JANUARY/FEBRUARY 2011
Volume 7 Number 1

# AQUA CULTURE

## Asia Pacific

Thailand leads in shrimp production

Rebound in aqua feed production

Recalculating amino acid requirements

Australian F2 progeny of the spiny lobster

Innovating the shrimp autofeeder

Show Preview -Aquatic Asia 2011

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# From the editor

## Outlook for 2011 – wish and watch list

It will be a bullish year for the shrimp industry, according to predictions from market analysts. In Japan, a trading house official predicted that shrimp prices will be firm during the year, propped by expanding demand in the United States and Europe. According to an editorial in seafoodsource.com, the current high prices are expected to prevail for another two to three years, particularly for large-size shrimp.

The outlook for the tilapia seems good too. Asian producers will increase output and Vietnam is the new player whilst Thailand has tilapia in its strategic plans up to 2014. Industry expects the European market to expand further as tilapia takes over the role of some traditional white fish. At the recent Tilapia 2010, Erik Hempel said that two distinct markets will develop in Europe, the mass market served by frozen fillets and fish from China and the upper end served by larger, thicker and high quality fillets.

Higher ex-farm prices and a floor price for markets other than the US for Vietnam's pangasius is a good start for the year. The MOU with WWF will look at how producers can achieve the Aquaculture Stewardship Council (ASC)'s pangasius standards. Perhaps, this will be the year when more recognition is given to producers for their efforts to adhere to standards in production and reduce culture impact on the environment.

The market is helped by increasing domestic demand. At the 15th China Seafood Expo in Dalian, Peter Redmayne said that more seafood is staying in China. At GOAL 2010 in Malaysia, the prediction by Ragnar Tveteras, a business economist at the University of Stavanger, is that China will be a net importer by 2011. Thailand's market analysts said that China will be a shrimp net importer by 2012. India and Indonesia are working towards getting higher domestic consumption of shrimp.

While volumes are good for the vannamei shrimp in Asia, we cannot forget that diseases are hanging around us. As in 2010, the wish is to see more farms adopt thorough biosecurity management. Most farms are yet to learn the importance of this in securing consistent harvests.

Is it time for the monodon shrimp to come back? A resounding yes! "Larger sizes of shrimp are in very short supply, with prices reaching the highest levels in two years. Importers and sellers of domestic shrimp, holding larger sizes, are expecting a further rise in price", said the November shrimp report by Globefish. It is time to take advantage of the good prices to return to the black tiger shrimp. More importantly, we need to avoid the demise of the black tiger shrimp or relegate it to a 'has been species'.

The US Department of Commerce is proposing to look at how it measures the antidumping tariffs of seafood imports. This may lead to a reduction in US anti-dumping duties or its abolishment and is likely to benefit India, China, Thailand, Vietnam, Brazil and Ecuador. We would like this to apply to the pangasius in Vietnam. In a reversal of tariffs, the 6th review raised rates to 100-130%, from almost zero in the 5th review.

Other items on the industry's wishlist for the year include

- More confidence in the quality of products from Asia
- Being market driven rather then production driven
- Making food safety a priority; and
- Realising that today's farmed seafood requires traceability and certification with no expectations of any premium on prices.

On our watch list are two items, commodity prices and climate change, with the latter affecting the former as well. Commodity prices have been rising but for Asian producers, it could be slightly offset by stronger currencies. An outlook report on US grains said that with the continuation from the summer of 2010, there is a potential for even more volatility and higher prices in 2011. Corn has risen to its highest and is related to ethanol production. Climate change is outside our control but what is now required is for monitoring and R&D by governments, and to translate this down to the farmer level, so that they can make the relevant changes to culture protocols.

In 2011, as AAP enters its seventh year of publication, these are some of the developments that we will cover in the next six issues as we lead aquaculture into its next phase of growth.

We wish all readers a Happy and Successful 2011!

Zuridah Merican

TARS 2011
The Aquaculture Roundtable Series 2011

### TARS 2011

AAP is pleased to announce the first of The Aquaculture Roundtable Series (TARS 2011). The inaugural meeting will be held in Singapore, 17-18 August, 2011. The focus will be Aquaculture Nutrition.

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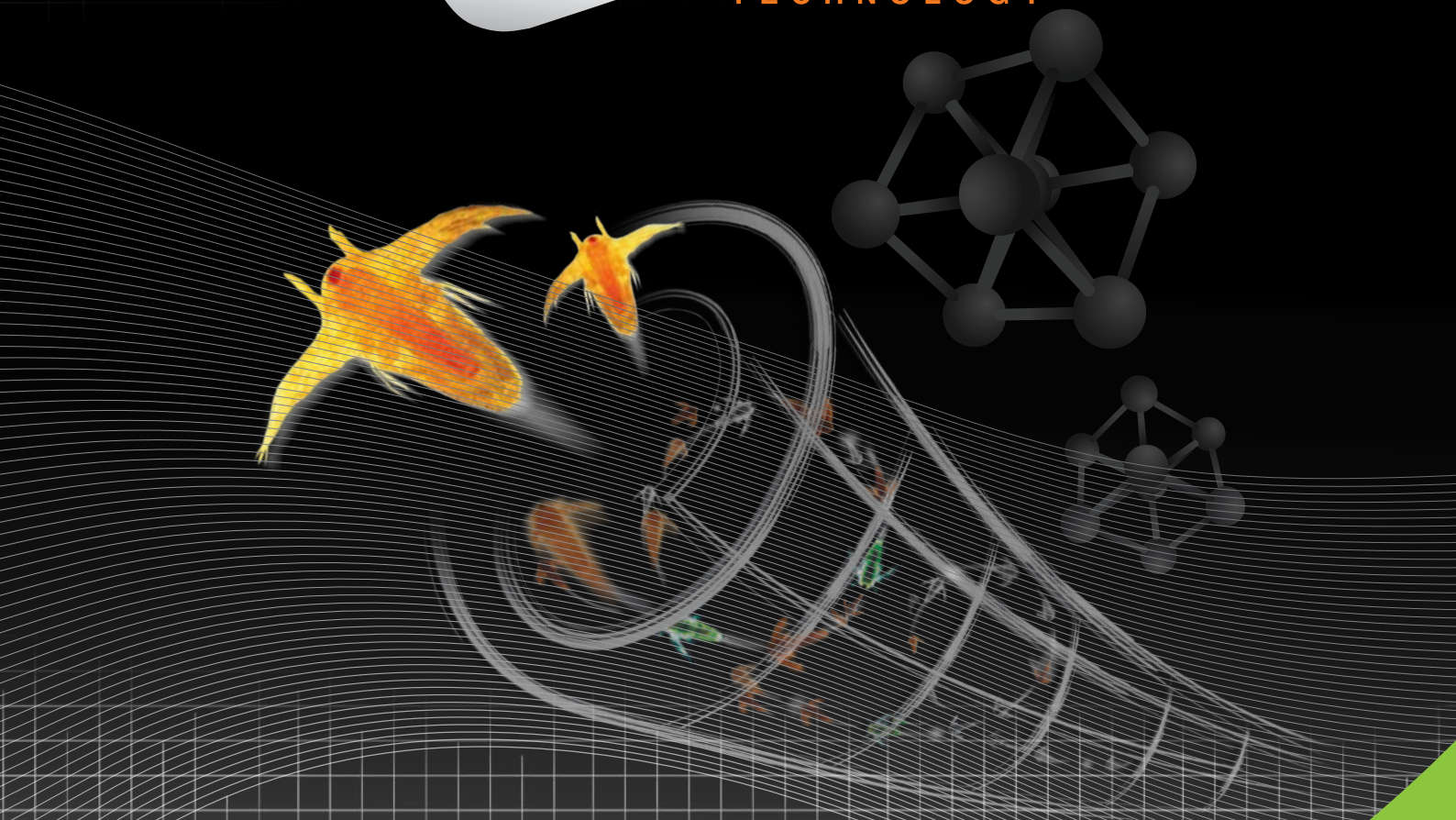

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# WWF u-turns and Vietnam's pangasius catfish is now 'towards certification'

**A potential marketing crisis was avoided when WWF puts off listing Vietnam's pangasius catfish as red.**

In November, the World Wildlife Fund (WWF) listed pangasius catfish as red on its influential seafood guides, which are extremely popular especially among European consumers and seafood buyers. This implied that on a sustainability scale of green, yellow and red, the group rated Vietnamese catfish as not sustainable, hence to be avoided. However, WWF gave pangasius certified as compliant to either the Aquaculture Stewardship Council (ASC) or organic standards a green rating. Non-organic catfish certified by the international industry group GlobalGap was rated yellow.

In doing so, WWF added to Vietnam's woes. In November, European Parliamentarian Stuart Stevenson also said that pangasius is raised in contaminated water and using slave labour. In June, the US catfish industry accused Vietnam of raising fish in unsanitary conditions and urged that the inspection of pangasius imports be transferred to the USDA.

Mark Powell, WWF International's global seafood coordinator, said that the organisation stood by its judgement that uncertified Vietnamese catfish is unsustainable because of the environmental impact of intensive farming practices.

## Impact and support

European markets currently make up almost 37% of catfish exports from leading companies. In the first 10 months of 2010, 184,360 tonnes of Vietnam's pangasius fish, valued at USD 423 million went to Europe. The impact is on the majority of producers which have not met GlobalGap standards. Vice chairman of the Vietnam Association of Seafood Exporters and Producers (VASEP) Nguyen Huu Dung, said only 20 companies have GlobalGap certification and this accounted for only 17-20% of farming area.

This WWF assessment of pangasius farming also came as a surprise to the International Collaborating Centre for Aquaculture and Fisheries Sustainability (ICAFIS, see box) who openly criticised both the methodology and the actual assessment. Support also came from outside Vietnam.

Frosta, the market leader for frozen meals in Germany and one of the largest producers of frozen foods in Europe expressed their support for the Aquaculture Stewardship Council (ASC) pangasius standards (fishnewseu.com). It added that their 'producers in Vietnam are committed to ASC as well. They have participated in the Pangasius Aquaculture Dialogue (the process to develop ASC standards for pangasius). They intend to seek certification as soon as the certification process is finalised.'

## From red to yellow and a MOU

On 17 December, Mark Powell agreed to remove Vietnam's tra from the red list in its advice to seafood buyers and to move it to a new "towards certification" category. VASEP and the Vietnam Fisheries Society (VINAFIS) signed a Memorandum of Understanding (MOU) with WWF whereby there will be a 5-year co-operation to help enterprises and farmers understand and achieve ASC certification. The global standards for pangasius aquaculture were finalised in August 2010 and ASC will start the certification process in mid 2011.

Dung has a positive outlook arising from all this. He said that the co-operation with the WWF will help Vietnam remove barriers preventing its pangasius from entering the world market.

"Nevertheless, the country's pangasius industry will have to adopt sustainable production processes and meet the higher requirements from the international markets. In the next two years, Vietnam is set to have 20% of its exported pangasius meet an international standard on sustainable pangasius aquaculture, including 10% with ASC labels. By 2015, all the country's exported pangasius would meet international standards and half would carry ASC labels."

## ICAFIS can help WWF to improve their assessment of pangasius

A year ago, the current Director of ICAFIS, Dr. Flavio Corsin was a consultant for WWF and was personally involved in commenting on the methodology using pangasius as an example. At that time, WWF scored pangasius as yellow, therefore acceptable. Although we understand that the methodology has somehow changed, we are puzzled as to why an industry which is improving by the day is now considered 'non-sustainable'.

WWF is known to strongly advocate for a multi-stakeholder approach towards sustainability. However, the methodology applied to conduct this assessment was developed by a small number of organisations, which is far from representing the 'views of the stakeholders'. In addition, the actual assessment results and scoring show extremely poor understanding of the pangasius industry and of the relevant regulatory frameworks. The assessment results were not discussed with any of the key organisations involved in pangasius aquaculture. This is hardly a multi-stakeholder approach!

Pangasius aquaculture is not perfect. This is why several stakeholders in Vietnam (including public and private sector, NGOs, etc.) have been working and succeeding in improving the sustainability of its culture. This is also why ICAFIS has been supporting efforts towards the implementation of ASC standards in pangasius farms. The ASC is by far a better approach to improve the sector than this 'traffic-light' listing. Condemning conventional pangasius production, even before the ASC is up and running, does not help anybody -neither the environment, nor the industry.

ICAFIS, which is also involved in developing global standards for shrimp, is supporting farmers to achieve certification. It is a member of the ASC technical advisory group and is willing to work with WWF and other organisations involved in developing and improving the methodology, so as to avoid unnecessary negative impacts on the industry. -Dr. Flavio Corsin, ICAFIS Director.

# China's rise in the international seafood trade

**Chinese producers target export markets whilst its importers look for supplies to feed a growing domestic market, at the 2010 China Seafood and Fisheries Expo in Dalian.**

The Chinese market is getting stronger because the country is becoming more prosperous and more people can afford both domestic and imported seafood, said Peter Redmayne, president of the US-based Sea Fare Expositions Inc. "China is importing more and more seafood even though the prices of some products, such as salmon and king crab, are rising. In 2010, China's international seafood trade will be worth more than USD 17 billion. In 2009, China's seafood trade was USD 16 billion whilst it was USD 16.7 billion, each for the US and Japan.

"It will likely overtake the United States and become the world's largest seafood-trading country. Compared with the rising imports, China's seafood exports have been falling slightly since 2007. Redmayne said. "It's partly because of the rising labour cost. Also, some imported products for reprocessing are not exported but stay in China for domestic consumption. The major exports from China are scallops, shrimp, tilapia, eel, catfish and freshwater prawn."

Liaoning Province Dalian Ocean Fishery Group Corp (Liaoyu Group), previously an export-oriented pelagic fishery corporation said that it is now paying more attention to the domestic market. "Exports are becoming less competitive with the potential appreciation of the yuan and rising labour costs. We are now rebalancing the two markets. We not only sell our own products in the domestic market, but also act as agents for overseas seafood products," said Lu Daqiang, vice-general manager of Liaoyu Group, in a news report (www. english.people.com.cn).

The 15th China Fisheries and Seafood Expo, the second largest seafood trade show was held from November 2-4, 2010 and was organised by Sea Fare Expositions Inc and the Agriculture Council of the China Council for the Promotion of International Trade. It featured 800 companies from more than 35 countries and regions. It also featured 14 country pavilions with new ones from Australia, Ecuador, Pakistan, Philippines, Papua New Guinea and Malaysia. A record number of trade visitors, estimated at 20,000 attended this event.

## Sustainable Seafood Forum 2010

This one-day forum gathered major seafood buyers, Chinese seafood producers, government and NGOs, to look at the need for sustainable seafood production in China. Peter Redmayne started the forum with an overview of China's role in the global seafood trade. Louise Brown, Den


*Scallops was the leading export item at 265,000 tonnes in 2008. The 50-year old Zhangzidao Fishery group is the main producer of scallops from the Yellow Sea.*

Norske Veritas said that 30% of US retail markets and 15% of food service markets have sustainable seafood policy in place. All shrimp products purchased by Wal-Mart are processed in Global Aquaculture Alliance (GAA) certified plants.

Cui He, Vice Executive President, China's Aquatic Products Processing and Marketing Association said China has to move from production driven to sustainable production. In the Sustainable Fisheries Partnership (SFP) and Chinese Tilapia Improvement Partnership programmes, Han Han, programme manager will assist with bench marking ecolabel standards, harmonisation of aquaculture standards and address environmental issues at a regional level. Through the Aquaculture Improvement Partnership (AIP) programme, SFP will engage seafood supply chains to adopt better farming practices and encourage the necessary policy and management reforms.

Richard Buchanan, President and CEO of AgriMarine Holdings said that China needs to commit to sustainable practices if it is to remain as the world's leader in aquaculture. Retailers need to source sustainable seafood and meet demands on food safety issues. This has to filter down to producers. The company has developed a close containment system and will establish salmon and trout farming in a sustainable manner in China. It hopes to compete with European imports of these fish in China.

Top global retailers gave their perspectives on the standard of exports from China. David Smith, VP Retail Strategy & Sustainability, Sobeys Inc., Canada said that sustainability is not a fad but is becoming a baseline requirement. Its procurement from China includes farmed tilapia and shrimp and it emphasises on Best Aquaculture Practices (BAP) and ASC eco certification and is moving to full transparency. Findus is Europe's biggest private seafood buyer and second largest frozen food producer. Steve Wardley, Purchasing Director, says that the cornerstone of its seafood sourcing is the 'Fish for Life' programme. This systematic and stringent tool assesses risk factors and applies responsible sourcing in both fisheries and aquaculture. It is also a way to identify areas of concern and engage with fisheries investors to help motivate improvements. Logan Kock, VP Strategic Purchasing and Responsible Sourcing of Santa Monica Seafoods (SMSF), said that as seafood restaurant patrons are considered knowledgeable with 63% regularly looking for and purchasing sustainable seafood, SMSF must make this available to their food service clients.

# News in Brief

## Ewos in Vietnam

Norwegian fish feed producer, Ewos has entered the feed market in Vietnam through a joint venture agreement between Anova Corporation and Cermaq, its parent company. Anova has a plant in Long Anh with an annual capacity of 85,000 tonnes and Ewos plans to utilise the full capacity in its first year of operations. The JV company will be led by Rune Vamrak as general manager and Philippe Serene will lead the initial marketing. In a press statement, Ewos said that it will utilise its research base knowledge within fish nutrition, raw material and food production to produce a more cost efficient feed than what is currently available. Kjell Bjordal, COO said, "Vietnam is the feed market for the future and the company is looking forward to employing its competence to outside the scope of salmonids."

## Investing for China market

Malaysia based Texchem Resources Bhd is "excited by future prospects in the China market as there is high demand for imported seafood which is perceived to be of higher quality and subject to stricter health and safety regulations," said its chairman Fumihiko Konishi. It expects higher demand for its soft shell crabs in China. Texchem plans to invest further in aquaculture activities over the next 10 years to meet rising demand from markets, such as China (www.btimes.com.my). The plan includes one or two fishmeal factories, likely to be set up in Java, Indonesia in the next few years. Exports to China will comprise over 3,900 tonnes of soft shell crabs, frozen seafood (including fish, squid and shrimp) and fishmeal. Texchem catches the crabs off the coast of Myanmar and grow-out these in ponds.

## Second anniversary of tilapia certification

In 2011, the Best Aquaculture Practices (BAP) program will celebrate the second anniversary of the first tilapia farm certified to the BAP standards. Following a two-year development process that included field trials in Thailand and China, the BAP tilapia farm standards were completed in September 2008. Elite Aquaculture Co., Ltd., a large, vertically integrated farm located in Guangxi Province in southeastern China, was initially certified in January 2009. It now produces 6,000 tonnes of tilapia a year, largely in cages on the man-made Xiaojiang Reservoir. Elite Aquaculture is one of several of tilapia farms in China, Thailand, Malaysia, Ecuador, Costa Rica, Colombia and El Salvador that have achieved BAP certification. Their annual production total nearly 73,000 tonnes.

## 2011 floor price for pangasius

In 2010, Vietnam is estimated to export only 645,000 tonnes of the pangasius catfish, valued at USD1.4 billion. Demand is increasing because of a 20% decreased supply of tilapia from China. Ex-farm prices increased to VND22,000 (USD 1) in December but supply is low because many ponds are not in operation. However, cost of production is higher due to high feed costs and higher interest rate of loans. At the same time, Thailand, Malaysia, Philippines, Indonesia are farming the fish. In 2011, the Vietnam Association of Seafood Exporters and Producers (Vasep) wants to cut exports down by 43% to only 360,000 tonnes from a production of 1 million tonnes of fish.

In October 2010, Vasep set the floor prices to USD 2.8/kg (excluding the US market) for 2011. This is to give the fish its real value and ensure profit to farmers and enterprises and avoid unfair competition that reduces prices and product quality. However, Vasep reiterates that the floor price is determined based on the production cost of pangasius.

## Full cycle in eel farming

Japan's Fishery Research Agency (FRA) has succeeded in full cycle culture of the Japanese eel, *Anguilla japonica*. This is a world first. In the report by the Japan Fisheries Association in August, the researchers have artificially bred eels to maturity and collected 250,000 fertilised eggs and developed 100,000 larvae. Feeding started 6 days after hatching, allowing for the smooth growth of juveniles. This is a major step towards a full cycle eel culture and will reduce the dependence on wild seed stock. The harvesting of wild juveniles for farming decreased to 10 tonnes from 100-200 tonnes in the 1950s and 1960s. Eel farmers in China and Taiwan also supply farmed eels to Japan and this success in breeding brings out the prospect of a self sustaining eel aquaculture industry.

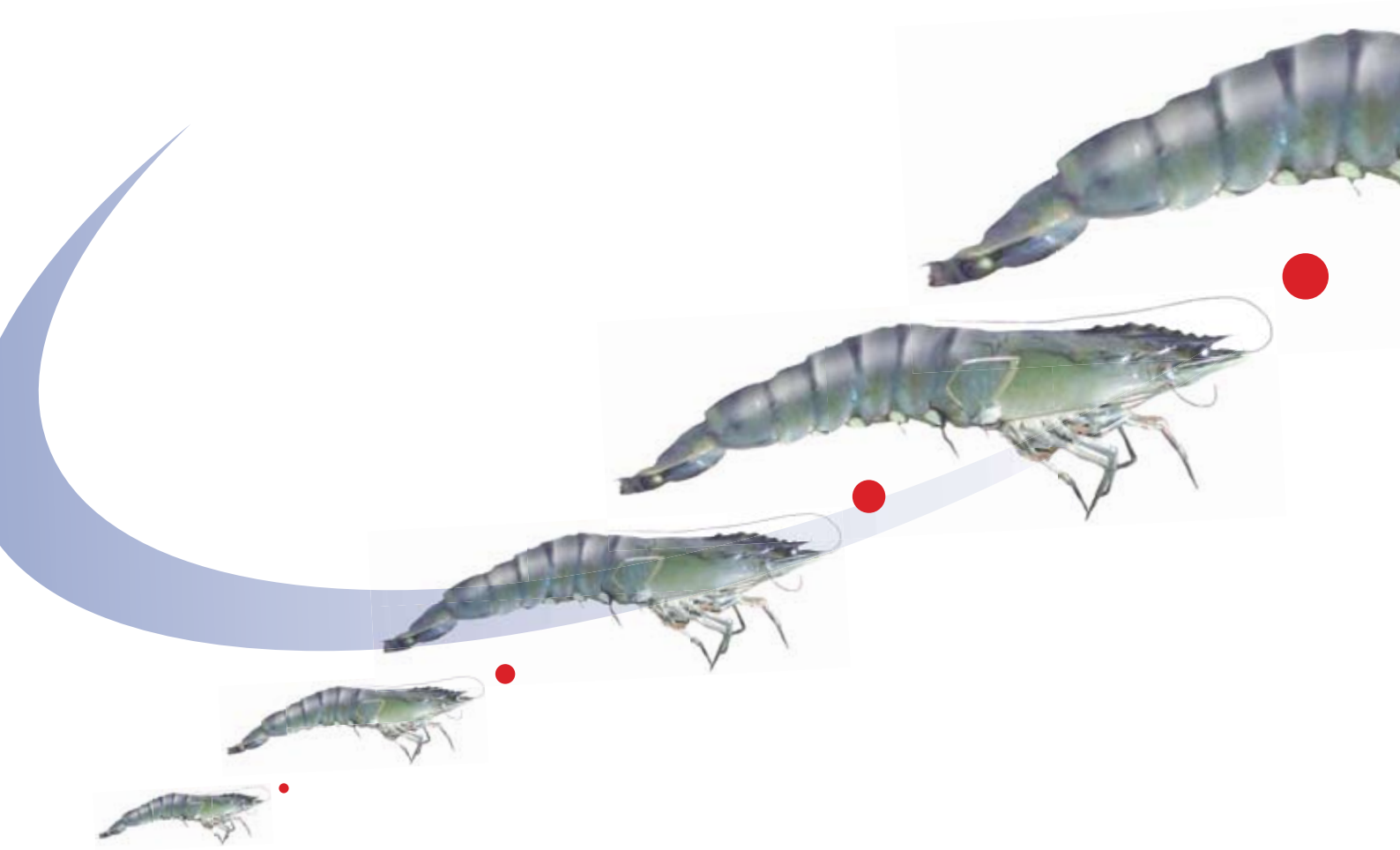
## First certified feed mill, Four-star company

The Best Aquaculture Practices (BAP) program has certified Asian Feed Co., located in Thayang, Petchburi, Thailand, as the first BAP-certified feed mill. The feed mill produces shrimp feed under the Champ, Extra, Hero and Rambo brands. With this, Asian Feed Co. Ltd, part of Asian Seafoods Coldstorage Public Co., Ltd., also becomes BAP's first four-star company. Asian Seafoods Coldstorage operates a BAP-certified seafood processing plant in Amphur Muang, Samutsakorn, in tandem with its Tawee and Aquapool shrimp farms, several of which are certified as BAP integrated operating modules. It sources its shrimp post larvae from its Tripetch hatchery and Best Hatchery Farm. Its processing plant has participated in BAP certification since 2006. "Its four-star certification expresses the company's continued commitment to sustainability as well as its use of responsible practices throughout the seafood production process, from pond to plate," said Wally Stevens, executive director of the Global Aquaculture Alliance, whose BAP standards form the base of BAP certification.

## White shrimp contract farming

In an agreement with Indian Overseas Bank, the Oceanaa group, based in Chennai, India will carry out contract farming of vannamei shrimp. Oceanic Bio-harvests, part of Oceanaa group, will identify farmers with a minimum of one hectare of suitable land with licence from the Coastal Aquaculture Authority and recommend them to the bank for loans of 85% of operating costs, repayable in six months. Joseb Raj, Managing Director of Oceanaa group said that the total cost of farming will be INR 475,000/ha/crop (USD10,500). There will be two crops a year. Oceanaa will supply seed, feed and health products to farmers against invoices to the bank. The company has its own shrimp hatchery with a 350 million post larvae/year capacity. It will also provide free technical assistance to farmers and buy back the shrimp at prevailing market prices. The group also has a processing unit at Marakkanam to process and sell shrimp in the domestic and export markets. For 2011, the target is to export at least 5,000 tonnes. The shrimp stock will also be insured against white spot syndrome and ponds against natural calamities by New India Assurance Company. The company is already carrying out black tiger shrimp culture since 2008 in the same way.

# GROWING IS BEAUTIFUL



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# Shrimp production in Asia in 2010

**With scarcity of supply, a good year for some with a price bonanza but others had production and marketing woes. AAP reports.**

Those in the shrimp farming business will remember 2010 as the bonanza year. Prices for *Penaeus vannamei* shrimp rose by 30% and for *P. monodon* shrimp by 35%. Prices were also the highest in five years, especially for large size shrimp, the result of increased demand and severe supply shortage. In the first half of 2010, brisk shrimp trading began as importers began to restock supplies after the destocking following the October 2008 crisis.

At the same time, vannamei shrimp supply was tight as production continued to slide in Indonesia, after the disease outbreaks in May 2009 and China was slow to start production because of cold weather, a typhoon on Hainan Island and disease outbreaks. In Vietnam, output was low because hot weather (38°C) brought diseases and affected growth rates (Globefish, 2010). It was reported that Mexican production was down by 50% when white spot syndrome virus (WSSV) hit Sonora state. Storms in the Honduras lowered production. Demand increased in the US to compensate for the 8-9% loss in supply from the Gulf of Mexico fisheries after the oil spill.

A severe supply shortage of the monodon shrimp was led by lower production by the main producers. Vietnam's extensive farms were slow to restock after facing persistent diseases and low ex-farm prices despite high offer prices. In India, monodon farming faced issues on post larvae (PL) quality and diseases. Bangladesh's production was down as farms reported mass mortality linked to inadequate pond preparation prior to stocking (Globefish, 2010). In 2010, more Malaysian and Philippine producers have shifted to vannamei farming.

It is unusual for the shrimp industry to see such short supplies from so many countries, said a shrimp buyer. "Buyers search for supplies and do not understand the problems faced by farmers. They need to secure quantities for processing. Shrimp buyers remained conservative in their buying approach but at the same time, there was panic, fearing massive shortages."

Currently, the estimate on production of vannamei and monodon shrimp in 2010 showed a lower Asian production of 2.78 million tonnes as compared to 2.84 million tonnes in 2009. The global production declined to 3.1 million tonnes from 3.2 million tonnes in 2009 (Table 1). However, according to industry in Thailand and China, their respective production volumes will be further lowered because of end of year crop failures. Available official estimates for selected countries are higher in comparison to the estimates provided by industry. With industry estimates for Vietnam and Indonesia, we can expect the 2010 production in Asia to further decline to 2.5 million tonnes.

## Golden year for Thai shrimp

Amongst Asian shrimp producers, there is no doubt that Thailand has benefitted from the low supply situation. In 2010, shrimp exports increased to 371,000 tonnes, up 8% from that in 2009. However, in terms of value, the increase was only 3% to USD 2.8 billion as the Thai baht appreciated against the US dollar, according to the Thai Frozen Foods Association. Since January 2010, the baht has appreciated by 7-8%.

In December 2009, ex farm prices were at the lowest at THB 100/kg (USD 3.3) for 70pcs/kg and Thai producer associations announced a cap on the following year's production. With current high prices such as THB 125/kg (USD 4.1) for 70 pcs/kg, Thai farmers are seeing good profit margins. Generally, shrimp growth rates are good at 100 pcs/kg requiring 60 days to reach marketable size with a FCR of 1.2. In November, a higher production was estimated but this needs to be adjusted as floods in the south destroyed most of the last crop for the year and there were reports of poor harvests in East Chantaburi due to WSSV. The southern provinces of Ranong and Suratthani account for almost 40% of shrimp production.

Throughout the year, farms reported lower survival and higher FCR because of white faeces syndrome. The syndrome usually occurs in the hot summer months (see page 25) and has a marginal effect on production but this year the weather has been hot. Thai farmers also usually expect poorer harvests at year end, as the rate of WSSV infections is highest during the winter months. Nevertheless, farmers have managed these well by reducing stocking density from 150,000 PL/rai (94 PL/$m^2$) to 120,000 PL/rai (75 PL/$m^2$) and adjusting management protocols, befitting the changes in climate and feeding regimes. They are well informed through the network comprising producers, stakeholders and experts (see next article).

The target production is 551,000 tonnes in 2011 under the second strategic plan of Thailand's Department of Fisheries. The early part of 2011 will still be a good year for Thai shrimp as industry expects that other countries will be unable to meet their production targets. In the first quarter in 2011, prices of large shrimp are expected to rise at the same rate as in 2010; 30% from THB 120/kg (2009) to THB 155/kg (2010) for 50 pcs/kg, according to the Thai Frozen Foods Association. However, if prices for smaller shrimp show larger increases, farmers will be inclined to farm these continuously to meet demand.

## Production and market trends

### *China*

In 2010, the shrimp industry estimated up to 30% decline in shrimp production as there were reports of high mortality during heavy rains and poor control of ponds and aeration. Diseases were reported in farms in Hainan and Zhanjiang provinces followed by emergency harvests at 100 pcs/kg instead of the planned 30-50 pcs/kg. Supply from the second crop in south China which usually accounts for 70% of the year's production was expected to be 50% less. Farmers would prefer to farm larger sizes with higher prices but are constrained by these problems.

The more successful shrimp farms are in inland areas with better growth and cost of production because of lower stocking density. The reported FCRs range from 1.1 to 1.2 for a stocking of 90PL/$m^2$ and harvests of 100pcs/kg. In the Pearl River Delta, farmers get three crops a year, since they use enclosures to maintain higher temperatures during the winter season.

Demand in the local markets has been increasing but domestic supply was down in December 2010. Local prices are good with ex-farm prices rising to RMB 26/kg (USD 3.9) and retail prices at RMB 38/kg (USD 5.7) for small shrimp (100 pcs/kg). The cost of production is RMB 15/kg (USD 2.26). Almost 80% of live shrimp is sold in domestic markets. At recent regional seafood shows, Chinese shrimp importers were desperately sourcing shrimp. Market analysts in Thailand expect China to be a net importer of shrimp in 2012. Jeff Jie-Cheng Chuang, Zhongshan President Enterprises Co., Ltd, China expects production to increase in 2011 as farmers have gained from the high profits in 2010 and will be stocking more. However, whether expectations can be met will depend on disease and weather conditions. If all goes well, the estimated production will be 1.3 million tonnes.

## Vietnam

Vietnam's General Department of Customs reported that Vietnam increased exports to 167,170 tonnes in the first nine months of 2010, up 14.2% in volume and 22% in value to USD1.4 billion compared to the same period in 2009. Until end of September, processing plants were looking for supplies but farms could only supply 40% of the demand. In Vietfish (September, 2010), Nguyen Thai Phuong said that even though US buyers required large shrimp, few Vietnamese suppliers could take up the opportunity. There were several reasons cited for the lower output in Vietnam, from hot weather, diseases, poor post larvae quality to the lack of capital as farmers suffered losses the year before. About 90% of the production is from extensive and semi extensive farms.

The official figure for the production in 2010 was 380,000 tonnes but industry estimated only 248,000 tonnes with a ratio of 34:66 for vannamei: monodon. In 2008, the culture of vannamei shrimp was allowed in the Mekong Delta provinces in intensive farms. With margins from vannamei shrimp farming almost double that of the monodon shrimp, provincial authorities slowly are opening up more areas for vannamei shrimp culture. In many provinces such as Tien Giang, there was equal production of vannamei and monodon shrimp in 2010. However, in Soc Trang, monodon shrimp dominated with 60,000 tonnes (up to November 2010). Farmers enjoyed high profit margins with record prices twice that for previous harvests. Prices were good at VND210,000/kg (USD 10.8) for 20 pcs/kg and VND170,000/kg (USD 8.7) for 30 pcs/kg and VND120,000/kg (USD 6.2) for 40 pcs/kg.

The cost of production of vannamei shrimp is VND30,000/kg (USD 1.53) as compared to VND 65,000/kg (USD 3.3) for the monodon shrimp. The average stocking density for vannamei shrimp ranges from 80-120 PL/$m^2$ to as high as 200-300 PL/$m^2$ for partial harvesting in central and northern regions. Yields are 8-10 tonnes of 70-100 pcs/kg. In contrast, stocking density of monodon shrimp is 20-30 PL/$m^2$ and harvest ranges from 3.5 to 5.6 tonnes of 30-40 pcs/kg.

## Indonesia

In 2009, Indonesia exported 240,250 tonnes of shrimp, valued at USD 1.6 billion. Up to August 2010, exports totalled 94,867 tonnes as compared to 100,668 in the same period in 2009. Some 80% comprised vannamei shrimp and 15% monodon shrimp. Export sizes were 50-60 and 70 pcs/kg. The slow recovery from several diseases including infectious myonecrosis virus (IMNV) is ongoing. IMNV is also affecting small and medium scale shrimp farmers in Lampung, East Java and South Sulawesi besides CP Prima, the largest integrated producer in Indonesia.

Total production was 350,000 tonnes in 2010 according to the Department of Marine and Fisheries, lower than its target of 400,000 tonnes. In contrast, industry estimates ranged from 20-30% of that in 2009 (240,000-275,000 tonnes) to as low as 160,000 tonnes of vannamei and 30,000 tonnes of monodon shrimp. CP Prima expects to resume production to 100,000 tonnes/year in the next 3-4 years (Kontan online).

In 2011, the target is 400,000 tonnes of shrimp and by 2014, Indonesia wants to expand production to 699,000 tonnes comprising 188,000 tonnes of monodon shrimp and 511,000 tonnes of vannamei shrimp. Ketut Sugama, from the Ministry of Marine and Fisheries, said that the country is on route with a broodstock breeding centre in Bali and the development of shrimp hatcheries and shrimp ponds. In Makassar, South Sulawesi, 80,000 ha have been revitalised with funds from 4 banks to produce 80,000 tonnes/crop. In Lampung, there are 25,000ha of ponds targeted for revitalisation.

## India

In 2010, vannamei shrimp production was reported at 30,000 tonnes by MPEDA (2010) and 40,000 tonnes by industry, out of the total

| | Actual production Total in 2008[a] | | Estimate/actual production[a] in 2009 | | Estimates of total production in 2010 | | % P. vannamei* |
|---|---|---|---|---|---|---|---|
| Country | *P. vannamei* | *P. monodon* | *P. vannamei* | *P. monodon* | *P. vannamei* | *P. monodon* | |
| China | 1,062,765 | 60,899 | 1,200,000[b] | 61,000[b] | 1,140,000[b] | 60,000[b] | 95 |
| Thailand | 498,800 | 8,000 | 537,000 | 3,000 | 553,000[c] | 3,000[d] | 99 |
| Viet Nam | 38,600 | 324,600 | 123,940[a] | 289,192[a] | 152,000[c] | 228,000[c] | 34-40 |
| Indonesia | 208,648 | 134,930 | 230,000[d] | 115,000[d] | 280,000[c] | 52,500[c] | 85 |
| Malaysia | 37,544 | 20,875 | 72,000[d] | 20,000[d] | 100,000[d] | 20,000[d] | 80 |
| India | | 76,000 | 5,000[d] | 80,000[d] | 30,000[b] | 40,000[d] | 40 |
| Philippines | 2,856 | 45,342 | 12,000[d] | 26,000[d] | 15,000[b] | 35,000[b] | 30 |
| Bangladesh | | 67,197 | | 71,000 | | 68,000[b] | 0 |
| Myanmar | | 48,604 | | | | | |
| Others | 12,141 | 13,046 | | | | | |
| Total Asia | 1,861,354 | 799,493 | 2,179,940 | 651,192 | 2,270,000 | 506,500 | |
| Latin America | 478,454 | – | 393,016[f] | – | 376,300[f] | – | 100 |
| Global Total | 2,339,808 | 799,493 | 2,572,956 | 651,192 | 2,646,300 | 506,500 | |
| | 3,139,301 | | 3,238,148 | | 3,152,800 | | |

*[a] Published production figures in 2008 (Fishstat Plus, 2010). Bureau of Fisheries and Aquatic Resources, Philippines, Office of General Statistics, Vietnam,*
*[b] Industry estimates ,China-Jeff, Jie-Cheng Chuang, Zhongshan President Enterprises Co., Ltd, Philippines- Department of Agriculture (DA), November 2010, Bangladesh- S. Chandrasekar (2010); India-MPEDA,*
*[c] Official estimates, reported by FAO, November 2010*
*[d] Industry estimates for India, Indonesia,Malaysia and Thailand*
*[f] GOAL (2010), The Advocate, January/February 2011, p10*
** vannamei shrimp= (volumes of vannamei shrimp/total volume of vannamei +monodon shrimp) x100*

production estimate of 70,000 tonnes. A lower production of monodon shrimp at the end of the year was due to large scale mortalities from WSSV. Monodon shrimp is also cultured in freshwater areas and India's strength is in the production of one crop of large shrimp. However, harvest size has dropped to 25g shrimp from 33-35g in line with market demands, according to S .Santana Krishnan (2010). With controlled production and biosecurity, yields can reach 4 tonnes/ha/crop with a stocking density of 10 PL/$m^2$ and a culture period of 165 days.

In vannamei shrimp culture, three types of culture systems were reported; high density production of 70-100 pcs/kg with stocking density at 60 PL/$m^2$ for the local market; moderate density culture, stocking 40PL/$m^2$ producing 50 – 60 pcs/kg for both export and local markets and the low density system, stocking at only 10-15 PL/$m^2$ and producing 30-40pcs/kg for export markets. The majority target the moderate culture system (Santana Krishnan, 2010). Feed companies and demonstration farms are showing yields from 6 tonnes/ha of 17-20g shrimp for 40 PL/$m^2$ stocking in 105 days to as high as 19-23 tonnes/ha of 31-34g shrimp with 77 PL/$m^2$ stocking.

In 2011, total shrimp production is expected to increase to 150,000 tonnes, half of which will be vannamei shrimp. An industry source said that although culture remains restricted to those licensed by the Coastal Aquaculture Authority (CAA), it is expected that those unlicensed will begin production too. Most unlicensed hatcheries will also begin to use second generation SPF brood stock to produce post larvae and this may affect their SPF status as well as growth potential.

### *Malaysia and Philippines*

In both countries, more vannamei shrimp was produced. In Malaysia, some large farms have moved to farm vannamei shrimp after mass mortalities from WSSV with the monodon shrimp. Harvest sizes for the vannamei shrimp are similar to Thailand but ex-farm prices are higher at MYR13-15/kg (USD 4-4.8) and stocking density range from 80-100 PL/$m^2$. The December ex-farm price for the monodon was MYR 24/kg (USD12.9) for 33g shrimp. Industry estimates a better 2011 with 10% increase in production from existing farms and some 3,000 tonnes from the first phase of a new 1,000 ha farm.

In the Philippines, the focus is small size chilled shrimp (10-15g) for the local markets but with increased supply, wholesale prices are dropping to PHP 240/kg (USD 5.44) from PHP 320/kg (USD 7.26). Farms in Luzon, have a competitive edge over those in the Visayas as they are closer to the main markets in Metro Manila and do not incur the PHP30/kg in transport costs. This situation is threatening vannamei farming in the Visayas.

## More monodon shrimp in 2011

In May, Charoen Pokphand Foods Plc announced that it wants to have a second product line with the monodon shrimp. It has developed a specific pathogen-free (SPF) monodon breeding stock in greenhouses. Using post larvae from these breeders, the yield can be more than 1 tonne of shrimp/rai (6.25 tonnes/ha). Farmers can find a niche by producing large black-tiger shrimp (20 to 25 pcs/kg).

This is also to keep Thai products competitive in the world market as it expects more competition from Vietnam and Indonesia with the vannamei shrimp. Since 2009, Vietnam has been increasing supply of vannamei shrimp and wants to be the regional shrimp processing hub within a few years. As the Japanese are demanding for monodon shrimp, the Philippines is also proposing to revitalise its production and increase the current 35,000 tonnes in 2010.

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*Corrections: In our shrimp report in Volume 6 Issue 1, p 8, the 2010 outlook for Indonesia should be 120,000 tonnes of P. monodon. We apologise for the error.*

# History of Thai shrimp farming: From follower to global leader

By Soraphat Panakorn

**The rise to be the most efficient marine shrimp producer is credited to the close relationship among farmers.**

The story of Thai shrimp farming started in 1973, when an officer in the Department of Fisheries (DOF) was successful in breeding the black tiger shrimp. Five years later, DOF with funds from the Asian Development Bank, subsidised villagers to carry out extensive shrimp farming, to improve their livelihoods in areas where agriculture was not possible. These farmers became average income earners.

In 1982, Taiwanese experts discovered that the areas around the estuary of the Chaopraya River were suitable for semi intensive shrimp culture. Thus, began the expansion of shrimp culture covering the three provinces around Bangkok: Samutsongkhram, Samutsakhon and Samutprakarn. Along the 2,815 km of Thailand's coastline, shrimp farms crowded the area.

Dr. Chalor Limsuwan often commented that during those days, 'There are so many farms on every inch of the land, ponds covering very large areas without any empty spaces but the water canal was too small to provide enough water to support all the shrimp ponds nearby'.

Later, the shrimp culture technology transferred by the Taiwanese to Thai farmers began to show its weaknesses in the area. Today, the remnants of this technology- cement water gate, highland and small size ponds are left abandoned in areas which no longer farm shrimp. Nonetheless, Thai farmers knew that the shrimp business is an attractive business especially because of the then high shrimp prices. In 1986, shrimp prices were 10 USD/kg (1 USD=THB 25) for 30 count shrimp. The culture quickly spread to the Gulf of Thailand

*Drs Surasak Dilokkeart (left) Chalor Limsuwan (middle)*

*An intensive farm in Phuket in South Thailand*

and Andaman coasts, and in many cases, still adopting Taiwanese technology.

Some ten years later, the Taiwanese style of farming metamorphosed into the 'Thai style' with its unique pond construction and aeration system, stocking and harvesting techniques.

## The early hurdles

Around 1988-1989, shrimp production expanded and exceeded the capacity of processing facilities, which led to prices falling. This was the first critical period for the farmer. Nothing was done but with time, the problem petered off. Then in 1991, with the yellow head virus (YHV) outbreaks all over the country, farmers lost crops. This was the second critical period. The prevention of YHV through a closed system was initiated by Dr. Chalor Limsuwan and his team, with the co-operation of shrimp farmers throughout the country.

The third critical period occurred a year later and came with the more damaging white spot syndrome virus (WSSV). Again, it was Dr Chalor who recommended its prevention which was to completely treat water before stocking and go for a fully closed system, which means no exchange of water. Water is added only to compensate for evaporation. Since then, there have been no huge disease outbreaks.

The next challenge came from issues regarding food safety. Chemical residues were discovered in exported shrimp. The shrimp industry was helped by the quick response by DOF which imposed strict controls on chemical use in the industry. It also began to push for better practices in farming and a more environmentally friendly shrimp culture industry.

## An 'environmentally friendly business'

This was the new order of shrimp farming. The aim was to think of shrimp farming as a long term business. Today, there are farms surrounded by mangrove forest. Contrary to the common perception that shrimp farming destroyed mangroves , it was the shrimp farmers who planted mangroves. During the last 6 years, more than 10,000 hectares of mangrove forest were planted by shrimp farmers or the planting was supported by others in the shrimp industry! This was done not to create an image but for our own sustainable future.

Farmers do not drain sludge out of the farm. It was because they have found that the sludge is very useful as organic fertiliser. Many farms use it for planting vegetables or palm trees, padi, fruits and para wood tree (*Hevea brasiliensis*). It was also left in the pond and with microorganisms added, is useful for the promotion of the colour of the water for the next crop.

The perception of farm labour also changed. As farming moved to be a business concept, the farming team became part of the production staff. Skilled labour was essential and with incentives for good harvests, they may earn higher incomes than graduates.

## Coming of the vannamei shrimp

A turning point in the industry was the severe decline in the quality of wild black tiger shrimp brood stock from 1999. Frequent occurrences of WSSV and coupled by the lack of quality post larvae shifted the industry to white shrimp in 2002. During this time, almost half of the farmer population decided to quit the shrimp farming business and moved to other occupations such as operating restaurants and hotels or converting their shrimp ponds to oil palm plantations. They had suffered too much from inconsistent yields caused by size variation, stunted growth, high feed conversion and poor survival on top of the difficulty in obtaining quality post larvae supply.

The introduction of the Pacific white shrimp *Penaeus vannamei* was liken to the arrival of the white knight to help enhance shrimp farming in the country. After a challenging learning period of 1-2 years,

the Thai shrimp industry returned to its peak production. Before 2002, shrimp production had never crossed 350,000 tonnes/year but since 2007 to 2009, the average production has reached around 500,000 tonnes annually.

## Current situation and the legend

At present, the total number of farms is around 10,000 to 13,000. At the height of shrimp farming, some five years ago, the total number was more than 30,000. Although the number of farms has been reducing year by year, farms are being consolidated into larger farms. At the same, the 'second generation' of farmers, taking over from their parents began to emerge. This group represents a new generation of educated farmers as most of them are graduates. They began to introduce sound management principles in farm management and are changing shrimp farming into long term business enterprises.

As a result of the consolidation in the industry, the total culture area decreased to 160,000 rai (25,600 ha) from 400,000 rai (64,000 ha) at its peak. Some 240,000 rai (38,400 ha) have disappeared by 'natural selection', as originally these were never suitable for shrimp farming but nevertheless used to farm shrimp during the boom period. After many crop failures (improper soil, water quality and supply), operations were stopped.

The average pond size is 4 rai (0.64ha) and pond depths ranged from 1-2m. More than 95% of the farms are fully closed systems, the average stocking density is around 60-70 PL/$m^2$. Some farms with access to high quality and sufficient water supply may exchange water 2-4 times during a crop cycle and also increase stocking density to 100-120 PL/$m^2$. Some farms have fully lined ponds but in general ponds have soil bottoms and sides. The yield per rai is about 1.6 tonnes/crop (10 tonnes/ha) and there are 2 crops/year. Today, most farms often innovate new techniques to improve their production such as improved oxygenation techniques, data collection by computer software, use of auto feeder (see page 40), adoption of culture techniques according to the conditions in their area, development of their own devices or instruments to match the requirement in each farm.

## How did Thai farmers arrive to this level?

Today, Thailand's shrimp industry is recognised globally as the leader in marine shrimp farming in all aspects along the supply chain, in terms of quality production, technical knowledge, innovations, yield, etc. How did the country achieve this?

### *Brain storming*

*Partial harvesting of shrimp*

*Joint effort in reforestation*

Thailand is divided into many provinces, each covering approximately 7,000 km$^2$. With this size, shrimp farmers were encouraged to set up and join clubs or associations, and this makes cooperation much easier. Farmers within the same area willingly open up and share experiences and together they seek solutions when problems arise. This 'brain storming' creates a flow of information and when faced with a problem, the response is usually very quick.

There are more than 30 farmer organisations in Thailand and they actively communicate with one another. More than half of these organisations are in the key shrimp farming areas. These include the Shrimp Club of Surat, Pattani, Trang, Krabi, Chantaburi and the Samroiyod shrimp cooperation. They often conduct seminars on shrimp farming and disseminate knowledge to members.

There are at least four technical conferences for farmers annually. During these conferences, up to date technical knowledge is disseminated by experts in the country as well as invited experts from outside Thailand. New products are launched. In the technical sessions, sharing experiences among farmers and other stakeholders commonly take place. Participants return to their farms with very useful information

### *No secrets*

A Thai farmer will openly reveal his new ideas and solutions. This is available in Thai language magazines and newsletters. These are monthly publications and available throughout the country. All support and associated sectors, such as feed companies, hatchery operators and processing plants also cooperate to help the culture sector to grow the business.

## Experts and role models

There are almost 100 dedicated experts in the industry. Some of them may be attached to universities but they work very closely with farmers and are able to bring their technical knowledge to farmers and together work quickly to find solutions. Dr Chalor Limsuwan is Thailand's 'shrimp guru' with almost 2 decades of involvement in the industry (see page 25). Aside from Dr Chalor, there is Dr. Surasak Dilokkeart, chairman and supporting team of all clubs and association.

The biggest aquaculture product company Charoen Pokphand Foods (CPF) is a role model leading the industry. Many new concepts, R&D findings, innovative and practical ideas, technical knowledge, farming standards have emanated from CPF. CPF is also credited with the development of effective culture techniques that brought the industry to its current success level.

## Education in aquaculture and fisheries

There are several universities offering courses related to the shrimp and processing industry and the output of degree and postgraduate students form the current and future workforce in the industry.

***All the stakeholders in the Thai marine shrimp industry have worked together to improve and bring Thailand to the current level but they also know that they will need to continue to innovate to retain Thailand's market leader position.***


*Map showing the locations of shrimp culture*

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# Rebound in 2010

## While shrimp feeds were pushed by demand, marine fish feeds were driven by species diversification.

This was a good year, according to most in the aqua feed industry. In Thailand, most feed producers increased production by 20% in volume as compared to the production in 2009. It was reported as 'one of the best years in the feed mill business for many years'. The situation is similar for Vietnam's shrimp feed business. Local production for the freshwater fish is expanding too. More production of extruded feeds in Malaysia, India and Vietnam was reported for tilapia and pangasius catfish (Table 1).

Interregional trade in feeds was significant. Malaysia imported about 25,000 tonnes of shrimp feeds from Vietnam and Thailand and almost half of its consumption of marine fish feed of 45,000 tonnes from Thailand, Vietnam, Taiwan, Japan, Australia, and Indonesia. The Philippines increased imports of feeds, estimated at 10,000 tonnes for vannamei shrimp farming in 2010. Both Indonesia and the Philippines import feeds for the culture of the grouper, sea bass and pompano. In Indonesia, producers fear imports of cheaper feeds from China with the Asean-China free trade agreement.

### Shrimp feeds

Although shrimp farmers faced a mélange of production problems linked with the high temperatures in 2010, many feed producers reported higher feed sales, albeit with monthly fluctuations. High

**Table 1. Some estimates on aqua feed demand (tonnes) in 2010 in selected countries[a].**

| Countries | Marine shrimp | Freshwater Fish | Marine fish |
|---|---|---|---|
| China | 1,500,000 | 10,160,000 | na |
| Thailand | 860,000 | 518,000[b] | na |
| Vietnam | 387,000 | 1,200,000[c] | na |
| Indonesia | 250,000[d] | 730,000[e] | 25,000 |
| India | 236,000 | 400,000 | Nil |
| Malaysia[f] | 125,000 | 100,000 | 45,000 |
| Philippines[h] | 15,650 | 206,200 | 290,000 |
| Bangladesh | 6,000 | na | Nil |

*a estimates by industry stakeholders and feed producers,*
*b Published data 2009*
*c mainly feeds for the pangasius catfish; 600,000 tonnes in integrator market*
*d Indonesia - calculated based on industry estimate of shrimp production of 190,000 tonnes in 2010, production capacity is 250,000 tonnes in open market and 200,000 tonnes by integrators.*
*e Includes 150,000 tonnes of tilapia feeds*
*f Malaysia - includes 25,000 tonnes of shrimp feed imports; Freshwater fish-mainly feeds for tilapia; Marine fish-includes imports for marine fish feeds*
*h Philippines - estimate production of top three producers. Information courtesy of Levy Manalac, ASA-IM, Philippines. Shrimp – include feed imports. Freshwater fish-tilapia only; Marine fish – milkfish only*

temperatures particularly in Vietnam and Thailand, gave rise to white faeces syndrome in shrimp. Feed conversion ratios (FCR) increased with loss of appetite but mortality rates were low.

Shrimp feed sales were also good in Vietnam. In the latter part of 2010, the demand improved with monodon shrimp feeds. "We saw our demand of monodon feeds increased by 30%. Farmers needed to culture shrimp for more than 5 months to fulfill the shortage of large shrimp in processing plants. FCRs are usually 1.5 to 1.7 for such large shrimp. However, prices for monodon shrimp were at historical highs. Ex-farm prices were VND 220,000/kg for 20pcs/kg," said Ming-Hsu Wu, Director of Aquatic R&D division, Uni-President Vietnam.

Although shrimp prices began to rise at the end of 2009, farmers were slow to start culture because of the hotter weather and drought. When they were ready, they were worried about the high fish meal prices in mid 2010 which would result in higher feed prices. Shrimp producers in Indonesia lament that their shrimp feeds are the highest in the region at IDR 10,000/kg (USD 1.04). This reduced their competitiveness. It was 20% lower in 2009. They have asked the government to remove the 5% import tariffs on feed ingredients.

Both shrimp feed producers for the integrated and open markets in Indonesia were affected by disease outbreaks. Feed sales declined to 8,000 tonnes a month, according to Denny D. Indradjaja, Chairman of the Feed Division and Shrimp Aquaculture Feed Manufacturers Association in August in the Jakarta Post. It was inevitable that sales will drop in such circumstances and Puspita Dewi Prijadi, President of PT Matahari Sakti said, "Our sales fell less than 12%. We have worked hard so that our customers are successful in their operations and are making profits."

## Marine fish feeds

In Vietnam, large cobia producers import extruded feeds from Chile and Canada. Most of the small scale cage culture farms use trash fish for the culture of groupers, sea bass and pompano. This changed in 2010 as trash fish prices rose to VND10,000/kg and at an FCR of 10:1, escalated the cost of feeding. Extruded feed cost VND 23,000 to 26,000 and the average FCR is 1.6:1.

"With this development, it will be more promising for our feed sales. More importantly, this is good for the industry and in pushing for better hygiene conditions in the culture environment. We also hope to see less disease outbreaks and a more sustainable production," said Wu.

In Malaysia, almost 100% of pompano and threadfin production are fed on extruded feeds whilst 50-60% of the sea bass and grouper production use extruded feeds. Local feed producer, Star Feedmills, part of Thailand's CPF group has the largest share of this feed market. However, Uni-President Vietnam also supply extruded feeds for these species to farms in Malaysia and in 2011, it expects to double feed sales.

## Ecuadorian feeds in Asia

As production expands, 2011 is expected to be a good year for shrimp and tilapia feeds and feed producer Expalsa/Gisis is looking at entering Asia.

The company has two feed mills for the production of extruded and pelleted feeds for tilapia, marine shrimp and pet foods located in Guayaquil, Ecuador. It already supplies tilapia feeds to the top tilapia fish producers in Central and Latin America and has almost 90% share of the Ecuador tilapia feed market. It exports about 3,000 tonnes of shrimp and tilapia feeds monthly and has 40% share of the shrimp feed market in Ecuador. Feed exports are to Central America, US, the Caribbean, South America and Africa. Monthly feed sales total 22,000 tonnes of fish, shrimp and poultry feeds.

"The feed business in Ecuador is very competitive as farmers are extremely fastidious on the feeds that they use. The country exports fresh tilapia to the US and fish is marketed as a high end product with a longer shelf life. In export markets, we have a 20 year history in supplying our tilapia feeds to US producers," said Carlos Miranda, administration manager, at their booth during Tilapia 2010 held in Kuala Lumpur, Malaysia in October 2010. Miranda and Juan Xavier Cordovez, vice president, Expalsa were at the conference and trade show to promote their range of tilapia and shrimp feeds as well as micro pellets produced using newly installed equipment.

*Carlos Miranda and colleague at Tilapia 2010.*

Expalsa/Gisis began operations in 1992 as an exclusive producer of floating and controlled sinking feeds. The range of feeds is for tilapia, Amazonian fish, catfish, marine fish (cobia, sea bass, sea bream and Kona kampachi), trout and shrimp.

"The success of the company is attributed to its location in the South Pacific Coast of Ecuador, which gives it good access to quality fishery based raw materials such as fish and squid meal, fish oil and hydrolysed meals," added Miranda. "Other features of the feed are the high technology used to make a very reliable product with state of the art equipment. Post extrusion vacuum coating allows for the addition of lipids to increase fat content of 20% to maintain a protein:energy ratio required by the salmonids and marine fish.

"Our strength is the production of organic tilapia and shrimp feeds for both species. Feeds for the monodon shrimp are certified by Ecocert (France) to be used under its standards and those for the vannamei shrimp are certified by Naturland. The critical raw materials in the production of these feeds are organic and GMO free including fish meal from tuna trimmings intended for human consumption. There should be a guarantee that no antibiotics and animal by- products are used."

Organic shrimp feed supports production at Expalsa's 2,200ha of organic shrimp farms in several areas in Ecuador. The company is a leader in fully integrated organic vannamei shrimp production. Organic certification of the shrimp is by Naturland (Germany), Biosuisse (Switzerland) and soon by GlobalGap.

"The Philippines had a large production of marine fish feeds which totalled 213,000 tonnes in 2009, but these were mainly for the milkfish", said Levy Manalac, Technical Manager, Aquaculture, ASA-IM. Imported extruded feeds from Japan and Taiwan are used for the culture of the grouper, sea bass, pompano and other species. The latter situation is similar in Indonesia, although it has a history of marine fish feed production since 2004. PT Matahari Sakti produces a range of feeds for the grouper, sea bass and pompano. According to Puspita Dewi, "Our marine fish feeds are acceptable for the pompano and thus our production is bigger for this feed as compared to those for the grouper and sea bass. We expect demand to increase as the government is pushing for more production."

## Freshwater fish feeds

Tilapia feed producers in South China reported a flux in feed sales throughout 2010. These were linked to several factors: weather, drought in Hainan Province, increased fry mortality, risks of *Streptococcus* and higher prices. Diseases were common in the first half of the year and sales dropped, according to one feed producer. Sales picked up when temperatures rose and farmers increased feeding rate. One feed mill increased sales because of enhanced services and a larger customer base. Low prices in 2009 deterred some from stocking and some farmers carried out polyculture of tilapia with shrimp. Low prices in December 2009, delayed a new crop but when fish prices rose, farmers rushed to complete the crop before winter by increasing feeding. This led to a higher feed demand in September 2010 (www.fishbao.net).

In 2010, the production capacity of extruded floating feeds specifically for pangasius catfish in India was 408,000 tpy. This will rise further (see box). Unfortunately, due to increased fish supply, ex-farm prices of pangasius have dropped to INR 28/kg. With a FCR of 1.2 to 1.3, the viability of using extruded feeds is being questioned.

In Vietnam, mills producing for the merchant feed markets began stepping back as demand declined with the pangasius fish integrators rapidly expanding their feed production capacity. The top pangasius integrator, Hung Vuong has recently expanded production with another feed mill. It has also joined with the largest pangasius feed manufacturer to supply its farms and contract farms.

## Higher costs and prices

Increases in feed prices were inevitable with the increasing prices of the major commodities, a result of changing climatic conditions (see box). "Low local corn production affected fish feed production and cost in Indonesia", said Suaedi Sunato, DSM Nutrional Products, Indonesia. However, in general, the higher exchange rate of most currencies against the US dollar slightly offset the price increases. The exception is Vietnam, which saw the devaluation of the dong by 2.8%.

Prices of soybean meal and wheat rose in August/September 2010 and as a result, G. Ramesh, customer service manager, Wenger South Asia said that the feed sector in India is also looking at feed formulations to include more plant protein ingredients. Prices have been thwarted by competition from biofuel production. "Even among the plant proteins, the industry is looking out for alternate plant proteins other than soy. As a consequence, nutritionists are scrambling to reformulate to keep feed prices down. They also want to experiment with the use of synthetic amino acids to balance their amino acid profiles in the feed formulation."

## Best Aquafeed Producer Award

Leading aqua feed producer, Uni-President Vietnam was selected as winner of the Vietnam Feed & Livestock Industry Award 2010-Best Aqua Feed Producer category. The award was presented by Dr Hoang Kim Giao, Ministry of Agriculture and Rural Development (MARD). The award recognises individuals and organisations that have contributed to the development of their respective sector in Vietnam. This was the highlight at Vietstock 2010 which was co-located with AquaFeed 2010 Expo and featured over 200 exhibitors representing suppliers from 30 countries. It was held in Ho Chi Minh City from 10-12 November, 2010.

In 2009, Uni-President Vietnam Breeding Co Ltd received the Gold Quality of Vietnam Aquaculture Award 2009, presented by MARD. Uni-President is recognised as the leading driver in the aquaculture supply chain in Vietnam. The company has been in Vietnam for 10 years. It has two 2 feed mills in Binh Duong and Tien Giang. It will start operations in its new mill in Quang Nam in March 2011. The total aqua feed production is estimated at 350,000 tonnes per year in 2011. Uni-President Vietnam also produces livestock feed, wheat flour, instant noodles and has a joint-venture beverage company in Vietnam.

To achieve its goals in aquaculture development and to find the best solutions for sustainable aquaculture, the company has collaborative research programmes with local and foreign universities, research institutes and private organisations. On-farm services such as PCR (polymerase chain reaction) testing and shrimp and fish disease diagnosis provide farmers with quick results, enabling proactive actions to avoid higher risks at farm sites. The company has a marine shrimp hatchery in Ninh Thuan and will set up another one in Quang Tri in 2011.


*Ming-Hsun Wu, Director Aquatic R&D division with the award.*

## A rapid expansion in fish feeds in India

India was hitherto not known in the formulated fish feed sector in the Asian region because until recently it relied on the traditional feeding system. This uses a few nutritionally poor agri-byproducts as feed ingredients.

*Vijay Anand P.E is Technical Director, Asia Subcontinent Aquaculture Program, American Soybean Association-International Marketing, based in New Delhi, India*

However, things are changing rapidly. Vijay Anand P.E from the American Soybean Association-International Marketing (ASA-IM) said that the organisation took a decision in 2003 to create a niche for better aquaculture feeds thereby linking the development to an array of better aquaculture practices to grow fish and increase the sector's dependency on soy-based fish feeds. Initial work focused on commercial feeding demonstrations to show economic returns to the industry. The industry was also supported with various technical and commercial aspects that helped accelerate this development.

"As a result of these efforts, India has now emerged as a significant producer of soy-based extruded floating fish feed as well as sinking pellets which are becoming popular in the freshwater fish farming industry. The industry has invested well in imported extrusion machinery to produce floating fish feeds."

"There are currently 6 feed mill operators with an installed capacity of 73 tph equivalent to 32,850 tpm at 90% mill efficiency. This is expected to expand to 90 tph and equivalent to 42,750 tpm by 2011. By the end of 2011, India should have a capacity to produce 0.9 million tonnes of extruded floating fish feed as per plans and investments existing on date," said Anand.

### *First in Andhra Pradesh*

Feeds are extruded using 3-6 mm dies and have a protein and fat content of 28-32% and 3-6% respectively. Soybean meal is the main source of protein in the formulations and the incorporation levels range from 35-45%. Feeds are predominantly used for the Pangasius catfish farming followed by a growing popularity for feeds for the carp culture segment. Most of these feeds are sold in Andhra Pradesh, the largest fish culture state in the country. However extrusion feed production is also spreading to other regions in India.

"ASA-IM estimates that India will produce about 1.2 million tonnes of extruded floating fish feed by 2012. Users have quickly adapted to the benefits derived from extruded feeds and more expansions in terms of the user base are forecasted. With this quantity of feed, about 1 million tonnes of freshwater fish at a FCR of 1.2 in India could be based on the feed-based system if more farmers adapt to this change."

### *Next marine fish feeds*

This trend with extruded feeds could pave the way for the development of two other new aquaculture systems, namely the inland and marine cages. ASA-IM also feels that the feed-based systems should help tie-in or develop species diversity, improve marketing opportunities and popularise the processed fish marketing for domestic utilisation in the country.

"Currently, there is no local production of feeds for the marine fish as the culture of sea bass is still in the feasibility and experimental stage. However, first, we have to show the ROI of cage culture to farmers. Present extrusion feed mills have adequate capacities to handle this expansion when it actually comes through. Additionally, the major bottleneck facing Indian aquaculture is the narrow species diversity and lack of hatcheries for the commercial production of seed stock for the new species in question," said Anand.

## The weather and higher commodity prices

In 2010, the situation with feed commodities was unfavourable for the aqua and livestock industry. Since June, the main commodities: corn, wheat and soybean meal, experienced an average increase in prices of 37, 38 and 55%, respectively. "There was a general tightness in the corn and wheat supply", said a senior commodity trader based in Singapore. The Russian drought and fires destroyed the wheat supply down to 40% of total supply and similarly in the Ukraine, its wheat supply reached only 80% of the expected total supply. The floods in Australia decreased supply to only 13 million tonnes from the usual 22.5 million tonnes.

For these three commodities, prices began to rise in December 2009. Corn prices have stabilised to USD 310/tonne in October and November and wheat rose to USD 320/tonne in September. Soybean meal prices showed a decline to USD 292.60/tonne in March from USD 349.6 in December 2009 but ended at USD 440/tonne in November 2010.

The prediction on the supply of these commodities in 2011 by commodity analysts is that wheat prices will increase by 20% and similarly, corn prices. World wheat ending stocks for June 2011 are expected to decrease to 168 million tonnes from 198 million tonnes in 2010, continuing from 2009 to 2010, June to June. Soybean meal supplies will not be compensated by those from Brazil. Indian soybean meal is not competitive.

Corn stocks are expected to decrease by 20%. Corn by product, DDGS is now priced at USD 350/tonne, an increase of 40% since June 2010. Prices will move in tandem with ethanol production. The mandatory inclusion of 5% of corn in the US biofuel ties corn prices to that of petrol. Currently, ethanol prices are lower which will push up consumption and in turn production. This will not happen at the negative profit margins. However, all these will depend on the price of petrol and the regulation on the percentage required in biodiesel.

A concern among aqua feed producers is fish meal prices. Prices began to increase in December 2009 but peaked at USD 1,960 in April 2010. It has now stabilised at USD 1,660/tonne since September 2010. The importance of fish meal, particularly in marine fish feeds cannot be underestimated despite measures to reduce its content with plant and poultry by product meals. Producers are seeking alternative supplies of good quality fish meal from the region.

## Expanding production

### *India*

With the prospect of higher demand from vannamei shrimp culture, the sector in India is increasing production. Currently, the production is 236,000 tpy and the three top produces, CP, Avanti and Waterbase have 84% of the feed market. Avanti which produces feed in collaboration with Thailand's Thai Union Feed mill is putting up a new pellet mill in Gujarat state with an installed capacity of about 25,000 tpy. Production will begin in June, 2011. Apparently, many of the fish feed producers with extruders are also looking at producing extruded shrimp feeds or add an additional pellet line for shrimp feeds. In turn, with the expanding market for fish feeds, many of the small pellet mills have resumed operations and are producing fish feed, according to an industry player.

### *Vietnam*

In March 2011, Uni-President Vietnam will start operations at its new aqua feed mill in Quang Nam province. "The initial capacity will be 40,000 tpy of aquafeed and it will mainly service vannamei shrimp farmers since the shrimp development in the northen area was significant during the past few years", said Wu (see box). Two major Norwegian aqua feed producers have entered the feed market in Vietnam. Skretting acquired Tomboy Feeds, a major producer of shrimp and marine fish feeds. Ewos is entering the pangasius feed market through a joint venture with Anova Corporation.

## Outlook in 2011

There is optimism with the demand in 2011 for shrimp feeds. In Thailand, feed mills will be increasing their production target by 15-20 %. In Vietnam, Wu is confident of increased demand in Q1 of 2011. In Indonesia, Puspita Dewi said, "We are very optimistic for 2011. We are seeing the signs that shrimp farmers are beginning to use appropriate culture protocols to sustain culture operations. They are reducing stocking density and applying biosecurity measures as well as use good quality post larvae. I expect vannamei shrimp production to increase by 20% and our feed sales will increase."

More fish feed production is expected in India, as there is increasing capacity for both floating and sinking pellets. The Indonesian aqua feed mill association expects fish feed production to grow at 12% in 2011. "Currently the capacity is 750,000 tpy", said Sunanto. However, Sunanto also expects the restructuring of Cirata reservoir to affect production of tilapia and thus the 150,000 tonnes feed market for the fish. According to Thailand's tilapia development strategy, the country will increase its tilapia output to 300,000 tonnes by 2014.

# Aqua feed production in South China

## A shift back to shrimp feeds at Uni-President's Zhongshan feed mill

**South China has more than 400 medium to small scale feed mills competing for the annual demand of 0.7 million tonnes of marine shrimp feed and 2.0 million tonnes of pelleted and extruded feed for various freshwater and marine fish. Pelleted tilapia feeds are mainly for polyculture and integrated culture with ducks in western Guangdong. Extruded fish feeds are mainly for marine fish farming and intensive culture of tilapia and grass carp.**

In Guangdong, Guangxi and Hainan provinces where almost 70% of shrimp farming is carried out, China's top aqua feed producers, Yue Hai, Evergreen, Haid, Tongwei and Chai Tai (CP) produce almost 520,000 tonnes of shrimp feed annually. A medium size player in this immense market is Zhongshan President Enterprises Company. Uni-President Enterprise, Taiwan's feed, food and beverage multinational set up the feed mill in 1995 with an investment of USD 19.4 million to focus on shrimp and eel feed production.

Currently, it produces 10,000 tpy of marine shrimp feed and 100,000 tpy of fish feed comprising feeds for the tilapia and eel as well as feeds for cold water fish such as the rainbow trout and sturgeon. The feed mill similar to all of the small to medium size feed mills, is unable to compete in the high volume low margins production of feeds for the carps and this is left to large companies such as Haid, Tongwei and New Hope.

Uni President has two aqua feed mills in China. Another feed mill, Shanghai Songjiang President Enterprise Ltd, is located in Songjiang District, near Shanghai and produces mainly shrimp, crab, freshwater fish and frog feed. Jeff Jie-Cheng Chuang, General Manager in China, is responsible for both companies since June 2009. He was previously Vice President of Uni President Vietnam.

*Jeff Jie-Cheng Chuang*

"Our current focus is on the production of pelleted and extruded feeds for integrated and intensive culture of the tilapia, respectively. Some years ago, the company shifted away from shrimp feed production because of high mortality due to diseases, sometimes up to 100% of a crop. In contrast, with fish, the mortality rate is much lower."

Recently, with the projected expansion of shrimp farming to meet market demand, our turn around plans have included shrimp feed production. One of the drawbacks of shrimp farming is the lack of good quality post larvae. We are just beginning to work with a branded *Penaeus vannamei* post larvae producer to acclimatise $PL_6$ to lower salinity and supply farmers in inland freshwater farms."

In China, the aqua feed market is very competitive and farmers look at both price and quality. Despite rising costs of raw materials, prices have been adjusted only once in 2010. It is also a difficult market largely based on credit terms. Local raw materials such as wheat flour and soybean meal are used. Although China is a major producer of fish meal, local fish meal can only be used if unadulterated. The company runs the usual quality checks on several raw materials, such as for antibiotics and urea contamination and, for fish meal in particular, tests for melamine. Sometimes, the amino acid profile is also checked.

"The specifications for almost all types of fish feed have been determined by the centralised Agriculture Department and we are required to follow these standards. Here, it is easy to start manufacturing a new type of feed as each provincial office is allowed to issue a manufacturing licence. In our experience in Vietnam, we were required to conduct trials before a feed specification for a particular feed was approved. Feed formulations are developed in house in Taiwan for species common for both countries but for those particular to China, we conduct our R&D in China itself," said Chuang.

The higher quality extruded tilapia feed produced in Zhongshan City and used in intensive ponds has a feed conversion ratio (FCR) of 1.5. These retail at RMB 4,300 /tonne as opposed to the medium priced pelleted feeds at RMB 3,600/tonne. There are also feeds sold at RMB 3,050/tonne as supplementary feed in integrated polyculture of tilapia and duck culture.

"As I see it, this feed market is challenging as well as exciting. Demand is increasing and we see the niche market with our feeds. Currently, our distribution network covers the whole of Guangdong and Hainan provinces. We will be expanding capacity of the mill in Zhongshan City to twice current capacity. There are also plans to set up a new feed mill in Western Guangdong to be nearer to Hainan Island and Eastern Guangxi."

# A novel way to feed *Artemia* cysts

## Feeding *Artemia* cysts yolk platelets, extracted and processed to the right particle size

by Bernard Devresse

**Traditionally, the nutrients present in *Artemia* cysts (protein, fat, minerals, etc.) are utilised by the early stages of shrimp larvae through feeding them with recently hatched living *Artemia* nauplii. Production of nauplii is a time consuming operation requiring steps which involve decapsulation, disinfection, hatching, separation and rinsing. Hatching typically takes 24 hours and requires the use of chemicals. It is not totally efficient since the hatching percentage is variable, depending on *Artemia* source and quality. However, recent research has shown that this is not necessarily the only way to feed shrimp larvae.**

### Yolk platelets

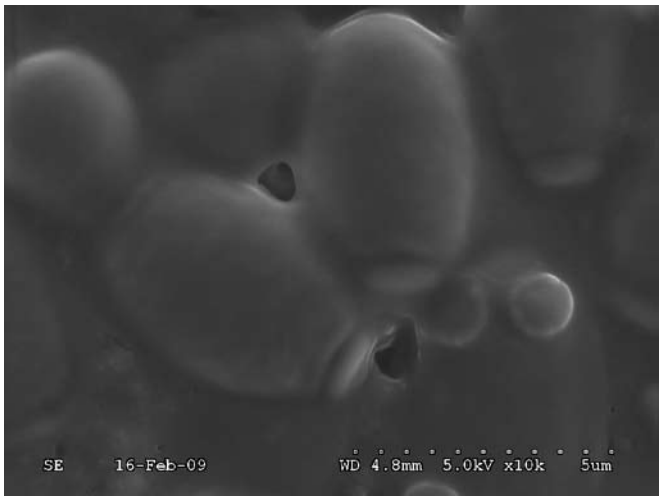
It is well known that *Artemia* cyst contains an embryo whose development has been arrested at the gastrula stage (Clegg et al., 1996). This embryo is composed of a small amount of cells and is surrounded by a huge number of very tiny packed granules of nutrient reserves called yolk platelets (Clegg, 2005).

Recent research has confirmed that the content of *Artemia* cyst is mainly composed of a very large number of small compact yolk platelets. These are very regular, well defined bodies measuring 3 µm in width by 5 µm in length with a disc-like structure at both ends. These yolk platelets are extremely stable in water and contain virtually all the nutrients needed by the *Artemia* embryo to continue its development from the gastrula stage.

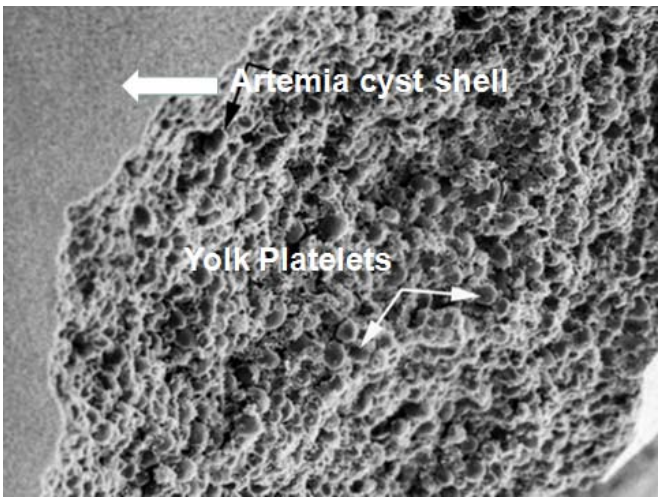
Yolk platelets are actually the most perfect micro-capsules that nature has produced. It is extremely stable in the slightly acidic pH (<6.5) found in diets and spontaneously dissolves at alkaline pH prevailing in the shrimp larval gut (8.5) (Utterback and Hand, 1987). Yolk platelets are therefore the ideal nutrient supply to young shrimp larvae since its digestion is not relying uniquely on shrimp larval enzymes, but is endogenous to the yolk platelet.

When properly extracted and processed into the right particle size, these yolk platelets show nutritional properties similar or better than live *Artemia* nauplii, when fed to shrimp larvae under commercial hatchery conditions. Both temperature and pH are keys to the preservation of the integrity of the yolk platelets.

Several experiments carried out in hatcheries have shown that *Litopenaeus vannamei* shrimp larvae fed with yolk platelets particles, fully replacing the use of live *Artemia* nauplii, grow better and survival is higher than the shrimp larvae fed with live *Artemia* nauplii. The water quality of culture tanks and the bacteria load in the water remained similar in both treatments.




*Scanning electronic microscopy photograph showing the Artemia yolk platelet structure and dimensions (3x5 µm). Yolk platelets are very tiny packed granules of nutrient reserves and are the most perfect micro-capsules with ideal nutrients for the young shrimp larvae.*




*Photograph taken with scanning electronic microscopy showing an Artemia cyst cut open. The membrane of the Artemia cyst is visible as well as its content which is mainly composed of yolk platelet. The Artemia embryo is composed of a small amount of cells and is surrounded by a huge number of very tiny packed granules of nutrient reserves yolk platelets.*

## Feed trials

A feeding regime (Table 1) was tested in a commercial hatchery in Mexico. The test was run in triplicate. Each tank contained 20,000 litres of water and contained 2.2 million to 2.5 million nauplii at the start of the test (120 nauplii/litre). Two treatments were applied. In one treatment shrimp nauplii were fed live and recently hatched *Artemia* nauplii and in the second treatment, the feed was a particle composed of carefully extracted *Artemia* cyst yolk platelets (Vitellus™)

The detailed results of the experiment carried out in Mexico in August 2009 are given in Table 2. Results indicate that Vitellus™ produced shrimp post larvae of equal size and quality (coefficient of variation (CV), stress test survival and pigmentation) are comparable to those fed live Artemia nauplii. Later in the next production season (December 2009 to March 2010) a total of 3.5 billion shrimp were reared in Mexico with Vitellus™ as total replacement for live *Artemia* nauplii. This confirmed the validity of the first experiment.

In terms of performance, Vitellus™ (patent pending), which composed of pure *Artemia* cyst extract is equal to that of live *Artemia*

**Table 2. Details on the assessment in feeding Vitellus™ versus live *Artemia* to post larvae ($PL_{15-17}$).**

| **Vitellus™: Results** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date: start of experiment** | Shrimp nauplii | Volume (1000 litre) | Density (nauplii/ litre) | Date: end of experiment | Post larvae stage at harvest | Absolute survival | Survival | Weight (mg) | Length (mm) | C.V | Stress test survival |
| **26 Aug 09** | 2,200 | 20 | 110 | 21 Sep 09 | PL17 | 1,085,000 | 49% | 3.18 | 8.19 | 0.1 | 99% |
| **27 Aug 09** | 2,500 | 20 | 125 | 21 Sep 09 | PL 16 | 1,450,000 | 58% | 4.96 | 9.22 | 0.1 | 96% |
| **28 Aug 09** | 2,000 | 20 | 100 | 21 Sep 09 | PL 15 | 1,313,333 | 66% | 3.69 | 8.42 | 0.1 | 98% |
| | 6.700 | 60 t | 112 N/L | | | 3,848,333 | 57.4% | | | | |
| **Live *Artemia* results** | | | | | | | | | | | |
| **Date: start of experiment** | Shrimp nauplii | Volume (1000 litre) | Density (nauplii/ litre) | Date: end of experiment | Post larvae stage at harvest | Absolute survival | Survival | Weight (mg) | Length (mm) | C.V | Stress test survival |
| **25 Aug 09** | 2,400 | 20 | 120 | 19 Sep 09 | PL 16 | 1,193,000 | 50% | 3.52 | 7.95 | 0.1 | 96% |
| **25 Aug 09** | 2,400 | 20 | 120 | 19 Sep 09 | PL16 | 1,275,000 | 53% | 3.70 | 8.46 | 0.2 | 98% |
| **26 Aug 09** | 2,200 | 20 | 110 | 19 Sep 09 | PL15 | 1,155,000 | 53% | 3.45 | 8.33 | 0.1 | 100% |
| | 7,000 | 60 | 117 | | PL 16 | 3,623,000 | 51.8% | | | | |

Shrimp post-larvae fed with Vitellus™

Shrimp post-larvae fed with Live *Artemia* nauplii

*These pictures show the digestive track of $PL_2$ sampled to evaluate their feeding behaviour. Feed can be found in animals from both treatments. The colouration found in the shrimp digestive track fed with Vitellus™ is more intense probably because the shrimp has ingested more feed.*

**Table 1. Feeding regime of larval shrimp until $PL_8$ in the feed trial in Mexico.**

| Stage | *Artemia* cysts/ million PL (g) | Vitellus/million PL (g) | Frequency (number of feeding/day) |
|---|---|---|---|
| Z3/M1 | 30 | 24 | 6 |
| M1 | 30 | 24 | 6 |
| M2 | 60 | 48 | 6 |
| M3 | 80 | 64 | 6 |
| M3/PL1 | 80 | 64 | 6 |
| PL1 | 100 | 128 | 6 |
| PL2 | 200 | 160 | 6 |
| PL3 | 240 | 192 | 6 |
| PL4 | 320 | 256 | 6 |
| PL5 | 320 | 256 | 6 |
| PL6 | 320 | 256 | 6 |
| PL7 | 320 | 256 | 6 |
| PL8 | 160 | 128 | 6 |
| Total | 2,260 | 1,856 | |

nauplii. However, a lesser amount is required and there will be a cost savings of 20-30% when *Artemia* cysts are used. It is also easier to use as no hatching and decapsulation of the cyst is required. In turn, the product is further enhanced with an enrichment of 3% of fish oil (EPA, DHA) and is ionised to guarantee as bacteria and virus free.

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## 16th DSM Aquaculture Conference Asia Pacific

# An interactive approach to aqua nutrition

**Highlighting amino acid requirements for fish and the development of diets without fish meal and fish oil.**

"The focal point of industry nowadays is sustainability. Aquaculture registered a 3.1% growth in 2009. Nevertheless, we need interactive approaches and those combining different disciplines. This is the objective of this conference, to lead industry into its next phase of growth," said **Dr Jacques Gabaudan**. Aquaculture Centre Asia Pacific, DSM Nutritional Products in his welcome to more than 300 participants at the 16th Aquaculture Conference Asia Pacific held in Bangkok on 18 November 2010.

"Since 2008, we have been focussing on fish meal and fish oil issues, be it in the commodity arena or in replacement studies. In general, prices of warm water fish have been low, although some species are experiencing better prices this year. The situation requires that the feed and culture sectors be innovative to remain profitable and expand production. In this conference, we cover topics related to changes in our industry. The price volatility and sustainability issues of feed ingredients require drastic formula changes incorporating ingredient substitutions and at the same time conserving the requirement levels of essential nutrients."

Leading the group of presenters are experts in fish nutrition and feed technology. Returning after three years to the same conference, Dr Sadasivam Kaushik, from the Nutrition Aquaculture and Genomics Research Unit, INRA, France, recounted recent achievements in fish meal and fish oil reduction in fish feeds conducted through an integrative approach of various institutions under the European Union's Aquamax programme. With regard to amino acid nutrition in fish, Dr. Dominique Bureau, of the Fish Nutrition Research Laboratory, University of Guelph, Canada, demonstrated to fish nutritionists in the audience the process to determine essential amino acids requirements in formulations and highlighting several common pitfalls in this process. Also in feed preparation, Dr. Jowaman Khajarern, from the Department of Animal Science, Khon Kaen University, Thailand, showed the effects on fish health and physiology of adventitious toxins, contaminants and adulterants present in ingredients. She also detailed out the use of several test kits developed in her laboratory.

*Jacques Gabaudan (right) with Peter Blyth (left) and Dominique Bureau*

A next set of presenters focused on the new regime in aquaculture which requires new ideas, particularly in feed management. Peter J. Blyth, from Business Development, AQ1 Systems Australia, related various technological advances in feeding shrimp and barramundi in ponds by using passive acoustics and adaptive control algorithms to determine the optimum feed ration. Meanwhile, Nguyen Hong Nguyen, from the WorldFish Centre, Malaysia, highlighted that through the genetic improvement of tilapia, we can see improvements in quality traits.

Several years ago, in this same conference series, Dr Chalor Limsuwan, Kasetsart University, Thailand discussed the devastation from diseases in the shrimp industry, then dominated by black tiger shrimp. At present, the industry consists of almost 90% vannamei shrimp and he focused on the white faeces syndrome occurring as a consequence of high summer temperatures. He also touched on the infectious myonecrosis virus affecting shrimp production in Indonesia.

*The team from CPF, Thailand with Dr Chen Ming Dang (second from right).*

*Chalor Limsuwan (left) and Nguyen Hong Nguyen*

## White faeces syndrome in Thai shrimp

### *How water temperatures affect shrimp health*

White faeces syndrome has been spotted in Thai shrimp farms since January 2010, affecting both black tiger and vannamei shrimp. **Dr Chalor Limsuwan** said this is common in ponds with very poor management with overfeeding and algal bloom. Ponds have poor soil bottom and low water quality, low dissolved oxygen and low alkalinity. Some 20 years ago, the white faeces syndrome was first reported in intensive shrimp ponds and *Vibrio* bacteria and protozoan gregarines were isolated. The solution for the latter was to use 10g of garlic per kg of feed.

"Current losses are moderate but I predict that we will not reach the expected high production. It was the unusually high water temperatures (33-34°C) in the afternoon which brought about the disease. In comparison, temperature was only 30°C last year. As the temperature rises, shrimp feed more and there is a tendency to increase feeds in the feeding trays."

The first signs of the disease are indicated by strings of white faeces in the water, followed by a decrease in feed consumption. This leads to loose shell syndrome and shrimp dying. Shrimp of 7-12g (50-70pcs/kg) were most affected regardless of salinity. Probiotics, immune stimulants or organic acids are suggested to overcome the problem.

Reports of the disease declined in July with the rains but its prevalence has continued. Limsuwan's advice is for farmers to stock at an appropriate density. Farms increasing stocking density to 90 post larvae/$m^2$ and using the same number of aerators have been more susceptible to the syndrome. Shrimp health improved when farmers were advised to stop feeding and use probiotics to improve water quality. He also recommended that the feeding rate be maintained at 30ºC and the feeding tray not be used to assess the demand for feed.

From year end until February 2011, white spot virus syndrome is expected again as the water temperature falls. This is more serious as mortality is chronic. His recommendation is for hatcheries to increase water temperature to 32±1°C for the last 7 days before stocking in grow-out ponds.

***Title: New developments on white faeces syndrome and IMNV in shrimp culture by Dr.Chalor Limsuwan, Faculty of Fisheries, Kasetsart University, Thailand***

## Replacement of fish meal and fish oil

***Using several analytical tools to derive not only best inclusion rates for growth but also healthy fish in terms of DHA and EPA levels.***

*Sadasivam Kaushik with Dr Mali Boonyaratpalin, DOF, Thailand (left) and Jowaman Khajarern (right).*

Aquamax, an integrated EU project, was initiated in 2006 involving more than 32 research and industrial partners from 14 countries in Europe and Asia. Elaborating on the purpose of the project, **Dr Sadasivan Kaushik** notes, "There is recognition that fish is healthy and important for human well being. Aquaculture continues to contribute to the supply. However, of importance are the health and food safety aspects of seafood that we consume. Since the supply of fish meal (FM) and fish oil (FO) used in fish feeds has been stable for the past 20 years, it is crucial that we do not overly rely on fish meal and fish oil as sources of macro nutrients; and there should be a strong urge to develop feed with alternatives of a sustainable nature. An integrative approach is required to make the entire aquaculture chain sustainable in the long term."

Another aim of the project is also to see the balance between the risks and benefits involved in changes in feed composition. This is a major task which is too large for a single laboratory to carry out on its own. Different scientific groups integrated currently available tools such as metabolic, biochemical, molecular and physiological tools and looked at flesh and nutrients interactions to analyse findings. Life cycle analysis was used to assess the sustainability aspect.

Another major issue in Europe is also the welfare and health of farmed fish. Using molecular tools, the consequences on different metabolic pathways due to dietary changes were analysed to arrive at pertinent biomarkers of metabolic disturbances, health and welfare of the fish. The short and long term studies of the various species and validation of laboratory results were validated with commercial trials with feed manufacturers.

"At the end of the day, what is introduced is for the benefit of the consumers. There are four programmes: alternatives to FM and FO; benefits of fish to health; safety of fish feed on new diets and perceptions of farmed fish by the consumer. Ultimately, it is to tailor feeds to produce high quality fish."

***…."Ultimately, it is to tailor feeds to produce high quality fish with very low levels of fish meal and fish oil."***

The species covered were species important to European aquaculture: Atlantic salmon, rainbow trout, gilthead sea bream and cyprinids. Globally, salmonids consume 27% of FM and 67% of FO, respectively; and for marine fish the figures are 21% and 14% respectively. Carps are small consumers at 16 and 7% respectively. The targets of FM and FO in the Aquamax diets are detailed in Table 1.

**Table 1. Status of fish meal (FM) and fish oil (FO) in feeds for fish farmed in Europe and Aquamax targets for fish meal and fish oil levels by 2010.**

| Species | 2005 levels | | Target levels | |
|---|---|---|---|---|
| | FM | FO | FM | FO |
| Salmon | 35-47 | 25-33 | 12-16 | 8-12 |
| Trout | 30-35 | 20-25 | 5 | 5 |
| Seabream | 40-45 | 15-20 | 15 | 10 |
| Carp | 20-25 | 5-10 | 0 | 0 |

### *Feed intake and growth*

In general, there was lower feed intake and growth during the first three months of the trial for Atlantic salmon fed lower fish meal and fish oils and it was not possible to catch up later in the trial. The trial showed that it was possible to grow Atlantic salmon from 70 to 1400g with feeds with 15% fishmeal. In rainbow trout, a reduction of 20% in growth was found with zero levels of fish meal and fish oil in diets.

In gilthead bream, there was no difference in growth. The fish can be fed with feeds with low FM and FO with no adverse effects on growth or feed utilisation. In Indian major carps, feeds without FM and FO performed as well as commercial feed used for common carp culture. It was not an issue as feeding fish with lower FM and FO diets is already a general practice.

### *Lipid metabolism*

Lipid metabolism was variable in the Atlantic salmon and rainbow trout where increased body fat was evident. Fish fed decreasing FM and FO in diets modified fat metabolism but with no difference in oxidation capacities and transport mechanisms. However, feeding finishing feeds high in FO for three weeks can alter the fatty acid composition. In the rainbow trout, it was possible to tailor flesh EPA+DHA levels to meet the recommendation of w3 intake by the International Society for the Study of Fatty Acids and Lipids (ISSFAL) of 3.5g/week. After 3 weeks of finishing, 300g fish previously fed with plant feedstuffs, or even 210g of trout provide the same after 12 weeks finishing with FO-enriched feed.

### *Nutrient x genotype interactions*

The programme also identified the genotypes with enhanced ability to utilise plant feedstuffs and those that maintain tissue n-3HUFA levels when fed diets low in n-3HUFA. The models are lean and fat (INRA)

strains of rainbow trout and One Commercial, a lean and a fat strain of Atlantic salmon. These were fed low FM and FO diets over long periods. The results indicated some heritability for flesh fatty acids composition.

## Nutritional value of fish

It was reported that different salmon strains respond differently to high vegetable oil (VO) diets in terms of growth, tissue lipid distribution, lipid concentration and retention and deposition of fatty acids. For example, feeding 100% VO for 55 weeks reduced flesh DHA + EPA levels by 75%, 66% and 66% in the MH, Lean and Fat strains, respectively. However, feeding a 100% FO finishing diet for 16 weeks restored flesh DHA + EPA to 94%, 99% and 88% of values seen in fish fed FO throughout. This is already a common practice among producers and show significant savings in production costs.

### *Food safety*

The use of plant meals and vegetable oils reduced the contamination levels of dioxin and dioxin-like PCBs load in the final fillet of the salmon. The loads of persistent organic pollutants (POPs) were reduced in the Atlantic salmon and gilthead sea bream fillet compared to current commercially farmed fish. However, the use of plant meals and oils increased levels of polyaromatic hydrocarbons (PAH, sum 16 EFSA PAHs) in the feed. The levels in fillet, however only increased marginally.

### *Flesh quality*

To evaluate the flesh and sensory qualities, samples were sent to discerning consumer groups. Results indicated that these consumers could not detect any differences in taste and quality. Samples were then subjected to electronic nose analysis which showed distinct differences.

In the field trials, the farmer chose the feed manufacturer to produce the feeds and then carried out long term trials. The fish output were subjected to consumer taste panels. Greek consumer attitudes towards the gilthead sea bream fed on Aquamax formulations were encouraging as some even preferred the fish over wild caught fish.

## FIFO ratios

When calculated using the most stringent method, post Aquamax feeds 'fish in fish out' ratios were reduced as indicated below.

**Table 2. Change in fish-in-fish- out ratios.**

| Species | 2006 | Post Aquamax |
|---|---|---|
| Salmon | >7 | 3.6 |
| Trout | 6 | 1.5 |
| Seabream | 4.5 | 3.0 |
| Carp | 1.5 | 0.0 |

$$\text{FIFO} = \frac{\text{FM, \% in feed}}{\text{FM yield from wild fish}} + \frac{\text{FO, \% in feed}}{\text{FO yield from wild fish}} \times \text{Feed Gain ratio}$$

The conclusion was that in all species no serious issues as regards growth, feed utilisation or physiological well-being were detected. The aim of lowering FM and FO in fish feed was achieved despite specific constraints and addressing issues of importance in the European context, i.e. no terrestrial animal products and no genetically modified products. There were no issues on fish health and welfare, nutritional value and food safety as well as environmental sustainability. (Refer to www.aquamaxip.eu for the published formulation, information and publications).

***Title: Recent achievements in fish meal and fish oil reduction in fish feeds: An integrative approach by S.J. Kaushik, Nutrition, Aquaculture & Genomics Unit, INRA, France. Email : kaushik@st-pee.inra.fr***

# Defining and meeting the essential amino acid requirements of fish

## *Are you using the right requirement levels of amino acid in fish feeds?*

The mode of expression of essential amino acid requirements (EAA) of fish is a topic of disagreement between fish nutritionists. According to NRC, 1993, requirements are best expressed as a percentage of diet (% diet). The other two expressions relate to the diet energy content (g/MJ digestible energy (DE), Rodehutscord et al.1997) and dietary protein content (% protein or g/16 g N, Cowey and Cho, 1993; Mambrini and Guillaume, 1999), respectively.

"When we compare formulations, they may or may not meet the requirements according to these three modes of expression. Overall, we know that individual EAA levels deemed adequate in the diet may be different depending on: the mode of expression adopted, the composition of diet, and the amino acids profile of the ingredients," said **Dr Dominique Bureau**.

"For each of these expressions, there are certain assumptions, which can be contradictory. In % of diet, it is assumed that the diet composition has no effect on amino acid requirement (relative to the 'mass' of diet). In the g/MJ DE expression, the assumption is that the amino acid requirement is directly related to DE intake of the animal. Higher DE feeds will need to be formulated higher in EAA levels compared to lower DE feeds, since there is a lower feed intake with high DE feeds.

Finally, in the % of protein expression, it is assumed that any excess amino acid is catabolised for energy and that the first limiting amino acid is not spared compared to less limiting amino acids. It also assumes that if when the feed is formulated to amino acid levels in excess of the requirement, the excess protein must be 'balanced'.

As an example, the dietary requirement for arginine according to NRC (1993) is 1.5 % diet dry matter, whilst Rodethutscord et al (1997) gave 1.0g/MJ DE and, 4.4 % of the crude protein.

## EAA values and evolution of aqua feeds

"For a long time, we have been trying to understand EAA requirements, how to meet them and formulate them into cost effective diets. In our experiments, when we express lysine in the three ways, we have up to 30% difference between the highest and lowest values. This is a large gap in my opinion. Researchers have been looking at refining estimates of nutrient requirements by using increasingly sophisticated techniques. However, they have largely forgotten that it is how this information is used in the field that matters most. Despite decades of research, we are still very much unaware of how the composition of the diet impacts EAA utilisation and requirements of fish and shrimp".

This is significant since the nutritional composition of aqua feeds has evolved quickly over the years. In the Atlantic salmon, fat levels have increased dramatically and protein levels have been reduced significantly. The composition of tilapia, carp and shrimp feeds has been evolving continuously.

Bureau's main question is how can we apply information derived from research done in the 1980s or 1990s and apply it to today's diets which have changed so much? The big questions are; how reliable are the estimates of requirement found in the literature; what is the best mode of expression and how does the composition of the feed affect the amino acid requirements of the animal?

## Finding answers

### *Using reference values*

In a study conducted to compare the effect of a high fish meal diet against those with a high corn gluten meal diet, it was found that lysine was deficient in the latter and needed supplementation. It was also shown that lysine was the limiting EAA in corn gluten diets and that the 1.8% of diet expression given in NRC was not a reliable reference value. Later results suggested that the lysine requirement was much higher. This demonstrated that feed formulators need to be more critical of published information and should refer back to the original research used to derive these reference values.

*"When we look at published literature, we can find more than 300 studies conducted on EAA requirements of fish and shrimp. Rather than reinvent the wheel, these can be used to recalibrate the information on requirements. This work was initiated by researchers at INRA in France. However, it became apparent to us that only 25% of published studies could meaningfully be reanalysed to extract more information. Thus we need to foster the adoption of better experimental designs and better data analysis techniques by nutrition researchers. We need to do some training and foster dialogue between researchers and feed industry stakeholders so we can improve the quality of the experimental work done and the usefulness of results from research trials."*

### *Broken line vs linear models*

In order to generate information on the effects of diet composition on lysine utilisation and requirements in rainbow trout, Bureau and his team studied the effect of using feeds with different digestible energy levels. At two levels of digestible energy levels (16 MJ and 20 MJ) studied, the estimate of lysine requirement was identical. Using different models, the lysine requirement by the broken line method gave 1.8% of diet and with the nutritional kinetic model, the value was 2.3% of diet. This showed that the model selected for fitting the data is extremely important. Using the two estimates of requirements, the difference in weight gain was small at 10g for 120g fish but a gross 7-8% improvement in weight gain is nonetheless substantial. Feed formulators could be formulating cheaper feeds with 1.8% lysine level but the fish would not express their full growth potential. Optimising growth is essential since profitability of aquaculture enterprises is largely driven by product sales.

### *Lipids and lysine*

A comparison with previous information confirmed that the protein level did not affect utilisation of the lysine and as such the expression of percent protein level is not recommended. When the digestible energy of the diet was increased by adding lipids, the utilisation of the lysine increased significantly but the lysine requirement expressed as a % of the diet did not change.

"This shows that fish probably catabolise amino acids for energy and that the catabolism of a deficient EAA can be further reduced by increasing lipid levels. Fish appear to be slightly different from pigs and chicken from this perspective".

### *Protein deposition and fillet yield*

In deriving estimates of requirement, the team at the UG/OMNR Fish Nutrition Research Laboratory showed that lysine required for maximum protein gain of rainbow trout is slightly higher than that for maximising weight gain. With the exception of the broken line model, estimates of lysine requirement for protein gain appear to be 5-15% higher than those for live weight gain. However, the greater impact was with the model used for fitting the data (Table 1). From a practical point of view, a lysine level of about 2.4% of the diet appears to be adequate to maximise both weight and protein deposition in this species.

In turn, increasing dietary lysine levels appear to increase whole body protein and lysine concentrations. This could impact flesh quality and fillet yield.

"In our study, as we increased dietary lysine, the protein content and lysine gain continuously increased. In broiler chicken, yield of breast meat increases in response to lysine, more than weight gain and protein deposition. In aquaculture, integrated producers should look at the impact of amino acid composition of diet, not just on weight gain and protein deposition of the animal but also on marketable product yield and quality. To date, work has been limited on this," said Bureau.

**Table 1. Varying estimates of lysine requirement using different models to fit data.**

| | Model | | | |
|---|---|---|---|---|
| Criteria | Four parameter logistic | Exponential | Polynomial | Broken line |
| Weight gain | 2.11 | 2.68 | 2.23 | 2.19 |
| Protein deposition | 2.44 | 3.15 | 2.41 | 2.22 |

## Factorial models

Bureau also discussed factorial models, increasingly used by feed manufacturers for estimating EAAs in shrimp and fish. These models are easy to construct and take into consideration water temperatures, life stages etc. Working backwards from sum of amino acid deposition for body protein deposition, maintenance, catabolism and faecal losses, the amount of amino acids is calculated based on predicted feed intake, weight gain and feed conversion ratio.

The downside of this is that these calculate requirement independently and do not take into account changes in amino acid efficiency and physiological condition as the animal grows and the impact of different components of diet on amino acid utilisation. Thus there is a need for better models.

*Jacques Gabaudan and Chalor Limsuwan with participants after the conference.*

***Title: The challenge of defining and meeting the essential amino acid requirements of fish. By Dominique P. Bureau, UG/OMNR Fish Nutrition Research Laboratory, Department of Animal and Poultry Science, University of Guelph, Canada. Email: dbureau@uoguelph.ca http://fishnutrition.uoguelph.ca***

## Passive acoustics technology

### *A tool to regulate feeding and improve feed conversion ratios*

It is through advances in mathematics and physics that this has emerged as a useful technology in monitoring and controlling feeding in ponds and cages, said **Peter Blyth**, AQ1 Systems Pty. Ltd, Australia. The company based in Hobart, Tasmania has been developing smart sensing, analysis and control technology for aquaculture production since 1990. It specialises in acoustic and optical technology for intelligent feeding systems and fish sizing technology such as hydrophone sensors and stereo video sizing, respectively.

In his presentation, Blyth said that the cost of feed is the biggest farm input (often >50%) but with the range of variables from water temperature, dissolved oxygen to lunar cycles and fish behaviour, it is impossible to predict exactly how much to feed and when. Additionally storms, rains and predators also affect feed intake. However, it is important to regulate the temporal and spatial distribution of feed accurately.

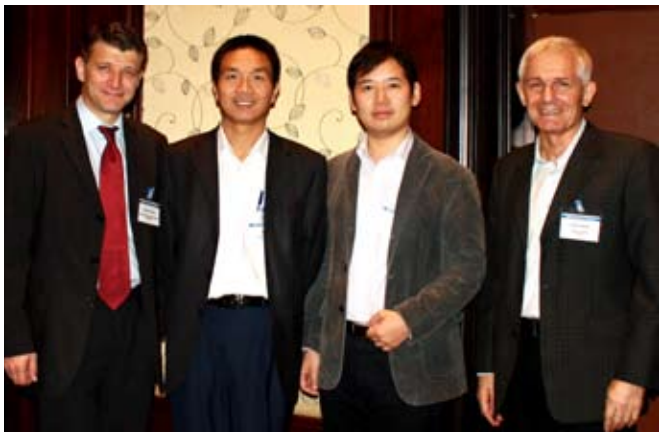
"Finfish aquaculture already uses feed sensor systems that detect feeding rate and have improved specific growth rate, feed conversion ratios, survival and reduced waste feed. Visual observation of feeding activity in ponds is not viable whilst feed trays are usually sampled well after the point of feed ingestion and can provide inaccurate feed intake data due to pellet degradation.

"In EU funded trials in Spain and Greece, FCR improved from 1.36 by manual feeding to 1.16 by sensor feeding for the sea bass. Similarly it changed from 1.86 to 1.6 for the sea bream. It is equally important that the sediment carbon input declined by 23.1% during the production cycle. The control feeding regime reduced waste output."

## Sound feeding technology

### *Barramundi is a noisy feeder*

In Australia, AQ1 began research on feeding by sound for the barramundi (*Lates calcarifer*) 5 years ago in co-operation with Australian Barramundi Culture Pty Ltd, Darwin. Currently barramundi farms in Australia average FCRs ranging from 1.5 to 2.5. The need is to control feeding by delivering feed when the fish wants to eat is key, as they are crepuscular feeders and consume food even in turbid water conditions. The system deployed in barramundi ponds and cages uses data from passive acoustic sensors to control feeding (hydrophone). At the same time, advanced algorithms identify feeding sounds and control feed. A detailed database for historical viewing and future modelling is also available.



*The DSM Team, from left, Dr Christos Antipatis, Regional Marketing Manager Asia Pacific, Wen Ming, Technical Executive and Jack Wu, District Sales Manager, DSM (China) Limited, and Robert Redman, GM-Regional Manager, Indochina.*

*From left, Candra Yanuartin, PT Sinta Prima Feedmill, Suaedi Sunanto, DSM Nutritional Products Indonesia and Virnanda Hapsara, CJ Feed Indonesia*

"Interestingly, the barramundi is a noisy feeder and showed a three stage feeding pattern; high feeding activity followed by relaxed feeding and cessation of feeding by most fish. The variation in feeding within the day and between days can be linked to environmental conditions. Controlled using passive acoustic feeding resulted in a 12% improvement in growth and a lowering of the FCR to 1.45 as compared to the previous farm average of 1.6 to 1.8 when fed by mechanical blower," said Blyth.

### *Shrimp feeds more during day*

In conjunction with Gold Coast Marine Aquaculture, Queensland and CSIRO, a study was carried out in several 0.3ha ponds stocked with around 150,000 post larvae of tiger shrimp in late September which by January averaged 16g with a biomass of 13.3 tonnes/ha.

"In the shrimp, the need for sound feeding technology to control feeding is also because food intake is a key indicator of shrimp health status or other biological issues such as moulting, pellet palatability, disease etc. Measuring actual instantaneous intake is critical to shrimp growth (to avoid under or over feeding) and to pond health by avoiding waste."

Shrimp feeding sounds were generated in the 1-20kHz range. Feed intake occurred mainly in daylight and quickly during the first 10-20 minutes. Feed intake and noise generated post-feed input were linearly related ($r^2$=0.8236). Nutrient leaching from pellets is a real issue that should be considered in order to ensure feed is eaten rapidly when offered as shown by Smith et al, (2002) where 12% of dry matter was lost by 4hr of immersion in water and nitrogen loss was at 15% by 2 hours after immersion. At the end of the trial in April 2010, shrimp averaged 43g with a yield of 22 tonnes/ha and an FCR of 1.4.

Generally, these novel feeding technologies are needed to achieve productivity improvements. In ponds where visibility is limited, passive acoustics is one of the best methods to gather feeding data from this environment and use this data to effectively regulate subsequent intake. Adoption of the technology is progressing with further replicated trials commencing in Australia, South East Asia and the Americas with particular focus on the vannamei shrimp.

***Title: Recent technological advances in feeding shrimp and barramundi in ponds –the use of passive acoustics and Adaptive© control algorithms to determine optimum feed ration. by Peter J. Blyth, AQ1 Systems Pty. Ltd., Australia. Email: pblyth@aq1systems.com***

## Adventitious toxins, contaminants and adulterants in fish and shrimp

### *Focussing on the effects of introduced contaminants*

The limited supply and relatively high price of marine and animal feed ingredients are directing feed formulators towards plant meals. However, plant meals are associated with naturally occurring anti-nutritional factors (ANFs) and toxins. These toxins can have a wide variety of effects ranging from reduced growth to severe toxicity and death.

"Protein meals (soybean meals and fish meal) are often in short supply and exhibit a variation in quality aspects or nutrient availability. Additionally, since these protein sources have high unit costs, the company must establish not only quality standards for the purchasing unit but also a method for examining physical qualities, especially for foreign materials, moulds and toxins, which is fast, accurate and practical. Receiving operators need to be well trained to recognise the quality of raw material visually and carry out quick physical and chemical examinations as well as know the proper methods of sampling," said **Dr Jowaman Khajarern**.

Some of these variables in feeds and feed ingredients were discussed. Different processing techniques will yield products or by-products of different qualities. Meat meal produced from wet rendering has a different colour, odour and protein content when compared to meat scrap produced by the dry rendering process. Adulteration is another important introduced variable at the point of processing. Higher priced and higher quality ingredients are intentionally contaminated with cheaper and lower quality ingredients to reduce the cost and nutritive quality to just meet the specification.

The most common is melamine adulteration in squid meal, fish meal and soybean meal. Elaborating on the health effects of melamine contaminant in the marine shrimp and several species of fish, Jowaman finds that there is swelling and deposits of crystals in the intestinal tract in marine shrimp, as well as edema and swelling of the hepatopancreas and head. In fish, the effects are black skin and swelling stomach in catfish, and loose scale, pale skin syndrome, scale erosion and liver and ovary damage in tilapia. Histological examination shows crystalline spherulites and granuloma around the crystal deposits of melamine cyanurate in trout kidneys.

*Aflatoxin (Aspergillus sp.)* contamination in catfish results in necrosis in several areas and broken liver function poisoning when fed with 120 ppb and 240 ppb of AFB1 after 22 weeks. Aflatoxin contamination in the catfish showed haemorrhaging in the tail and the pancreas. In tilapia fed on a diet containing 100 ppm aflatoxin, the liver showed basophilic, spindle shaped cells surrounding necrotic hepatocytes.

***Title: Effects of ingredient adventitious toxins, contaminants and adulterants on fish health and physiology by Jowaman Khajarern, Department of Animal Science, Faculty of Agriculture, Khon Kaen University/and Faculty of Veterinary and Animal Science, Mahasalakam University, Thailand***

## Genetics of flesh quality in fish

Genetic improvement has led to substantial increase in productivity in farmed animals and in tropical fin fish, this is evident in tilapia. The GIFT (Genetically Improved Farmed Tilapia) strain of Nile tilapia (*Oreochromis niloticus*) has been developed by the WorldFish Centre (formerly known as ICLARM), Norwegian Institute of Aquaculture Research and national research partners from Philippines (1988-1998) and from Malaysia (2000- present). Over many generations of selection, the fish show several favourable characteristics: fast growth, high fillet weight, good flesh quality, disease resistance and good adaption to various farming systems.

In discussing genetic aspects of flesh quality in the GIFT strain, **Nguyen Hong Nguyen** said, "Four groups of traits were studied. They included carcass traits (fillet weight and fillet yield), flesh composition (%protein, %fat and %moisture), flesh quality attributes (pH, colour) and fatty acid composition. Over a study period of three years (2006 to 2008), a total of 5322 individual fish at an average body weight of 530g was slaughtered. Fillet samples were randomly taken across families, selection lines, sex, batch of filleting within generations and were sent to a specialised laboratory for the analysis of flesh quality attributes."

The team at WorldFish found that in GIFT tilapia there was genetic variation in flesh quality traits which provides scope for genetic improvement. The heritability for fillet weight and yield was moderate (20-33%). Low to moderate level (0 to 24%) of genetic variation was observed for flesh composition (protein, fat and moisture contents) and pH and color were lowly heritable (4-5%).

"We also examined the effects of selection on flesh quality of GIFT tilapia. The selection programmes for high growth rate in GIFT has resulted in a significant increase in fillet weight. The accumulated response in fillet weight up to the latest generation of selection included in this study (corresponding to the spawning season in 2008) was 23%. In contrast to fillet weight, change in fillet yield was non-significant. There was very limited impact of selection for increased growth rate on flesh quality traits and fatty acid composition."

Nguyen and his colleagues at the WorldFish Centre concluded that there was a potential for genetic improvement for flesh quality. Selection for high growth rate increased fillet weight. There was no detrimental effect on flesh quality. However, a close monitor of correlated changes in economically important traits as a result of selection for high productivity is recommended in breeding programmes.

***Title: Genetic improvement of fillet traits and flesh quality in aquaculture species by Nguyen Hong Nguyen and Raul W. Ponzoni, The WorldFish Centre, Penang, Malaysia. Email: n.nguyen@cgiar.org***

# The threat of mycotoxins in aquafeeds

by Pedro Encarnação and Ines Rodrigues

**This annual worldwide survey on contamination levels shows a continued threat of mycotoxins in fish/shrimp health, even with the generally reduced level of contamination in complete feeds as compared to the previous year.**

In recent years, the awareness of mycotoxin-related issues within the aqua industry has grown, supported by increasing scientific evidence of the negative impact of mycotoxins on aquatic species and by frequent reports on the prevalence of mycotoxins in many raw materials.

Mycotoxin contamination of aquafeeds is widespread, especially in countries with humid tropical climates which provide conducive conditions for mold growth. Contamination with mycotoxin is often an additive process, beginning in the field and increasing during harvest, drying and storage. In tropical and subtropical conditions the risk of mycotoxin contamination is further increased due to storage under humid and hot conditions, favourable for fungi contamination of stored feed and grain (CAST, 2003).

The increasing globalisation of trade and incorporation of imported raw materials in aquafeeds expose feed manufacturers and their clients to the risk of combinations of mycotoxins either from multiple mycotoxins in the same raw material or from different mycotoxins in different ingredients in the same formulation (Fegan and Spring, 2008). Due to the rising prices of feedstuffs, feed manufacturers are looking for more economical raw materials to avoid increasing feed prices. However, the use of cheaper raw materials of lower quality might increase the risk of mycotoxin contamination in the feeds. For example, dried distiller grains with solubles (DDGS) are an economical source of energy and protein that can be used in animal feeds, but reports show that these are contaminated with multiple mycotoxins (Rodrigues, 2008).

## Structurally diverse

Mycotoxins are structurally very diverse, a characteristic that leads to a wide range of symptoms in affected animals, from decreased production efficiency to mortality. Generally, non-specific symptoms associated with mycotoxin exposure make diagnosis difficult. Further, complications in the diagnosis of mycotoxicoses in farm animals can be caused by synergistic effects resulting from the presence of multiple mycotoxins in feeds and by secondary symptoms resulting from opportunistic disease related to the suppression of the immune system. Additionally, sensitivity to mycotoxins varies greatly between species and is dependent on several factors which can modify the expression of toxicity including age, gender, nutritional and health status prior to exposure and environmental conditions (Whitlow and Hagler, 2002).

## The Mycotoxin Survey 2009

Since 2005, Biomin GmbH is responsible for the Mycotoxin Survey Program, which this year was done in collaboration with Romer Labs and SAMITEC (Brazil). From January 2009 until December 2009, a total of 9 030 analyses were carried out for the most important mycotoxins in terms of agriculture and animal production, namely aflatoxins (Afla), zearalenone (ZON), deoxynivalenol (DON), fumonisins (FUM) and ochratoxin A (OTA). Due to the high limit of detection at 125 µg/kg (ppb) with the Thin Layer Chromatography (TLC) method for T-2-toxin determination, this toxin was omitted from the survey as occurrence at levels lower than that may already cause serious problems to animals.

Samples tested were diverse, ranging from cereals such as corn, wheat and rice to processed by-products, namely soybean meal, corn gluten meal, DDGS and other fodder such as straw, silage and finished feed. Origin of the samples was varied, namely from the Asia-Pacific region, Europe, Middle-East and Africa and the Americas (North and South America).

As can be seen in Table 1, from all survey samples 33%, 35%, 50%, 56% and 28% tested positive for contamination with Afla, ZON, DON, FUM and OTA, respectively. If compared with data from the previous years (2007/2008), an increase on the occurrence of Afla and OTA was observed. Figure 2 provides an overview on the distribution of mycotoxins throughout the different regions worldwide. Table 1 gives an overview on the survey results.

**Table 1. Overview of the survey.**

| Results 2009 | Afla | ZON | DON | FUM | OTA |
|---|---|---|---|---|---|
| No. of Tests | 1735 | 2342 | 2432 | 1653 | 1060 |
| Percent Positive (%) | 33% | 35% | 50% | 56% | 28% |
| Average of positive (µg/kg) | 82 | 221 | 831 | 2270 | 15 |
| Maximum (µg/kg) | 6105 | 8952 | 29300 | 32510 | 1582 |
| Commodity found | Corn | Barley | Barley | Corn gluten meal | Finished feed |
| Country of origin | Vietnam | US | US | Malaysia | Pakistan |

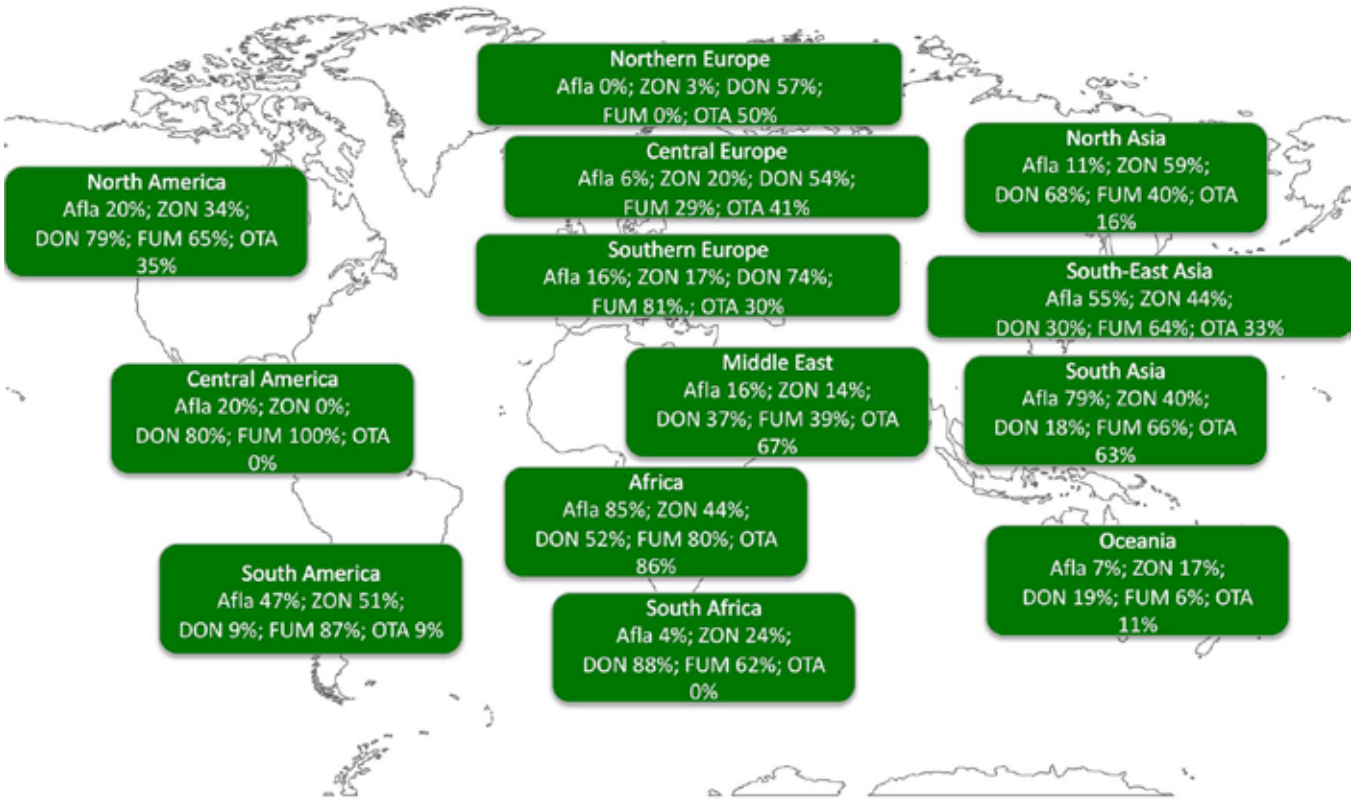
## Results by geographic region

Due to the various origins of the different samples, data were categorised into regions. Detailed data regarding mycotoxin prevalence in the different regions is given in Table 2.

### *North Asia*

Some 17% of the samples analysed in this survey were sourced from North Asia, and within North Asia, the majority originated in China. In comparison with the previous survey, the percentage of samples positive for mycotoxin contamination decreased for all analysed mycotoxins, except for ZON for which a small increase was observed (from 57% to 59% positive results). However, contamination levels did not follow the same trend, as increases were observed for the average of positive results for ZON (from 243 ppb to 326 ppb) and FUM (from 1024 ppb to 2057 ppb). DON, ZON, FUM, OTA and Afla were found in 68%, 59%, 40%, 16% and 11% of the analysed samples, respectively.

Figure 2. Prevalence of mycotoxins in different geographic regions.




## South-East Asia

Unlike in the earlier trends where mycotoxin contamination in South-East Asia was usually lower than that of North Asia, in this survey, the contamination levels of both Afla and DON for South-East Asia were higher than that of North Asia. FUM was the most abundant mycotoxin in the region, present in 64% of the analysed samples at average levels of 1688 ppb. Afla, ZON, OTA and DON were present in 55%, 44%, 33% and 30% of the samples, respectively. The highest level of Afla for the whole survey was found in a corn sample from Vietnam (6105 ppb). Also from this region came the highest FUM-contaminated sample (32510 ppb), a corn gluten meal sample from Malaysia.

## South Asia

As in previous years, the number of samples analysed from this region was lower than that from the other regions in Asia (4% of total survey samples). Nevertheless, the trend was similar. Aflatoxin is a major concern in this area, as 79% of the samples tested positive for this mycotoxin (against 71% of positive results for the previous year).

The average contamination of Afla, although lower than previously, was also the highest found amongst all regions (128 ppb). Increases in the prevalence of Afla, ZON, FUM and OTA were also observed. Also in terms of contamination levels, increases were seen in the average of positive results for DON, FUM and OTA. FUM, OTA, ZON and DON were found in 66%, 63%, 40% and 18% of analysed samples. The highest level of OTA registered in the survey (1582 ppb) was observed in a finished feed sample from Pakistan.

## Oceania

Some 19%, 17%, 11%, 7% and 6% of the samples analysed in this region were contaminated with DON, ZON, OTA, Afla and FUM, respectively. This represented a decrease in comparison with the previous survey. Also in the case of contamination levels, decreases were observed, except in the case of ZON, which increased from 332 to 444 ppb.

Table 2. Survey results by geographic region I.

| North Asia (includes China,Taiwan, Korea, Japan). | | | | | |
|---|---|---|---|---|---|
| North Asia | Afla | ZON | DON | FUM | OTA |
| Number of tests | 428 | 402 | 418 | 446 | 431 |
| Percent positive (%) | 11 | 59 | 68 | 40 | 16 |
| Average of positive (µg/kg) | 50 | 326 | 841 | 2057 | 7 |
| Maximum (µg/kg) | 570 | 7422 | 10320 | 14654 | 52 |
| South East Asia (includes Malaysia, Philippines, Thailand, Vietnam, Indonesia) | | | | | |
| South East Asia | Afla | ZON | DON | FUM | OTA |
| Number of tests | 379 | 357 | 246 | 379 | 248 |
| Percent positive (%) | 55 | 44 | 30 | 64 | 33 |
| Average of positive (µg/kg) | 118 | 162 | 938 | 1688 | 5 |
| Maximum (µg/kg) | 6105 | 2721 | 11836 | 32510 | 80 |
| South Asia (includes India, Pakistan, Bangladesh) | | | | | |
| South Asia | Afla | ZON | DON | FUM | OTA |
| Number of tests | 99 | 96 | 85 | 99 | 97 |
| Percent positive (%) | 79 | 40 | 18 | 66 | 63 |
| Average of positive (µg/kg) | 128 | 124 | 424 | 657 | 34 |
| Maximum (µg/kg) | 2454 | 1099 | 1330 | 6196 | 1582 |
| Oceania (includes Australia and New Zealand) | | | | | |
| Oceania | Afla | ZON | DON | FUM | OTA |
| Number of tests | 82 | 81 | 80 | 82 | 80 |
| Percent positive (%) | 7 | 17 | 19 | 6 | 11 |
| Average of positive (µg/kg) | 8 | 444 | 387 | 2433 | 8 |
| Maximum (µg/kg) | 14 | 3909 | 2577 | 5438 | 41 |

## Results by commodity

Results by commodity are given in detail in Table 3. Table 4 shows the prevalence of the different groups of mycotoxins in the different commodity groups.

**Table 3. Prevalence of mycotoxins in different commodities.**

| | 1st | 2nd | 3rd | 4th | 5th |
|---|---|---|---|---|---|
| Corn | FUM | DON | Afla | ZON | OTA |
| | (83%) | (49%) | (45%) | (29%) | (13%) |
| Soy/soybean Meal | DON | OTA | Afla | ZON | FUM |
| | (30%) | (21%) | (19%) | (12%) | (10%) |
| Wheat/bran | DON | OTA | ZON | Afla | FUM |
| | (57%) | (16%) | (14%) | (12%) | (7%) |
| Corn Gluten Meal | FUM | ZON | DON | Afla | OTA |
| | (100%) | (91%) | (82%) | (55%) | (55%) |
| Rice/bran | ZON | Afla | OTA | FUM | DON |
| | (70%) | (53%) | (48%) | (20%) | (14%) |
| DDGS | DON | FUM | ZON | OTA | Afla |
| | (94%) | (86%) | (74%) | (35%) | (28%) |
| Finished Feed | FUM | ZON | DON | OTA | Afla |
| | (72%) | (54%) | (51%) | (47%) | (41%) |
| Straw/Silage | DON | ZON | OTA | FUM | Afla |
| | (53%) | (38%) | (11%) | (9%) | (1%) |
| Barley | DON | FUM | ZON | Afla | OTA |
| | (44%) | (32%) | (12%) | (4%) | (0%) |
| Other feed ingredients | DON | OTA | Afla | ZON | FUM |
| | (43%) | (33%) | (28%) | (23%) | (14%) |

## Corn

Continuing the trend of past years, corn was shown to be the most extensively and highly contaminated commodity from the survey. With 83% of positive results for FUM, 49% for DON, 45% for Afla, 29% for ZON and 13% for OTA. The highest contamination value found for Afla (6105 ppb) was detected in this matrix.

## Soybean and soybean meal

Soybean and soybean meal showed an increase in both prevalence and concentration of mycotoxins when compared to data from previous years. 30, 21, 19, 12 and 10% of the samples tested positive for DON, OTA, Afla, ZON and FUM, respectively.

## Wheat/bran

In the case of wheat/bran, the most prevalent mycotoxin was still DON, which was present in 57% of tested samples, with an average contamination of 875 ppb. OTA was present in 16% of the samples with an average contamination of 4 ppb. Afla was present in 12% of the samples (average: 4 ppb), ZON in 14% of the samples (average contamination: 134 ppb) and FUM in 7% (average: 406 ppb).

## Corn gluten meal

A relatively low number of corn gluten meal samples were tested. Therefore conclusions must be taken with care. Nevertheless, all tested samples were positive for FUM, 91% were contaminated with ZON, 82% with DON and 55% were positive for Afla and OTA contamination. Except for the latter, contamination levels found in this raw material for all mycotoxins were rather high. In fact, the highest FUM level for the whole survey was found in this ingredient.

## Rice/bran

The most prevalent mycotoxin found in rice/bran was ZON, with 70% of samples testing positive for this mycotoxin at average levels of 75 ppb. Afla, OTA, FUM and DON were found in 53%, 48%, 20% and 14% of the tested samples. Average contamination levels found for this matrix were somewhat lower when compared to the other tested ingredients.

**Table 4. Survey results by commodity.**

| Corn | Afla | ZON | DON | FUM | OTA |
|---|---|---|---|---|---|
| Number of tests | 537 | 692 | 633 | 538 | 232 |
| Percent positive (%) | 45 | 29 | 49 | 83 | 13 |
| Average (µg/kg) | 117 | 280 | 735 | 3230 | 37 |
| Maximum (µg/kg) | 6105 | 7422 | 6000 | 23100 | 355 |
| **Soybean** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 73 | 68 | 74 | 71 | 39 |
| Percent positive (%) | 19 | 12 | 30 | 10 | 21 |
| Average (µg/kg) | 10 | 183 | 278 | 510 | 6 |
| Maximum (µg/kg) | 42 | 807 | 908 | 2035 | 21 |
| **Wheat/bran** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 100 | 220 | 254 | 90 | 61 |
| Percent positive (%) | 12 | 14 | 57 | 7 | 16 |
| Average (µg/kg) | 4 | 134 | 875 | 406 | 4 |
| Maximum (µg/kg) | 20 | 513 | 11022 | 874 | 7 |
| **Corn Gluten Meal** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 11 | 11 | 11 | 11 | 11 |
| Percent positive (%) | 55 | 91 | 82 | 100 | 55 |
| Average (µg/kg) | 74 | 1273 | 2423 | 9249 | 8 |
| Maximum (µg/kg) | 413 | 2721 | 11836 | 32510 | 24 |
| **Rice/bran** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 30 | 30 | 29 | 30 | 29 |
| Percent positive (%) | 53 | 70 | 14 | 20 | 48 |
| Average (µg/kg) | 25 | 75 | 310 | 700 | 5 |
| Maximum (µg/kg) | 113 | 193 | 503 | 2545 | 20 |
| **DDGS** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 47 | 61 | 65 | 44 | 34 |
| Percent positive (%) | 28 | 74 | 94 | 86 | 35 |
| Average (µg/kg) | 9 | 172 | 1845 | 1927 | 7 |
| Maximum (µg/kg) | 35 | 2319 | 10945 | 8449 | 21 |
| **Finished Feed** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 545 | 612 | 669 | 521 | 335 |
| Percent positive (%) | 41 | 54 | 51 | 72 | 47 |
| Average (µg/kg) | 47 | 124 | 671 | 1077 | 15 |
| Maximum (µg/kg) | 2454 | 1705 | 7754 | 22693 | 1582 |
| **Straw/Silage** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 209 | 247 | 287 | 210 | 193 |
| Percent positive (%) | 1 | 38 | 53 | 9 | 11 |
| Average (µg/kg) | 175 | 258 | 679 | 1961 | 5 |
| Maximum (µg/kg) | 342 | 3909 | 7092 | 7090 | 29 |
| **Barley** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 25 | 187 | 200 | 19 | 16 |
| Percent positive (%) | 4 | 12 | 44 | 32 | 0 |
| Average (µg/kg) | 2 | 686 | 1319 | 2977 | - |
| Maximum (µg/kg) | 2 | 8952 | 29300 | 10485 | - |
| **Other feed Ingredients** | **Afla** | **ZON** | **DON** | **FUM** | **OTA** |
| Number of tests | 158 | 214 | 210 | 119 | 110 |
| Percent positive (%) | 28 | 23 | 43 | 14 | 33 |
| Average (µg/kg) | 149 | 297 | 802 | 1872 | 16 |
| Maximum (µg/kg) | 570 | 6587 | 10320 | 11333 | 80 |

However, despite the relatively low average contamination levels, the co-occurrence and synergistic effects of mycotoxins should not be discarded when using this feedstuff in animal nutrition.

### DDGS

Compared to the previous survey, less DDGS samples were analysed this year. However, interestingly, a higher prevalence of all mycotoxins was observed, except in the case of ZON, for which the percentage of positive results decreased from 90% to 74%. The most prevalent mycotoxin was DON with 94% of positive results, followed by FUM (86%), ZON (74%), OTA (35%) and Afla (28%).

### Finished feed

Finished feed samples represented the highest share of the survey with the highest number of analysed samples. Contamination levels were generally reduced in comparison with data from past years. Exceptions for this were the percentage and contamination level for OTA, FUM percentage of positive and average contamination levels and average Afla contamination level. The most prevalent mycotoxin in finished feed was FUM (72%), followed by ZON (54%), DON (51%), OTA (47%) and Afla (41%). The sample with the highest contamination of OTA (1582 ppb) for the whole survey was found in a finished feed sample.

## Conclusion

The results of this survey show once again that the presence of mycotoxins is ubiquitous not only globally, but also in terms of commodity. On a daily basis, animal producers are confronted with the fact that even at low contamination levels, mycotoxins have negative impacts on animal health and performance. These negative impacts are enhanced when animals are stressed.

On the other hand, animals often undergo extreme performance losses in the field, even at low contamination levels, enhanced by the co-occurrence of more than one mycotoxin in the feed. The high prevalence and high contamination of non-adsorbable mycotoxins such as deoxynivalenol was attested by this report, thus confirming the importance of the use of a proper Mycotoxin Risk Management tool.

The Mycofix® Product Line is the result of years of research and its efficacy was proven in scientific and field trials. It guarantees a protection against a wide range of adsorbable and non-adsorbable mycotoxins by combining three strategies – Adsorption, Biotransformation and Bioprotection.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*F2 TRL juveniles Exmouth Hatchery 2010*

# Exciting developments: Generation F2 of the tropical *Panulirus ornatus*

By Roger M. Barnard, Matthew D. Johnston and Bruce Phillips

**After a world's first in 2006 with hatchery reared post-larvae, closing the cycle with the F2 progeny in 2010 brings it closer to commercial farming of the spiny lobster in Australia.**

All wild, spiny lobster fisheries are either fully exploited or over-exploited, with many experiencing trends of catch declines over the past several years. The tropical spiny (rock) lobster *Panulirus ornatus* is the most highly prized and most valuable of all the tropical spiny lobster species. Increasing demand from China has outstripped supply. The solution to this imbalance is lobster aquaculture.

However, the spiny lobster is widely recognised as one of the most difficult of all aquaculture species (and the most difficult crustacean) to propagate due to the protracted and complex larval phase, and extremely delicate larvae known as phyllosoma.

## 'World First' with F1 generation

More than ten years ago, the Australian company MG Kailis initiated research on propagating *P. ornatus.* They produced the first hatchery-reared *P. ornatus* post-larvae (pueruli), believed to be a 'World First', in 2006, in Exmouth, Australia. The achievements of producing pueruli and juveniles in 2006 were repeated in subsequent years by Lobster Harvest, a company established by MG Kailis in 2007 for the purpose of commercialising lobster aquaculture technology. The cohorts were again reared from eggs in the hatchery through the complete larval phase (Stages I – XI) and through metamorphosis to the pueruli and juvenile stages in 2007 and 2008.

First generation (F1) female tropical spiny lobsters from the 2006 cohort were stocked in maturation raceways, together with first generation males from the 2007 cohorts. In 2009 mating occurred, with 'tar-spots' observed on the females. Spawning of these first generation females occurred in late December 2009, with the first hatch of second generation (F2) larvae produced on 24 January 2010.

*Roger Barnard with TRL F1 broodstock, mother and father, Exmouth Hatchery 2010*

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Three cohorts of the second generation and one cohort of the first generation *P. ornatus* have been successfully cultured through the larval phase to pueruli and the juvenile stage in 2010. Survival rates of 9.6% were achieved with stage I newly-hatched larvae to juveniles, using small-scale tanks. Concurrent productions with survival rates near to rates deemed commercially viable were also achieved in production-scale tanks.

## Unique propagation technology

Lobster Harvest has been spectacularly successful in rearing the tropical rock lobsters *P. ornatus* and *P. versicolor* and also the slipper lobsters (bugs) *Thenus australiensis* and *Thenus parindicus* through their complete life cycles in the company's large scale laboratory and pilot-scale lobster hatchery systems.

The company's commercial development programme is now focused on further developing larval nutrition and scaling-up larviculture tanks in the hatchery. Commercial survival rates in the hatchery of 5 to 10% have already been achieved, albeit using small-scale tanks, in replicated experiments. Mean survival in the best feed formulation replicated experiment was 8.1% to the juvenile stage in 2010, with the highest tank survival in a small-scale tank at 9.6%. Scale-up to commercial scale began in 2010 with the unique Lobster Harvest larviculture custom-designed and built tanks. Production-scale tanks have repeatedly produced juvenile *P. ornatus* group in 2010, at survivals of 4.4% and 4.0% from stage I to juvenile.

The repeated production of first generation *P. ornatus* and the recent success in closing the life cycle with the production of second generation progeny are significant steps towards the commercialisation of tropical spiny lobster aquaculture. The development of Lobster Harvest's unique propagation technology places them in a strong unprecedented position to benefit from this situation and to expand the lucrative spiny lobster market.

Vietnam has an established grow-out industry, fattening the fast-growing and robust *P. ornatus*. The fattening activity relies on using wild-caught post-larvae and juveniles, and the lobsters have an estimated annual export value of USD 80 million.

The results of this research will be presented at Aquaculture America 2011 conference and trade show in New Orleans (28 February to 3 March 2011).

# A sustainability concept: Recycling of end-of-life netting materials

**An advanced recycling technology is helping to recycle polyamide 6 spent nets into carpeting and apparels.**

*Closing the loop, clockwise recovering net yarns from fishing and aquaculture, processing yarns to carpets*

The Aquafil Group specialises primarily in the production, marketing and supply of nylon 6 synthetic yarns and polymers. Recently, it has developed a strong focus in applying the sustainability principles in two ways. The first is in the development of new sustainable products, together with co-marketing activities both with clients and suppliers. The second is the use of low environmental impact or renewable energies during production.

The Group employs more than 1,900 people and has a presence in three continents: Europe, North America and Asia. In Europe, it has 5 production facilities in Italy, 3 in Slovenia and one in Croatia. The North American facility is in Georgia, USA. In Asia, there is a facility in Thailand and in the first quarter of 2011, it will start a new production facility in China, located in Jiaxing City, near Shanghai.

The Aquafil mission is to generate a closed loop cycle to produce sustainable polyamide 6 products. In doing this, the group has also discovered a wide range of end-of-life goods that can be used as for this purpose, such as fish-nets (gill, trawling and purse seine nets, cage farm nets etc). This is possible due to an advanced recycling technology. The recovery of polyamide 6 spent nets also avoids environmental concerns to water bodies, oceans and beaches, from stray or abandoned ghost netting materials. The group is currently in the final stages of building a post consumer recycling and recovery plant in Slovenia.

## Recycled polyamide

The recycled polyamide content is called Econyl. With this project, Aquafil attains full sustainability in its production process while at the same time overcoming the problems associated with regulations on waste. At the end of their useful life, these spent products are typically land filled or stored in perpetuity. Both of which are a negative impact to the environment and industry growth. In some cases the nets are incinerated, in the best cases for fuel or energy recovery, but this is a lower value proposition than Aquafil's plan of recycling to recover the polymer content for brand new sustainable products.

More importantly, closed cycle recycling these materials at the end of their useful life directly displaces and reduces the consumption of natural resources, both in the form of raw materials derived from crude oil, and as electricity, thermal energy and utilities in general obtained from fossil fuels.

This Econyl project is Aquafil's path towards full sustainability in its production process. The company says that, "this is one of the highest and noblest recycling systems. It starts with nylon 6 polymers and ends up with yarns that are made into carpeting/apparel, returning to top-quality nylon 6 polymers in a continuous cycle."

"However, all these processes will be more promising with the cooperation with clients, associations and groups that will help to recover the end of life goods needed in closing the 'reclaim-recycle and reuse' loop."

***The fishing and aquaculture industry can support this sustainability initiative by supplying end-of-life netting materials. Aquafil is seeking the assistance of industry members, stakeholders, associations and government organisations to identify possible sources. It will also make compensation and transport arrangements. Those interested, please contact: Ladislao Labriola (ladislao.labriola@aquafil.com). For Canada, North and South America: Jim Lindsey (jim.lindsey@aquafil.com)***

# A Thai farmer's innovation: the shrimp auto feeder

By Soraphat Panakorn and Panupong Petchkaew

**Changing the way shrimp is fed with the third generation feeder developed in Chantaburi.**

Fish farmers have been using auto feeders or demand feeders in their ponds and cages for several years. However, the use of auto feeders in shrimp farming has yielded poor results, with the feeding behaviour of the shrimp the primary constraint.

Prayoon Hongrat the owner of Sureerath farm recently revealed the secret to his success in using an auto feeder effectively. This came about a year of experimentation. Sureerath farm is located in Amphoe Leamsing, Chantaburi Province in the eastern part of Thailand. Hongrat has 167 ponds, each with an average size of 0.64ha. Three years ago, his organic shrimp was certified by Naturland, Germany. To reduce feed consumption, he began to produce the algae *Enteromorpha intestinalis* in his ponds before stocking of less than 50 PL/$m^2$.This improves shrimp growth and at the same time reduces feed consumption.

In 2010, he also developed his third generation auto feeder model. The use of auto feeders in Thai shrimp farming is not new. Auto feeders were introduced in 2006, but farmers gradually moved back to either manual feeding from a boat or feed blower from the pond dykes as they were not satisfied with the performance of the auto feeder. They cited two problems: that the auto feeder was not correlated to shrimp feeding behaviour and that the feeding technique was not clearly defined.

## What is in this new model?

In this new auto feeder, Hongrat has added a feeder valve to broadcast feed freely when the machine is running. The feed will continue to be released as long as the feeder is running. He has also added an electric break to stop the feeder. In comparison, the previous model would continue to run and stop at a certain interval. In addition, to ensure that feed will drop at the longest radius from the feeder and not near the feeder only, there is another adjustable valve to match the feed size, and a PLC box to accurately control feed, in terms of time and amount.

*Adjusting devices to match feed sizes*

*In the pond, the feeder should be installed at a distance of 15m from the dyke*

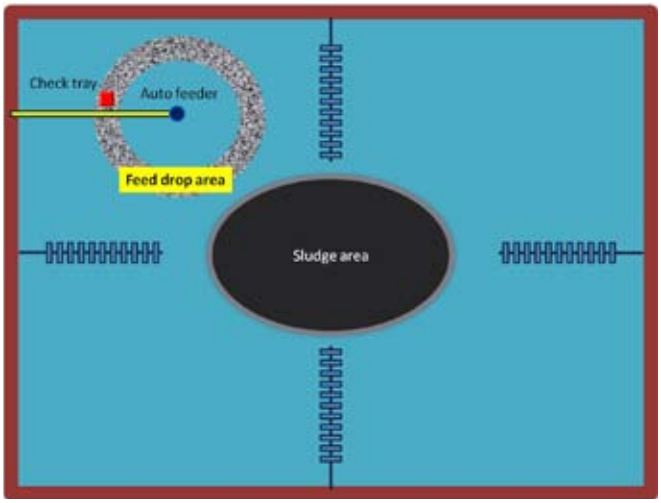
## Rules in installation

"The feeder should be installed at a distance of 15m from the dyke in an area where the water depth is at least 1.5m. It is important that the radius of feed dispersion does not overlap the dyke and sludge area," said Hongrat.

"The feeder must be positioned at least 80cm above the water surface. Each feeder is for 700,000 shrimp and if the pond has more shrimp, then there should be more feeders. When there are two feeders in the pond, the feed radius around each feeder should be 5m. Each auto feeder can load 140kg of feed. The check tray must be in areas where the feed drops and should be positioned 10cm above the pond bottom."

## Feeding technique

The use of the auto feeder is recommended at 20-25 days of culture (DOC). Prior to this, farmers should feed manually. On the first day of using the auto feeder, only a 0.1 second broadcasting of the feed, followed by 5 minute intervals of stop feeding is recommended. Slowly,




*Where to position the feeder*

*Feed is broadcasted within a specified radius*

*Checking feed consumption*

the interval is reduced to 4.5 minutes until a one minute stop interval is reached. Concurrently, the feed broadcast time is increased from 0.1 to 0.2 and so on to a maximum of 3 seconds of feeding time.

"Each second of feeding time will release 60-90g of feed depending on feed size. This means that the maximum amount of feed for 100,000 shrimp will be 35kg/day by the time the shrimp reach 70-80pcs/kg (12.5-14g). After this size, the amount of feed should be maintained until harvest. However, when stocking 700,000 shrimp, the maximum amount of feed should be 245kg/day," said Hongrat.

There are other rules during feeding. The time of feeding is 1440 minutes/day and the amount is 170g/minute. The release of medium size feed is 70g/second of feed and the best broadcast time is 2.5 seconds. This is calculated so that shrimp will eat the feed within 10 seconds and that no feed should reach the pond bottom. In the checking tray, monitoring of feed is carried out twice a day at 6-7 am and 6-7pm. If the shrimp do not finish the feed, the amount must be reduced by 3%, achieved by reducing the feeding time.

## Benefits

Once the auto feeder is used effectively, the farmer can expect the following benefits: a 30% reduction in FCR, better average daily growth, uniform shrimp size and less scaring on the shrimp shell (Table 1).


Water quality in the pond also improves due to the reduction in leftover feed. Cost of production improves not only because of better FCR but a reduction in labour as one worker can handle 4-5 ponds. However, similar to manual feeding, dissolved oxygen in the pond water must always be optimal with adequate aeration.

**Table 1. Results of feeding vannamei shrimp using auto feeders in Chantaburi Province (ponds 1-3) and in Chumphon, southern Thailand (ponds 4-5).**

| Pond | Stocking (number of PL) | Area ($m^2$) | PI/$m^2$ | DOC | Shrimp/ kg | Harvest (tonnes) | FCR |
|---|---|---|---|---|---|---|---|
| 1 | 1,800,000 | 12,800 | 140.6 | 62 | 72 | 22.4 | 1.05 |
| 2 | 1,000,000 | 9600 | 104 | 77 | 53 | 13.6 | 1.32 |
| 3 | 900,000 | 9600 | 93.75 | 77 | 55 | 13.2 | 1.29 |
| 4 | 600,000 | 6400 | 93.75 | 65 | 52 | 10.7 | 1.4 |
| 5 | 1,600,000 | 6400 | 250 | 65 | 80 | 17.5 | 1.4 |

As testimony to the success of the auto feeder, almost 50% of all shrimp farmers in Thailand are now using this auto feeder.


*Prayoon Hongrat and wife*

*Panupong Petchkaew*

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# Feeding rising demand for shrimp post larvae in China

**A strategic alliance and adapting technology to local conditions to solve major production bottlenecks.**

In southern China, the annual demand for *Litopenaeus vannamei* shrimp post larvae is 400 billion and more than half of production comes from around Xiamen in Fujian Province. There are nearly 1,500 hatcheries in operation for an annual shrimp production of 900,000 tonnes in 2010 (as compared to 1.2 million tonnes in 2009). The sheer size of this market and its unique local conditions make China a challenge for INVE Aquaculture and other providers of hatchery solutions. Until recently, the focus was merely on sufficient numbers of post larvae to be produced for feeding a promising high density culture of vannamei shrimp. Not only was the hatchery feed market very competitive, it was also skewed towards the use of local or lower cost diets and imported *Artemia* cysts of Russian or Kazakhstan origin. Today, we see a slow but steady move towards quality fry production and a more sustainable approach.

The original brood stock for the production of vannamei shrimp post larvae was imported from Florida, Hawaii (or other providers of SPF broodstock). Offspring was raised to be the second generation of brood stock. Today, the post larvae produced from imported brood stock cost between RMB 150 to 160/10,000 $PL_{10-12}$ (USD 22-23.5) while post larvae produced from locally grown brood stock cost RMB 20/10,000 PL (USD 2.9). Presently, demand for post larvae is year-round as farmers in the south enclose ponds to keep temperatures optimal for a winter crop. It is anticipated that the future will support production of quality post larvae only and those hatcheries producing poor quality seed stock will gradually be phased out.

"There is a steady change in China supported by the government for food safety considerations in aquaculture. Among growing middle class consumers with higher disposable incomes, there is an increasing demand for quality. Quality can and will in a first instance be delivered by larger companies and especially integrations focusing on the evolving consumer preferences and incorporating this need for consistent quality in their operating standards. With these changes taking place, Inve Aquaculture considers that it is the right time to focus on China again. Since late 2009, we have been discussing the set-up of an alliance with the Guangdong Evergreen Group," said Rudi Bijnens, commercial director for Far East Asia.

The vision of the alliance between Inve Aquaculture and the Evergreen group is to produce quality post larvae to supply contract farmers and quality products for the Chinese market. Evergreen is the biggest shrimp feed supplier in China and also an integrated producer of shrimp and tilapia with expansion plans to produce 20 billion post larvae. It also intends to expand shrimp culture to 3,000ha. The Evergreen Group is expanding its hatchery business via acquisitions of existing hatcheries as well as setting up new ones. The synergy with Inve Aquaculture also extends to the grow-out of shrimp and thus a sales channel for its Sanolife health products.

## Redesigning for China market

According to Bijnens, from their experience, the market in China is fundamentally different from other parts of Asia and with some products, adaptations of formulations and testing in hatcheries and farms are required. Inve Aquaculture is now ready with a portfolio of products specially designed for the Chinese market. Since 2009, it has been introducing innovative products such as, the chemical free one step separation of hatched nauplii from cyst shells, SepArt®. Results have been very promising in Thailand's shrimp hatcheries with 60% of *Artemia* sales being SepArt®. In China, it is currently used by 20-30 marine fish hatcheries. SepArt® has also been very successfully introduced in European marine fish hatcheries with almost 100% of *Artemia* sales. Inve Aquaculture plans to bring this technology to shrimp hatcheries in China.


*Inve Aquaculture was well represented at China Fisheries and Seafood Expo in Dalian held from November 2-4, 2010. At the booth, from left, Rudi Bijnens,(centre) with Pepino Candreva, Business Development Manager, INVE Aquaculture, Belgium (right) and Justin Holgate, Aquaculture Specialist, Thailand (left).*

"We are here in China, not to ask producers to adapt to our technology but to adapt our products to their conditions and needs. We have redesigned some Inve Aquaculture hatchery feeds for the vannamei shrimp to be introduced soon in China. Vannamei shrimp post larvae are mostly produced with a very limited amount of algae which are often of poor quality. The newly designed VANNA® line for shrimp is the answer of Inve Aquaculture for this problem.

The company's focus is also on health products for hatcheries and farms. The challenge here is to excel in a very competitive market where numerous cocktails of products are being used. Also, Inve Aquaculture wants to introduce and show the benefits of applying higher quality products."

# 9th Asian Fisheries and Aquaculture Forum (9AFAF)
# 21st – 25th April 2011, Shanghai, China & the 9AFAF Trade Exhibition

***Organized by the***

## *Asian Fisheries Society & Shanghai Ocean University*


*with support from the 4th International Symposium on Stock Enhancement & Sea Ranching (4ISSESR) , the 9th International Symposium on Tilapia Aquaculture (9ISTA) , the 3rd Global Symposium on Gender in Aquaculture & Fisheries (GAF3) & AquaFish CRSP. A full list of financial and other supporters of 9AFAF is given in our website: www.9afaf.org*

***The forum will be held in the new Lingang campus of Shanghai Ocean University, Shanghai, China***

# *Come and join us at the 9AFAF*

***Important Dates:***

| | |
|---|---|
| Full paper due date: | **February 20th 2011** |
| Trade Exhibition + post-forum tours: | **February 20th 2011** |
| General Assembly of the AFS | **April 21st 2011** |

***For further information and registration, please visit: www.9afaf.org or contact Tina Zhou: ttzhou@shou.edu.cn or 9afaf@shou.edu.cn***

# Aquaculture innovations at Aquatic Asia 2011

**A showcase of developments, products and innovations for Asia's aquaculture industry.**

With several months still to go, the organisers are expecting to offer over 350m² of aquaculture innovations to 3,000 visitors. Ruwan Berculo, Project Manager Aquatic, is not surprised by the numbers. "During the 2009 edition of VIV Asia, we monitored the visitor number with specific interest for aquaculture. Over 25% of the VIV Asia visitors had an outspoken interest in the target area that is now covered by Aquatic Asia 2011." With only a few booth spaces left, the organisers have confidence that the first edition of Aquatic Asia will be fully booked.

## A growing aquaculture business

The aquaculture business has growth potential. In this growing market the Asia-Pacific region has secured a substantial position. Over 85% of the global production is positioned in the region. This justifies a dedicated event for the Asian aquaculture industry. Marnix Muylearts, Sales Manager Sonac B.V. explains their participation, "Our range of products goes far beyond only aquaculture feed, but we do believe in the opportunities the rapidly growing aquaculture industry has to offer."

## Together with VIV Asia, a full market coverage

The Aquatic Asia event is organised at the BITEC centre and is co-located with VIV Asia 2011. The two trade shows together cover all aspects of the aquaculture business. Berculo says, "Several companies with a wider range than just aquaculture are participating in VIV Asia 2011. As the two trade shows are co-located, registered Aquatic Asia visitors will have free entrance to VIV Asia 2011 and vice versa. This enables visitors to make the most of their visit."

## Conference Program

The Aquatic Asia team has joined forces with companies to present an extensive range of interesting topics related to the aquaculture business. Novus Aquaculture and Bayer Animal Health have offered their knowledge in creating content interesting for every aquaculture professional.

| | |
|---|---|
| March 8 (the day before Aquatic Asia) | Mycotoxins 2011-a one day technical conference hosted by Positive Action Publication |
| March 9 | Disease Management – a nutritional prospective, a one day conference hosted by Novus Aquaculture |
| March 9 | International Acidifier Summit- a meeting on the use of organic acids and the respective salts in feed preservation and animal production. |
| March 10 | Culturing quality seafood from Asia-a one day conference hosted by Bayer Animal Health |

## Walk-in seminars

The majority of exhibitors such as Addcon, Asian Aquaculture Network and Intervet-Schering Plough Animal Health will host walk-in seminars. Seminar topics include feed and feed ingredients, animal health and recirculating aquaculture systems. The walk-in seminars are hosted in the halls and will be free of charge. Feel free to walk in and learn all about the latest developments in the aquaculture business.

At press time, some of the confirmed seminars are:

| Wednesday 8 March 2011 | |
|---|---|
| 10.45 - 11.10 | Dr Christian Lückstädt, Addcon - Natural growth promotion in fish and shrimp with a special perspective on the situation in South Asia. |
| 14.15 - 14.40 | Dr. Jacques Gabaudan, DSM- Nutritional options to reduce reliance on medications |

## Aquatic Asia 2011 Exhibitors

**ADDCON**´s expertise in aquaculture and fisheries is in the field of promoting fish growth through the use of organic acids and their salts as well as in stabilising and preserving fish and fish by-products.

The demand for fish and shrimp is growing and the demand is also for sustainable fish and shrimp production; free of residues. Addcon´s aquaculture experts have developed a range of products that promote growth sustainably and effectively with organic acids. The booming aquaculture industry does not only produce a large number of final products, but also a substantial amount of by-products. These by-products can be used in other industries as a valuable ingredient, if stored properly. Addcon offers a range of products to improve storage in a cost-efficient way.

*Booth: 2.A022*
*Contact: Kurt Wegleitner (kurt.wegleitner@addcon.net)*
*Web: www.addcon.net*

The **Applied Plasma Physics** Odour and Dust Abatement Systems are recognised as Best Available Technique (BAT) at IPPC. The efficiency of these systems have been demonstrated globally in a wide variety of industrial applications. It offers a low investment cost and very low operation and maintenance cost. As a result of urban sprawl, many production plants, originally sited at a distance from the population, now find themselves surrounded by housing. Local communities have also become more willing to use the available laws of nuisance in taking legal action against owners and operators of odour and pollution sources. All indications are that these trends are likely to continue into the future. APP, does not only provide drastic removal of odour and dust, but put the science and energy to do so in the most environment friendly way.

*Booth: 2.C011*
*Contact: Havard Vetrhus (havard.vetrhus@app.no)*
*Web: www.app.no*

**Aquatic Eco-Systems, Inc.** is the largest distributor of equipment and supplies to the global aquaculture industry. It offers items from the smallest of aquarium air diffusers and pumps to the largest blowers and compressors for commercial aquaculture. In business for more than 30 years, it has a complete inventory of over 13,000 products for the aquarium and aquaculture industry, as well as a reputation for shipping worldwide most items on the same day payment is received. A full staff of biologists and technicians are available for answering questions ranging from help on choosing the right product for a certain application to sizing and designing a complete aquaculture system.

The International Division can provide a price quotation in 24 hours after receipt of a request. All price quotations include freight charges to the port of destination as well as documentation required for importation. A complete line of exclusive aquaculture products include sweetwater regenerative blowers, compressors and air diffusers, clear water low space bioreactors, quicksand fluidised bed filters, sweetwater water pumps amongst others.

*Booth: 2.C045*
*Contact: Bruce Vizueta (internationalsales@aquaticeco.com)*
*Web: www.aquaticeco.com*

**Asian Aquaculture Network (AAN)** was established in 2009 as a regional professional network of communication, knowledge and sharing practical technical information on aquaculture. The primary focus is on promoting sustainable development and profitable practices in Asian aquaculture. AAN aims to help aqua culturists and farmers operate a profitable and environmentally sound business to sustainably feed the world with affordable products of high quality. To achieve this goal, it is creating and facilitating networking, technology transfer, information exchange and collaboration among our members and connect them into a regional professional network. It also provides updated information and news on aquaculture through "The Practical" quarterly magazine.

*Booth: 2.C037*
*Contact: Amornrat Boonchuay (amornrat@asianaquaculturenetwork.com)*
*Web: www.asianaquaculturenetwork.com*

**Axcentive SARL** from France is bringing Halamid®- the universal disinfectant to the attention of the aquaculture stake holders in Asia. This is the professional disinfectant for total hygiene in aquaculture operations. Microorganisms such as *Vibrio* spp, *Flavobacteria*, *Ichthyophthirius multifiliis, Saprolegnia* and many more are effectively eliminated with the help of this powder disinfectant which is also a common part of livestock biosecurity measures. Halamid® is also recommended for nauplii disinfection. Tested in laboratories and used in farms around the world under various circumstances for water treatment as well as surface disinfection (tank, equipment, etc), this is reliable, safe and environmentally friendly. The company is looking for a closer cooperation with key distributors in the region.

*Booth: 2.A030*
*Contact: Paul van Lenthe (p.vanlenthe@axcentive.com)*
*Web: www.axcentive.com and www.halamid.com*

In Asia Pacific & Latin America **Bayer Animal Health** together with regional partners, as Novozymes Biologicals or AQUI-S New Zealand Ltd are positioned as innovation leaders. Today's aquaculture portfolio focus is shrimp and is also extended to finfish in markets in Chile and Korea. Farmer's needs are catered with biocides eradicating pond parasites and disease vectors. Brands such as Remedor Aquatic and Aquasept A are water disinfectants. Pond water conditioners such as PondPlus modulate phytoplankton bloom. PondDtox and PondProtect are ultimate solutions metabolizing highly toxic hydrogen sulfide and nitrite levels. Complimentary are true speciality products such as AQUI-S®, Coforta A or Grow Shrimp for managing various handling-stress impacts and Hadaclean as innovative in-feed endecto-parasiticide.

*Booth: 01.A020*
*Contact: Jan Koesling (jan.koesling@bayerhealthcare.com)*
*Web: www. bayerhealthcare.com*

**Beijing Sunpu Biochem. Tech. Co. Ltd** is a professional feed additive producer. With ISO9001:2008, FAMI-QS, and HACCP certification, it has developed vitamin C phosphate, vitamin C coated, allicin, feed antioxidant, mould inhibitor, carnitine hydrochloride etc., some of them are patented and follow national standards. It is very active in aquaculture and in the animal feed industry both in domestic and overseas markets. The products have been exported to Europe, North and South America and Asian countries and the company strives to provide better solutions and services to customers and the industry.

*Booth: 2.A010*
*Contact: LI Zhiwei, Ph.D. (zhiwei_li@ sunpubc.com)*
*Web: www.sunpubc.com*

**BIOMIN** has been leading the R&D of innovative feed additives for the livestock industry. Extending this competency in animal nutrition to aquaculture, the Aquaculture Centre for Applied Nutrition (ACAN) in Thailand is devoted to conducting feeding trials for validation of new research findings that translate into proven scientific solutions. The aim to help producers increase productivity and profitability. Biomin develops and produces feed additives, premixes and services with the aim to improve animal health and performance in a natural and economically viable way. Using the latest technology Biomin promotes sustainable solutions and supports environmentally friendly animal production with more than 20 years experience in mycotoxin risk management and with a groundbreaking new natural growth promoting concept as well as specific solutions for dietary problems.

Consult BIOMIN experts at the booth on the benefits of unique mycotoxin risk management strategies and natural solutions that enhance gut health, optimise feed efficiencies, manage feed hygiene and pond water environment for aquaculture production.

*Booth: 2.C023*
*Contact: Pedro Encarnacao (pedro. encarnacao@biomin.net)*
*Web: www.biomin.net*

**Blue Aqua International** is a one stop solution provider for livestock and aquaculture industry in Asia Pacific. It manufactures and distribute specialty products and services to customers in four specific areas:

- Nutrient and Feed Quality: meeting the needs of nutrition and enhancement for feed production. Environment: providing solutions by creating sustainable and productive environment for land and aquatic animals.
- Disease & Health: addressing key approaches and solutions for disease prevention, biosecurity and health optimisation.
- System & Equipment: bringing innovative systems and equipment to deliver value and meet the evolving needs ofcustomers and the emerging industry.

*Booth: 2.C037*
*Contact: Amornrat Boonchuay (amornrat@asianaquaculturenetwork.com)*
*Web: www.asianaquaculturenetwork.com*

**Charoen Phatara Panich Co., Ltd** is an experience manufacturer of plastic and rubber for more than 50 years. It is a manufacturer and exporter of porous pipe which consists of aeration hose and soaker hose. O2Bubble aeration hose use for aquaculture, transportation for aquatic animal and waste water treatment system. It could create finer bubbles which have higher surface area to transfer oxygen into the water and help achieve maximum dissoluble oxygen level more efficiently. Therefore, the operating cost could be lower by using O2bubble aeration hose as it consume much less energy compared to other aeration systems. *O2Bubble aeration hose, an expert in aeration.*

*Booth: 2.C019*
*Contact: Jampeeruang, S. (Sunee) (thaicpphoses@gmail.com)*

Adding value to feed with quality ingredients: **DSM Nutritional Products** is the world's leading supplier of vitamins, carotenoids, enzymes and other additives to the feed industry. These products are highly developed feed additives allowing the aquaculture industry to optimise its production through the guaranteed content of active substance and the formulation designed for this specific use. DSM is at the forefront of research for innovative product solutions. Strict quality assurance procedures guarantee that all products are delivered with a consistent high quality.

*Booth: 2.A036*
*Contact: Jacques Gabaudan (jacques.gabaudan@dsm.com)*
*Web: www.dsmnutritionalproducts.com*

At the booth of **Cargill/E75**, there will be Empyreal® 75, a new generation, renewable, 75% protein (82% dry basis) corn protein concentrate (CPC). It provides manufacturers with a proven, high-energy, highly digestible and cost-effective source of naturally pure protein for aquaculture. It is produced with full-product pasteurization, creating a safe, consistent, and high-protein feed source that binds other ingredients well and expands well in extrusion for low-starch diets. In addition to providing a renewable, cost-effective and natural source of protein, research has shown that Empyreal 75 is a highly digestible protein source that provides excellent feed intake and gain.

*Booth: 2.B031*
*Contact: eric_bell@cargill.com*
*Web: www.e75aqua.com*

**Harvest Co. Ltd** is a direct foreign investment of King Car Corporation (Taiwan) in Vietnam. It was establish in 2002. The company specialises in producing and trading in aqua feeds. It has invested in a modern processing line from Taiwan and is supervised by master foreign engineers and well trained staff. Harvest has brought to the aqua feed market in Vietnam, good quality and diversified products, manufactured following ISO 9001-2008 and ISO 22000. Products include feeds for the pangasius, tilapia, black tiger and vannamei shrimp marine fish.

*Booth: 2.A040*
*Contact: Thuy Quy Hoa, V. van (ctyharvest@vnn.vn)*
*Web: www.harvestaquafeed.com*

**Intervet-Schering-Plough Animal Health** is focused on the research, development, manufacturing and marketing of animal health products. The company offers customers one of the broadest, most innovative animal health portfolios, spanning products to support performance and to prevent, treat and control disease in all major farm and companion animal species. It is the world leader in pharmaceuticals and vaccines for aquaculture and major products in its portfolio are the antibiotic AQUAFLOR® (florfenicol), the parasiticide SLICE® (emamectin benzoate) and the vaccine ranges AQUAVAC® and NORVAX®. The company is based in Boxmeer, The Netherlands.

*Booth: 2.B022*
*Contact: Jessianne Slaats (jessianne.slaats@sp.intervet.com)*
*Web: www.aqua.intervet.com or www.intervet.com*

**LIPTOSA** offers innovative solutions in areas of animal nutrition and animal feeding additives to enable a more natural approach to animal production. The respect for animals and the continued overuse of antibiotics has been the company's inspiration to make the best natural products. With the aim of meeting client requirements, it has exclusive and innovative products launched after thorough R&D process carried out in-house. It manufactures, trades and exports (to more than 40 countries) animal nutrition products, dietetics and natural animal feeding additives under the ISO 9001:2008 norm and EU Regulations for poultry, ruminants, swine and aquaculture. For further details, visit the stand at Aquatic Asia 2011.

*Booth: 2.C015*
*Contact: Laura Munoz (laura.munoz@liptosa.com)*
*Web: www.liptosa.com*

**Mosaic** is the world's leading producer and marketer of concentrated phosphate and potash, two of the primary nutrients required to grow the food the world needs. The business engages in every phase of crop nutrition development, from the mining of resources to the production of crop nutrients, feed and industrial products for customers around the globe. The customer base includes wholesalers, retail dealers and individual growers in more than 40 countries. Mosaic was formed in 2004 through the combination of IMC Global Inc. and the crop nutrition business of Cargill, Inc and is has its headquarters in Plymouth, Minnesota. It has approximately 7,400 people in eight countries and shares are traded on the New York Stock Exchange under the ticker symbol MO.

*Booth2.A014*
*Contact: surachai@progressionagro.com*
*Web: www.mosaicco.com*

**NOVUS** creates health through nutrition products for livestock, pets and people. Novus has employees working in over 90 countries, serving more than 2,500 customers worldwide. Based in St. Charles, Missouri, Novus has facilities including corporate offices, research and development laboratories and manufacturing operations in more than 35 countries, as well as smaller offices with field staff in an additional 60 countries. The Novus vision, established 20 years ago, is to Help Feed the World Affordable, Wholesome Food and Achieve a Higher Quality of Life. Novus International, Inc. is proud to celebrate 20 Years of innovation with integrity.

*Booth: 3.B001*
*Contact: Ramakanta Nayak (Ramakanta.Nayak@novusint.com)*
*Web: www.novusint.com*

**OCIALIS**, the aquaculture brand of EVIALIS, manufactures and sells feeds for shrimp and fish in Vietnam, Brazil, Mexico, France and Indonesia. It also manufactures and sells aquaculture premix and additives in France, China, India and South Africa. OCIALIS is the specialist of tropical aqua feed. It has a leading position in its main market and ranks third in the world tropical aqua feed market. EVIALIS is the feed division of INVIVO NSA, the world specialist in animal nutrition and health. INVIVO NSA has 75 manufacturing sites in more than 18 countries around the world. Its turnover is Euro 1.4 billion.

*Booth: 2.B011*
*Contact: Stephane Ralite (ocialis@ocialis.evls.net)*
*Web: www.ocialis.com or www.invivo-nsa.com*

**SONAC** is a leading manufacturer of reliable ingredients of animal origin. With an active R&D program, reliable processes and sustainable end products Sonac continously adjusts to market needs. A broad portfolio of fats, proteins, minerals and specialities makes Sonac a trusted partner for many international producers in aquafeed. Sonac produces raw materials of animal origin into valuable and essential ingredients of which the key words are : natural, digestible and sustainable.

*Booth: 2.B030*
*Contact: Marnix Muylaert (marnixmuylaert@sonac.biz)*
*Web: www.sonac.biz*

**Sun Rise E&T Corporation**, established in 1995, is the biggest HDPE pipe / fittings manufacturer in Taiwan. Our current maximum extruding size is up to OD1600mm, and will soon become one of the only few manufacturer in Asia. It designs the products according to requirements. Products include Injection fitting (Socket & Butt-fusion Type): Tee / Y-Tee / Cross-tee; Reducers; Stib-endD; 22.5, 60, 45 & 90 DEG Elbow bend; End Caps; Male / Female Adapters; Couplers and Bracket of fish cage

Sun Rise E&T Corporation is an ISO9001 and ISO14001 certified company. It also holds various Taiwanese certifications. Sun Rise E&T Corporation will ensure the best in both price and quality.

*Booth: 2A.044*
*Contact: Eric Tung (srhdpe@srise.com.tw)*
*Web: www.srise.com.tw*

**Tartu Mill, Dobele Mill** and **Saalemühle** are forming 1 Group. All companies are based in West Europe. They are all in the heart of Europe's (Germany and the Baltic States) most fertile grain cultivation area, proved to be the perfect base from which to achieve first-rate products. Due to the innovation drive of the company, it is today one of Europe's most productive mills with a young flexible team, who understand the grain/wheat flour business in detail. In line with the philosophy of sustainability, long-term business relationships with customers are particularly important to us. The focus for the group is integrity, honesty and safety in the food, aqua and shrimp feed industry.

*Booth: 2.A018*
*Contact: Natali Zvonko (natalija.zvonko@dzirnavnieks.lv).*
*Web: www.tartumill.ee, www.saalemuehle.de, www.dzirnavnieks.lv*

**Unity Technoproduct** was started in 1993 by a group of experts committed to the research of new technologies and products. The aim to be able to increase productivity of aquaculture and respond quickly to problems during culture. All of the products distributed or manufactured are assured of quality. These include probiotic bacteria, vitamin supplements, water conditioning and minerals. As it has been able to answer to the needs of farmers in a timely manner, the Unity team has been able to rapidly grow the company and some of their pharmaceutical supplements are best sellers. Their promise to the industry is to discover and develop new products for maximum benefits.

*Booth: 2.B045*
*Contact: Khunnen, K. (Song Rit) (unitythailand@yahoo.com)*
*Web: www.unitythailand.com*

**Tanachock Paisan Limited Partnership (Tnc)**
*Booth 2.B044*
*Contact: T. Ratanaprapaporn (thanachock_tnc@hotmail.com*

## Event details

### *Dates and opening hours*

| | |
|---|---|
| Wednesday March 9 | 10.00 - 18.00 hrs |
| Thursday March 10 | 10.00 - 18.00 hrs |
| Friday March 11 | 10.00 - 16.00 hrs |

### *Venue*

BITEC, Bangkok International Trade & Exhibition Centre, Bangkok, Thailand

### *Admission*

Admission is free for trade professionals, business visitors, holders of invitations and registered visitors only. Register on our website www.aquatic-asia.net for free entrance.

# Marketing tilapia and shrimp from China

**In 2008, China exported 224,000 tonnes of tilapia valued at USD 730 million and 194,000 tonnes of shrimp valued at USD 1.2 billion (Redmayne, 2010). The major integrators have a large market share of this export volume and at the 15th China Fisheries and Seafood Exposition and China Aquaculture in Dalian, they demonstrated the scale of their production in terms of volume and quality.**

*Tie Teck Lok, Skretting China Co Ltd (second right) and his team and guest, Carina Ong from the Philippines (second left).*


*Jim Wyban and assistant at the Hi Health Aquaculture (HHA) booth. As a first time exhibitor at this trade show, Wyban was in China promoting SPF broodstock. A new product is SPF Penaeus stylirostris*



*Yang Sei Seafoods*

Maoming, in Western Guangdong Province is the major tilapia producing area with 14,568ha of tilapia ponds. The annual output is 180,000 tonnes which is a third of the total production from Guangdong Province and one eighth of national production. In 2010, Maoming was named the 'city of tilapia'. **Maoming Changxing Foods** is involved in the processing and sale of tilapia products. The production capacity is 30,000 tonnes of tilapia and 30,000 tonnes of shrimp. To ensure supply of raw material, Changxing Foods contracts with CIQ (China Inspection and Quarantine) registered tilapia farms of 2,000ha and shrimp farms of 670ha. In addition, it has its own tilapia farms covering 1,200ha and 267ha of shrimp farms. The company supports farmers with standard management protocols.

**Hainan Xintaisheng Industry** is a Taiwan-China joint venture company established in 2005. The annual processing capacity of tilapia fillet is 18,000 tonnes. Another tilapia producer, **Yang Sei Seafoods** emphasised that they are from Taiwan. However, since 2002, the company has invested in 230 ponds and a processing plant to farm and process tilapia in Guangdong. Cost of production is much lower than in Taiwan. The company, based in Foshan City, exports various product forms, from fillet with skin to super deep skin.

## Quality management

Tilapia integrators such as Maoming Changxing have various certification and quality management certifications. Changxing and Yang Sei Seafoods both have BAP certification for culture areas. Changxing's processing plant is BAP certified and they also work with Zhongshan University of Life Sciences in innovating aquatic products production. Equipment such as LC/MS/MS at Changxing and Yang Sei Seafoods strengthen the inspection levels for chemical residues.

## Quality checks

Two years ago, the German company **Nehring & Battaglia** (N&B), GmbH set up testing services office in Xiamen, Fujian, China. According to Marco Stampfli, Executive Director of N&B in China, retailers and trading companies such as those from Germany want checks on quality before shipment. For example, they ask that reprocessed Alaskan salmon in China be tested for nematodes, microbiology and chemical residues like heavy metals. Although FDA does some testing of products, usually European buyers insist on their own testing procedures.

The company has a laboratory complete with modern equipment for chromatographic, microbiological and general chemistry assessments. The team is well trained in the Chinese and European official analytical methods as well as those required by European importers. Thus it is well equipped to assess the quality and safety of products. Stampfli is responsible for all N&B activities in China and is the link between customers in Europe and China. More information: ms@nehring-battaglia.ch (Marco Stampfli) Web:www.nehring-battaglia.com




*Hainan Golden Springs Foods Ltd is a major tilapia and vannamei shrimp producer with farming and processing facilities.*

## Making 'Hainan Tilapia' a first choice

This was the aim of 18 Hainan producers who gathered with buyers for this networking event during the Seafood Expo in Dalian. The 'Hainan tilapia' brand belongs to the China Aquaculture and Marketing Association, Hainan Branch. The fish is exported to 50 countries, mainly to the US, Japan, South Korea, Russia and Europe. The tilapia was developed as a high quality and high value fish. Cost of production is higher in comparison with conventional tilapia and it comes with a traceability process with tests at each stage in its production.

Tilapia and vannamei shrimp contribute significantly to the GDP from fisheries of the province. The island has ideal attributes; temperatures of 22 to 25°C, and sufficient rainfall and sunshine. There are 42 processing companies with a production capacity of 510,000 tonnes, of which 30 are HACCP certified, 15 are EU registered and 23 registered with Russia.

Production of tilapia and shrimp has expanded rapidly. In 2000, shrimp production was 2,000 tonnes and this rose to 16,000 tonnes in 2009. Tilapia production was 6,000 tonnes in 2000, and rose to 88,000 tonnes in 2009. According to the Hainan Provincial Department of Ocean and Fisheries, producers are also proud of the quality of their products, branding them 'green' and 'pollution free'. They say that quality is ensured by an effective monitoring system during each stage of the supply chain. In 2004, they started chemical residue monitoring. Rated at almost 100% of clean products, this is an outstanding record in China.

At this event, Peter Redmayne, Sea Fare Expositions Inc complimented Hainan producers on their success which was attributed to the close working relationship between the Bureau and industry. His message was that Hainan should produce seafood in a sustainable way with the commitment of industry and government. It has the support of a strong generic marketing programme. Big is not better if it means sacrificing the environment and it is important to maintain the 'best product, best marketing and best price' concept.

TILAPIA 2010 Kuala Lumpur

Kuala Lumpur Malaysia
27th -29th October 2010

# The versatile tilapia is poised for further growth especially in Asia and Africa

**This conference is a follow up to the very successful Tilapia 2001 and the Tilapia 2007 both also held in Kuala Lumpur, and organised by INFOFISH. Reports Eric Roderick.**

*At the booth of Star Feedmills Sdn Bhd, Sean Lai Yoke Wai (middle) and team*


*Angus McNiven, Farm Aqua, Thailand and his team. Farm Aqua supplies equipment and accessories for fish farming in Thailand and the region. Namsai Farms produces monosex fry for the domestic and international markets.*

Gold sponsors were Intervet Schering-Plough Animal Health and Star Feedmills, Malaysia , along with Aquatic Ecosystems and AquaFish as silver and bronze sponsors respectively. With almost 230 delegates and 30 speakers from 34 countries, tilapia farming is indeed a global business. The trade show was relatively small but was well attended, and most companies reported a lot of interest.

The keynote given by **Professor Kevin Fitzsimmons** from Arizona University in the USA covered 'Tilapia – a major contributor to world food security' was an excellent overview of the global tilapia situation. Key points covered are that the major cultivated fish in 2010 are carp at 18 million tonnes/year with tilapia at 3.2 million tonnes/year, catfish at 2.3 million tonnes/year and salmonids at 2.1 million tonnes/year. In 2009 tilapia was the 5th top seafood consumed in the US, a position it has maintained since 2006. China is the biggest tilapia consuming and exporting country (followed by Thailand), while the USA is the major tilapia importing country.

## Production growing

Regions of rapid production growth include **Vietnam** where the pangasius catfish has been moved from cages to ponds and the vacated cages are now stocked with tilapia. Indonesia is also rapidly expanding using cage culture and polyculture. Regal Springs is increasing production, and is now exporting fresh fillets to Europe as well as the established markets in the USA. **Malaysia** is also taking advantage of government support and private sector investment to expand cage farming of tilapia in many of the big lakes such as Sg Como in Lake Kenyir Trengganu state. Current tilapia production of 36,624 tonnes is planned to expand to 180,000 tonnes/year by 2020, according **Nik Wahab Mat Diah**, Department of Fisheries. **Thailand**, due to better reporting is also showing significant increases.

**China**, is also reporting strong domestic demand and with low production costs, will always be the biggest player in the tilapia industry. Production in China was covered by **Xie Biao**, Nanjing Normal University, China, who stated that "there was no large scale tilapia culture during the 1970s and 80's, but since 1990 there has been a huge expansion programme. Tilapia, *Oreochromis niloticus* x *O. aureus*: hybrid tilapia from female *O. niloticus* and male *O. aureus* are favoured in southern China, while the pure Nile tilapia is found in northern China, especially in Shandong province. The GIFT strain of Nile tilapia is also widespread.

Guangdong, Fujian, Guangxi and Hainan are the main tilapia producing regions due to their location in tropical or subtropical regions, where tilapia can be cultured and supplied all year, accounting for about 90% of the total production in 2009". China produced 1.15 million tonnes in 2009 which will reach 1.2 million tonnes in 2010 with 2 billion fry produced. Some 46% of production remains in domestic markets. It exported 453,000 tonnes of fillet in 2009 and prices hovered at USD 1.6 to 2.3/kg. In 2009, its share of exports by value in the international markets rose to 69% as compared to only 35% in 2002.

**Egypt** is looking at continued intensification to cater for the increased domestic demand as well as the possibility of exporting to the EU. **Izzat Feidi** from Egypt covered the **MENA** region (**Middle East and North Africa)** where there is some production in most countries, but the highest by far is Egypt with 477,458 tonnes (91,272 tonnes capture and 386,186 tonnes cultured) produced in 2008.

**Africa**, the home of tilapia and a continent with huge potential, is experiencing a current wave of optimism sweeping the continent with increased commercialisation, and lots of investors showing interest in tilapia projects. **Erik Hempel** and **Blessing Mapfumo** gave a joint presentation covering **Sub-Saharan Africa**. SARNISSA, INFOSA,

*The team at the Intervet Schering Plough Animal Health booth.*

AASA and other organisations are working hard in the region to try to improve production and disseminate relevant information. The region has over 200,000 square km of freshwater lakes and reservoirs, with an estimated one million tonnes production annually. 98% of Africa's total aquaculture production comes from inland water bodies. Africa's total farmed production of tilapia reached 433,000 tonnes in 2008 with 89% produced by Egypt with Nigeria, Uganda and Zambia also important producers.

Of this total production, very little is exported with Lake Harvest from Zimbabwe the only serious exporter sending around 2,500 tonnes to Europe annually. One of the reasons for this is the strong domestic demand in most African countries and also a very good price being paid in the local markets. The main challenges to African aquaculture include no development in production technologies, shortages of fingerlings and good quality feed, financial institutions are poorly informed and consequently reluctant to finance aquaculture, and finally an inadequate regulatory framework. These are compounded by lack of infrastructure, disease, corruption, scale of operation and the role of the government.

## Developments

**Kevin Fitzsimmons** said that "Tilapia can be used as a model for how the aquaculture industry should develop. Environmentally sustainable 'Green Aquaculture' is possible as no fish meal is required in the diet, no antibiotics are routinely used and many farms reuse effluents for crops. Integrated farming systems are slowly replacing monoculture e.g. tilapia grown with grapes, wheat, olives, barley, sorghum, cotton, melons and peppers as can be seen in Arizona. Other examples include tilapia with citrus fruits in Hainan, China; with shrimp and halophytes in Eritrea; with shrimp and seaweed in Indonesia; while in Guyana the effluent is used for rice and sugar cane".

Some of the excellent breeding programmes include; G.I.F.T. in Malaysia, Genomar in Norway and Brazil, Chitralada in Thailand and GIFT Excel in the Philippines together with salt-tolerant tilapia hybrids (Molobicus, *O. niloticus* x *O. mossambicus* and BEST, *O. aureus* x *O. niloticus* x *O. spirulus*) and the YY supermale breeding programmes which are taking place in Swansea (Wales, UK), Philippines, Egypt and Indonesia.

In Africa **Erik Hempel** mentioned some big tilapia projects throughout the region, including a 40,000-tonnes project in Botswana, a 10,000-tonnes farm in the Eastern Cape in South Africa, Lake Harvest in Zimbabwe is planning to expand to 20,000 tonnes, Maldecco in Malawi expanding to 3000 tonnes, Uganda where SON is expanding to 2000 tonnes, Tropo in Ghana to expand to 5,000 tonnes and in Kenya where Dominion Fish Farm is expanding up to 2,000 tonnes. All these countries have reported large increases in the number of new smaller farms.

Kevin Fitzsimmons in his second presentation covered the latest developments in the Americas, where production is still increasing throughout the region, not only for export to the USA but also to satisfy strong domestic demand particularly in Mexico (which is now importing tilapia from China), Columbia, Brazil and the Caribbean. Honduras, Ecuador and Costa Rica have large production, but most of this is exported as fresh fillet to the USA, which is still the largest importer in the world with only 5% of the US market being supplied by domestic producers, with much of that production targeting live sales. Mexico has a large domestic market with a one kg per capita consumption relative to the 0.5kg per capita in the US.

In disease and health management, **Neil Wendover**, Intervet-Schering Plough Animal Health in Singapore in his presentation on *Streptococcus* in tilapia, outlined some recent developments in laboratory and field tests with the new Aqua Vac® Strep Sa –a biotype 2 vaccine for the tilapia against the bacteria *Streptococcus agalactiae*. Laboratory challenge tests showed that a single application conferred protection. He concluded that the future is in understanding disease and raising production standards. **Dr Kai Kühlmann**, Addcon said that as the EU prohibits import of aquaculture species containing antibiotic growth promoters (AGP) residues, the alternative for producers is biodegradable acidifiers. In their studies with Potassium-Diformate (KDF), benefits were a general growth increase, improved digestibility and anti-bacterial effects.

## Marketing

Processing and 'value-adding' technology will intensify, especially in China where preserved (breaded) tilapia goods will become a significant contributor to profitability. The internet has an increasing role in marketing new products. In the Philippines **Dr Raphael Guerrero** III mentioned specialised products from tilapia including use of fish scales in collagen cream as well as 'Tilapia Crunch' produced from baby tilapia.

**Norbert Sporns** from HQ Sustainable Maritime Industries based in Seattle gave an in-depth overview of the US tilapia markets. HQ produces tilapia in Hainan China. The use of tilapia by products is becoming increasingly important, such as calcium supplements from the bones of tilapia, and collagen from the skin and scales. He also mentioned proteins from the brains of tilapia used by HQ in the production of an Alzheimer treatment product. McDonalds was mentioned as considering the use of tilapia in its white fish blocks which, if this did happen, would vastly increase demand for tilapia on a global scale.

Sporns said, "The FDA is advising Americans to eat healthy fish as obesity is a problem Challenges for the industry include resistance to aquaculture and more work must be done to counter negative campaigns from some groups and competing aquaculture sectors."

*From left: Haydar H Alsahtout, Al Fulk National Co, Saudi Arabia, L. Nand Kumar and Dr N.S Allada, Synergy Biotechnologies, Ramakishnan Kulasekaran, Kula Aqua Consulants, Dr D.V.S.N Raju, RGCA and I.P.R. Mohan Raju, HES Infra Pvt Ltd*


*Yosuke Hirono (left) and Ricardo Arias at Aquatic Ecosystems which provides integrated solutions for the entire aquaculture production chain.*

*Blessing Mapfumo, Regional Aquaculture Advisor, Infosa, (middle) with Fatimah Ferdouse and Tarlochan Singh (left), Infofish*

*Ir Maskur, Centre for Freshwater Aquaculture Development, West Java (left) , Welliam Iskandar and Purnomo, PT Matahari Sakti, Indonesia (right)*

Guerrero stated "that trends in Asia are moving towards organic tilapia, with no chemicals and antibiotics used and with little or no methyl testosterone used for monosex fry production. The application of Food Quality and Safety Standards are becoming increasingly important especially HACCP, ISO 9100 and ISO 22000".

**Erik Hempel** in his second presentation covered the European markets. He explained that "tilapia was competing in the whitefish market, against traditional species like cod, saithe, pollack, hake and haddock, as well as newer species such as pangasius, nile perch, barramundi or seabass, cobia and seabream. The biggest threat to tilapia's success in Europe is the pangasius, which is cheaper than tilapia, and is being marketed strongly throughout the EU".

The EU market for whitefish is estimated to be around 4 million tonnes, with tilapia's share at just 0.6% means there is huge room for improvement. Also the availability of the traditional species is declining ensuring more demand for the newer species like tilapia. He states that "two very distinct markets will develop in Europe, the mass market which will mostly be served by cheap frozen fillets and whole fish from China, and an upper end market, served by larger, thicker and higher quality fillets and prepared value added products. His conclusion is that tilapia will need a lot of promotion in the European markets to improve its market share.

Overall it was a very successful conference and INFOFISH should be congratulated . A follow up conference on the tilapia was proposed to run in 2 or 3 years time.

aquaculture europe 10

# Seafarming for tomorrow at AE2010

## Ilustrating the progress in marine finfish farming and what is the future

**Most of the delegates at this annual conference and trade show were impressed by the developments in marine aquaculture in Europe. Farmers had a dedicated session and delegates involved in offshore aquaculture had an insight into production costs and the challenges to remain competitive.**

The event was organised by the European Aquaculture Society (EAS) in Porto, Portugal from October 5-8, 2010. AE2010 attracted more than 1,100 participants from 49 countries. This is a record attendance for an Aquaculture Europe stand-alone event. The premium and health session sponsor was Intervet Schering Plough Animal Health. Gold sponsor was Aquasoja, Silver and nutrition session sponsor was Novus and the Feeds session sponsor was Biomin.

### Production

The first plenary speaker, **Gilles Bœuf**, Université Pierre et Marie Curie/ CNRS and President of the French National Museum of Natural History, France presented a broad and comprehensive overview of the 'Future aquaculture in a changing environment'. Boeuf discussed the effects of ocean acidification, transport of pollutants, over-exploitation and alien species introduction. He added that the problem is not the changes but the speed of change. He looked at the various aquaculture production systems at a global level and their effects on the environment, while also addressing the issue of fish meal usage.

In his plenary on 'A licence to produce?, **Javier Ojeda**, General Manager of APROMAR (Spanish Marine Aquaculture Producer's Association) gave his viewpoints on the reasons why European aquaculture is stagnating or even declining. He argued that the main constraint to development is the availability of appropriate sites. He used some interesting quotations to underscore his messages, notably from Richie Flynn (2005) - "*Stop dedicating so much effort (and money) on capture fisheries. It's a sunset industry...Pay more attention to aquaculture, a dawning industry.*" He also provided some solutions, through concepts, frameworks, methods and tools and finished with a quote from aquaculture pioneer Bjorn Myrseth, who stated in his plenary address to Aquaculture Europe 2005, that "Successful aquaculture nations have availability of sites, favourable legislation and political will."

*Gilles Bœuf (left) and Roy Palmer, Seafood Services, Australia*

### Reducing costs

**Paco Padilla**, Dydmar, Spain compared costs of production in small scale and large scale enterprises in growing sea bass, sea bream, meagre and oysters. Feed and labour costs increase with size of farm and in his opinion, costs can only be reduced with technology. Surface cages have high costs because of storms and escapees, high maintenance and frequent use of divers. Submerged cages will require less maintenance and thus less use of divers and labour. Cages can be raised to ease harvesting and a new pumping system will reduce labour by half during harvesting. Feeding systems monitored and controlled

*Courtney Hough with EAS Presidents Selina Stead (2008-2010) and Yves Harache (2010-2012).*

### Courtney Hough receives highest EAS Award

At the opening session, Courtney Hough, General Secretary of the Federation of European Aquaculture Producers (FEAP), was presented with an Honorary Life Membership of EAS. This is the highest EAS award and is given to those persons that have had a marked impact on the development of European aquaculture. The award was presented by the EAS 2008-2010 President Selina Stead who described Hough's many contributions to European aquaculture, notably his role in the transformation of the Federation Européenne de Salmoniculture in 1994 to become the FEAP of today; his positioning of aquaculture in the European Commission Advisory Committee on Fisheries and Aquaculture; his encouragement to the Commission to make the first aquaculture strategy in 2002 and his ongoing support of aquaculture issues to expert hearings to the Committee on Fisheries of the European Parliament.

by cameras save feed usage. Cost of production is reduced to €3.8/kg, lower than small scale farms (€4.0/kg), although the aim should be to reduce costs further to €2.5/kg.

In Japan, **Dr Tsumoda Noda**, Miyako Station, Fisheries Research Agency conducted experiments on labour saving seedling production of the black rockfish *Sebates schlegeli*. Here, rotifer culture and EPA enrichment were performed concurrently and temperature regulation is only required in one tank, instead of two. Cost savings were in labour and reduction in working hours, which decreased from 20 hours to less than 5 hours. Survival rate also improved.

## Marketing

On the final day of the conference, **Philippe Paquotte** of the European Commission DG MARE addressed the question "How can European sea-farming production correspond to trends in consumer demand?" He outlined the European market for farmed seafood products, in terms of both market size and segmentation and also its image and perception. His final message was that innovation and keeping the positive image of farmed products among consumers will have to be a global effort, from fish farming to retail, through processing and packaging. Promotion and communication must not be any more the prerogative of NGOs and media, but be based on the real attributes of the products and delivered in the form of intelligible stories.

## Sustainability of EU-Asian trade in aquaculture products (SEAT)

This is a large scale collaborative research project to explore the sustainability of trade in aquaculture products from Asia to European destinations. It will look at the value chain for tilapia, catfish and shrimp. It works with business 'from farm to fork' to strengthen the knowledge base so that the industry can expand and at the same time ensure a fair deal for producers. The latter will need to meet social and environmental goals to ensure safe and sustainable products. (www.seatglobal.eu)

*At Aquacria Piscicolas, SA, Renata Serradeiro explains to participants the work at the facility.*

## Study tour

The study tour was to a 2,000 $m^2$ facility practising shallow raceway culture of turbot and sole, south of Porto in Torreira and an outdoor farm culturing sea bass, bream and meagre in Aveiro. The facility has several modules of 10 tanks/module in three layers and produces 130 tonnes/fish/cycle. In 2009, it invested €2.5 million to upgrade the farm for a production of 400 tonnes/cycle. Seawater from a 40m deep well is recirculated through a newly installed biofilter. In winter, hot air is injected to the 16°C incoming water to reach 21°C. Commercial feeds with 55% crude protein and 10% fat and costing €1.3/kg are used. The culture period is 15 months for 1.2 kg turbot and 12 months for 330g sole. Cost of production is €4-5/kg and ex-farm prices are €8/kg for the turbot and €12/kg for the sole. Bath vaccination is carried out on 5g turbot and 3g sole. Fresh fish are mainly exported to Italy.

The next Aquaculture Europe 2011 will be held in Rhodes Greece from October 18-21. More information: www.easonline.org

## Copper alloy cages

Cages made from copper alloy mesh have been used in fish farms for 30 years, but it was only recently that a coordinated effort is being made by industry producers, researchers and farmers to advance this technology. In her presentation on advances in global offshore copper alloy cages, **Carol Powell** from the Copper Development Association in UK said that the technology is providing productive and sustainable solutions for fish farmers. An adherent protective oxide layer forms on prolonged exposure of the alloy cages to seawater and this naturally inhibits the attachment of fouling organisms, although there will be some micro fouling. This improves water flow and circulation whilst reducing the need for cage cleaning. Increased oxygenation inhibits pathogens and diseases. The semi rigid cages maintain their shape even against strong currents and waves. They can provide a means of protection from predators as well as preventing fish escaping. The resistance to corrosion gives a longer life span and to date there are copper alloy mesh cages still in operation after 5-8 years. Current data has also indicated an improvement in feed conversion ratios with a reduction in feeding costs of 15% and, as well, a reduction in mortality rates by an average of 62%.

There are three types of copper alloys used in marine aquaculture. The copper-zinc alloy has been used in marine aquaculture for a long time. Ashimori Industry Company has installed 300 Cu-Zn alloy cages in Japan, typically 20mX20mX10m for raising *Seriola* sp, and 28 cages in Tasmania for salmon. The technology from Japan has been transferred to cages in Ecosea Farming with 44 cages of 30mx30mx12m for salmon and trout.

*Nigel Cotton (left) and Irina Dumitrescu (middle), European Copper Institute and guest with a display of a chain link copper alloy mesh*

The other two alloys, copper-silicon and copper-nickel, are being introduced to the market as alternative materials. The Cu-Si alloy and 90:10 Cu-Ni have rigid mesh forms although other forms are now available. All three alloys are fully recyclable.

The use of copper alloy cages is growing. In the Panama, Blue Sea Farms has aquapod cages made from the three types of copper alloy for cobia culture. In the North Atlantic, the ASA-IM offshore cage aquaculture technology (OCAT) programme successfully tested 120$m^3$ cage submerged 10m below sea surface for cod farming. A three year programme by the East China Sea Research Institute started using copper alloy cages for black sea bass, fugu, large yellow croaker and cobia. Trials on the performance of cage designs under a range of marine conditions and species are being conducted in Norway, Turkey, China, Korea, Panama, South Africa and USA.

# Appointments

## Brian Plattner appointed to KSU Adjunct Faculty

Described as 'an invaluable resource for research and industrial client activities of the university's extrusion laboratory', **Brian Plattner**, process engineering manager at Wenger Manufacturing, Inc., was recently appointed as an adjunct instructor in the Department of Grain Science and Industry at Kansas State University.

As a member of the adjunct faculty, Plattner will assist with teaching at K-State, as well as participate in department research and support. "Brian has already become a regular guest lecturer for the extrusion class, which I have been teaching as part of the curriculum since 2002," says Dr. Sajid Alavi, associate professor in the Kansas State University Department of Grain Science and Industry. "Plus, he has been an instructor in the Extrusion Processing: Technology and Commercialization short courses held here in Manhattan and in India since 2005."

The latter are one-week courses designed for food processors, entrepreneurs, researchers and students. It covers the fundamentals and operation of extruders as well as the latest trends in extrusion processing. While the course in India is designed for Indian professionals and companies, the course held on the KSU campus is open to professionals in the food and feed industries from around the world.

Plattner has also worked on several research and client service projects at K-State. These have benefited both the university and the industry. Speaking in reference to the formal appointment, Alavi adds, "I think this is an excellent opportunity to formalise the great relationship we have established over the past several years with Brian and with Wenger as a major stakeholder and supporter."

Plattner is a 1997 graduate of Kansas State University with a Bachelor of Science Degree in Biological and Agricultural Engineering and earned his professional engineering license in 2003. In his current position at Wenger Manufacturing, he is responsible for process specification, which calls for helping customers specify new lines and/or improving existing ones. He is also involved in researching new innovations for Wenger's line of extrusion and drying equipment and he has authored an extensive list of publications, book chapters and patents that highlight his extensive technical background.

"It's an honour to be named to the adjunct instructor position. I believe it is something that will benefit all of us, especially on the research side. K-State historically looks at emerging technologies that can be several years from realisation. Wenger, which is market-driven, focuses on the short-term needs of the food and feed industry. This partnership will allow us to combine our efforts to develop and identify the technologies that will be required for the future. I believe it will also give us more exposure on campus and allow us to offer continuing education benefits and a wider range of training options for our clients. So I look at this as a win-win situation and a way to build an even more solid relationship."

Wenger Manufacturing, Inc., headquartered in Sabetha, Kansas, USA, is a global designer, manufacturer and distributor of extrusion processing equipment and related replacement parts. Wenger systems are distributed in over 90 countries, through international sales offices in the U.S., Europe and Asia. Wenger offers a full product line including single and twin screw extruders, snack extruders, forming extruders, conical co-rotating twin screw extruders, universal pellet/cookers, dryers and flavour coating and enrobing systems for animal feeds, snack foods and cereal foods. More information: Doug Baldwin, Director of Business Development, (DougB@wenger.com)

## Aqua Specialist joins Meriden

**John Clark PhD** has joined Meriden Animal Health Limited as an Aquatic Animal Health and Nutrition Technical Consultant. He will contribute to business development in the Asia-Pacific Region. Clark brings with him over 20 years of nutrition and aquatic experience in warm water fish, shrimp hatchery and grow-out. In addition he has a very strong research foundation and was a Post-doctoral Research Fellow employed by the UK Science and Engineering Research Council. John has a PhD from the Department of Chemical and Process Engineering, Heriot-Watt University, Edinburgh, Scotland, UK and his research focussed on 'Microencapsulated Diets for Marine Fish Larvae'. Email: sales@meriden-ah.com

# What can you expect from Aqua Culture Asia Pacific in 2011

| Volume 7 2011 | | | | | | |
|---|---|---|---|---|---|---|
| Number | 1 - January/February | 2 - March/April | 3 - May/June | 4 - July/August | 5 - September/October | 6 - November/December |
| **Issue focus** Recent developments and challenges for the next step | Aqua Feed Production | Cage Culture | Sustainable & Responsible Aquaculture | Health Management | Hatchery | Food Safety & Traceability |
| **Industry Review** Trends and outlook | Marine Shrimp | Groupers | Catfish | Tilapia | Freshwater Fish/Prawn | Marine fish (Cobia/Sea bass) |
| **Feeds & Processing Technology** Technical contributions influencing the final value of aqua feeds | Additives/ Protein meals Processing Technology | Micro-nutrients /Vitamins & Minerals Extrusion | Feed Enzymes/Lipids Post Pellet Additions | Nutritional Health Feed Management | Feed Probiotics Drying Technology | Novel Feed Ingredients/ Nutrition |
| **Production Technology** Technical information and ideas | Biofloc Technology | Breeding and Genetic Improvement | BMP, Standards and Certification | Recirculation Aquaculture Systems | Hygiene & Food Safety | Health Management & Biosecurity |
| **Aqua business** Feature articles | Experiences from industry, including role models, benchmarking and opinion articles in shrimp/fish culture | | | | | |
| **Markets** | Market trends, product development and promotions at ESE 2011,Vietfish 2011 and regional trade shows | | | | | |
| **Show Issue** Distribution at these and regional events (TBA) *Show preview | VIV Asia 2011/Aquatic Asia 2011, Bangkok, Thailand 9-11 March* | 9th Asian Fisheries and Aquaculture Forum & ISTA 2011, Shanghai, China, 21-25 April* | Vietfish 2011, Ho Chi Minh City, Vietnam 28-30 June<br><br>World Aquaculture 2011, Natal, Brazil 6-10 June | | Aquaculture Europe 2011, Rhodes, Greece 18-21 October<br><br>16th China Seafood & Fisheries Exposition & Aquaculture China 2011, Qingdao, China, 1-3 November | Third International Symposium On Cage Aquaculture in Asia, Kuala Lumpur, Malaysia 16-18 November |

# 9th Asian Fisheries and Aquaculture Forum (9afaf)

# Ninth International Symposium on Tilapia In Aquaculture

## April 21-25, 2011, Shanghai Ocean University, Shanghai, China.

This is the triennial forum of the Asian Fisheries Society. It will be organised together with the Shanghai Ocean University, in collaboration with few other government and non-government agencies. 9AFAF with the theme, 'Better Science, Better Fish, Better Life' will be held from April 21-25, 2011 at the Shanghai Ocean University, Shanghai, China.

There will also be two key international symposia during the 9AFAF,

- 4th International Symposium on Stock Enhancement and Sea Ranching (4ISSESR);
- 9th International Symposium on Tilapia Aquaculture (ISTA9).

ISTA9 will be hosted by the China Aquatic Products Processing and Marketing Association and Shanghai Ocean University. It will be co-sponsored by the American Tilapia Association (ATA) and AquaFish Collaborative Research Program (AquaFish CRSP). Sponsors are Intervet-Schering-Plough Animal Health and the American Soybean Association.

This will be the ninth of the highly successful series of symposia that have brought together tilapia biologists to review the latest information in tilapia nutrition, physiology, reproductive biology, genetics, ecology, improvements in production systems, and other fields related to tilapia and their use in aquaculture. The symposium will have a special emphasis on best management practices, quality control, new product forms, international trade and opening new markets for farmed tilapia products. Field trips are being organized to nearby aquaculture sites.

The three day conference and trade show will bring together leading aquaculture and fisheries scientists and key commercial stakeholders from all over the world to discuss important issues pertaining to sustainable aquatic resource production, utilisation and management in the Asia-Pacific. It is expected to be attended by government administrators, scientists, industry partners, students, and experts in aquaculture and fisheries. Presentations and working language will be English.

As at press time, organisers have announced the following speakers for the plenary sessions:

- Dr Meryl Williams - ***Better Science, Better fish, Better life***
- Dr Stephen Hall – ***Better Science:*** New approaches to sustainable fisheries: certification and fisheries science – what are the prospects for Asian and Pacific countries?
- Prof Li Sifa - ***Better Fish:*** Higher productivity and quality through genetic modifications and selection
- Prof Patrick Sorgeloos - ***Better Life*** covering markets, consumers or economics of production

In the special session/research reports, the following will be discussed;

- The research reports from the Mekong River Commission
- Papers from the ASEM-SEAT program
- Managing Resilience in Coastal Zone Aquaculture - A session run by the RESCOPAR program involving Indonesia, Vietnam and the Philippines.

Technical sessions will include:

- Aquaculture, Environment and Impacts
- Aquaculture Nutrition and Feeding
- Aquatic Animal Health Management
- Cage Aquaculture
- Freshwater Fisheries and Culture
- Pangasius Aquaculture and others
- Aquatic Biotechnology & Breeding
- Integrated Aquaculture & Aquatic Resources
- Fish, Human Nutrition and Health
- Marketing and Globalisation
- Fisheries Policy and Governance
- Fisheries Assessment and Management
- Fishing Gear and Technology
- Socio-economic and Fisheries
- Fishwatch Asia-Pacific
- Aquaculture and Fisheries Education
- Biodiversity and Conservation
- Harvest and Post-harvest
- Technology, Value Adding

## Trade show

There will be a trade show, which will provide a forum for industry suppliers, seafood marketers and aquaculture stakeholders to meet directly with researchers and producers. This will bring local and international exhibitors and manufacturers together to showcase the latest in aquaculture and fisheries innovations in equipment, advances in fish health management, cages, feed and feeding technologies etc to all participants. The exhibition offers five types of booths.

Registration will be for all events. For more information: Web: www.9afaf.org
Conference: Email: 9afaf@shou.edu.cn; ttzhou@shou.edu.cn
Trade show: For reservations, contact the Forum Secretariat:
Ms Tina Zhou at ttzhou@shou.edu.cn

## January 17-20

**Asian-Pacific Aquaculture 2011 and Giant Prawn 2011**
Kochi, India
*Email: worldaqua@aol.com*
*Web: www.was.org*

## February 6-8

**Aqua Aquaria India 2011**
Chennai
*Web: www.mpeda.com*

## February 28- March 3

**Aquaculture America 2011**
New Orleans, USA
*Email: worldaqua@aol.com*
*Web: www.was.org*

## March 9-11

**VIV Asia & Aquatic Asia 2011**
Bangkok, Thailand
*Web: www.vivasia.nl; www.aquatic-asia.net*

## March 31-April 1

**12th Aquaculture Insurance & Risk Management Conference**
Kinsale, Co Cork, Ireland
*Email: info@aums.com*
*Web: www.aquacultureinsurance.com*

## April 21-25

**9th Asian Fisheries and Aquaculture Forum & 9ISTA-International Symposium of Tilapia Aquaculture**
Shanghai, China
*Web:www.9afaf.org*
*Web: http://ag.arizona.edu/azaqua/ista/ISTA9/ISTA9.htm*

## May 3-5

**Victam International 2011**
Cologne Germany
*Web:www.victam.com*

## May 3-5

**European Seafood Exposition/Seafood Processing Europe**
Brussels, Belgium
*Email: food@divcom.com*
*Web: www.euroseafood.com*

## June 6-10

**World Aquaculture 2011**
Natal, Brazil
*Email: worldaqua@aol.com*
*Web: www.was.org*

## June 14 - 16

**International Scientific Conference on Probiotics and Prebiotics - IPC2011**
Kosice, Slovakia
*Email: info@probiotic-conference.net*
*Web: www.probiotic-conference.net*

## June 28-30

**Vietnam Fisheries International Exhibition (Vietfish) 2011**
Ho Chi Minh City, Vietnam
*Web: www.vietfish.com.vn*

## September 16-18

**6th Strait (Fuzhou) Fishery Expo**
Fuzhou, Fujian, China
*Email: xmcdw@163.com*
*Web: www.fishexpo.cn*

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