact on productivity. The recent economic downturn has sharply dampened the demand for aquaculture products, especially for marine shrimp and freshwater prawn. In turn, this has depressed production volumes and selling prices. To mitigate these problems of disease outbreak, uncertain market outlook and unfavourable environmental conditions, some shrimp farmers are moving toward the cultivation of shrimp and fish in adjacent ponds in a single farm.



This trend creates the need for a range of aqua probiotic products (APP) which can be used at the same time for both shrimp and fish. The environment to cultivate shrimp and fish are different in terms of microbial and algae diversity, organic loads and other parameters.

However, formulating aqua probiotic products for fish and shrimp (APPFs) poses many challenges as compared to the formulation of aqua probiotics for a single species. This is because optimal conditions for the culture of multispecies are very different. For example, shrimp and fish require different types of algae and tolerate different stress levels

of organic load in the ponds during grow-out.

Interactive Micro-Organisms Laboratories Pte Ltd (IMO) and Bionovar International Pte Ltd, both aquaculture biotechnology companies, have jointly developed a range of aqua probiotic products for marine fish and shrimps that is suited for the cultivation of both shrimps and fish. These products have been successfully tested in the field in an aquaculture farm in Pekan, Pahang, Malaysia, operated by FLS Aquaculture Sdn Bhd.

## Aquaculture without Frontiers (AwF)

is an independent non-profit organisation that assists in the alleviation of poverty in developing countries by supporting projects designed to provide fish for food and income through sustainable small-scale aquaculture. AwF has also assisted in tsunami relief work.



So far we have project activities in Bangladesh, India, Indonesia, Malawi, Nepal and Thailand and our AwF Volunteers have provided assistance in several other countries including Ghana, Kenya, Liberia, Papua New Guinea and Peru.



Please help us to help others by donating yourself or by organising fund-raising activities!

Further information on our activities can be found at:  
[www.aquaculturewithoutfrontiers.org](http://www.aquaculturewithoutfrontiers.org)

**Aquaculture without Frontiers** -  
*be a part of something special.*

## Aqua probiotics

Both shrimp and fish are cultured at the Pekan farm. Situated near the Pahang River, the location is a source rich in marine microbial isolates. The APPF were developed from marine samples taken from the surrounding mangrove, estuary, river banks, sediments as well as from the culture ponds. Using proprietary isolation and cultivation techniques, marine bacteria belonging to the genera *Bacillus* and *Pseudomonas* were isolated, as well as marine yeasts and other non-pathogenic, free-living proteobacteria. Non-pathogenic free-living proteobacteria comprises several genus of bacteria that has the ability to metabolise wide range of bacteria that has versatile degradative capabilities of various compounds.

Further studies on these microorganisms show that they are tolerant to stressful environmental conditions such as acid-sulphate soils, prevalent in most coastal farms in Peninsula Malaysia, as well as fluctuating alkalinity, dissolved oxygen, salinity and temperature.

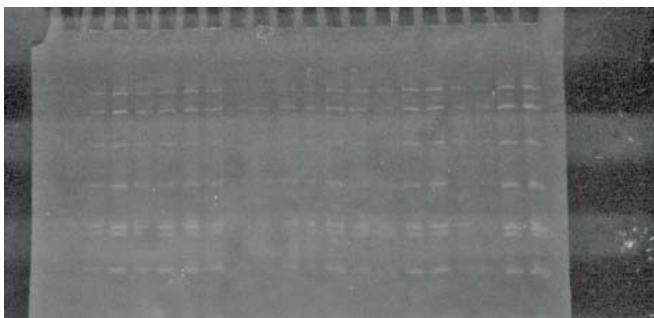


Fig. 1. DGGGE profile of microflora in the aquaponds

The APPF were then tested in the Pekan farm on white shrimp *Litopenaeus vannamei*, black tiger shrimp *Penaeus monodon*, and tilapia *Oreochromis niloticus*.

Microbial diversity and their succession were monitored using molecular biology techniques such as the Polymerase Chain Reaction (PCR) technique coupled with Denaturing Gradient Gel Electrophoresis (DGGGE). The use of specific DNA primers allowed for the tracking of the persistence of the microorganisms as well as comparison on the diversity of the indigenous microflora. This is compared with environmental conditions as well as prevalence and population of pathogens, such as *Vibrio* and *Aeromonas*. Recent results showed that in the advent of a *Vibrio* proliferation, the application of 105 cfu/ml of the APPF for three consecutive days reduces the *Vibrio* count drastically.

## Water quality conditions

Measurements of water quality showed significant improvements in terms of the ease of application, faster turn around time and general efficiency as compared to other probiotics. The study showed that during the early days of culture, the application of the APPF with a 105 cfu/ml microbial concentration every 10 days can maintain good water quality in comparison to a much higher dosage or more frequent applications of other products over the same period of time.

Algal diversity is also monitored as an indication of water quality. Field results showed the prevalence of chlorophytes, such as *Nannochloropsis*, *Isochrysis*, *Braetococcus*, and diatoms, such as *Navicula*, *Nitzschia*, and *Chaetoceros* in treated ponds as compared to untreated ponds which showed presence of cyanobacteria (blue green algae) and euglenoids. Elevated numbers of chlorophytes and diatoms are indications of increased primary productivity in the ponds while the presence and abundance of euglenoids and cyanobacteria are indications of environmental pollution brought about by high organic load.

## Induction of algal-bacterial flocculation

Algal-bacterial flocculation, or bioflocs, is an aggregation of microorganisms in a pond environment. It has been documented in the literature that bioflocs serve as nutrients for cultured species in aquaculture and can remediate environmental pollution, such as nitrogen compounds. The common practice to induce flocculation is to add a large amount of starch to the ponds.

IMO Labs and Bionovar started the bioflocs program last year with the aim of inducing bioflocculation by introducing algal cultures that are known to be beneficial for fish and shrimp and using bacterial-yeast inoculants in the presence of a limited amount of carbon source. Laboratory as well as initial field studies show that the APPF can stimulate algal flocculation of selected strains of algae such as *Nannochloropsis* and *Tetraselmis*. Flocculation is observed upon inoculation of seed cultures of the algae, application of the probiotics and addition of a small amount of carbon source. Studies and trials to induce flocculation for other algal types are still on-going.

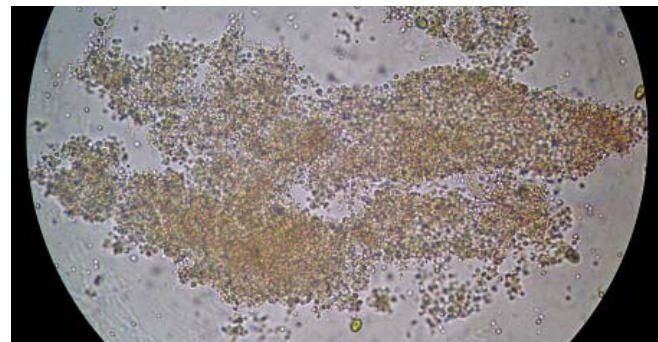


Fig. 2. Aqua probiotic induced algal species of *Nannochloropsis* and *Tetraselmis*

## Trials

The APPF show promising results in water quality maintenance, algal diversity and growth, bioflocculation and over all growth of both fish and shrimp cultures. Trial results show that the use of the APPF in *L. vannamei*, *O. niloticus* and *P. monodon* cultures increased growth rates, 10%, 15% and 12%, respectively, and increased the average body weight of the culture species by as much as 15-20%. Feed conversion improved as total biomass compared to feed consumption was higher. Preliminary results attributed this factor to the ability to sustain algal population and maintain flocs at their optimal size and density.

Trials are continuing for different fish-shrimp cultures by varying species and pond management techniques. It is the aim of the group to provide a range of robust aqua probiotics suited for culturing both shrimp and fish.

Table 1. Comparative average body weight in *Oreochromis niloticus* using APPF

PONDS	Days of Culture				
	12	41	69	97	125
Normal culture	37	115	230	300	379
APPF treated	49	139	270	340	425
Difference, %	32.4	20.9	17.4	13.3	12.1



**Angelito O. Abaoag** is Chief Scientific Officer at IMO Laboratories. His work is in developing microbial solutions using natural microflora and applied in various industries. Email:lito.abaoag@imolabs.com



**Seah Choon Meng** is Vice President for Business Development at Bionovar International. Email:seahcm@bionovar.com

# Host-targeted antibody has positive impact on tilapia survival and performance

By Carrie L Cook, John S Clark, Kyle Montgomery and M. D. Yang

**A novel approach directly tackles the problem of excess gut inflammation by targeting the biochemical mechanisms of the host with an antibody against a gut enzyme.**

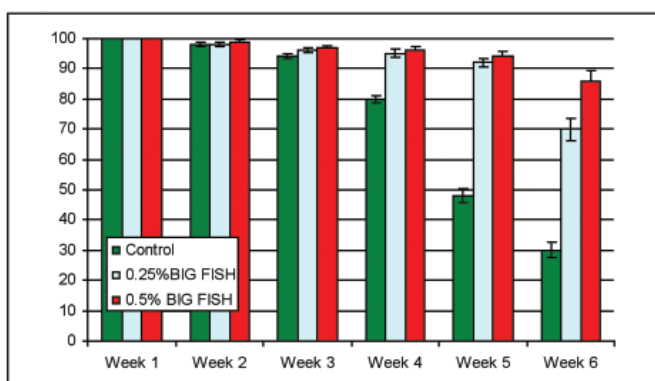
The more we learn about inflammation, the more it captures a key role in our understanding of disease mechanisms and general health in both humans and livestock. The immune system (IS) is incredibly complex and highly effective at combating the universe of pathogens to which cultured organisms are continually exposed. When the IS is activated, an array of specialized cells, proteins and signalling molecules are rapidly produced and mobilized to fend off any threat, whether it be real or perceived.

Providing for such vigilance and flexibility represents a high metabolic cost, therefore, avoiding excessive IS activation— inflammation—can facilitate mobilization of metabolic resources (energy and nutrients) to be used elsewhere, such as for growth and reproduction. Many IS activities are concentrated in the gut, which contains more than 70% of all the immune cells in the body. Enteric challenges can decrease weight gain, feed intake, feed efficiency, survivability, uniformity and the ability to adapt to environmental conditions. Achieving optimal gut health should be of primary concern for producers striving for higher animal performance.

There are many ways for producers to minimize costly gut inflammation, which can be caused by disease, ingestion of inappropriate feedstuffs, toxins, parasites, and, particularly, by bacteria and viruses. Avoiding these factors generally falls under routine management. Gut inflammation caused by inappropriate feedstuffs, on the other hand, can be a complicated issue. Fluctuating agricultural markets and cost pressures influence feed formulations such that nutrient sources of differing quality, digestibility and palatability may be used for each batch of feed. Soy is often added to replace fish meal as a protein source in fish feeds, but this plant-based feed has been clearly shown to cause gut inflammation in carp and salmon, and most likely occurs in other species as well. The economic gains from reduced feed cost must be carefully weighed against production losses arising from increased gut inflammation.

A novel approach directly tackles the problem of excess gut inflammation. Instead of targeting pathogens or other factors in the gut, the biochemical mechanisms of the host itself can be targeted. This host-targeted approach has been successfully applied using an antibody against a gut enzyme, phospholipase A2 (PLA2), and now marketed as BIG FISH™. PLA2 is a key participant in the inflammatory response of vertebrates and enables one of the earliest metabolic steps in the inflammatory cascade. By targeting the host animal's PLA2, this product modulates the action of many key inflammation mediators in the gut, resulting in suppression of excess inflammation. Most importantly, this does not compromise the immunological status of the

**Figure 1. Enhanced survival ( $\pm$ SD) of tilapia raised with a PLA2 supplementation, upon ongoing *S. agalactiae* challenge in weeks 4-6.**



animal, which is still fully able to mount an effective response to acute health challenges.

A recent commercial trial specifically examined if BIG FISH™ confers any protection against a disease challenge. Tilapia fingerlings were raised on 0% (control), 0.25% or 0.5% BIG FISH™, starting with triplicate tanks of 330 fish for each treatment. After 8 weeks, 200 median-sized fish from each treatment were distributed into ponds and challenged by feeding fish that had died from *Streptococcus agalactiae* along with regular rations. A remarkable protective effect was seen for treatment groups (Figure 1), demonstrating that targeting host PLA2 with this product does not compromise immune function, and in fact enabled these fish to better fight off an acute disease challenge. Additionally, the group noted increased biomass and reported that feed conversion in the BIG FISH™ groups was “vastly superior” than controls.



**Dr. Carrie Cook** is Senior Research Scientist at Aova Technologies USA. Email: [carrie@aovatech.com](mailto:carrie@aovatech.com)



**Kyle Montgomery** (pic) is Manager, New Business Development and M. D. Yang is Vice President R&D at Aova Technologies. John Clark is Consultant.

# A promising role of organic selenium in stress and disease management

By Shery Kurian and Chris King

**A proven nutritional antioxidant in vertebrates, selenium may be a tool to overcome viral infections in marine shrimp. The use of organic selenium to mitigate occurrences of white spot syndrome virus in black tiger shrimp culture in field trials in India has brought some reprieve from the disease.**

The intensification in aquaculture to increase production volumes has increased animal stress which eventually results in disease and associated losses. In the case of terrestrial animals, the controlled conditions bring a certain amount of predictability in farming. However, in aquaculture, with a number of factors such as water quality parameters, management, nutrition, environment, larval sources etc. acting as variables, stress management is less conventional. The impact of stress is on performance and immunity, both of which ultimately has implications on the economic viability. There are various tools used to control stress in aquatic species but these are not always feasible.

Viral diseases are a major challenge for the animal rearing systems worldwide. In the case of aquaculture, the importance of managing viral diseases cannot be overemphasized. In India alone, which predominantly farms the black tiger shrimp, annual losses have been estimated at INR 6000 million (USD 120 million).

A number of viruses pose a threat to shrimp farming. The major threats are from Taura syndrome Virus- TSV, white spot syndrome virus- WSSV, infectious hypodermal and hematopoietic necrosis virus, IHNV and infectious myonecrosis virus, IMNV. In some countries in Asia, the almost complete shift to vannamei shrimp with specific pathogen free brood stocks would have helped to reduce viral incidences. However, in Vietnam and Malaysia, where both species are cultured, diseases such as WSSV will still be a threat. Similarly, in South Asia, where the transition to vannamei shrimp is happening now, the same situation might manifest and add to the current challenges in disease management.

WSSV has been infecting farmed marine shrimp for the last two decades and is the most devastating pathogen reported. Due to the lack of a well defined immune system, the vaccination strategies that are commonly used against the viral infections in fish could not be effectively employed in shrimp. In aquatic organisms, another issue will be an efficient and targeted delivery of vaccines. Various other prophylactic measures such as immunostimulants, probiotics, and bioremediators are mostly used for prevention and control of WSSV albeit with limited success.

Research conducted by K. Mohankumar and P. Ramasamy (2005) has shown that the lipid peroxidation in WSSV infected shrimp may be due to increased oxidative stress in the cells as a result of depletion of antioxidant scavenger systems. The reduced activity of antioxidant enzymes in WSSV-infected animals could be due to inactivation of antioxidant enzymes by oxidative stress thereby generating free radicals, which accumulate in the cells. They argue that a further understanding of the biochemical alterations induced by viral infections, including changes in the antioxidant status and oxidative stress, could help to advance the therapeutic methods for control of WSSV in shrimp.

## Role of selenium

The trace mineral selenium is now added to the list of nutritional antioxidants, substances that offer protection against our most dreaded

diseases and aging. Indeed, selenium, as a component of several enzymes, does help rid the body of destructive oxidation products.

Selenium is required by the body to maintain normal metabolism. It is also increasingly being studied for its anti-cancer properties. Although other nutrients usually bind to proteins, selenium actually becomes incorporated into proteins, forming what are called selenoproteins. These selenium-containing proteins are believed to slow the spread of infections.

During the last decade, research has indicated an important geographical link between regions of selenium deficient soils and peak incidences of HIV/AIDS infection. AIDS disease appears to involve a slow and progressive decline in levels of the trace element selenium (Se) in the blood along with CD4 cells, which are both independent predictors of mortality.

Flu virus mutations create new virus strains each year, it becomes virtually impossible for the body's immune system to develop a permanent defense. However, taking adequate amounts of selenium can help prevent those mutations from occurring. In one experiment two groups of laboratory mice were exposed to a relatively mild flu virus strain, which also infects people. Flu viruses infecting selenium-deficient mice developed 29 mutations, which led to greater virulence. In contrast, selenium-replete mice experienced no mutations in the infecting virus and had milder symptoms.

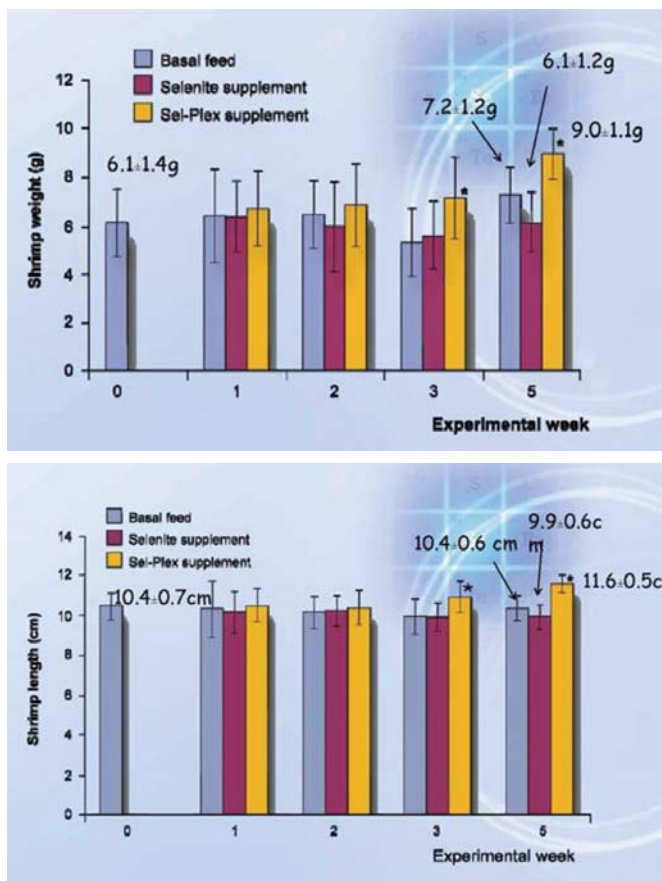
The preliminary studies conducted indicate that the virus mutations in RNA virus could be controlled by the selenium supplementation. A similar work with pox virus *Molluscum contagiosum* has also shown reduced viral replication on selenium enrichment.

## Source of selenium

Many traditional raw materials used in feed production contain selenium. Although selenium can be obtained from fish meal in the diet, the content and bioavailability can be quite low and vary considerably depending on source and processing methods. Unlike some other minerals such as zinc and copper, selenium cannot be chelated and free selenomethionine 'chelates' often consist simply of a mixture of



Figure 1 Effects of organic selenium on growth of *P. vannamei* shrimp. (a) weight and (b) length



Molecular Biology and Biotechnology, Faculty of Science, Mahidol University, Thailand. In this trial, a basal shrimp diet was compared with the addition of inorganic (sodium selenite) or organic selenium (Sel-Plex) both added at the rate of 0.3 ppm to white shrimp *Penaeus vannamei* Kona strain that is highly susceptible to Taura Syndrome Virus (TSV) challenge. The studies showed an initial improvement in shrimp body weight and length which was significant in the Sel-Plex organic selenium group before shrimp were challenged at day 30 with TSV at an LD50 injection dose (Figure 1 and 2). In Figure 3, Sel-Plex organic selenium improved the shrimp survival level after TVS challenge to 66.7(± 7.8%) from 13.3 (± 12.2%) in the basal feed, in comparison to 35.5 (± 9.3%) in sodium selenite group.

### Tool to address the challenge posed by WSSV

Following the reported effect of Sel-Plex in controlling the TSV related mortality in vannamei shrimp, it was of interest to see whether similar results could be replicated in black tiger shrimp in field conditions where the major challenge was WSSV. Besides a research trial initiated, it was important to get observations and feedback from the farm studies to see how laboratory results are translated in the field.

The major challenge in black tiger shrimp farming is the very frequent WSSV outbreaks. This was especially true in the central shrimp farming districts of East and West Godavari of Andhra Pradesh state. Usually, farmers in these areas practice early stocking (January/February) and when faced with large scale mortality, go for restocking. The very low and often fluctuating temperatures during the early months are assumed to be the reasons for the large scale outbreaks. Another contributing factor could be the high incidence of infected wild brood stock during these months and used in hatcheries. With the risk it carries, it was imperative for the farmers to try out any risk

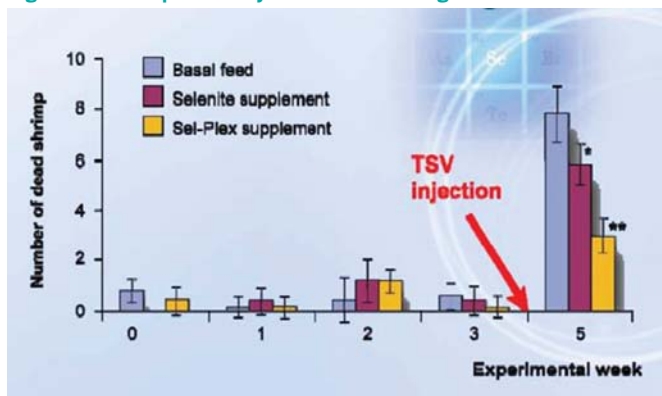
methionine and sodium selenite.

Traditionally feed formulations use trace amounts of selenium mostly in the sodium selenite form. The disadvantage is that beyond a certain limit sodium selenite can be toxic and will act as a pro-oxidant. Inorganic selenium cannot be stored in the body and hence it will not be available for emergencies. The advantage with organic selenium is that it can be stored in the body; it is a cellular level antioxidant and has a much higher safety profile. Sel-Plex® is a selenium yeast in which selenium has replaced sulphur in all sulphur-containing biomolecules such as selenomethionine, selenocystine and selenocysteine, highly available forms of selenium commonly found in natural plant ingredients.

### Selenium supplementation and effect on viral mortality in marine shrimp

One of the initial studies on the effect of selenium on shrimp survival was done by Kallaya et al, (2008), at the Centre of Excellence in Shrimp

Figure 2. Shrimp mortality after TSV challenge



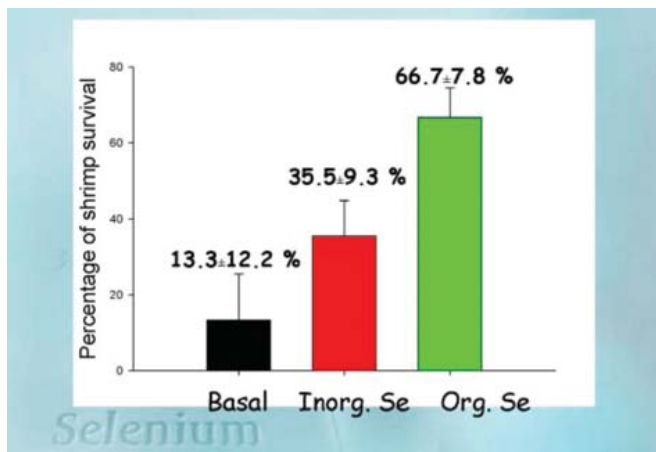
Keep up with the latest developments in the regions's industry



Subscription rates (6 issues/year)  
 – SGD 70 for Asia  
 – SGD 100 for rest of World

Online subscription at [www.aquaasiapac.com](http://www.aquaasiapac.com)

Graph 3. Shrimp survival after TSV challenge



mitigating tool at their disposal.

After attending Alltech's Asia Pacific Lecture Tour of Alltech in 2007 and referring to the literature on the observed effect of Sel-Plex on viral diseases, N.V.S.Raju, a farmer and hatchery operator in Amalapuram decided to use selenium in his farms to see whether it would have an effect in controlling the incidence of WSSV. In addition he was successful in persuading a group of other farmers to join him. "It was fear that prompted us to start the usage of Sel-Plex," said the group.

He considered it important to avoid the risk during the initial periods, where large scale mortalities can happen. One of the difficulties was managing the low inclusion rate (150g/tonne or 300ppm) of the product and hence they decided to mix Sel-Plex with NuPro. In the areas of Tandanappally and Godi, 15 ponds were tried with the combo. The crops were harvested from 45 to 28 counts (20g to 35.7g), with no interruptions due to viral outbreaks.

Raju has seen rampant outbreaks over the years. In 2007, out of 600 people whom he surveyed there was a 95% success rate but this dropped to only 60% in 2008. According to him, farmers who have used the selenium product for a longer duration had a more than 90% success rate. In his own farm, during the periods of stress, he used to administer the selenium in all the feeds continuously for 6 days. Both growth rate and shrimp condition improved.

Babji of Uppumili, East Godavari and his group has a total of 70 acres (28.3ha) under culture. As a group, they used to source the seeds from the same hatchery since 2001. Until 2006, they carried out low stocking density culture and they had relatively low viral issues. However, when they attempted a higher stocking density in the 2006-07 crop, viral outbreaks became extremely high. "High stocking density is always a risk", he said.

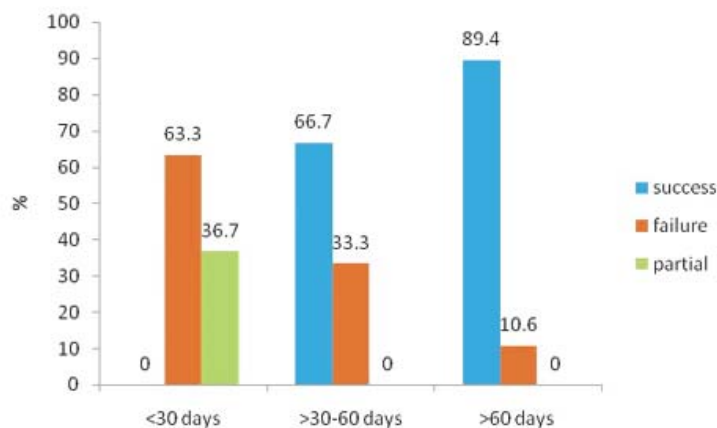
Some in the group applied the selenium up to 100 days and some ceased using it after 20-30 days. "The longer we used Sel-Plex, we were able to harvest bigger counts of shrimp". The harvest varied between 100 counts (10g) which was due to outbreaks and 40 count (25g which was the target size). The group said that there is a positive effect of selenium on the mortality, shrimp condition and shrimp activity as well.

Venkateswara Aquaculture, is a major farm in Kakinada and they also tried the selenium. They had a low stocking density (9 post larvae/m<sup>2</sup>) in 23 ponds, out of which 10 ponds were treated ponds for first 60 days, which was considered to be the risk period. Both treated and control ponds had successful harvests. However, the treated ponds recorded a 10% increase in survival as compared to the ponds where the product was not used.

"I believe organic selenium as a critical ingredient in aquaculture" says Mr. Ali Hussain, Managing Director of Bismi Group in Tamilnadu.

Ali Hussain, was looking at a complete integration of the whole aquaculture operation and launched his own brand of feed in 2008. He

Figure 4 Success and failure rates in harvests in 30 ponds when Sel-Plex was used up to 30 days culture (No of ponds=30), >30-60 days (No of ponds=18) and more than 60 days (No of ponds=85).



gets advice on the formulations from the Indian Council of Agricultural Research (ICAR) and he continuously looks at improving his feed formulations. He has done a number of comparative studies with feeds with relatively high levels of squid and clam meal added. He has seen that such formulations had a better immunity against viral incidences in these trials.

"The experts who advise us suggest a possible role of organic selenium, which according to them is abundant in those ingredients". Currently, he is supplementing yeast derived organic selenium (Sel-Plex), as a part of all his formulations.

Mr. E. Yeshwant Kumar, at Anantavaram, Prakasam district also used a formulation containing the selenium product. This was applied to all 8 ponds. He was able to harvest at 30g size. "The area surrounding my ponds was getting devastated from WSSV, with few exceptions. That was the time when I came across Sel-Plex and started using it from day 15 until harvest. All my ponds survived and I will attribute it to the use of selenium" says Kumar. "The major challenge faced by the farmers is viruses and any method available to mitigate the risk of losing the crop has to be promoted. I believe the best way of administering it is at the feed manufacturing level, as it ensures a proper mixing and dosage and ease of usage".

Overall, the feedback supports further exploration of the usage of selenium as a tool to address the increasing risk of viral incidences. Further small scale and commercial evaluations are being coordinated by Alltech but present research has indicated the potential for significantly improved survival of viral challenges in shrimp through implementation of organic selenium.



**Shery Kurian** is Technical Sales Manager, Aquaculture- Alltech, based in Chennai, India. Email: skurian@alltech.com



**Chris King** is Asia Pacific Commercial Manager, Aquaculture, Alltech Bangkok, Thailand. Email: cking@alltech.com

# Intensive farming of the goby fish in the Mekong Delta, Vietnam

By Tran Ngoc Hai, Nguyen Thanh Phuong and Nguyen Tan Nhon

The economic potential in the culture technology has been developed for the euryhaline goby fish *Pseudapocryptes lanceolatus* in alternate culture with marine shrimp. The next step is hatchery production of fingerlings.



The Mekong Delta (MD) of Vietnam with an area of about 600,000 ha of brackish water surface is an important region for brackish water aquaculture. However, coastal aquaculture has focused mainly on shrimp culture with over 470,000 ha producing more than 350,000 tonnes yearly (Nien, 2005). In recent years, there is a trend towards species diversification especially with the culture of various brackish water fish.

Out of the several species under culture, the euryhaline and indigenous goby fish *Pseudapocryptes lanceolatus* has a high potential because its price (Yen, 1993). Early trials in the extensive culture of this species using wild caught seed stock were started from 2003 (Long et al., 2004). Seasonal recruitment of seed stock of this species in the coastal areas of Bac Lieu province was studied to develop management strategies (Toan, 2005). Recently, pond culture of the fish has increased in coastal areas, especially for local markets. Its culture is favoured, particularly in Soc Trang, Bac Lieu and Ca Mau provinces. Bac Lieu province alone has more than 1,500ha of fish ponds.

To evaluate the culture status of the goby fish in the region, a survey was conducted during April - June 2008. This involved a total of 19 fish nursery farms in Bac Lieu province and 61 grow out farms from three coastal provinces of Soc Trang (20 respondents), Bac Lieu (20 respondents) and Ca Mau (21 respondents). Primary data collected focused on the status as well as trends in culture technology and economics of nursery and farming of the fish.

## Seed collection, acclimation and supply

Since hatchery produced fish fry are not available in the Mekong Delta, fish fry collection and nursery has been rather dynamic in the coastal area of Soc Trang, Bac Lieu and Ca Mau provinces to supply grow out farms. Fish fry are caught from the shallow waters along the muddy sand beach. Fishermen usually use fishing gears such as scoop nets or push nets with fine mesh size of 0.5-1mm for catching fry during the spring tide period. The season for fishing is between May and November. Fish fry are then sold to middle men who will acclimate and nurse fry for several days before selling to farmers.

For acclimation and nursery of fry, simple earthen tanks lined with

nylon sheets are commonly used. The mean area of nursing tanks is about 8.58m<sup>2</sup> and total nursing area of each farm is about 35.26m<sup>2</sup> (Table 1). Brackish water of 10-15ppt salinity from canals is filtered and used for nursery with tank water levels of 0.2-0.6m. Fish fry of 1.2-4cm body length are stocked at an average density of 42,305 fish/m<sup>2</sup>.

During nursery stages, fish may be fed with artificial feed or there is no feeding. Water is exchanged daily at 50-90% or sometimes there is no exchange of water throughout the nursing period of 2 to 4 days. The mean survival rate of fish fry is about 85.16 ± 8.72%. Yearly, each household can nurse about 3-7 batches which could supply a very large number of 3.04 ± 2.28 million fry for farming. The activity is also very profitable with annual net incomes of USD2598 ± 3064/household or USD 122.4 ± 79.4/m<sup>2</sup>.

Table 1. Characteristics of nursing fry of *Pseudapocryptes lanceolatus*

Characteristics	Mean value
Total area of nursing tanks (m <sup>2</sup> )	35.26 ± 51.42
Tank area (m <sup>2</sup> )	8.58 ± 9.75
Water level (m)	0.53 ± 0.21
Number of batch/ yr	5.05 ± 2.01
Body length of fry (cm)	1.95 ± 0.77
Stocking density (ind/m <sup>2</sup> )	42305.26 ± 41099.72
Feeding	
Yes (% total household number)	21
No (% total household number)	79
Water salinity (‰)	11.37 ± 3.20
Duration of nursery (days)	2.26 ± 0.93
Survival rate (%)	85.16 ± 8.72
Production (millions of fry/household/year)	3.04 ± 2.28
Production cost (USD/m <sup>2</sup> /year)	409.41 ± 258.24
Gross income (USD/m <sup>2</sup> /year)	531.76 ± 314.12
Net income (USD/m <sup>2</sup> /year)	122.35 ± 79.41
B/C ratio	0.33 ± 0.16

## Intensive grow out in ponds

Intensive culture of the fish is usually practiced in shrimp ponds during the rainy season and alternating with a shrimp crop in the dry season. Ponds are about 3,000-5,000m<sup>2</sup> in area and 1-1.5m in depth (Table 2). After completing a shrimp crop, the ponds are prepared usually with lime (7-10kg/100m<sup>2</sup>) for fish culture. Brackish water from the canal is filled directly to the pond without any chemical treatment. The water level is very low at about 0.3-0.4m for the first month and it is then increased gradually to 1.5m for the later stages. During grow out, water is exchanged 2-8 times per month. The average is about 3-4 times with exchange rate of 20-40% of water volume each time.

Fish fry of 1.5-4cm from nurseries are stocked intensively at



densities ranging from 40-150 fish/m<sup>2</sup>. The average stocking density is 80 fish/m<sup>2</sup>. Fish are fed with commercial powder feed of 40% crude protein for the first two weeks and gradually changed to commercial pellet feed of 28-30% crude protein for the later stages. Floating feed of about 2mm in particle size is given twice daily to satiation. Food conversion ratio (FCR) is about 1.74±0.19.

During culture, prevention of predators such as birds is very important. Colorful nylon lines or nylon nets are used for this purpose. In some cases, net fencing on the pond dykes is also used to prevent fish from escaping.

### Harvesting

After 4-5 months of culture, fish reach harvest sizes of 20-25g. There are several methods for harvesting. Fish are firstly caught with a seine net at night to harvest about 70-80% of fish stock. The pond is then drained out and dried for several days. Fish will live in hollows in pond bottom. Later the pond is filled up with canal water and a trap net is set at the inlet to catch fish swimming against the current to the net.

**Table 2. Characteristics of intensive farming of *Pseudapocryptes lanceolatus***

Characteristics	Mean value
Total culture area per household (ha)	0.60±0.70
Pond depth (m)	1.13±0.18
Culture season	
Dry season	15%
Rainy season	85%
Size of seed (cm)	1.91±0.90
Stocking density (fish/m <sup>2</sup> )	80.9±44
FCR	1.74±0.19
Water exchange frequency (times/month)	3.33±1.80
Water exchange rate (%/time)	30.9±6.7
Culture duration (months)	4.23±0.43
Body weight at harvest (g)	22.38±2.41
Survival rate (%)	28.37±16.09
Yield (kg/ha/crop)	4884±3013
Production cost (USD/ha/crop)	10136.65 ± 5708.06
Gross income (USD/ha/crop)	15452.47 ± 10501.06
Net income (USD/ha/crop)	5315.76 ± 5637.18
B/C ratio	0.46±0.40

### Yields

Fish yield and survival rates are 4,884±3013 tonnes/ha/crop and 28.37±16.09%, respectively. With production cost of USD10,136.65 ± 5708.06 ha/crop, the net income is about USD5,315.76 ± 5637.18 ha/crop. Feed cost and seed cost are the main components of production costs accounting for 44.0% and 36.2% of the total cost, respectively (Fig 1). With good prices of about USD3-4/kg, easy transportation and high local demand, the farming of the goby is very promising.

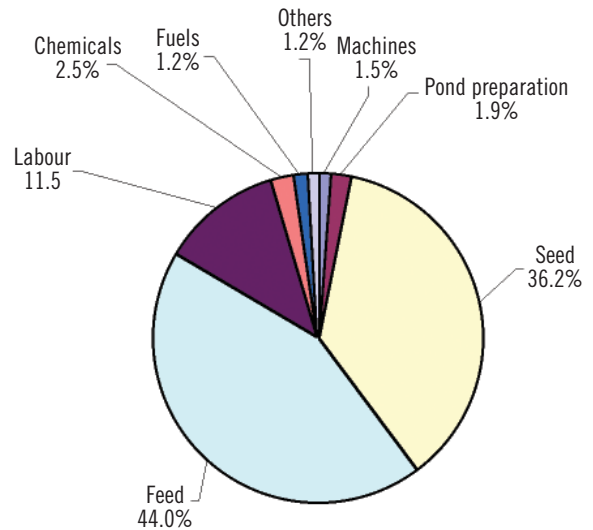


Fig. 1. Components of production cost for goby fish farming

### Conclusion

The intensive culture of the euryhaline goby fish has been recently developed in the Mekong Delta and there are indications that it is an important and profitable aquaculture species. It alternates with shrimp culture during the rainy season and diversifies culture systems in the coastal region. However, there is an urgent need for further studies on seed production.

### References

Long, D.N., H. T. Nhan and N. A. Tuan, 2004. Trials on pond culture of brackish water fish (*Pseudapocryptes lanceolatus* Bloch, 1801) in Ba Tri, Binh Dai and Thanh Phu District, Ben Tre province. *Scientific Journal of Can Tho University*. 2004 (2) 127-135

Nien, N.M. 2005. Status of aquaculture in the coastal provinces of the Mekong Delta, Vietnam. In *proceedings of the national workshop on research and technologies applied in aquaculture*. Publishing House. Hanoi. 101-116.

Toan, V.T. 2005. Exploitation and recruitment of fish (*Pseudapocryptes elongatus*) in Bac Lieu province. Master Thesis, Can Tho University. 59pp.

Yen, M.D., 1992. *Freshwater fish of the Southern Vietnam*. Publishing House of Science and Technology. 350 pp.



Dr Tran Ngoc Hai (pic) and Assoc. Prof. Dr Nguyen Thanh Phung are from College of Aquaculture and Fisheries, Can Tho University, Vietnam. Nguyen Tan Nhon is from the Division of Fisheries, Department of Agriculture and Rural Development of Can Tho City. Email: Tran Ngoc Hai (tnhai@ctu.edu.vn)

# INVE Aquaculture and INVE Nutri-Ad join competences

**The Aquaculture Feed Additives Division of INVE Nutri-Ad has been formed with the fusion of know-how and expertise from two core business units of the INVE group: INVE Aquaculture and INVE Nutri-Ad.**

INVE Aquaculture is a pioneer in specialty nutrition for hatchery production of marine fish and shrimp since the early 1980s. It has developed over the last decade to provide nutritional and health care solutions for grow-out stages of various fish and shrimp species worldwide. INVE Nutri-Ad is a global prime supplier of specialty feed additives and ingredients based on state-of-the-art production technologies, flexible customer services, continuous product development. The company's differentiated value proposition is mainly articulated around its commitment to support users in applying products properly based on sound diagnostics and risk assessments. It strives to provide natural and environmentally friendly solutions to the global feed industry. INVE Aquaculture on the other hand will keep its leading function in providing life feed and health solutions to hatcheries and farms worldwide.

The new Aquaculture Feed Additives Division has an ambitious plan to "work side-by-side with its aquaculture feed producers to achieve improved profitability and sustainability for them and increasing product quality for the consumer. Ben Letor, Global Marketing Manager INVE Nutri-Ad said, "This recent incorporation of aquaculture feed specialists complements our existing scientific and technical teams to improve our commercial network in the key aquaculture markets in Asia, Europe and America."

Dr. Peter Coutteau is the newly appointed Business Development Manager Aquaculture for INVE Nutri-Ad. He has more than 20 years experience in research, product development and customer support related to aquaculture nutrition, of which over 10 years was with INVE Aquaculture.

"The concentration of Inve's competences in the field of aquaculture feed additives under the newly created Aquaculture Feed Additives Division of Nutri-Ad yields a unique combination of R&D capabilities, expertise, product diversity and customer service focused on developing and bringing the best additive solutions to the aqua feed industry. Our team of aqua feed experts has over a decade of industrial experience in aqua feed formulated for different species and farming conditions. We expect exciting innovations to result from teaming up with the scientific, technical and commercial teams at Inve Nutri-Ad.

They are recognized experts in developing, manufacturing, applying and marketing a broad range of specialty feed additives, so far mostly focused on land animals."

This aquaculture extension within Inve Nutri-Ad has resulted in a diversified product portfolio for aquaculture organized under six programs:

- Performance enhancement covering key issues such as the replacement of marine ingredients, maximizing feed cost efficiency by optimizing feed conversion and minimizing harmful waste effects in the environment;
- Health and well-being which centers around supporting good health condition in animals through reliable immunostimulants, anti-microbials, anti-parasitics, ammonium binders, and key vitamins;
- Preservation and stabilization to provide feed additives for avoiding spoilage of ingredients and finished feeds;
- Feed-Food Safety for prevention of harmful effects developed by micro-organisms and toxins,
- Production aid, for improving physical characteristics of aqua feed including water stability, smell and colour;
- Natural alternatives, to ensure that animal nutrition is based on natural ingredients including natural pigments and phytobiotics.

The aqua feed industry is expanding and maturing from a young, pioneering industry into a more professional feed industry. Compared to agrifeed milling, aquaculture nutritional know-how is still far more limited because of the greater variety of fish and shrimp species being farmed. An increasing degree of specialization is therefore required to be able to respond to the dynamic environment of horizontal and vertical integration. To assist the feed industry in taking up these challenges, INVE Nutri-Ad is now in a position to offer professional and innovative products and services powered by a continuous screening program leading up to novel concepts through in-house research combined with external collaborative research at universities and institutes around the globe. More information: INVE Nutri-Ad – Belgium, Email: [b.letor@inve.be](mailto:b.letor@inve.be)

## NEXT ISSUE

**July/August** issue will feature

- Health management
- Freshwater fish/prawn
- Biosecurity
- Fish meal replacements

Submit your technical article  
by 2 June 2009

Book your advertisement  
by 6 June, 2009

Email: [zuridah@aquaasiapac.com](mailto:zuridah@aquaasiapac.com)  
[enquiries@aquaasiapac.com](mailto:enquiries@aquaasiapac.com)

# People Planet Profit at the Nutreco forum

This was a combination of presentations in livestock and aquaculture directed at clients. It was held at the Royal Orchid Sheraton, Bangkok on 11 March 2009 and organised by Trouw Nutrition International. Nutreco, with a heritage going back to the family business Skretting in 1899, is now a leading global player in animal nutrition and fish feed. The forum gathered presentations from the company as well as from Rabobank, informing the audience on what to expect in the food and agriculture value chain during this financial crisis.



Viggo Halseth (centre) with Ng Hiang Chek, Trouw Nutrition Hifeed BV (left) and Sim Sih Yang, Regional Product Manager, Asia Pacific

In Asian aquaculture, the company is a leading marine fish producer with a significant presence in Australia, Japan and China under the name of Skretting. Globally it has 35% of the salmon feed market. In Japan and Asia Pacific, recent acquisitions of Marine Net production facilities have strengthened its market position in yellow tail, red sea bream production. The global revenue of Nutreco in 2008 was almost EUR 5 billion.

COO Juergen Steinemann said Skretting in Asia will be strengthening its position as a producer of specialty products such as in marine hatchery feed and health diets. It also foresees more interest in the tilapia and catfish farming in Asia. In Japan, it will consolidate its position as the producer of marine fish feeds and in New Zealand and Australia, it will continue to harness growth opportunities. Nutreco is committed to sustainable management of natural resources and it participates in the round table for responsible Soy (RTRS) and responsible palm oil (RSPO).

## Aquaculture feeding the future

Sustained aquaculture is key for the future, said Viggo Halseth, Managing Director, Business Group Trout & Marine Feed, Skretting. Aquaculture is gaining momentum with 9% annual growth in the last 15 years and 46% of fish consumed is produced from aquaculture. Possible environmental impact is habitat destruction, abuse of chemicals and antibiotics, changes in biodiversity and lastly, use of unsustainable feed raw materials.

Viggo emphasised that feed has a significant impact in the production, not only on growth performance but also on fish health. A bad environment through the use of less digestible feeds such as 65-88% ADC has an impact on fish health. A 70% digestible feed gives twice the amount of faeces as feed with 85% digestibility. A less digestible feed has a higher feed conversion ratio (FCR) which in turn increases pollution. Over specification also increases the excretion of nutrients to the environment.

Skretting feed is built on research and the company spends EUR 10 million per year to develop new products, least cost formulations, health

promoting diets and medicated feeds. It researches into processes in feed production and standardisation of analytical methods. The focus of R&D on digestibility is to meet the nutritional needs of the fish, defined as proteins, amino acids, fatty acids, vitamins and response to energy levels. This requires defining nutritional needs of the major species and fish digestibility for major raw materials at different temperatures. Near Infrared Spectroscopy is the key instrument in sample analysis prior to feed formulation. Quality assurance of each feed batch to ensure consistency is achieved when the NIR is calibrated for all raw materials and is synchronised through the internet.

A sick animal has to be treated but the rule is that well balanced feed which covers all nutritional requirements of the species should be sufficient under normal conditions. There are some components that can strengthen fish health such as immune modulators and gut stabilisers. Anti bacterial effects of plant extracts are also promising.

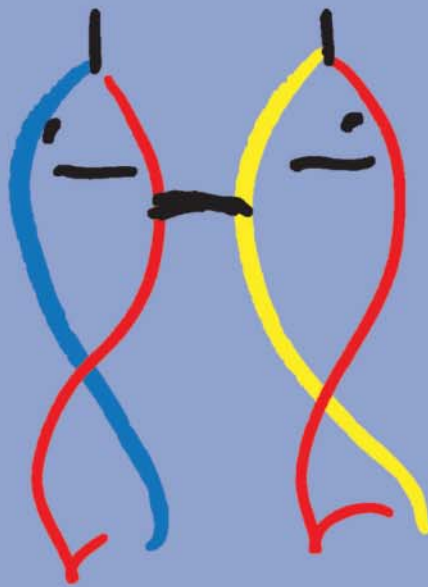
As a major feed company, use of sustainable raw materials is part of the company culture. Viggo also emphasised that issues with GMO (genetically modified) and Land Animal Products (LAP) are not linked to sustainability but are issues of marketing and food safety, respectively. The future may see a higher usage of GM products because vegetable proteins will substitute fish meal and fish oils. New types of genetically modified plants will have improved nutritional qualities such as long chain fatty acids. Products from livestock production such as protein rich co-products from chicken processing, are also used.

The Skretting Sustainable Aquaculture concept is using sustainable raw materials to produce efficient and environmentally friendly feed. The company demands that suppliers provide adequate information to demonstrate that fish meal and fish oil comes from a responsible managed fisheries.

"There has been a continuous effort to reduce FCR. In the Atlantic salmon, this has been reduced from 1.31 in the 1990s to 1.10 in 2000s. Current formulations for salmon have reduced crude protein from 45% to 36% whilst fat have increased to 36% from 18%. The target for feeds for carnivorous species is to use lower amounts of fishmeal to produce the same amount of fish. If prices of fish meal rise, our researchers have the technology to produce feeds with only 5% fish meal", said Viggo.



Ending the forum with a cruise along the Chao Praya River for visitors from Malaysia



# ASIAN PACIFIC AQUACULTURE 2009

and

## Malaysian International Seafood Exposition 2009

November 3 - 6, 2009 • Kuala Lumpur, Malaysia

Hosted by: Department of Fisheries, Ministry of Agriculture & Agro-Based Industries, Malaysia



**For More Information Contact:**

**Conference Manager**

**P.O. 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) • [www.was.org](http://www.was.org)**



# Aqua VIV Asia 2009

Asia's main feed and ingredient exhibition, VIV Asia, held from 11 to 13 March in Bangkok, Thailand was highly successful, despite the economic situation. The review by the organisers indicated a total participation of 568 exhibitors from 41 countries. There were 20,831 visitors, of which 47% were overseas visitors and 53% from Thailand itself. The visitor profile showed a majority of managers, followed by marketing sales, technical and farm owners.



Scott Schneider, Aova Technologies with Erin Tan (right) and Sugania Vijayan, Syndel, Malaysia



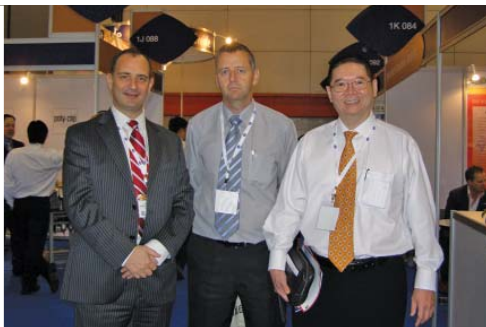
Dr Robert Gauthier and Ronald Co, Jefe Nutrition



Dr Li Zhiwei, Beijing Sunpu Biochem, China



Dr Brian Hunter at the Diamond V booth



Gold Coin's team, from left JC Filippi, Neil Pleydell and Sam Soh



Dr Franz-Peter Rebacka (right) and Bernd Grobe Holthaus, Geflügel-Protein Vertriebsgesellschaft mbH & Co

The first edition of the Aqua VIV Asia was equally successful and fulfilled the needs of visitors and exhibitors alike for innovative products and services for their aqua business. Aqua VIV Asia comprised booths dedicated to aquaculture in the aqua pavilion, an aqua forum where company representatives gave the technical seminars and two full day conferences organised by Novus Aqua on 11th March (see box) and by Bayer Animal Health on the following day (see page 29). There were 24 booths dedicated to aquaculture whereas 21% (113) of exhibitors in the main VIV Asia also had products for aquaculture at their booths. The main interests of visitors to Aqua VIV Asia were in feed ingredients, additives, raw materials and animal health.

## Aqua seminars

### New Products

New to aquaculture is the AG 175™ from **Jefe Nutrition, Canada**. **Dr Robert Gauthier** said that this fermentation product has a strong protease activity. It contains a stable alkaline protease with 3 fractions having an optimum activity pH between 6.5 and 9.0. The protease increases the 'in vivo' digestibility of a wide range of protein sources, both vegetable and animal. At low inclusion rates of 175g/tonne of feed, it reduces the use of fish meal. The enzyme resists the antiprotease factors found in some protein sources. Numerous trials in trout, carps, tilapia, shrimps and sea breams were conducted at various water temperatures and helped determine the best nutritional approach to using AG 175™. The stability of the protease in AG 175™ has been demonstrated under commercial conditions, both in extruders

and expanders, up to 121°C, with a recovery rate of 70% of the enzyme activity. Under normal pelleting conditions, there is no loss of enzyme activity.

Robert concluded that the product can be used to improve the absorption capacity of the intestine, improve protein digestibility, improve the performance of fishes and crustaceans on standard diets and ultimately, reduce feed cost (lower protein diets) while maintaining normal performance.

Another new aqua feed product is the fermented soya bean meal called the Golden Protein, produced by **Green Era Biotech Corporation** based in the Philippines. **Dr Mao Yen Chen** said that this is a replacement for fish meal. During fermentation, enhancers and selected microorganisms are added. Various specific probiotics such as lactic acid bacteria yeasts, proteolytic bacteria and natural enzymes were added in high concentrations. Trials in Taiwan showed that feed conversion ratio improved with pompano *Trachinotus spp* from 1.48-1.64 to 1.30 and for the threadfin *Eleutheronema tetradactylum*, it improved from 1.78 to 1.48. Mortality was reduced because of stable water quality conditions. Golden protein was used to partially replace fishmeal at 28% and the total inclusion rate of the product was 10% in the feed.

### Nutrition and feed development

On the topic "Balancing Performance and Profitability in Aquaculture", **Dr. Pedro Encarnaçao**, Biomin's aquaculture technical director said that first consideration for feed manufacturers should be the

development of cost-effective diets focusing not on minimizing the cost of the feed (\$/kg feed), but rather maximize the conversion of feed into biomass/product, thus minimizing feed cost per unit fish biomass gain (feed cost \$/kg fish produced). Their target is to adapt the ingredient composition of the feed according to production objectives. Feed formulators should use ingredients that are economical but understand their characteristics and limitations in relation to nutrient requirements and nutrient utilization of the different species cultured. In addition, they should make use of available feed additives proven to improve animal performance and/or reduce the negative effects of some anti-nutritional compounds present in feed ingredients (mycotoxins, NSP's, peroxides, etc). Thus, the use of suitable diets maximizing fish production can significantly increase profitability.

**Jacques Gabaudan** from **DSM Nutritional Products** focused on vitamins in fish and shrimp. Monitoring vitamin deficiency is important as not to stop the fish from eating and becoming weak. DSM has developed the optimum Vitamin Nutrition Concept (OVN). Vitamin allowances (total amount of vitamin in the diet) lead to an optimisation of the overall animal response in terms of growth, feed efficiency, reproductive performance and immunity. An issue in vitamin is the accurate potency as declared value can be lower than actual potency. It is also important to be able to specify the active component to make the product cost competitive. The combination of availability and miscibility of vitamins has been well researched at DSM. It is important that the vitamin molecule is present in each pellet and this can be extremely difficult when amounts are minute (biotin is required at 1ppm only). Other issues are in vitamin and mineral handling, dust levels and flowability of the materials. Rovimix Stay C ensures good flowability and mixability in aqua feeds, said Jacques.

**Dr Li Zhiwei, Beijing Sunpu Biochem. Tech. Co. Ltd,** China said that from a production of less than 1 million tonnes per year in the early 1950s, aquaculture production in 2006 was reported to be 51.7 million tonnes with a value of USD78.8 billion, representing an annual growth rate of nearly 7%. The farming of aquatic animals has led to concerns on water and environmental pollution in inland and coastal areas. Sustainable aquaculture must be introduced and carried out. Technical solutions were presented from nutrition and feed processing aspects.

**Dr Vincent Fournier, Aquativ, France** presented the concept of palatable proteins in shrimp and fish feed. He showed some results of trials with several species and under different culture conditions. These are hydrolysed and fermentation products from marine and poultry by products, processed to obtain a high level of biologically active compounds such as peptides and free amino acids. These have been confirmed to be very attractive to fish and to have high feed utilisation. These have been shown to be very palatable in European sea bass, catfish and tilapia under different conditions such as with



From left: Dr. Pedro Encarnaçao, Biomin, Benoit Reynard, Livestock Feed Ltd, Mauritius, Herve Brun, Aqua Techna, France, Thomas Levallois, Aquativ, France, Daliel Bonille, LFL, Mauritius and Anh Ngoc Nguyen, Aquativ Vietnam.

zero fish meal feeds, commercial feeds and in conditions of stress.

"The application of these palatable components showed good feed efficiency with increased feed intake and thus improving productivity. Our next step is to identify among the peptides the most important and the most biologically active in fish and shrimp. Basic research undertaken with other laboratories will also proceed to characterise these components", said Vincent.

#### Feed processing

The presentation on "Extruder and Dryer Advancements" by **Joe Kearns, Wenger, USA** focused on improved thermal energy inputs with Residence Time Control of preconditioners. It also covered Specific Mechanical Energy input control in the extruder barrel with the use of either Mid Barrel Vales or the popular Back Pressure Valve. Increased sanitation in the extrusion area utilizing the environmentally friendly Waste Recovery System was introduced which greatly decreases water and solids into the environment by placing them back into the feed while effectively reducing extrusion losses.

Wenger's continued efforts in energy use reduction focused on control systems for dryer and cooler automation. The mechanism for a computerized moisture and energy control for the dryer is with the extruder and dryer communicating with each other. The moisture and energy control system allows for exacting moisture of the final feeds with reduced energy consumption. Final moisture algorithms continuously measure set parameters to adjust final moisture in the feed according to input specifications by compensating for changes in air temperature and atmospheric conditions. It can also maximize dryer energy efficiency by controlling exhaust air humidity. This system offers control that cannot be achieved by operators since it takes in to account the atmospheric or environment changes that may occurs simply when we go from day to night or season to season.

#### Disease diagnostics

**Dupont** introduced a novel molecular diagnostic test kit at the aqua seminar. **Dr Sri\_Nhonghang Supornchai** demonstrated the three steps—sample preparation, amplification and detection for the Virkon aquatic white spot syndrome Virus (WSSV) test kit. He said that the kit will make it easier and faster for farmers to detect the disease at the pond site. The added advantage is that it can also detect viruses at an early stage. Some of the features of this kit are the affordability, delivery of results within 105 minutes as compared to 6 hours with a one step PCR. It has a test sensitivity superior to the methods such as immunoassays and comparable to other laboratory based methods such as nested PCR methods. This kit is part of the DuPont's Virkon Aquatic Biosecurity Monitoring system product line. New test kits for other pathogens will be launched in the future.



Rock Chen (left) and Joe Kearns, Wenger.



Erich Erber (right) at the launch of Poultry Star with (from second right) Piyapa Erber, Marnie Betts and Florian Zehner.

## At VIV Asia 2009 Biomin

Biomin welcomed customers, staff and media to VIV Asia with a cocktail function in Bangkok on 10 March 2009. This is the most important event for the company which has participated at VIV exhibitions since 1991.

In his welcoming address, Erich Erber, CEO said that the company has 25 years of development in health and animal nutrition and at the function was ready to announce new innovations such as the 'PoultryStar', probiotics for the livestock industry. It also announced the Mycofix® Secure, the latest addition to Biomin's Mycofix® product line. This a risk management solution against aflatoxins and fumonisins in animal feed. It is a highly effective and economical solution for growers and finishes, broilers and layers where feeds are contaminated with aflatoxins, fumonisins and ergot alkaloids only. A special 2009 edition of the Biomin Mycotoxin Survey Report will be released soon. This two-part comprehensive report will reveal the contamination results of the year 2007/2008 as well as the analyses and trend studies of mycotoxin contamination since 2005.

### Specific for aquaculture

"We are bullish on aquaculture's role in food supply especially of

the catfish in Asia. In the UK, beef consumption is decreasing whilst that of fish is increasing. Aquaculture is a more cost effective way to provide a protein source in the future as compared with land animals. We pushed ahead with aqua 5 years ago and have started to look at using our products on warm water fish species. Admittedly being a company with a strong R&D on animal nutrition and health products, we need to have a different team to think aquaculture and grow our aqua line of products. We have ACAN in Thailand which does research and development for our aqua line of products. It does adaptations of these products for warm water species", said Erber.

"Applications for probiotics for use in aquaculture are ongoing and after some processes of registration, it will fully introduce AquaStar to the industry. The ranges comprise products for pond treatments, shrimp hatcheries and pond grow out. These are already sold in Ecuador and we are progressing well with trials in Vietnam and Thailand. We have not started in China and India".

Biomin also featured several aspects in aquaculture with presentations at the Aqua Seminar on "Balancing performance & profitability for aquaculture" by Dr Pedro Encarnaçao.

## Launch at VIV Asia

### New phytogetic feed additive for marine shrimp

Delacon, Austria, has introduced ENVIRO Plus, a phytogetic feed additive for commercial shrimp production with the benefit of improving production efficiency. Since its foundation in 1988, Delacon has been operating in the business of development, production and worldwide sales of phytogetic feed additives, mainly for animal production industry.

Phytogetic feed additives are well-blended compositions of special plant-based raw materials and mineral-based carriers. The active ingredients of ENVIRO Plus are based on a standardized complex of triterpenoid saponins, which improve attractiveness of feed as well as the performance parameters such as weight gain, feed conversion and survival. Triterpenoid saponins are harvested from the Quillaja tree, native to South America. These saponins improve gut wall permeability and show better retention of nutrients.

The feed additive has been shown to increase daily weight gain by 15% and increase survival rate by 8%. In commercial trials with post larvae of white shrimp *P. vannamei* conducted with Chulalongkong University, significantly higher growth was obtained with the products at 150ppm inclusion in the diet. Test for palatability, carried out in the laboratory at Burapha University Thailand showed better feed attractiveness as compared to yucca saponins. Significantly higher weight gains were also obtained when the product was used at 300 to 600ppm in diets which demonstrate clearly a dose-response effect. Survival rates improved irrespective of inclusion rates. More information: [www.delacon.com](http://www.delacon.com)



# Novus Aqua conference

**Novus Aqua organised a one day conference to address issues of profitability and sustainability within the current economic crisis. The concern was how the crisis would affect consumption of seafood and thus the seafood supply chain. The solutions to lower feed formulation costs and improving feed efficiency were discussed at this conference. Two presentations gave an overview of the market situation for the pangasius catfish from Vietnam and global tilapia.**

## Finding a competitive edge

The main issue in shrimp culture is cost of production. Dr Chalor Limsuwan, Aquaculture Business Research Centre, Thailand said that the financial crisis in the EU and Japan has affected consumption and this translates to lower income for producers. In his presentation on industry trends and the global economic crisis, he said that producers in Thailand have agreed to cut back production by 20% to stabilise prices but if prices increase, there may be possibility of additional output. With most countries producing the white shrimp, the competitive edge is with good quality post larvae and to be able to control diseases. Dr Chalor discussed these two issues in detail in his presentation.

## Aqua feed and nutrition

Feed issues were discussed in three presentations. Dr Bob Swick said that current issues in aqua feed production centred around the ingredient costs which are much lower at the end of 2008 as compared to in early 2008. Interest rates are low now but credit is tight. Issues in aquaculture nutrition are in fishmeal and fish oil replacement as consumers are asking for sustainable production of seafood. Opportunities are in using GMO soy oil, soy protein concentrates and acidifiers. SDA soy oil has a much higher amount of linolenic acid (omega 3) and lower linoleic acid (omega 6) with conversion to EPA proven in humans. Soy protein concentrate (SPC) in *Penaeus vannamei* was shown to be equal to diets with fish meal. Acids and acid salts result

in a general increase in growth, improved digestibility, antibacterial effects in fish and increased survival and optimised feed efficiency. Dr Lukas Manomaitis, ASAIM discussed training farmers on feeds. He outlined the basic information on feeds and feeding which farmers should be aware and use in managing feed usage in farms.

## Biofloc shrimp culture

The application of traditional pond based shrimp farming practices has met with limited success in the USA due to economic and environmental constraints. Among them, the water exchange required for these systems increases the discharge of nutrient rich water into natural ecosystems and increases the possibility of introducing harmful and pathogenic organisms. Seasonally low temperatures also limit pond production systems to only one cycle per year. Dr Jesus Venero, from Novus International, said that as an alternative, scientists have developed biosecure aquaculture systems.

These systems consist of greenhouse-enclosed raceways for intensive to super-intensive shrimp production (i.e., *Litopenaeus vannamei*) with zero to limited water exchanges that can be operated year round. In these systems shrimp have been raised initially at densities of 300-750 PL/m<sup>2</sup> and now reaching up to 1000 PL/m<sup>2</sup>. The Waddell Mariculture Center, in Bluffton South Carolina-USA, one of the pioneer institutions working in these type of systems, has reached stocking records of 814 PL/m<sup>2</sup> and production of 69 tonnes/ha in one cycle.



Dr. Somying Piumsomboon, Director General, Thai Department of Fisheries (left) and Mr Thad Simons, CEO Novus cutting the ribbon.



Dr. Chalor Limsuwan, Committee on Agriculture and Biology of National Research Council of Thailand

He pointed out that when shrimp are reared at high densities without water exchange in these closed units, a biofloc develops in the culture water that has several advantages for shrimp culture. These include increased recycling of wastes allowing for an overall reduction in pollutant discharge to receiving bodies when waters are released at harvest. A lower amount of feed is required, which improves feed conversion rates. Water quality has also been found to be more stable and competition within the diverse microbial community apparently reduces pathogenic micro-organisms, such as vibrios. An additional benefit of biofloc system is the increase of natural productivity that can be used as a natural complement to prepared feeds. Also the high nutritional value of the biofloc particles has allowed the formulation of diets in which all the fish meal protein has been completely replaced by plant protein sources, such as soybean meal. Furthermore, replacement of fish oil by oil produced through microbial fermentation of marine algae, rich in highly unsaturated omega 3 fatty acids, has allowed the complete removal of marine fish ingredients. These plant-based diets have been evaluated and compared with commercial feeds containing fish meal under laboratory and production conditions, both in ponds and in closed raceways. Initial results have shown similar performance in

production parameters (i.e., growth, feed conversion ratio (FCR), and survival) between shrimp fed with both type of diets.

Finally Dr Venero indicated that although it is still early, these raceway enclosed biofloc systems seem to be a viable alternative to face the environmental and sustainability concerns of the marine shrimp industry. A higher level of sustainability is expected to be achieved when less fish meal is used to produce one unit of live weight of shrimp. Additionally, the limited discharge of residual waters to the environment makes these systems more environmental friendly and sustainable at the same time that improve the public perception of the aquaculture industry.

### Catfish and tilapia

The Vietnamese production of *Pangasius* catfish increased to 1.13 million tonnes in 2007. Production will continue to expand but the government will ensure sustainable production methods. A presentation on the pangasius catfish farming in Vietnam by Chau Thi Tuyet Hanh, Department of Aquaculture-Ministry of Agriculture and Rural development indicated that this will include control on the pangasius culture area, management of seed, managing ingredients in feeds and encouraging farmers to follow GAP/CoC practices and apply for certifications. *Pangasius* was marketed in 128 countries in 2008. The opportunity to expand in the EU is because of the limitations on fishing for white fish in the EU countries. Africa is a potential market for the fish.

In tilapia production and marketing 2009, Dr Kevin Fitzsimmons, said that US consumption of tilapia increased in 2008 to 453,264 tonnes of live weight. The market is expanding as Europe is following the US trend of adopting tilapia to replace traditional fish. Demands are high for food safety, organic and green tilapia products. Improved quality control is required for US, EU and Japan markets. Future production of tilapia is expected to rise to 3 million tonnes by 2010 from the 2.6 million in 2007.

## What to expect in AQUA CULTURE Asia Pacific Magazine in 2009

VOL 5 2009	July/August	September/October	November/December
<b>Issue focus</b> <i>current trends &amp; challenges</i>	Health Management	Cage culture	Hatchery Management
<b>Industry review</b> <i>with profiles &amp; outlook</i>	Freshwater fish/ prawn	Marine shrimp	Offshore cage culture
<b>Feed technology</b>	Fish meal replacements/ novel meals	Processing/ Immunostimulants	larval feed/new ingredients
<b>Suggested topics for technical articles</b>	Biosecurity	Fish diseases/ Biotechnology	Pond culture technology
<b>Show preview /issue</b>	Asian Pacific Aquaculture 2009 & Malaysian International Seafood Exposition 2009 Kuala Lumpur, Malaysia 3-6 November		Shanghai International Fisheries and Seafood Expo (Sifse 2009) Shanghai, China 9-12 December
<b>Deadline for articles</b>	June 1	August 3	October 1



# Introduction of Shanghai International

# Fisheries & Seafood Expo (Sifse2009)

**SIFSE2009 will take place on Dec 9-12 .2009**

**Shanghai Everbright Convention&Exhibtion Center,China**

SIFSE Expo sustained three years continuously development under the great support and concern in fishery and Seafood industry at home and abroad.SIFSE Expo achieved qualitative progress in terms of scale,professionalism,international popularity,thus make SIFSE to be the most influential event in marine products industry in East China even whole China and best gateway to access to China's fishery and seafood market.

European Brussel and American Boston fishry expo is prone to being the exchange center of global fisheries and seafood companies,China's fishery and seafood market just like China's economy need to be gradually Incorporated into world market to facilitate the accession to China's market for the fishery and seafood giant and China's companies also are calling for a high-grade local expo to expand world market.

Shanghai,lie on the midpoint of China's coastline geographically,the most highly internationalized city around Yangtze River Delta,influence the Yangtze River Delta even China with it's powerful economic strength and potentially huge fishery and seafood market,besides the advanced exhibition industry conceive and shape the SIFSE expo

Shanghai Fisheries Trade Association, associated with Shanghai Fisheries Office, China Aquatic Products Processing & Marketing Association and Taiwan Aquaculture Marketing Cooperative together with China Tongyuan Corperation are going to hold SIFSE2009 together

We will survive and grow hand in hand in presence of global economic recession under the support of China's huge market demand and purchasing power for fishery and seafood. You will catch a big "fish" in Sifse2009.book your stand now for your business opportunity from organizer



Shanghai Gehua Exhibition Service Co.,Ltd

Web of Sifse.[www.sifse.com](http://www.sifse.com)

Mr Daniel

Tel:+86-21-34140855

E-mail:[daniel@sifse.com](mailto:daniel@sifse.com)

M.P:+86-13817672984

Fax:+86-21-64516467



# Aqua India 2008 – New Technologies and Initiatives



**This was the annual event of the Society of Aquaculture Professionals (SAP) of India. It gathered 250 participants from India as well as from other countries for two days in February 2009. The event originally scheduled for November 2008 was cancelled because of the Mumbai bombings and closure of the airport in Thailand. SAP invited local and international experts to present papers on various aspects in shrimp and finfish culture.**

D. Ramraj, President, SAP in his welcome address highlighted the need for the adoption of technologies proven elsewhere in the world in order to overcome the crisis in the Indian shrimp industry. The benefits of vannamei to India and the adaptations required for farming vannamei were presented and discussed. He also noted the changes in fresh water aquaculture in India with the application of better practices and the opportunities in species diversification.

## Approaches in shrimp farming

In his overview of the farming of marine shrimp and freshwater prawn (scampi), S. Chandrasekar, Country Manager, INVE, said that in 2007-08, production dropped to 75,000 tonnes of marine shrimp and 16,000 tonnes of scampi. Currently only 33% of shrimp hatcheries and 20% of the scampi hatcheries are operational. Reasons given were WSSV infections in brood stock, loose shell syndrome and slow growth in marine shrimp and white muscle/tail disease in scampi. The indications for future growth are with SPF monodon shrimp and SPF vannamei shrimp and selective breeding for all species. With intensification, India may produce 80,000 tonnes each of monodon and vannamei shrimp and 40,000 tonnes of scampi by 2012. Markets diversification and developing domestic market for shrimp will be needed too.

In his comparison of the marine shrimp industry in Thailand, Indonesia, China, Vietnam and Malaysia, Martin Guerin, Technical Manager Godrej Gold Coin Aqua Feed Ltd said that India has similar cost of production compared to most Asian countries, but much lower per hectare profits. Poor health status often jeopardized the profitability of shrimp farming in India. Opportunities are there for India with the introduction of the vannamei shrimp but she has to catch up with others. His view was that India has been producing monodon for the niche market and that advantage is threatened with the production of large sized vannamei by other countries. Several countries are

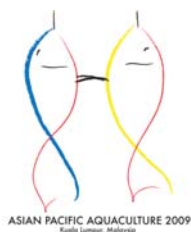
developing a strong local demand for shrimp. His recipe for success lies in getting back to fundamentals such as quality inputs and address food safety issues.

The benefits and challenges with vannamei shrimp farming were discussed by several speakers. Dr. Jim Wyban, President Hi Health Aquaculture Inc., Hawaii compared the biological, technical and economic benefits of vannamei shrimp over that of the black tiger shrimp. He added that during the global economic crisis, consumers will prefer inexpensive small shrimp and vannamei is best suited for this. The forecast was a global production of 4 million tonnes of vannamei by 2015. Dr. Matthew Briggs of Vannamei 101, Thailand discussed the technological adaptations required when switching over from monodon to vannamei. Mr. Glen Illing of Syaqua, Thailand highlighted the benefits selective breeding has brought about in developing strains of fast growing and disease resistant vannamei.

Manavendra Rao, Former Director of Aqual'ma, Madagascar shared his experiences in a large, fully integrated operations with the 9th generation domesticated SPF monodon. The combination of strict biosecurity features, quarantine and disease screening processes and a dedicated approach makes it possible to produce SPF monodon stocks and achieve faster growth rates through selective breeding. In two other presentations, Dr. Prakan, Charoen Pokphand, Thailand spoke on the role of minerals in shrimp farming, the importance of the ionic composition and the right ratio of different minerals in pond water for proper growth and health of the shrimp. NaCSA's CEO, N.R. Umesh presented the progress in best management practices among farmers.

## Finfish culture

Dr. P.E. Vijay Anand, Technical Director, ASA-IM said that the Indian freshwater aquaculture sector is slowly converting to pellet based feeding and that several new feed plants are being established in the country. Dr. Ram C Bhujel, Asian Institute of Technology, Bangkok presented AIT's efforts in the promotion of tilapia culture questioned why tilapia farming has not picked up in India. Tilapia farming would go a long way in supplying cheap protein to the large Indian population and also provide livelihood opportunities. In the hatchery and grow-out technology development for the sea bass farming, Y.C. Thampi Samraj, Project Director, RGCA and Dr. A.R. Thirunavukkarasu, HOD, Finfish culture Division of CIBA described the recirculation water systems used to spawn and produce sea bass fry throughout the year at the two establishments.



# Asian-Pacific Aquaculture 2009

**3-6 November, Kuala Lumpur, Malaysia.**

This year, the biennial meeting of the conference and trade show of the Asian-Pacific Chapter, World Aquaculture Society will move to Kuala Lumpur. This will be the first major aquaculture conference and trade show for industry in Malaysia. It will be hosted by the Department of Fisheries, Ministry of Agriculture and Agro-based Industries. Concurrent with this conference, the Malaysia Department of Fisheries (DOF) will also organize the Malaysian International Seafood Exposition (MISE 2009).

Asian-Pacific Aquaculture 2009 will also be the venue for the global aquaculture industry to learn more on the rapidly growing industry in Malaysia and her neighbours, Singapore, Thailand, Vietnam and Indonesia. Participants will have the chance to visit some of the interesting aquaculture developments in the country during the farm tours. At the 70 booth trade show, the newest technology in aquaculture from around the world will be displayed. The last conference and trade show in Hanoi, Vietnam in 2007 attracted more than 1,000 registered participants from 50 countries. More than 40 companies were represented at the 70 booth trade show.

## Technical program covers the latest research

Plenary topics will focus on marketing aquaculture products. Tentative topics are Promoting Trade in Seafood – a Buyer's Expectation and Ensuring Fair Trade in Seafood – An Aquaculture Perspective. DOF will also present trends and prospects in aquaculture in Malaysia. Similar to the previous conference and trade show in Hanoi in 2007, there will be concurrent sessions and technical workshops. Tentative sessions for the technical program are as listed in the box. All presentations will be in English.

## The trade show

A broad section of industry from Asia and elsewhere is expected at this show. These will feature complete feeds, feed ingredients and additives, micro nutrients, aquaculture equipment and services and health management. At press time, exhibitors confirming their participation are in feed, feed additives, education, health diagnostics and aquaculture.

<b>Marine Shrimp</b>		
• Production	• Breeding	• Nutrition & Health
<b>Tilapia</b>		
• Production	• Nutrition	• Health
<b>Freshwater Fish Culture</b>		
• Cyprinids	• Catfish	• Integrated Culture Systems
<b>Marine Finfish</b>		
• Culture Systems	• Nutrition & Diseases	• Seed Supply
<b>Production Systems</b>		
• Recirculation Systems	• Technology and Equipment	• Cost Efficiencies
<b>Mollusc Culture</b>		
• Hatchery	• Production	• Health
<b>Marketing and Trade</b>		
• Certification & standards	• Supply Chain	• Post harvest • Food Safety
<b>Others</b>		
• Genetics in aquaculture • General Aquaculture • Aquatic Animal Health • Aqua feeds • Aquaculture Biotechnology	• Macrobrachium • Seaweeds and Algae • Education and Training • Economics and Management • Aquaponics • Risk Management	• Crabs and Lobsters • Ornamentals • Development & Planning

For more information on how to participate in this conference and trade show, contact:

**Asian-Pacific Aquaculture 2009, Conference Manager, P.O. Box 2302**  
Valley Center, CA 92082 USA, Tel: +1-760-751-5005; Fax: +1-760-751-5003  
Stay in touch with the program developments at: <http://www.was.org>

## The early bird registration ends on August 25, 2009 Call for Papers-July 1, 2009

Asian-Pacific Aquaculture 2009 encourages the submission of high quality oral and poster presentations. All abstracts must be in English - the official language of the conference. The deadline is July 1 2009. All abstract should be submitted on line at [www.was.org](http://www.was.org)

## Special industry session

This will be a gathering of marine fish, marine shrimp and freshwater fish producers on Thursday 6 November for a half day session. Technical presentations will feature hands on experiences by international producers and experts to impart critical information on general problem solving, marketing and feed and disease management. Malaysian farmer attendance will be sponsored by the DOF. Details on the presentations will be published soon on the web page of the event at [www.was.org](http://www.was.org).

## Call for papers at Aquafeed Horizons Asia Conference

This is the specialty aqua feed conference at Victam Asia 2010. Aquafeed Horizons Asia returns once again to Bangkok, March 3, 2010, alongside the feed industry's major trade show, Victam Asia, at the Queen Sirikit National Convention Centre, Bangkok, Thailand.

The conference attracts senior-level technical and management staff from the aquafeed sector from throughout the Asia Pacific region and farther afield. Aquafeed Horizons Asia will deliver an expert level of technical information to meet the needs of the commercial aquafeed industry in Asia Pacific. Previous meetings have attracted some 160 – 200 delegates from the international feed industry. The FIAAP Conference is organized by Linx Conferences, the conference arm of

the aquafeed information portal, Aquafeed.com and the feed industry portal, FeedLink.

Papers are now invited from qualified professionals on the following topics:

- Impact of market trends on feed development,
- Aquafeed processing technology,
- Aquafeed ingredients and formulation
- Quality control

A 'Call for Papers' form is available for download from the conference website: [www.feedconferences.com](http://www.feedconferences.com). The deadline is April 30, 2009. For more information, visit [www.feedconferences.com](http://www.feedconferences.com) or email [info@feedconferences.com](mailto:info@feedconferences.com).

## ILDEX India Aquaculture 2 to 4 July 2009, New Delhi, India

This is the third mega International show to be held at Pragati Maidan, New Delhi India. Some 142 exhibitor and 12,000 visitors from 17 countries participated in ILDEX India 2008. The show is supported by government agencies, associations and others. It is organised by Pixie Consulting Solutions, India and NEO, Bangkok Thailand

IlDEX India Aquaculture provides a gateway to SAARC and other countries for exporters to display their products and importers to meet their local consumer needs. International meet and match club provides an excellent opportunity to explore international partners.

India ranks third in total aquaculture production but according to FAO only 10% of marine and 30% of inland resources has been utilized in India. There is still tremendous scope for expansion in feed, processing, cold chain, pharmaceutical, ornamental and aqua equipment supplies. In IlDEX India Aquaculture 2009, Ministry, fishery associations and export agencies are jointly organizing a one day national workshop on fisheries development. Other sectors covered in IlDEX India will be poultry, dairy and meat processing. For more information, Email: [ildex@pixie.co.in](mailto:ildex@pixie.co.in)

## Integrated Technologies for Advanced Shrimp Production October 13-15, 2009, Hawaii, USA

A 3-day symposium to provide a platform for reviewing the current status of shrimp farming technology worldwide and exchanging information in key areas such as biosecurity (health management), genetic improvement, and environmental management. International experts will be invited to provide keynote speeches for each session. Plenary speakers include:

- *Shaun M. Moss- Maturation of a global shrimp farming industry: challenges and opportunities*
- *Donald V. Lightner -The global status of significant infectious diseases of farmed shrimp*
- *Grace Chu-Fang Lo- Advances in diagnosis and prevention of white spot disease using molecular technologies*
- *Marcela Salazar -Emerging diseases in shrimp culture: overview of viral and bacterial diseases in America*
- *Arun K. Dhar- Genetics of disease resistance in shrimp*

- *Ana M. Ibarra - Genetics of shrimp reproduction*
- *Nigel Preston- Breeding of *Penaeus monodon* or *P. japonicus**
- *Jianhai Xiang - Breeding of *P. chinensis* in China – molecular biology approach*
- *Claude E. Boyd- Environmental management of shrimp farms in Asia to promote healthy shrimp and reduce negative impacts*
- *I. Chiu Liao - Shrimp aquaculture development in Eastern and Western Hemisphere – art and sciences in egg fried rice versus hamburgers*
- *Qingyin Wang- The culture of shrimp *Litopenaeus vannamei* in China: Development and challenges*

The deadline for reduced registration fee is June 24, 2009.  
More information: Email: [shrimp2009@oceanicinstitute.org](mailto:shrimp2009@oceanicinstitute.org)  
Web: [www.oceanicinstitute.org](http://www.oceanicinstitute.org)

## New Dates for World Aquaculture 2009 (WA2009), Veracruz, Mexico September 25-29, 2009

Due to the progression of events related to the recent swine flu outbreak in Mexico, the World Aquaculture Society in consultation with the partners and sponsors of WA2009 has decided to postpone WA2009. The new date is September 25-29, 2009. The schedule will be the same as it was for the May dates. Schedules etc will be

revised and will be available on the web site. The organisers also assured that all abstract submissions, registrations, payments and assignments will be carried over to the new dates with appropriate time for changes/cancellations.

More information: Web: [www.was.org](http://www.was.org)

### May 28-31

**Aquarama 11th International Ornamental Fish Exhibition**  
Singapore  
Email: [linda\\_tan@cmpasia.com.sg](mailto:linda_tan@cmpasia.com.sg)  
Web: [www.aquarama.com.sg](http://www.aquarama.com.sg)

### June 12-14

**Vietfish 2009- Vietnam Fisheries International Exhibition**  
Ho Chi Minh City  
Email: [quochanh@vasep.com.vn](mailto:quochanh@vasep.com.vn)  
Web: [www.vietfish.com.vn](http://www.vietfish.com.vn)

### August 14-17

**Aquaculture Europe 2009**  
Trondheim, Norway  
Web: [www.easonline.org](http://www.easonline.org)

### September 7 - 10

**Larvi 2009-5th Fish & Shellfish Larviculture Symposium**  
Belgium  
Email: [larvi@ugent.be](mailto:larvi@ugent.be)  
Web: [www.aquaculture.ugent.be](http://www.aquaculture.ugent.be)

### September 16 - 19

**World Fishing Exhibition**  
Vigo, Spain  
Email: [IRoberts@mercatormedia.com](mailto:IRoberts@mercatormedia.com)  
Web: [www.worldfishingexhibition.com](http://www.worldfishingexhibition.com)

#### NEW DATES

### September 25-29

**World Aquaculture 2009**  
Veracruz, Mexico  
Email: [worldaqua@aol.com](mailto:worldaqua@aol.com)  
Web: [www.was.org](http://www.was.org)

### October 13-15

**Integrated Technologies for Advanced Shrimp Production**  
Hawaii, USA  
Email: [shrimp2009@oceanicinstitute.org](mailto:shrimp2009@oceanicinstitute.org)  
Web: [www.oceanicinstitute.org](http://www.oceanicinstitute.org)

### November 3-6

**Asian-Pacific Aquaculture 2009**  
Kuala Lumpur, Malaysia  
Email: [worldaqua@aol.com](mailto:worldaqua@aol.com)  
Web: [www.was.org](http://www.was.org) (see page 51)

### November 3-5

**14th China Fisheries & Seafood Expo'2009**  
Qingdao, China  
Email: [seafoodchina@seafare.com](mailto:seafoodchina@seafare.com)  
Web: [www.chinaseafoodexpo.com](http://www.chinaseafoodexpo.com)

### November 8-11

**International Symposium on Aquaculture, Biology and Management of Commercially Important Crabs – 2009 (ISABMC-2009)**  
Shanghai, China  
Email: [shanghai09crabconference@gmail.com](mailto:shanghai09crabconference@gmail.com)  
Web: [www.crablab.org](http://www.crablab.org)

### November 27-30

**1st International Symposium on Aquaculture and Fisheries Education (ISAFE)**  
Pathumthani, Thailand  
Email: [aarm@ait.ac.th](mailto:aarm@ait.ac.th)

### December 9-12

**4th Shanghai International Fisheries & Seafood Exposition**  
Shanghai, China PRC  
Email: [daniel@sifse.com](mailto:daniel@sifse.com)  
Web: [www.sifse.com](http://www.sifse.com)



## After we've fitted the final piece, we find a new puzzle

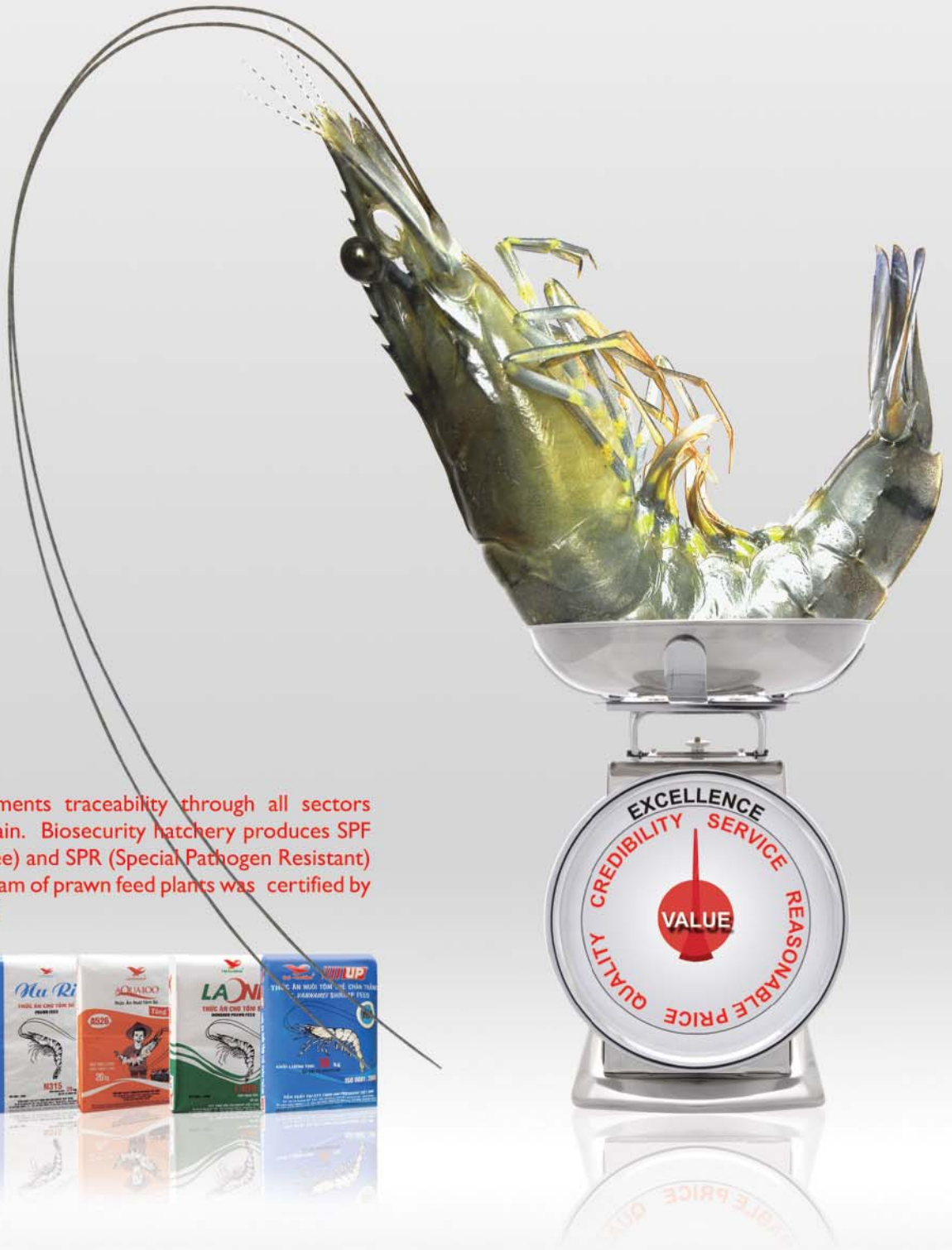
How can we find new alternatives to fishmeal and fish oil, and how can we increase the omega-3 content in fish raised on such feeds? How can we boost fish health and performance through functional ingredients? The researchers at Skretting Aquaculture Research Centre are committed to finding answers in a world that changes rapidly. Their priorities are consumer safety, fish health and productivity, improved feed management and sustainability both in feed production and in fish farming. Their discoveries benefit fish farmers directly, by ensuring that consumers can eat healthy, sustainable and delicious fish. [www.skretting.com](http://www.skretting.com)

**Feeding your passion for fish**

SKRETTING 



# CREATES THE VALUE OF PRAWN



Uni-President implements traceability through all sectors along with supply chain. Biosecurity hatchery produces SPF (Special Pathogen Free) and SPR (Special Pathogen Resistant) larvae. Quality program of prawn feed plants was certified by ISO 22000 & HACCP.



• 16-18, DT 743, Song Than II Industrial Zone, Binh Duong, Vietnam.  
• Tel: +84-650-3737626 - Fax: +84-650-3790819  
• Email: aquafeed@upvn.com.vn



CTY TNHH UNI-PRESIDENT VIỆT NAM  
UNI-PRESIDENT VIETNAM CO., LTD.

Establishing a Healthy and Happy Tomorrow

# AQUA Culture

## Asia Pacific

Be updated on developments in the fast expanding aquaculture industry in Asia Pacific with industry trends, technical information and features, company and product news and show reports.

## Do not miss an issue... Subscribe NOW

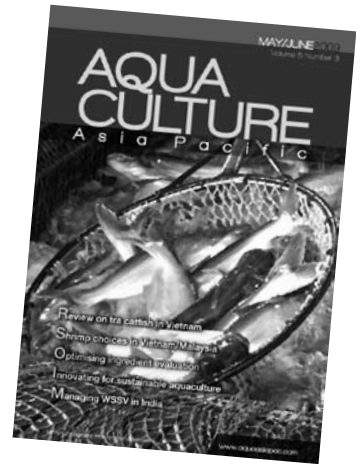
A one year subscription of six issues (airmail delivery) costs:

- Asia – SGD 70  
 Rest of World – SGD 100

(one SGD = 0.68 USD)

### How to subscribe:

For online subscription go to [www.aquaasiapac.com](http://www.aquaasiapac.com)



OR Complete the form below and fax/mail to **Aqua Research Pte Ltd**

**3 Pickering Street, #02-36 Nankin Row, China Square Central, Singapore 048660. Fax +65 6223 7314**

Name: \_\_\_\_\_

Company /Association: \_\_\_\_\_

Position: \_\_\_\_\_

MailingAddress: \_\_\_\_\_

City: \_\_\_\_\_ Country: \_\_\_\_\_ Postal Code: \_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_

Email: \_\_\_\_\_ Website: \_\_\_\_\_

### Payment by credit card *(Note: your card will be charged in Singapore dollars)*

- Visa  Mastercard

Credit Card No: \_\_\_\_\_ V Code No : \_\_\_\_\_ *(three digits after card number at back of card)*

Name of cardholder: \_\_\_\_\_

Expiry date: \_\_\_\_\_ Signature: \_\_\_\_\_

Billing Address (if different from mailing address) \_\_\_\_\_

**Telegraphic Transfer:** Email/Fax for details

### Payment by cheque

We accept only cheques/drafts in Singapore dollars drawn on a Singapore bank.

Make cheques payable to **Aqua Research Pte Ltd**

- Please send me a receipt.