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From the editor

Relevant and Sustainable

Asia has come a full circle since the crisis of 1997/1998 when the Thai Baht, Korean Won and Indonesian Rupiah devalued like falling stones together with other Asian currencies against the US Dollar. Many countries took advantage of this by exporting their way out of the crisis. Fast forward to 2012 when the same Asian currencies have all appreciated against the US Dollar and many of the same exporters are now finding it difficult to sell to a US economy which is spluttering to start up again. A recent report from Seafood.com stated "Thai processors reportedly failed to garner large-lot contracts from USA traders at the Boston Seafood Show (March 11-13, 2012), as demand from the USA remains stagnant."

The aquaculture industry in Asia faces the challenge of remaining relevant and sustainable as we can no longer be the lowest cost producer. In order to be the major supplier of seafood and fish, the industry must look at a different strategy. It must move from a 'big scale back-yard' operation into an industrialised supply chain. Can Asia remain cost competitive in this move? The answer is yes and the role model should be the salmon industry in Norway which ranks as one of the most expensive countries in the world but yet produces cost competitive salmon. Let's look at the driving factors which contribute to this industrialisation in an Asian context.

The major component is productivity and efficiency which lowers the cost of production per kg. This may come from economies of scale which allows for a larger volume produced to be depreciated over a fixed cost. Good examples are already seen in the Asian shrimp and pangasius industries. The common feature is the culture of a single species which allows for focus, integration and efficiency. In comparison, the marine cage culture operations in Asia are multi-species with higher mortality and hence production costs. There will always be a demand for a high priced live fish segment which has a limited volume, high price elasticity and a localised area of market coverage. This will remain a niche market.

Another major component is innovation and automation. As Asian economies develop, employment improves together with costs and standards of living. China is already facing high labour costs and shortage of workers and certain states in India are encountering the same problem. Governments in Thailand and Vietnam have raised salaries and Malaysia is contemplating a minimum wage.

Norwegian salmon farms use automated feeders where the feed is pneumatically transported from large silos on land or on barges. This can be managed by one person in a control room at the farm. Again this requires economies of scale but both the farm and the feed supplier save on labour and packaging material. During Aqua India 2012, Dr Victor Suresh, Integrated Aquaculture International shared trials for feeding shrimp in Brunei with a similar system. Some shrimp farms are already a step ahead with auto feeders, placed in the middle of ponds or on pond dykes. Harvesting is another labour intensive segment of Asian aquaculture operations especially in large scale farms. The technology for automated harvesting equipment already exists but requires some refinement both in terms of operations and cost. If the capital expenditure is cost prohibitive, perhaps the harvesting operation could be out sourced to a specialised company which is willing to invest in such equipment and can then service many farms to recover their costs.

Getting the most from the aquaculture area is important, particularly for land based aquaculture such as freshwater fish and marine shrimp farming. Not only is there a scarcity of finding new areas but also increases in land leases. Disease remains the major challenge for the industry (covered in the last editorial) and we cannot over stress the point that innovation and investment must catch up with the industry. Tackling disease requires animal health companies to innovate and we look to this sector for advice and feedback. Basically, the options are out there and we need to work together to develop them and not try to reinvent the wheel.

The second in the series of aquaculture roundtables, TARS 2012 organised by Aqua Culture Asia Pacific and Corporate Media provides such a platform for the improvement of the shrimp industry across the value chain to ensure profitability and sustainability (see page 54).

Zuridah Merican

OUR MISSION

- We strive to be the beacon for the regional aquaculture industry.
- We will be the window to the world for Asia-Pacific aquaculture producers and a door to the market for international suppliers.
- We strive to be the forum for the development of self-regulation in the Industry.



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New growth in India: The Changing Era

Participants at Aqua India 2012 in March expect an expansion in production of the vannamei shrimp in 2012 but simultaneously, expressed concerns on the direction of growth.

During the opening session of Aqua India 2012, **Santhana Krishnan**, president of the Society of Aquaculture Professionals (SAP), which organised the biennial gathering of the aquaculture industry in India, said, "2011 was a good year for the shrimp aqua industry, in particular vannamei shrimp production. SAP has a key role in advocating responsible aqua farming in India. The government institutions such as the Coastal Aquaculture Authority (CAA), Marine Products Exports Development Authority (MPEDA), Ministry of Agriculture, Indian Council for Agricultural Research (ICAR) and the Central Institute of Brackishwater Authority (CIBA) have been supporting and playing significant roles as 'a friend of aqua farmers'. The role of the Rajiv Gandhi Centre (RGCA) of MPEDA, which operates the quarantine facilities is highly acknowledged."

"Our theme 'changing era' shows that things are changing in India, after ten prominent years of crop losses and poor revenues with the black tiger shrimp. The good news is that we are now seeing the most sustainable and profitable aquaculture in India. This growth is not specific to shrimp, but also for fresh water fish. India also witnessed a large production of pangasius in 2011. Marine finfish farming in earthen ponds has been initiated recently through various farmer based trials conducted by CIBA, RGCA and Central Marine Fisheries Research Institute (CMFRI). Our shrimp feed milling capacity alone is over 400,000 tonnes/annum and it still attracts investors in feed production. This is not just limited to shrimp, but also to meet the growing demand in fresh water fish farming. All these are positive indicators but we need to understand what the problems are there, will be and how to cope up with them."

A golden year

The Pacific white shrimp *Penaeus vannamei* was introduced in India in 2009. Production peaked during the second half of 2010 to 20,000 tonnes and was in full swing to 70,000 tonnes by the end of 2011. Vannamei shrimp farms have to be registered under CAA. In 2011, a typical farm produced large 33-40 pcs/kg shrimp (25-30 g size) and stocked 60 PL/m² which is the maximum stocking density allowed by CAA. Survival was 80% and ex-farm price was around INR 280/kg (USD 5.60/kg). The direct cost of production was USD 3.50/kg for small farms and USD 4.00/kg for larger farms (>10 ha) due to higher overheads.

"The shrimp supply chain in India has benefited with vannamei shrimp production. Market forces supported this with high and stable prices. Ex-farm vannamei shrimp prices ranged between INR 250-320/



SAP's president S.Santhana Krishnan (left) with, from right, S. Muthukaruppan (general secretary, SAP), S. Chandrasekar and Roeland Wouters, INVE Aquaculture, Belgium

kg for 30 pcs/kg sizes; INR 195-245/kg for 40 pcs/kg; INR165-210/kg for 50 pcs/kg and INR 140-190/kg for 60 pcs/kg. However, some farms in Andhra Pradesh reported lower ex farm prices. The devaluation of the Indian rupee (INR) helped with exports. In 2011, production of 30-40 pcs/kg sizes dominated the large size niche market. Furthermore there have been only few rejections in export markets for Indian shrimp." said **S. Chandrasekar**, vice president of SAP and India country manager, INVE Aquaculture in presenting highlights of the Indian shrimp industry. The exchange rate of INR to the USD shifted from INR 44.40 in July 2011 to INR 52.50 by end of 2011. It was at INR 50.40 in March 2012.

Andhra Pradesh on the east coast produced 66,603 tonnes of vannamei shrimp, which comprised 95% of the total production of vannamei shrimp in 2011. Black tiger shrimp production was 48,500 tonnes. Farmers in the state are enterprising in nature. Almost 93% of farms in Andhra Pradesh culture the vannamei shrimp whilst in West Bengal, Gujarat, Orissa and Tamil Nadu, the black tiger is the dominant species. The state is also the leading exporter of shrimp with quite a few integrators with hatchery, farms and processing plants. The 2 top producers each with a capacity of 1,800 and 1,000 tonnes/annum, respectively are based in Andhra Pradesh.

"Out of an overall export of USD 2.60 billion, 70% was contributed by farmed shrimp valued at INR 9,000 crores (USD1.8 billion). India helped to supply the deficit of 50,000 to 60,000 tonnes of shrimp from Thailand due to floods, 53,000 tonnes from Vietnam because of disease outbreaks and the inconsistent production from Indonesia since 2010", said Santhana in his overview on the farmed shrimp markets.

"In general the bumper crop in June and July 2011 revitalised processing plants to 150 to 200% of capacity from the previous years at only 30%. Large size vannamei shrimp hit major markets with the lack of large size black tigers, and in the US markets, demand for Indian shrimp substantially increased with imports doubling in Q2 of 2011. India had ranked as the 6th largest exporter to the US in the 1st half of 2011 but moved to 3rd largest in the second half. Vietnam resumed imports from India in late 2011. Overall India's shrimp industry benefited with better prices; internationally and ex-farm."

Learning curve

Generally, there are 1.5 cycles per year to produce large shrimp 30-40/kg sizes with one main harvest per crop. The majority are slowly



The traditional lighting the lamp to start Aqua India 2012



From right, Dr Manoj Sharma, Mayank Aquaculture and Saji Chacko, ABG, both farming vannamei shrimp in Gujarat, Ali Husain, Bismi farms black tiger shrimp in Tamil Nadu (see page 38) and DK Gulati, Nurture Technology Pvt.Ltd



Participants, from left: T.Gnanamani (Kemin, South Asia), Srinivas Rayaprolu (Novus, India), S Mohanty (Avanti Feeds Limited, India) and N.Venkatrama Raju, Sri Bhagavan Traders, West Godavari.



From left, Firmansjah S, Jimmy Jeong and Dr Rajeev Kumar Jha, PT Central Proteinaprima, Indonesia

improving their farm infrastructure which is required for vannamei shrimp farming. Most are still on the learning curve with the new species and most of the medium and small farmers (formerly black tiger shrimp farmers) are taking a 'slow and steady' approach in farming the new species. The larger farms armed with technical and financial resources have entered its farming rapidly.

"Our lack of infrastructure and handling facilities adversely affected the industry during the last peak harvest season. In June/July 2011, ex-farm prices dropped for a brief period of time to as low as INR 220/kg for 30 pcs/kg and processing capacity could not cope with demand. There was also panic due to the acute shortage of labour in the processing units," said Chandrasekar.

On highlights in the grow-out sector, Chandrasekar said, "In general, our success was due to the use of specific pathogen free (SPF) post larvae and the production of large size vannamei shrimp. However, disease affected 10% of production and White Spot Syndrome Virus was the single largest factor affecting production. Farmers have attributed the problem to the use of post larvae from pond reared brood stock. There were some unknown problems too where more than 50% of the shrimp stocked had heavy mortality at 8g size. Once shrimps reached 8g, the tail muscle turned red colour and start surfacing on the side of the dykes and mortalities were experienced in 3 days."

"The advantage with the vannamei shrimp is the consistency of harvest, but the Indian farmer must know that the vannamei model is different from that for black tiger shrimp. Farmers just cannot all produce for the niche 30/kg size but must learn to harvest with market demand. The preferred harvest sizes from 70/kg to 30/kg are possible with partial harvesting. Exporters need to work with markets to absorb the large production volumes, produce raw headless shell-on (HLSO) and peeled products and move away from the current model of large volume rather than value," said Santhana.

2012

According to Chandrasekar, "If conditions remain as good as in 2011, in 2012 we can progress with higher production of 150,000 tonnes of the vannamei shrimp and 80,000 tonnes of the black tiger shrimp.

"However, at the start of 2012, there are already reports of delays in stocking with changing weather conditions and poor quality of black tiger brood stock with WSSV infection and reduced fecundity. The year will be tough with more challenges. Corrections and careful planning will be required and there are now 7,000 ha of farms approved for vannamei shrimp farming. Farms have to be modified with an effluent treatment system (ETS) for vannamei farming." CAA has been active in the enforcement that only SPF post larvae are supplied to registered farms. However, Chandrasekar said that there should be a faster way for the mandatory registration of farms and expressed that CAA is already proactive on such registrations.

Industry also expected a constraint with the production of post larvae from SPF brood stocks. The quarantine system for the imported supply of SPF vannamei brood stock have been adequate for the 33 hatcheries registered in 2011 but with 74 registered hatcheries by April 2012, can the RGCA operated quarantine centre cope with the demand? Ravi Kumar Yellanki said that this constraint has led to Indian farmers paying extremely high prices for post larvae. The other fear is the use of pond reared brood stock (see page 8).

"The situation has also led to unauthorised production of post larvae using second generation pond reared brood stock and industry fears potential disease outbreaks. In addition, there are teething problems in the maturation of vannamei brood stock", said Chandrasekar.

Red flag in 2012

These included expected increase in costs of production. There is the proposed reclassification on aquaculture inputs which will bring up the electricity tariff from 5% to 30%. In several states, the power interruptions forced farmers to use generators. In Tamil Nadu, there is a 6 hours/day blackout. Contrary to agriculture, diesel for aquaculture farmers is not heavily subsidised. Agriculture farmers are not taxed either. SAP and industry stakeholders are proposing this for aquaculture operations too. The lack of labour and lack of trained professionals in farm and hatchery operations was also raised. SAP conducts professional training and institutions of learning have programs but this is still insufficient to meet industry needs.

Watch on risks

During the meeting, Joint Secretary of the Ministry of Agriculture, **Tarun Sridhar**, said that the expansion in the farming of the marine shrimp and fish, is actually pushing the profile of agriculture. The Ministry is also working its best to include aquaculture under the agriculture sector to benefit from subsidy, tax benefits etc.

"Aquaculture is also to grow the community. Although these are opportunities for India, there are challenges for the aquaculture professionals. The red flag is the desire to churn out money quickly. The culture cannot continue to be unscientific and reckless. We need to understand the benefits and costs and also seek certifications and standards. In the case of fish farming, our productivity is low at only 2.7tonnes/ha. The aim should be higher but not too high at the expense of sustainability".

"We are still working on the national aquaculture policy. We need guidelines on shrimp culture in freshwater such as in Haryana state and I also would like to see more emphasis on diversification of species such as to include blue shrimp farming. We have however ratified the guidelines on the farming of the tilapia."

News in Brief

Vegetarian pangasius

During the European Seafood Exposition in April, Invivo NSA proudly launched the 100% vegetarian pangasius developed through R&D of Ocialis Vietnam and project partners, Caseamex, Davigel and Nautilus. Alexandre Beljean, Global Aquaculture Business Unit Manager said, "This is a global first in the production of 100% safe, natural, traceable and 100% vegetal fed pangasius". Four years ago, when pangasius production in Vietnam suffered from a negative image, we came up with this idea of pangasius production fed entirely on plant ingredients. This was in response to consumers seeking a more responsible aquaculture of the pangasius which takes into consideration aspects of ecology and the environment."

Ocialis then put in place new R&D for the species, aided by Invivo Labs. Both companies are part of the Invivo NSA group in France. Farming is carried out in dedicated ponds by Caseamex, a leading pangasius producer and processor. Ocialis and its partner Davigel monitored each stage in the production chain. Davigel is part of the Nestle group and a major supplier to restaurants and food service industry. The full chain audit is carried out twice a year by Bureau Veritas Vietnam. In 2012, French seafood importer and producer of value added products, Nautilus launched the new product in supermarkets in France.

China approves countries for imports

In October, 2011, China's General Administration of Quality Supervision, Inspection and Quarantine published the list of approved countries for imports into the country following a notice in May 2011, on the inspection, quarantine and supervision for imports and exports of aquatic products into the country. Vietnam, Thailand, Pakistan, Japan, Philippines, Myanmar and South Korea are AQSIQ approved. Ten countries from Europe, 7 from the American continent as well as Australia and New Zealand are also included in the list of approved countries. At the time of publication, India was not included. This is a set-back for Indian producers as China is the largest market with 20% of total seafood exports or 159,000 tonnes, valued at INR 19.78 billion (USD 395.6 million) in 2010-11. The report in www.rediff.com added that the value of these exports, mainly bulk items, to China and West Asian countries have increased sharply in the last 5 to 6 years.

Thailand opens to Asean Investments

Under the Asean Economic Community, to be established in 2015, there will be a single regional common market covering Brunei, Cambodia, Indonesia, Lao, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. Ahead of its establishment, Thailand will open its fisheries sector to Asean investment. In the Bangkok Post in March, Dr Wimol Jantrarotai, director-general of the Department of Fisheries said that only investments that utilise high technologies and have a minimal impact on local communities will be considered. "The farming of lobsters and sea cage aquaculture, for instance, are categories that we would offer to foreign investors", during a seminar held to prepare DOF officials on the AEC. Fish farming is currently barred under the Thai Foreign Business Act. According to Dr Wimol, a fisheries investment could be initiated as a joint venture between Thai and foreign partners, and the foreign entity may be able to take full ownership at some point in the future. Not only will the area for sea cage aquaculture be restricted but investment must be substantial and proper environmental safeguards must be put in place.

Integrated lobster production by 2020

In Sabah, Malaysia, US based Darden Aquafarm, a subsidiary of

Darden Inc, and Inno Fisheries, a joint venture company with the Sabah Foundation, will jointly develop a MYR 2 billion (USD 666 million) integrated lobster aquaculture park (ILAP) off Timbun Masa, Semporna, Sabah. This will be vertically integrated with hatchery, feed production, farming and processing. The area will cover 9,300 ha comprising 6,000ha for grow out, 700 ha for R&D, training and demonstration farms and 2,600 ha for mussel farming as feed. It will incorporate the participation of small and medium scale enterprises in contract farming, a buy-back scheme and is an entry point project under the Government of Malaysia. In www.kentucky.com, the company said that it hopes to start production by 2017 and reach the annual production of 18,000 tonnes by 2029. As the tropical lobster looks different from the North American species, Darden will use the latter for its Red Lobster restaurants and whole lobsters menu and use spiny or rock, lobsters for other dishes.

Frozen tilapia in Spain

In 2010, Spain consumed €8.6 million or 3,400 tonnes of tilapia, making it the second largest consumer of the tilapia in 2010 at 20% of total EU consumption. Poland consumed 33%. In a report on frozen tilapia in Spain, EF Youmanitas said demand for the tilapia was fuelled by low prices. In 2011, the average price was €2.44/kg and import tariffs are 9% for frozen tilapia and 5.5% for imports from countries with the Generalised System of Preferences (GSP). Consumption rose by 57% in the first half of 2011 in comparison with that in the same period in 2010, with imports from developing countries increasing at an average of 63% and accounting for 97% of tilapia imports. China is the leading supplier, followed by Vietnam. Spain hardly re-exports the tilapia. With the economic crisis in Spain, price is a determining factor but developing countries are expected to gain market share. There are uncertainties such as competition from other white fish and Spanish retailers are interested in value addition. In early 2010, demand was negatively affected when the Organisation of Consumers and Users recommended consumption to once a week as imported products contained pesticides and mercury. Competition is from tilapia from the UK, sold as fresh fish. Non-legislative requirements are getting stricter as large retailers gain market share.

More supply lowers Thai shrimp prices

Thai shrimp prices are likely to decline further as the hot weather will force early harvesting and lead to an oversupply in the market, according to a Bangkok Post report on April 26. Prices have been falling for several weeks with no sign of recovery, said Suwattanachai Visetcharoen, head of the Samut Sakhon Shrimp Farming Club. "Currently, 70/kg size shrimp sell at THB 103/kg (USD 3.35/kg) down from THB 120 (USD 3.90/kg) two weeks ago, even though April is not normally a peak production period. Local market prices have declined following a huge shrimp harvest in the first quarter of 138,000 tonnes, a 15% rise from the same period of 2011. Daily 200 containers of shrimp from the southern provinces go through the Mahachai seafood market in Samut Sakhon." He also added that at the Boston Seafood Show recently, Thai exporters were not successful in getting sales orders as buyers opted to wait for prices to fall further. Foreign traders believe Thai shrimp production this year could reach 700,000 tonnes whilst the Thai Shrimp Association forecasts a volume of 670,000 tonnes. Thailand exports 90% of its vannamei shrimp production. In the first two months of 2012, Thailand exported 14,700 tonnes of shrimp products to the US, a drop of 26% drop from the same period in 2010. Exports to the EU in the same period fell 12% to 5,820 tonnes, and those to Japan were down 12% to 9,626 tonnes.



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Restructuring the supply chain

The 'Q & Q' (quota & quarantine) on import of *Litopenaeus vannamei* brood stock affects the other Q & Q (quality and quantity) of post larvae. In addition to this, industry in India needs to address changes to the supply chain, said Ravi Kumar Yellanki during Aqua India 2012.



Ravi Kumar Yellanki

Unique to India is the mandatory registration of hatcheries and quarantine system for the imported supply of SPF vannamei shrimp brood stock. There are nine registered suppliers of brood stock from USA and Thailand. These can only be imported by the 74 registered hatcheries for vannamei post larvae production but must undergo a 5-day quarantine at the RGCA operated centre in Chennai.

Hatcheries apply for yearly import permits for SPF brood stock; the annual numbers are based on their registered capacity. Ravi Kumar Yellanki from Vaisakhi Bio-Marine (P) Ltd sees these as bottlenecks facing the industry.

"This preventive measure has been successful as there are no reports of diseases in brood stock. Facilities were sufficient in 2011 with only 33 registered hatcheries but with the increase in hatcheries, the current capacity at the quarantine system cannot meet our demands for brood stock. There is also a rigorous process with import documents for the shipment of brood stock followed by booking of quarantine cubicles.

"We are constrained by the number of animals that can be imported because of the limited quarantine facilities. There are also logistical uncertainties such as when shipments are delayed leading to loss of booking for the quarantine facility. The facility can accommodate 30,000 brood stock a year whereas our requirements are 73,000 pieces. We need to find alternatives such as the private sector or a consortium of hatcheries managing a quarantine centre, or reducing the quarantine period to 2 days, which is ample for disease checks, and converting the two receiving areas into holding cubicles. This could increase the capacity at the RGCA quarantine centre six fold."

Highest post larvae prices

The quota system has given rise to a low supply of quality post larvae. During high demand, Indian shrimp farmers pay the highest vannamei



shrimp post larvae prices at INR 520-550/1000PL (USD 10.4 - 11). This is unseen of in other countries where prices per million PL are almost half as much and have remained relatively stable (see below).

PL* prices according to industry sources (prices in USD/million PL)

Source of brood stock	India	China	Malaysia	Indonesia	Vietnam	Thailand
SPF	9,921-10,913	3,492-2,539	3,279-3,934	2,961-3,838	2,642-3,602	2,500-4,000
Pond reared	8,929	952-1,428	2,000	768-1,425	2,667	nil

Range of prices in 2011-Q1 2012. In India, Vietnam and Indonesia, based on stocking season and location; Thailand, Malaysia and China, based on PL performance. In Thailand, the preferred criteria is PL performance data rather than SPF. Conversion: USD on 2 April 2012: INR50.40; CNY6.3; MYR3.05; IDR9120; VND20820; THB30.8

"As hatchery operators, we should be happy with these prices but as stakeholders in the industry, we do not wish that farmers in India should have to pay such prices, merely because of this bottleneck in brood stock availability. We can incorporate 'SPF nauplii centres' into

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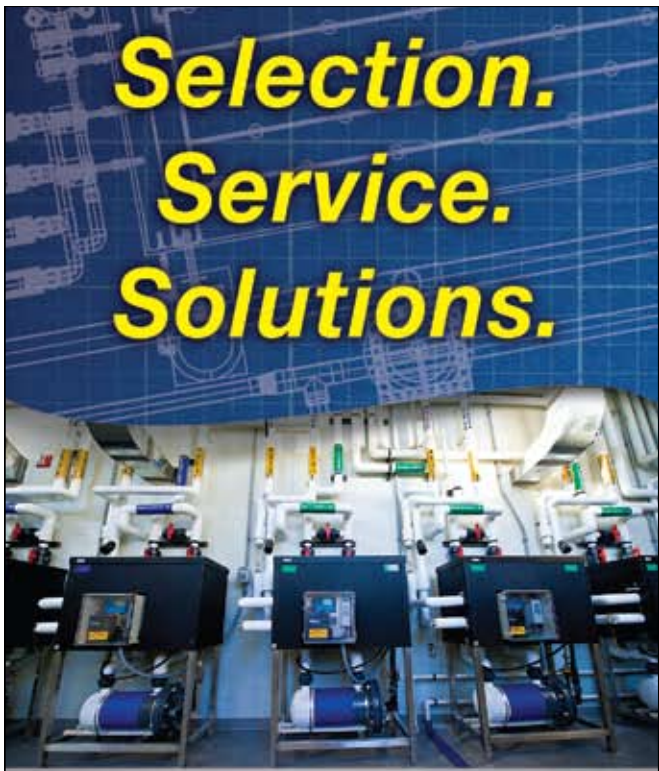
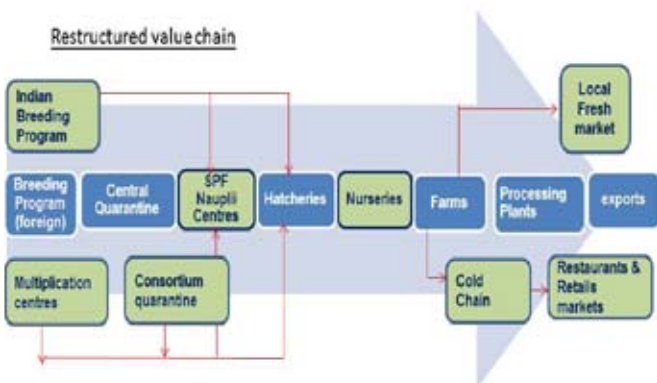
the value chain and increase the efficiency of the sector. It will reduce the use of pond reared brood stock. Nurseries will give new opportunities to some farmers and hatchery operators. This phase would give an opportunity to farmers to combat WSSV during the cold season and allow farmers to go for staggered stocking and spread out demand for PL. With more crops and regular harvesting, producers will be spared from low offer prices by processors during an oversupply.

“Our ultimate solution is our own breeding program but this will require a large investment which may only be possible with the participation of the government, seafood exporters and hatchery associations and so forth. It has to be located in a secluded place such as the Andaman Islands. The other option is a multiplication centre which will involve a major SPF brood stock supplier. However, if prices are still based on a global level, our only advantage is that the brood stock is always available in the country and not cheaper brood stock. However, if the centre starts to sell PL, then a monopoly may arise,” said Ravi.

Cold chains and domestic markets

According to Ravi, “All operations along the supply chain must be scaled up to handle increases in production. As we increase supply, we need to seek new markets. We have a robust GDP and a young population with 65% under 35 years old and who are changing to healthy food habits. Now the small size shrimp (100/kg) coming out of distress and forced harvests are in the wet markets, usually in the vicinity of large farming areas. To really establish these markets, one needs to establish exclusive outlets with refrigeration facilities. However, we need to move shrimp to the inland and large cities as well to have better market penetration. What we do need are cold chains to move shrimp around. However, investments in cold chain infrastructure are capital intensive and will yield slow returns.

“Retail, one of the largest sectors in the global economy (USD 7 trillion) is going through a transition phase in India. The Indian sector is estimated to have a market size of about USD180 billion; but the organised sector represents only 2% of this market. The rest of the market includes push carts, wet markets, neighbourhood ‘kirana’ stores and so forth. These ‘kirana’ stores are generally located in small spaces and have no cold storage facilities. A strong retail front-end can provide the necessary boost to food processing by establishing cold chains. Currently 100% foreign direct investment (FDI) is not allowed. However India presents a huge opportunity and is all set for a big retail revolution.



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Vannamei shrimp post larvae in India: feeding demand

Good year with high PL prices but pace of growth must meet needs of farmers. By Zuridah Merican

When it was decided that India would start farming the vannamei shrimp, the Coastal Aquaculture Authority (CAA) opened up registration to hatcheries to import brood stock in 2009. It was an opportunity for the Vaisakhi group, a leading black tiger shrimp hatchery operator in the country to be the first to import vannamei broodstock from Florida, USA.

"On 9 September 2009 (9/9/09) we shipped 999,999 post larvae (PL) to the 75 ha ABG farm in Gujarat run by Saji Chacko, the first to farm vannamei shrimp in Gujarat. This was a milestone for us. Production was 50/kg shrimp at 98% survival. Today, we have achieved a reputation as a producer of quality PL. With the emphasis on quality, both in vannamei and black tiger PL, we have raised the bar for PL in India and we feel proud that we have achieved this," said Ravi Kumar Yellanki, managing director of Vaisakhi Bio-Resources and Vaisakhi Bio-Marine. An engineer by training and with an MBA from the Xavier Institute of Management, Ravi, with two directors, started Vaisakhi Bio-Resources (P) Ltd hatchery near Visakhapatnam in 2002 to produce black tiger shrimp PL. Ravi is also secretary of the All India Shrimp Hatcheries Association.

The group's business has since expanded, with hatcheries along the east coast from Pondicherry in the South to Visakhapatnam in the North. It now owns two hatcheries in Marakkanam and Visakhapatnam, both dedicated to the vannamei shrimp, and has leased three hatcheries in Visakhapatnam and one in Chennai for producing black tiger shrimp PL. Two years ago, Best India Marine Harvests and one year ago, Bay Fry (P) Ltd joined the Vaisakhi consortium for vannamei PL production.

The group has a large share of the PL market in India. Production of vannamei PL in India rose from 2 billion in 2010 to 4.2 billion in 2011 and that of black tiger shrimp was 6.0 billion to 6.5 billion in 2010 and 2011 respectively (Chandrasekar, 2012). Their largest market is in Andhra Pradesh for the vannamei PL. West Bengal is a large market for black tiger PL for the largely semi-intensive and traditional farms. Central to the group's success is being recognised for quality PL.

Quality and price

"Farmers are very quality conscious. In Gujarat, where Vaisakhi has a major market share of the PL market, they are confident of the quality of our black tiger PL as there have not been any incidences of vertical transmission. Yearly, they collectively buy direct from us some 150-200



Brood stock



Taiwanese technician, Tsai Ming Yen's role is to increase efficiency at the hatchery

million black tiger PL. In West Bengal, where farms are smaller, sales are through distributors. Unlike some hatcheries which are integrated or collaborated with feed companies, we have opted to be independent to serve the open market.

"PLs from our first batch were sold for 35 Indian paise (USD 6/1000PL). Today the price has escalated to USD 13/1000 PL, mainly because of high demand. Pond reared PL are filling the gap with a USD 6/1000PL price but the fear is not only poor biosecurity in ponds but the pond-reared PLs as PLs from SPF brood stock sold at inflated prices. Although as a producer, I am benefitting from the high prices, I would like to see more equitable pricing of PL to help our farmers," said Ravi.

Transition to vannamei

In contrast with black tiger shrimp hatchery management where gravid spawners from the wild are used, the industrial operations of vannamei PL production requires maturation of specific pathogen free (SPF) brood stock. In accordance with the registration with the CAA, the hatchery at Kaipenikuppam Village, Marakkanam, Tindivanam Taluk in Tamil Nadu added an isolated maturation section, run as a separate entity with its own water treatment and reservoir tanks. There is also a dedicated team for this section. Spawning to larval rearing follows a modular system. There are four modules with 24 tanks each. Biosecurity has been enhanced with foot baths and hand washing stations at every entrance, and each tank has its own separate paraphernalia, including separate air blowers. This modular system allows for a shutdown of 10-15 days on each module.

"With the vannamei shrimp, we had to modify our maturation facilities. Now it is not just having physical facilities but also learning the maturation process. In maturation tanks, brood stock is fed with polychaetes, squids and oysters. However, we need to randomly check on diseases in polychaetes."

Gearing up efficiency

Currently, the registered production capacity of Vaisakhi is 280 million and based on this, it is allowed 1,960 pairs of brood stock per year to be imported for the group of hatcheries. With rising demand, the hatchery needs to get the most from the brood stock. This is increasing efficiency with reduction in mortality rates in larval rearing.



Maturation tanks are in a separate area



The hatchery in Marakkanam, Tamil Nadu



Ravi with technician showing PL10

“After eye stalk ablation, we can only use the brood stock for 10-12 times within a 6-month period. Fecundity rises from 70,000 eggs in the first spawning to as high as 300,000 eggs but at this point, the performance in the larval rearing stage decreases. Ideally, it will be good if we could shorten this to 4 months but we are limited by the quota and limitations in the quarantine system. At this hatchery, I have recently engaged a Taiwanese consultant to help us to increase productivity from each spawning,” said Ravi.

“Our in-house research showed that it will be possible to raise stocking density to 250 nauplii/litre. We have tried 200 nauplii/litre with success. This is only necessary when the quota is increased or liberalised. However, in the current situation, we do not need to do so although in my opinion, this is critical for reduction in costs in vannamei hatchery operations and the way forward for industrialised hatchery operations.”

Ravi added, “Nevertheless, this will be essential when we are allowed to sell nauplii to registered hatcheries from April 1. Currently,

our nauplii are only distributed to our consortium partners. I see this as a major step and a way for industry to self-regulate. We can produce nauplii for registered hatcheries and increase supply of quality PLs. It will also regulate prices and slowly reduce the demand for cheaper and PL of doubtful quality from pond reared brood stock.”

Expansion

Organic expansion is limited for the company, said Ravi. “Currently we focus on the PL market in Gujarat, Tamil Nadu and Andhra Pradesh, Orissa and West Bengal. There is a possibility of expansion in Gujarat, Orissa and West Bengal but this will depend on further expansion of farming activities. Currently, we are happy with sending PL via air freight.

“Other possibilities of expansion will be vertical such as in feed production where we can use our strong relationships with producers. The demand for shrimp feed is currently at its highest. Another option would be to enter the seafood retail business within India, a niche market with no significant players.”





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From nauplii to farmers

The aim is to get the best output. Increasing hatchery performance is critical.

As part of the consortium with Vaisakhi Bio Marine Pvt. Ltd., Best India Marine Harvest receives vannamei shrimp nauplii and grows these to post larvae (PL)10 for sale to farms in several areas in Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu. Sixty to seventy percent of its sales go to farms in Andhra Pradesh. The target at the hatchery is to have quality, and prices are determined by supply and demand. Prices were as high as 70 INR paise/PL in 2011 (USD15/1000PL), but is stabilising this year as more hatcheries have the licence to produce vannamei post larvae in 2012. However, production costs are on the rise with increases in artemia prices as well as power and manpower costs.

The target production at the hatchery is 100 million PL/year and this is based on a 25-35% survival from nauplii to post larvae. Established in 1998 by R. Srinivasan and S. Muthukaruppan, aquaculture technocrats based at Chennai, initially for black tiger shrimp post larvae production, vannamei shrimp post larvae production was started only 3 years ago.

Transition and technology

"There are similarities and differences in hatchery management of vannamei shrimp when compared to that of the black tiger shrimp," said Dr PV Nageswara Rao, person in charge of projects (technical) at the hatchery. Armed with a Master of Science in aquaculture and



These are one tonne to 10 tonnes tanks for outdoor culture of live feeds

Ph.D in probiotics, Rao spent 17 years in hatchery operations in Visakhapatnam and Bangladesh.

"As we only receive nauplii, we do not face the challenges with brood stock maturation. In comparison with a black tiger shrimp hatchery, we need 50% more aeration and complete isolation of algal rearing and water treatment facilities. Larval and post larval culture are done in the same tanks. Each module has to be stocked within 3- 5 days to avoid zoea syndromes. The advantage with the vannamei post larva is the smaller size. We can pack PL10 (10 mm) at 3,000-5,000/bag whereas for the black tiger shrimp PL15 is packed at around 1,500-2,000 PL/bag only.

"Optimal temperatures are 29°C to 31°C, but in November and December, this goes down to 24°C and heaters are required for the zoea stages. However, zoea syndrome occurs easily with increase in bacterial loads especially *Vibrio* species along with poor quality micro algae.

"Usually hatcheries take 10-12 days to rear nauplii to PL1 stage. We have managed to reduce this to 8-10 days. It takes 4 days for the zoea 1 to metamorphose to zoea 3 and another 4 days from mysis 1 to PL1. It is possible to reduce this further to 7 days at 33°C but PL quality might be affected.

"It is also possible to increase the maximum stocking to 200 nauplii/litre similar to the operations in Mexico but again this is not necessary for us. We only maintain 100-150 nauplii/litre. In comparison, the black tiger shrimp larvae can be stocked at 80 to 100 nauplii/litre."

Better culture conditions

In this hatchery, Rao controls the bacterial loads in tank water using various probiotics. These are added at 2 ppm on the first day and subsequently reduced to 1 ppm. However, when conditions are serious, the dose is increased to 3 ppm. Probiotics are used to substitute for antibiotics. When there is a specific bacterial problem, Rao isolates the bacteria on TCBS agar and decides on the best probiotic consortium to resolve the problem.

"There are several probiotics for aquaculture use which are readily available in the Indian market. They range from imported ones such as

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Rao (right) and his team in the indoor larval rearing section.



Seawater passes through a sand filter before storage in these treatment and reservoir tanks.

those from INVE, Biomin, Epicore-Networks and Lallemand to locally produced ones by Best India's sister company, Poseidon Biotech. Their probiotic, Hi 5 is engineered for the specific needs of Indian hatcheries and widely used during all seasons and all cycles at an affordable price" said Rao.

"We have noted that tolerance of *Vibrio* is decreasing. Frequently we plate and see the pathogenic green *Vibrio* colonies. The remedy is to use probiotics with orange *Vibrio* colonies for instant antagonistic results. For example, Superbiotic from CP (India) Pvt Limited contains useful *Vibrio* species. In other hatcheries, some technicians will transfer water from tanks with 90% survival rates to those with low survival rates."

The management at Best India Marine Harvest believes that there is a certain level of susceptibility associated with post larvae from domesticated stocks in comparison with black tiger shrimp post larvae produced from wild brood stocks. The hatchery requires strict clean-up protocols, disinfection with chlorine at 100 ppm for the facility and of the water with 10 ppm chlorine. This is for a minimum of 3 days. There is cleaning of equipment with HCl and detergents and drying for 48 hours. Air lines are cleaned, sometimes with formalin. Technicians and skilled labour are completely isolated from one facility to another.

Understanding the farmer

This is important as they are clients, said Rao. "In the hatchery, prior to delivery we ensure that post larvae quality meets our standards. We conduct tests such as the formalin stress test and check on the muscle gut ratio. Before selling, the 6th segment's muscle width must be 4 times that of the gut for PL10. The ratio indicates the level of nourishment. We prefer to give PL older by two days for farmers farming shrimp at very low salinities, such as at 1 or 2 ppt after prior acclimatisation to the same parameters at our hatchery.

"One of the issues that we face with farmers is that few are professionally trained and understand the value of quality and price. We have, for example several groups entering shrimp aquaculture from other industries. The difficulty we face is trying to make farmers understand the quality process that we go through. When there are problems, we even check their ponds and if need be, replace the PL. Another strategy is to get new customers to interact with experienced and successful farmers."

"Our mission is to go with nature and apply innovative strategies for quality production and marketing and explore all possible opportunities for a long-term, sustainable aquaculture industry," said Rao.



PV Nageswara Rao (left) and Senthil Kumar, Poseidon Biotech



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A successful production of black tiger shrimp in the Philippines

By Henry David L. Fong, Patricio Raphael, Henry K. Young, Amelyn Bravo, Olivier Decamp and Maryann Solis

In this showcase in the Visayas, the collaborative efforts of a feed and aqua health team increased production at HKY Farm to 9.3 tonnes/ha.

The black tiger shrimp, *Penaeus monodon* industry in the Visayas province of the Philippines has faced several challenges over the last 4 years, from low farm gate price, White Spot Syndrome Virus and other disease outbreaks, deteriorating rearing environment, poor climatic conditions to increased production cost. This led to dramatic changes such as a shift in production from shrimp to tilapia and milkfish, the down-sizing of operations or even the closure of farms.

San Miguel Foods, Inc., a major player in the aquafeeds business, with an annual production of 150,000 tonnes in 2010, decided in late 2009 to establish a *P. monodon* shrimp showcase in Visayas province, and more particularly in Negros. The region was selected because the shrimp industry in the Negros which was once the centre of intensive black tiger shrimp production in the Visayas, experienced a decline, with nearly 30 farms active in 2008 and only 22 in 2010. Shrimp feed consumption reduced from an estimated 5,000 tonnes/year to 3,600 tonnes/year in 2010. It was a very dramatic year with a long dry spell caused by 'El Nino' and numerous disease outbreaks.



Part of the team at harvest. From left; Jun Zamora, Mary Ann Solis, Patricio Raphael and Henry Fong

The company decided to evaluate an improved grow-out protocol at HKY Farm, located in Saravia in Negros Occidental. This shrimp farm is located between two large sugar mills and the incoming water is therefore affected by the sugar plantation run-offs and the heavy silt deposit. In the period 2008-2009, HKY operated only 6 ponds, with an average production of 7.2 tonnes/ha/crop. Following this collaboration, the production increased to 7 ponds, with a production level of 9.3 tonnes/ha/crop.

HKY farm

The improved production protocol was evaluated between the second quarter of 2010 and the first quarter of 2011, during the 'El Nino'



Treatment pond equipped with electrolysis machines.

season. This was a challenging period characterised by long dry spells and very high water temperatures. Towards 2011, black tiger shrimp production in the whole Visayas province declined by 21% (i.e. 3,401 tonnes) from a production of 4,300 tonnes in 2009 (B.A.S, Bureau of Animal Statistics, 2011).

At the HKY farm, the incoming water is pumped to a 1.2 ha settling pond, stocked with tilapia, mangrove snapper and milkfish, and kept for 3 days maximum, before being pumped to a 1 ha treatment pond equipped with electrolysis machines. Electrolysis in saline water produces chlorine, with a salinity of 20 to 25 ppt sufficient for the production of 11 to 12 mg/litre of chlorine (Chanratchakool, 1991). Each electrolysis machine consists of two electrodes of titanium-based material that are submerged 1 m into the water, but without touching the pond bottom. Typically, 6 electrolysis machines are installed for the 1 ha treatment pond, with a maximum of 6 paddle wheel aerators placed in the treatment pond to stimulate water circulation. Water is ready for use 24 to 36 hours after electrolysis.

Shrimp was fed an enhanced diet, BMEG CE-90 with astaxanthin. This feed is manufactured and marketed in the Philippines by the feeds and livestock division of San Miguel Foods, Inc. This is a subsidiary of the Philippine food and beverage giant, San Miguel Corp. The feed is formulated for semi-intensive and intensive black tiger shrimp production, highlighted by good survival rates and good feed efficiencies.

Managing conditions

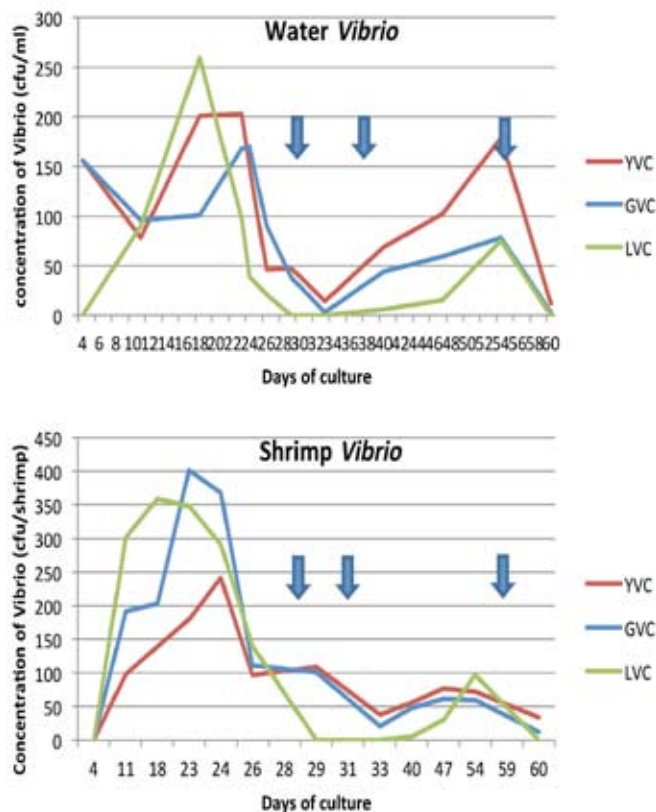
Some of the culture management protocols include the following. Agri-lime and dolomite were applied according to water parameter conditions. Dolomite was also applied on pond and dykes after heavy rainfall or during acid sulfate leaching from the dykes. INVE aquaculture health products were used to manage the water and pond bottom quality, control pathogens and boost the immune system of shrimp during challenge. These include Sanocare PUR at 0.3 to 0.5

ppm. In case of a major challenge, the dose is increased to 1 ppm to control high readings of *Vibrio* in the water during shrimp culture. As shown in Figure 1a and b, the addition of this health care product leads to a reduction in *Vibrio* concentration (yellow colonies, green colonies and luminescent colonies), both in the pond water and in the shrimp.

The farm also uses the probiotic (Sanolife PRO-2) that is coated on the feed at a rate of 2-4 g/kg, with the purpose of promoting healthy gut microflora, leading to improved food digestion and feed conversion. This and a mixture of immunostimulants and nutraceuticals (Sano TOP S) are top dressed on feeds at a rate of 510 g/kg. During periods of disease challenge and poor weather conditions, these top-dressed feeds are applied simultaneously during incidence of white faeces, and high *Vibrio* concentration in the shrimp. The *Vibrio* count in the white faeces can reach up to 10^8 cfu/g. The inclusion of selected probiotics in the feed helps by preventing the colonisation of the shrimp's gastrointestinal tracts by *Vibrio*. It also helps in fighting the *Vibrio* that would be present in the faeces that are released in the pond. As previously reported in Brazil, *Bacillus* are recovered in high concentration in the faeces of shrimp that received the probiotic treated feed.

In addition, Sanolife PRO-W is used for waste degradation, ammonia and sulphide control and maintenance of a stable algal bloom. It is applied at a rate of 100-200 g/ha. In cases of elevated levels of ammonia and sulphide, 10-35 kg of Sanolife Nutrilake was mixed with 100-200 g of Sanolife PRO-W, and broadcasted on areas with high accumulation of sludge, such as in the corners and centre of the pond. The former is a natural source of sodium nitrate that maintains the oxidation level of the pond sediments while supporting the metabolism of the *Bacillus* strains from the water treatment probiotic. The synergistic action prevents the formation of sulphide and other reduced chemicals.

Figure 1. Reduction in *Vibrio* in the pond water (1a, top) and shrimp (1b, bottom) following the application of Sanocare PUR (as indicated by the blue arrows).



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The performance of the protocol was evaluated at two stocking densities 15 PL/m² and 22.5 PL/m².

Showcase conditions

All ponds used for the showcase project were well prepared, with a good soil profile: organic matter contents of 0.4% to 1.0%, slightly alkaline soil pH of 7.55 to 8.35 and low level of available iron in the range of 216 to 673 ppm. However, ponds stocked at reduced stocking density did not necessarily perform better than those stocked at 22.5 PL/m². The recommended pond management protocol led to a successful harvest, with USD 4.31 profit per kg of shrimp produced (Table 1).

Table 1. Performance of ponds following the revised protocol.

Stocking density	22.5 PL/m ²
Pond size - 0.4 ha	0.015
Initial average body weight (g)	
Final average body weight (g)	35
Total days of culture (DOC)	156
Actual harvest biomass	3,804 kg
Harvest production/ha	9,510 kg
Total feeds consumed	5,380 kg
Final feed conversion ratio - FCR	1.41
Farmgate price	370 (USD 8.68/kg)
Income (PHP)	1,407,813 (USD 33, 019)
Cost (PHP)	
Fry	42,300 (USD 992)
Feed	283,562 (USD 6,650)
Salaries/Farm rental	79,000 (USD 1,852)
Land preparation	34,286 (USD 804)
Electricity	215,524 (USD 5,054)
Chemicals and health products	52,416 (USD 1229)
Harvest expenses (ice, fuel and outside labour)	2,000 (USD 46.9)
Total cost	709,089 (USD 16,631)
Profit	698,723 (USD 16,388)
Production cost/kg	186 (USD 4.37)
Margin per kg	183 (USD 4.31)

The electrolysis machines performed well in water with low suspended solids. Problems with the electrolysis are encountered in the presence of high suspended solids binding the chlorine or during high rainfall leading to a reduction in salinity and a lower production of chlorine. The application of 1ppm Sanocare PUR was adequate to control the *Vibrio* concentrations.

Combating slow growth

The study showed that in the event of slow growth, the best option is to maintain optimal shrimp health so that the growth delay could be recovered once growth conditions improve. The shrimps fed with CE-90 shrimp feed enhanced with astaxanthin showed superior survival rates (>90%) despite the severe environmental and disease challenge. If this approach had not been undertaken, the weaker shrimp would have been more sensitive to pathogens and disease outbreaks could easily occur.

The periodic weight gain was not necessarily directly related to feed uptake. Growth is always influenced by factors such as fry quality, feed quality, shrimp health status, environmental conditions and stress factors. These have to be considered when analysing the results.

As suggested by the GOAL 2011 survey, the mood among shrimp actors from the Philippines is quite optimistic, with the majority believing that the global shrimp market will strengthen in 2012. Thus the knowledge acquired during this showcase can be applied to other species, such as *P. vannamei* shrimp, milkfish, pangasius and African catfish.

Reference

Goal 2011 (<http://www.gaalliance.org/update/GOAL11/DiegoValderrama.pdf>).



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Centrifugal sifting in processing of oily aquaculture products

The change from vibratory to centrifugal screening netted a 60-fold screening improvement, thus removing a bottleneck in the production of shrimp farm feed products.

Epicore BioNetwork produces biological and aqua feed products that nurture shrimp over their lifecycle, which necessitates producing feed particles with diameters from 300 microns (0.3 mm) through 1,200 microns (1.2 mm). It had been using a 762 mm diameter circular vibratory screener to scalp oversize particles prior to packaging, but oil in the feed caused particles to agglomerate and plug or 'blind' apertures in the screen. After attempts to rectify the problem, the company decided to replace its vibratory unit with a centrifugal screener.

Vibratory screeners rely on gyratory motion to promote the passage of on-size particles through apertures in a horizontally oriented screen. In contrast, centrifugal screeners utilise rotating paddles that accelerate the flow of particles against the interior wall of a horizontally oriented, stationary screen cylinder. In addition to boosting the rate at which on-size particles pass through the screen, increasing the speed at which particles impact the screen also serves to break-up soft agglomerates of the type that were plugging vibratory screens and being ejected as oversize clumps.

Quality holds key to aquaculture products

Shrimp farms ring the world from Belize and Ecuador to Thailand and Vietnam. "Our microbes and enzymes enable shrimp farms to grow more and healthier shrimp, suppress the outbreak of disease, and also clean up their ponds after harvest," said plant manager, William Castner.

Epicore resolved to enter the feed business when it found that low-grade feed products encouraged the buildup of harmful bacteria. "We decided to make a premium grade of shrimp feed that would promote faster, healthier growth and at the same time reduce the pollution load."

The formulation to nurture shrimp throughout its life cycle, includes conventional fish meal, refined ingredients, such as hydrolysed vegetable and fish proteins, vitamins, and up to 15% lipid. Feed particles are sized accordingly, in diameters of 300, 500, 700, and 1,200 microns.

The production process starts with a ribbon blender in which grains, lipids, vitamins, and other nutrients are combined. After mixing, the feed exits the blender's discharge at the bottom of the trough and travels to a hammer mill, which reduces the feed to a consistent size. It is then extruded under mild heat and chopped into 1,200 micron (1.2 mm) pellets and dried. The feed is then reground in the hammer mill to specific particle sizes appropriate for the growth stage of the shrimp for which it is intended.

At this point, the particles are packaged in 25 kg plastic bags

which are stored for screening. "We screen primarily for quality control immediately prior to final packaging, not for classifying, to ensure that the mixture does not contain any oversized grains or contaminants, although we also remove fines on occasion," said Castner.

Preventing screen blinding

The company was using a 762 mm diameter circular vibratory screener with a 14 mesh (1,310 mm openings) screen. The vibrating screen separated on-size material from oversize particles which were ejected for re-milling. The high lipid content of the feed caused grain particles to agglomerate, ball and blind the vibrating screen.

"We tried a number of solutions," said production manager Sam DeMore. "We purchased an antiblinding device that essentially acted like a set of rubber windshield wiper arms that swept across the vibrating screen to remove particles lodged in the apertures. We also tried antiblinding rings, which vibrated against the underside of the screen. Both helped, but not enough."

"We typically filled one 20 kg drum per hour of our high lipid feed, or about 150 kg per hour of our lower lipid feed," said DeMore. "Of course, throughput was highly dependent on the lipid content of the feed."

Low sifting rates during the early stages of shrimp feed production were tolerated but as business grew, the company needed to boost productivity.

The conversion from vibratory to centrifugal screening overcame the screening bottleneck. "Throughput was always dependent on the oil content of the feed, but the typical output of the circular screener was 150 kg per hour, and the worst case was about half of that. To confirm anticipated improvements prior to purchasing its screener, Epicore tested a Centri-Sifter™ model MO centrifugal screener at Kason Corporation, manufacturer of the equipment. "We scheduled a demonstration at the Kason test lab using 45 kg of our bagged particles," DeMore recalled. "In 17 seconds, the Centri-Sifter screener processed what would have taken over 17 minutes with our circular vibratory screener."

Rotating paddles prevent agglomeration

The centrifugal sifter consists of a vertically mounted feed inlet and a horizontally-oriented, cylindrical sifting chamber. As material enters the feed inlet, a feed screw redirects it into the cylindrical screen where a rotating helical paddle assembly continuously propels the material against the screen without coming in contact with it. Particles either pass through apertures in the screen, break apart and then pass through the screen, or in the case of oversize particles, travel to the open end of



Oversize and agglomerated particles fill a container beneath sifter's discharge.



Inspection port allows operator to determine if screen requires cleaning.



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Hinged cover at discharge end of sifter allows cylindrical screen to slide freely from the cantilevered shaft for cleaning.

the cylinder where they are ejected through an 'overs' discharge spout.

Epicore's model MO Centri-Sifter is a medium capacity unit developed for food, dairy, and pharmaceutical applications. It has a cantilevered shaft mounted on three external roller bearings located on the motor end, near the material feed point, and at the hinged cover at the discharge end. When the cover swings open, the other two external bearings support the shaft. This allows internal components to slide freely from the opposite end for rapid cleaning, screen changes, and inspection. During operation, the shaft is supported on both end bearings for vibration-free operation at high speeds required for high capacities.

The Kason screener is powered by a 2.25 kW direct drive motor, and uses nylon screening media, which is more economical than stainless steel and works well with the soft shrimp feed.

DeMore designed a waist-high support for the screener, and a 1.8 m high platform above it. Forklifts now deliver 1,000 kg pallets of bagged extrudate to the top of the platform. One employee works on the top of the platform, opening bags and pouring their contents through a magnetic screen (to trap any metal contaminants) and into the sifter.

A second employee below weighs the sifted product and rolls it onto a conveyor for shipment.

The new centrifugal screener has resolved the plant's production bottleneck, enabling the company to meet growing demand for its premium shrimp feeds. The equipment's reserve capacity is also expected to accommodate the company's projected expansion over the next several years.

(More information: email: information@epicorebionetworks.com; www.epicorebionetworks.com; www.kason.com; www.dtdeng.com.au)



(L-R) Aquaculture feed product, screened product, and discharged oversize particles.



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The concept of *NutriEconomics* applied to the aquaculture industry

By Pedro Encarnação and Goncalo Santos

This approach to nutrition factoring nutritional and life sciences, micro- and macro-economics and environment gives a new emphasis on optimising profitability as shown in this example with the pangasius in Vietnam.

Increased fish consumption and the stagnation of capture fisheries create pressure for aquaculture business to develop further. Demand for fish will continue to increase in the near future and aquaculture production is estimated to increase more than two fold by the year 2050. This rapid increase will create pressure on fish meal prices. Despite the fact that new sources of protein (mainly from plant origin) are now being used, competition from the food, feed and biofuels sectors will also increase the price of these commodities. It is therefore important to improve efficiencies and add value through other means, such as quality genetics, improved management and biosecurity, and more precise feed formulation using a combination of feed ingredients and additives that best enhance the animal's health and performance.

The concept of *NutriEconomics* targets three important factors in its approach to nutrition – namely, nutritional and life sciences, micro- and macro-economic considerations, and the ecology or environment. By applying knowledge from life-sciences and nutrition, economics and ecology, the *NutriEconomics* program provides a holistic approach



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to safe and efficient animal nutrition. This approach considers animal nutrition in the light of business profits and the natural environment.

Nutrition and economics

Nutrition is the science of identifying, quantifying and supplying an animal the essential chemical nutrient substances required to perform its normal physiological functions – including maintaining a highly effective natural immune system, growth and reproduction. Feed supply the ingredients which when fed to the animal is intended to supply its nutritional requirements. The feed must contain the required nutrients in the proper ratios and in highly digestible and available forms. In addition, it must be wholesome, attractive and palatable to the animal. Thus, the major goal in this area is to select the proper ingredients to develop a feed that can deliver maximum growth and survival of fish and shrimp.

The economic consideration towards formulating diets is not simply based on the cost of ingredients but also the benefit that is accrued to the animal in terms of health and performance. The effect of growth rate, FCR and mortality directly affects profits and this issue should be evaluated using economical models. Feed is the single largest cost item in aquatic production and because of this, the aquaculture industry strives to reduce feed costs by buying cheaper feeds, feeding for lower FCRs and evaluating feed performance. These strategies can be often flawed and have the effect of reducing profitability. Reducing feed cost is very often seen solely as the process of minimising the cost of the feed (\$/ kg feed) where it should rather focus on minimising feed cost per unit fish biomass gain (feed cost \$/kg fish produced).

Consequently, improving cost-effectiveness of feed is not simply a least-cost formulation process (minimum cost per unit of weight of feed) but a process that should also take into consideration the amount of feed needed to more efficiently produce one unit of biomass or 1 kg of fish. By using simple economic modelling, it is possible to calculate feed value under different production scenarios. Reformulating diets to include non-traditional feed sources and make use of useful feed additives may be necessary to fulfill this objective, and should be viewed as a worthwhile investment that yields returns for the producer.

Additionally, environmental considerations should also be addressed. Aquaculture production systems affect and are in turn also affected by the ecological environment in which they operate. Accumulation of solid (faecal) organic matter in the bottom which leads to high biological oxygen demand (BOD) and reduction of dissolved oxygen level is, arguably, the main concern for pond culture of fish and shrimp. Another significant concern for freshwater operations is the excretion of phosphorus (P) under chemical forms that can potentially become available for plant and algae since P is, in general, a limiting factor for algae growth in freshwater. Ammonia (NH₃) is also a concern for shrimp and fish culture operations. Ammonia is toxic at low concentrations and it is a determinant factor of water exchange requirement of land-based aquaculture operations. Controlling the impact on the environment by reducing waste discharges is the responsibility of the industry. This also comes at an economic cost.

The implementation of a *NutriEconomics* concept during feed formulation, farming and product development is a commitment

towards improving the use of scarce production resources to achieve the end goals of sustainable, ecologically sound yet profitable animal farming. At Biomin, all product development and application takes into account the concept of *NutriEconomics*, where product performance is evaluated based on the nutritional (growth, survival, FCR), economical (ROI, profitability, breakeven) and environment parameters (waste output, P and NH₃ discharge and CO₂ emissions). As an example we show the evaluation of the application of a phytogetic additive (Biomin® P.E.P 125) in pangasius farming in the light of the *NutriEconomics* concept.

Pangasius farming

A trial was carried out at the Hung Ca commercial farm in Thanh Binh district, Dong Thap province, Vietnam from October 2009 to July 2010. Around a million healthy pangasius fingerling of approximately 16g weight were released into two ponds with similar stocking density (17 fish/m³). Experimental diets were also randomly chosen to use for two trial ponds.

Management of the trial ponds was done in accordance to the normal procedures at the trial farm for pangasius production. Growth performance results (Table 1) show that fish in both groups reached a similar final weight (1.1kg), but with fish fed the phytogetic feed additive supplemented feed achieving a 5.10% higher specific growth rate (SGR) and 6.73% lower feed conversion ratio (FCR). In addition, fish fed the phytogetic additive also showed a better fillet colour with 28.6% white fillet while the one fed control diet just had pink and yellow fillet. This was a relevant biological factor that had an important economic impact, due to the higher offer price for white fillet.

Table 1. Performance, mortality, feed utilisation and fillet colour of pangasius in response to phytogetic additive supplementation¹.

Item	Control	Treatment ¹
Days of experiment	260	254
Average final weight (g/fish)	1.08	1.07
Mortality (%)	32.64	33.96
Feed intake (kg of dry matter)	646,675	564,038
Production (kg)	368,109	343,397
Specific growth rate – SGR (%)	1.57	1.65
Feed conversion ratio – FCR	1.80	1.68
Fillet colour assessment (%)		
- White colour	-	28.6
- Pink colour	28.5	28.6
- Yellow colour	71.5	42.1

¹ supplementation with (Biomin®P.E.P)

Table 2. Economic evaluation in VND¹ from supplementation of phytogetic additive in pangasius.

Item	Control	Treatment ¹
Feed cost	6,014,940,219	5,279,247,888
PEP cost	-	70,956,000
Total cost	6,014,940,219	5,350,203,888
Feeding cost per kg of fish	16,759	15,941
Price per kg of fish	15,800	16,200
Total income	5,816,122,200	5,563,031,400
Gross revenue	- 198,818,019	212,827,512
Return on Investment (ROI)		1 : 5.8

¹Exchange rate, One USD = VND 20,780 on 9 April 2012

The economic analysis (Table 2) was carried out by calculating the feeding cost and revenue of each group (table 3), without any other management costs. It was calculated that the inclusion of Biomin® P.E.P 125 resulted in total extra revenue of VND 411,645,531/pond of 8,000 m² and a return on investment (ROI) of 1:5.8 which means that for each USD1 invested in the product a return of USD5.8 was achieved.

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【 STANDARD 】 GB/T 22548-2008

Item	Standard
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This was achieved by the improvement in FCR that allows producing the same amount of fish with lower feed costs and due to the high quality of the fillet in the phytogetic additive group that allowed a higher sale price for the fish.

Table 3. Change in environmental impact (amount of waste, N and P in kg) with supplementation of phytogetic additive in pangasius catfish diets.

	Control	Treatment	Difference
Total Waste¹			
Solid Waste	155,202	135,369	-19,833
Dissolved Waste	123,264	85,271	-38,092
P Waste²			
Solid P	3,233	2,820	-413
Dissolved P	2,460	2,099	-361
N Waste²			
Solid N	2,690	2,690	-344
Dissolved N	16,141	14,078	-2,062

¹ Estimated based on the Biological method of Cho et al 1995
² Based on the biological method of Cho et al 1995, and on the values for N and P content in pangasius carcass by Yi et al, 2001.

Finally, the environmental analysis (Table 3) highlights the additional benefits that the supplementation with the phytogetic additive in pangasius feeds brings to the farming conditions. It was observed a major reduction in total waste outputs (less 19 tonnes of solid waste and 38 tonnes of dissolved waste) and in particular dissolved nitrogen (N) waste (less 2 tonnes of N compound), which means a lower excretion of ammonium (later converted to ammonia) by fish. Such reduction in the waste output, not only improves the environmental conditions in the pond, but in a time of stricter environmental regulations and high

demand for certified products, could represent a significant advantage in terms of certification and image value.

Thus, under the *NutriEconomics* concept, modern aquaculture should focus on optimising profitability while maximizing performance and achieving the end goal of sustainable and ecologically sound fish and shrimp farming.



Pedro Encarnação



Goncalo Santos




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Fighting disease on multiple fronts

By Ole Fretheim

The first line of defense against pathogens can be enhanced by the use of beta-glucans, but the efficiency depends on the type of beta-glucans.

Both sea and land based aquaculture need a constant focus on all health related measures. This constant battle against pathogens cannot be fought in just one area. Clean nets, water treatment and correct nutrition are all critical factors in the fight against disease. Additional focus on one of the less obvious areas in the battle against pathogens is the one constantly fought by the immune cells. Biologically active defence modulators, specifically, are an important way of combating intruders and sustain a good production.

As the fastest growing food production system, aquaculture contributes half the aquatic food supply, according to FAO data (Ng, 2011). Much of this rapid growth can be attributed to the development of high quality feedstuffs and specialty ingredients. Even with this high technology, productivity can easily be damaged largely due to the constant threat of disease. Outbreaks can result in major economic losses for the producer as well as the consumer. Specific and specialised feed components are providing an effective solution to counter disease outbreaks.

Intensive aquaculture provides us with high yields, but it also provides an excellent environment for disease development, a result of even small production stresses or reduced immunity. The battle against diseases, including external and internal parasites and microbial pathogens, must be fought on a number of fronts. The aquatic environment, gills, gastrointestinal tract and the skin are all on the front line, supported by the immune system.

Antibiotics and vaccines play important therapeutic and prophylactic roles in maintaining fish health. However, while both can be highly effective concerns are increasing for pathogen resistance by the use of antibiotic and anti-parasitics. For many diseases, effective vaccines have yet to be developed. In addition, the administration of vaccines can have significant physiological stress on fish, weakening their immune systems. The best possible usage of the fishes own defence system is therefore of great potential. Here, again, feed additives are paving the way to prime the immune system ready for the battle ahead.

Training the army

Evolution has provided all animals with a defence in the form of an innate immune system. This consists of a number of different types of cells: macrophages, granulocytes, monocytes and dendritic cells. Recent research on how the immune system works has provided valuable information that can be used in developing innovative strategies to maximise fish resistance against pathogens.

These immune cells have hundreds of different receptors that bind specifically to certain chemical structures. Beta-1,3/1,6-glucan is one of these structures. Commonly found in the cell walls of micro-organisms, beta-glucans are among the molecules that bind to receptors on the surface of immune cells (as illustrated in Figure 1), triggering either a 'self' (no reaction) or 'antigenic' ('foreign', resulting in immune reaction) response.

Depending on which receptor is being engaged, receptor binding causes up- or down-regulation of signalling substances which relay information on the state of the invasion by potential pathogens. The presence of bacterial fragments such as the lipopolysaccharides (LPS) found on the surface, for instance, is known to generate pro-inflammatory signals. In one such study, Djordjevic and colleagues (2008) documented that when a beta-glucan was given to trout before a challenge with LPS, the expression of acute inflammatory genes was modulated, thereby eliciting a more anti-inflammatory response.



Fish farming in Japan (photo Ole Fretheim)

Enhancing beneficial responses while reducing detrimental reactions, is one of the requirements of a good beta-glucan product.

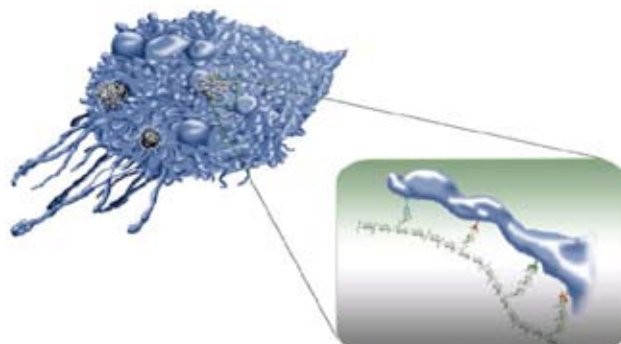
Effective leadership

We can say that the 'General' for the immune system is the macrophages. Activation of macrophages happens directly in response to the presence of micro-organisms starting a sequence of changes which allows the macrophage to handle the 'intruders'. Many pathogens have evolved ways of weakening immune cells which can be complicated by environmental factors such as stress, nutrition or handling to suppress the immune defense system.

Immune cells can also distinguish between direct and indirect microbial contact. Thus, they are only recruited to initiate direct anti-microbial responses (phagocytosis and reactive oxygen species) when needed as a result of a specific receptor called Dectin-1 (described in detail by Goodridge and colleagues in 2011). This distinction between immediate and distant threat may be the mechanism by which the immune system can effectively direct its response to invasion and save energy until needed and pathogens can be handled effectively.

The beta-glucan's role in this mechanism is especially interesting. Dectin-1 signalling is only activated by particulate beta-glucans. 'Priming' the immune cells with beta-1,3/1,6-glucan makes them ready to combat new intruders immediately. Evidence has been mounting for a number of years for the effective deployment of beta-glucan as an immune-modulator and gradually, the modes of action by which it exerts its effects are being uncovered. Importantly, the ability to up-regulate genes associated with immune and mucus function against

Figure 1. Glucan mode of action. The mode of action of Beta-1,3/1,6-glucan is slowly being unravelled, but at its core is the modulating effect on the immune system, via the surface receptors of immune cells. An illustration of macrophage receptors binding beta-glucan side chains.



pathogens and modulate the inflammatory response mean that these molecules will play an even more important defence role in the future, against microbial and parasitic diseases.

Immune Modulation is preferred to Immune Stimulation in the fight against disease.

Improving the first line of defense

On mucosal surfaces, including the gills, gastrointestinal tract and skin, the mucosal barrier plays an important role in preventing pathogen invasion, both as a physical and chemical barrier. Mucins, the glycoproteins that make up most of the mucus layer, are in fact a complex matrix of molecules, which are home to many active substances, including antimicrobial peptides such as piscidines and defensins (Rossel & Delmotte, 2004; Zhao et al., 2009). A healthy mucosa can thus prevent almost any agent from entering the circulation. Supporting this first line of defence should be considered an essential first step in the fight against external agents.

The mucosal barrier itself can be influenced or modulated by the addition of beta-glucan to the feed. Recently, it was shown that addition of beta-glucan to the diets of carp significantly improved the expression of genes for beta-defensins in both gill and skin (van der Marel et al., 2012). This was the first time that such a relationship was demonstrated and it also explains some of the action behind the reduced parasitic infestation found in other studies. In amberjack, for example, the ectoparasitic fluke, *Neobenedensia girellae* (or Hadamushi, as it is known in Japan), was effectively controlled systemically by feeding a diet containing beta-1,3/1,6-glucan, MacroGuard (Figure 3, Seim et al, 2010). Similarly, in Atlantic salmon, Refstie (2010), also reported an association between beta-1,3/1,6-glucan and reduced infestation with sea-lice. More recently, trout fed a beta-glucan supplemented

Figure 2. Beta glucans extracted from the cell walls of baker's yeast (*Saccharomyces cerevisiae*).

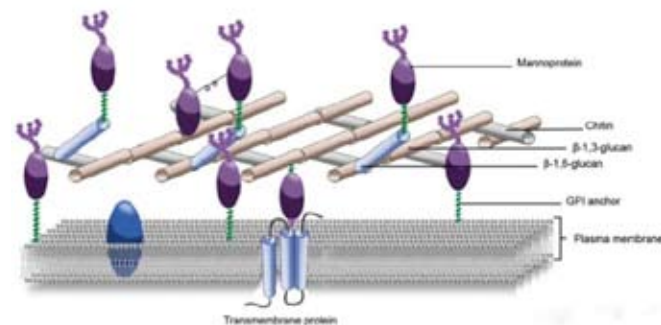
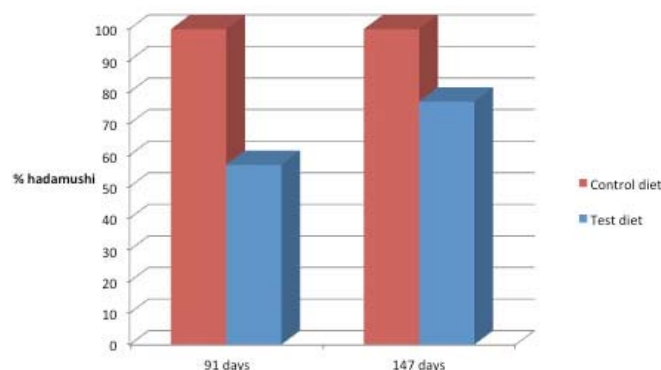


Figure 3. Percentage reduction in the numbers of Hadamushi flukes on fish fed beta-1,3/1,6-glucan.



diet exhibited a greater resistance to white spot disease caused by the parasitic ciliate *Ichthyophthirius multifiliis* (Ich) (Xueqin, 2012).

Choosing the right weapons

Beta-1,3/1,6-glucan is found in fungal cells, with bakers yeast being the most common source for commercial products. The beta-1,3/1,6-glucan is covered by cell wall material (mannoproteins) and needs to be extracted to be in a bioactive state. The extraction process is vital to the final structure of the beta-glucan product (Figure 2). Any reduction of branching or tertiary structure will give loss to biological activity. Size also matters.

These factors were demonstrated implicitly in the report of Goodridge et al., in 2011. In proposing a mechanism by which the immune response is directed to respond to immediate or distant pathogen signals, the group showed that a particulate, large, branched chain beta glucan was required to allow the immune system to mount an effective defence. Smaller, soluble beta glucans merely blocked the cell surface receptors without initiating the signalling pathway.

Choosing which beta-glucan to use, therefore, is perhaps not so straightforward as it might seem. The amount of glucan is not the important factor. Documentation of biological effects from species-specific trials is essential for beta-glucan products, not only to prove effect, but also the right dosage.

References are available on request



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Enhancing fish immunity and nutrient absorption

By Dhanunjaya Goud, Serge Corneillie and Fuci Guo

A bioactive fraction in extruded feeds for the pangasius catfish improved health and growth rate.

In India, the steady growth in freshwater aquaculture is led by the recent production of the pangasius catfish. Previously, 80% of production was contributed by the Indian Major Carps. The major shift from the traditional feeds (deoiled rice bran and groundnut cake) to formulated feeds gave farmers the opportunity to adopt higher stocking densities for higher yields.

However, under intensive production methods and poor culture management, fish are exposed to stressful conditions leading to growth reduction and higher susceptibility to various diseases. The successful control of disease in aquaculture requires a multifaceted approach, whereby better management practices are combined with the use of specially selected fish stock and adequate nutrition to improve overall fish health.

In intensive culture systems, improvement of natural health and immunity in fish is dependent on proper nutrition. This article will discuss the effects of a specific prebiotic, a bioactive fraction derived from yeast cell wall, Actigen™, on growth performance and health status of the pangasius catfish. Indirectly, we illustrate the potential to reduce cost of antibiotic inputs in aquaculture through the improvement of gut health and nutrient absorption and ultimately a healthy immune status of the fish. Actigen™ is derived from the yeast cell wall of *Saccharomyces cerevisiae* and was developed by Alltech Inc. as a result of 20 years of research focusing on the application, in animals, of the mannan structures present in yeast cell wall.



Why gut health?

The gastrointestinal tract is a prominent part of the immune system. Microorganisms are kept at bay by an extensive immune system comprising gut-associated lymphoid tissue (GALT). In terrestrial animals including humans, the microflora of the gastrointestinal tract plays an important role in affecting nutrition, health of the host and in the balancing beneficial and harmful bacteria. A ratio of 80% beneficial to 20% harmful bacteria is considered normal. The bacteria in the water surrounding the fish are continuously ingested either with the feed or when the host is drinking, causing a natural interaction between the microbiota of the ambient environment and the gut environment. If the bacterial challenge exceeds a certain level, the health of the animal is in danger, as the animal alone cannot defend itself sufficiently.

Tools to enhance gut health and immunity

The potential for reducing stress and enhancing immunity and disease resistance by nutritional feed additives and functional feed materials has been demonstrated in warm-blooded animals. However, very little work in this area has been conducted in aquaculture. Thus, the effects of nutrition and feeding strategies need to be assessed to develop economically viable feeds and feeding practices to optimize growth, improve stress resistance, immune response and disease resistance, and improve the product quality of aquaculture species. However, is this really possible? The answer is yes, through the promotion of early gut development with nucleic acids, organic trace minerals as well as 'feeding the gut' to maintain intestinal health.

Immune competence of the pangasius catfish

In this study, we looked at the immune competence of *Pangasius hypophthalmus* when subjected to the prebiotic during grow-out in ponds. This was conducted in a farm located in Losari, West Godavari District, Andhra Pradesh, India. The farm contained 30 ponds of which 20 suffered from higher than normal outbreaks of disease. The farm was applying antibiotics (Enrofloxacin @ 15g/tonne of fish biomass)



Table 1. Culture parameters in trial ponds.

Ponds	Stocking numbers	Area (ha)	Stocking Density (No/m ²)	Initial average body weight (ABW,g)	Days of culture (DOC)
T1	46,600	2	2.33	135	38
T2	25,000	0.8	3.13	80	38
T3	38,450	1.4	2.8	213	37
C1	69,752	2.2	3.1	256	30
C2	69,993	2.2	3.1	194	30
C3	76,251	2.2	3.5	201	28

^a Actigen™ at 1kg/tonne (applied along with premix in floating feed)
^b Antibiotic treatment. One at start of trial 4/10/2009 + following treatments at disease outbreak.
 Note: As this is a field trial, we were limited in controlling some parameters such as initial weight and days of culture.

Table 2. Summary of production parameters and inputs used.

Ponds	ABW (g) Initial	ABW (g) final	Biomass Increase (g)	Feed Used (tonne)	Actigen used (kg)	Antibiotic used (g)	Mortality (number)
T1	135	470	335	28.01	28.01		7
T2	80	447	367	16.52	16.52		
T3	213	639	426	29.48	29.48		
C1	256	846	590	61.73		6.97	350
C2	194	610	416	52.41		6.99	500
C3	201	713	512	62.47		7.62	275

Table 3. Summary of costs.

	Treatments (INR)	Controls (INR)
Actigen	29,600	-
Antibiotic	-	55,000
Loss due to mortality	3.64	12,200.6
Total cost	29,604	67,201



Figure 1. Growth performance of pangasius catfish over three months.



to treat disease. As disease outbreaks became more frequent, the farmer faced losses from heavy mortalities and increasing costs of treatments. In this study we selected three ponds as treatment ponds (T1, T2, T3) and three control ponds (C1, C2, C3), where the standard procedure of using antibiotics was continued.

During the three month trial, weekly sampling by weighing 100 fish was carried out. Data recorded included growth rate and fish mortality. The diets used were a standard balanced floating feed. The treatment diet contained the prebiotic at 1kg/tonne of feed. Fish in the control ponds were fed the standard balanced floating feed with antibiotic treatments added at 5g/tonne of fish biomass for 5 days in each application.

Conclusion

Often it has been hypothesised that fish invest more energy in immunity than in other physiological functions. Moreover, seasonality is thought to act as an important factor in determining the levels of fish physiology and immunological activity. However, the inclusion of certain immune enhancers will help fish to improve their immune status and spend less energy on those defence mechanism leading to lower inputs for treating fish.

In this case study the addition of Actigen helped in reducing the mortalities and dependence on the antibiotics and also ensured better returns for the farmer. Based on the above field observations, we can conclude that, the use of the prebiotic in the extruded feeds will enhance the complete utilisation of feed, thereby leading to less excretion (less pollution) and higher profitability for the farmer.



Dhanunjaya Goud



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Sustainability of the pangasius trade

By Douglas Waley, Richard Newton, Patrik Henriksson and Lam Phan Thanh

The SEAT project, Pangasius and Action Research looks at Vietnamese and European ends of the value chain highlighting feed supplies and management of pond sediment as key sustainability concerns. Next for the consortium of partners is to work with industry and academics in Vietnam and Europe to improve sustainability and enhance the reputation of the product.

The EC FP7 funded SEAT project (Sustaining Ethical Aquaculture Trade) has been researching practices, constraints and sustainability perceptions with hundreds of stakeholders throughout key aquaculture value chains between Asia and Europe. Pangasius, being a major commodity species for the European market is a significant part of the project.

The project design has two main elements. First is the establishment of an evidence base on the sustainability of current practices and trends within the value chain. Second is for the scientists involved in this in-depth analysis to carry this knowledge forward and affect improvements in the sustainability of the pangasius trade.

To achieve a holistic view of sustainability and an ability to enact change, the project brings together experts in a variety of fields including Life Cycle Assessment (LCA), Environmental Life Cycle Costing (ELCC), environmental modelling, value chain analysis, risk assessment, socio-economic analysis, food safety, ethics, utility of information, and policy. The consortium has 13 partners, some with extensive experience in aquaculture and fisheries. This is the breadth of the research working towards reports, scientific publications and models for public use and all are contributing to the EAFI (Ethical Aquatic Food Index), an evidence based index of sustainability indicators to inform certification schemes, policy makers and industry. Industry consultation on this index will be launched at the Seafood Summit in Hong Kong in September 2012.

Countering negative publicity

Beyond the original design of the project, its research has put SEAT in a position to counter the wave of negative publicity the pangasius has received in Europe. SEAT's research provides an evidence base which refutes many of the ill-informed criticisms made by media, NGOs and politicians alike. The project actively engaged influential Member of the European Parliament Struan Stevenson and was instrumental in his turnaround from public statements which criticised pangasius production which he, at the time, described as 'filthy', 'poisoned' and which exploited 'slave labour'. He has since changed his position to praising the industry for 'meeting world class welfare and hygiene standards and for producing a quality product under first-rate conditions'.

Key concerns in Vietnam's pangasius value chain

Initial research with two hundred pangasius farmers plus interviews with feed mills, chemical suppliers, processing plants and policy makers was followed by a 'State of the System' workshop bringing all these stakeholder groups together. This was an opportunity to share and verify the results of our work to date and to discuss and investigate the major constraints and perceived sustainability concerns within Vietnam's pangasius value chain.

Combining extensive research with key informant interviews and bringing in the experiences of those working in the value chain every



Pangasius catfish pond

day, allows for identification of the key sustainability constraints. The stand-out sustainability concerns for those in the Vietnamese value chain are the cost of inputs (especially feed), disease, water quality and the instability of both supply and prices. Intermediaries between the Vietnamese and European ends of the value chain echo these concerns in highlighting the traceability of feed supplies and the management of pond sediment as the key sustainability concerns for importers.

Action Research

This method has been adopted by SEAT to affect improvements in sustainability during the lifetime of the project and to lay the foundations for continuing improvements beyond the project. Action Research is an enquiry where participants and researchers co-generate knowledge through collaborative, communicative processes in which all participants' contributions are taken seriously.

It takes place in real-world situations, aims at solving specific problems, the initiating researchers openly acknowledge their bias towards the target group of the research, and co-learning contributes to the sustainability of the change affected. An iterative approach to diagnosing, planning, acting and reflecting on results before making new plans and carrying out new actions is central to the Action Research method. This approach facilitates the application of science into real-world situations and integrating improvements into existing value chains.

Pangasius production

Recent research has demonstrated that pangasius expend significant amounts of time and energy on air-breathing due to anoxic conditions in ponds. This negatively influences the time and feed required to grow the fish to marketable size. SEAT is bringing engineers from Thailand specialising in aeration systems to Vietnam to work with pangasius farmers in the Mekong Delta, alongside academics from Can Tho University and the University of Stirling. The goal is to develop a system to aerate the top two metres of ponds while maintaining the sedimentation role of these four to five metre deep ponds, bringing improvements in feed conversion ratios (FCR) and in water quality.



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SEAT is carrying out detailed analysis of the sediment from pangasius ponds to confirm its suitability for use as fertiliser in agriculture, both from a contaminants/safety perspective and from a nutrient balance perspective. Action Research will go beyond this technical research to bring sludge handlers, agricultural producers and various technical specialties together and integrate the use of this valuable resource into value chains. This will be a major step in reaching the standards set by international certification bodies, enhancing the sustainability and reputation of the product, through improving the quality of water and other outputs from pangasius farms. It will also improve the economic viability of the farms.

Action Research gives SEAT a method for disseminating its information in a way that addresses information gaps and fulfils the needs of those working in the pangasius value chain. Posters depicting the pangasius value chain are available on the project website. The information on these posters is a result of SEAT's initial stages of research and the feedback from stakeholders on what information is not available to them. Taking an iterative approach to this dissemination effort allows for updating of information and ensuring information is targeted at the real requirements of those in the value chain.

By-products

By-products from aquaculture processing often constitute over 50% of the weight of the production. The contribution that processing by-products can make to value addition is often overlooked, especially in Europe where they are often regarded as a waste product and a disposal problem. In Asia this is not the case. Pangasius by-products constitute 65% of the total weight of the fish, and are highly valued. Most of these by-products are currently reduced to fishmeal and oil and



By-product materials from the Bien Dong processing plant in Can Tho

are used in livestock feeds. Reportedly these perform as well as those from traditional by-catch fish sources. As pangasius feeds generally contain only around 2% to 4% fishmeal, pangasius can be regarded as a net fishmeal producer, increasing resource efficiency and sparing the use of trash fish in other industries. The SEAT project is looking to assess these resource efficiencies as part of Life Cycle Assessment work which will provide a complete picture of the inter-relationships of these industries in Vietnam. The Action Research element of the project is engaged with industry players on where pangasius by-products can make a higher value contribution to feeds for other animals.

Feed manufacturers in Vietnam are constantly sourcing high

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Processing lines at Bien Dong processing plant in Can Tho

quality ingredients to improve their feed formulations. In SEAT we are working to improve pangasius catfish feeds by including by-products from the salmon industry. Rossyew Ltd. in Scotland produces a highly nutritious protein concentrate from the hydrolysis of salmon viscera. This product is already used as a feed attractant in shrimp feeds in Thailand with excellent results. With only a small inclusion, the feed conversion and survival performance of shrimp can be improved substantially. Therefore, the SEAT project is conducting nutrition trials with salmon protein concentrates in juvenile catfish diets. Pangasius mortality is high at the juvenile stage and this may be due, in part, to feed quality. By improving the palatability and digestibility of the diets, it is hoped that the overall performance of catfish juveniles can be improved. The inclusion of these salmon products, therefore not only improves the efficiency of the salmon value chain, but also that of aquaculture value chains in Asia.

More information on SEAT and its action research with pangasius, tilapia, shrimp and prawn in Vietnam, Thailand, China and Bangladesh is available on the project website (www.seatglobal.eu). The project would like to hear from you if you have something to contribute to and gain from the sustainability of these value chains.



Douglas Waley Richard Newton Patrik Henriksson Lam Phan Thanh

Douglas Waley is a PhD student at Stirling University and with Kasetsart University, Thailand is pursuing action research across the SEAT project.

Richard Newton is a PhD student working on the efficient use of by-products from aquaculture production and processing for reducing waste and adding value. He has also worked for over 5 years within the industry in several roles.

Patrik Henriksson is a PhD student at CML, Leiden University, Belgium as part of the SEAT project. His work is on the evaluation of the environmental performance of aquaculture production in SE Asia using Life Cycle Assessment.

Lam Phan Thanh is manager, Department of Inland Fisheries Resources and Capture, Research Institute for Aquaculture No. 2 (RIA2) in Ho Chi Minh City, Vietnam. Since 2009, Thanh is a PhD student under the SEAT program. His main task is on the state of system assessment, ELCC and Action research. Email: lam.phanthanh@stir.ac.uk

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Towards sustainability: Vaccinated pangasius in Vietnam

By Pham Cong Thanh and Jan Oppen Berntsen

The pangasius industry in Vietnam has been one of the fastest growing segments within the global aquaculture industry in the last decade. However, there are signs of stagnation in the last two years. What is happening?

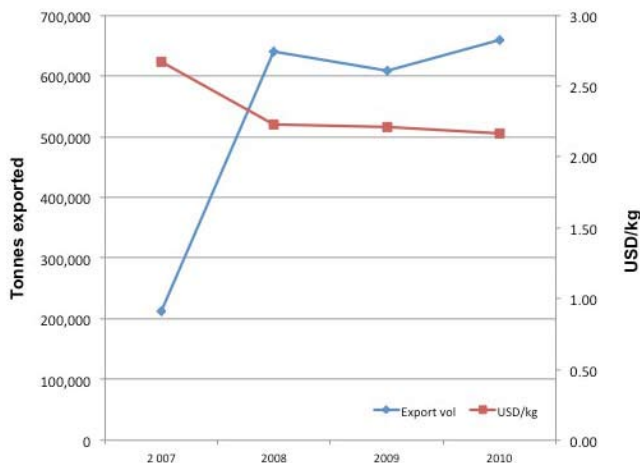
Pangasius catfish is a leading aquaculture commodity in Vietnam. It also holds the top position among seafood exports. According to the Ministry of Agriculture and Rural Development (MARD), in 2011, the production of pangasius was 1.14 million tonnes and it was 1.3 million tonnes in 2010. In general, there has been rapid increase in production in ten years since commercial farming began in 1992, led by intensification whilst farming areas have remained stagnant at around 6,000ha.

MARD has targeted a yearly production of 1.2 to 1.3 million tonnes. Although there has been no major epidemic disease outbreak in pangasius farming to date, the industry does suffer from negative reports on hygiene, food safety and the use of non-approved chemicals to treat diseases. Efforts have been on-going to improve farming techniques and reduce adverse environmental impacts.



Vaccination in progress

Figure 1. Volume and price development of the Vietnamese pangasius industry. (VASEP)



Keeping up fish health

All segments of aquaculture that have expanded, mainly through high stocking densities, have experienced the threats of disease. Subsequently, treatment of disease is the first step but this is usually effective for a limited period. The disease problem will eventually escalate, mortality rises and treatment doses are then increased. In due course, these treatments do not work at all.

Prevention is usually the solution but such new fish health management tools take time, money and special knowledge to develop. Reports from the field on resistant bacteria and failed treatments are beginning to be more common.

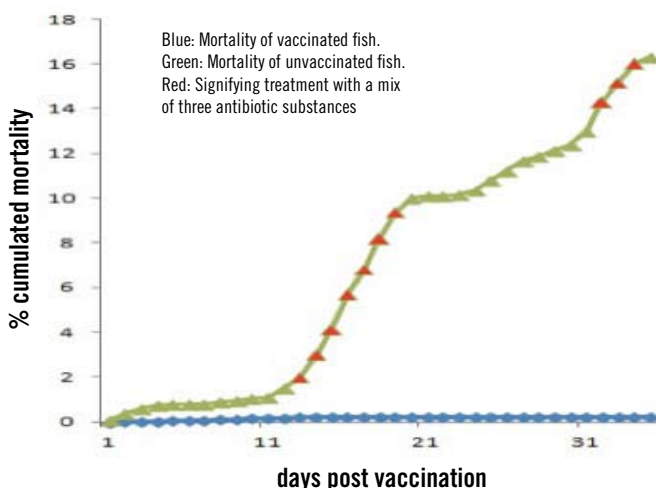
Dung (2008) found that 70% of *Edwardsiella ictaluri* strains investigated were resistant to three commonly used treatments (trimethoprim, oxytetracycline and streptomycine) and reduced sensitivity towards three more drugs were reported (flumequine, oxolinic

acid and enrofloxacin). Two years later Dung (2010) reported that 97.5% of the *E. ictaluri* strains checked developed multiple resistance towards three commonly used treatment drugs.

PHARMAQ Vietnam Ltd is a pharmaceutical company specialising in servicing the global aquaculture industry with sustainable solutions for its fish health challenges. In 2006, PHARMAQ started to invest in research and development of a vaccine for the pangasius industry of Vietnam. Today, five years later, the first fish vaccine developed for Vietnam is used on a commercial scale in the Mekong Delta.

Millions of fish have been vaccinated and at this point in time, vaccinated fish are being monitored by PHARMAQ staff and National Veterinary Center officials. The findings are interesting, but not very surprising to someone that has followed the development of many aquaculture segments around the globe during the last few decades (Figure 2)

Figure 2. Field observations with ALPHA JECT Panga 1.



Prevention is better than cure

The idea of insuring fish against disease and mortality through vaccination is already very evident with the salmon industry where today hardly a single salmon smolt is transferred to sea without this lifesaving insurance. This is still not common in the pangasius industry, at least at the moment. Different from the salmon, the pangasius is much smaller at slaughter and does not command high ex-farm prices. However, the advantages of vaccination are the same:

- Increased survival because fish is protected against specific diseases.
- Better growth, as healthy fish eat more and grow better; reducing the production cycle and time to market.
- Reduction in cost of antibacterial treatments; reducing the general dependency on antibacterials and the danger of resistance.
- Reduced use of antibacterials also eliminates the risk of residues in the fish and subsequent problems in trading the fish in international markets.
- Vaccines are definitely setting a new standard as far as food safety is concerned. This should in fact be the trigger factor for a responsible industry to start vaccination on a large scale.

The vaccination process – a new industry in itself

Currently, we can see that a new industry is being created in Vietnam. The vaccination process is a logistic challenge where biology meets geography and transport. Juveniles are health checked prior to any vaccination. The whole vaccination process has to be considered.

- Special working tables are built to facilitate a smooth vaccination process.
- The quality of the vaccination process is checked as well as the health status of the fish immediately following the vaccination.
- A general check of fish is also done once during the production cycle. If there is an outbreak of disease, a diagnosis will be carried out to find the cause of mortalities.

The company already has 40 trained vaccinators and is adding new staff every month. Today, these new professionals are forming a new industry and they are all proud to be a part of the new beginning for Vietnam's pangasius industry.



Pham Cong Thanh is technical service and marketing manager in PHARMAQ Vietnam Co. Ltd. His role is to provide services and technical support to customers. He is also responsible for sales and marketing of products in Vietnam. Currently, Thanh has a special focus on the implementation of the first

ever fish vaccine in Vietnam. Thanh has a Master of Science in aquaculture. Email: pham-cong.thanh@pharmaq.no



Jan Oppen Berntsen is sirector, international sales, PHARMAQ AS, Oslo, Norway. He is responsible for business development and sales and marketing issues with special focus on Asia. He has worked in international business to business since 1982 and with animal health and fish health since 1989. Jan has a Master of Science in chemistry.

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Future of pioneering shrimp farm at stake

A unique sustainable shrimp farming model integrated with mangroves faces an uncertain future due to potential damage from the coastal environment.

During a visit in 2007 (AAP, Vol. 3 (3) May/June 2007), we showed how at Bismi farm, mangroves planted outside ponds and inside an effluent treatment area and water outlet canals helped to reduce nutrient loads and seepage. It also created a permanent shield against storms and flash floods in this low lying area of the Perunthottam coast.

The ecological restoration of the farm, formerly a group of abandoned ponds began in 1993. The idea, according to S. Ali Hussain, managing director of Bismi Prawn Farms, in Perunthottam, Sirkali Taluk in Tamil Nadu was to show that shrimp farming can be environmentally friendly. "All we need is to understand the interactions between the environment, ecosystem, water and soil inputs. He has walked the talk and remained semi intensive with black tiger shrimp farming."

The farm has now expanded to 250 acres (100 ha) and today there are around 100,000 mangroves trees from seven mangrove species (up to 7 m height), including salt tolerant mangroves *Avicennia marina* and *A. officinalis*, red mangrove *Rhizophora mucronata*, and mangrove apple *Sonneratia alba*.

"Together with some coastal plants, these offer substantial protection and also increase the productivity of the Perunthottam coastline. Even the Indian Council of Agricultural Research (ICAR), New Delhi has appreciated our integrated farming method by offering an ICAR Award to Bismi in February 2009," said Ali.

"Since 2006, we have also been working closely with the Central Institute of Brackish Water Aquaculture (CIBA) and The Marine Products Export Development Authority (MPEDA) of the Indian Ministry of Commerce to carry out their fishery experiments in some of Bismi's culture ponds supporting national scientific research."

Sustainable and integrated

There are 50 ponds which in 2011 produced 250 tonnes of black tiger shrimp. Ali has already registered the farm for the culture of the vannamei shrimp with CAA but insists that he will only start its culture when post larvae prices come down. In the meantime, it is the black tiger shrimp.

The farm is licensed as a modified extensive farm and the maximum stocking density is 10 PL/m² of black tiger shrimp. The average survival rate is 80%. The target size is 32-40 g, although at times, the production has been only 20 g shrimp. Partial harvest is practised starting with 14 g shrimp. Prices are INR 120/kg when there is an emergency harvest and INR160/kg with planned harvests. (USD 2.7/kg and USD 3.6/kg at USD1=INR45 in June, 2011).

"For the past 19 years, we have maintained the ponds in a pristine condition with these protocols. I would like to think that I am conserving the environment for the future generation. Even during pond drying when it rains, these ponds do not have any smell.

"Our average production is 3-4 tonnes/ha/crop. I can get 3 crops in two years. We produced post larvae at our own hatchery using wild



In this effluent treatment pond, mangroves trap sediments.



Ponds ready for water preparation and the next crop in late March.

brood stock. The days of culture (DOC) to reach 14 g shrimp is 100-110 and for 40 g it is 200. Salinity is 33-35 ppt but during the monsoon season, the salinity will drop to 10-15 ppt. Without any water exchange, salinity can rise to 48 ppt. The season starts from March. In January, the cold weather at 22-24 °C will bring on diseases," says Ali.

Integrated feed mill

The idea of a feed mill came from Ali's collaboration with CIBA which developed the formulation and manufactures feed processing equipment in India. There is also a fish meal plant with an output of 20 tonnes/day made from 100 tonnes of locally sourced fresh material. The minimum crude protein level of the fish meal is 60.3% whilst the TVBN is less than 150. The capacity of the feed mill is 2,000 tonnes per shift (8 hours) annually, and the feed produced is for the farm and also sold to local farmers. Feed prices have increased to INR 55/kg in comparison to the earlier price of INR 45. With the change in exchange rate to USD (INR 51 in March 2012), prices have remained at approximately USD 1/kg. According to Ali, the best feed conversion ratio is usually at 120 days or less, at 1.4. At 160 days, FCR rises to 1.8 and at 200 days, 2.2.

Trends

These are positive in the case of ex-farm prices for black tiger shrimp. In 2011, ex-farm prices for the larger shrimp were INR 220-250 for 22-25 g shrimp; INR 300-350/kg for 30-35 g shrimp and INR 400-450/kg for 45-50 g shrimp. Ali remembers a time when 33 g shrimp used to fetch only INR 330-380/kg in 1995 when he had his first harvest. In 2000-2001, this rose to INR 480-520/kg. Cost of production in 1995 was around INR 140-160/kg but this is going up fast, in particular due to rising labour and energy costs, with the present cost of production at INR 240/kg.

"In 1993, our monthly cost for labour including food and lodging was INR 1,000/person. Now we have to pay INR5,500 as salary and another INR 1,500 for food, etc. Diesel used to cost INR 9.50/L and today it is INR45/L," said Ali.

However Bismi farm's future is now at stake from the proposed siting of a coal-fired power plant in the area and an ash pond to contain waste from the power plant next to his farm. Ali worries about the effect of the degradation of the coastal environment on the water quality for the shrimp farm.

"On top of all these, I have another concern: will the farm be operational in the future with the threat to the coastal environment from the proposed coal power plant? The assessment report has largely ignored the existence of my farm. I am appealing to the authorities but also seek help from environmental groups or NGOs."

An appeal from Ali Hussain

There is a proposed coal fired thermal power project in Sirkali Taluk, Nagapattinam District. This will not only affect operations at the Bismi Farm but also around 56 smaller farms in the area. Unfortunately, the report on the effects on the surrounding environment has not identified the existence of Bismi's large complex and neither did it identify other farms in the surrounding areas. Instead the aquaculture activities are shown as salt pans in the thermal power project company's EIA maps and its reports.

Ali is clear in outlining his concerns, "Apart from this, a catastrophic impact on the thickly populated human habitations and the environment may be expected with the proposal for five more similar mega coal based plants within the radius of 12 km from Perunthottam village to Anaikoil village. It will cause irreversible damage to the productive Sirkali coastline. The cumulative capacity of these 5 mega plants is around 6,000 MW and estimated tentatively to burn 91,200 tonnes of coal per day and generates 32,000 tonnes of ash per day as solid waste.

"In addition, each one of these plants will operate their own jetties and desalination plants and will also have continuous dredging. Firstly, I fear that the quality of water will be affected with chemical spills and ash output from coal burning and I draw water 500 m out at sea. The ballast water from ships bringing coal (from Indonesia) will be a means of transboundary transfer of shrimp diseases into farms in the area.

"From an ecological point of view, we expect a massive impact on the aquatic life in the coastal waters from the deterioration in water quality. The tidal wetlands and backwaters are nursery

grounds for several species of marine life, valuable for the sustenance of our commercial fisheries. These are also feeding and breeding grounds for migratory and resident birds. The beach has sand dunes as natural protection barriers and is also the breeding ground of the endangered Olive Ridley turtles."

For more information: email: sah_bismi@rediffmail.com (S. Ali Hussain)



Ali Hussain. In the background are mangroves in the water outlet of ponds.



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Expanding industry in India

By Eric Roderick

The India International Seafood Show (IISS) 2012 was held from 29 Feb – 2 March at the Chennai Trade Centre. This year, IISS joint organisers, the Marine Products Export Development Authority (MPEDA) and the Seafood Exporters Association of India (SEAI) celebrate their 40th anniversary. Both are instrumental in the overall development of the seafood industry in India.

The biennial show in its 18th year, is a major seafood event in Asia and has been increasing in popularity over the last few years. This year, a total of 211 companies exhibited, 175 from India and 36 international companies. Some of them took large booths whilst others such as the Japanese delegation brought together many small companies under one trade stand. It was well attended with over 1,092 delegates registered (967 from India and 125 from overseas) with another 1,013 visitors to the show.

The exhibitors included seafood exporters, processors, buyers, certifiers and allied industries related to the seafood sector from India, Japan, USA, Germany, Netherlands, Denmark, Vietnam, Spain, Taiwan, Malaysia, Argentina, Singapore, China and Thailand. The overseas delegates came from Japan, Netherlands, UK, China, USA, Spain, UAE, Turkey, Lebanon, France and Thailand.

The show was opened by the Governor of Tamil Nadu state, **Dr K Rosaiah**, and was assisted by **Leena Nair**, chairman, MPEDA, **D. B. Ravi Reddy**, president, SEAI, **Thiru Gagandeep Singh Bedi**, Governor Secretary, IAS, Government of Tamil Nadu, **Anwar Hashim**, vice chairman and **Dr N. Ramesh**, director marketing, MPEDA and **Elais Sait**, secretary general, SEAI.

Higher export value in 2012

In her opening address, Nair reported that seafood exports reached their highest value in 2010-11 at USD 2.8 billion, and predictions for 2012 are up to at least USD 3.5 billion. India's fisheries resources account for 3.9 million tonnes from the marine sector and 4.2 million tonnes from the inland fisheries. India is the second largest aquaculture producer in the world, farming 3.48 million tonnes. The highest value products are frozen shrimp and scampi, with production of 136,822 tonnes and 8,778 tonnes, respectively for 2010-11. In terms of volume, frozen fish and cephalopods (squid and cuttlefish) make up most of the trade and both squid and cuttlefish exports were down in quantity, but up in value.

In developing the aquaculture sector, MPEDA through the Rajiv Gandhi Centres for Aquaculture (RGCA) run by **Dr Y.C.Thampi Sam Raj**, project director, is currently focusing on SPF tiger shrimp *Penaeus monodon* and tiger grouper *Epinephelus fuscocottatus* production in the Andaman and Nicobar Islands, pacific white shrimp *Litopenaeus vannamei* in Chennai, freshwater prawn or scampi *Macrobrachium rosenbergii* in Andhra Pradesh, Asian seabass *Lates calcarifer* and mud crab *Scylla serrata* in Tamil Nadu, tilapia *Oreochromis niloticus* in Andhra Pradesh where both GIFT and Fishgen's YY stocks are being evaluated, cobia *Rachycentron canadum* in Trivandrum, and finally *Artemia franciscana* large scale culture in Tamil Nadu.

RGCA's main objectives are to carry out research on suitable species for aquaculture throughout India, and disseminate the data through training centres as well as assist in the setting up of hatcheries and grow-out farms to commercialise the species in a sustainable way. MPEDA, as part of its commitment to increase the exports of seafood from India, also organised a 2-day comprehensive technical session with 17 speakers covering a complete spectrum of topics relating to



Entrance to the trade show at the Chennai Trade Centre

seafood produced in India. The sessions were very well attended and each half day session was chaired by a distinguished expert in the relevant topics covered by the speakers.

Value addition

In the first session on processing and value addition, **Bernard Leveau** manager of Multivac of Switzerland spoke on 'Value Addition through Innovative Packaging'. He made an excellent case for the benefits of improved packaging. Many examples were shown of identical fish products which had dramatically different profit margins due entirely to the use of innovative packaging. With the global seafood market valued at USD 100 billion, value added trends in the market should dramatically increase profits, especially for producer countries which instead of exporting unprocessed product, start adding value and process in their own country. Leveau covered a range of parameters which can affect the product, from shelf life, water activity, pH, composition of the product and microbial loading and one of his key take home messages was that if its 'no good at the beginning then it won't improve'.

Dora Su, Hola enterprises, Taiwan discussed infrastructure requirements for value addition and challenges in marketing of seafood. Su showed a video of breeding machines which can add significant value to fresh seafood. Breaded products are one of the fastest growing value added items. The company is also a supplier of high quality sea cages on which much of the marine farming expansion will be based. **Ashok Uniyal** presented advances in freezing techniques for seafood and emphasised that 'the quality of products were now determined by the speed of freezing'. The presentation covered in detail the technicalities of fast freezing and the latest technologies available in the industry.

Waste utilisation

Dr Ravi Sankar, principal scientist at Central Institute of Fisheries Technology (CIFT) in Kochi spoke on the utilisation of waste in the seafood industry for cosmetic and pharmaceutical products. Sankar highlighted the importance of fish in today's diet to help combat lifestyle diseases we hear so much about these days. He also discussed the importance of aquaculture in replacing overfished natural resources and as 40% of all fish is currently wasted, there is a need for total utilisation of the product. These include chitin and chitosan, rich in glucosamine, squalene from shark liver oil, gelatine from collagen, cephalopod ink and fish maws. In these economic times, all seafood components should be utilised when possible.

Quality control and ecolabels

In the sessions on quality control and regulations, speakers were **Dipesh Shaw**, consumer safety officer for US Food and Drug Agency (FDA), India and **Dr G. Srinivasan**, deputy director Food Standards Authority of India in Chennai. Both speakers gave in-depth overviews of the regulations relating to exporting and food safety during production. UAE based, **Chandraith** gave an overview of the developments of food safety and quality management systems (QMS) in seafood industries. All the ISO and HACCP regulations were covered well, showing how highly regulated the seafood export industry is becoming now, with extremely high standards being demanded by import authorities around the world.

Melanie Siggs, senior advisor on Fisheries, International Sustainability Unit, UK gave an overview of the 9 main ecolabels, and standards currently being used in seafood around the world. The Marine Stewardship Council (MSC) is the most widely recognised standard with 13,546 products in 84 countries, and the Aquaculture Stewardship Council is making some progress amongst farmed species. The Global Aquaculture Alliance (GAA) seems to be the biggest certifier in the aquaculture sector. Fair Trade focussing on social issues at source is also making some progress. The International Fishmeal and Fish Oil Organisation (IFFO) is promoting its global standard for responsible supply and working with MSC, hopes to increase the current 25% of stocks currently accredited.

Norbert Karikkassery of Interseas gave an overview of ecolabelling of seafood products. The 400 ecolabels in existence in 2011 is giving rise to considerable confusion both for the producers and the consumers. There is an urgent need to standardise ecolabelling to provide total transparency in the industry. **Laurent Galloux** of Bureau Veritas, France highlighted the MSC schemes and the benefits of producers signing up to the Bureau Veritas scheme. Bureau Veritas also won the runner up Best International Trade Booth with Japan taking the first place in the awards ceremony.

The China and US factors

Jean-Yves Chow, Rabobank International in Hong Kong showed the China Swing Factor which is that China is now importing luxury food products such as salmon, tuna and lobster. Also labour costs in China are increasing faster than any other country in Asia and so exported products will become more expensive. There is also much more 'interAsia trade' than previously, with value added products particularly breaded seafood in demand. Rising incomes especially in China will mean that people will want to try new premium products.

K Shivakumar, consultant with SEAI talked extensively on the status and possible interventions of the US antidumping duty. This controversial and complicated subject involves selling in the USA below 'fairvalue'. In 2011, 47,000 tonnes of Indian shrimp valued at USD 500 million was sold to the USA, so factors affecting the pricing structure is extremely important. **Venguswamy Ramaswamy**, global



MPEDA highlighted 40 years in India's seafood business



Author, Eric Roderick is CEO of Fishgen presented on the global trends and introduced the YY male tilapia technology developed by Fishgen. He is involved in projects in more than 30 countries.



At the Bureau Veritas stand. Laurent Galloux (left) with Vinod Parashar, head operations in India (right) and visitors to the stand.



Thampi Sam Raj (fourth, right) showing special invited guests some of the new techniques for producing all male freshwater prawn at the RGCA trade stand.



Demonstration of tuna cutting and sampling at Moon Fisheries trade stand.

head of ION, Tata Consultancy Services in Mumbai, showed how ICT can create value for seafood exporters and processors. The main take home message is not to export raw materials to other countries to add value, but to do it in the producing country.

Tilapia and organic aquaculture

Dr Meenakumari deputy director general Fisheries, Indian Council of Agricultural Research (ICAR) chaired the aquaculture session. **Erdmann Wischhusen** chairman of WAB Trading International Germany said that the world market for organic aquaculture was 68% from the EU and only 14% from the USA. Germany is the largest consumer of organic products in the EU. He predicted a large growing market for organic shrimp, but cautioned against large premiums for organic products. **Dr Mathew Briggs**, director of Vannamei 101, Thailand, who gave a comprehensive overview of the shrimp industry in Asia, discussed on how to produce a premium product. **Eric Roderick** of Fishgen in the UK then gave an overview of global tilapia production, including tilapia products and market potential. With India poised to become a significant producer of tilapia, this was very opportune and there was a lot of interest from the delegates regarding Fishgen's YY male tilapia technology. Thampi Sam Raj, a very well know aquaculture expert said

that the diversification efforts in export orientated aquaculture in India covered all aspects of RGCA'S varied projects throughout India.

This seafood expo has grown significantly in recent years and the feedback from the organisers highlight another very successful event ensuring the continued expansion of the sector in India.



What can you expect from Aqua Culture Asia Pacific for the rest of 2012

Volume 8 2012			
Number	4 - July/August	5 - September/October	6 - November/December
Issue focus <i>Recent developments and challenges for the next step</i>	Food Safety & Traceability	Culture models	Hatchery & breeding technology
Industry Review <i>Trends and outlook, demand & supply</i>	Marine fish (Cobia/Sea bass)	Tilapia	Freshwater Fish/Prawn
Feeds & Processing Technology <i>Technical contributions influencing the final value of aqua feeds</i>	Feed enzymes Good manufacturing practices	Feed probiotics Post pellet additions	Novel feed ingredients Formulation
Production Technology <i>Technical information and ideas</i>	Recirculation Aquaculture Systems	Certification and Regulations	Hygiene & Food Safety
Aqua business <i>Feature articles</i>	Experiences from industry, including role models, benchmarking and opinion articles in shrimp/fish culture		
Markets	Market trends, product development and promotions at local and regional trade shows		
Show Issue <i>Distribution at these events as well as local and regional meetings</i> <i>*Show preview in prior issues</i>	TARS 2012 – Shrimp Aquaculture August 15-16, Phuket, Thailand AQUA 2012 , September 1-5, Prague, Czech Republic	17th China Seafood & Fisheries Exposition 2012 , 6-8 November, Dalian, China	



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Innovations at FIAAP, VICTAM and GRAPAS 2012

Together, the co-located FIAAP, VICTAM and GRAPAS 2012 tradeshow was the largest event for feed and grain processing industries in Asia.

This ninth event in Asia was held for the first time in BITEC, Bangkok from 15-17 February 2012. In comparison to the show in 2010, this was 40% larger and showed the importance exhibitors gave to the event and also the growing influence of the markets in Asia. The 166 exhibitors came from 29 countries.

Organisers Victam International BV reported that audited figures showed that over the three days of the exhibition, there were 6,198 visitors to the shows; an increase of 10% on the 2010 event, and over 550 delegates attended the conferences. The visitors came from 73 countries. They also said that

- Over one third of the visitors were CEOs, director or operational directors.
- 95% of the visitors intend to visit the show again in 2014.
- 48% of the visitors were interested in GRAPAS exhibitors.
- 52% of the visitors were interested in FIAAP, looking for feed ingredients and additives.

There were several concurrent events such as Aquafeed Horizons, the Thai Feed conference, Petfood Forum, GRAPAS and FIAAP conferences. Several companies had their own technical conferences. The event in 2014 will be held from April 8-10 in BITEC, Bangkok, Thailand.

A number of new companies introduced new products and have entered for the three coveted innovation awards. In our last issue, we featured two of them; the winner of the Aquafeed.com Innovation award, Wenger, USA and runner up Geelen Counterflow.

Asian Feed Miller Award 2012

Santeh Feeds Corp from the Philippines won the Asian Feed Miller Award 2012. This is an annual feed industry award initiated by Asian Feed Magazine and sponsored by Addcon of Germany.

"Santeh Feeds has been doing a great job in the Philippines to build up a top notch aquaculture feedmill. Its aquafeed products are not only said known for quality in the country, but also throughout Southeast Asia," said Kurt Wegleitner, chief marketing officer of Addcon and a judge for the award announced at Victam Asia 2012. A panel of judges selected the best four entries as the finalists for the award.

Along with Santeh Feeds, other finalists include PT Malindo Feedmill, Indonesia, Aftab Feed Products, Bangladesh and CJ Philippines Inc. Asian Feed Magazine initiated the award in 2010 to encourage innovative in milling operations among feedmillers in Southeast and South Asia.

There are a total of five judges for the 2012 award. The judges screen the candidates for their innovativeness in four categories including industry leadership, use of technology, quality control and safety and logistics. Addcon will sponsor two representatives of Santeh Feeds to



Recipient of the award in 2011, Dao Manh Luong (left), managing director of Austfeed passes the Asian Feed Miller Award 2012 to Baby S. Chua, AVP Systems and Quality at Santeh Feeds. On the right is Kurt Wegleitner.

visit Eurotier 2012 in Hannover, Germany or Victam International 2013 in Cologne, Germany.

Innovation awards

High resolution in-line analysis

Foss won the GRAPAS innovation award for its in-line flour production monitoring solution called Profoss™ Flour. The award was given to the company displaying the most innovative and economically beneficial equipment, process or service.

This uses NIR based analysis technology which ensures accuracy and reliability with measurements of ash, protein and moisture. The advantages include improved yield and profit achieved through: savings in raw materials; consistent product quality; higher value products for customers; increased energy efficiency and reduces the rework. In-line means that the system is integrated into the process control system. This is a more advance way to improve product consistency. It gives product quality close to target, reduced start up variation and alarms when there is out of spec production.

"This is not just for its technology but its broad application in flour milling, dairy powder, meal, feed and corn milling," said **Darren Robey**, international marketing manager, Grain and Milling.

Denmark based Foss is a leading provider of analytical solutions for the food, agricultural, chemical and pharmaceutical industries. It has proven technology for accurate and trouble free operations. It also offers a range of options to suit a business. (www.foss.dk).



Darren Robey at the Foss booth



Andritz Feed and Biofuel at Victam 2012

Essential oils mix to promote health and growth

The selection for the FIAAP Asia 2012 award for innovations in feed ingredients and additives sponsored by AllAbout Feed magazine was GrowNat™ MixOil™, manufactured by Animal Wellness Products - AWP s.r.l., based in Reggio Emilia, Italy. The founders of the company, established in 2002, have several years of experience in plants extract and in the field of animal nutrition. It has invested in R&D of unique and functional products for animal nutrition.

"The mission of AWP is improving the quality of finished products and we focus on clients who have these same goals. The emphasis of the company is the wellness concept, which is doing the best for quality and safety. We are here in Asia as it is a big and developing market and many producers are looking at upgrading and improving on the quality of their products," said **Anne Bornhauser**.

Grow Nat™ MixOil™ Aqua is a highly concentrated mix of essential oils created for aqua species. It can also be considered a flavouring as it stimulates digestion. A general improvement in the health status of the fish can be achieved. With better consumption, it will reduce feed costs and higher returns on investment. Studies show that there is general increase in survival rate, immune response and growth performance. Water quality in the pond environment improves and alleviates the use of treatments for disease. The product is available in liquid, powder and microencapsulated forms. In the microencapsulation process, the company uses ultrasound to assure the protection of the essential oils.

Two other products available for the Asian market are PreNat™, a natural antioxidant which can substitute for chemical antioxidants commonly used in fish/shrimp feed production such as BHT, BHA and ethoxyquin. A comparison on the antioxidant activity of Pre Nat with ethoxyquin in seed oils showed that the natural antioxidant at 400ppm has a higher peroxide value. The third natural product is the Toxinfibre™, a combination of essential oils and plant fibres.

"This complements Grow Nat/ Mix Oil and will give a higher absorption of aflatoxin B1. On its own, Toxinfibre binds mycotoxins in feed and in the gastro intestinal tract controlling fungi and moulds," said **Paolo Cristofori**. "It does not show any toxicity in tests conducted in France. It can be used in all commercial feeds including organic feed under the Natural Organic Product (NOP)." (www.awpint.com)

Plant extracts with organic acids and prebiotic component

Dr. Eckel GmbH won the AllAboutFeed Innovation Award at FIAAP 2012 with its Anta@Phyt line of feed additives whilst the Anta@Phyt Aqua

was a close second with the Aquafeed Innovation Award. This is one of the 'Discover Ecknowlogy®' concepts of the company.

As aquaculture continues to grow there will be a need to use alternative raw materials and resources for instance soybean meal instead of fishmeal and consumers are likely to insist on environmentally friendly production and safe products with consistent quality. It has been well established in animal nutrition in general that a healthy digestive system is crucial for optimal performance. Though the effect of the intestinal microflora is not as well known in aquatic species as in land animals, it has been shown that fish also depend on host microbiota interactions for immune responses and metabolic activity. With Anta@Phyt Aqua, Dr. Eckel has developed a line of feed additives that is uniquely suited to be used in aquaculture.

Anta@Phyt Aqua is a customised combination of special plant extracts with organic acids and prebiotic components that was developed for their efficacy and palatability in a wide range of species. The product was selected for fish and shrimp nutrition and is uniquely adapted to this purpose. Apart from prebiotics and acidifiers, it contains a group of plant based components that have already demonstrated their anti-inflammatory and antimicrobial activity in a number of *in-vitro* and *in-vivo* trials.

The acidifiers contained in Anta@Phyt Aqua have been designed to minimise odour and vaporisation of the acid. Specific carriers and an internally developed coating process allow for an optimal availability of the active ingredient in the feed. Yeast cell walls and nucleotides, which also play an important role in immune stimulation in fish nutrition, round off its composition.

Anta@Phyt Aqua is a tool to improve gut function and health in aquatic species. The key selling points include an improved growth performance due to the optimised combination of active ingredients, improved feed intake, enhanced digestion and absorption, antioxidant and immune stimulating activity and antimicrobial effect. (www.dr-eckel.de)



The AWP team, Paolo Cristofori and Anne Bornhauser



James Chang, president of Idah Machinery (right) and Mars Huang, Avantron Micro Company, the marketing company of Idah Machinery

A contra twin screw extruder

During the show, Idah Machinery of Taiwan, submitted this ContraTwin screw extruder for the Aquafeed Innovation award. The extruder has patents and the innovation is line with the company's development focus to reduce energy costs in feed processing. The machine uses smaller horse power motor and the simple mechanism allows for a footprint reduction.

According to **Mars Huang**, executive vice president, in contrast with a co-rotating twin screw, this machine reduces pressure at the gaps for water and steam injections. It also has lower energy costs with the shaft running at 380 rpm in comparison with 500 rpm or higher for a co-rotating twin screw extruder. ContraTwin carries new screw designs and with the new configuration it consumes more thermal energy than mechanical energy. This low speed and thermal extrusion gives ContraTwin a multiple of benefits: lower energy consumption, less wear and wider product characteristics. The capacity is 4-10 tonnes per hour of 5.0mm diameter pellets and is suitable for the processing of floating, slow sinking and sinking feed for aqua and pet feeds. Feed sizes can be from 0.8mm to 27mm. The whole system comprises the ContraTwin screw extruder with a stainless steel stirring feeder to feed material evenly and a DDC pre conditioner. The pre conditioner with



Idah's Contra Twin Screw Extruder

reverse rotation and design paddles in stainless steel lasts longer and also keeps the material longer, up to 150 seconds retention time.

"In an extruder set up in the Netherlands three years ago, we showed that we can make highly sticky ingredient when heated and add colour to pet food such as for the rabbit, dog, cat and bird. The relatively high priced food grade stainless extruder must be able to process a variety of food types to be cost effective. The reduction in wear and tear in the screw gear box brings cost down, lower than with a co-rotating twin screw. There are also advantages over a single screw extruder. There is no cross wear in the design and it is less sensitive to wear. The extruder has lasted 3 years according to a user in Holland, and in Vietnam it has been in use for 6 years in fish feed production."

Idah machinery has been developing extruder technology for more than 20 years. It is already well known for its shrimp pellet mills in Asia. It also provides turnkey solutions. The processing of aqua feed poses new challenges with the variety of raw materials and the company considers it vital to develop an extruder which is suitable for many types of raw materials. The company says that ContraTwin screw extruder is its best solution.

Main principle to reduce energy

This was the main aim of this innovation. In a normal twin shaft extruder, the energy inputs are 46% for preconditioning steam, 23% for extruder or 15% for extruder with steam and 15% for twin shaft conditioning. This is in line with Idah's two innovation principles.

"One is with the process; to lower capital cost by energy reduction and wear cost and the other to improve production rate, quality and consistency. The same concept is applied to our vertical cross counter-flow rotary dryer VC²R which we are also introducing at this show. It has the lowest steam consumption at 230kg/hr (8 bar, 170°C) to dry 1,000kg of feed.

"The vertical dryer technology is already in Europe and last year, we bought the technology to manufacture this in Asia. The key point of the vertical dryer is to keep feed moving as it removes moisture. It removes moisture with tolerance of $\pm 0.25\%$ across the bed as compared to the belt and box dryers which attain $\pm 2\%$ and $\pm 1\%$, respectively, of moisture tolerance. Thus, it is precise and cost wise, the processor can gain when making up packing weight. We have sold one dryer to a company producing shrimp and fish feed. This dryer is particularly useful for extruded fish feeds when the mix has 25% moisture and we need to remove moisture for the final feed with 11% moisture. For pelleted shrimp feeds, we are talking about a removal of small amounts as the wet pellets contain only 15% moisture. The dryer has a small footprint of 9m²," said Huang.



Sam Soh, Gold Coin group (right) and Dr Fuci Guo, Alltech, Malaysia.



TAT managing director, Channarong Preechakul (left) and Yiannis Christodoulou



Buhler's colourful pelletiser was sold as is



Dr HC Chin, Singapore (right) with Hidajat Handaja and Bambang Setyawan (left), PT Suri Tani Pemuka, Indonesia.



Nancy Chou (left) and Vicky, Nachang Lifeng Industry and Trading Co Ltd. Lifeng has LF synbiotics and lysozyme 98% for aqua feed production

Queue Plus Software

Agentis Innovations and its strategic partner, TAT Energy and Engineering, Thailand received recognition for their innovative feedmill software Queue-Plus as a commended product in the GRAPAS award.

According to Agentis Innovations president **Yiannis Christodoulou**, "We understand the complexity of raw material and finished feed transport in Asia Pacific because of the reliance on bagged products. Recognising this fundamental and important difference in the operation of many Asian feedmills, Queue Plus was developed to provide an accurate estimated time to pick up and load each truck and the number of bags for each feed type to be loaded. This innovation helps to schedule the most efficient delivery assignment for all drivers and trucks and reducing on-site traffic congestion. Queue Plus ensures the best utilisation of feed distribution staff to expedite the load out process and eliminate human error."

Christodoulou said that "Agentis Innovations and TAT work closely with customers to understand their specific needs in terms of the degree of automation required within the feed production process, the supporting hardware and data reporting formats. As a result of our technology and market approach we are realizing strong demand for our complete feed mill automation control system, Smart Feed Mill".

Mill Plus and Smart Feed Mill is a fully integrated and complete solution for automation of the mill process control and data analysis system including raw material receiving, grinding, batching and blending, micro dosing, conditioning/pelleting, cooling, fat coating and finished product loading and packing, including bags which are common in many developing regions within Asia Pacific. The information allows for full traceability and can be automatically incorporated into Management Information Systems.

Technology solutions

Christodoulou recently founded Agentis Innovations to provide and develop technologies that automate manufacturing processes and integrate data collection for the livestock, aquaculture, petfood and associated industries (grain milling and premix, food and biofuel plants).

"Together with TAT, we work closely with client's to identify and realise their operational needs prior to, during and after the projects are completed, including configuration, training and ongoing real-time service. Agentis Innovations fully understands that service can be just as important as the software, which is why our service doesn't stop once the installation is complete. We are proud to offer a 24/7 service hotline, remote training support, and a comprehensive annual maintenance package", he added. (www.agentisinnovations.com)



Jan Koesling at the Bayer booth

A consolidation of businesses

Bayer Health Care South East Asia and Dr. Eckel GmbH, both exhibiting at this event, had several portfolios to market under its transforming aquaculture program.

In the past 20 years, Bayer AP has been strong with feed additives and premixes. Now it has partnered with other businesses and expanded its presence in the Asian region. It still strives as the 'best in class' in the feed additive business where it is present, said Dr Jan Koesling, regional manager based in Bangkok.

"During the past years we have added to our portfolio, three more technology platforms, Clariant (formerly Süd-Chemie AG), Agraquest Inc and Dr Eckel GmbH. These three companies have progressive nutraceutical business development of toxinbinder, direct fed microbials, enhanced organic acids and phytogenics. Latibon®Plus ME from Dr. Eckel GmbH and an additional endotoxin claim for Toxisorb®Premium are two products launched in 2011 which are presently gaining importance in this market.

"For the aquaculture and aqua feed sectors, there are products such as Microax, an algal derived astaxanthin which currently has most of its application as a human nutraceutical. The animal application development in Asia for tilapia and shrimp is ongoing. Significant interest in such products has been indicated by feed mills in Asia."

Quality analyser

At the end of 2011, Bayer Animal Health, in cooperation with Bayer Technology Services Bayer HealthCare launched a pilot customer service in mycotoxin diagnostics using the Bayer Quality analyser (BQA). This is operated by the Bayer Microlabs. It has been validated to analyse 4 to 6 mycotoxins including DON, ZEA, OTA and T2 at a time in corn, corn gluten, barley and wheat.

Koesling explained that the first machine was installed in Malaysia. A non-professional can easily learn in 20 minutes how to use the plug and play machine. It is a versatile method which does not require a special laboratory facility to be operated accurately. It can analyse with an externally validated method and give quantitative calculations on the value. This is done in 20 minutes after sample extraction and pipetting onto a Bayer Micro Lab (BML) chip. A method extension for the BQA to analyse processed materials and finished feeds can easily be added, for the quality control of finished products.

Transforming aquaculture

Bayer AP has a new contract relationship with Tasmanian, Australia based AQ1 systems. "They have a real time feed management system which uses sounds. The cooperation of both companies facilitated to establish the commercial pilot in intensive farming of *P. vannamei*. Further trial work confirmed as 'proof of concept' the usefulness of the machine for instant quantification of shrimp feed palatability. The commercialisation of sound feeding system in Asia has been started and Bayer is able to offer the system included in product sales packages. (www.bayerhealthcare.com)

Innovative health solutions

Novus Aquaculture launched a new product and discussed 'How important is the health of your animals?' at a seminar. New to the aquaculture market in 2012, Previda® prebiotic solution is a unique product with demonstrated growth enhancement, improved survival rates and increased feed efficiencies when fed in aqua diets.

Ramakanta Nayak, Novus sales and marketing manager for aquaculture in Asia, said, "The mode of action of Previda builds on the traditional and well-known effect of specific oligo-saccharides (OS) on gut flora and pathogen binding, but expands it to a whole new level of practical functionality. The unique characteristic is that it is not comprised a single OS, but rather of a combination of OS including galactose, mannose, fructose and xylose, which have the potential to inhibit a broader range of pathogens than single mannan-oligosaccharides (MOS) or fructo-oligosaccharides (FOS). Studies across multiple fish species and shrimp show that Previda effectively enhances resistance to stress, growth and feed conversion ratio in aquatic species."

Dr. Anant Bharadwaj, aqua nutritionist at Novus, discussed how trace mineral deficiencies can impair immune status, overall health, fitness and performance. Mintrex® chelated trace minerals is an efficient solution for functional mineral nutrition. Recent studies in the pangasius, Japanese sea bass, olive flounder and Pacific white shrimp, all point to the benefits of using this as a source of bioavailable mineral nutrition as compared to other forms of trace minerals.

"Due to the true chelation of trace minerals in the Mintrex molecule, we can ensure that trace minerals are directly delivered for absorption at the brush border membrane of the enterocytes in the intestinal lumen. The chemical functionality effectively reduces antagonistic effects from other minerals and anti-nutritional factors such as phytic acid. In short the chemical functionality of the Mintrex molecule allows better mineral nutrition at lower inclusion rates. Our studies prove this mode of action and the physiological benefits such as higher growth, higher immune responses, and lower feed conversion ratio," said Bharadwaj.

Dr. Ei Lin Ooi, manager of Novus Aqua Research Centre in Vietnam focused on active plant components as a powerful tool for health management in aquatic species, largely due to their recognised antimicrobial properties. Next Enhance® 150 is a source of thymol and carvacrol, which are nature-identical and protected through proprietary encapsulation technology. Plant extracts can be highly volatile after extraction, and rapidly degrade during storage and ration mixing. However, the active ingredients in the product are protected by two layers of a unique, patented coating.

According to Ooi, "Our studies across multiple species have shown consistent and efficacious results. The functionality is assured by its strong antimicrobial activity coupled with enhancement of immune function, as demonstrated by several challenge studies against *Vibrio* sp. and *Aeromonas hydrophila* and other pathogens as well as other response variables such as macrophage phagocytosis and prophenoloxidase cascade (in shrimp)." (www.novusint.com).



The audience at the Novus aquaculture seminar



THE AQUACULTURE ROUNDTABLESERIES™ 2012

A shared vision for aquaculture in Asia



SHRIMP AQUACULTURE – SHAPING THE VALUE CHAIN

15-16 August 2012, J W Marriott Phuket Resort & Spa, Phuket, Thailand

TARS 2012

An unprecedented opportunity for multiple stakeholders!

Shrimp aquaculture has crossed the threshold to become an industrial business with a value chain starting from breeding and genetic selection to hatchery; farming and health management; feeds and feeding and processing to marketing and branding. However, this value chain suffers from challenges within each of its segments to the integration of all these segments.

TARS 2012, one of the industry's foremost opinion-leading events, will take a holistic approach to tackle these challenges. The meeting presents a neutral forum for multiple stakeholders to come together, and through shared knowledge and expertise, provide substantial input to improve the sustainability of shrimp production in Asia. This will be critical as the industry faces economic uncertainties and vulnerabilities resulting from the changing market conditions, including food safety, quality standards, and the threat of diseases.

TARS 2012 targets the participation of key players in the shrimp culture supply chain – from geneticists to hatchery managers, shrimp culturists, shrimp feed producers, processors and integrators.

The **Aquaculture Roundtable Series (TARS)** is designed as a series of roundtable sessions focusing on specific sectors of the aquaculture industry. Its aim is to provide a platform for all stakeholders to share knowledge and expertise in the different aspects, prioritise areas for R&D and formulate a new direction for the sector in light of current and emerging challenges facing the industry.

Dialogue with Experts!

Plenary Session: *Where Are We Today?*

A host of international experts will present an overview of the state of the shrimp aquaculture industry, current knowledge, trends and emerging challenges impacting the various segments of the **shrimp value chain** in Asia and the global arena.

Breakout Session: *Where Do We Want To Be Tomorrow?*

Breakout groups will deliberate on challenges, identify opportunities, and propose strategic directions to steer the sector forward. The discussions will focus on:

- breeding and hatchery management
- culture and health management
- feeds and feeding
- marketing, branding and certification

Registration

Pre-registration is required.
Walk-ins are not encouraged.

To book your space now, register online at
www.tarsaquaculture.com/registration

Limited to
200 participants only
Register now!

Early Bird Registration extended to 20 June 2012

* Fees include cocktail reception, tea breaks,
lunches and conference materials.

For more information on Program and Speakers, visit
www.tarsaquaculture.com/program_highlights
or email conference@tarsaquaculture.com

Organisers:



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www.tarsaquaculture.com

Industry experts form SMART Aquaculture consulting group

SmartAqua is re-launching itself as a one-stop aquaculture consulting model consisting of five highly experienced individuals covering a wide spectrum of aquaculture disciplines. The team focuses on providing a service that delivers real performance improvements with tangible financial outcomes to the aquaculture industry. The five team members, with combined experience of over 100 years, have lived and worked across the globe including Australia, Scotland, Canada, USA, Chile, Norway, Greece, Ireland, Japan, Singapore, Indonesia, and New Zealand.

The core team, Alastair Smart, Mark Asman, Alistair Brown, Scott Nolan and Tim Kildea cover skills in farming and aquaculture business management, nutrition, processing, value adding, food safety, harvesting, quality, environment, welfare, health and biosecurity. The team has worked with a variety of aquatic species such as Atlantic salmon, Pacific salmon, kingfish, barramundi, tuna, mussels, abalone, prawns, and even crocodiles.

"The concept has been a year in the making with all of us seeing a need for aquaculture advice coming from people with real hands-on industry experience – no one person can deliver the range of skills required so we joined forces," said Asman, ex-COO for Tassal.

The group will operate globally with a focus on the fast growing Australasian Industry. As Alastair Smart sees it, "we see a lot of growth in the industry but the skill and expertise is not always able to keep up to the level required for global best practice. We believe we can help organisations focus their efforts in areas that will add to their bottom line." With their combined skill set, this team will be



The smart aqua team of (from left) Alastair Smart, Tim Kildea, Scott Nolan, Alistair Brown and Mark Asman make up a combined aquaculture experience of over 100 years.

able to assess and evaluate a company's performance in a variety of areas, recommend a way forward, and participate in implementation. Other services include "smart" training, due diligence in mergers and acquisitions, and technical advice to boards.

SmartAqua, due to its larger network, has alliances with several other aquaculture service companies based in the northern hemisphere which will complement and expand the service they can offer. (Email: smartaqua@smartaqua.com.au Web: www.smartaqua.com.au)

Advanced biotechnological products for Asia

Chennai, India, based Poseidon Biotech was formed in 2004 as a part of the Poseidon group to focus mainly on advanced biotechnological products needed for the aquaculture industry. The company founders are R. Srinivasan and S.Muthukaruppan, technocrats in aquaculture and biotechnology. Both started their careers in 1995 by providing consultancy services in aquaculture through the company Poseidon Aquatch Pvt Ltd. Each have more than 25 years of field experience.

Poseidon Biotech has developed a range of products from probiotics, sanitisers, feed additives, immunostimulants to diagnostic kits for aquaculture. The other group company, Best India Marine Harvests (see page 12) is involved in shrimp hatchery operations producing vannamei shrimp post larvae.

The company is also associated with well-known institutions such as Anna University, Madras University and Department of Biotechnology for their R&D work. ISO 9001:2008 certified, it is recognised for research work by the Department of Scientific & Industrial Research, Ministry of Science and Technology, Government of India. Poseidon Biotech has its production facility in Chennai and is in the process of building a new state-of-the-art facility with expanded capacities for future use. The company assures that the 50 strong technical and marketing staff are experienced and well

trained and have the full support of farmers and hatchery operators using their products.

It has a network of dealers all over India. IFB Agro Industries, Onaway Industries, Tej Aqua feeds, Sakthi Aqua Farm, HN Indigos, Priya Aqua farm, SS Trading, Gayatri Sea Foods, Vaisakhi Biomarine, BMR Industries, Asian Aqua Feeds & Needs, Sai Sandesh Aqua feeds, Winner Aqua Agencies and SADA Aquatech are some of their leading dealers/clients.

The current range of products include THIONIL (soil probiotic), PRO-TECT (water probiotic), B4 (new generation probiotic), Hi 5 (hatchery probiotic), Immuzone (immunostimulant) and Ex-Am (new generation detoxifier). The major market for the aquaculture products are farms in India. Thionil, Pro-TECT and Ex-am are also used by farms in Indonesia, Vietnam and Thailand. In Malaysia, Biologic P1 prepared for treatment of palm oil mill effluent (POME) and composting is already being sold successfully in Malaysia through its alliance with BAR Formula Sdn. Bhd.

Their future plan is to enter into the business of probiotics and bacterial inoculums for fields other than aquaculture, recombinant protein and industrial enzymes. (Email: contact@poseidonbiotech.com Web: www.poseidonbiotech.com)

AQUA

2012



Global Aquaculture

SECURING OUR FUTURE

AQUA 2012 is the combined meeting of the European and World Aquaculture Societies, incorporating the "Aquaculture Europe" and the "World Aquaculture" events



The beautiful city of Prague – a prime central European location with easy access

The AQUA 2012 program covers all topics and all species from warm water, cold water, freshwater and marine habitats. So if you work in Europe, the Americas, Asia-Pacific or elsewhere in the world, you will find everything at AQUA 2012



Feedstuffs, Feeds and Feed additives
Molluscs & other Invertebrates
Marine Shrimp



Environment, Biodiversity
Climate change
Standards & Certification
Production Systems



Marine Fish Culture – Coldwater & Warmwater



Seaweeds and Algae
Ornamentals
Capture-based Aquaculture
Other Species Culture



General Finfish Culture
Freshwater Fish Culture



Economics
Education
Policy
Regulation



Animal Science
Health & Welfare
Breeding
Genetics



September 1-5, 2012 Prague, Czech Republic

www.was.org • www.easonline.org • worldaqua@aol.com

Krill board ARK

A group of eight krill fishing companies have formed the Association of Responsible Krill Harvesting Companies (ARK). This is to help and support CCAMLR in managing the Antarctic krill fishery.

CCAMLR is the Convention on the Conservation of Antarctic Marine Living Resources which came into force in 1982, mainly in response to concerns of that an increase in krill catches in the Southern Ocean could have a serious effect on the populations of krill and the marine populations which feed on it. ARK will coordinate and cooperate with CCAMLR on research and information on krill. Along with this will be information gathered on the krill fishery itself and its impact on the Antarctic ecosystem. The aim is to contribute to CCAMLR's work to manage the krill fishery on a sustainable basis.

In the late 1960s, vessels from the former Soviet Union were in the Southern Ocean to see if there was potential in fishing for the world's largest biomass. Despite the Soviets finding major problems in trying to harvest the zooplankton, production rose to 528,000 tonnes by 1982. The industry collapsed for the most part after the demise of the USSR.

However, during the last 11 years the Antarctic krill industry has picked itself up and is expanding with catches around 200,000 tonnes, shared mostly between Norway, South Korea, Japan and Poland. With more nations interested in krill fishing, more effort is required to manage the fishery.

Sigve Nordrum, vice president of Aker BioMarine, said that Aker BioMarine and the other founders of ARK are in the krill industry for the long term. "The nature of the krill business makes it by default a business with a long term horizon," Krill fishing is a



Sigve Nordrum

highly specialised and demanding fishery, requiring huge upfront investments. Combined with this is a slow market development and product adoption.

"We acknowledge the need for more data and information on the fishery, krill stock and Southern Ocean ecosystem. So how can the fishing companies contribute to a sustainable krill harvest going forward?"

Dr Simeon Hill, British Antarctic Survey, said, "The sustainability of krill fisheries has become a hot topic with many commentators willing to pronounce on whether krill fishing is or is not sustainable. This has real world implications. While current krill catches are a small fraction of the available biomass, there are still issues to be resolved to manage the risks associated with further expansion of the fishery."

It was pointed out that ARK is not an industry association fighting a political battle for the fishing companies, but instead it wants to accomplish the following:

- Be a centre of information collection and distribution between members and CCAMLR entities
- Promote research for the sustainable harvest of Antarctic krill
- To achieve observer status in CCAMLR
- Establish good links with national delegations

While all eight companies are onboard ARK with these goals, how they will be accomplished though is still under debate. Aker BioMarine is the first and currently only participant in the krill fishery to receive the MSC certification because of its commitment to environmental harvesting, managed catch levels and responsible approach to fishing. In addition, the company actively collaborates with environmental organisations such as WWF Norway to adopt and promote new standards for operations where the health of the environment is foremost, including Aker BioMarine's Eco-Harvesting.

Appointments

New technical manager for team in Thailand

Recently, Dr. Supranee Punpang, a graduate of Kasetsart University in Bangkok, started to support ADDCON Asia Co. Ltd in Thailand. Supranee's professional background is in the field of agricultural biotechnology and animal nutrition and she will focus on ADDCON product promotions for the Thai market in aquaculture, poultry and swine industry. Furthermore, she will be contributing to the improvement of feed raw materials and feeds by promoting organic acid blends to inhibit moulds and yeasts following the green chemistry concept of the German based company.

"Supranee is another asset for the young ADDCON team in Asia as she strongly combines scientific strength with progressive sales enthusiasm", said Dr. Kai-J. Kühlmann, Application marketing manager of ADDCON Asia Co Ltd. "We wish her a great start into her new field of professionally contributing to the growth of the Asian agriculture industry."



Dr. Supranee Punpang

NEXT
ISSUE

July/August 2012 issue will feature

- Food safety & traceability
- Black tiger shrimp/marine fish
- Feed enzymes
- Recirculation aquaculture systems

Show Issue

- TARS 2012 -Shaping the Shrimp Aquaculture Value Chain, 15-16 August, Phuket Thailand
- AQUA 2012 , September 1-5, Prague, Czech Republic

Deadlines: Technical articles – June 1, 2012
Advert bookings – June 8, 2012

Contact information: Email: zuridah@aquasiapac.com ; enquiries@aquasiapac.com

On-farm responsible aquaculture program

During the traditional GLOBALGAP press conference at the European Seafood Exposition (ESE) in Brussels in April, Chairman Nigel Garbutt announced several developments relating to the certification program.

“With more than 2 million tonnes of certified seafood from aquaculture farms in 22 countries, the program offers more products from certified farms than all other aquaculture labels combined. This has quadrupled since 2010 and now covers more species than any other major program. Salmonids (including rainbow trout), shrimp, tilapia and pangasius, barramundi, pike-perch, sea bass and sea bream are all included, with molluscs soon to come,” said Garbutt

“We have extremely good partnerships between the production side and those in marketing and retailing. This partnership can be defined as reaching consumers in the most practical way and realistically to start the implementation of on-farm sustainable aquaculture.”

Aquaculture assurance from feed to fork

Version 4 is intended for any aquaculture species from the finfish, crustaceans and molluscs, available on our product list based on demand. Now seafood buyers can find GlobalGAP certified salmon, rainbow trout, shrimp, tilapia, pangasius, barramundi, sea bass and sea bream.

“The current Version 4 is the result of four years of research and consultation. Throughout the 4-year period, feedback from 500 stakeholders worldwide was obtained, making the standard focused on consumers’ needs yet achievable on the farm. We have taken a realistic approach with safety and sustainability and focus on food safety, environment and ecological care, worker and animal welfare and traceability. Another aspect is how we take the certification system to the entire production channel; from the sustainable issue right through to the consumer in an open and transparent way. I think that it is crucial for all to see what is been done in the industry. But we know that we still have a long way to go for responsible aquaculture,” said Garbutt.

“Throughout all the drafts up to the final version, the technical committee used the FAO Technical Guidelines on Aquaculture Certification as a reference. As aquaculture in several countries is by small scale producers and we want to support them as much as we possibly can for responsibly produced products. We have been developing small holder interpretation guidelines and basic ‘how-to’ implement GlobalGAP standards in many different languages.”

The choice for the producer on which certification to use was explained by Cristian Swett, general manager, Alimentos Multiexport Foods Group, Chile. The company produces 60,000 tonnes of salmon yearly. “In 2010, our certification was more towards a management system which did not consider animal and staff welfare. To fit into the requirements of customers in Europe, the company chose GlobalGAP in 2011.”

Reaching out to consumers

To meet growing seafood buyers’ demands, the program has developed a new branded traceability logo. An integrated QR code will lead to the GlobalGAP website www.my-fish.info, where consumers will find



Nigel Garbutt (left) and Trygve Berg Lea

information on responsible aquaculture practices. All of these are validated during the annual on farm certification process.

Baicy Terbrüggen, Sustainability and Environment, Corporate Quality Management - METRO AG and vice-chairwoman of the GlobalGAP Aquaculture Technical Committee explained, “the QR-Code is an effective way to give our customers immediate information and thus transparency on products available in our stores.”

The Compound Feed Manufacturing standard

The Chain of Custody – the certification of the supply chain – is an important part of the aquaculture standard. It identifies the certification status of the product through the entire process, from producer to retail counter. Compound feed suppliers have also responded to consumer demands and certification has been developed and updated to address these needs. GlobalGAP launched the Compound Feed Manufacturing standard in December 2011, with a new section covering the responsible use of raw materials that focuses on the responsible supply of fishmeal and fish oil.

Through the new updated version, the CFM standard supports the feed industry in assigning priority to the responsible and sustainable sourcing of this important raw material.

Trygve Berg Lea, International product manager, Skretting group is in the working group in Norway and said, “The standards address elements which are important in the value chain. More and more Skretting factories such as those in Turkey and Norway are now GlobalGAP certified. Those in Chile and Canada are working towards certification. The standards are not niche standards but are industry standards.”

In the case of the feed producer Ocialis Vietnam, Alexandre Beljean, Global Aquaculture Business unit manager, Invivo NSA, France, said, “Since 2011, with certification, it has been helpful to explain to customers what the fish are eating. It has helped them recognised the high quality feeds of the brand and the way forward towards responsible farming of the pangasius in Vietnam.”

Dr Pham Anh Tuan, Ministry of Agriculture and Rural Development, Vietnam said that the national working group made the standards relevant to the local industry. In two years, GlobalGAP has made a difference in Vietnam with improvements in aquaculture systems and building up capacity. The standards are available in Vietnamese.”



Alexandre Beljean (left) and Mark Nijhof, director R&D, chief sustainability officer, Heiploeg Group, The Netherlands



Pham Anh Tuan (right) with Cristian Swett



THE AQUACULTURE ROUNDTABLESERIES™ 2012

A shared vision for aquaculture in Asia



SHRIMP AQUACULTURE – SHAPING THE VALUE CHAIN

15-16 August 2012, J W Marriott Phuket Resort & Spa, Phuket, Thailand

Shrimp aquaculture is one of the fastest growing forms of aquaculture and production was estimated to rise to 3.3 million tonnes in 2011. Most shrimp aquaculture occurs in China, followed by Thailand, Indonesia, India, Vietnam, Brazil, Ecuador and Bangladesh. The majority of farmed shrimp is imported to the European Union, United States and Japan. Its growth has generated substantial income for countries – particularly in Asia and Latin America. At the same time, it has also raised concerns about how shrimp farming affects the environment and society.

"We cannot stress enough how shrimp aquaculture needs to make the quantum leap into the next phase of growth but to be successful, it has to be an industrial supply chain that is self-regulated", says Dr Zuridah Merican, editor of *Aqua Culture Asia Pacific Magazine*.

Shrimp aquaculture, she adds has crossed the threshold to become an industrial business with a value chain starting from breeding and genetic selection, to farming and health management; feeds and processing to marketing and branding. However, this value chain suffers from challenges within each of its segments to the integration of all these segments.

As one of the industry's foremost opinion-leading events, **The Aquaculture Roundtable Series (TARS 2012)** focusing on **Shrimp Aquaculture – Shaping the Value Chain** aims to take a holistic approach to tackle these challenges. This conference is a follow-up to the successful inaugural series (TARS 2011) held in Singapore where 180 representatives from Asia convened.

Unprecedented opportunity for multi-stakeholders

TARS 2012 presents a neutral forum for multiple stakeholders from the public-private sector, academia and nongovernment organisations to share new knowledge and expertise, and provide substantial input to improve the

sustainability and profitability of shrimp production in Asia. This will be critical as the industry faces economic uncertainties and vulnerabilities resulting from the changing market conditions, including food safety and quality standards, and the threat of diseases.

"Learning from the disease issues facing many farms in the region, no man is an island. We have witnessed how occurrences in one country can affect another. We need a concerted effort to find solutions," Merican reiterates.

International faculty of experts

Following the same format as the inaugural roundtable, TARS 2012 will host a plenary session facilitated by international experts from Asia, the Americas and Europe. They will present an overview of the state of the shrimp aquaculture industry, current knowledge, trends and emerging challenges impacting the various segments of the shrimp value chain in Asia and the global arena.

The meeting will also incorporate a breakout session focusing on five areas to provide the opportunity for discussions and deliberations to take the shrimp industry forward. Participants will brainstorm and identify key priority areas and challenges. The result will be a self-initiative to direct the development in a guided manner, yet allowing for the opportunity to 'think outside the box'.

Who will benefit?

TARS 2012 will be held from August 15-16, 2012 in Phuket, Thailand and targets key players in the shrimp culture supply chain – from geneticists to hatchery operators, integrators, producers and technicians, feed producers, seafood processors, marketeers, to suppliers of equipment and services, academia and governments.

TARS 2012 is organised by Aquaculture Asia Pacific Magazine and Corporate Media Services, and supported by the Department of Fisheries, Thailand.

Program Highlights

Growth, disease resistance, and reproduction: so many traits and so little time



Shaun M. Moss

"Selective breeding can improve commercially important traits in shrimp but there are challenges associated with current approaches to genetic improvement. I will explore the relationship between commercially important traits (e.g. growth and disease resistance), identify challenges that shrimp farmers face in trying to maximize the genetic potential of shrimp in an uncontrolled environment, and suggest ways that biosecurity can help in realizing this genetic potential..."

Current major disease threats for Asian shrimp farmers



Tim Flegel

"For both vannamei and monodon shrimp in Asia, viral pathogens such as WSSV and YHV have caused the most severe production losses. Since 2009, there is acute hepatopancreatic necrosis syndrome or AHPNS, sometimes also called early mortality syndrome (EMS). For *Penaeus vannamei* only, a threat is infectious myonecrosis whilst that for *P. monodon* only, it is the monodon slow growth syndrome (MSGS). HPV and MBV may be problematic when captured *P. monodon* are used for post larval production without the implementation of proper preventative measures..."

Balancing basic pond management and biosecurity systems to reduce farm losses



Pornlerd Chanratchakool

"In the past ten years, biosecurity protocols have become a crucial part of our standard operation practices in both hatchery and grow out facility to reduce or prevent disease risks in shrimp farming. However, serious diseases outbreaks still occur in many farms, notwithstanding the presence or not of full biosecurity, especially when the weather fluctuates. This contradiction may imply that other factors may have a stronger impact to trigger an outbreak..."

Extruded feeds for better management in automated and intensive systems



Joe Kearns

"We have new developments in extruders which increase capacities while making specifically heavier densities. Water durability is improved with no added binders. Protein sources are not limited. These machines truly allow for least cost formulations to be made into feeds yielding quite acceptable feed conversion ratios. Testing is underway now to show the grow-out results of extruded and pelleted shrimp feeds compared against each other in automated and intensive systems..."

More more details on program, presentations and speakers at http://www.tarsaquaculture.com/program_highlights.html

Program (at press time)

Day 1 Wednesday, August 15 2012

Breeding and Hatchery Models

- **Growth, disease resistance, and reproduction: so many traits and so little time** – *Shaun Moss, Oceanic Institute, USA*
- **Taming the tigers: a sense of urgency** – *Ravi Kumar Yellanki, Vaisakhi Bio-Resources, India*
- **Hatchery protocols – A comparison of Asian and Latin American models** – *Olivier Decamp, Inve Aquaculture, Thailand*

Managing Shrimp Health

- **Current major disease threats for Asian shrimp farmers** – *Tim Flegel, Centex Shrimp, Faculty of Science Mahidol University, Thailand*
- **Balancing basic pond management and biosecurity systems to reduce farm losses** – *Pornlerd Chanratchakool, Novozymes, Thailand*

Nutrition and Feeds

- **Extruded feeds for better management in automated and intensive systems** – *Joe Kearns, Wenger Manufacturing, Inc, USA*
- **Nutrition and health for the shrimp** – *Jacques Gabaudan, DSM, Thailand*

Culture Systems and Management

- **Probiotics in shrimp farming: do they work?** – *Pedro Encarnaçã, Biomin, Singapore*
- **Future of biofloc technology in Asia** – *Nyan Taw, Blue Archipelago, Malaysia*
- **Extra nutritional additives: feed is more than a source of nutrients** – *Peter Coutteau, Nutriad Belgium*

Day 2 Thursday 16 August 2012

Marketing, Branding and Certification

- **Case study of Thailand: shrimp to the world** – *Panusuan Jamnarnweij, Thai Frozen Foods Association, Thailand*
- **Evolution of the European shrimp market and the importance of the right certification** – *Herve Lucien-Brun, Consultant, France*

Breakout sessions

Where will we be tomorrow? The challenges facing each segment in the supply chain are varied. The participants will form break-out groups to identify key challenges, priority areas for improvement and recommend strategies to take the industry forward. Led by a facilitator, there will be multiple groups brainstorming on the suggested areas below, namely:

- Breeding and hatchery management
- Shrimp health
- Culture systems and management
- Nutrition and feeds
- Marketing, branding and certification

Review session

An interactive session where representatives from each break-out group will highlight key findings on challenges, identification of priority areas for improvement, and recommended strategies to steer the shrimp sector forward. Common factors will be identified, summarised and prioritised in a report that will be accessible to all participants.

Organisers:



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Registration

The number of participants will be limited to 200. Pre-registration is required. Walk-ins are not encouraged. Register online or complete the registration form to reserve space. You will be asked to specify your preferred area of interest for the breakout session.

For more information on registration, program and presentation update, visit www.tarsaquaculture.com Email: conference@tarsaquaculture.com

Probiotics in shrimp farming: do they work?



Pedro Encarnaçã

"Maintaining the balance of critical parameters in ponds is a fundamental requirement for successful aquaculture. Well-defined probiotic strains are able to reduce pathogenic bacteria, thereby enhancing performance and efficiency in production. However, the success of probiotic application depends on the clear understanding of the bacteria strains used, its function, the concentration and management used..."

Hatchery protocols: a comparison of Asian and Latin American models



Olivier Decamp

"There are different hatchery protocols used in selected Latin American and Asian countries, including the various biosecurity steps and contingency plans. I will also discuss broodstock management, approaches taken towards the management of algae, Artemia and diets and recirculation or multi-phase systems and put forth recommendations for the improvement of hatchery production..."

Evolution of the European shrimp market and the importance of the right certification



Hervé Lucien-Brun

"In 2011, the EU remains the largest shrimp market in the world but it showed a slight decline of 1.2% compared to 2010. Consumption rose 5% in volumes in Spain but only 1.2% in value, possibly reflecting importation of small size shrimp. In all EU countries, the market of certified shrimp is growing. But even if the labelling of the products allow shrimp to reach market with better prices, it is really difficult to choose the good labels in this market "jungle". It is very important to analyse the benefits of the selected label and the costs..."

Future of biofloc technology in Asia



Nyan Taw

"Biofloc technology has been applied with success in commercial shrimp farming in Indonesia and Malaysia with a maximum of 50 tonnes/ha production, FCR of 1.1 and energy efficiency of 1.0 tonne/HP. With emerging viral problems and rising costs for energy, biofloc technology appears to be the answer for sustainable production at lower cost..."

Extra nutritional additives: feed is more than a source of nutrients



Peter Coutteau

"As shrimp producers consider the seedstock quality, biosecure husbandry and healthy nutrition, prevention of diseases through dietary manipulation is increasingly important in intensive systems. The various strategies and mechanisms in the supplementation of extra nutritional compounds will be discussed..."



Future Fish Eurasia 2012, Izmir, Turkey, 7 – 9 June

Heading for another successful edition

Future Fish Eurasia 2012, the 6th International Fair for fish imports/exports, processing, aquaculture and fisheries will be held at the Izmir International Fair Centre from 7- 9 June 2012. Over 200 companies from 28 countries will display their innovative products and services in an area of 11,000 square metres.

A series of workshops and meetings will be organised during Future Fish Eurasia 2012. The INTRANEMMA project is one of them. This is supported by the European Union and will identify priority vocational skill needs in the Mediterranean mariculture industry. It will develop and pilot an innovative sector led programs specifically for the Mediterranean region, aimed towards improving vocational skills and ensuring sustainability in sea bass and sea bream aquaculture.



The project will significantly increase multinational cooperation between training professionals and the labour market of a combined total of 330 small medium enterprise members (650 fish farms) which refers to a total production of 230,000 tonnes of sea bass and sea bream (84% of the global production) employing approximately 12,000 people and creating € 880 million in income for Greece, Turkey and Spain.

Workshops will include "Utilization of copper alloy nets in aquaculture". This is co-organised by University of New Hampshire and Canakkale Onsekiz Mart University. Current experimental cages have been set up in Canakkale to overcome heavy weather conditions and fouling issues that farmers are facing. Ege University will organise a workshop on "Scientific and technological developments in aquaculture". In addition, CIP (Competitiveness and Innovation Framework Program) will co-organise pre-arranged one-to-one meetings during Future Fish Eurasia 2012. The aim is to increase technology transfer between international and local parties. More information: www.future-fish.com/eng/iletisim.htm; Email: info@eurasiafairs.com

Details on the events below are available online at <http://www.aquaasiapac.com/news.php>
To have your event included in this section, email details to zuridah@aquasiapac.com

May 1-4

Australasian Aquaculture 2012

Melbourne, Victoria, Australia

Email: sarah-jane.day@aquaculture.org.au

Web: www.australian-aquacultureportal.com

May 9-12

8th Philippines Shrimp Congress

Bacolod, Philippines

Tel: +34 433-2131/0920-908-4620

June 7-9

Future Fish Eurasia 2012

The 6th International Fair For Fish Imports/Exports, Processing, Aquaculture & Fisheries

Izmir, Turkey

Email: selin@eurasiafairs.com (Selin Akpınar)

Web: www.future-fish.com

June 26-28

Vietnam Fisheries International Exhibition (Vietfish) 2012

Ho Chi Minh City, Vietnam

Web: www.vietfish.com.vn

August 15-16

The Aquaculture Roundtable Series 2012

- Shrimp Aquaculture

Phuket, Thailand

Email: conference@tarsaquaculture.com

Web: tarsaquaculture.com

August 23-26

AES Issues Forum & And 9th International Conference on Recirculating Aquaculture

Roanoke, Virginia, USA

Email: aquaconf@gmail.com Web: www.recircaqua.com

September 1-5

AQUA 2012

Prague, Czech Republic

Email: worldaqua@aol.com

Web: www.was.org

September 5-7

Aquamar Internacional

Cancun, Mexico

Email: coordinacion@aquamarinternacional.info

Web: www.aquamarinternacional.com

October 17-19

Offshore Mariculture 2012

Izmir, Turkey

Web: www.offshoremariculture.com

Email: ktolley@mercatormedia.com

November 6-8

China Fisheries & Seafood Expo

Dalian, China

Email: seafoodchina@seafare.com

Web: www.chinaseafoodexpo.com

November 6 – 8

GLOBALG.A.P. Summit 2012

Madrid, Spain

Web: www.summit2012.org

December 7-9

Shanghai International Fisheries & Seafood Expo 2012 (SIFSE 2012)

Web: www.sifse.com/en

Email: kim.yang@gehuaexpo.com (Kim Yang)

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