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AQUA CULTURE

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Review: Aqua Feeds in Asia
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- Larger Industry in India
- Fast and Furious in Vietnam

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Contents

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Aeration at Chaiwat farm, Thailand (see page 8)

Editor/Publisher
Zuridah Merican, PhD
Tel: +60122053130
Email: zuridah@aquaasiapac.com

Editorial Coordination
Corporate Media Services P L
Tel: +65 6327 8825/6327 8824
Fax: +65 6223 7314
Email: irene@corpmediapl.com
Web: www.corpmediapl.com

Design and Layout
Words Worth Media
Management Pte Ltd
Email: sales@wordsworth.com.sg
Web: www.wordsworth.com.sg

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Aqua Research Pte Ltd
3 Pickering Street,
#02-36 Nankin Row,
China Square Central,
Singapore 048660
Web: www.aquaasiapac.com
Tel: +65 9151 2420
Fax: +65 6223 7314

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Consequences and Communication

Zuridah Merican

A press release issued by the EU commission on the first day of the Seafood Expo Global was picked up by the Guardian newspaper, amongst other news services (see box). This is the most high profile action taken against illegal unreported and unregulated (IUU) fishing since it was set up in 2010. This means that unless Thailand cleans up its fishing industry, it risks an embargo on its exports to the EU in October. The Guardian was quick to inform its readers that the 'UK has a large appetite for Thai fish, consuming over Euro 153.4 million annually. It also raised some bad images of the industry, such as '39% of wild caught seafood entering the US is estimated to be illegally caught.'

How does this affect us in aquaculture? One would like to think that aquaculture provides a sustainable alternative to the fishing industry and profit from this. But actually we are not disassociated from the fishing industry!

During the three day Seafood Expo Global in Brussels (April 21-23), there were already expressions of disinterest amongst EU buyers for seafood of Thai origin (and that includes fish and shrimp from aquaculture). This 'Formal Notice' on Thai Fisheries' became a major talking point during the show, adding salt to the wound of the 'slave labour' issue faced by the Thai fishmeal sector reported last year. Seafood buyers would like to take the safest route and avoid buying Thai unequivocally because of uncertainty and fear of backlash from retailers, consumers and NGOs.

Certainly, this notice by the EU Commission has consequences on aquaculture. Thailand's aquaculture has been tainted with the same brush and the perception is real. The Thai fishmeal sector relies heavily on the shrimp and marine fish feed sector. In 2014, Thailand produced 350,000 tonnes of shrimp feed (see page 18) utilising at least 10% fishmeal in the formulation. Thailand is a significant fishmeal producer and the local fishmeal is preferred due to the duties paid on imported fishmeal. Thai fishmeal is of good quality and is also used in aqua feeds by other feed millers in the region.

The aquaculture industry is 'not an island' and all industries are heavily dependent on its supply chain. Even if companies are not integrated, the question of traceability obliges each segment in the supply chain to be responsible for its raw material supply so illegal fishing affects fishmeal which affects shrimp feed and ultimately the shrimp product. The way forward requires both a regulatory framework as well as an industry strategic framework. From a regulatory standpoint, Thailand's Ministry of Agriculture has already announced a six point plan to counter illegal fishing.

Of equal concern now is the response from the aquaculture industry. This would be a good opportunity to learn from the EU fish feed and farming industry. Siri Johnsen (CEO of G.O. Johnsen A.S., Norway) said "NGOs are major stakeholders and have interests and concerns over the way farming is done. Communication and dialogues with NGOs, public, retail consumers are part of getting permission to grow."

It is time for us in Asia to understand the market and for the need to get permission to grow.

For those interested, TARS 2015 will explore this concept further through a targeted presentation and discussion.

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The fifth of The Aquaculture Roundtable Series (TARS 2015) will be held in Hanoi, Vietnam from August 19-20 2015. It will focus on **Aqua Feeds 2.0: From Farm to Plate**. For more information: visit www.tarsaquaculture.com

Yellow card to Thailand

In its press release, the European Commission placed Thailand on formal notice for not taking sufficient measures against illegal fishing. It added that as result of a series of discussions with Thai authorities since 2011, the Commission has denounced the country's shortcomings in its fisheries monitoring, control and sanctioning systems and concludes that Thailand is not doing enough.

This decision also started a formal procedure of dialogue with the Thai authorities to undertake the necessary corrective measures. They will be given six months to implement a corrective tailor-made action plan. Should the situation not improve, the EU could resort to banning fisheries imports from Thailand.

Each year, between 11 and 26 million tonnes of fish (at least 15% of world catches), are caught illegally. As the world's biggest fish importer, the EU does not wish to accept such products into its market. Since 2010, the 'IUU Regulation' allows access onto the EU market only to fisheries products that have been certified as legal by the flag State concerned. When flag States are unable to certify their products, the Commission starts a process of cooperation and assistance to help them improve their legal frameworks. The milestones of this process are the warnings (yellow cards), the green cards if issues are solved and red cards *leading to a trade ban* if they are not.

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A healthier pangasius industry

A stakeholder dialogue to address challenges and opportunities at the Seafood Expo Global 2015

The aim was to address bottlenecks along the value chain and increase the sustainability of the pangasius industry. This is important as pangasius is the main seafood export item in Vietnam. The forum held on 22 April, was attended by 50 participants, comprising Vietnamese exporters, European importers, wholesalers, retailers and other stakeholders involved in the pangasius supply chain. It was a follow up to the first forum held in 2014, also in Brussels. The forum was organised by the Vietnam Association of Seafood Exporters and Producers (VASEP) and Centre for the Promotion of Imports from developing countries (CBI), Ministry of Foreign Affairs, the Netherlands.

Dr Pham Anh Tuan, deputy director, Directorate of Fisheries (D-Fish), Ministry of Agriculture and Rural Development, reiterated on the need to share experiences and improve sustainability for a win-win situation for all stakeholders. His update indicated that pangasius production in 2014 was 1.16 million tonnes which was less than the production in 2013 (1.22 million tonnes). The pond area was 5,550 ha in 2014. The main production areas are in Dong Thap, An Giang, Can Tho and Vinh Long, in the Mekong Delta.

Pangasius exports totalled USD 1.76 billion in 2014. The European Union is still the leading export market at 19.5% of the total export value. Pangasius exports to the EU have been decreasing in the last few years. It was valued at only USD 344.3 million in 2014 as compared to USD 580 million in 2008. Spain, Netherlands, UK and Germany are the leading markets with a total share of 61% of the EU market. The US market was 19% in 2014. Other markets were the ASEAN countries at USD 136.57 (7.72%), China at USD 113.15 million (6.4%) and Brazil at USD 122.97 (6.95%). Apart for the EU and US, exports to the other countries have been increasing (VASEP, 2015).

In the pangasius value chain, Tuan showed that despite recent rises in farm gate prices, profit margins at the producer and processor levels remain low and when marketed in Europe, the pangasius is one of the cheapest fish. The gains increase at super market chain levels. Average export price of Vietnam frozen pangasius fillets to the EU in 2014 ranged from USD2,302 to 2,499/tonne, which is higher than that in 2013.

Tuan added that both government and industry have been working together to promote the catfish product image and to improve on the sustainability of the industry. The main constraints are at the supply and production chain levels.

"Capacity can be increased but this requires a balance between supply and demand. There should be a win-win situation for all in the supply chain. There is a need to improve on the quality, transparency and consistency in supply. At the consumer end, the demand is on quality and adherence to social and environmental issues."

"There should be a win-win situation for all in the supply chain. There is a need to improve on the quality, transparency and consistency in supply." - Tuan

On certification, Tuan said, "Certification for good aquaculture practices is widely required in the industry but unfortunately, there can be requirements for certification under several standards which are overlapping. Having just one standard may reduce the cost of production."

In the drive towards sustainability, the government introduced Decree No 36/2014/ND-CP on April 29 2014. This relates to several aspects of pangasius farming, processing and exporting. "On the production side, we will reutilise farming areas and all farms with industry coding will be 100% VietGAP certified by the end of December 2015. VietGAP was formulated to have similar standards and regulations under the GlobalGAP and Aquaculture Stewardship Council (ASC). The conditions for the processing sector are to use raw materials from registered and certified farms. Effective from January 2015, there will be only one quality of fillet. The moisture content should not exceed 83% of net weight (of defrosted pangasius fillet). Glazing on exported pangasius should adhere to the regulations of importing countries. In other circumstances, glazing ratio should not be in excess of 10%," said Tuan.

Implementation of decree No 36

The key agenda at the forum was the status on the implementation of this regulation. The issue according to Tuan was whether buyers would be willing to pay more for better quality pangasius fillet. "According to a survey conducted, not all customers are ready to pay higher prices for the higher quality product. As such, D-Fish decided to postpone the implementation of this decree to January 2016.

"We continue to work to promote the pangasius product image and traceability. We now propose a discussion on the implementation of decree 36. An alternative option is to have two standards – a premium standard as well as a lower standard which still maintains the image of the pangasius. We need to decide on the best course of action before June 2015."

At the forum, European importers noted that it is not easy to dictate to a market which has been around for the past 15 years and to change perceptions of market players. Nevertheless, a standard on moisture content should be set to assure buyers on the quality of fish but more importantly, there should be transparency.

Pham Anh Tuan

Le Xuan Thinh (second left) with some of producers and processors at the SUPA booth during Seafood Expo Global 2015. Pham Thi Thanh Tan (left) is with An Giang Fisheries Import and Export Joint Stock (Agifish) in Long Xuyen, An Giang province. Tran Van Tao (second right) is with Long Phu Joint Stock Company an integrated company with aquafeed, 50ha of farms and processingin Hau Giang province. Linh Pham (right) is with Bien Dong Seafood in Can Tho City.

Differentiation in quality can be made available in the market. For every product quality, there will be a market. The right information on the product should be declared on labels to enable buyers and consumers to make the right decisions on the product and to be aware of what they are buying. This is the way to gain trust of buyers and consumers. Some European importers were impressed by the taste and texture of the pangasius sampled at the Vietnam pavilion during the show. They commented that such premium quality pangasius can easily find good markets.

Representatives from the processing industry in Vietnam said that they have been working with the government on this issue. Their mission is to provide a product which the market wants. The forum brought forth the need for transparency, which is essential to protect the image of pangasius products from Vietnam. This will be reconciled into the new labelling regulations recently introduced for imports into the EU.

Supporting cleaner pangasius in markets

In 2014, AAP reported on the work carried out by the SUPA team (Establishing a Sustainable Pangasius Supply Chain in Vietnam) at the farm level. The team is now working on reducing production costs at the processing level. The aim is that by the end of the project period (48 months from April 2013), at least 50% of the targeted middle to small scale pangasius producers and processors will supply products which meet sustainable certification (such as ASC) requirements of the EU market and other markets. SUPA is co-financed by the European Commission through the SWITCH Asia program. The leading partner is the Vietnam Cleaner Production Centre (VNCPC). Others are WWF (World Wide Fund for Nature) Austria, Vietnam Association of Seafood exporters and Producers (VASEP) and WWF Vietnam.

"We are implementing the Resources Efficiency and Cleaner Production called the RE-CP consultancy program. We work with local consultants to explain to processors how they can reduce consumption of energy and water resources and also how to mitigate environmental impacts. At the beginning, it was not easy as they thought that they were doing the right thing until we instructed them on improved technologies in the processing industry in Europe ," said Le Xuan Thinh, SUPA.

"At the moment, all processors have to treat their waste water before discharging it into the river. We showed them how to reduce water consumption by 5-10% and save costs by using less chemicals. There are also more refined water treatment technologies which we want to introduce but this will take more effort. We work with small and medium scale processers (less than USD 5 million investments and less than 500 employees). Interestingly, we have the larger processors willing to train these small and medium scale enterprises."

"In the production sector, we have pilot farms where we demonstrate to other farms good farm management practices. We have encouraged some production changes in farms after demonstrating how they can reduce feed conversion ratio to 1.6 from 1.7, and how to increase survival rates with better aeration in ponds using small pumps," added Thinh.

MOU to advance responsible aquaculture in Vietnam

The Global Aquaculture Alliance (GAA) has signed a memorandum of understanding (MoU) with the Directorate of Fisheries (D-Fish) Vietnam in which the two organisations will work collaboratively to advance responsible aquaculture in Vietnam and globally through the exchange of information and research.

Carson Roper, international business development manager for GAA's Best Aquaculture Practices division, and Dr Pham Anh Tuan, deputy director general of D-Fish, signed the MoU in GAA's exhibit at Seafood Expo Global in Brussels, Belgium, on April 22.

In the MoU, GAA and D-Fish agreed to benchmark the Best Aquaculture Practices (BAP) finfish and crustacean farm standards to the VietGAP standards, and vice versa, using a mutually agreed upon methodology followed by a parallel audit to determine equivalence. GAA agreed to offer training to help Vietnamese pangasius producers comply with the VietGAP standards as part of a stepwise approach to pursuing BAP certification. The two organisations also agreed to share information and research pertaining production, disease management and other aquaculture-related matters.

"We are delighted to formally recognise the collaboration between GAA and the Directorate of Fisheries (D-Fish) Vietnam to promote responsible aquaculture in Vietnam. This benchmarking project of VietGAP and the BAP farm standards will build a solid foundation for the use VietGAP as a stepping stone toward BAP certification for pangasius and shrimp farms in Vietnam," said Roper.

D-Fish is part of the Vietnam Ministry of Agriculture and Rural Development (MARD).

Insect meal and the EU

IPIFF, the International Platform of Insects for Food and Feed is asking for the revision of the EU feed legislation in order to allow insect products reared on 100% vegetables substrates to be used as sources of proteins for aquaculture, poultry and pigs. The current EU legislation is not tailored to insect proteins specificities. IPIFF will strive to make insect protein available to EU farmers, companies and consumers. This lack of legal certainty is jeopardising the investments and production plans of companies. In the EU, insect companies mainly produce for pet food. However, the potential for insect meal is huge, especially for the aquaculture feed sector. IPIFF's vice-president Tarique Arsiwalla said, "Production techniques have been developed in recent years and are now being deployed at industrial scale by companies which comply with stringent risk management procedures. Insect derived products can therefore be used in nutritional and functional feed applications at competitive prices, whilst complying with EU highest standards in terms of food and feed safety".

Concern on the future of marine aquaculture

In March, a plankton bloom wiped out more than 500 tonnes of fish along the Johor Straits. It also affected farms on the western side of the island of Singapore. In a Straits Times report, farmers said that despite the early warning by the Agri-Food and Veterinary Authority (AVA) they were shocked at the suddenness and severity of the bloom. Losses were in the range of 35 tonnes of fish for one farm. Frank Tan of Marine Life Aquaculture said that unlike in 2014, the bloom was more difficult to detect. Out of Singapore's 126 farms, 117 are coastal and have floating net cages to culture multi-species marine fish. The answer for the future may be a closed containment system to shield from external environmental factors such as temperatures and these blooms. Industry said that such systems which can be on land or on platforms at sea, are too costly. The AVA recently awarded a tender to developed closed rearing systems to five companies

Red Sea shrimp and barramundi

The National Aquaculture Group (NAQUA) said that its vannamei shrimp product cultured in ponds at very high salinity has a special flavour, reported SeafoodSource at Seafood Expo Global in April. The company has 400 ponds, each of 10ha in which it expects to produce about 17,000 tonnes of vannamei shrimp annually. Its barramundi production in cages is about 5,000 tonnes. About 60% of NAQUA's seafood production is exported to Asia, the United States and the EU. The company launched a promotion campaign to build awareness of its 'Red Sea Barramundi' in the US market since November 2014. Michael Fog, sales director for NAQUA said that the company is looking to the regional market for its products. "There are 400 million people in the region, 90 million in Egypt alone. But the goal at Seafood Expo Global is to attract more international business."

More cobia from Panama

In February, Miami, Florida-based cobia firm Open Blue began operating out of its new processing plant and Panama hatchery facilities. This hatchery will produce 2.5 million juvenile cobia a year. Mike Magnus, president told *Undercurrent news* that the company expects volumes to increase in 2015. Products are currently exported to the US and Europe. Open Blue is looking at markets in Southeast Asian and China. "China knows cobia but their key concerns are health and safety. Our farmed cobia can have two or three times the omega 3 levels of rival species, and as for safety, our complete integration from hatchery to processing is a great advantage." He added that cobia from Taiwan or China, cannot match Open Blue's in terms of size range or grade quality. The company is GlobalGap certified.

New JV on shrimp processing in India

Global seafood company, Thai Union Frozen Products (TUF), plans to expand in India and build new shrimp-processing plant in India through a share joint venture (JV) with Avanti Feeds, which TUF already has a 25.1% share. Rittirong Boonmechote, president for the global shrimp business of TUF, said in April, that this will be via a new JV, in which it would hold a higher stake. The new shrimp plant will have a production capacity of 15,000 tonnes per year (tpy) with an investment of USD10 million to USD20 million. TUF chose to expand in India because it already has a base there, while it can provide better technologies and access to markets such as the US, where it has a distribution network. TUF wants to boost shrimp products under its own brands to half of total sales in five years from 30% at present. It also aims to raise its sales to new markets from 5% to 30% in three years to reduce its reliance on US and European markets, which currently account for the lion's share.

Third 4-Star BAP certification in India

Avanti Feeds Limited is India's third group to achieve four-star Best Aquaculture Practices (BAP) status for shrimp or any species, The Global Aquaculture Alliance announced in late April. Four-star BAP status denotes that the processing plants, farms, hatcheries and feed mills from which a group sources are BAP certified. It is the highest such achievement in the BAP program. "Avanti Feeds has always promoted sustainability and reliability in aquaculture, and, as part of this effort, had its processing plant and feed mills BAP certified," said the company in a statement. Avanti Feeds achieved four-star BAP status on confirmation that it sources shrimp from BAP-certified farms and BAP-certified hatcheries. In early April, Penver Products Ltd. became India's first group to achieve 4-star BAP status for shrimp or any species, followed by Suryamitra Exim (P) Ltd.

Export of milkfish and grouper seedstock

Indonesia's Ministry of Marine Affairs and Fisheries (MMAF) announced that it would not continue with the plan to ban the export of fry and fingerlings of milkfish and grouper. Early in the year, news of the impending ban created jitters among regional marine fish farmers who depend on imports of fry and fingerlings from Indonesia for their grow-out activities. Based on official data, Indonesia's milkfish seed production continued to increase significantly to 3.2 billion fry in 2014, higher than the production in 2010 at 2.4 billion fry. Local hatcheries claimed that local production exceed local demand. In tempo.co, Ketut Gendise, a representative of fingerlings producers and entrepreneurs said that they can triple production for local demand if required. He added that a fingerling center in Bali can produce up to five million milkfish fry per day from 2,000-3,000 broodstock. Local demand for fingerlings could reach 10 million per day. MMAF wants to increase annual domestic fish supply, milkfish included, to 1.2 million tonnes.

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How to culture marine shrimp successfully in freshwater ponds

By Soraphat Panakorn

The two key points to successful farming of marine shrimp in freshwater ponds are stocking shrimp according to the pond carrying capacity and providing the right and effective minerals as seen in this farm in Thailand

When the region's shrimp farming industry faced a crisis with early mortality syndrome or EMS outbreaks, one common observation was that crop losses were more rampant in saline or brackishwater ponds in comparison to those in fresh water areas. This has led to a gradual increase in popularity of fresh water shrimp culture. This trend is seen not only in Thailand but also in China, Vietnam and India. However, after several successful crops in freshwater ponds, farmers could not continue to achieve success. Crop losses were due to soft shell disease or mortality after heavy rains. Many farmers were reluctant to continue with shrimp culture after the failed crops.

To maintain shrimp production, farming in freshwater ponds is a good option, but to ensure its sustainability, there should be a better understanding that the freshwater culture system is unlike that of saline or brackishwater systems. Culture management is also different. The key factor is that shrimp need minerals (which they absorb from three main sources; soil, water and feed) for their exoskeleton and physiological functions.

During the first few crops in freshwater ponds, it is possible to utilise minerals released from the soil. This will be depleted after several crops and problems such as slow mortality syndrome, soft shell, thin shell and blue shell conditions, cramping, slow growth, large size variation will increase. Large swings in plankton populations result in plankton crash. As such, consistent success in shrimp farming in a freshwater environment requires a thorough understanding of the requirements and roles of minerals in shrimp growth. The two key points to successful crops are stocking shrimp according to the pond carrying capacity and providing the essential minerals for the production of healthy shrimp.

In this article, I will illustrate how a farmer in Thailand achieved sustainable farming of shrimp in freshwater culture ponds without any problems in the past 17 years.

Chaiwat farm

The farm belongs to a friendly and kind hearted couple, 56 year old Chaiwat Teintongkam (Wat) and 53 year old Naruemol Tientongkam (Da). Their farm is located in Lumsai Subdistrict, Lumlukka District, Pathumtani Province. The place is northeast of Bangkok and is about 50 km from the Gulf of Thailand. The water source is exactly 0 ppt in salinity. The area is surrounded by paddy fields and fruit and vegetable gardens.

Some 21 years ago, Chaiwat and Naruemol decided to leave well paying jobs in Bangkok to start an aquaculture farm. They started by farming hybrid catfish but after 4 years found that its genetics was inconsistent and it was difficult to control production. They looked for an alternative and found that black tiger shrimp is a good choice. However, initially, they also faced the same problems as other farmers–success with only 2-3 crops and then serious problems. They then spent time to study and search for knowledge and information on shrimp farming in freshwater until they found the perfect management protocols suitable for their location. In 1998, they started off farming black tiger shrimp for 6 years, then changed to vannamei shrimp culture for another 6 years, before reverting back to black tiger shrimp 5 years ago.

Chaiwat Teintongkam (right) and Naruemol Tientongkam

"When you have failed, do not blame but investigate. Recording and analysing with statistics are also very important. Da is a former auditor so we perform this well." - Chaiwat

Success in a simple way

At the farm, Chaiwat said that over 14 years, they have had a stable production of about 5 tonnes/ha per crop with less than 10% of losses or crop failures. They have 31 ponds, with sizes ranging from 3,000-4,000 m^2. The total farm area including reservoir and water treatment ponds, housing for staff and pathways etc is 30 ha.

"At 115 days of culture (DOC), I have achieved an average feed conversion ratio (FCR) of 1.3. The average harvest size is always size 40-50/kg.

"We always share our experiences and provide free advice to 23 neighbouring farms. Now these 23 farmers seldom have failed crops and in fact, most of them are expanding their farms. We do get their respect as "oldest brother". I have been using the same culture technique for more than 10 years, I am confident that my method works," said Chaiwat.

Pond preparation

Chaiwat also detailed his pond preparation practices. At the farm, after each harvest, they will use a tractor to spread out sludge over the pond. This will be exposed to sunlight until the surface dries up. Usually this takes a month. Next is to broadcast dolomite (calcium magnesium oxide –$CaMgO_2$) over the pond to enrich the soil with the most important mineral for shrimp as well as to increase alkalinity and maintain pH.

> **"We offer 15% above market price to get the best post larvae. We stock with an exact number and at around 35 PL/m². We do not exceed this number." - Naruemol**

The pond is slowly filled with water from the reservoir with a 4-inch (10cm) pump after passing a multi-layer fine mesh screening cloth, 3-5 m in length. The water is clear and free from any disease carriers. Chaiwat also recommends pumping only at the middle of the water column to avoid getting sludge, toxic gases and pathogenic bacteria into the pond. Water depth is 1 m.

Since they are located amidst paddy fields, Chaiwat hangs a cloth bag with 5 kg potassium permanganate ($KMnO_4$) in front of the water inlet. This is to neutralise any insecticide from the paddy fields. The water in the pond is allowed to rest for 3 days so that any eggs of aquatic animals will hatch out and then a crustacide is applied to kill the hatchlings.

"A chain boat is used to drag over the pond twice daily for about a week, to mix the lime thoroughly into the soil. This boat is specially designed with a 3-inch (7.5cm) spine fork to dig the soil when dragging," said Chaiwat.

Other practices are the application of a disinfectant in case of a risk of serious disease. They also apply probiotic manure fermentation which is a combination of seasonal vegetables, molasses, *Bacillus* probiotic and water. These are aerated and allowed to ferment for 7 days and the aim is to stimulate the phyto- and zooplankton. Chaiwat also recommends to aerate pond water from the beginning to promote natural plankton growth and eliminate all toxic gases that might occur.

High saline water at about 8,000 L/4,000 m³ of pond water is added to provide trace elements and essential minerals before stocking. The water colour is fine tuned by applying soluble manure to get a stable phytoplankton bloom within a 10-day period.

Post larvae and stocking

The farm ties up with a reliable hatchery to get good quality post larvae (PL). "We offer 15% above market price to get the best post larvae. We stock with an exact number and at around 35 PL/m². We do not exceed this number. Since the water in our grow-out farm is exactly 0 ppt, we ask the hatchery to slowly drop the salinity in the hatchery tanks 3-5 ppt daily to meet 12-13 ppt before delivery. We do this to acclimatise shrimp to low salinity to match pond salinity and to avoid salinity shock," said Naruemol.

In the pond they will fix a curve shape plastic cage to let water flow freely with aeration at the side of the pond. This cage area is about 220 m². The water here is mixed with very saline water

Saline water is channelled through a PVC pipe with many small holes placed in front of the aerator.

The curve shape plastic cage in the pond lets water flow freely with aeration on the pond side. The water here is mixed with very saline water (120-150 ppt) obtained from salt pans.

(120-150 ppt) obtained from the nearby salt pans. The amount is 7,000 L in order to secure 8-10 ppt in pond water. The water is then aerated for 3 days before stocking begins.

"Next is to stock post larvae in the cage but first we will float the post larvae bag to equalise the temperature of the water in the bag with the temperature of the pond water. The bags are then opened slowly allowing the pond water to mix with the water in the bag for 5-10 min before the final release of the post larvae," explained Naruemol. "In addition we only stock at 7 pm. The number of post larvae is counted accurately so that the exact number of post larvae is stocked. Overstocking can mess up our farming system and lead to serious problems in the future."

Another interesting practice is the use of a small blue net cage to stock 100 post larvae. This is to check survival rate. The number of post larvae surviving in the blue net after a week is used to estimate the total shrimp left in the pond and the correct amount of feed is given accordingly.

"Within the plastic net cage, first feeding of the post larvae is with feed number 1 or the smallest pellet size at a rate of 150g /100,000 PL/day and post larvae are fed three times/day. We increase the feed amount by 5-7% the next day. After a week, we pull the edge of the cage down one foot (30cm) under the water surface to let strong post larvae swim out to fill the whole pond area slowly. The water salinity of the plastic cage water will also slowly drop down to 0 ppt after 3 days and at this time, we will remove the plastic cage."

Feeding is strictly on demand

Subsequently after the removal of the plastic cage, feeding will start at 1 kg/100,000 PL/day. The daily increase will be about 300 g for about a week. This is followed by monitoring the feed in the checking tray. Feeding times are 7.00 am, 12.00 am, 17.00 pm and 21.00 pm.

"We add feed to the checking tray at a ratio; 2-2.5 g/kg feed/ tray. We have one tray for every 1,500 m^2 of farming area. Checking is done every 2 hours. We use the checking tray to determine feed rate as in the table. Additionally, we adjust the feed amounts according to the weather, water conditions, water colour, dissolved oxygen in the pond, and whether the shrimp have molted.

Feed amount in checking tray	Shrimp fecal matter	Action on feeding rate for next meal
No feed	None or short faecal strands	Increase
No feed	Long faecal strands	Maintain
Some feed left		Decrease by 20-40%

Managing water parameters

One crucial practice is to apply mineral premix with feed in every meal. This is very important since shrimp need a high concentration of minerals. But in freshwater ponds, minerals are limited. If this practice is not followed, it can lead to soft and thin shell conditions, cramping, plankton crash and shrimp dying slowly. The whole body of the soft shell shrimp can be easily eaten by other shrimp. The farmer will never notice the dead shrimp but will have a low survival rate after harvesting.

"We also apply high saline water monthly or after we detect some signs of mineral deficiency in shrimp. At first before stocking, it is 8,000 L/4000 m^3 of pond water and the second time at the end of the first month at 10,000 L. The third time is at the end of the second month with 14,000 L and lastly, before harvest at 14,000 L. The capacity of the saline truck tank is about 14,000 L. This volume of saline water will not increase the salinity but will contribute minerals.

"We apply magnesium oxide at 10 kg/ha weekly at about one day before full moon or an eclipse. In case of mass molting we will need to apply another dosage at night when shrimp is molting. With regards to water salinity, we apply saline water through a PVC pipe with many small holes placed in front of the aerator. We let saline water mix thoroughly with pond water. If we apply directly, saline water is heavier than freshwater, and the saline water will go down and settle at the bottom. Next day, we will see dead shrimp.

Chaiwat also emphasised that very saline water means that the salinity must be between 120-150 ppt only, to avoid disease contamination and to get the complete composition of minerals from sea water. At a salinity lower than 100 ppt, *Vibrio* is still active. At higher than 160 ppt, there will be crystallisation of salt and some essential minerals will settle down. He also applies 300kg/ha salt every 10 days in the sludge area, followed by effective probiotic in the next two days.

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Pond	Stocking (number of PL in 3,000 m² pond)	Shrimp size (per kg at DOC 110)	Survival rate %	Production (kg)	Current price /kg (for vannamei shrimp)	Total income	Investment cost	Total benefit
1	100,000	48	80	1650	USD 6.5	USD 10,725	USD 4/kg	USD 4,125
2	200,000	75	65	1730	USD 4.3	USD 7,439	USD 4/kg	USD 839

The farm also adheres to some common practices such as keeping water alkalinity at over 120 ppm with lime application. The morning pH is maintained at not less than 7.5 and afternoon pH at not over 8.2. When the pH shifts, this needs to be corrected with lime application or by controlling plankton and feed. Another way is the application of probiotics on a weekly basis together with soluble manure.

Vitamin C is added to feed at every meal to prevent stress and strengthen resistance. The level of aeration with long arm paddle wheels with 40 paddles is 5HP per pond at 80 RPM. Aeration is only stopped for two hours for feeding during the first month only.

"We regularly check on the shrimp early in the morning. Shrimp observation at early morning may provide indication and prediction of problems that are likely to occur in the next 2-3 days. The best time to check is 2.00-5.00 am," said Chaiwat.

Message

Chaiwat has several messages for other shrimp farmers. "When you decide to venture into shrimp farming, you need to commit yourself wholly. If you wish for success, you need to be a specialist in your job. To be a specialist there are sacrifices to be made. To me it is time, love, attention, knowledge sourcing, learning, thinking, analysing and evaluating. Patience is required and thinking out of the box is critical. You need also to set up a good plan and make the right decision.

"When you fail, do not concentrate on blaming others but you need to investigate why you have failed. Recording and analysing with statistical evaluation are very important. Da is a former auditor and is cut out for this job. The table above demonstrates a 12 year old record from our farm and that of our neighbours."

Post larvae are stocked after equalising temperature. Stocking is only done at 7pm and a blue net containing 100 post larvae is for calculation of survival rate.

This boat is specially designed with a spine fork to dig the soil when dragging.

Soraphat Panakorn is Commercial Development manager, aquaculture Asia Pacific, Novozymes Biologicals, Thailand. Email: january161975@hotmail.com

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Servicing small farmers in Ben Tre

These are at centres where farmers meet and get updates on culture practices while waiting for results on analysis of pond water.

In recent years, there has been a marginal increase in shrimp farming areas in Ben Tre to 35,958 ha in 2014. Out of this, 10,694 ha were used for semi-intensive and intensive shrimp culture. Once the domain for the monodon shrimp, farms in Ben Tre shifted to vannamei shrimp in 2010 and the production ratio was 70:30 (monodon:vannamei). In 2014, the ratio changed to 14:86 (monodon: vannamei shrimp). This province in the Mekong Delta contributed 54,300 tonnes to the national shrimp production in 2014 (Vasep, 2014). The shift to vannamei shrimp is the reason for the 3.8% rise in production.

Family-owned and small-scale farms (less than 10 ponds, each usually of 3000-4000m^2) account for 75-80% of shrimp farms in Ben Tre. Many of these small farms migrated from farming black tiger shrimp in extensive tidal systems to the more intensive farming of the vannamei shrimp. For most farmers, farming vannamei shrimp is a different ball game.

Small farms have to grapple with frequent disease outbreaks in their switch to intensive culture systems. In 2011, farms in Vietnam (Ben Tre not excluded), faced massive crop losses with the early mortality syndrome or EMS. Even during the days of farming the monodon shrimp, Ben Tre farmers faced diseases such as white spot syndrome virus-WSSV, yellow head virus-YHV, monodon baculovirus-MBV and white faeces syndrome-WFD since 2005 (AAP, 2005). In 2005, Ben Tre provincial fisheries offices have set up six PCR-polymerase chain reaction machines for the detection of viral infections.

Servicing small farmers

In general, small-scale farmers depend on feed distributors for help with their culture activities. In turn, feed distributors derive technical information and help from their respective feed companies. As such, aqua shops operated by feed distributors are common in provinces such as Ben Tre. Unique to Vietnam are service centres run by feed producer, Sheng Long Bio-Tech International which has 30% of the shrimp feed market in Ben Tre. The majority of Sheng Long's feed clients in Ben Tre are small-scale farmers who depend on services provided such as pond water analyses and disease detection.

Table discussions at the service centre with Nguyen Khac Hai (middle left) and Nguyen Thi Kim Phien (middle right). Second left is farmer Kieu Quoc Hung. Others are technicians with Sheng Long, from left, Than Van Bac, Trinh Thi Hong Thuy (second right) and Nguyen Thi Hong Van (right).

Nguyen Khac Hai, service centre manager who oversees six service centres in Ben Tre said, "Mornings are busy times at the service centres. A farmer will normally come to the service centre 1-2 times a week bringing pond water for analysis. They wait for the results. If the analysis indicates that water quality is unfavourable for stocking they will delay stocking. Stocking is also delayed when they notice diseases in nearby ponds. While waiting for the results, they also meet other farmers at the service centre and watch videos on shrimp farming practices. By mid-morning, they leave to stock or attend to their ponds.

"At the end of 2014, threats with white spot syndrome virus superseded that with EMS. Farms were successful with the first and second crops in 2014 but usually failed with the third crop due to disease and poor weather conditions. In general, the success rate was 50%. In 2015, I have observed that from January to 15th March only 20-25% of farms were stocked," said Hai, who qualified with a degree in fisheries engineering at Nha Trang University.

At a service centre run by feed distributor, Nguyen Thi Kim Phien, Sheng Long occupies a small space for the laboratory operated by two technicians. The set up comprises a microscope linked to a TV monitor, microbiology equipment to spot bacteria and test kits for water quality measurements. The microbiology results of these tests are displayed on the monitor. The centre is also the one-stop shop for purchase of pond chemicals and other essentials.

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At the demonstration farm, farm manager Phan Trong Kha (middle) with Nguyen Khac Hai (left) and Than Van Bac (right).

Regulating stocking

Mid to end of March is a busy period for the two technicians at the service centre. Water quality measurements include all the prerequisite tests such as ammonia, pH, nitrite, nitrate and alkalinity. Composition of *Vibrio* (yellow and green colonies) in the water sample is also carried out.

"Ben Tre is unique as authorities regulate that farms are only allowed to start stocking after March in each year. We also provide analysis on *Vibrio* populations. Actually, not all farmers will require these tests but most will ask for them. Farmers get the results within 24 hours."

Hai added, "Most farmers use vannamei shrimp post larvae (PL10 –PL12) from the hatchery in Ninh Thuan and stock at 100 PL/m^2. Pond depth is 1.4-1.5 m. There are two main crops per year, starting from the end of March and harvesting after 70-80 days in June/July. The second crop can be immediate or later with harvesting completed by October. Some farmers continue with a third crop in October to December but this is not common. The third crop is usually less successful. Harvests are size 60-70/kg after 70-80 days. The average feed conversion ratio (FCR) is 1.2 for Sheng Long's Dragon feed brand," said Hai.

"Farmers who frequent my service centre usually draw water from the estuary. Usually, they will use chlorine at a dosage of 30 ppm at the beginning of the culture season. However, there is a tendency for farmers to change to cheaper water treatment products for the next cycle, even though the previous ones have been working well for them. The main factor is cost, as they always seek to lower production costs," said Phien.

Managing diseases

Farmer Kieu Quoc Hung who has two ponds, said, "With only two ponds, each measuring only 4,000 m^2, it is not possible to allocate any pond as reservoir pond. Water in the pond is treated with chlorine at 45 ppm and incoming water during culture is not treated. The removal of soil on pond bottom is only carried out after the second crop. This is a new practice to prevent diseases."

He added that previously, in the 10 years that he has been farming, he has only removed bottom soil in 2011-2012, when he started to farm vannamei shrimp as he wanted to create a good environment for the shrimp. His cost of production is high at VND 80,000 to 85,000/kg(USD 3.7 to 3.9/kg) in his leased pond and lower at VND 75,000-80,000/kg (USD 3.5-3.7kg) for his own pond to produce shrimp of size 100/kg. This is inspite of a survival rate of 80% when shrimp do not succumb to diseases.

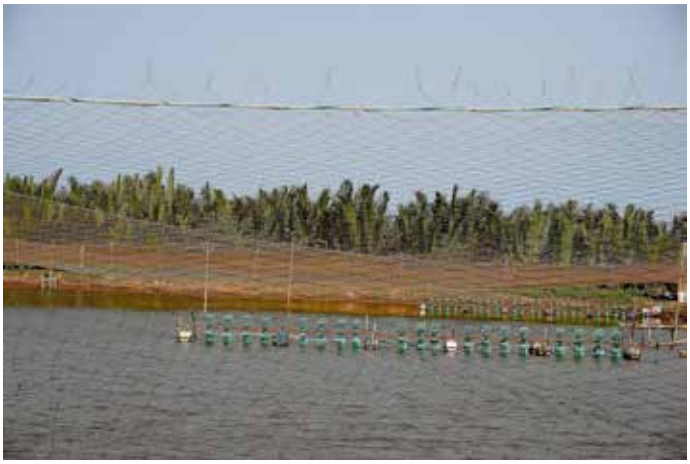
Hung attributed the high cost to the use of chemicals and probiotics. The relatively high prices at VND 90,000-92,000/kg (USD 4.2-4.3/kg) for size 100/kg to VND 114,000 -116,000/kg (USD5.3-5.4/kg) for size 70/kg is apparently insufficient for a farmer such as Hung to invest in biosecurity measures and pond renovations. Crab fencing is commonly seen in almost every farm but bird scare netting over ponds is a rarity in Vietnam.

At the service centre, the discussion among Hung, Hai and Phien centred on the recent poor performance of some farms. For the past year, farmers have reported shrimp mortality from 10-50 days. At large sizes, it was possible to have emergency harvests. At small sizes, the remedy recommended by Phien is to add vitamins to the feed but this has not helped to improve shrimp health. Affected shrimp display redness in the hepatopancreas and gut. Shrimp lose weight because of lower feed intake.

"This situation of poor feed consumption and high mortality has been reported by other farmers too. However, at our service centres, one of the technicians did some smears after returning from training at the University of Agriculture and Forestry in Ho Chi Minh city. She saw worm-like entities in the gut and hepatopancreas. We now know that these are gregarines," said Hai. "As such farmers are asking us on solutions to eradicate these pathogens."

Demonstrating new technology

This is the role of the three-pond demonstration farm in Ben Tre. Here, farm technician Phan Trong Kha carries out pond trials on feeds. Sheng Long has leased this farm with three ponds of average sizes of 5,000 m^2. All ponds have bird scare netting covering the pond area.



These demonstration ponds have extensive netting over the whole pond area.

One of the trials at this farm is the testing of probiotics mixed with crumble feed (of size number one) which is fermented for 48 hours. This technology has been applied in China, Thailand and Malaysia and Sheng Long is testing it under Vietnamese pond conditions. This feed is used for the period from stocking to 30 days of culture. After this period, commercial feeds are applied and fermented feed is added intermittently. The hypothesis is that fermented feed will stimulate the growth of natural food in ponds for the shrimp and its consumption will improve shrimp immunity against diseases.

2014: Selective growth again

By Zuridah Merican

Bearish sentiments with falling currencies, and the lacklustre shrimp industry.

A higher production of shrimp feeds was seen in Indonesia, India, Vietnam and China in 2014. This corresponded with higher demand following better shrimp prices, intensification of culture with new-shrimp farms and a shift to intensive vannamei shrimp farming from semi and extensive monodon shrimp culture.

On the contrary, shrimp feed millers in Thailand and Malaysia continued to have a hard time with low demand. Some referred to the shrimp feed business as a 'bad headache', particularly for those involved only in shrimp feed production. In 2014, shrimp feed production in Thailand dropped 30% from the estimated 480,000 tonnes in 2013. The expected recovery from early mortality syndrome (EMS) did not happen in these two countries. Nevertheless, industry in Thailand is optimistic that a recovery will occur in 2015.

A less volatile fish feed market helped fish feed millers. China's fish feed production is mainly pelleted feeds for carps, tilapia and catfish, produced by small and medium feed plants. They however faced a new challenge. In 2013, the government introduced regulations which required many small and medium feed companies to upgrade equipment, regulate the feed processing operations and undertake quality control on raw materials and products.

Indonesia showed a stable production of fish feeds at 1.1 million tonnes according to the data provided by the Aquaculture Division of the Indonesian Feedmill Association (Indradjaja, pers comm). Fish feed volumes in India were less than 40% of the installed capacity (1.55 million tonnes per year, Vijay Anand, 2014). Vietnam's 2014 production comprised mainly feeds for the pangasius at 1.6 million tonnes and 363,300 tonnes for the tilapia. Feeds for the tilapia increased by a phenomenal 61% as compared to volumes in 2013 (David Serene, pers comm).

Table 1 shows estimates provided by industry in selected countries. The large range demonstrates the difficulty in collecting data on production. There are some major differences such as industry reporting only 500,000 tonnes of marine fish feeds in China in 2014 as compared to 900,000 tonnes reported by China Aquatic Products Processing and Marketing Alliance (CAPPMA) for the seabass, eel, pompano and groupers in 2013.

In preparation for this article, feed millers were asked to rank challenges affecting them in 2014. The top challenges for feed millers were raw material supply, replacement of fishmeal and fish oil and poor feed demand for fish and shrimp. Malaysian and Indonesian feed millers were very concerned with the effects of currency depreciation. Feed and food safety, contamination and government regulations were additional challenges for industry in nearly all countries, Ethoyxquin residues in shrimp feeds was ranked highly by a feed miller in Malaysia whilst industry in Thailand indicated

Raw material supply and sourcing

Other than sustainable fishmeal and fish oil from Peru and Chile, feed millers seek more sustainable sources of fishmeal and fish oil, namely certified by IFFO (International Fishmeal and Fish Oil Organization), Marine Stewardship Council (MSC) and from non IUU fishing as required for fish and shrimp entering the US and European markets. According to the IFFO website, three fishmeal producers from Vietnam and one from Thailand, are certified to its Global Standard and Certification Programme for the Responsible Supply of Fishmeal and Fish Oil (IFFO- RS). Thai feed millers depend mainly on local high quality fishmeal produced from a combination of by-catch or trash fish caught around the seas of Thailand. Only 60% of Thailand's annual fishmeal production of 180,000 tonnes is from recycled trimmings. The issue with this production is lack of full traceability and use of illegal, unregulated and unreported (IUU) fish (see editorial).

Despite the price (USD 2,390/tonne in December 2014 for Peruvian, indexmundi.com), fishmeal is still considered essential. China imported more than 1 million tonnes of fishmeal in 2014. Where available and if suitable, feed millers use local fishmeal for some feeds and high quality imported fishmeal for premium feeds. Indonesia, Malaysia and India have local sources of fishmeal but the quality does not match international standards. In some freshwater fish feeds, fishmeal is either not included in the formulation or added at low levels (5%). Even at this

Table 1. Industry[a] estimates on production in 2014 (tonnes) and projections on demand for 2015 in selected countries in Asia.

	Production 2014			Projections in 2015	
	Shrimp feeds	Freshwater fish feeds (% extruded)	Marine fish feeds	Shrimp Feeds	Total Fish Feeds
China	1,700,000	15,800,000 (16%)	489,000	+6%	+9%
Thailand	300,000-375,000[b]	544,000[b]-760,000 (80-95%)	26,500-40,000	+5%	+6
Vietnam	450,000-680,000	2,500,000-2,664,800 (100%)	27,500-49,980	+10%	+2%-10%
Indonesia	322,800-390,728[b]	990,000-1,088,300[b] (60-65%)	108,000-110,000	+30%	+8-10%
India	500,000-610,000	430,000-600,000 (80-85%)	Small amounts	-2%	+<5%
Malaysia	60,000-110,000	84,000-120,000 (92-97%)	36,000-60,000	+5%	+0-20%
Bangladesh	5,000	800,000 (25%)	-	+20%	+12.5%

[a]Estimates by industry stakeholders and feed millers.
[b]Indonesian Feed Mills Association (GMPT) and Thailand Feed Mill Association

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Small size extruded feeds from Guabi, Brazil on display at Aquatic VIV Asia 2015. The company is now exporting its extruded fish and shrimp feeds to parts of Asia. *(see page 56)*

low level, the cost can be as high as 24% of selling price of a low priced fish feed (USD 0.48/kg). The aqua feed industry in Indonesia imported 70,000 tonnes of its annual fishmeal demand of 100,000 tonnes from China, Chile and Vietnam. In December 2014, Denny Indradjaja, head of the Aquaculture Division of the Indonesian Feedmill Association urged the government to seek IFFO certification for its fishmeal from *Sardinella* (businessnews.co.id).

With imports accounting for as much as 80% of raw materials in aqua feeds, feed millers continuously seek lower cost raw materials. Dr Thomas Wilson, feed consultant, summarised the situation in Thailand.

"In general most in the industry depend on the same core group of proteins such as Thai fishmeal, HiPro soybean meal and imported animal by-products such as meat and bone meal (MBM), meat meal, blood meal, feather meal, rapeseed meal and DDGS. Other main ingredients are rice bran, wheat bran and palm kernel meal, and carbohydrate sources are corn, cassava, and broken rice."

Replacement of fishmeal/fish oil

The tight supply means we must find replacement for fish meal and fish oil 'if we wish for feed prices to be competitive', said an Indonesian feed miller. Research and know how are imperative as current information show that when there is substitution with plant meals, growth performance is lower than with feeds containing fish meal. In salmon feeds in Norway, substitution is effective with soy protein concentrate (SPC). An alternative ingredient of interest in Malaysia and Indonesia is insect mealwhich will require more research and commercial trials.

"The major problem is the replacement of fishmeal. The selection is limited. The ban on poultry by product meal (PBM) in aqua feeds has been lifted and even though we can use these, they are expensive because we have to compete with the petfood industry. Thailand buys a lot of animal by-products from Europe, but European suppliers get better prices if they deliver to local customers in Europe. Porcine products are available, but many feed companies are reluctant or unable to use them because of Halal requirements. Canola meal is available but when prices rise, importers stop importing. Lupin meal from Australia is too expensive. Soy protein concentrate is a good replacement for fishmeal but in Thailand the government has a high excise tax on it, making it too expensive for normal usage," said Wilson.

Currency depreciation and rising costs

Across Asia, the weakening of currencies against the US dollar increased costs of imported raw materials since commodities are priced in US dollar. On the contrary, feeds are sold in the local currency. The Malaysian ringgit for example declined 16% to its lowest level in several years.

In each country, feed millers reported higher costs for energy, labour and transport. Higher costs of labour was attributed to the implementation of a minimum wage in Malaysia and together with India, another difficulty was obtaining adequate manpower. Transport and energy costs in Malaysia and Indonesia increased with the removal of fuel subsidies. Some feed plants in Thailand mitigated higher energy costs by operating during off peak hours.

Consequently, feed prices have risen in most countries as shown in Table 2. In comparison to prices in 2013, shrimp feed cost increased by less than 1.2% in Vietnam but as high as 10-15% in Malaysia. In Thailand, one feed miller reduced prices of extruded fish feeds whilst another increased prices by 10%. In Malaysia, a feed miller raised marine fish feed prices once by 3-4% but farmers reacted by shifting to another feed brand.

Poor demand

A common situation all over Asia was the low ex farm prices for freshwater fish. In China, about 80% of feed volumes was for carps and snakehead with prices often lower than production costs. Prices improved during Chinese New Year. In India, pangasius farmers shift from extruded to pelleted and mash feed depending on the fish price. In Malaysia, 70,000 tonnes of *Clarias* catfish was produced and the feed market could be large. However, feed demand is dependent on ex-farm prices. The breakeven price is MYR 3.80/kg (USD 1.1/kg) and below this, the

Table 2. Range of aqua feed prices in USD/kg in 2014 and changes from that in 2013

Feed types	China	Thailand	Vietnam	Indonesia	India	Malaysia	Philippines	Bangladesh
Shrimp feed (vannamei)	1.1-1.4	1.05-1.37	1.33-1.48	0.96-1.09	1.06-1.22	0.98-1.14	1.05-1.50	0.6-1.3 (monodon)
Change	+	+<1%	+<1.2%	+3.5-6%	+ 5%	+10-15%	na	+5%
Freshwater fish (pelleted)	0.48-0.53	0.50-0.61	-	0.48-0.69	0.29-0.37	0.54-0.66	0.54-0.66	0.45-0.50
Change	+	5%	-	+3-5%	No change to +5%	+6%		+5%
Freshwater fish (extruded)	0.69-0.75	0.55-0.85	0.59-0.68 (tilapia) 0.48-0.55 (pangasius)	0.64-0.70	0.40-0.64	0.72-0.88	0.54-1.20	0.53-0.70
Change	+	Reduce/+10%	no change/- 4 to 5%	+1-4%	+2%	+12%	na	+5%
Marine fish(extruded)	1.4-1.6	1.28-1.52	1.18-1.33	1.20-1.45	0.96-1.28	1.29-1.53	0.54-1.20	na
Change	+	+20%	no change/ +2.5%	+3.5-5%	-20% to 2%	+15%	na	+5%
Conversion rate into USD		32.88	21,350	12,437	62.5	3.50	44.50	

farmer uses chicken entrails as feed. According to a feed miller, this feed market will only grow when the government regulates hygiene in the farming sector with MYGAP (good aquaculture practices) certification. With low prices for the tilapia, farmers cut down on feed costs by harvesting smaller grade C fish (less than 500g). Here the feed conversion ratio (FCR) is 1.2 in comparison with grade A fish (more than 700g) with a FCR of 1.45.

There is also the effect of weather, said Anang Hermanta, PT Sinta Prima, Indonesia. "In early 2014, flooding affected most catfish ponds, a major species. However, due to the lack of fish supply, prices went up to IDR 17,000/kg which in turn triggered more stocking in March to April. The subsequent mass harvest resulted in low prices at only IDR 10,000-12,000/kg (whereas the normal price would be IDR 14,000-15,000/kg). Feed purchases went down even though feed prices were only IDR 8,750/kg and FCR 1.1. In all, there was either no growth or less than 1% growth in feed sales in 2014."

In India, Dr Victor Arul Suresh, feed consultant, said, "Especially for the pangasius, fish prices in Andhra Pradesh (AP) dropped in 2014 and never recovered significantly for feed millers to make profits. However, pangasius farming is gaining in other states. Since fish and feed production are centred in AP, we will see a period of adjustment in terms of species composition, expansion of feed manufacturing in other states and someone coming up with processing of fish to change the market dynamics".

David Serene, feed consultant at Nutrispices said, "The low price and long credit terms of the pangasius farming industry is still a major issue for the Vietnamese industry. As long as the margin and payment terms of the pangasius feed industry remain the same, there will be no investment and innovation in the feed sector".

Feed specifications and standards

Whilst many see that specifications and standards on aqua feeds as a way for governments to standardise and control commercial feed quality, some feed millers have the opinion that these actually restrict progress towards improved and more cost efficient feeds. In Vietnam, the government announced a series of new measures such as cancellation of value added tax on raw materials and final products. However, it added more requirements to the standards and implemented regular checks on feed quality.

"Today, with advances in breeding improving growth rates of both fish and shrimp, increased demands to care for the environment, and overseas buyers and certification schemes asking producers to improve sustainability and culture conditions, demands on commercial feeds have changed. However, the feed regulations we are using are based on 30-year old science. New ingredients, numerous technical feed additives and enzymes are available today to increase the efficiency of feeds. But the regulations are so restrictive that there is no way to create distinctive products in the market. The only way we can compete is on price. This is not leading to needed advancements and it has to change," said Wilson.

Suresh said, "No registration for feed mills in India is required and neither are there any regulations on feed composition. Aquaculture farmers have very high demands on feed quality and performance and this drives the industry. Regulations are not necessary as we have seen the impracticality of such regulations on feed composition in the region."

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India: A larger aquafeed industry in 2014

By D. Ajaya Bhaskar

Expansion to meet aqua feed demand in 2014 is now curtailed by challenging times in shrimp and fish farming

The Indian aquaculture industry continues to expand from year to year. During the early days, commercial farming was located mainly in Andhra Pradesh and Tamil Nadu but now it has expanded to all coastal states such as Orissa and West Bengal in the east coast and Gujarat in the west coast of India. In 2014, India exported 20,000 crores (USD 3.5 billion) of vannamei shrimp. The forecast for the year 2015 is USD 5 billion, if all goes well.

The golden era for vannamei shrimp farming in India began in 2012 and continued to 2014; prices were very good and farming areas almost doubled. Unlike recently, shrimp farmers were not worried about diseases such as white spot syndrome virus (WSSV), running mortality syndrome (RMS) and early mortality syndrome or EMS. However, the last crop (second crop) of 2014 was a big failure and the production dropped to 60% of that in 2013. In the early days of vannamei shrimp farming, there were two crops but now the production is from three crops a year in some areas.

Recent trends

After the introduction of the vannamei shrimp in India, the entire scenario of the aqua feed business in the country underwent a great change. After seeing the growth and potential of vannamei shrimp farming, new companies entered into the feed business and existing feed companies have expanded installed capacities in recent times.

Extruded (floating) and pelleted (sinking) fish feeds sold loose in Kolkata, West Bengal.

Now we have nearly 25 aqua feed companies producing both fish and shrimp feeds. The total production of aqua feeds in 2014 was estimated at 1.25 million tonnes of both fish and shrimp feed. Shrimp feed comprised approximately 600,000 tonnes and fish feed 650,000 tonnes. We have not calculated the sales of small companies and toll feed millers. If included, it will be more than 1.5 million tonnes. There is little government supervision on feed

quality. As such there is a wide range of feed products in the market. As demand for shrimp feed is high, it is easy to sell any feed even low quality ones.

Shrimp feeds

Leading the entire shrimp feed market are 2-3 companies which together have up to 80% of the market share. The major shrimp feed companies are CP Aquaculture (India), Avanti Feeds, Godrej Agrovet, Growel Feeds, The Waterbase, Grobest Feeds and Nexus Feeds. CP Aquaculture (India) and Avanti are the market leaders and together they sold an estimated 500,000 tonnes of shrimp feeds. The main competition is between these two companies. Furthermore, CP Aquaculture (India) continues to invest in buying and building new factories. Demand for shrimp feeds is increasing and in 2015, Avanti Feeds is planning to sell 50% more feed than in 2014. In contrast some shrimp feed companies are producing as much as 50% less than installed capacity. In 2016, some companies will cease operations if they do not change their marketing strategies and improve their feed quality and technical services for farmers.

Fish feeds

Most of the fish feed companies are located in Andhra Pradesh. In India, only 25% of the fish farmers use formulated feeds. The rest still continue to use traditional mash feeds containing rice bran and de-oiled cakes of various grains. In the case of commercial fish feeds, 90% of the feed used is extruded floating feeds and the remaining 10% is sinking pellets. Companies with pellet mills are promoting sinking feeds. The major fish feed producers are CP Aquaculture (India), Growel Feeds, Indian Broiler (IB), UNO Feeds, Ananda Feeds, Godrej Agrovet, Cargill India, Deepak Nexgen Feeds, Rudra Techno Feeds and Nexus Feeds.

Premium floating feed for juvenile fish such as the Indian major carps and the pangasius.

There is constant expansion to meet future demand for fish feeds. Poultry feed companies are diversifying their businesses into aqua feed production. Fish feed prices range from INR 21-35/kg (USD 0.35 to 0.6/kg, USD1=INR60) based on protein content and transportation costs. Feed conversion ratio (FCR) is difficult to calculate in fish farming. In a scientific farming system where farmers use only formulated feeds, follow good pond management and monitor water quality and fish health, FCR ranges from 1.5:1 to 2:1. With this FCR, the profit margin is small when fish prices are low such as INR 50-55/kg (USD 0.8-0.9/kg) for the pangasius. With frequent fluctuations in fish prices, farmers are forced to adjust their feeding methods and schedules to ensure reasonable profits. They frequently shift between traditional mash feeds to commercial extruded and pelleted feeds. This presents uncertainties in fish feed demand.

Marketing feeds

Companies sell their feeds mainly through distributors and a network of dealers. Sales are direct to corporate farms. Feed companies also explore ways to increase feed sales and market share with incentives and discounts. However, farmers are more attracted by quality feeds assessed via a good FCR, healthy shrimp and finally successful crops.

In India, fish feed sales are mainly based on credit terms. With large volumes of credit given out, many feed companies are facing losses and are contemplating selling their plants and business. However, the larger companies with stronger financial resources can withstand these credit conditions. Feed prices are different for cash and credit buyers. At present, the retail price for shrimp feed is approximately USD 1.1 - 1.4/ kg. Farmers paying cash are given a discount of 10-15%, while dealer discounts are usually 10-15%. The feed mill profit is 10-15% of which production cost is 5% and marketing and logistics is another 5%.

The marketing success is also dependent on the level of technical services provided and the company's relationship with clients. The latest laboratory facilities such as Near Infrared Spectroscopy (NIR) and R&D facilities are essential to update formulations and improve feed quality. My opinion on the difference between foreign and local companies is that the local companies focus mainly on production and marketing whereas the foreign companies give equal importance on quality control and R&D along with production and marketing.

Farmers are using fish feeds with a nutrient specification of 20-32% crude protein and 3-5% fat. Shrimp feeds have crude protein levels ranging from 32-38% and fat level of 5-6%. Some companies have produced extruded sinking pellets for shrimp. But marketing these feeds have not been very successful. All feed companies claim that their feed is the best in the market. Feed companies are mainly focusing on growth performance to attest the quality of their feeds. However, in the field, shrimp farmers are getting FCRs from 1.4:1 to 1.8:1. In extremely rare cases, some have reported better FCR than the stated range.

Raw materials

There is local production of variable quality fish meal, meat meal and soybean meal. Prices are not stable and often fluctuate. The quality and consistency of these raw materials depend on the price and suppliers. Most of the good quality raw materials are exported. Imports of animal meal are not allowed and the import tax ranging from 30-40% is high for several raw materials such as soy, corn and wheat by products. Some raw materials such as squid meal, krill meal and fish solubles are difficult to procure and are very expensive. In traditional fish farming, farmers feed their fish with rice bran in combination with de-oiled cakes of mustard, cotton and ground nut. The quality of these raw materials is linked to offer prices, usually lower prices translate to lower quality.

For a nutritionist in India, it is a challenge to formulate consistently good quality feeds. We can see lots of compromise in raw material purchases to reduce feed cost. Some small companies are not even using premixes at all and some use poultry premixes. Most of the branded feed additives are available here but their usage is minimal due to high prices.

Farmers should demand feed companies to supply quality feeds. Poor quality feeds deteriorate the soil and water conditions leading to serious impact on the final product quality. Farmers

A large fish pond near Kolkata, West Bengal. Farmers in this area feed fish with slaughter house wastes leading to deterioration of pond water.

should follow good management practices (GMPs) to overcome diseases. Farmers should follow feeding protocols and maintain farm records. Probiotic usage helps the farmer to reduce harmful bacteria and improve pond conditions. Basically, good quality feed contain well balanced nutrients, are water stable and palatable to support not only growth but also give rise to healthy animals. Colour, smell and size of feeds are secondary.

Hatchery feeds

The hatchery feed business is growing in India. Multinationals such as Zeigler Feeds (USA), Inve (Belgium), Biomar (Denmark) and Nutreco (Norway) are selling their brands here. In the case of fish, traditional hatcheries are near the farming areas. They rear fry in nurseries and fingerlings in small ponds until they are harvested for sale to grow-out farmers. In a hatchery they can produce several species of fish fry. The demand for good quality shrimp post larvae is high. Throughout the coastal belt there are hundreds of shrimp hatcheries. The demand for specific pathogen free (SPF) post larvae is even higher.

Increasing fish and shrimp production

Our major fish production is the Indian major carps (60%), pangasius (30%) and others (10%). Tilapia farming is in its infancy. Kolleru lake, Krishna and west Godavari of Andhra Pradesh are the main production areas in India. The main domestic market for these fish is Kolkata, West Bengal. In the last few years, demand has expanded to other northern states. In India, some farmers are doing cage culture in reservoirs in a smaller scale and using floating fish feeds.

There is a need to diversify to other species. West Bengal has several large water bodies and fish farming is increasing. This has attracted new feed companies to start production of feeds for local species such as the Indian carps, which have higher farm gate values ranging from INR 90-100/ kg (USD 1.4-1.6/kg). Marine fish will have export potential and value and there should be more effort to encourage the farming of seabass, grouper, cobia, pomfret and milkfish.

Due to EMS, supplies in Southeast Asia and China have gradually dropped by 30-40% since the disease was first reported in 2011, resulting in higher prices. With no reports of EMS in India, it is an opportunity for industry in India to increase vannamei shrimp production. In India, the production of shimp comprises 90% vannamei and 10% monodon shrimp. Monodon shrimp is now being farmed in Gujarat, West Bengal and some parts of Andhra Pradesh. The stocking density of vannamei shrimp in India is 25-50 PL/m^2.

Seafood is a highly perishable food item. Farmers have requested for government operated cold storage facilities to

keep their fish and shrimp products whilst they wait for a good price. Recently the Indian government encouraged food parks, such as the one proposed in Bhimavaram, West Godavari district, to promote consumption of more seafood. Corporate bodies are interested to sell ready to cook seafood products. From the recent FAO report, the per capita consumption of fish in India is less than 6 kg, lower than in neighbouring countries like Bangladesh and Sri Lanka. The purchasing power of consumers has increased in recent times. Government support is required to promote and create awareness on the health benefits of fish to the public.

There is a need to develop a domestic market for shrimp, through hotels, restaurants and super markets and export markets for fish. As the export price of shrimp is declining, shrimp farmers are now worried on the production costs. They want fixed prices for their shrimp from the processors and government. The production cost for size 40/kg is between USD 4-5/kg based on the type of feed and energy source used.

Emerging markets

Gujarat and West Bengal are the emerging aqua markets in India. West Bengal is the biggest market for fish and supplies come mainly from Andhra Pradesh. The present trend for West Bengal is to be self-sufficient and produce their own fish. The state has huge water bodies and the government is providing leases to grow fish. It is also supporting the small scale fish farmers and cooperative societies by giving subsidies.

In West Bengal, new feed companies have started producing both fish and shrimp feeds. Local companies such as Anmol Feeds and Amrit Feeds are supplying sinking fish feeds to the market. The Shalimar group is planning its feed business. All major feed players are already selling both fish and shrimp feeds.

In some places, farmers are using poor quality raw materials or non-nutritive ingredients to feed fish. This means that farmer education is very much needed in this area. Farmers are interested in ready to use technology in farming. In due course these farmers will adapt to the latest farming techniques and conditions will be improved.

We look forward to a future where feed companies will have a more responsible role for sustainable aquaculture and provide technical support to the farmers.

Dr. D. Ajaya Bhaskar is a feed consultant in India since 2014. He has 11 years of experience in the Southeast Asian aquaculture industry, particularly in formulations of both fish and shrimp feeds. He started his career in 2004 as technical manager in Cargill, India and in 2006 joined Thailuxe Feeds, Thailand as formulator. In 2012 he was general manager (technical) in Vijay feeds until 2013. Ajaya has a Bachelors degree in fisheries, Masters in Aquaculture and Ph.D in Nutrition. Email: dasariajay@rediffmail.com
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Fast and furious in Vietnam's shrimp feed business

As it celebrates the opening of its new plant in Long An, Sheng Long Bio Tech International Co is set to grow fast in the region with plans for a feedmill in India and hatcheries in India and Malaysia.

In less than four years, Sheng Long Bio Tech International or Thang Long in the Vietnamese language has made a mark in Vietnam's shrimp feed industry. It now has the fourth largest market share joining long-time market leaders, Grobest Feeds, Uni President Vietnam, and CP Aquaculture Vietnam. Such an achievement has not been easy since when it entered this feed market in 2011, shrimp farming in Vietnam was beset by outbreaks of early mortality syndrome or EMS.

On 18 March 2015, Sheng Long, a subsidiary of the Haid group, held an opening ceremony to mark the completion of the expansion works (where two new pelleting and two extrusion lines were added) at its second feedmill in Duc Hoa Industrial Park, Long An Province. There are plans for another extrusion line. With this addition, total production capacity from three feedmills in Binh Duong, Nha Trang and Long An will increase to 14,400 tonnes per month (tpm) of shrimp feeds and 6,000 tpm of fish feed. There are five brands of starter to grow-out feeds for the monodon and vannamei shrimp (Tiger, Royal Dragon, Lion, Bitech and Panda) and four brands for booster feeds (Golden Tiger, Golden Lion, Baccarat and Marina).

The ceremony was attended by 600 participants, comprising distributors from Vietnam, India and Malaysia, suppliers of raw materials as well as local and national government officials. Also present was Dr Lin Yu Hung from Taiwan Pingtung University of Science and Technology, Dr Le Thanh Hung and Dr Nguyen Nhu Tri, Nong Lam University, Vietnam. In his opening address, Jeff Jie Cheng Chuang, general manager said, "Together with my team, we have been developing in terms of reorganisation, improved quality management, brands rebuilding and distribution networks. Since day one, we have made it our motto that quality is our top priority. Together with strategies which include continuous development of solid networks with our leading brands, promotion of quality marketing services and the creation of our image as a 'professional producer with an excellent service record', we aim to be a leading aqua feed company.

"We were undeterred by the decline in the local aquaculture industry in the past 3 years and showed an incredible growth rate of 900%. I am happy to say that we have become one of the top four shrimp feed producers in the Vietnamese market with a 14% market share. In certain regions, we have the lion's share.

"The shrimp feed market has expanded with an overall increase in shrimp farming area to around 3%. The area used for monodon shrimp farming has declined slightly, but we can see a rapid growth for vannamei shrimp. By volume, shrimp production in Vietnam has increased by 22%, mainly because more farmers in the southwestern provinces have been changing their farming models from extensive system for monodon shrimp to intensive systems for vannamei shrimp. In parallel, in 2014, Sheng Long's sales volumes increased rapidly by 72% while that for the overall shrimp feed industry increased by 22%."

In their respective speeches, Nyugen Huy Dien, deputy director general, Directorate of Fisheries, Ministry of Agriculture and Rural Development (MARD) and Phanh Van Ranh of the People's Committee of Long An province, complimented Sheng Long on its success. Dien said that the company has contributed to the supply chain in aquaculture and in particular, by following regulations. Ranh said that this project has created 500 jobs for the province. It has also contributed USD 3 million to the provincial budget.

Ribbon cutting, Chuang, centre with distinguished guests comprising Nguyen Huy Dien, deputy director general of the Directorate of Fisheries Vietnam, and Pham Van Ranh, the vice chairman of People's Committee of Long An Province.

Feed distributor in Soc Trang, Nguyen Thanh Tuan complimented the company on its success. "I still remember the first year of my cooperation with Sheng Long in 2011. The total sales volume reached approximately 10,000 tonnes/year. At that time, farmers did not trust Sheng Long feeds, partly because its feed brands were not widely known. Within 4 years, Sheng Long has created a firm foothold in the market. Because of its outstanding effort, I strongly believe that Sheng Long is capable of reaching its targeted sales in 2015. I believe that there is no best aqua feed but just a better one. The service oriented strategy of Sheng Long certainly helps."

> **"Our role is to promote healthy products through workable farming models to increase farming success and growth rates, and avoid risks. We believe only in professional innovation and customer service. If the farmer succeeds, it is a win-win situation, both for the farming community and for our feed business." - Chuang**

Feedmill and PL supply

The new feed plant is a modern complex with nine levels. The automatic systems incorporated into this new plant allows for a more stable production. It has two Wenger top of the line twin-screw extruders which allow for flexibility in the production of floating and sinking marine fish feeds. The shrimp pelletiser is equipped with 4-pass conditioner.

Raw materials are automatically directed into the grinder for under 12 mesh grinding and for first mixing. According to the formulation, there is a second grinding for 92% of 80-mesh size and a second mixing. In the pelleting process on the second floor, steam is added during the preconditioning stage for 5 min. Post conditioning follows for 40 min and a water stability phase for 120 min. Level one houses the drying, cooling and shifting facilities while the bagging facilities are located on the ground level. Fines are limited to less than 0.5%.

"The total investment for this modern aquafeed plant was USD 15 million and it has taken a year to complete. It also won the National Gold Quality Award for aquaculture. The total annual production capacity of our three feedmills has reached 250,000 tpy with 9 lines for shrimp feed pellet processing and 3 extruder lines for fish feeds," said Chuang.

R&D director Bao Le Quach (right) with Vietnamese distributors, suppliers and visitors. From second right, Duong Xuan Cuong, technical director and Li Yi Hui, production director.

"Under the Hisenor brand, we have set up three hatcheries located in Ninh Thuan, Hue and Tien Giang provinces. Each has a production capacity of 2 billion specific pathogen free (SPF) *Litopenaeus vannamei* post larvae. We believe that the farmer should have a good start in each crop We estimate the sales volume of 160,000 tonnes of aquafeeds and 1 billion of SPF post larvae in 2015. In 2014, feed sales were more than 90,000 tonnes, comprising mainly feeds for the marine shrimp."

Chuang added, "Currently, we are trying to promote a suitable farming model with the combination of high quality seed from our Hisenor hatchery and from Sheng Long, the production of high-quality feed and animal health products. We also promote antibiotic-free farming. Among the small farms, it is really difficult to eliminate the use of antibiotics and to rely solely on high quality aqua feed. As we are part of the industry, we continue to develop innovations in farming techniques and additives, successful breeding patterns, application of probiotics or vaccines in order to be completely free of antibiotics use.

"Our role is to promote healthy products through workable farming models, to increase farming success and growth rates and to avoid risks. We believe only in professional innovation and customer service. If the farmer succeeds, it is a win-win situation, both for the farming community and for our feed business.

"We also provide a variety of tests for our customers from our local service centres to reduce risks and improve success rate. The same model will soon be introduced into other international markets such as Malaysia and India."

R&D and service oriented strategy

Sheng Long benefits from the R&D of the Haid group which spends USD 30 million to improve feed formulation and aquaculture at its research centre in Guangdong, China. Here, 200 researchers with PhD and Master degrees and some 900 researchers with BSc degrees work on basic and applied research in nutrition, microbiology, physiology and biotechnology applications of aquaculture. The company also benefits from the service oriented strategy developed by the Haid group for its feed clients in China and similarly has applied this to service feed clients in Vietnam (see page 14-16).

Another investment at the new plant is a state-of-the-art laboratory in the newly expanded feed plant for routine feed analyses. Facilities include a PCR laboratory, an electrophoresis room, analytical balance laboratory and a chemical storage room. These facilities allow the feedmill to keep a database of nutritional information on ingredients as well as to implement a quality assurance system based on ISO 9001:2005 and HACCP.

Willson Chen Wei Min, vice president, Sheng Long Bio-Tech (M) Sdn Bhd (second left) with Malaysian visitors and distributors.

Expanding the fish feed business

In 2013, Sheng Long began to produce a general feed for marine fish and tilapia. At the moment, fish feed production is a small part of its feed business. Production was only 5,600 tonnes in 2014. The parent company Haid Group has undertaken considerable research on fresh water fish species in China especially on breeding techniques for the tilapia and snakehead. Chuang will help expand fish feed production in the future to include feeds for snakehead and pangasius.

"We will be introducing fish breeding techniques into Vietnam to provide local farmers with quality fingerlings. We believe in these advanced techniques and with extensive research on formulation, we can achieve a leading position in the Vietnamese market within 3-4 years."

Regional plans

Sheng Long has also expanded into the regional markets in Malaysia, India, the Philippines, Sri Lanka and Brunei. This expansion in Vietnam will meet the feed demand for customers in Southeast Asia. In Malaysia, it has established an operating centre and will invest in a vannamei shrimp hatchery.

Chuang also outlined plans for the business in India. "In our next three-year plan, we will be developing a feed plant and a vannamei hatchery in India. This feed plant will cover sales to South Asia, Middle-East and African markets. The feed production will only be 30,000 tpy and 2.5 billion SPF post larvae after our Indian feed plant and hatchery start operating by 2016.

Optimise opportunities and mitigate the risks

According to Chuang, the aquaculture industry in Vietnam continues to face many difficulties. These are trade and technical barriers and changing climate and environmental conditions.

"However it is a leading export sector for the country with favourable conditions for aquaculture development. There are opportunities for future growth. To be competitive, we have to not only develop advance farming models and innovate continuously to help our customers, but also to expand our business line for fish feed manufacturing, introducing health products, and focusing on the breeding of freshwater fish."

With the development of its export business unit in Vietnam and in future, India, Sheng Long is poised to become one of the top leading aquafeed companies in Asia. In addition to the hatchery business, the Hisenor group has been progressing with the development of a broodstock pool. The aim is to provide high-quality broodstock. Chuang added that they will be looking for a suitable partner to develop the seafood processing sector.

"With the constant support and unwavering trust of our distributors and farmers, we have made outstanding progress. Yet we have been working hard to improve our technology, human resource development and to concentrate more on the welfare of the farmers to secure the confidence of customers. We will continuously progress to become one of the leading companies in the aqua business of the world," added Chuang.

Kumaresan (fifth from right) with distributors and staff of Sheng Long Bio-Tech India Pvt Ltd

Chuang with Kumaresan (right) and Sudhakaran (middle)

The Indian connection

Sheng Long Bio-Tech India Pvt Ltd was set up in 2014. On the sidelines of the celebrations for the Long An feedmill, Kumaresan, director-marketing and feed distributor, M. Sudhakaran explained how they are building the business in India.

Sheng Long Bio-Tech India has its registered office in Chennai. It has two regional managers; the regional manager for south India, Bhaskaran is in charge of the southern markets in Tamil Nadu and Andhra Pradesh whilst the northern regional manager, Kiron covers markets in Odisha, West Bengal, Gujarat, Kerala and Karnataka. According to Kumaresan, "The success in securing markets is due to feed quality and the distribution network. Our two distributors are Aqualife System in Andhra Pradesh and Magnum Sea foods in Odisha and West Bengal. The Magnum group has a well-established shrimp farm and is the third largest seafood exporter in India. It has a buy back scheme for farmers in addition to the production from its own 60 ha of farms. In 2014, it sold 8,000 tonnes of feeds.

"Currently, we have five dealers in Tamil Nadu and in future we will appoint dealers in Gujarat. The feed brands are Lion, Tiger and Royal Dragon which are for black tiger and vannamei shrimp production. In the last quarter of 2014, we imported feeds from the feedmill in Vietnam which totalled 1,000 tonnes for some trials. In 2015, we expect sales of 20,000 tonnes."

In Andhra Pradesh, M. Sudhakaran started using Sheng Long feeds in November 2014. "Farms under the Aqualife group total almost 250 ha and feed consumption will be 6,000 tonnes in 2015. Too many feedmillers in the industry may be disadvantageous for investors but as a producer, I believe this is good as farmers will have a larger choice of quality feeds. We can benchmark these imported feeds with feeds from local producers. Through Marine Impex group, we also have shrimp processing facilities," said Sudhakaran.

Maple Hung Hsiang Shun (left) and Ramesh Mahapatra

Opportunity in India

"The consumption of shrimp feeds in India has grown to almost 800,000 tonnes annually," said Kumaresan. "The top two feedmillers, CP Aquaculture (India) and Avanti Feeds have almost 65% of this market in 2014. The volume may be too high for a production of only 350,000 tonnes of shrimp in 2014. This is because average survival rates dropped due to running mortality syndrome (RMS) where shrimp start dying gradually from 40 days of culture (DOC)."

"What we are seeing in India is that since 2014 with RMS, farmers are reducing stocking density of vannamei shrimp to an average of 30 post larvae (PL)/m² and targeting larger size shrimp (30/kg) for exports. This contrasted with the higher stocking density of 60 PL/m² and more in 2012 and 2013. We started with 30 PL/m² in 2010 to produce size 30-40/kg in 100-120 days. The stocking density of black tiger shrimp is still low at 5-7 PL/m²," said Sudhakaran.

At Magnum farms, Ramesh Mahapatra, chairman of Magnum Group, India said that they have been advocating care for the environment in their shrimp farming operations. "We have been farming with success since the mid-1990s. Today, we are well equipped with generators to run aerators but we still continue with low stocking density in our ponds. My farm technicians may have been tempted to increase stocking density for higher harvest volumes, but have ultimately decided that consideration of the environment and 100% success is the way to go."

Sheng Long will continue to expand in the Indian market. The company plans to build a feedmill in Odisha for 50,000 tpy production in 2016. Next will be another plant in Ongole/Nellore in 2017 with a capacity of 100,000 tpy. There will also be a hatchery in Tamil Nadu with a capacity of 1 billion vannamei post larvae production, scheduled to market in 2016.

Since local production is the next step in Sheng Long's foray into the Indian market, Sudhakaran said his main concern is feed quality. "As a farmer and distributor, it is important that with this shift to local production, feed quality remains unchanged. On the other hand, the presence of newcomers will benefit farmers as with more competition feedmillers will need to improve on the quality of their feeds. Prices will be competitive too."

Maple Hung, Sheng Long's vice president of exports said, "In India, our strategy is to first focus on the black tiger shrimp farmers in West Bengal and Odisha. The trial shipment delivered in 2014 demonstrated to local farmers the extraordinary response on both growth rate and quality of shrimp. Slowly, we expect more recognition for our feeds when farmers realise the quality of our feeds in comparison to what is available locally."

Co May installs new fish feed production line

Despite of a slight fall in pangasius fish exports from Vietnam, Co May Co., a fish feed producer in Vietnam's Mekong Delta, is moving against the tide by installing a new fish feed line which achieved full capacity in just a month.

The new line was added to its new fish feed plant in Dong Thap Province. It has a capacity of 15,000 tonnes/month producing only pangasius fish feeds. Locally known as 'ca basa' and 'ca tra,' the fish is a major Vietnamese seafood export, generating over USD 2.5 billion dollars annually.

"We keep improving the quality of our feed over time as consistency in quality is the key that boosts our fish feed sales. We achieve this by using high quality raw materials that are processed into feed through state-of-the-art technology," said Pham Minh Thien, director of Co May.

Situated on the banks of the Mekong River, the plant was designed to have two production lines with a combined capacity of 30,000 tonnes/month. Costing USD 15 million, the new production line was completely installed and started operating in the middle of 2014. "Its operations reached full capacity in only a month," he said.

The line consists of a hammer mill from Stolz, France, a belt driver and dryer from Andritz, Denmark and an extruder from Triumph Engineering, Thailand. "Stolz's hammer mill is ideal for us because it has a high capacity despite consuming less energy. At the same time, we chose the extruder from Triumph Engineering because it is durable, and if anything goes wrong, it is easy to find spare parts as Thailand is not far from Vietnam," said Thien.

Co May's new fish feed production line has a capacity of 15,000 tonnes/month. Its operations reached its capacity just one month after its installation.

Feed quality

Typically, fish feeds produced by Co May contain rice bran and soybean meal up to 70-80%. Its fishmeal use is very little, comprising less than 5% in all the rations. The company produces three formulations comprising fingerling, grower and finisher feeds. They contain the same level of protein at 26%. Formerly, the level of proteins varied from feed to feed, at 30% in the fingerling feed, 26% in the grower feed and 22% in the finisher feed.

"Our customers tested our feeds repeatedly and they found that at the level of 26% protein, the growth of the fish and the feed conversion efficiency is optimised," said Thien.

Amino acids such as lysine and methionine are added into the feed to meet the requirement of the fish. Provimi, part of Cargill, USA, supplies vitamin and mineral premixes to Co May. "By using Co May feeds in conjunction with applying improved genetics and sound management, the farmers could expect their fish to grow up to 1 kg with feed conversion ratio (FCR) as low as 1.5-1.45," claimed Thien.

Maintaining competitiveness

Although the fish feed business in Vietnam is not as competitive as the livestock feed business, Co May is very careful in maintaining its competitiveness in the market. Apart from the feed quality, the company also comprehensively provides technical and financial support to its customers in order to ensure their success in fish farming.

"Whether you are a local or multinational fish feed producer, no one producer is more competitive than the other in the pangasius fish feed market in Vietnam. Therefore, success depends on the extent a company is able to help its customers to be successful," said Thien.

Pham Minh Thien

Co May offers a credit scheme for its customers to buy feed for the final two months before the fish is harvested. During this stage, the feed intake of the fish is very high, so the credit helps relieve some of the financial constraints faced by the farmers. At the moment, the fish farmers spend 8 months to raise the pangasius fish to the market size of 750g. Along with this, the company's technical team also works closely with customers in order to make sure that the fish are well managed and the fingerlings are source from reliable hatcheries.

"Pangasius is the fish that has long been traditionally farmed in Vietnam. We know well how to manage it and pay attention to all details in order to produce fish with high quality flesh at a reasonable cost," said Thien.

Together with the opening of the new fish feed plant, Co May transformed its old fish feed mill for livestock feed production. Also located in Dong Thap, the old plant was fitted with a new pellet mill with a capacity of 5,000 tonnes/month for producing feeds for ducks, pigs and chickens.

"Dong Thap is rich in rice bran and broken rice and we will seize this opportunity to turn the by-products from rice milling into quality feeds for livestock, especially ducks which are famously raised for both meat and eggs in the Mekong Delta," said Thien. Co May is also a major rice exporter in South Vietnam and operates its own rice mill.

Global feed survey

The Alltech 2015 Global Feed Survey released in January 2015 showed that there was a steady increase in global feed production and industry is closer to the one billion tonne mark in 2014. The survey revealed an estimated total of 980 million tonnes of feed produced globally in 2014, an increase of about 2% over that in 2013.

The top 10 feed producers in the world in 2014 remained the same as 2013: China, USA, Brazil, Mexico, India, Spain, Russia, Japan, Germany and France. Some of the smaller countries saw significant jumps in productivity, including Indonesia, Turkey, Vietnam, Poland, Romania and Morocco.

China once again won the title of leading feed producer in this annual Global Feed Tonnage Survey with 182.69 million tonnes manufactured throughout the country's 9,500 feed mills; however, this is the second year the nation has reported a decline in production.

According to Aidan Connolly, chief innovation officer and director of Alltech's Global Feed Tonnage Survey, there were many areas of ups and downs in worldwide production. These were impacted by both positive and negative influences such as slow markets, shifting raw feed material costs, fluctuating governance over import/export standards and animal diseases such as PEDv in pigs and bird flu in poultry. He estimates the feed industry's net worth at USD 460 billion, based on the average prices of material throughout 2014.

"This is the fourth consecutive year that Alltech has conducted a global feed survey analysing feed production," Connolly said. "This undertaking requires a significant amount of work each year, mainly because the feed industry is measured differently and in varying degrees of thoroughness from country to country. Yet, each year, better information is discovered and more is learned about how farmers around the world feed their livestock."

The Global Feed Survey assessed the compound feed production from 130 countries in Dec. 2014 through information obtained in partnership with local feed associations and Alltech's sales team, who visited more than 31,000 feed mills annually. The Global Feed Survey outlines Alltech's estimate of the world's feed tonnage and trends to date and is intended to serve as an industry resource for the coming year.

Aquafeed production: lower in China

Global aquafeed production grew by 1.8% to more than 41 million tonnes. The total tonnage of aquafeed for 2014 was 40.98 million tonnes. It was a 1.45% rise in production as compared to the production in 2013. Aqua feed production makes up 4% of the total livestock feed production globally.

Asia Pacific produced 27.05 million tonnes, which makes it the regional leaders after Latin America. The top 12 producers are China, Vietnam, Indonesia, India, Thailand, Philippines, Bangladesh, Japan, Taiwan, Australia, Korea, Malaysia and Myanmar. During VIV Asia 2015, Connolly discussed some of the findings.

"What surprised me was how we saw the drop in aquafeed production in China. Tonnage in global aquafeed production went from 40.4 in 2013 to 40.86 million tonnes and that did not look so good. I looked at the information and realised that China's aquafeed production dropped by two million tonnes and because China produced 40% of the feed volume, that meant that the rest of the world went up by 3 million tonnes. The difference was one million tonnes. With the exception of China, most of the rest of the world still saw a small or large increase in aqua feed production."

Connolly (left) with Dr Mark Lyons, Global vice president and head of Greater China, Alltech at VIV Asia 2015, Bangkok.

Connolly added, "Instead of slow growth, we see normal growth for the rest of the world and negative growth for the industry in China. The Chinese situation is very problematic. It has many factors. Fish is very much a luxury item in China. The crackdown on banquets hosted for Chinese officials meant that fish consumption has dropped as with several other luxury goods. Added to this is the economic downturn.

"It is also true that we are moving to more efficient aquaculture farming. We talk about feed conversion of 1:1 in the industry in the western hemisphere but this is not true for Asian aquaculture. Feed conversion for the catfish, tilapia and shrimp are not well understood. As we move towards better farms and farming, we are moving towards better feed conversion which means that even though aquatic production is increasing, feed consumption will not move in the same way.

"I would have thought that aquaculture would be growing on average at 10-15% a year. Out of the 41 million tonnes of feeds, 18 million tonnes were produced in China and 23 million tonnes from the rest of the world. This is a 12% increase."

The Global Feed Survey outlines Alltech's estimate of the world's feed tonnage and trends to date and is intended to serve as an industry resource for the coming year.

"I found that it was difficult to be sure of aquafeed production in comparison with information on poultry feed production. However, year by year we get more robust information and are more confident with the figures that we get. In the next survey 2015, I will put more emphasis on the feed production for species that utilise less volume of feed, which is aquafeed and petfood. In addition, it would be nice to have information on the value of the feed i.e the average price in each country. We have done this for the pig and poultry industry but not for the aqua and pet.

"We do our best to get information and even the United Nations in Rome also ask for the right numbers. This is not a perfect science. We have been doing this for the last four years and when the numbers become more consistent, we also become more confident. We will do the fifth survey in 2015 and this will be a very good database of information. I request Aqua Culture Asia Pacific readers to give me comments and criticisms. I am happy to receive any comments," said Connolly.

A summary of the 2015 Alltech Global Feed Survey findings, including graphs, may be downloaded at: http://www.alltech.com/sites/default/files/global-feed-survey-2015.pdf.

JV on high performance aquafeed production in China

Europe's BioMar group has signed a Memorandum of Understanding with China's Tongwei Co. Ltd to establish a Joint Venture (JV) dedicated to producing and selling high performance feed for aquaculture in China. The target of the JV is to become one of the leading suppliers of high performance feed to the Chinese aquaculture sector and in a second step to expand further to other Asian markets.

The two companies have agreed to start building a feed factory with an annual capacity of more than 100,000 tonnes in China, scheduled to start operations in 2016. In the next stage BioMar and Tongwei target to expand with 3-5 new factories of a similar or larger scale in China and to expand with production and sales in other countries in Asia.

BioMar's entry into the Chinese market is according to the CEO of the BioMar Group, Carlos Diaz, a part of a global expansion strategy initiated a few years back with the establishment of a feed production unit in Costa Rica followed by a new factory in Turkey. Diaz explained that BioMar and Tongwei complement each other extremely well in terms of product ranges and market access.

"China is the world largest aquaculture market and Tongwei holds the leading position as a feed supplier to the aquaculture industry in China. BioMar will as a leading global supplier of specialised larval and fry diets as well as high performance grower diets and functional feeds contribute with know-how and product ranges for the fast growing production of high value fish species in China."

The product range for the new JV factory will include starter and grower feeds for marine and fresh water species such as sea bass, sea bream, cobia, turbot, bass, grouper, trout, sturgeon, tilapia, eel, and shrimp.

While BioMar will directly apply feed recipes and product ranges for some species, Diaz underlines that BioMar also brings a well proven approach in product development securing highly efficient, safe, and sustainable diets, "We have in the salmon segment as well as in other species built a model for feed development, which will be of great value in the development of feed for the new species which are gaining importance in aquaculture across Southeast Asia."

Referring to recent reports pointing to limitations in water resources as one of the greatest challenges for the expansion of aquaculture production in China and the rest of Southeast Asia, Diaz pointed to another key strength of BioMar: "In this scenario with water becoming an increasingly scarce resource BioMar can contribute with a huge amount of knowledge in environmental management, reduction of emissions from aquaculture to the aquatic environment, and especially with highly specialised diets developed for intensive fish production in recirculation aquaculture systems with very limited water consumption. BioMar has over the years through a proactive research effort and collaboration with farmers, authorities, and research institutions achieved a leading position in this field. This knowledge will be very important in the future development of aquaculture in China as well as the rest of Asia."

BioMar and Tongwei will each hold 50% of the new JV. Tongwei Co. Ltd is a leading feed producer in China. The Tongwei Group is listed on the Shanghai Stock Exchange. Tongwei operates nationwide in China as well as in Southeast Asia with over 100 branches and subsidiary companies. In 2014, Tongwei produced around 2.5 million tonnes of aqua feeds. This makes Tongwei the world's largest aqua feed manufacturer. It has held the leading position in the Chinese aqua feed industry for the last consecutive 22 years and it is continuing a rapid expansion within aquaculture research, aquaculture, animal health care, and food processing. The annual sales revenue of Tongwei exceeds CNY10 billion (USD 1.6 billion)

Founded in Denmark in 1962, the BioMar Group A/S is a leading supplier of aqua feeds, ranking among the top three suppliers in the field of high performance feed worldwide. Currently BioMar has 11 production facilities, producing feed for more than 30 different species including among others salmon, trout, sea bass, sea bream, eel, tilapia, shrimp, and sturgeon. BioMar feeds are sold to more than 60 countries and a new factory is at present being built in Turkey. In 2014, the sales volume of BioMar was close to 1 million tonnes with a turnover around Euro 1.1 billion. BioMar is fully owned by Danish Schouw & Co listed at the Nasdaq Copenhagen stock exchange.

Marketing nursery feeds in the Philippines and Indonesia

The Ocialis team led by Mathieu Guillaume, Country manager (second left) and Florian Renault (third left) with shrimp producers during the 9th Philippines Shrimp Congress in Bacolod, Philippines.

For the nursery stages, Bernaqua NV, part of the French international animal nutrition and health specialist member of InViVo NSA, offers MeM Fish Prime™(Micro Extrusion Marumerisation) feeds. These feeds contain 60% crude protein and 15% lipid. The composition is made possible by the technology used which was developed by Bernaqua in 2005 in Belgium. InViVo NSA acquired Bernaqua in 2008.

These new nursery feeds with pellet sizes 200-300µ, 300-500µ, 500-800µ and 800-1200µ are suitable for feeding the grouper, barramundi and pompano. The efficacy of these feeds has been proven at marine fish farms in Vietnam. The feed uses a cold micro-extrusion and marumerisation process, which does not denature proteins by cooking and ensures full water stability of soluble and insoluble nutrients in the feed.

At the hatchery stage, the suggestion is to use the Caviar™, with sizes ranging from 50µ to 500µ. Again these have been used successfully in farms in Vietnam. They contain krill, a small marine crustacean *Euphausia superba* (more than 23% of the composition) from the Antarctica. "This feed shows a better price/quality ratio than other feeds of similar sizes in the market," said Florian Renault, Aquaculture export manager in South-East Asia.

"Bernaqua is a global leader in the market for hatchery feed, with the Royal Caviar™ as the leading brand. There are other brands such as BioSpheres™, which is a standard feed containing Spirulina and is feed for shrimp at the zoea stage. Another unique product is the Vitellus™, comprising Artemia cysts, and is processed into micro-encapsulated feed of 75 µ, which is smaller than Artemia, to up to 400µ"

In Indonesia, PT Wirifa Sakti, InViVo NSA Indonesia has a huge success with the Nanolis™ range of feeds for the hatchery and juvenile stages of freshwater fish such as catfish, tilapia, gourami and carp. As far as sales for this fingerling feed is concerned, Indonesia is leading followed by Vietnam, Philippines and Malaysia.

"This is because of a lack of competition and quality feeds in Indonesia. Two other companies, Grobest and PT CP Prima produce feeds for the juvenile stages but they only market one size of feeds. An upcoming competitor is PT Matahari Sakti, which has started producing starter diets for fish since 2012," said Renault.

"The small starter feeds are manufactured in Vietnam and imported into Indonesia," said Tri Krismiyarto, marketing manager Fish Feeds Division, PT Wirifa Sakti. "Sales are mainly to the freshwater farms and hatcheries. Here in Indonesia, we produce feeds for livestock and freshwater fish under the Laguna brand at our two feedmills in Jakarta and Surabaya. These are mainly for the tilapia and catfish and is sold all over Indonesia."

"Our strategy is to use the feedmills which we have built and developed in Vietnam, with equipment for feed production for the marine fish and shrimp. We then import these feeds into Indonesia. The freight time is not an issue as it only takes 25 days by sea from Vietnam. Next, for the Indonesia market, we will target the Nutrilis feeds for marine fish, specifically for barramundi and pompano," said Renault.

Experimental challenge show the potential of functional feed additives for EMS/AHPND prevention

By Loc H. Tran, Phuc Nhu Hoang, Oanh Hoang Bui, Trang Dai Nguyen, Allen Ming-Hsun Wu, Sam Ceulemans and Peter Coutteau

Results with three feed additives show that these are not a magic bullet but rather an essential component to control microbial balance throughout the production cycle

Early Mortality Syndrome (EMS) or more technically known as acute hepatopancreatic necrosis disease (AHPND) is a new shrimp disease that is presently disrupting production in the major shrimp producing countries China, Thailand, Vietnam and Mexico. It is caused by specific strains of *Vibrio parahaemolyticus* that are difficult to eradicate from the production environment. AHPND will require a very different approach than the current strategies against white spot virus (WSSV) based on specific biosecurity measures.

The control of EMS is through the avoidance of early contamination through the broodstock and larvae, combined with continued control of the microbial populations particularly during the initial month of the cycle. The use of antibiotics to control microbial developments throughout the production process is not desirable due to the risk for resistance build-up and its rejection by legislators and consumers.

The shrimp industry requires alternative ways to control the microbial ecosystem in production systems. Sustainable approaches to modulate the gut microflora in shrimp include the use of a wide variety of natural compounds capable of modulating the microflora towards a favourable composition such as probiotics, organic acids, yeast extracts and phytobiotics. Synergistic effects between these different compounds is most probable, for example phytobiotics can enhance the establishment of probiotic bacteria and therefore enhance the effects of probiotic inoculations in the production system. Functional feeds containing gut health promotors deliver with every meal an adequate concentration of natural antimicrobial activities into the shrimp gut. These feeds are a key component of any strategy to prevent EMS.

However, the success of this approach will depend on the efficacy of the selected gut health promoter against the pathogenic bacteria involved in EMS. The gut modulating feed additive ideally should be heat stable and can therefore be easily incorporated into the feed at the feedmill and be present in every meal from the starter feed onwards, without requiring major adaptations of the production protocols at the nursery or farm. Natural feed additives combining different action mechanisms against *Vibrio* species such as direct bactericide/bacteriostatic properties as well as Quorum Sensing inhibition properties at concentrations below MIC, are most promising to reduce the impact from EMS.

In the present study, three different types of health promoting feed additives were evaluated on their capability to reduce the effects of an experimental AHPND infection on the build-up of *Vibrio* in the shrimp's digestive system and the mortality during two weeks following the infection.

Trial design and treatments

The challenge trial was performed at the Minh Phu AquaMekong Shrimp Vet Laboratory (MPA). Juvenile whiteleg shrimp *(Penaeus vannamei)* were fed with a commercial diet mixed with one of three feed additives for 21 days prior to the challenge with EMS-causing *Vibrio parahaemolyticus* (VP). During the 15 days of post-challenge follow-up period, shrimp continued to be fed the same diet they received during the pre-challenge period to determine if functional feed additives could confer protection against VP.

The team at Minh Phu AquaMekong Shrimp Vet Laboratory; from left to right : Dr Loc Tran, Trang Dai Nguyen, Nguyen Cam Tran, Oanh Hoang Bui, Dr D. Lightner (visitor), Phuc Nhu Hoang, Van To Le.

Specific pathogen free (SPF) post larvae 12 days old (PL12) (Shrimp Improvement Systems, SIS broodstock) were transferred from the hatchery to MPA where they were grown in strict biosecurity for another 45 days to reach the size of 1-2g. One day prior to the start of the study, *P. vannamei* at 1-2/each were transferred to 90L tanks. All animals in these tanks were fed their respective test diet for 21 days at approximately 5% bodyweight each day. All aquaria were outfitted with an oyster shell filter, aeration and covered with plastic to reduce the risk of cross contamination.

The positive control tanks were fed a control diet, which was a commercially pelleted shrimp diet for the duration of the 21 days of the experiment. The experimental diets were made by grinding and re-pelleting a commercial feed. Three different types of additives with anti-microbial properties were evaluated compared to the un-supplemented control diet. Diet 1 contained Sanacore, a synergistic blend of natural antimicrobial compounds with multiple actions including bacteriostatic and quorum sensing inhibition (Coutteau & Goossens, 2013). Diet 2 contained Phyto, a botanical blend with antimicrobial activity and diet 3 contained OAC, a blend of organic acids.

Challenge methods

MPA in conjunction with the University of Arizona's Aquaculture Pathology Laboratory (UAZ-APL) has developed some standardised challenge methods used to challenge small juvenile shrimp with the strain of *Vibrio parahaemolyticus* causing EMS/AHPND simulating the natural routes of infection (via water exposure and cannibalism). In this study, two challenge methods were used: bathing (immersion) and direct feeding of bacteria (per os).

For the immersion challenge, Tryptic Soy Broth +2% sodium chloride (TSB+) inoculated with a consistently virulent strain of *Vibrio parahaemolyticus* (strain LA37), incubated for 18 hr at 28°C, was added directly into tanks to reach a bacterial density of $3X10^5$ cells/ml measured by optical density absorbance (OD_{600} nm). For the per os challenge, TSB+ medium inoculated with LA37 and incubated for 18 hr, was mixed with commercial shrimp feed at 20% v/v ratio and air-dried for 15 minutes. The shrimp feed coated with bacterial culture was fed to shrimp for only one

meal at 3% body weight. The negative control tanks were also fed with a commercial shrimp feed but were treated with sterile TSB+ instead of bacterial suspensions.

A day zero sample consisting of two animals was preserved in Davidson's AFA fixative prior to the start of the challenge study to document the animals' SPF health status for white spot syndrome virus (WSSV), taura syndrome virus (TSV), EMS/AHPND, and infectious myonecrosis virus (IMNV). Shrimp total *Vibrio* count on TCBS were done in serial dilutions on day 5, 10 and 15 post-challenge animals of each treatment.

Sampled shrimp were peeled, homogenated in saline water and diluted serially before plating on plates of different media for counting. The tanks were checked twice daily, all mortalities were removed from the tank and frozen for later PCR test. On day 21 (just prior to the challenge tests), and on day 5, 10 and 15 post-challenge up to three moribund animals of each treatment were preserved in Davidson's AFA fixative and processed for routine histology and PCR to confirm the presence of EMS/AHPND pathology. At termination of the challenge study, all live animals were counted as survivors.

Histological analysis

The histological analysis shows that shrimp in the negative control groups remained negative to EMS throughout the experiment. Meanwhile, shrimp from all other challenged groups exhibited EMS lesions after challenge. Interestingly, shrimp in the challenged groups in general showed positive to EMS after 5 days and 10 days of challenge but may not show lesions of EMS after 15 days of challenge. This may indicate that shrimp may have the capability to recover from EMS infection if they still survive the challenge.

Figure 1. Survival of shrimp during 15 days following two types of experimental infection with an EMS/AHPND causing strain of *Vibrio parahaemolyticus*. Data show survival for negative (non challenged) and positive control group (challenged, fed on control feed), and three treatments (challenged, pre-fed control feed supplemented with different health additives).

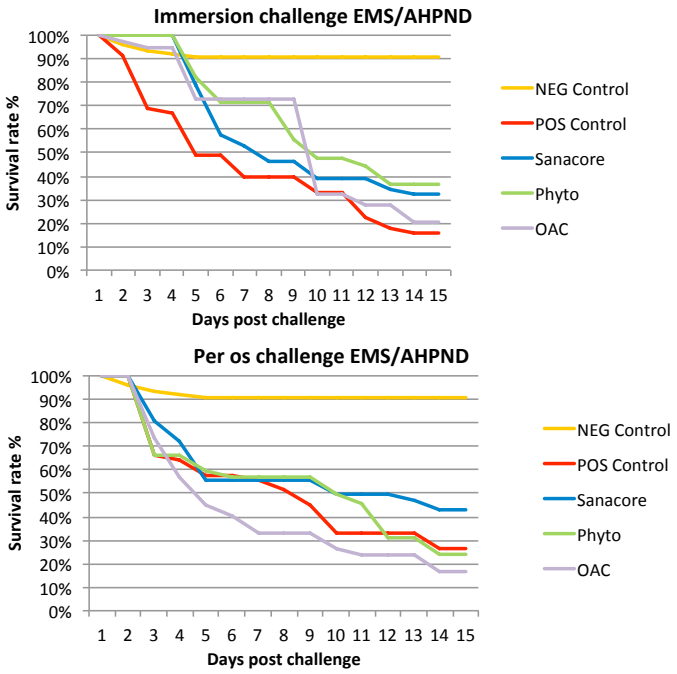


Figure 2. Final survival for positive control group and three treatments fed different health additives, experimentally infected by immersion or *per os*.

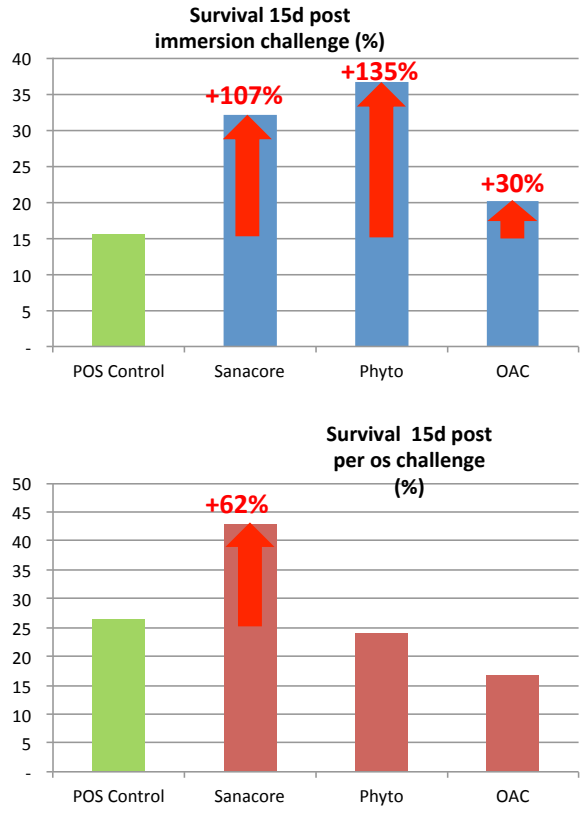
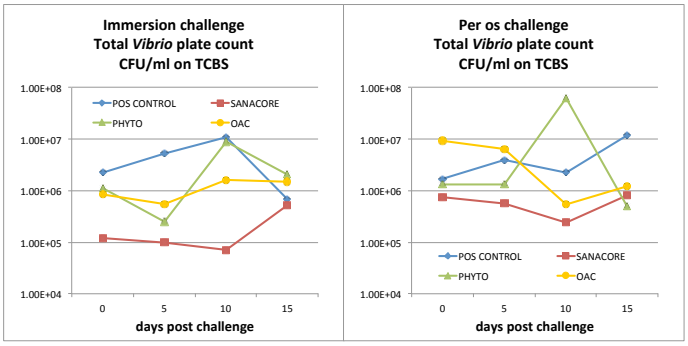


Figure 3. Total *Vibrio* count in the shrimp digestive system during post-challenge follow-up for positive control and three treatments fed different health additives, experimentally infected by immersion or per os. Day 0 shows results after 21 days of pre-challenge acclimatization on the different dietary treatments, prior to challenge.



Slower mortality

The non-challenged, negative control group showed an average survival of 91% which indicated that the shrimp used in the current challenge trial were in a good health and nutritional status throughout the trial. Following challenge, the mortality occurred gradually during the 15 days of post-challenge for both types of experimental infections, which is due to the selection of a VP strain with medium virulence (Figure 1).

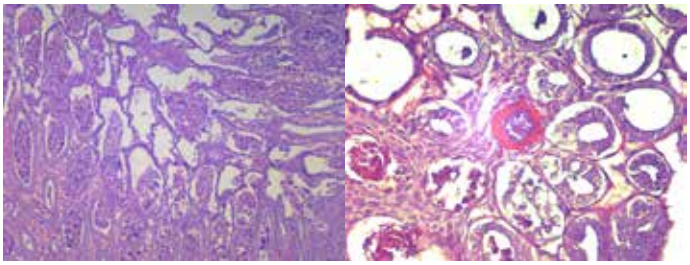
Nevertheless, in the immersion challenge shrimp supplemented with feed additives showed a slower mortality initially compared to control. This was not the case for the more direct per os challenge. Shrimp fed the control feed (positive control treatment) showed a final survival of 15.6% and 26.7% for the immersion and per os challenge, respectively.

Supplementing the feed with different health additives during 21 days prior to the challenge and following 15 days after the challenge did not result in significant differences in challenge survival compared to the control for any of the treatments (average survival 16.7-42.9%; Figure 2). However, survival at the end of the trial indicated some trends which differed according to the two types of challenges (immersion and per os; Figure 2). The shrimp supplemented Sanacore tended to show higher survival compared to control in both types of challenges (+107% in the immersion challenge, +62% in the per os challenge). The group fed the botanical mix (Phyto) showed higher survival only in the immersion challenge (+135%). The group supplemented with the mix of organic acids (OAC) did not show any effect in any of the two challenges.

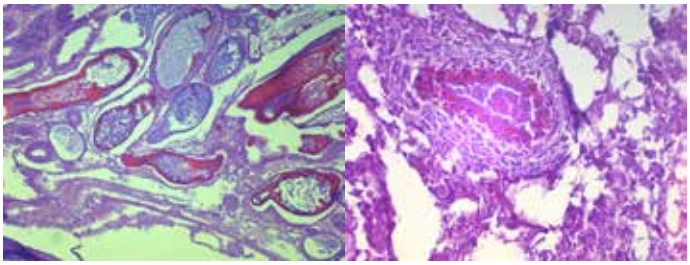
The treatment resulting overall in the best challenge survival (Sanacore) exhibited consistently lower plate counts in the shrimp's digestive system compared to the other treatments, both in total heterotrophic count and total Vibrio count (Figure 3). Interestingly, the lower total *Vibrio* count compared to the control group was already established for this treatment following 3 weeks of acclimatization to the diet (day 0 in Figure 3).

Conclusion

The current laboratory results using a controlled AHPND infection are consistent with recent results obtained from field trials in Mexico and Vietnam in EMS affected farms. These field data indicated that specific health promoting feed additives bring up survivals from medium levels (60-70%) to pre-EMS levels (>85%). However, farm results also show that such feed additives are not a magic bullet but rather an essential component of a total farm management strategy aiming at controlling the microbial balance throughout the production cycle.



Histology of the hepatopancreas of EMS/AHPND infected shrimp: acute phase with tubular epithelial cells sloughing of (10x left; 40x right)



Histology of the hepatopancreas of EMS/AHPND infected shrimp : terminal phase with massive bacterial infection (10x left; 40x right)

Dr Loc H. Tran is assistant professor at the College of Fisheries, Nong Lam University. **Phuc Nhu Hoang, Oanh Hoang Bui** and **Trang Dai Nguyen** are with the Minh Phu Aquamekong ShrimpVet Laboratory, Ho Chi Minh city, Vietnam. Email: thuuloc@email.arizona.edu/ thloc@hcmuaf.edu.vn

Allen Ming-Hsun Wu, **Sam Ceulemans** and **Peter Coutteau** are with Nutriad International, Dendermonde, Belgium.

The consequences of fumonisins in fish feed

By Verena Starkl and Karin Naehrer

Toxicity effects in carp and catfish ranged from lower weight gain to brain damage

In the recent years, fumonisins –a group of mycotoxins mainly produced by *Fusarium verticillioides* and *F. proliferatum* – have attracted more attention as greater awareness coupled with new research has shed light on the toxic metabolites.

Fumonisins like the most frequently occurring fumonisin B1 (FB1) are produced by *Fusarium* spp., commonly occurring fungi which are responsible for the production of a broad range of mycotoxins. In a worldwide survey on mycotoxin contamination of feeds carried out by BIOMIN yearly since 2004, fumonisins and deoxynivalenol were the most frequently found.

According to the most recent 2014 results, 51% of the aqua feed samples that were tested were contaminated with fumonisins at a high average concentration of 637 parts per billion (ppb), with one sample reaching up to 7534 ppb. Furthermore, 76% of the aqua feed samples contained more than one mycotoxin. This poses additional risk to animals since in many cases the combined effects of two mycotoxins are higher than the individual effects of each toxin alone.

Corn is a major component of fish feed and represents the commodity most affected by fumonisins. Fumonisins disrupt sphingolipid metabolism and block the synthesis of complex sphingolipids from sphinganine (Sa) and sphingosine (So). As a consequence, Sa and So accumulate in tissues. The accumulation of Sa and So can be used as a biomarker to indicate fumonisin contamination.

Effects in fish

Effects of fumonisin intoxication depend strongly on the species; studies of aquaculture species reported the following symptoms:

- Lower weight gain
- Lower survival rates
- Necrosis
- Inflammation
- Increased susceptibility to disease
- Brain damage

Channel catfish showed lower weight gain and survival rates after a bacterial challenge when feed was contaminated with 20 ppm fumonisins. Fumonisin at 10 ppm increased the Sa/So ratio in the serum, liver, kidney and muscle. Fumonisins exert similar toxic effects in carp and catfish which include decreased body weight gain, necrosis, and inflammation in the kidney, liver, heart, spleen and brain when 10 ppm fumonisins were fed. As little as 500 ppb fumonisin negatively affected blood chemistry and weight gain. Carps from trial groups were more affected by bacterial infections. Fumonisins in carp can also cross the blood-brain barrier, causing severe damage to the brain. In rainbow trout, FB1 served as a tumour promoter.

Catfish

Catfish feed typically contains 30-35% of corn. Channel catfish in their second year of growth fed 80 mg FB1/kg of diet showed significantly lower weight gain and significantly lower survival rates when challenged with *Edwardsiella ictaluri.* Antibody production against deactivated *E. ictaluri* cells was significantly lower in fish fed 20 mg fumonisin/kg diet. (Lumlertdacha & Lovell, 1995). In an earlier study with year-1 channel catfish (average initial weight 1.2 g) from the same group of researchers, it was observed that 20 mg of fumonisin per kg feed was sufficient to significantly reduce growth performance (Lumlertdacha, 1994).

Fusarium proliferatum

Channel catfish (average initial weight of 1.5 g) were fed diets formulated to contain 0, 20 and 40 ppm FB1 for 10 weeks. Fish fed diets with the lowest concentration of FB1 (20 ppm) had lower ($p<0.05$) weight gain than the control fish after exposure of barely 2 weeks. Haematocrit concentration was lowered ($p<0.05$) when 40 ppm diet was given. Dose-dependent increases in the Sa/So ratio were obtained with increasing concentrations of dietary FB1 (Yildirim et al., 2000). Even lower dosages of FB1 (>10 mg/kg diet) increased the Sa/So ratio after 12 weeks of exposure in the serum, liver, kidney and muscle, but not the brain of channel catfish (Goel et al., 1994).

Carp

Year-1 carp (127g/8 fish) were exposed to 10 and 100 mg fumonisins/kg feed. Even the lower dose under these scientific conditions was toxic to carp, indicating the relatively high sensitivity of this species to fumonisins. Both groups showed decreased body weight gain. Apoptosis, necrosis, inflammation and increased number of rodlet cells were found in the kidney, liver, heart, spleen and brain in the group fed 10 mg fumonisins/kg diet. These effects were more pronounced in the 100 ppm group. The liver and kidney were most affected by fumonisins (Petrinec et al., 2004).

In a different experiment, year-1 carp consuming pellets containing 0.5 and 5 mg FB1/kg body weight for 42 days had increased liver enzyme activities and bilirubin concentration, indicating liver damage, as well as increased creatinine concentration, indicating adverse impact on the kidneys. In both groups (0.5 mg and 5 mg FB1/kg body weight), young carp lost weight and a higher incidence of infective bacterial dermatologic lesions was observed in the higher dosed group (Pepeljnjak et al., 2003).

Fumonisins were also shown to cross the blood-brain barrier causing severe damage to the carp's brain neuronal cells. One-year-old carp were fed 10 and 100 mg fumonisins/kg diet for

Feeding pangasius catfish in Vietnam

42 days (Kovacic et al., 2009). This resulted in vacuolated, degenerated or necrotic neural cells scattered around damaged blood capillaries and in the periventricular area.

Rainbow trout

Rainbow trout were kept under experimental conditions from fry until the end of experiment to evaluate the carcinogenic effect of FB1. FB1 does not act as a complete carcinogen in the absence of an initiator. When more than 23ppm FB1 were fed over 42 weeks FB1 acts as a tumour promoter for aflatoxin B1-initiated liver tumours in rainbow trout. Short term treatment (1 week) does not have the same effect (Carlson et al., 2001).

Nile tilapia

A study in Nile tilapia (initial weight 2.7g) revealed that 40mg FB1/kg diet significantly reduced weight gain compared to control fish and increased the Sa/So ratio in the liver of fish fed (Tuan et al., 2003). No differences in mortality were observed but performance was affected.

Counteracting fumonisins

Although it is known that fumonisins in fish diet impair health and performance of aquatic species, further investigations are still needed especially on the co-exposure of fish with fumonisisn and other mycotoxins. Formation of fumonisins cannot be completely avoided by preventive measures. Consequently, constant monitoring and mitigation of fumonisins contamination are necessary in the aquaculture industry. Until now, the binding of fumonisins to adsorptive substances was the only solution available to counter fumonisin intoxication. Due to the molecular structure of these mycotoxins and pH dependence of the reaction, fumonisins are only insufficiently adsorbed by mycotoxin-binding products in the gastrointestinal tract. Therefore, biotransformation of fumonisins to non-toxic hydrolysed fumonisin B1 using a purified, specific enzyme is the best way to protect animals.

Verena Starkl (left) and **Karin Naehrer** are both product managers with BIOMIN Holding GmbH
Email:
verena.starkl@biomin.net
karin.naehrer@biomin.net

Effect of silica supplement on growth performance and health condition of juvenile shrimp

By Wutiporn Phromkunthong

SILICA+ is activated quartz which improves the animal's digestive system by stimulating enzymatic exchange. In swine, Silica+ has a positive effect on growth performance by promoting not only growth but reducing ammonia emission in the environment. We also found that the product can increase the dissolved oxygen concentration in water and improve water quality as it decreases ammonia, nitrate and nitrite. The purpose of this study is to confirm whether the supplementation with this silica product has a positive effect on growth performance and whether it improves the health condition of Pacific white shrimp *Litopenaeus vannamei*.

A feeding trial was designed to determine if the inclusion of Silica+ (Ceresco Nutrition, Canada) in diets for juvenile shrimp could result in growth, feed efficiency and health conditions compared to shrimp fed a control diet.

Experimental details

The feeding trial on shrimp was conducted at the indoor facility of the Kidchakan Supamattaya Aquatic Animal Health Research Center, Department of Aquatic Science, Faculty of Natural Resources, Prince of Songkhla University, Hat Yai, Thailand. Fibreglass tanks of 235-L (water volume 180-L) were used for rearing the shrimp. These were part of a continuously aerated system. The water temperature in the aquaria was 26-27°C, pH ranged from 7.2 to 7.8, and dissolved oxygen level was no less than 6.0 mg/l. Mean values for total ammonia and nitrite were 0.01 and 0.02 mg/l, respectively.

Shrimp post larvae (PL13) were obtained from Nattapon Hatchery, Songkhla, Thailand and maintained on a commercial feed in the experimental rearing units for 3 months before the start of feeding trials. The average body weight of the shrimp at the start of the feeding trial was 2.17g. Thirty shrimp were randomly released into each of the 24 tanks (6 tanks per treatment) in the set-up.

Feeds and feeding regime

Experimental diets were formulated with fishmeal (FM) as the major protein source. Other feed ingredients included dehulled soybean, poultry meal, wheat flour, squid liver meal and corn meal. Diet 1 (T1) contained 15% FM whereas diet 2 (T2) was formulated to contain equal amounts of FM and nutrients as in T1 but 0.02% silica supplementation was added. Diet 3 (T3) was formulated to contain 7.5% FM while diet 4 (T4) was formulated to contain the same amount of FM as T3 but with 0.02% silica supplementation. Feed composition is presented in Table 1. All diets contained nutrients according to the requirement of the shrimp. They provided 39% crude protein and 6% lipid (Table 2).

The diets were made into sinking pellets (pellet diameter: 2 mm) using a Hobart mixer (Model A200T, USA), oven-dried at 60°C and stored at -20°C. Details of diet preparation have been previously described in our former study (Phromkunthong et al., 2013). Shrimp were hand fed four times per day at 08:00, 12:00, 16:00 and 20:00, to satiety. The apparent intake of the experimental feeds was recorded every two weeks during the 8-week trial by visual inspection of the aquaria.

Table 1. Formulation of the experimental diets

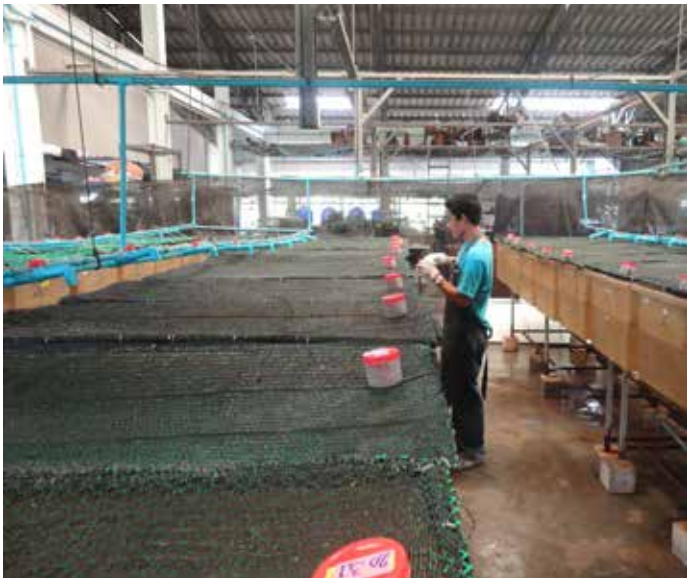
Ingredients	Experimental diets			
	T1 (control)	T2 Silicia+	T3 (control)	T4 Silicia+
	FM 15%	FM 15%+Si+0.02%	FM 7.5%	FM 7.5%+Si+0.02%
Fish meal (FM)	15	15	7.5	7.5
Soybean de-hulled	21	21	29.5	29.5
Poultry meal	18	18	19.5	19.5
Wheat flour	3	3	3	3
Squid liver meal	2	2	2	2
Corn meal	5	5	5	5
Fish oil	0.9	0.9	1	1
Lecithin	1	1	1.3	1.3
Choline chloride	0.1	0.1	0.1	0.1
Vitamin & mineral premix (ROVIMIX 2050)	0.2	0.2	0.2	0.2
Inositol	0.04	0.04	0.04	0.04
Mono-ammonium phosphate	1.73	1.73	1.98	1.98
BHT	0.02	0.02	0.02	0.02
Calcium carbonate	0	0	0.82	0.82
Cassava flour	32.01	31.99	28.04	28.02
Silica (Si)	0	0.02	0	0.02
Total	100	100	100	100
Cost (THB/kg)	20.44	20.61	20.04	20.21

[1]Vitamin & Mineral premix (ROVIMIX®2050, DSM Nutritional Products) deliver the following in unit kg-1 diet: vitamin A 7,000 IU; Cholecalciferol (D3) 3,000 IU; Tocopherol (E) 1,500 mg; Menadione sodium bisulfite (K3) 30 mg; Thiamine (B1) 25 mg; Riboflavin (B2) 20 mg; Pyridoxine (B6) 25 mg; Cobalamin (B12) 0.02 mg; Niacin 100 mg; Calcium pantothenate 80 mg; Ascorbic acid (C) 200 mg; Biotin 1 mg; Folic acid 10 mg; Copper 25 mg; iron 30 mg; Zinc 100 mg; Manganese 30 mg; Cobalt 0.2 mg; Iodine 1 mg; Selenium 0.35 mg, Silica (Ceresco Nutrition, Canada) Exchange rate: USD 1=THB32.5 on 31 March 2015

Table 2. Proximate composition of experimental diets[1](% dry matter basis)

Diets	Moisture	Protein	Fat	Ash
T1 (control)	5.41±0.20	38.75±0.11	6.18±0.11	11.05±0.22
T2	5.31±0.03	39.72±0.15	6.15±0.10	10.84±0.10
T3 (control)	5.35±0.11	38.30±0.39	6.21±0.06	11.09±0.58
T4	5.24±0.14	39.72±0.14	6.20±0.12	10.86±0.39

[1]Analyses of 3 batches of feed given as mean ± SD



Experimental tanks

Performance

The bulk weights of shrimp were recorded from each tank at the start of the feeding period and every fortnight in order to estimate the weight gain. The initial body composition was determined from a minced sample obtained from 30 shrimp. At the end of the study, three shrimp were collected from each replicate of the six treatment tanks in order to analyse body composition, as described in our previous study (Kiron et al. 2012).

The performance parameters for the 8-week feeding period are presented in Table 4. Specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER) and apparent net protein utilisation (ANPU) were presented.

Enzyme analyses

The activity of phenoloxidase (PO) and superoxide dismutase (SOD) was determined. The activity of total protease in the intestine was also analysed. Details of all measured parameters are indicated below.

Phenoloxidase (PO) activity

Haemolymph samples were individually drawn into microtubes containing cacodylate buffer (CAC, pH 7.4) at a dilution of 1:3 which were then immediately immersed in liquid nitrogen. Samples were homogenised with ice and centrifuged at 12,000 rpm for 15 min at 4˚C. Supernatant was collected into new microtubes for PO activity test.

Superoxide dismutase (SOD) activity

SOD activity was measured using a commercially available kit (Cayman Chem, USA) by the detection of superoxide radicals generated by xanthine oxidase and hypoxanthine.

Total protease activity

Shrimp intestine was individually extracted based on the method of Vega-Villasante and co-worker (1995) with a slight modification. The protease activity assay was determined using casein as a substrate.

Statistical analysis

In this trial, FM*Si denotes interaction between FM levels (15% or 7.5%) and Si (with or without Si supplementation). If the statistical testing if P<0.05 in the table there are significant differences among the two parameters). Mean values are reported with 3 standard deviation of the mean (SD). After confirming normality and homogeneity of variance, the data were analysed by two-way ANOVA (SPSS, version 11.5), using fishmeal and Silica+ concentrations as the two factors. Where two-way ANOVA showed a significant interaction between the two factors, one-way ANOVA was used to identify significantly different means using Tukey multiple comparison. Differences were considered significant at P<0.05.

Results

There were significant differences in terms of average body weight from week 2 onwards as higher inclusion of FM (15%) gave higher growth compared to the lower FM level (7.5% FM) (P<0.05) (Figure 1). The inclusion of silica provided higher average body weight than that of un-supplemented groups in both the FM levels from week 4 onwards.

Table 3. Average body weight of shrimp fed on the experimental diets for 8 weeks[1]

Experimental diets	Average body weight (g)				
	week 0	week 2	week 4	week 6	week 8
T1 (control)	2.17± 0.00^{ax}	3.15± 0.11^{bx}	4.23± 0.19^{bx}	5.22± 0.23^{bx}	6.79± 0.34^{bx}
T2	2.17± 0.00^{ax}	3.19± 0.11^{bx}	4.39± 0.05^{by}	5.52± 0.32^{by}	7.29± 0.25^{by}
T3 (control)	2.17± 0.00^{ax}	2.89± 0.08^{ax}	3.64± 0.11^{ax}	4.66± 0.21^{ax}	6.16± 0.57^{ax}
T4	2.17± 0.00^{ax}	2.99± 0.09^{ax}	3.86± 0.05^{ay}	4.97± 0.45^{ay}	6.52± 0.40^{ay}
FM level	0.329	0.000	0.000	0.000	0.000
Silica level	0.329	0.087	0.001	0.028	0.016
FM*Silica	0.329	0.470	0.561	0.964	0.726
[1]Mean ± SD from each of the 6 replicate tanks. FM level ^{a,b} , Silica level ^{x,y}					

In addition, growth performance in terms of weight gain (WG), specific growth rate (SGR) and average daily growth (ADG) had the same trend as compared to average body weight (P<0.05) (Table 4).

Feed conversion ratio (FCR) of shrimp fed on diets incorporated with silica was better compared to un-supplemented diets in both FM levels (P<0.05) (Table 4). The average mortality for all the treatment groups was low (less than 10%), and there were non-significant differences between the treatment groups in survival (Table 4). The feed intake was insignificantly affected by the dietary silica supplementation (P>0.05) (Table 4).

Protein efficiency ratio (PER) and apparent net protein utilisation (ANPU) gave the same trend as indicated for FCR. Shrimp fed on the diets containing silica with different FM levels had a higher PER and ANPU compared to unsupplemented diets (P<0.05) (Table 5). The supplementation of Silica+ seems to increase lipid content , especially in the diet formulated to contain 7.5% FM (<P 0.05) (Table 5).

The supplementation of Silica+ in the shrimp diet formula significantly increased phenoloxidase activity (PO) and superoxide dismutase activity (SOD)(P<0.05). Furthermore, total protease activity in the intestine of shrimp fed diets supplemented with silica was higher when compared to that of the un-supplemented groups (P<0.05) (Figure 2).

Table 4. Survival rate, weight gain (WG), specific growth rate (SGR), average daily growth (ADG), average feed intake and feed conversion ratio (FCR) of shrimp fed on the experimental feeds for 8 weeks[1]

Experimental feeds	Survival rate (%)	WG (%)	SGR (%/day)	ADG (g/day)	Average feed intake(g/shrimp)	FCR
T1 (control)	96.11±3.90^{ax}	212.76±15.76^{bx}	2.0±30.09^{bx}	0.08±0.01^{bx}	10.14±0.47^{ax}	2.24±0.12^{by}
T2	96.67±4.22^{ax}	235.71±11.39^{by}	2.16±0.06^{by}	0.09±0.00^{by}	9.61±0.64^{ax}	1.91±0.19^{bx}
T3 (control)	94.44±3.44^{ax}	183.02±25.94^{ax}	1.85±0.16^{ax}	0.07±0.01^{ax}	10.06±0.36^{ax}	2.66±0.41^{ay}
T4	92.78±3.90^{ax}	200.42±18.61^{ay}	1.96±0.11^{ay}	0.08±0.01^{ay}	10.01±0.35^{ax}	2.41±0.15^{ax}
FM level	0.094	0.000	0.000	0.000	0.401	0.000
Silica level	0.729	0.016	0.013	0.017	0.149	0.007
FM*Silica	0.491	0.719	0.853	0.739	0.217	0.724

[1]Mean ± SD from each of the 6 replicate tanks
FM level ^{a,b} , Silica level ^{x,y}
WG: weight gain, SGR: specific growth rate, ADG: average daily growth, FCR: feed conversion ratio were calculated using the following formulae:
SGR (% day^{-1}) = 100 [Ln (mean final body weight, g) – Ln (mean initial body weight, g)]/feeding days
FCR = dry feed intake (g)/[final biomass (g) initial biomass (g) + biomass of the dead fish (g)] PER = wet weight gain (g)/protein intake (g)
ANPU (%) = 100 [(protein content (g) of fish at end of experiment protein content (g) of fish at start of experiment)]/fed protein, dry (g)

Conclusion

The results from this present study showed that the supplementation of Silica+ in shrimp diet enhanced growth performance and feed utilisation (FCR, PER and ANPU). Similar to other trace elements, silica may play an important role as cofactor in many biochemical processes in the cells of shrimp. It promoted immune system functions in shrimp as PO and SOD increased. These two endogenous antioxidants are crucial for the control of reactive oxygen species (ROS) production and the prevention of oxidative damage of cells (Lesser, 2006) and PO and SOD were increased when marine invertebrates are naturally exposed to stress conditions (Abele and Puntarulo, 2004; Guerriero et al., 2002; Martínez-Alvarez et al., 2005; Pannunzio and Storey, 1998). In our study, shrimp were not subjected to stress, but PO and SOD significantly increased as Silica+ had positive effects in this regard.

Table 5. Protein efficiency ratio (PER) and apparent net protein utilisation (ANPU) of shrimp fed on the experimental feeds for 8 weeks[1]

Experimental feeds	PER	ANPU
T1 (control)	1.17 ±0.05^{bx}	22.61±2.49^{bx}
T2	1.35 ±0.10^{by}	25.91± 3.02^{by}
T3 (control)	1.03 ±0.15^{ax}	18.80±2.26^{ax}
T4	1.09 ±0.08^{ay}	20.19±1.14^{ay}
FM level	0.000	0.000
Silica level	0.009	0.023
FM*Silica	0.194	0.328

[1]Mean ± SD from each of the 6 replicate tanks
FM level a,b , Silica level ^{x,y}
PER = wet weight gain (g)/protein intake (g)
ANPU (%) = 100 [(protein content (g) of fish at end of experiment protein content (g) of fish at start of experiment)]/fed protein, dry (g)

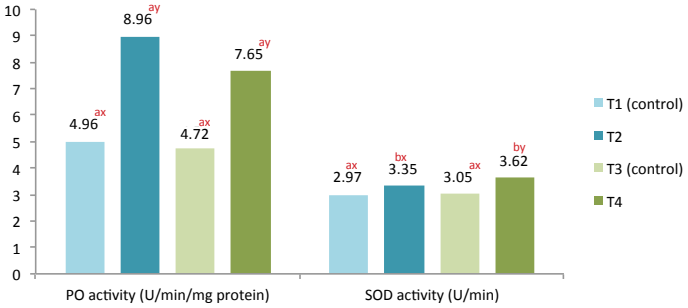
Table 6. Proximate composition of whole body shrimp fed on the experimental feeds for 8 weeks1 (% on dry matter basis)

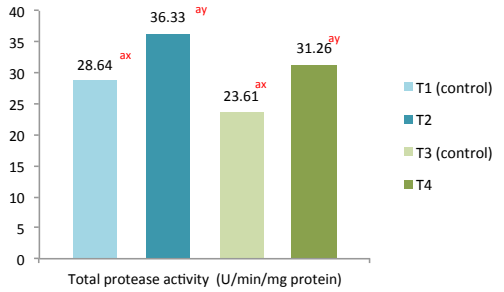
Experimental feeds	Dry matter	Protein	Fat	Ash
T1 (control)	23.44±1.43^{ax}	73.76±0.85^{c}	3.28±0.45^{a}	12.77±0.39^{ax}
T2	23.99±1.26^{ax}	72.45±1.57^{b}	3.38±0.23^{a}	12.39±0.70^{ax}
T3 (control)	23.63±0.52^{ax}	70.27±0.40^{a}	3.07±0.14^{a}	12.57±0.21^{ax}
T4	23.63±0.74^{ax}	71.13±0.52^{a}	4.05±0.62^{b}	12.36±0.66^{ax}
FM level	0.847	0.000	0.178	0.603
Silica level	0.531	0.579	0.004	0.189
FM*Silica	0.536	0.011	0.015	0.708

Values (%) are given as mean ± SD; n = 5 shrimp from each of the 6 replicate tanks
FM level ^{a,b,c} · Silica level ^{x,y}

The elevation of the total protease activity in the gut of shrimp receiving diets supplemented with Silica+ suggests that this product has a positive influence on protein digestion.

Figure 2. Blood parameters (phenol oxidase activity, PO; superoxide dismutase activity, SOD and total protease activity in the intestine of shrimps which conducted after the termination of growth study. Values are given as mean ± SD; n = 20 shrimp from each of the experimental feeds. FM level [a,b] , Silica level [x,y]





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Dr. Wutiporn Phromkunthong is associate professor and head of the Department of Aquatic Science at the Prince of Songkla University, Thailand. He received his Ph.D. in Biology from the University of Heidelberg, Federal Republic of Germany in 1995 and has been working as a lecturer at the PSU for more than 25 years. His research mainly focuses on aquatic animal nutrition. Email: wutipornp@yahoo.com/wutiporn.p@psu.ac.th

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Tilapia 2015
Part 1: Regional developments in tilapia production

By Eric Roderick

Production is estimated to increase to 5 million tonnes in 2015 with rapid growth in Vietnam and Indonesia.

Tilapia 2015 is a follow up to the past successful conferences on the production and marketing of the tilapia organised by INFOFISH, in 2001, 2007 and 2010. The global diversity of tilapia farming was manifested by the almost 300 delegates and 31 speakers from 22 countries. The trade show had only 12 booths, but was well attended, and most companies reported a lot of interest. Tilapia 2015 was held from April 2-4 in Kuala Lumpur, Malaysia.

The three day conference program included presentations covering four areas in the tilapia industry: production status, marketing, technological developments and health management. There was a special session on fish health, genetics and functional nutrition conducted by MSD Animal Health, which together with Nutriad International and Kula Aqua, India were sponsors of the conference. The article in this issue focuses on developments in production and some challenges. It will be followed by part two on markets and technological developments including nutrition.

Global production and marketing

Professor Kevin Fitzsimmons, University of Arizona, USA presented his keynote address on "Market Stability: Why Tilapia Supply and Demand have avoided the boom and bust of other commodities". Tilapia production for 2014 was 4.7 million tonnes and is expected to pass 5 million tonnes in 2015 with a value of over USD 10 billion. Farmed in over 140 countries globally, the tilapia was the fourth most consumed seafood in the US in 2014, a position it has maintained since 2006. China is the biggest tilapia production, consuming and exporting nation (followed by Egypt, Indonesia and the Philippines), while the USA is the major tilapia importing country (over USD one billion of tilapia was imported during 2013)

According to Fitzsimmons, the regions of rapid production growth include Vietnam where the pangasius catfish have moved from cages on the Mekong to inland ponds and the vacated cages are stocked with tilapia. Indonesia is also rapidly expanding using cage culture and polyculture. Regal Springs the world's largest producer with farms in Indonesia, Honduras and now Mexico is increasing production, and is now exporting fresh fillets to Europe as well as the established markets in the USA. There is also a big expansion in the use of tilapia in polyculture with shrimp particularly in Asia, as new research has shown positive effects in the control of EMS disease in shrimp just as there was in Ecuador during the white spot syndrome virus (WSSV) epidemics.

Asian production

China

"In 2013, China produced 1.66 million tonnes of the tilapia which was 7% of China's total farmed fish production," said **Dr Jun Rong Liu**, Dalian Ocean University. Some 96% of tilapia production was from Guangdong (42%), Fujian (8%), Guangxi (17%), Yunnan (8%) and Hainan (21%). The Yunnan region is the only region of significantly increased tilapia production mainly providing high quality tilapia from its rich reservoirs.

The export market is very well developed mostly to the USA but Mexico and Russia are also big importers of tilapia from China. Liu said that Guangdong had 56% of the Mexican and 45% of the USA market in 2013. Hainan has 47% of the EU market and Fujian, 57% of the market in Russia.

There is now a large effort to expand the domestic market, which will decrease the amount of fish available for export as well as improve the quality and image of the product. Live fish is sold close to producing areas and processed fish to first tier cities (Beijing, Shanghai and Guangzhou). China, the world's biggest producer by far, is maintaining its position, and with low production costs, will always be a major producer.

Indonesia

Artati Widiarti, Ministry of Marine Affairs and Fisheries highlighted the importance of the tilapia in Indonesia. Over 500,000 tonnes were produced in 2013 in a very wide range of culture systems from freshwater through to brackish water ponds, in paddy fields and in cages. The biggest expansion is in brackish water areas and several new salt tolerant tilapia varieties have been developed for these habitats such as the *Sri Kandi* (adapted for 10-30 ppt salinity) and *Salina* for 20-30 ppt salinity. Several selection programs have resulted in fast growing, fatter fish, male tilapia and disease resistant varieties. South Sumatera was the biggest production area with an increase from 25,119 tonnes in 2009 to 84,913 tonnes in 2013. The export market is very strong, mostly to the USA but some tilapia are also exported to Canada, Japan and Europe. This is mainly from the Regal Springs operations which have full international certifications to meet the import requirements of these markets. Domestic consumption of the tilapia is highest in south Sumatera at 2.5 kg/capita/year.

Angus MacNiven (right) and team. FarmAqua, Thailand provides equipment and services to the aquaculture sector in the region.

Kevin Fitzsimmons (left) with Eric Roderick. Fitzsimmons is wearing a vest and cap made from tilapia skin.

Speakers from left, Jun Rong Liu, Shirlene Anthonysamy (Infofish), Mazuki Hashim and R.S.N. Janjua. Shirlene presented in the marketing session.

Philippines

"This is the third largest producer in Asia at 316,536 tonnes in 2013 and 95% was from freshwater pond, cages and pens," said **Dr Rafael D. Guerrero III**, Aquatic Biosystems. Production of tilapia in existing areas is limited, and brackish and mariculture are being looked at closely and new salt tolerant strains such as *Molibicus* hybrid (*O. mossambicus x O. niloticus*) are being developed. Future expansion will be farming in lakes in Mindanao Island in the south. New developments are aquasilviculture, the growing of tilapia in fenced mangrove areas and organic culture with the use of organic feeds and non-chemical inputs.

Bangladesh

"Tilapia production in Bangladesh reached 228,000 tonnes in 2012/13," said **MD Zillur Rahman**, Department of Fisheries. Production is from various culture systems; Bangladesh started to export the tilapia in 2013-14 with 333 tonnes. Monoculture mainly of the GIFT and monosex male is cultured widely with a production recorded at 27,713 kg/ha/year. Zilur listed the several government initiatives for the expansion of tilapia aquaculture. One of Zilur's recommendations was to replace methyl testosterone sex reversed tilapia fry with the YY supermale technology as consumers are demanding more environmentally friendly safe food. "This YY supermale technology developed by Fishgen in the UK, is expanding rapidly around the world," said **Eric Roderick**, CEO of Fishgen in his presentation. The YY supermale technology is the only viable alternative to hormone sex reversal as consumers look for sustainable eco-friendly fish. Fishgen's YY technology is now used in over 50 countries.

Vietnam

In his presentation on the Vietnam Tilapia Story, **Dr Nguyen Huu Dzung**, Vietnam Association of Seafood Exporters and Producers (VASEP) said that the tilapia is the second white farmed fish, after the pangasius. Its production rose to 125,000 tonnes in 2014, a 25% increase from that in 2013. It is mainly farmed in cages in the open water bodies in the Mekong Delta and in the central and northern regions.

There is a national program for tilapia development, which is targeting for an increase to 25,000ha of tilapia farms for a production of 200,000 tonnes by 2020, and of which 80,000 tonnes will be for export. The current farming area is 15,992 ha. In 2014, Vietnam exported tilapia to 66 markets valued at USD 35.8 million, an increase of 265% as compared to that in 2013. The top six markets are USA, Spain, Colombia, Netherlands, Belgium and Germany.

"The potential for expansion is large with several leading pangasius producers already farming the tilapia," said Dzung. "Among them is Navico, the leading tilapia producer. It farms the tilapia in 20 km long cage systems in the Mekong River in An Giang Province. Production is integrated with a hatchery (producing 1 billion fingerlings/year) and processing facilities. It has a cooperation program with Norway's Genomar in broodstock development. Vinh Hoan, another leading pangasius producer and processor is farming in Dong Thap and Tien Giang provinces and Minh Phu, the leading shrimp producer is farming tilapia in Ca Mau and Hau Giang provinces. The first tilapia farm certified by ASC is Hoang Long in Dong Thap Province. We can expect more farms to diversify to the tilapia soon."

Rest of Asia

Dr Marzuki Hashim, Department of Fisheries said that Malaysia produced 44,000 tonnes of both red tilapia (*Oreochromis niloticus hybrid*) and nile tilapia (*O. niloticus*). However, there are significant expansion plans, especially using the red hybrid varieties of tilapia. The biggest constraint in Malaysia is the lack of good quality tilapia fry, and fry are being imported from Taiwan, Thailand and Indonesia. The government is providing the private sector with opportunities to expand cage farming of tilapia in many of the big lakes such as Lake Kenyir in Terengganu and Temenggor Lake in Perak where Genomar's Trapia operation is located.

India is now allowing the import of tilapia broodstock and would like to follow in Bangladesh's success. **Dr P.E.Vijay Anand**, US Soybean Export Council, India said that India produces 4.20 million tonnes of aquaculture products of which tilapia accounts for just 5% and with tilapia gaining in popularity, expansion is going to be very fast. "Commercial tilapia production is a recent new phenomenum in Pakistan but it will be expanding" said **R.S.N. Janjua**, American Soybean Association, Pakistan. He outlined some feeding trials with soy based floating extruded feeds.

"In Papua New Guinea, tilapia production is small at only 15,000 tonnes in 2013," said **Gideon Pama**, Department of Fisheries. "However, there is a large potential demand from the domestic market. Farmers can make between USD 4-7/kg on fresh or cooked tilapia. Frozen wild captured tilapia is sold in local stores at USD 6-8/kg. Some farmers have started semi-intensive cage farming of tilapia."

African production

"There is a current wave of optimism sweeping the continent with increased commercialisation, massive increase in domestic demand, high prices and lots of investors showing interest in tilapia projects," said **Blessing Mapfumo**, FAO advisor for Africa. The region has over 200,000 km^2 of freshwater lakes and reservoirs. Africa's total farmed production of tilapia reached 816,000 tonnes in 2014 with 800,000 tonnes produced by Egypt and the remainder produced by Uganda, Nigeria, Zambia and Ghana. Most of this production is now consumed domestically. Lake Harvest, the only big commercial operation in Africa, with farms in Zimbabwe, Uganda and Zambia produced 10,000 tonnes in 2014. It used to export most of its production to Europe but there is now very strong domestic demand in most African countries with high prices in the local markets making exporting uneconomical. The main challenges to African aquaculture are shortages of fingerlings and good quality feed.

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CHILE:
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Tel: (56-65) 2435090
Claudio Berkhoff
cberkhoff@mundoacuicola.cl

CHINA:
Tope Exhibition
Services Co., Ltd.
Tel: +86-21-54711012
Summer Fang
topechina@163.com

DENMARK:
Royal Embassy of
Denmark
Tel: (56-2) 2941-5100
Casper Rundager
casrun@um.dk

SPAIN:
Cámara de Comercio de
España en el Perú
Tel: (511) 212-5333
Andrea Riega Pastor
ariega@cocep.org.pe

INDIA:
Thais Expo Pvt. Ltd.
Tel: +91-98123 90009
Jitender Kumar
jkumar@thaiscorp.in

TURKEY:
Amiral Fair
Tel: 90-533-5435789
Erhan Ersever
info@amiralfair.com

U.S.A.:
B-FOR International
Tel: +1-540-373-9935
Kathryn Barry
kbarry@exhibitpro.com

Organizer: THAIS CORPORATION - Tel.: (511) 201-7820 - Email: thais@amauta.rcp.net.pe

Asia benefits from krill

Aker BioMarine is an integrated Norwegian biotechnology company, dedicated to harvesting krill sustainably and developing krill-derived biotechnology products. Since 2010 Aker BioMarine has provided Asia with its products for aquafeed and human consumption, and next in line will be pet food. Recently, **Nils Einar Aas**, sales director at Aker BioMarine, shared some of his observations on the Asian market.

Aker BioMarine has several krill-derived products for fish and humans, and recently launched in Europe, a product for pets. Can you tell us more about your products and their benefits?

Krill are small crustaceans, like shrimp. *Euphausia superba* live in large schools in the cold, pristine waters of the Antarctica. Aker BioMarine produces krill meal and krill oil. The products have a high level of bioactive ingredients; in particular omega-3 bound phospholipids and highly unsaturated fatty acids, EPA (eicosapentaenoic acid), DHA (docosahexanenoic acid) and astaxanthin. These ingredients have documented positive effects on humans and animals alike.

The krill meal is used for animal and aquaculture feed. Our product, krill for aquafeed, Qrill Aqua, accelerates growth, is organic and a market differentiator. Our recent commercial scale project shows that fish fed diets with krill meal in the last weeks before harvesting offer significantly improved fillet quality and yields.

There is also a strong scientific basis for krill as a growth accelerator and efficiency driver in shrimp feed formulations, and this is also a very important application for Qrill across the Asian continent. As fish meal supply is limited, krill as an efficiency driver in low fishmeal shrimp diets is a very relevant benefit for our customers.

The krill oil (Superba) is used for human consumption. It is a pure, natural source of the health-promoting essential omega-3 fatty acids EPA and DHA, and the naturally occurring antioxidant astaxanthin. Superba is unique because the omega-3 fatty acids come in phospholipid form. They are more efficiently incorporated into cell membranes and therefore effectively support the heart, brain and joint functions.

The products are provided with 100% traceability from the Antarctic sea to the end user. Aker BioMarine is the only company that manages a krill fishery and that has been re-certified with the Marine Stewardship Council (MSC) certification.

What is your Qrill Aqua market presence in Asia?

Our presence in Asia includes Qrill Aqua which is used in a broad range of marine fish and shrimp feeds. We are committed to markets where there is an application need for krill in aquafeed and we see that there is an opportunity to grow. In Asia, we are present in major aquaculture countries including Japan, Korea and Taiwan, as well as throughout South East Asia and Australia.

With the krill originating from the pristine waters of the Antarctic, how does Aker BioMarine sustainably produce these products?

With opportunities come responsibilities. Conventions limit the catch and we operate within the requirements of the Convention of the Conservation of Antarctic Marine Living Resources (CCAMLR), an international treaty that continues to oversee krill fishing and is endorsed by 25 members. Today the catch level is about one third of its allowable level. Aker BioMarine also provides monthly haul-by-haul data from fishery which are monitored by scientific international observers.

The Marine Stewardship Council, an international non-profit organisation with an independent certifying body and a public assessment process, re-certified Aker BioMarine's krill fishery as sustainable and 100% traceable. Today you can find a blue eco-label on our products.

Aker BioMarine also works actively with NGOs, including the World Wide Fund Norway, and its main ship Saga Sea even turned off its lights for Earth Hour on March 28, 2015.

More information: www.akerbiomarine.com

Aker BioMarine Qrill meal is in a broad range of marine fish and shrimp feeds in Asia.

Technical Director FEED

Dr Christian Lückstädt

ADDCON has announced the appointment of **Dr Christian Lückstädt** as the new technical director of its "Feed" business unit. Formerly Addcon's R&D manager and previously serving as technical director for Asia, Lückstädt received his PhD in Animal Nutrition from the University of Hohenheim in Stuttgart, Germany and has worked for the past 12 years world-wide with dietary organic acidifiers in animal production.

"He has shown an excellent track record over the last years within the R&D department of the company. It is an honour to hand over more responsibilities to Christian. I am sure that he will continue to do a great job in leading the R&D team FEED", said Kurt Wegleitner, MD of Addcon. "Due to the growth of the company in all markets, we keep hiring more staff for the R&D department," added Wegleitner.

Aquatic at VIV Asia 2015

A sustainable aquaculture focus

Aquatic Asia was a special event at VIV Asia for the aquaculture sector. It featured 20 exhibitors with innovative products for the sustainable farming of fish and shrimp. The event was lively not only with seminars, displays and discussions at some booths but also concurrent half-day and full-day conferences. Feeds, feed ingredients, health and culture management were the leading topics. VIV Asia 2015 was held from March 11 – 13 in Bangkok, Thailand.

In contrast to the last and previous versions of Aquatic at VIV Asia, exhibitors in 2015 agreed that this was the best to date. With a steady flow of visitors, most exhibitors were pleased with the number of responses they received. For feed ingredient company, Biomax, a new exhibitor to VIV Asia, it was a very exciting and good show. It was also a first for Brazil based Guabi, and Diogo M. Villaça, foreign trade manager was pleased with their presence at this event, which allowed the company to make direct contact with the aquaculture industry in various countries such as Iran, Pakistan, Bangladesh, Japan, Korea, India and Russia. (see page 56). At the Olmix booth, Jean Peignon, Technical Support, Aquaculture Department said that the main purpose of attending a trade show such as this is business networking. However, the conference program and sharing of knowledge were also stimulating. (see page 58).

A larger VIV Asia

Organisers of this 12th edition of VIV Asia, VNU Exhibitions reported that the companies present this year included 178 that were exhibiting for the first time. Visitor numbers over the 3 days reached 38,425, representing an increase of 15.6% from the 33,229 visitors in 2013. From registration details on visitors' region of origin, double-digit percentage increases were recorded for the number of people visiting from Asia, Oceania, the Middle East, Africa, North and South America and Western Europe. Foreign visitors from the 123 countries, outside the show's home country of Thailand rose by 18.2% to 25,302. Thailand itself was among 15 Asian nations sending more visitors to VIV Asia in 2015, with the region's largest increases coming from Cambodia, Bangladesh, Pakistan, Sri Lanka and China.

The visitor profile showed that the main interest was in animal health and nutrition products at 66.2%. An estimated 19.2% of visitors were interested in shrimp and fish farming in comparison to 52% in poultry production. Some 30.1% of visitors were general managers or directors followed by 18% from sales and marketing and 14.5% from the technical and engineering sectors.

Project manager Ruwan Berculo, said, "VIV Asia 2015 has exceeded our expectations. We wanted it to be a show that was relevant to everyone in Asia and also to the milk, aquaculture, meat and egg businesses as well as its established theme of feed to meat. This was most definitely achieved, and the show has been bigger again.

"The key point in my opinion is that VIV Asia is now definitely established as the priority meeting place for professionals from throughout Asia involved in producing and processing of animal proteins. Everyone in the business realises they must attend because they know that their competitors and colleagues will be there. They recognise that it is the place to come in order to be well informed about techniques and markets, innovations and international suppliers."

Meet the Press

Held on March 9, this event brought representatives from the global media. Some 30 participating exhibitors made short pitches on their marketing objectives at VIV Asia 2015. This was followed by speed date sessions, where media representatives meet selected exhibitors to get details on their activities. The Aqua Culture Asia Pacific team talked with company representatives of Provimi, Singapore. The company markets Nutribull, a feed

The Camden Industries Inc team is from the Philippines. From left, Von Cordova, Neil Peralta, Gretchen Uy, Antonio Choa and Jojo Castro.

Iwan Sutanto (left) with participants at the Blue Aqua International seminar. From right, Duk Park Young, Ning Widjaja, SyAqua, Indonesia, S. Muthukaruppan, Poseidon Biotech, India, Martin Guerin, Gold Coin Group, Malaysia and Dilip Sathyanathan, PT Indonusa Yudha Perwita, Indonesia.

Olivier Derome, (right) president and CEO at the Sopropeche booth with Kelly Xue, general manager of the China Branch, Seah International in Qingdao.

additive for fish and shrimp produced in Vietnam which works well against some viral diseases such as white spot syndrome virus. The aqua market is growing for Provimi in Asia and Mexico. It is also promoting the new proprietary nutrient formulating platform Cargill Nutrition System (CNS) to the aquaculture market.

The newly formed Taiwan Agricultural Technology Research Institute (ATRI) serves as a platform for the application of advanced agricultural technology. The institute will bridge the gap between academia and industry with the latter providing solutions. To date there are 10 companies in ATRI involved in feed additives and vaccine development, and some of them are exhibiting at the show. The Netherlands Agro, Food & Technology Centre (NAFTC) is providing a window for Dutch companies to market in Asia though representative offices. Currently, there are two in Asia – Beijing, established since 2008 and New Delhi since 2011, and one in Africa in Cape Town, which was launched recently. These offices are available for Dutch companies, training and knowledge institutions, and NGOs with an interest to provide products or services to the local agrifood markets. At the moment, companies participating are in the livestock industry.

Feed ingredients and additives

This is the first year that **INVE Aquaculture** actually participated with a physical booth, despite having a close association with the event in previous years from its base in Thailand. The company promoted the principle of 'Best Balance' between live feed and dry diets based on research and experience with large commercial runs of vannamei shrimp in countries such as Vietnam. Inve Aquaculture also organised a seminar for 40 key Asian customers on the holistic management towards sustainable aquaculture production. Topics included aquafeed formulation and its management at pond side, post-larval quality and best health management practices as well as case studies in India and Brazil (www.inveaquaculture.com).

Soleval has a range of fish meal and fish oil replacers for aquafeeds. It has a broad range of natural ingredients from land animals. These are processed animal protein (PAP) and blood meal from pork or poultry and hydrolysed feather meals. Fats are also from pork or poultry. These are sustainable alternatives in feeds for many species such as shrimp, salmonids, sea bass and tilapia. It conducted trials on shrimp and tilapia in Thailand.

HyPro™ is their new range of highly digestible feather meal which has higher palatability and enhanced pellet processing properties arising from the high levels of soluble proteins. The product also has low levels of biogenic amines and is free from contaminants such as PCBs (polychlorinated biphenyls) and heavy metals compared to standard fish meal. Based in France,

From Mexico, the Vimifos team of Marcelo Costero (left) and Alejandro Diaz Alonso.

Soleval is a subsidiary of Akiolis, a member of the Tessenderlo group (www.soleval.akiolis.com).

Germany based **Leiber** was in the Aquatic session to promote its Leiber® Beta-S, described as a highly purified beta-glucan from brewers' yeast for strong, immunocompetent fish. The product studies with rainbow trout and carp showed significant increases in innate immunity and increases in survival rates after bacterial infection (www.leibergmbh.de). The new power in protein was introduced by the **Empyreal** team, part of the Cargill Corn Milling North America. This is Lysto™ which is a safe high protein (75.8%) and digestible plant derived concentrate with a complete amino acid profile (www.LystoProtein.com).

The shrimp aquafeed industry is familiar with the soluble fish protein manufactured by the 45-year old company, **Sopropeche** in France. This uses a unique production process based on natural enzymatic hydrolysis. It also supplies French steamed dried fish meal, low temperature-organic Scandinavian fish meal as well as meals from various other fish and squid, krill and shrimp shell meal. Other high quality feed ingredients include fish oils, vegetable proteins, algae, yeasts and feed additives (www.sopropeche.com). Another producer of fish oil is **Sea Promega**, France which has custom blends such as crude, semi refined and fully refined fish oil from various fish sources (www.seapromega.com).

Evonik Industries, Nutrition & Care, Animal Nutrition recently introduced DL-methioine for Aquaculture™ with a particle size optimised for aqua feed to provide the most effective methionine source to the aquafeed industry. Particles which are 90% smaller than 300 microns, are distinctly finer than commercially available standard DL-methionine. At VIV 2015, it conducted an aquaculture symposium. Dhanapong Sangsue, technical sales manager, Singapore presented on the supplementation of DL-methionine and L-lysine to improve nutritional values of low fishmeal diets in tilapia fingerlings. Dr Karthik Masagounder, technical sales manager presented on AQUAVI® Met-Met (Dipeptide of DL-Met) – a novel methionine source for shrimp feed. Dr Albert Tacon, technical director, Aquatic Farms Ltd., USA discussed recent developments in shrimp feed formulation and on-farm feed management (www.evonik.com/feed-additives).

Fish/shrimp health management

At the show, GeneReach Biotechnology introduced its new diagnostic kit Pockit™ which is a novel easy to use field deployable PCR system for detection of *Vibrio* causing the early mortality syndrome. This hand held nuclei acid analyser is based on insulated isothermal PCR (iiPCR) technology and has the capability for DNA extraction in 2 minutes with a throughput of 1-4 samples per run (www.genereach.com).

Fish Vet Group (FVG) recently opened its Asian office in Bangkok. At its booth, visitors were drawn by the videos on fish welfare and on FVGs health services as well as discussions with expert consultants(see box).

Farming technology

These were presented by Marine Leader of Thailand (see box). Blue Aqua International has the patented Mixotrophic protocol on how to successfully manage and balance nutrient cycles and micro-organisms in the pond in different stages for super-intensive and intensive shrimp culture. Blue Aqua also conducted

a half day seminar where Iwan Sutanto, Shrimp Club Indonesia (SCI) presented on how producers in Indonesia have achieved successful harvests consistently. In his presentation, Iwan said that shrimp production in Indonesia has been increasing at an annual rate of 20% and SCI contributed 200,000 tonnes to the 2014 production of 400,000 tonnes of both vannamei and monodon shrimp. Integrated operations contributed a total of 40,000 tonnes and traditional and semi intensive farms contributed 160,000 tonnes of monodon shrimp.

Iwan gave examples of productivity data from his own farm in Bengkulu and Jogjakarta where he is applying the mixotrophic system (plankton and bacteria). Stocking is at 173-186 PL/m^2 in 1,500 m^2 ponds in Bengkulu. Harvests are from 4.8 to 5.7 tonnes/pond and there are four partial harvests starting at 93 days of culture (DOC) for size 60/kg followed by others at DOC110, DOC130 and DOC146 for size 46/kg, size 36/kg and size 33/kg, respectively. Iwan stressed that the critical points are minimum fluctuations in water and soil parameters, 24 h aeration, minimal water exchange and optimal N:P ratio at the beginning of culture, followed by optimal C:N ratio at the middle to the end of culture. (www.blueaquaint.com)

Empyreal Products team, from left, Vorapong Pattrakulchai, Eric Bell, Zach Longhini and Claudio Paredes.

Marine Leader

Satit Phanich (middle) with his team.

Marine Leader is one of Thailand's leading aquaculture suppliers. It is now expanding into markets in India, Bangladesh, Malaysia, Vietnam and Philippines. In February, it was at the Aquaria India show in Vijayawada, India. This is the first time that the company is exhibiting at Aquatic/VIV Asia event.

Satit Phanich set up Marine Leader in 2000. Satit has more than 20 years of experience in the shrimp aquaculture business. He formed the company after working in Charoen Pokphand Thailand for 6 years. He decided to be the link between industry and researchers in Chulalongkorn University when they developed probiotics for black tiger shrimp farming and needed some marketing expertise. He also worked with researchers at Thailand's National Science and Technology Development Agency (NSTDA) to develop water quality tests kits.

"Our vision is to focus on adapting knowledge from research for the farming industry. We will select and support research appropriate for farming because we would like to be a company that brings the breakthrough technology and successful factors to the farmers. We want to ensure that right technologies and knowledge are explored and continue to be developed in line with the need of a sustainable industry.

"We have complete lines of products for shrimp and fish farming, from brood stock maturation, hatchery to farm equipment and products. For the shrimp broodstock, we market frozen polychaetes farmed in Thailand as well as the Red Dragon extruded feeds. Our frozen products are specific pathogen free (SPF) for known diseases such as WSSV, EHP and EMS and negative for virus, bacteria and protozoa, *Vibrio* spp., microsporidia etc.,"

Aside from products available now, Marine Leader develops diagnosis strip test (Q test) for primary screening or confirmation of WSSV infections, and water quality test kits for on-site measurements. Other products include the Bi Omega range of feeds, which has a combination of DHA and krill oil.

"This is our most recent launch. We developed a feeding program for the freshwater prawn hatchery. At the brood stock stage, we feed with brood stock diets. After hatching, we feed enriched artemia every hour and on day 10, we feed a combination of boiled eggs, DHA and chelated minerals Aqua Mac at 3-5ppm. On day 18 in the ponds, Bi Omega is added directly into the pond. Such a hatchery nursery protocol will also benefit farmers in Bangladesh, India and Malaysia.

"We also encourage nursery culture for marine shrimp and our protocol is feeding extruded MPL SS feeds which are very small (500µ) during the nursery stage. These are extruded feeds contain 52% crude protein and 8-10% lipids. The industry should learn to use such micro-particulate feeds which will preserve water quality."

More information:www.marineleader.co.th

Fish Vet Group

With aquatic animal diseases costing the aquaculture industry USD billions annually, it was no surprise that there was never a quiet moment at the Fish Vet Group (FVG) booth.

Discussions focused on disease and on strategies for pathogen control and management. Thailand alone has lost an estimated USD 3 billion since the onset of acute hepatopancreatic necrosis disease (APHND) of shrimp and while pre-AHPND Thailand was the world's number one shrimp exporter, post-AHPND it has been overtaken by Ecuador, India, Vietnam, China and Indonesia.

Showcasing its technical expertise, the following FVG mini-seminars attracted interested participants to the booth. Elsewhere, there was standing room only at the Bayer booth for FVG's Dr Matthijs Metselaar's invited talk on 'Why biosecurity is important for aquaculture production'.

- Assessing shrimp post-larvae quality by Dr Leo Galli
- The shrimp defence mechanism: simple but efficient by Dr Pikul Jiravanichpaisal
- Gill health in finfish aquaculture by Dr Hamish Rodger and
- Fish and shrimp parasites by Dr Andy Shinn.

On display at the FVG booth was a mobile iiPCR machine which is a simplified insulated isothermal reverse transcriptase PCR for in vitro use by workers with basic laboratory skills for the qualitative detection of RNA from specific pathogens. This mobile iiPCR delivers results for key shrimp and fish diseases including AHPND, white spot syndrome virus, Taura syndrome virus and yellow head virus diseases of shrimp, and nervous necrosis virus and koi herpes virus of fish in the field in less than 90 minutes, inclusive of RNA extraction time, and which can run multiple and different disease tests simultaneously.

At the FVG mini seminar on fish and shrimp parasites by Dr Andy Shinn.

Visitors were particularly keen to learn that FVG has recently opened wet lab facilities in Chonburi, approximately 90 minutes south east of Bangkok, where confidential challenge tests can be conducted for freshwater, brackishwater and marine fish and shrimp in replicated tanks systems, which may be of interest to commercial feed and feed additive companies to verify the efficacy of emerging products against diseases like AHPND of shrimp.

Fish Vet Group (www.fishvetgroup.com) is promoting total aquatic animal health services and economic, environmentally friendly and ethical aquaculture systems to meet the global growing demand for sustainably produced aquatic products. FVG's services include site visits, biosecurity assessments, the development of aquaculture health plans as well as the collection and evaluation of samples for bacteriology, histopathology, parasitology or characterisation of aquatic pathogens by molecular-based technologies. More information: Don Griffiths, Operations director at don.griffiths@fishvetgroup.com)

Bringing extruded shrimp feeds into Asia

At the Guabi booth, Diogo M. Villaça (right) and Francis Poyares who is responsible for supply chain.

In the global shrimp farming industry, Brazil based Guabi is uniquely a leader in the production and marketing of extruded shrimp feeds. It has 10 years of experience in the production of extruded shrimp feeds and corners the domestic market, in particular for extruded shrimp feeds. Guabi has been in the animal nutrition business since 1974. It has six feed plants all over Brazil and produces 500 products for livestock and aquaculture. In addition, the company exports to 21 countries in the Americas, Africa, Asia and Europe.

"We want to come to Asia which can be a huge market for fish and shrimp feeds. Recently, we began to export to farmers in Asia; shrimp feed to India while shrimp feed to Malaysia is at the negotiation stage. Our shrimp feeds have been formulated for the vannamei but we can formulate custom made feeds for monodon too as well as feeds with specific additives on demand. We also have the state-of-the- art shrimp feeds which uses quorum sensing for the QS Guabi feeds in our portfolio. This contains herbal extracts and has been shown to improve survival rates and growth performance." said Diogo M. Villaça, Foreign Trade manager at their booth during at Aquatic Asia, VIV Asia 2015 in Bangkok.

"Today we focus on our aquafeed business, extruded shrimp and fish feeds for export. Out of the total feed production in Brazil of 300,000 tonnes, aquafeed represents a good part of this total. Aquafeed is produced at 4 plants, each with at least 2 extrusion lines. This gives us the flexibility and capacity. Brazil is a large country and having plants in these four locations saves us on land transport costs which is high in Brazil. We produce feeds for the trout, carnivorous freshwater fish and tilapia. We can also develop feeds for marine fish such as the cobia. In Nigeria, we have a good market for feeds for the catfish."

Guabi only uses extrusion technology in the production process. Their forte is shrimp starter feeds with additives included. Villaça added, "We are fortunate that Brazil has good quality and cheap raw materials such as poultry, pork and ruminants by-products. We have a lot of grains. Then we have the extrusion process which is much more expensive than pelleting technology. We have distribution centres and very competitive sea freight costs ex Brazil. It is cheaper to ship the feeds to Asia than to ship to ports within Brazil. The shipping cost is USD1200/container of 26 tonnes to Asia and USD2000/container to local ports.

"We can offer our extruded shrimp feed at competitive prices. It is important to realise that extruded shrimp feeds offer us the advantage of less leaching in ponds, high feed conversion ratios, better growth rates, at least 4% less water in feeds which extends shelf life and the use of specific ingredients. With less water, we sell more nutrition.

"Extruded shrimp feed are more dense than pelleted feeds, and have more cut uniformity in length; These characteristics allows for more pellets per kg of feed, decreasing competition between animals in the feed tray. This is more than important in Brazil for example, when some farmers use intensive culture systems."

In Brazil, farming conditions have been changing and we are now closer to those in Asia. This helped us understand farming conditions in Asia. The stocking density has increased from 10 post larvae (PL)/m^2 to as high as 100-200PL/m^2, although the average is still in the 20-30PL/m^2 range. In marketing our feeds, we do not promise the lowest price but the best results," said Villaça.

More information: www.guabi.com.br

Making waves at VIV Asia

In their third successful year exhibiting the Halamid® brand at VIV Asia France-based Axcentive sarl has every reason to be happy with the results. Visitor numbers were high and Axcentive collected dozens of leads for potential new customers and candidate distributors.

Halamid® has been regarded as an essential and reliable product for aquaculture for many years. Its unique formula is designed to be powerful against diseases yet safe to fish, shrimpand aquatic environments. Halamid® is used in salt, brackish and fresh water environments and is the biocide of choice in many fish farms. Its biocidal efficacy towards many micro-organisms in the presence of aquatic animals is widely admired – against EMS, white spot syndrome virus and Costia in Asian shrimp and tropical species just as it is against gill conditions in North Atlantic salmonids.

Arno Schut, Technical Development manager at Axcentive, commented, "As always, VIV was a great opportunity to meet and support many of our existing distributors in the Asia-Pacific region, as well as a platform to introduce our brand to new parties."

Arno Schut (centre) pictured with Jaroek Loylib and Charoenchai Limsuthiwanphum of Kaset Centre.

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At VIV Asia, launch of MFeed+

The Olmix team at VIV Asia. From left, Jean Peignon, Marie Gallissot, Chakrit Ridmontri, Asia Marketing Manager, and Olivier Biannic, Marketing Executive.

French feed additive company Olmix keeps innovating in algae and clay, associating them in a new patented technology OEA. It took the opportunity of its presence at VIV Asia to launch MFeed+ in Asia. The product was launched for the European markets in September 2014 in France.

The feed additive functions as a booster in enzyme activity in the intestine and provide many diverse metallic ions which are sometime absent in the feed. These metallic ions are required as cofactors for the activation of enzymes. By doing this, the additive provides for a better use of the feed. In the field this improvement translates into better growth performance and feed conversion ratio. MFeed+ is designed for inclusion in swine, poultry and aqua feeds.

At their booth during VIV Asia 2015, Jean Peignon, Technical Support, Aquaculture Department and Marie Gallissot, Technical Supervisor discussed this product.

"As far as aquaculture is concerned this is a promising product and is Olmix's answer to the problem with the use of fishmeal in aquafeeds. Our other product MT.X+ is an algae based mycotoxin binder. All of our products are algal based," said Peignon.

"In Europe, MFeed+ is well received. In Asia, we have conducted several studies before the launch which showed good results in shrimp. For example, we are able to reduce the feed conversion in juvenile shrimp and the survival rate also improved. MFeed+ works on gut health by improving the digestion of the feed. We counted *Vibrio* bacteria in the gut at the end of the study. This is our digestive health marker. The reduction in *Vibrio* bacteria was dose dependent in shrimp fed MFeed+," said Gallissot.

"We have carried out more commercial than laboratory trials but it has been difficult to get clear numbers. In Indonesia, we conducted trials with the *Clarias* catfish and users are happy with the results. The next step will be to work with Asian seabass. In Europe, we tested with the salmonids and the monitoring of results is relatively easy."

MFeed+ is a feed additive added at 1-2kg/tonne of feed. Registration requirement varies in the potential markets as the product is an algae and clay combination. "The seaweed in the product helps to modify the structure of the clay. It will boost the properties of the clay and bring out the properties of up to 20 specific metallic ions which are co factors to activate enzymes in the gut. Some of these are absent in the feeds. The enzymes are non-specific. The seaweed would have most of the ions present in seawater."

"The product is developed through a patented technology developed by Olmix. The clay layers are separated with algal extracts of *Ulva* sp and *Solieria chordalis*. The new product call OEA-Olmix Exfoliated Algoclay become favourable surfaces for the action of the enzymes. Enzymes in contact with OEA have better stability and activity. They contact with metallic ions used as co factors to activate exogenous and endogenous enzymes in the gut. Some of the metallic ions are naturally in the clay but we also also bring in more diverse metallic ions from the seaweed extract. Non-selective metallic ions can tailgate many more enzymes to be active. We know that carboxypeptidase is activated with zinc and lipase is activated with copper. The more diverse the metallic ions, the more will be the chances of boosting these enzymes by the co-factors and stabilising gut enzymes."

Peignon added, "For the moment, the product is aimed to support the endogenous enzymes. Later and hopefully, as we get more information we can see how we can link the performance of the metallic ions to the type of enzymes available in the feed formulation. In the meantime, we wish to emphasis that the additive will add value to the use of poor quality raw materials. In poultry, with feed of lower quality, the additive will increase feed performance through improvement in digestibility."

More information: www.olmix.com

New corporate identity for Lesaffre Feed Additives

In January 2015, the LESAFFRE animal care business unit officially took the name PHILEO. A new website, www.phileo-lesaffre.com accompanies this new name and branding. These changes were unveiled at the IPPExpo in Atlanta where Lesaffre was an exhibitor.

Driven by a pioneering business dynamics, the Lesaffre animal care business unit has adopted a new corporate identity. Lesaffre Feed Additives has thus changed its name to PHILEO. Taken from the Greek verb "to love," this word conjures up notions of care, respect and protection. Its spiral-shaped logo illustrates new momentum and a forward-looking attitude. Joining forces with this evocative brand name is a new philosophy, which is equally resonant: "Raising life".

Well-recognised in the world of farming, Phileo applies its philosophy on a daily basis. Working at the crossroads of nutrition and health, its innovative nutritional solutions help enhance animal health and performance. To be at the forefront of innovation, Phileo has a dedicated R&D division. Its engineers, nutritionists and veterinarians work in tight collaboration with Lesaffre's own R&D department as well as universities and institutes around the world.

The teams' expertise includes fundamental *in vitro* research, development of industrial processes and validation through scientific animal studies in research institutes and farming. This contributes to the creation of groundbreaking solutions, which respond to both current and future needs for the ruminant, pig, poultry and aquaculture industries, from traditional to intensive farming.

Phileo, with 30 years of experience and 114 employees around the world, is a key player in the animal feed industry. Its capacity for innovation and knowledge of the manufacturing process, allow it to respond to the most crucial demands of the industry and livestock production. With its worldwide presence, Phileo is connected with its markets and is able to effectively adapt to its customers' needs.

Family group based in northern France, Lesaffre has now become a multi-national and multi-cultural company that is committed to providing the best in each of its business areas: bakery products, taste and pleasure of food, human, animal and plant well-being, nutrition and health, industrial biotechnology. Lesaffre employs 7,700 people in more than 70 subsidiaries based in about 40 countries. Since 1853, innovation has been at the heart of Lesaffre development. The new name Phileo fits perfectly with the company's philosophy: "Working together to better feed and protect the planet."

Views on sustainable aquaculture at 'Safe Fish' seminar

by Sarah Mellor

Malou Cuvin-Aralar (centre) who also guided proceedings throughout the seminar with some of the presenters, from, left; Don Bulanhagui, Christian Lückstädt, Wing-Keong Ng and Kurt Wegleitner.

The one-day seminar, under the umbrella of Aquatic Asia at VIV Asia 2015 was held on March 12 at BITEC in Bangkok. It was hosted by leading companies in functional feed additives for aquaculture; ADDCON, Biorigin and Phytobiotics.

Safe Fish!" opened on the theme of consumer demand as a key driver of sustainable aquaculture with a presentation by Kurt Wegleitner, managing director of Addcon. He stressed on the FAO Fish 2030 report's findings that over the next 15 years, demand for fish will require that aquaculture production continue to grow at the expense of wild caught fish. Based on this growth, the amount of fish available will increase from 123 million tonnes in 2009, to 152 million tonnes by 2030. Within this framework, he also stressed the effects of market requirements, especially the demand for sustainability within the aquaculture production chain.

Professor Wing-Keong Ng, Universiti Sains Malaysia gave a comprehensive explanation on the use of functional feed additives in sustainable shrimp aquaculture, especially in the light of the challenges posed by emerging shrimp diseases, such as the early mortality syndrome or EMS. In this regard, he highlighted research already done on the use of organic acids, ß-glucans and phytogenics. Dr. Tobias Steiner explained in more detail the use of such phytogenic feed additives in aquaculture. Steiner concluded that there is a positive consumer perception due to their natural image. However, standardisation and quality control is key to consistent benefits which include, stimulation of feed intake, modulation of the immune system and reduction of intestinal challenge, improvements in growth and feed efficiency and enhanced survival.

Dr Malou Cuvin-Aralar, from the Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC-AQD) in the Philippines, focused her talk on sustainable formulations in aqua diets. With the growth of demand for aquaculture products driving the industry towards intensification, it is even more necessary to produce nutritionally complete feeds sustainably, as laid out, for example in the Regional Guidelines for Responsible Aquaculture in SE Asia. Feed additives, she explained, have a valuable role to play in the economic efficiency of feeds.

Taking the customer perspective, Dr Prakan Chiarahkhongman, from Charoen Pokphand Foods (CPF) Thailand, discussed the role of BAP (Best Aquaculture Practice) in producing safe, economically viable products for the market. Although there is no 'silver bullet', he discussed how feed additives, including ß-glucans can, as part of a BAP system, help to manage healthy growth in fish and shrimp.

Table 1. The use of dietary organic acids (Potassium Diformate, Aquaform®) in Asian seabass under controlled conditions (Arreza et al., 2014).

Parameter	Negative control	0.5% KDF	P-level
Final body weight (g)	54.5±7.5[a]	62.7±2.8[b]	0.026
Weight gain (d)	38.8±6.6[a]	46.5±3.8[b]	0.028
Survival (%)	82.0±13.3[a]	98.3±3.7[b]	0.014
Feed conversion ratio	2.72±0.94	1.95±0.30	0.061
FPI	141.4±79.9[a]	243.2± 56.3[b]	0.026
PER	0.75±0.22	0.96±0.14	0.055

Don Bulanhagui, an independent consultant from the Philippines, explained in detail the production techniques for safe feed for fish and shrimp. These include the crucial relationship between temperature and humidity, based on the psychrometric chart. This physical relation can be used to predict the probable outcomes of feed pelleting and storage, relative to the potential danger of microbial contamination. Under SE Asian conditions, this is especially relevant.

On the use of dietary acidifiers in tropical aquaculture, Dr. Christian Lückstädt, the newly appointed technical director of Addcon, discussed the production of safe feeds for healthy fish and shrimp production. He said that in times of high raw material prices, especially protein sources, the use of such additives may become more relevant, since it has been demonstrated by many researchers that the use of dietary organic acids and their salts improve protein digestibility in various aquaculture species.

The seminar closed with a podium discussion. For interested readers, the presentations of all speakers are available for download from Addcon's website (www.addcon.com).

Sarah Mellor is an independent writer from Weinheim, Germany.

FIAAP, VICTAM and GRAPAS Asia 2016

Henk van de Bunt (right) with Pornsil Patchrintanakul

In March 10, in Bangkok, Henk van de Bunt, general manager, Victam International BV announced the dates and details for FIAAP, VICTAM and GRAPAS Asia 2016, Asia's largest dedicated feed and grain show. The exhibitions and conferences will take place from March 29-31 2016, Bangkok, Thailand

"2016 is a very special year for us in Thailand as it is our 25th Anniversary. It seems amazing that the very first Victam Asia event was held in a hotel car park here in Bangkok in 1991. In those days not so many people came, in fact less than one thousand and our exhibitors were happy and demanded that we repeat the whole thing again and now here we are talking about a show in 2016!" said van de Bunt

FIAAP ASIA 2016 is the only specialist exhibition and conference for the ingredients, additives and formulation of feeds for animals, aquafeed and dry petfood for the expanding Asia/Pacific markets. This show is co-located with VICTAM Asia 2016, Asia Pacific's largest exhibition of equipment, technology and ancillary systems required for the safe and effective production of feeds for animals, aquafeed and dry petfood and biomass pellet production. GRAPAS ASIA 2016 is for rice and flour milling systems, grain processing, and related industries.

The conference and trade show will be supported by various agencies in Thailand, among them the Thai Ministry of Agriculture & Co-Operatives, Thai Department of Livestock Development, Thai Department of Fisheries, Thai Feed Mill Association and Thai Chamber of Commerce.

Pornsil Patchrintanakul, President of the Thai Feed Mill Association said, "The 2016 event offers a wide variety of innovations and latest technologies pertaining to animal feed and grain processing industries, as well as, showcase advances and industrial capacity of the animal feed processing industry in Thailand. We believe that, with wider publicity and quality, Thailand's animal feed industry will grow."

Van de Bunt said that during the show in 2014, it was decided to form the Federation of Asean Feed Milling Associations. In 2016, the Federation will meet again for the 2nd Asean Feed Summit at BITEC.

There are a number of supporting conferences. For the aquaculture industry, there will be The Aquafeed Horizons Asia 2016, organised by Aquafeed.com. The electronic registration form will be available online at:www.fiaap.com;www.victam.com; www.grapas.eu

What to look forward to in **Aqua Culture Asia Pacific in 2015**

Volume 11 2015			
Number	4 – **July/August**	5 – **September/October**	6 – **November/December**
Issue focus *Recent developments and challenges for the next step*	Industrialisation & Aquaculture Insurance	Health Monitoring & Disease Management	Biofloc Technology
Industry Review *Trends and outlook, demand & supply*	Catfish	Marine fish	Freshwater Fish/Prawn
Feeds & Processing Technology *Technical contributions from feed industry*	Feed Enzymes, Additives & Probiotics	Feed Safety & Hygiene Processing & Environment	Nutrition & Formulation
Production Technology *Technical information and ideas*	Sustainable & Responsible Aquaculture	Genetics in Fish/Shrimp	Aeration Technology & Waste Removal
Aqua business Feature articles	Experiences from industry and opinion article covering role models, benchmarking, health management, SOPs, social investments, CSR, ancillary services etc		
Markets	Developments in markets (live fish, product development, market access, certifications, branding, food safety etc)		
Company/Product news	News from industry including local and regional trade shows		
Deadlines for Technical articles	**June 1**	**July 27**	**September 28**
Deadlines Advert bookings	**June 8**	**August 3**	**October 5**
Show Issue & Distribution at these events as well as local and regional meetings ****Show preview***	**The Aquaculture RoundTable Series (TARS 2015)** August 19-20, Hanoi, Vietnam **Vietfish 2015,** August 24-26 Ho Chi Minh City, Vietnam	**20th China Seafood & Fisheries Exposition 2015,** November 4-6 Qingdao, China **10th Philshrimp Congress,** November 11-13, General Santos City, Mindanao	

THE AQUACULTURE ROUNDTABLESERIES® 2015

A shared vision for aquaculture in Asia

August 19-20 2015, JW Marriott, Hanoi, Vietnam

AQUA FEEDS 2.0: FROM FARM TO PLATE

SPEAKER HIGHLIGHTS (as at press time)

Session 1: State of Industry and Science

State of the Aqua Feed Industry in Asia: Trends, Challenges and Opportunities

"We present an overview of recent trends in aqua feeds in Asia, the good, the bad and the ugly. There is a lot of upside in taking feed to the next level of development. Is the industry in Asia up to the task?"

John Diener, *Aqua Division, Gold Coin Group, Singapore*

Finfish Nutrition: A Gap Analysis and Potential R&D Partnership between Academics and Industry Stakeholders in Asia

"...state-of-the-art is a bit deficient and R&D efforts are a bit disparate and of unequal quality. There is a need for systematic compilation and analysis of research information and cooperation among stakeholders to improve quality of R&D efforts..."

Dominique Bureau, *University of Guelph, Canada*

Shrimp: Review of Nutrient Requirements for Different Life Cycle Stages

"...details on shrimp requirements across their lifecycle are scarce and in most cases diet specifications have had to be based on assumptions and/or the application of a "one-size-fits-all" approach to using data of shrimp nutritional requirements..."

Brett Glencross, *Ridley Aqua-Feed, Australia*

Pangasius Nutrition, Feeds and Feeding: Present Status and Future Perspectives

"Feed enzymes and feed immunostimulants can be applied to produce more digestible feeds and also to reduce fish mortality during larval rearing and growth..."

Le Thanh Hung, *Nong Lam University, Vietnam*

Session 2: Broodstock and Early Stage Feeding

Finfish Broodstock Nutrition and Holistic Management Approach

" ...for a long time broodstock have been considered and treated just as adult fish to be exploited for spawning..Here I will describe the state of the art of the most advanced broodstock management techniques..."

Alessandro Moretti, *INVE Aquaculture, Italy*

Recent Progress of Larval and Early Juvenile Stages Nutrition and Feeds

Shunsuke Koshio, *Kagoshima University, Japan*

Shrimp Maturation Diets: Replacing Live Feeds for Biosecurity

(TBA)

Session 3: Targeted Grow-out Feeds

Industry Perspective: The Needs of a Commercial Nutritionist

"The nutritionist has the unenviable task of balancing the expectations of the farmer and the profitability of the feed industry. For the aqua nutritionists, just formulating a feed for optimal growth and FCR will not be sufficient under today's scenario..."

Kenneth Chin, *PT Intraco Agroindustry, Indonesia*

Producing Feed that Improves Economics and the Environment: Tale of A New Era

"There are gaps in our understanding of feed-gene-environment interactions. I will highlight ingredient optimization with enzymes..."

M A Kabir Chowdhury, *Jefo Nutrition Inc., Canada*

Shrimp Feed Considerations, Past, Present and Future

"There are biological and physiological constraints involving the relationship between temperature, dissolved oxygen, metabolism and daily nutrient requirement...For the future direction of shrimp, the chicken industry is considered the model to follow whereby production predictability is key..."

Dean M Akiyama, *Aquaculture Consultant, Indonesia*

Session 4. Sustainability and Health Interactions (1)

Next Step in Sustainable Aqua Feeds

"The new reality requires that aquaculture producers document traceability and sustainability of every single ingredient utilized in the feed and that every single process in the value chain is performed in a responsible manner..."

Henrik Aarestrup, *Biomar Group, Denmark*

Growth in aquaculture is driving the market for the region's aqua feed industry. With increasing global demand for safe and sustainable products, this sector has to not only stay ahead of demand but also be able to support sustainable farming.

AQUA FEEDS 2.0: FROM FARM TO PLATE

"As aquaculture moves towards an integrated supply chain, the industry faces multiple challenges. Markets demand superior feeds based on sound nutrition and sustainable practices that address environmental, social and food safety aspects," says Dr Zuridah Merican, Conference Chair and Editor of Aqua Culture Asia Pacific magazine, in its press release.

"There should be more focus on science and less dependence on empirical information to design optimal feeds for each stage of the animal's growth as well as the demands of the consumer.

In this fifth successive year, **The Aquaculture Roundtable Series (TARS 2015)** will take place in Hanoi, from August 19-20 2015. TARS 2015 is organised by Aqua Culture Asia Pacific and Corporate Media Services. Supported by Directorate of Fisheries, Ministry of Agriculture and Rural Development (MARD), TARS 2015 will draw 200 participants representing the industry and key stakeholders from the region. Industry sponsors include INVE Aquaculture, Biomar, Biomin, Nutriad, Jefo, DSM, SPF Aquativ and Alltech.

Dr Merican says, "The supply chain for shrimp, freshwater and marine fish share similar bottlenecks but each has its own opportunity and threats. Through TARS, we hope to equip industry players with sound science, knowledge and technologies to stay ahead of the game. TARS presents a unique platform to ensure that everyone in the industry has a voice.

Supported by: Directorate of Fisheries, MARD Vietnam

Organised by: Aqua Culture Asia Pacific; corporatemedia The Total Communications Company

Sponsors: INVE Aquaculture shapingaquaculturetogether; BioMar; Biomin; nutriad applying nature; Jefo Species-specific additives; DSM Bright Science. Brighter Living.; Aquativ; Alltech

REGISTRATION IS LIMITED TO 200 PARTICIPANTS. Early bird registration ends on 20 June. Walk-ins are not encouraged. For more information and updates, please go to www.tarsaquaculture.com • Email: conference@tarsaquaculture.com

Replacing Fish Meals with Renewal and Sustainable Ingredients: Cost Effective Strategies and Reassessment of Nutrient Requirements

"Introduction of animal by-products and plant ingredients affects nutrient profiles and introduces excesses and deficiencies of amino acids, minerals, and other nutrients that have to be re-balanced..."

Thomas Wilson, *Aquaculture Nutrition Consultant, Thailand*

Feeds, Feeding Strategies and the Environment

"Feeds based on high quality and digestible feedstuffs that can improve feed efficiency is recommended as long as it is profitable and compatible with the environment..."

Pedro Encarnação, *Biomin Singapore Pte Ltd, Singapore*

Towards a Paradigm Shift in Feed Specifications

"... feed is also the most efficient vehicle to transfer a wide range of natural compounds with biological activity to fish and shrimp..."

Peter Coutteau, *Nutriad International NV, Belgium*

Nutritional Health and its Assessment

Ei Lin Ooi, *Aquaculture Centre Asia Pacific, DSM, Thailand*

Session 5. Innovation and Branding to Plate

The Omega 3 Story: Aquaculture's Contribution for Human Health

"FAO recommends a daily intake of 250 mg DHA or annual 100gm DHA for good health. Aquaculture should use the DHA factor as a marketing tool for promotion and establishing its right to grow..."

Serge Corneillie, *Alltech, Japan*

Growing the Aqua Feed Industry: Getting Communication Right

(TBA)

BREAKOUT SESSIONS

Redesigning Feeds for the Future

Led by team leaders, participants will break into 4 main groups to deliberate on challenges impacting the supply chain for shrimp, freshwater and marine fish aquaculture, in particular, the role of the aqua feed industry. Participants will also identify priority areas for improvement and recommend key strategies to take the industry forward.

Feeding Today's Shrimp (FTS)
- Complete replacement of live feeds
- High nutrient density nursery feeds
- Functional feeds for disease prevention and therapy
- Feeding to meet consumer demands

Freshwater Fish Feeds (FFF)
- Feeding to maximise genetic potential
- Nutrition for fillet yield
- Modulate for human health
- Environmental sustainability

Marine Fish Feeds (MFF)
- Biosecurity and feeds
- Species specific nutrition
- Feed for RAS
- Capitalising on heart-healthy benefits of eating fish

Aqua Feed Industry (AFI)
- Constrains to growth
- Cooperation and generic marketing
- Fish meal issue- elephant in the room
- Regional R&D support

REVIEW (REPORT) SESSION

At this final session, team leaders from each breakout group will report on key discussion points. Participant will provided further inputs and recommendations to take the aqua feed industry forward. A final report will be made available to all participants.

6th AQUATECH

May 28-29 2015, Tagaytay City, Philippines

The 6th AQUATECH Aquaculture Expo & Convention Philippines will be held on May 28-29, 2015 at Summit Ridge Hotel, Tagaytay City, Philippines. It will be organised by Events Quality & Interactive Promotions (EQUIP), Inc. in partnership with B-MEG Aquatic Nutrition and in cooperation with Asian Fisheries Development Center-Aquaculture Department (SEAFDEC-AQD).

With a month to go, at press time, the organisers have released the program and speaker information for the conference as below.

Session: Aquaculture Production Updates

The seafood future of Chonalyn – the Philippines' 100 millionth baby *(Dr Jose Ingles, GMMC)*
Aquaculture development scenarios in the Philippines: Initial results and recommendations *(Dr Maripaz L. Perez, WorldFish Center)*
Hatchery and grow-out technology of groupers *(Jonah van Beijnen, Centre for Sustainability)*
Emerging species: Siganid *(Dr Westly Rosario, NIFTDC)*
Emerging species: Eel *(Dr ApolinarioYambot)*
Emerging species: Giant Freshwater Prawn *(Dr Ma Lourdes Aralar,SEAFDEC)*
Induced Breeding of Caranx ignobilis, Maliputo *(Myleen L. Magistrado, NFRDI-NFBC)*

Session: On-Farm Management Methods

Status of the freshwater sardine, *Sardinella tawilis* in Lake Taal *(Theresa M. Mutia, NFRDI-NFBC)*
Addressing challenges in sustainable fish production through aquaculture genetics *(Rowena Eguia, SEAFDEC)*
Fish health management *(Dr Apolinario Yambot)*
National shrimp health management program- *(Abegail Albaladejo, BFAR)*
Sustainable white shrimp farming in asian perspective *(Dr Partha Bandyopadhyay, Biostadt)*

Economics and Trade

Breeding and production of freshwater ornamental fish *(Frederick B. Muyot, NFRDI-NFBC)*
Abalone stock enhancement: an emerging export commodity *(Dr Nerissa Salayo, SEAFDEC)*
Philippine trade in fisheries and aquaculture products *(Dr Danilo Israel, PIDS)*
Best alternatives for seafood and aquarium campaign/pacu *(Gregg Yan, Best Alternatives)*
Nanotechnology: developed in aqua, yields high productivity, ends in higher profit *(Walther Alvarez, ATOVI)*

More information: mgv.equipinc@yahoo.com
(Mary Ann Venturina)

2015

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@aquaasiapac.com**

May 25-27
Asia-Pacific Aquaculture Expo 2015 (APAEXPO 2015)
Xiamen City, China
Email: apaexpo@chgie.com
(Ping Yang, Dr Lisa Pang)
Web: www.apaexpo.com.cn

May 26-30
World Aquaculture 2015
Jeju, Korea
Email: mario@marevent.com
(Mario Stael for trade show)
Web: www.was.org

May 26
World Aquaculture Aquaforum 2015
Jeju, Korea
Email: mario@marevent.com
Web: www.was.org

May 28-31
AQUARAMA 2015
Singapore
Web:www.aquarama.com.sg

June 9
8th Aquafeed Horizons
Cologne, Germany
Web: www.feedconferences.com

June 9 – 11
FIAAP VICTAM GRAPAS International 2015
Cologne, Germany
Email: patriciaheimgartner@victam.com.
Web: www.victam.com

July 20-22
International Conference on Aquaculture & Fisheries
Brisbane, Australia
Email: aquaculture@conferenceseries.net
Web: www.aquaculture-fisheries.conferenceseries.com

August 19-20
The Aquaculture RoundTable Series (TARS 2015)
Hanoi, Vietnam
Email: conference@tarsaquaculture.com
Web: www.tarsaquaculture.com

August 24-26
Vietfish 2015
Ho Chi Minh City, Vietnam
Email: quocthanh@vasep.com.vn/
tienloc@vasep.com.vn
Web: www.vietfish.com.vn

August 25-27
2nd Annual International Conference on Fisheries and Aquaculture.
Colombo, Sri Lanka
Email: isanka@tiikm.com
Web: http://aquaconference.com/2015/

October 6-8
International Conference of Aquaculture Indonesia (ICAI) 2015
Jakarta, Indonesia
Email:icai.aquaculture@gmail.com
Web: icai.aquaculture-mai.org

October 8-9
Inaugural Institution of Aquaculture Singapore (IAS) Conference 2015
Singapore
Email: secretariat@aquaculturesg.org
Web: http://iasaqua2015.wix.com/aquaconference2015

October 14-16
Aqua Fisheries Myanmar 2015
Yangon, Myanmar
Web: www.myanmar-aquafisheries.com

October 20-23
Aquaculture Europe
Rotterdam, Netherlands
Web: www.easonline.org

October 22-26
10th Symposium of World's Chinese Scientists on Nutrition and Feeding of Finfish and Shellfish, Wuhan, China
Email: SWCSNFFS2015@ihb.ac.cn

November 11-13
10th National Philippines Shrimp Congress
General Santos City. Mindanao
Email: r.usero@yahoo.com
(Roselyn Usero)

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Greg Hart
Director
Wild Oceans Pty. Ltd.

November 4-6, 2015

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For more information
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Fax: (206) 789-0504
E-mail: seafoodchina@seafare.com

Sea Fare China Ltd.
16 F/A No. 58 Freetown Center
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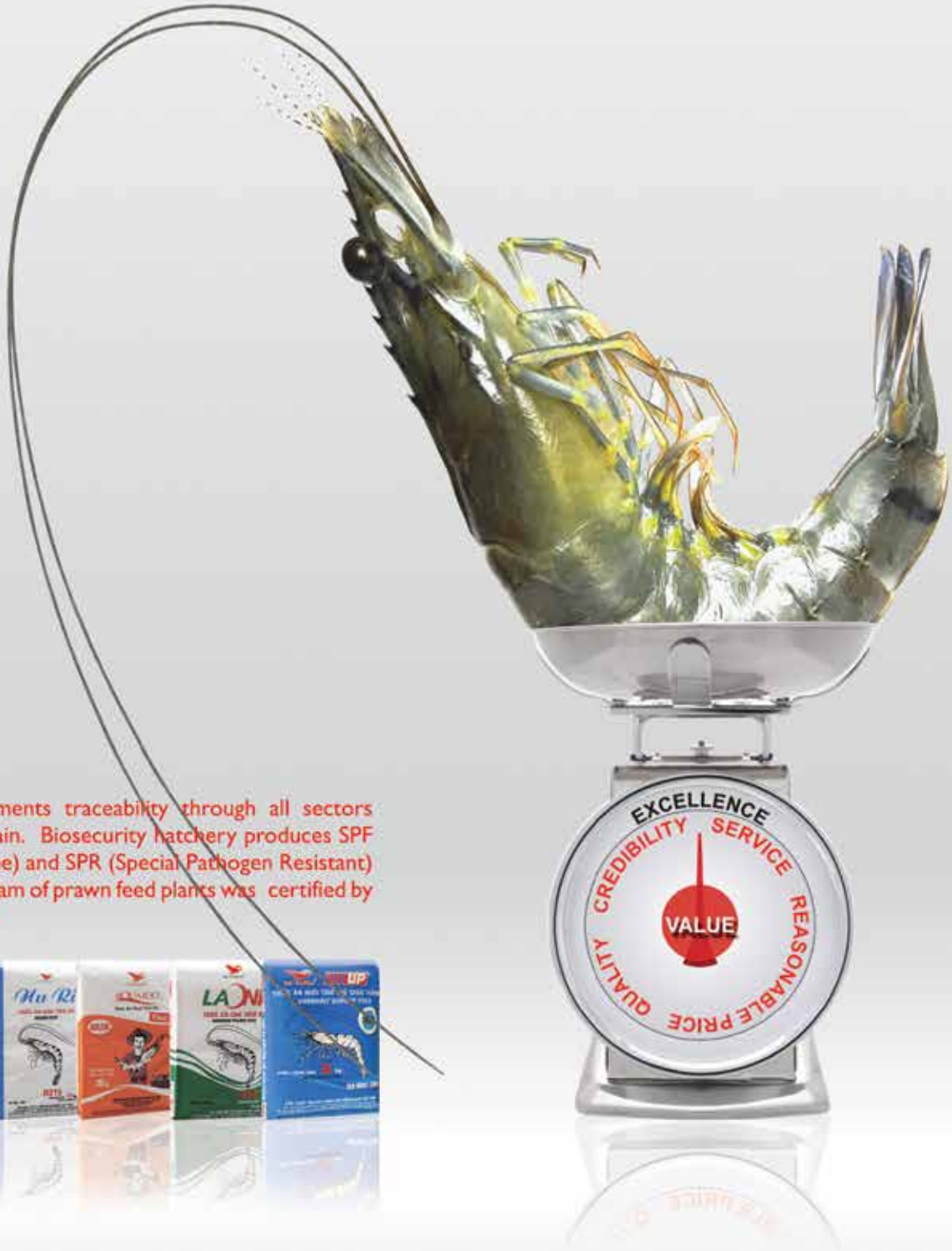
Uni-President®

CREATES THE VALUE OF PRAWN



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

- 16-18-20, DT 743, Song Than II Industrial Zone, Di An, Binh Duong, Vietnam
- Tel: +84-650-3737626 - Fax: +84-650-3790819
- Email: aquafeed@upvn.com.vn

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Establishing a Healthy and Happy Tomorrow