

# AQUA CULTURE

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Gen 2 in Vietnam: Sustainability in Mind

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Growing the Aquafeed Business

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Skeletal Anomalies in Farmed Marine Fish

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EU-Thailand: Matching Business and Technology

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## Ecological Intensification in Asian Aquaculture



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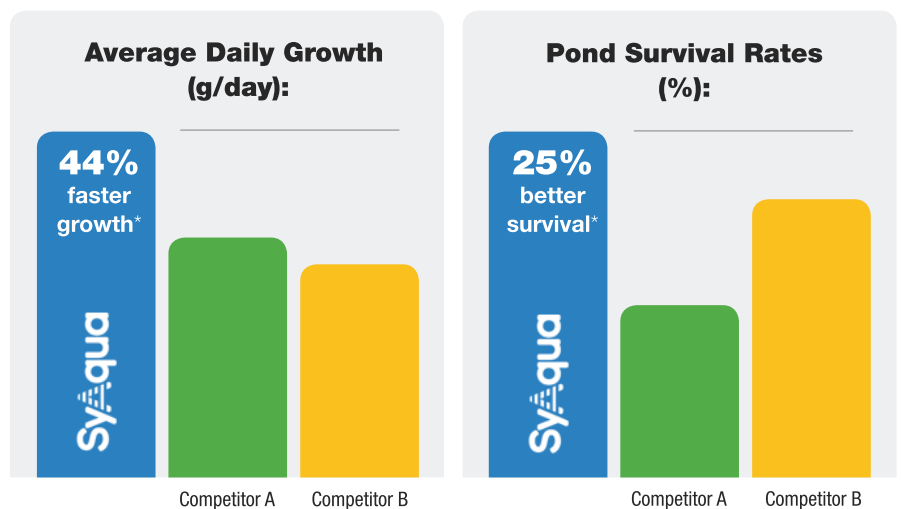
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Zuridah Merican

## 2019: A year of start-ups, China rising, sustainability and RAS

In 2012, China became a net importer of shrimp without much fanfare. However, it came as a surprise to the shrimp industry when in January, China imported 65,000 tonnes of shrimp in a single month of which nearly 25,000 tonnes came from Saudi Arabia. The import data in May showed Ecuador and India competing, leading to a fall in prices (USD/kg) of 18% and 9%, respectively compared to that in May 2018 (undercurrentnews.com). This may be an indication of things to come as competition heats up for the Chinese market. It is difficult to pin down an exact number for the size of the market. An estimate puts 2018 imports at 450,000 tonnes which ranks third after the EU and US for shrimp imports. With prices falling as supply looks to exceed demand and diseases increasing the cost of production, this is a wake-up call for Asian shrimp producers to increase efficiency.

As aquaculture grows, there is a critical need for new feed ingredients to augment the static supply of fish oil and fish meal for farmed seafood. The SeaWeb Seafood Summit 2019 held in Bangkok saw innovation in action when representatives from alternative protein meal and oil suppliers, and Thai Union discussed the challenges of replacing both ingredients in shrimp and marine fish feed. As an integrator, Thai Union is a proponent of novel ingredients but the farmer was identified as the current bottleneck as he/she still had to be convinced there was an economic benefit for that segment of the supply chain. During the Seafood Expo Global in May, large retailers and food service buyers said that they would be willing to pay a small premium as long

as there is traceability in the supply chain. It is clear that all segments along the supply chain have to play their part to see sustainable aquaculture feed succeed.

Is recirculating aquaculture systems (RAS) finally gaining traction or is it a passing fad? The earlier school of thought was that a land-based RAS could never compete with intensive shrimp culture in ponds or fish culture in cages. This is exacerbated by falling prices in certain species exerting pressure on margins. However, RAS is gaining ground in the city state of Singapore where both land and water are at a premium. RAS has also found a foothold in nursery systems for shrimp in Vietnam and elsewhere for the marine fish where controlled conditions are key to producing disease-free juveniles. RAS also faces a challenge with economies of scale especially where the capital expenditure is so significant and has to be amortised over longer time periods. Compare this to cages which can be added on at comparatively lower cost to increase production volumes. RAS could be a game changer but it would be a high risk – high return type of investment.

The good news is that Asian aquaculture is not stuck in the status quo and any change bodes well for the industry.

The European Aquaculture Society unveiled its Innovation Forum during Aquaculture Europe 2019 on October 9 in Berlin. EAS wanted (and still wants) to promote and support start-ups and emerging business models by matching ideas to investors who can push the development of new companies and products. During this forum, 12 companies pitched for investments to develop, and the majority were looking for series A to B funding which could amount to approximately USD 10 million. The investors included Nutreco whose Chief Innovation Officer, Viggo Halseth spoke on 'What an investor looks for in a start-up'. Many of these start-ups were guided by Hatch Blue – an accelerator and investor. Start-ups were also present at GOAL 2019 in Chennai, and many were guided by another global investment fund, Aqua-Spark. At the Taiwan International Fisheries and Seafood Show, it was the world of IoT and AI. Aquaculture has come of age and start-ups are not only the mainstay of the technology sector that one finds in the San Francisco Bay area. Could aquaculture emulate large pharmaceutical companies constantly looking for small companies to develop into the next potential blockbuster?

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## Bali Bound for young shrimp farmers in Indonesia

A reminder to go back to basics and care for the environment



PMI and SCI members with speakers, from left, Suryanaga (Bali); Benedict Standen, Abung Maruli and Anwar Hasan (Biomin); Bobby Indra (Garut, West Java); Reynard Suharja (Lombok); Sebastian Setio (Bali); Harris Muhtadi (CJ Feeds Indonesia); Rizky Darmawan; Andi Solomon (Probolinggo); Fauzan (Skretting Asia); Agus Saiful Huda; Hugo (Situbondo) and Ho Gim Chung (Skretting Asia)

In August, members of the Indonesian Young Farmers Association (PMI) headed for Bali for its annual meeting in Nusa Dua. It took advantage of the presence of stakeholders in the aquafeed sector attending TARS 2019 for this gathering cum seminar, held on August 12-13. The focus was on "taking care of the environment in shrimp farming" where Agus Saiful Huda, shrimp farmer and consultant at ASH Consulting, reminded the young farmers under the age of 40 and on average about 6 years in the shrimp farming business, to go "back to basics" and to place importance on the environment which he said is a new concept first introduced in 1989. Start-ups such as JALA and PasarUdang, enhanced the message further with their use of Internet of things (IoT) and artificial intelligence (AI) for pond and feed management 24/7.

These young farmers in PMI run some of the highly successful commercial farms in Indonesia. Rizky Darmawan runs his family farm in Sumbawa (see page 42). In Banyuwangi, another young farmer practises the clean water system and managed to produce size 36/kg (27g/shrimp) in 83 days, stocking at 300 post larvae (PL)/m<sup>2</sup>. In general, successful farms stock shrimp at 250-300 PL/m<sup>2</sup>. Some older counterparts may stock at only 100 PL/m<sup>2</sup> and use synbiotics to handle disease such as white faeces syndrome (WFS).

As he endorses the use of IoT and robotics in shrimp farming for his concept of Budidaya 2.0 (translated as Aquaculture 2.0), Agus said, "Technology will surely help the new generation to monitor conditions in the pond and whether feed has been eaten. We see that stocking at 125-200 post larvae (PL)/m<sup>2</sup> with no water exchange, there is difficulty maintaining water quality and at 100 days of culture (DOC), survival is low."

Agus has a formula  $D=H(A+S^2)$  on the relationship between disease (D) host (H), etiological agents (A) and the environment (S). One role is to reduce the dominance of vibriosis. It is the fluctuations in parameters which lead to stressful conditions; all farmers need to grasp this basic point. "The environment must find its balance." This comes with biological engineering (using prebiotics and probiotics) and physical engineering (stabilising water quality, microbial management and biosecurity)," added Agus. Michael Leger, Skretting, Vietnam provided information on *Vibrio* control with quorum sensing (QS) and how his company has developed its health concept. He demonstrated the success

achieved in Vietnam with improvements in growth and feed conversion ratios.

### Smart farming

In smart farming, Jala CEO Liris Maduningtyas explained the work they are doing with farmers on IoT in shrimp farming. She said that the focus is on diseases; once this is settled, the crop can be extended for a longer term. This is followed by work to monitor farm efficiency. In the 3 years of digitalisation of its own farm, Jala can show a 98.3% accuracy using data analysis. "All that is needed is equipment, mobile phone and real time monitoring," said Liris. Jala has been working with 100 farms and a new version for Android IOS is in the works and will be released in December 2019. It is also working with an insurance group (ACA) where for Jala monitored farms, data will be sent to ACA to settle claims. The insurance premium is 3%.

PasarUdang is a group working on upscaling shrimp farms through management. Co-founder, Christopher Jason said that industry development is constrained by limited access to information, outdated and unstructured farm management, delay in operational updates and low traceability. "We want to help modernise the shrimp farming business. Most do not digitalise their data and reports. We hope that by using PasarUdang, the farmers can improve their traceability and practices."

PasarUdang is also developing the buying and selling of shrimp in the app. "We hope with this we can connect buyers and farmers while at the same time further improve traceability."

For investors, shrimp farming often comes with high risks and Alex Farthing, co-founder of the start-up Alune Aquaculture said that Alune works closely with the investor and shrimp farmer to ensure a successful business and investment with operation capital, using cutting edge technology and leading expertise.

Other presentations included Romi Novriadi, Aquaculture Division, Ministry of Marine Affairs and Fisheries; Benedict Standen and Anwar Hasan, Biomin, and Alexandre Vielle, Olmix Indonesia. The meeting was supported by industry leaders: Haris Muhtadi and H. Hardi Pitoyo, Shrimp Club Indonesia (SCI) and Itang Hidayat, Suri Tani Pemuka.

## Ecological intensification in Southeast Asian aquaculture



Jacques Slemmbrouck (centre) and Domenico Caruso (right) with participants and invited guests at the conference in October. From left, Dr Hav Viseth, Deputy Director General of the Fisheries Administration and Olivier Joffre, Worldfish, Cambodia; Professor Marc Verdegem, Wageningen University, The Netherlands, Dr S.K. Das, India and Dr Surjya Kumar Saikia, Visva Bharati University, West Bengal, India.

Some 20 years ago, the Indonesian government, through the National Institute for Freshwater Aquaculture and Fisheries Extension (RIFAFE) and the French National Research Institute for Sustainable Development (IRD) started a collaboration in freshwater aquaculture research. In 1996, Jacques Slemmbrouck, IRD, initiated research on the characterisation of the local catfish *Pangasius djambal* or locally known as patin jambal, as a new candidate for domestication and culture in Indonesia. A technical manual on its artificial propagation was released in 2003. "Although there are some farming activities of *P. djambal*, today most of the farming is on the more robust *Pangasius hypophthalmus* which is exotic to Indonesia," said Slemmbrouck. Today, there is also the farming of the hybrid of *P. djambal* and *P. hypophthalmus*.

In October, as IRD celebrated its 75th anniversary in France, a conference exploring whether ecological intensification could be a rational alternative to increase aquaculture production by maximising the use of ecological processes and ecosystem services, was held in Bogor, Indonesia. The conference on "Ecological Intensification: A New Paragon for Sustainable Aquaculture" focused on how ecological intensification (EI) in aquaculture is able to attain more from less. It was attended by 180 participants from 15 countries discussing various aspects and new ideas on EI.

"The radical shift from traditional practices of Asian aquaculture toward intensified production systems is a major trend and the sustainability of these intensified systems needs to be addressed," said organisers, IRD and RIFAFE. "Maximising the use of ecological processes and ecosystem services provided by diversity and EI could be a rational alternative to increase fish production in a sustainable way," said Domenico Caruso, scientist at IRD. "EI

depends on several practices and production processes which may have been carried out decades ago, but today, using more global concepts, new knowledge and approaches as well as sharing of information by researchers, governments and industry, systems such as integrated multi-trophic aquaculture (IMTA) are being promoted as a more sustainable aquaculture practice."

The concept of EI came from agriculture. In his introduction to the conference, Joël Aubin INRA UMR SAS-Rennes France, said that in aquaculture, the shift in paradigm is very much needed, to provide a response to consumers' demand. No one solution will fit and responses should be adapted to the different contexts and production objectives. Aquaculture is well fitted to EI, helped by the demand for seafood consumption, dependency on fish meal/oil, dependency on fragile ecosystems, and the culture of many species. The long experience in polyculture will be an interesting concept to explore.

Over three days, researchers from several research and extension centres in Indonesia deliberated on the various dimensions of EI. The aim was also to help strengthen the role of research toward sustainable development of aquaculture, and broaden the debate on sustainable innovation in this sector involving also the civil society.

In freshwater aquaculture in Indonesia, there are areas of concern such as in the farming of several species like the *Clarias gariepinus* African catfish, where the cost of producing 1kg of fish needs to come down to match the ex-farm prices offered by buyers in the domestic market. At the same time, there is a need to increase fish production to feed a growing demand. See pages 53-55 on several aspects of EI in freshwater aquaculture in Indonesia.



Dr Sujint Thammasart, COO Aquaculture Business, CPF (fifth left) and Umitron Co-founder and Managing Director Masahiko Yamada (third right) at the MOU signing ceremony

## AI and automation technology for environment-friendly farms

Singapore based UMITRON Pte Ltd announced the start of a joint project with Charoen Pokphand Foods Public Company Limited (CPF) to develop the future sustainable model for shrimp aquaculture. CPF operates an integrated agro-industrial and food business in Thailand and is the largest shrimp business enterprise in the world. Umitron will provide its solution such as AI and automation technology to CPF's environment-friendly farms.

The project aims to improve quality of work and biosecurity and reduce waste feeding which would help minimise the environment impact. Ultimately, the parties encourage spreading sustainable seafood idea in the consumer markets in Japan and Asia and contribute to providing sustainable food in the world.



Picture credit: CPF/Umitron

Umitron is a Singapore and Japan based deeptech company empowering aquaculture through technology. It builds user-friendly data platforms for aquaculture by using IoT, satellite remote sensing, and artificial intelligence (AI). Co-founder and Managing Director Masahiko Yamada, wants the technology to help farmers improve farm efficiency, manage environmental risks and in turn increase business revenues. The final goal is to utilise computer models in combination with aquaculture to help the world sustainably and efficiently deliver protein in a human-friendly and nature-friendly way. Ultimately, we aim to "install Sustainable Aquaculture on Earth". [www.umatron.com](http://www.umatron.com)

## Large-scale smart aquafarming in South Korea

In October, South Korea unveiled an ambitious project to develop its marine biotechnology industry and other relevant sectors into multi-billion-dollar businesses, reported [koreabiz.wire.com](http://koreabiz.wire.com). Among others, under the project, South Korea plans to expand a marine biobank in a move to nurture the bioindustry, according to the Ministry of Oceans and Fisheries. This includes the development of a medical adhesive made from a mussel protein. The ministry also said the government will select an additional site for aquafarming by end 2019. Two sites have already been selected for large-scale smart aquafarming clusters that use big data and artificial intelligence. South Korea said it will increase the number of oceans-related start-ups with annual sales of 100 billion won or more to 20 by 2030 from five in 2022. The International Maritime Organization has said the sulphur content limit for marine fuel oil will be lowered to 0.5% from the current 3.5% by January 2020. Atmospheric sulphur oxides lead to acid rain, harming crops, forests and aquatic species and contribute to the acidification of the oceans. The move is part of South Korea's broader efforts to develop its maritime and other relevant sectors into a market worth 11.3 trillion won (USD9.4 billion) by 2030, up from 3.3 trillion won in 2018.

## Land based RAS set to disrupt salmon supply

Rabobank sees the tide turning for recirculating aquaculture systems (RAS) and its potential as an emerging technology to change aquaculture over the next decade. An increasing number of proposed RAS projects, mainly for the farming of salmon are in the process of building a platform for future success. If the risks within RAS operations are managed effectively, Rabobank is of the view that RAS will disrupt aquaculture trade flows, supply chains and the marketing of salmon within the next decade. The number of proposed projects to farm various species on land using RAS, is increasing day by day. Many of them focus on salmon farming. There are 50 RAS proposed projects, and more are coming up for salmon farming on land. The total estimated production up to 2030 is equal to 25% of total current salmon produced. Two proposed projects in China and Japan is planned for a production of 137,000 and 11,500 tonnes respectively. Although the RAS concept is still under development and there are uncertainties, the bank's view is positive. The report contained an evaluation of 4 scenarios for RAS up to 2030.



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## Gen 2 takes over Vietnam's Quoc Viet with sustainability in mind

At the sidelines of Vietfish 2019, President Ngo Quoc Tuan elaborated on challenges ahead to bring the company up to the next level.

By Zuridah Merican



Quoc Viet's farm is only 3 km or 15 minutes away from its processing plant

Family-owned and operated, Quoc Viet is one of the pioneers in commercial shrimp farming in Vietnam. Ngo Van Nga started the company in 1996, after many years in shrimp farming and processing. Today, the company is a leading exporter of shrimp products; both vannamei and monodon shrimp in various forms, ranging from raw head-on shell-on, cooked headless, to nobashi tail blanched shrimp and peeled tail-on breaded shrimp. Raw materials come from its own farms in Ca Mau province in the Mekong Delta, south Vietnam, supplemented by other farmer ponds, also in Ca Mau. Today, Quoc Viet is among the largest integrated shrimp farming businesses, with processing and farms. Coming soon is a hatchery business.

Ngo has now passed the running of the company to his three sons, Ngo Quoc Viet, Ngo Quoc Tuan and Ngo Quoc Kiet and daughters, Ngo Thuy Kieu, Ngo Thuy Huyen and Ngo Thuy Thi. Some 13 years ago, fresh from college in 2006, Tuan took over the reins of his father's shrimp farming business. Now its president, Tuan said, "Since the 1980s, my father had a basic yet efficient farming model. We had long term relationships with many farmers we were working with. This model also worked well for us as well

as for farmers all over Vietnam and in the rest of Asia. More than 10 years ago, this changed as the markets, consumers, retailers, distributors and NGOs started to pay more attention to the sustainability of aquaculture, in general and in shrimp, the supply chain and processing."

Among Tuan's driving force for the business, is the focus towards a sustainable production system, to meet the demands of buyers. Quoc Viet has always played a leading role in Vietnam's shrimp farming sector. It was a platinum sponsor at the annual Vietfish International, a gathering of seafood producers, held this year from August 29-31 in Ho Chi Minh City. Quoc Viet is also a leading supporter of the Seafood Task Force (STF) which together with IDH, sponsored a conference to garner producers to join the former in reaching for a more sustainable shrimp farming industry in Vietnam.

In this interview with AAP, Tuan elaborated on his aspirations to bring Quoc Viet up to the next level of sustainability and on the challenges ahead.



Ngo Quoc Tuan with a sister, Ngo Thuy Huyen, Commercial Director, Quoc Viet with some awards at their booth during Vietfish 2019.



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### What has changed in shrimp farming in Vietnam today as compared to your father's time?

During my father's time, the basic farming model worked well for us and for other farms in Vietnam. Today, social and environment sustainability is important. However, as we are close to farms and markets, we saw this coming and quite early, began our journey to attain certifications. We chose to go along with market demands. We started by working to achieve VietGAP and then looked at others such as GlobalGAP and Best Aquaculture Practices (BAP). These required investments to upgrade and as we seek to apply for other certifications, we are open to investments.

**“Carrying on my father's legacy, we will continue with a genuine commitment to sustainability and the environment.”**

**- Ngo Quoc Tuan**

We are very lucky, as our father passed on to us the great appreciation and respect for the land, sea and all its people. Carrying on my father's legacy, we will continue with a genuine commitment to sustainability and the environment.

We plan to upgrade with the latest technologies and sustainable practices to reduce cost of production, produce the best quality, good looking shrimp with good taste and have 24 hours monitoring of the shrimp, environment and water. Then we will apply those technologies to the small and large scale farmers we are working with. In today's industry, it is not just production, but technology.

Disease was a big problem for us. We suffered from early mortality syndrome (EMS) a few years ago but with R&D, implementation of innovative techniques, we have solved the EMS issue. The worst years were in 2014 - 2015 where mortality rose to as high as 70%.

### What is required from Quoc Viet to achieve these standards?

Quoc Viet has been progressing rather well in terms of volumes; we produce 10,000 tonnes per year of farmed shrimp in our farms around Ca Mau in the south. As our processing capacity is 50,000 tonnes/year of raw material, we need the small farmers. Our plant is around 3 km or 15 minutes from our farms. Today, these farmers come from around Ca Mau but when we develop the efficient farming models, we will also reach out to independent farms in neighbouring Bac Lieu and Soc Trang.

Our export markets are mainly in Europe and the US; each support different third-party certifications. Other markets such as Japan, Australia and Korea have their own programs. China has started to care about BAP. Thus, creating a sustainable business is crucial for Quoc Viet. We have a four-star BAP for the processing plant, farms, hatchery and feed which is enough to meet the requirements of some markets. In terms of expansion, we are looking at setting up a hatchery business to make sure we have a consistent supply and 100% control of the supply chain. Integration into feed production is also important for us.

### What are the innovations that Quoc Viet is looking at?

We are looking into recirculation aquaculture systems, biogas, treatment of waste water, auto feeders to control feed distribution and reduce feed conversion ratios (FCR) and feed waste, sensory systems to observe shrimp health, water and environment 24/7, systems to count shrimp population in the pond and other technological developments or artificial intelligence (AI) in shrimp farming. We only have in-house R&D teams for product development, but we work closely with scientists from local and foreign universities.

Today, our own farm is still considered small compared to our total processing capacity. When we invest more and can fulfill 100%



of capacity from our farms, we believe that scientists, local and overseas, will be happy to join us and work for the overall benefit of the total industry in Vietnam; us and small farmers alike.

### Why is the US market important for Quoc Viet?

The US market is a stable one with large volumes. Sometimes, the price may be very competitive but on the other hand, some big retailers and distributors look at consistency in product quality and sustainable supply chain. The good news for Vietnam is that most of the major exporters receive zero tariff for antidumping duties for the US market. This is a benefit for us to continue to focus on this market.

### How did Quoc Viet reach this level?

In Vietnam, we can confidently say that we are one of the top companies and have been in shrimp farming and producing for a very long time. We have extensive experience in processing high value shrimp products. My father attributed where we are today to a historical relationship with Japanese customers. He said that with Japanese buyers, the business can be good and consistent. Initially, he faced a difficult time as Japanese buyers are very discerning and have very high and tough product requirements. But the more he worked with them, he began to appreciate them and learnt a lot. They are loyal and cooperative customers. When we did well in the Japanese markets, it was then easy to expand into other markets.

We believe that low price and low quality products are not a sustainable business. We need to produce good quality products consistently at reasonable costs. The consumer will appreciate value and will pay for them. We constantly work towards developing a consistent and sustainable business model.

### What are your ambitions on the farming side?

Our ambition is to raise our own shrimp farm to the highest standards in shrimp farming in Vietnam. We want to transfer knowledge and technology to all the farmers and to our future investments in bigger farms.

We need to standardise the technology and farming models at both small scale and large-scale levels. To ensure sustainability in the entire supply chain, we could take over smaller farms, especially as shrimp farming is not an easy business. But if small farmers wish to continue farming, we will then try to get them to become shareholders of the Quoc Viet shrimp farming organisation. This way we control and economically help them to improve their lives. We want to guarantee the sustainability of the shrimp industry in Vietnam.

In farm technology, today our FCR is 1.3:1 but we would like to reduce to 1.1:1. We do not intend to change culture intensity as today; whether it is extensive, semi-intensive and intensive depends on the location of farms. The Mekong region's mangrove



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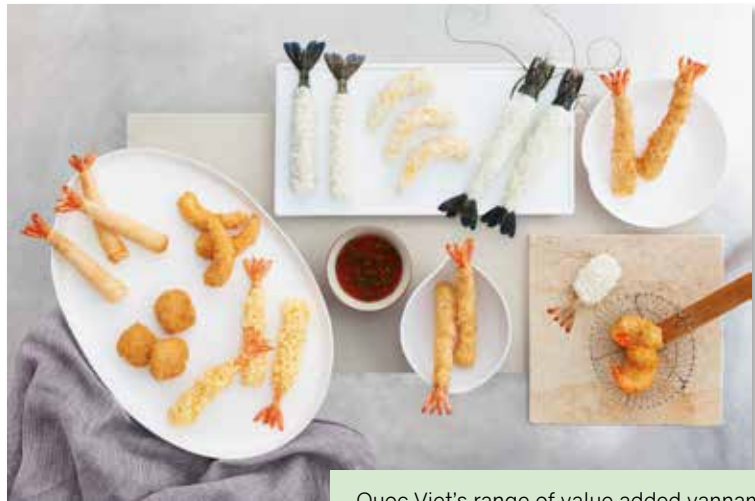
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forests are UNESCO reserve environments and is valuable for our people and for earth. As a company, we will do our best during our CSR activities to protect this environment. Therefore, we are keen to maintain extensive farming of black tiger shrimp in Ca Mau and we support the government by helping small scale families to farm this shrimp. Intensive farming is a solution for the shrimp supply chain while semi-intensive farming is for some places where we cannot implement intensive farming systems. It is the government and scientists who have come up with the semi-intensive model.

**What are you looking forward to?**

Recently our Prime Minister expressed interest in shrimp farming as a key economic sector, which is very favourable for all stakeholders. There are plans for sustainable development that is adaptable to climate change and is environmentally friendly. There are some USD500 million open for investments from the private sector, which is already investing and developing the shrimp supply chain.



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The 10-year government plan from 2020 to 2030 is to move to a hi-tech shrimp industry and large-scale eco-shrimp farming. It has targeted 710,000ha of shrimp farming (600,000ha for *Penaeus monodon* and 110,000ha for *Penaeus vannamei* farming) to produce a total output of 800,000 tonnes of shrimp at a ratio of 320,000:480,000 (monodon:vannamei) by 2020. During

2021-2025, the output planned is 1.1 million tonnes at a ratio of 400,000:700,000 (monodon:vannamei) from 600,000ha for monodon and 150,000ha for vannamei shrimp farming. By 2030, the target is 1.3 million tonnes from the same area at a ratio of 550,000: 750,000 (monodon:vannamei). Our aim is to have the highest farming standards in the world.



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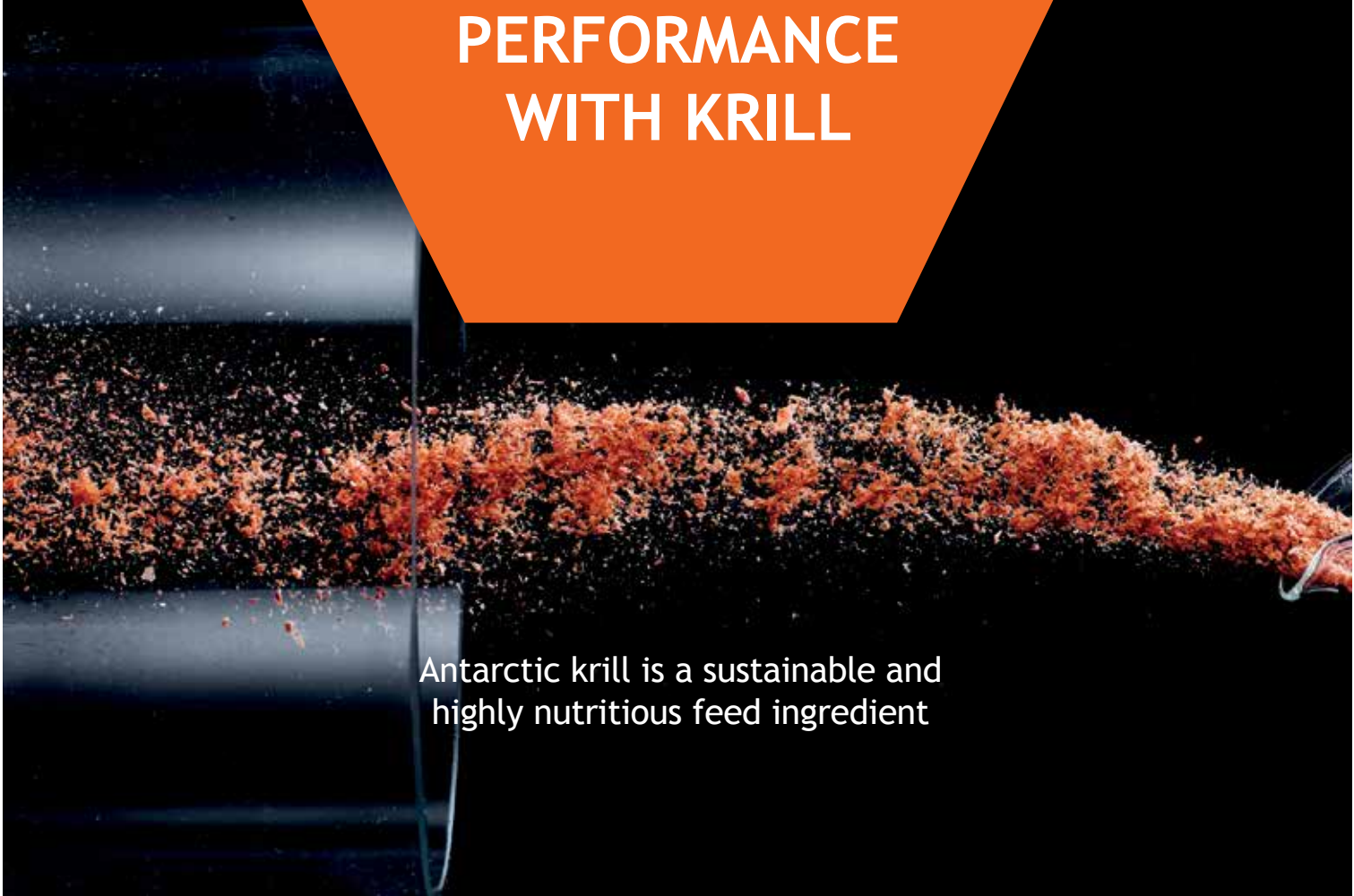


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<http://vietfishmagazine.com/aquaculture/ca-mau-builds-certified-shrimp-farming-area.html>  
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## A hatchery segment in India

A young team helms an essential business segment for Sheng Long



Charlie Cui (left) and Nick Lui.

Sheng Long Bio-tech India Pvt. Ltd began to import shrimp feeds from Vietnam in 2014 and when volumes continued to rise, plans were made for a feed plant to cater to the needs of client farmers. It also put in place a hatchery to provide quality *Penaeus vannamei* post larvae using its experiences with post larvae production in Vietnam.

In June 2019, the plan of Sheng Long to integrate feed production and post larvae supply was realised. This was a lengthy process from land acquisition since 2014 to the start of hatchery operations. In India, Sheng Long now joins a list of companies; seafood processors diversifying into feed production and upstream to farming, and feed producers diversifying into hatchery operations. It is also interesting to see a young team managing operations at the hatchery.

Hatchery Manager Charlie Cui is leading the team of 60 technicians and workers at this new hatchery located in Cheyyur Taluk, Kancheepuram District, Tamil Nadu. Team members include Nick Liu who is in charge of hatchery production, Ross Zang and Fay Han, handling administration and finance respectively. This is an international team with an average age of 27 years. They are assisted by Dr K. Velayutham, Production Manager, formerly from BMR. "The startup of this hatchery went rather well," said Nick, who was part of the Hisenor hatchery team in Vietnam. "The protocols that we are following come from our Vietnam operations. We had to make some changes in operating procedures as the design came from a hatchery in China, but slowly we are modifying to meet our requirements."

In October, Charlie said, "We started in June and to date, we have managed to produce and meet our first target of 80 million post larvae/month. We will operate for only 10 months of the year and now we are ready to shut down for dry-out at year end. During this time, we will be working on renovations and repair works. Slowly, the team is gearing to reach full capacity. Please remember, that we just started in June."

"In the first two cycles for 2019, we achieved 45-50% survival from nauplii to post larvae (PL10) stage. Our protocol involves washing the nauplii twice: first time at N2 and a second time at the N5 stage. Feeding starts with 80% microencapsulation diets at the zoea stage (Z2). Our main challenge remains overcoming the zoea2 syndrome."

### Fulfilling a demand

Sheng Long's strategy for this hatchery is to fulfill the demands from customers and to provide complete support for clients. But Ross is clear that there is no bundling of feeds and post larvae. "The intention is a simple one stop service in feed and post larvae supply, if our clients want this. We deliver PL10-12 to farms in Andhra Pradesh, Tamil Nadu, Kerala and perhaps in the future to farms in Gujarat and West Bengal. Ross added that for biosecurity reasons, farmers wishing to buy the post larvae are only shown the post larvae. "The usual practice in India is that potential buyers take a sample to send to a laboratory to confirm the disease-free status of the batch. This is despite the fact that Sheng Long has already carried out the usual tests required for disease pathogens which include the main diseases in this region such as: early mortality syndrome (EMS), *Enterocytozoon hepatopenaei* (EHP), white spot syndrome virus (WSSV), and infectious hypodermal and hematopoietic necrosis (IHHNV)."

"At the hatchery, we conduct the usual tests on post larvae: microbiological and physical checks such as stress tests by reducing the salinity to 0ppt, and formalin tests. During production, the water salinity is 25ppt. Some farmers will request that we acclimate to as low as 5ppt, to meet the salinity of their pond water." In India, the vannamei shrimp farming cycle starts in the first week of February and hatcheries start their post larvae production cycle from January. There is a second crop after May-June but post larvae demand is more erratic and will depend on several factors such as weather condition, willingness of some farmers to continue a second crop, disease situation and shrimp price.



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The hatchery sells PL10 (9mm).

### Combining protocols from Vietnam and India

The hatchery built on 2.7ha, has a planned capacity of one billion post larvae/year. There is space to expand with more units to double capacity. The location along the east coast of Tamil Nadu, 1.5 hours away from Chennai was chosen because it has a good source of freshwater and is at least 6km away from any shrimp hatchery activities. While most parts of the hatchery are typical of any hatchery in India, Charlie said that the unique attributes of this hatchery are the water treatment protocols which follow the practice in Vietnam.

In this hatchery, the water is drawn from the coast at a depth of 5-7 feet (1.5 -2.0m) which then passes through a series of treatments; sand filtration, chlorination at 20ppm, slow sand filtration and subsequently storage of water in a circulation solid reservoir (CSR). Further treatment continues with carbon filtration, 1µ bag filtration and UV before being channeled to areas housing culture tanks.

In algae culture, the microalgae stock is of two species; *Thalassiosira weissflogii* and *T. pseudonana* are obtained regularly from Vietnam. These are live feed for the zoea and mysis stages and have been chosen for their particle size. "We sell our post larvae PL10 with a size of 9mm."

"The hatchery has a maturation unit. An arrival, broodstock from Florida, usually 48g, go to the Aquatic Quarantine Facility (AQF) in Chennai, as per the regulation in India. This requires booking of the quarantine space well in advance," said Ross. The broodstocks stay in this facility for 5 days before they can be released. The broodstocks are used over 4 months post ablation. During this period, the best fecundity occurs after 2 months and in the last month, there is a dramatic decline in nauplii quality. Broodstock are fed imported complete feeds, frozen squid and polychaete. "Being in India, we do have extra costs such as the 18% GST and with imports of feeds such as those from Thailand, Europe and the US. Our broodstock feeds cost INR3,900/kg (USD55.7/kg)," added Charlie.



Larval rearing tanks. The hatchery operates for only 10 months of the year and in October was getting ready to shut down for dry-out during the year end.

### Zoea2 syndrome

According to Velayutham, this syndrome is a regular scourge in hatcheries in India. Hatchery operators in India attribute the high incidences of Z2 syndrome to extremely high temperatures during mid-summer in June, where the ambient temperature can go up to as high as 36°C. The team indicated that the Z2 syndrome also occurs in hatcheries in Vietnam and China, but the incidence level is comparatively lower.

"We experienced Z2 syndrome during our first cycle, but that was manageable. When all is well, the metamorphosis rate is 80% from zoea to mysis. With Z2 syndrome, the rate can go down to as low as 20%. However, in our second cycle, we experienced a more serious attack of Z2 syndrome. On what is the action plan in the case of Z2 syndrome, Nick said, "We will abort the cycle if we face mortality of more than 50% in 50% of the tanks." Velayutham added, "With Z2 syndrome, everything happens quickly. Mortality occurs within 4-5 hours and losses on the next day can be 100%."

### At the farms

Data have shown that their post larvae are getting good reviews. Similar to hatcheries in India, 20% more post larvae are provided for each consignment. "Farmers are happy with the quality of our post larvae and by word of mouth, more are coming to our hatchery. It also helped that our shrimp feed is well accepted in India. But some of the farmers' requirements are difficult." Charlie said that there are farms stocking at 40-50 PL/m<sup>2</sup> in Oppt and obtaining size 50/kg within 75 days, when no EHP occurs."

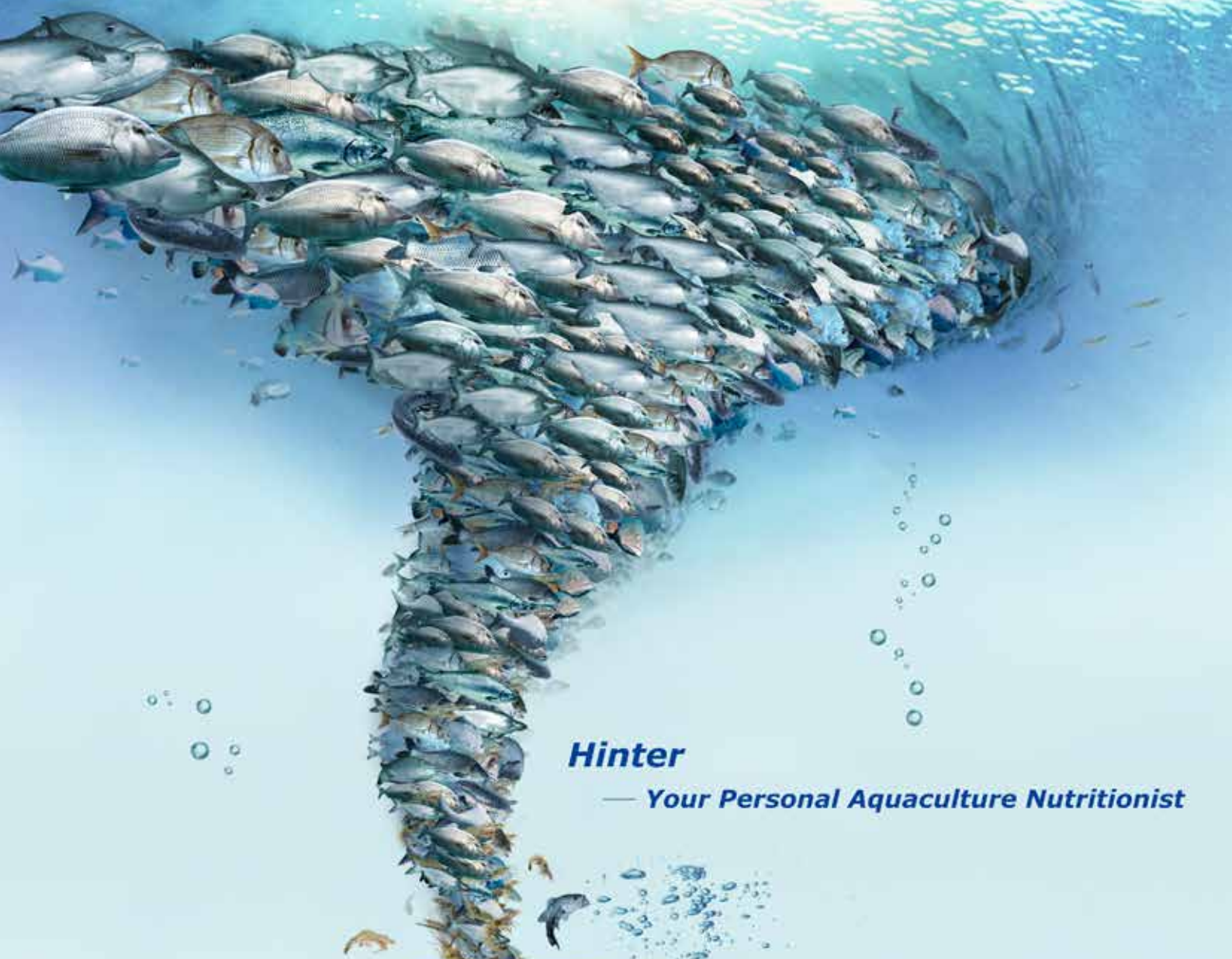
### Full steam ahead at the feed plant

After two and a half years in constructing its first feed plant in India, the Sheng Long (India) team went full steam ahead with the first batch of shrimp feeds leaving the factory in November 2018 and in June 2019, the warehouse was full of shrimp feed bags for delivery. Today, production has reached 5,000 tonnes of sales/month. The height of demand for shrimp feeds in India is from March to July and the factory is working with two shifts. After August, while the farming season is closed for farms in Gujarat state, shrimp farming will continue in farms in Andhra Pradesh, Tamil Nadu and Odisha.

The state-of-the-art feed plant spans across an area of 5.57 ha located in the SIPCOT Industrial Park of Theruvoy Kandigai, Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu. It has three lines for vannamei shrimp feed production of its feed brands; Lion, Royal Dragon and Tiger Feed. There is space for further expansion of another 50,000 tonnes per year of shrimp feeds. The facility includes an aqua health product manufacturing unit to supply quality products to customers, such as NutriPro, Supermix, etc. This feed plant will also supply markets in Sri Lanka, Bangladesh, Myanmar, the Middle East and African markets when there is a demand.



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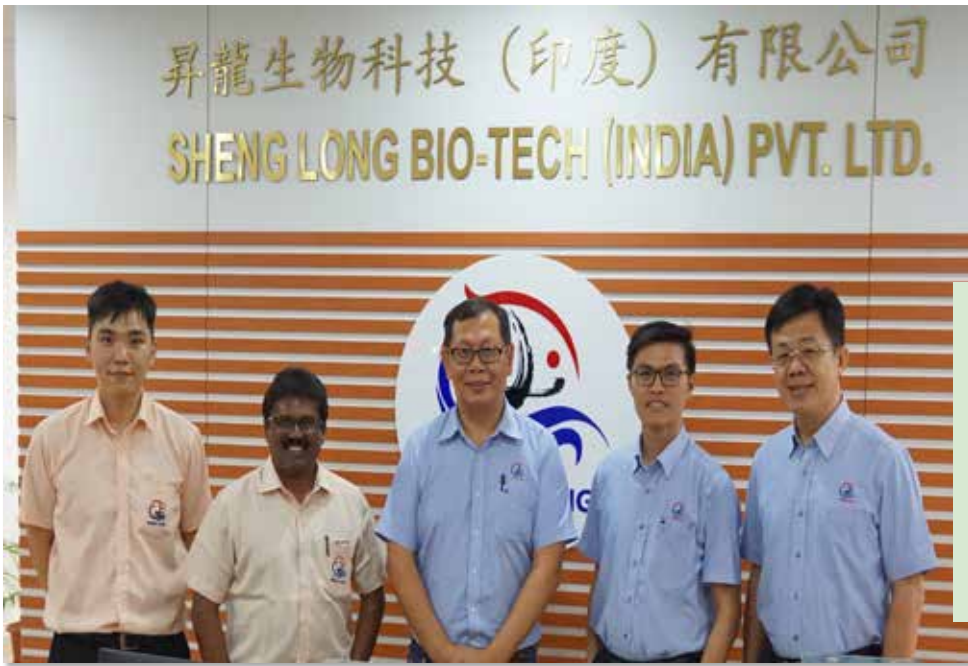
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Sheng Long Bio-Tech (India) team; Steven Shi (second right), Kumaresan (second left) and Randi Shi, Administration Manager with Jeff, Jie-Cheng Chuang, General Manager (centre) and Maple Hung, Vice President, Global Marketing (right) from Sheng Long Bio-Tech International, Vietnam.

Here in India, the feed plant is managed by Steven Shi (Ji Yang), General Manager and his team. Shi has been with the Sheng Long group since 2016. His local counterpart is Kumaresan, in charge of marketing. "We have been importing more than 30,000 tonnes of shrimp feeds into India from Vietnam since 2013. As volumes have been increasing, it was just fitting to set up local operations here in India. Aside from shrimp feeds, we can also look into production of Indian major carp (IMC), seabass or tilapia feeds, when farming of seabass and tilapia farming expands," said Steven.

On why this site in Tamil Nadu, Steven added, "This site in SIPCOT was chosen because of the strength in Tamil Nadu of the marketing team, and local support of our biggest customer Diamond Seafood. Since our initial markets for shrimp feeds was also in Odisha and West Bengal, we also looked at a location for a feed plant in Odisha."

Today, Sheng Long India's feed markets are in Tamil Nadu, Andhra Pradesh, Odisha, West Bengal and Gujarat. "Here in India, there are special requirements such as feeds for high saline shrimp farming such as in Gujarat and in Tuticorin. In the latter, farming is at 40-45ppt. In Punjab, our farmers have farming in inland areas. As we grow in India, we will have a plant in Odisha and bring us closer to the fish feed markets in Bangladesh," said Steven.



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# Experiences at a farm-based, pond-type *Penaeus vannamei* nursery in India

Part 2: Nursery operations from pond preparation, water and feed management to transfer of juveniles to ponds.

By Surendran V, Ravikumar Y, Chandrashekhar JYR and Anantheswara Bhat P

In Andhra Pradesh, over two years, the team from the Vaisakhi group developed and tested a nursery concept. They have achieved a production of 72 million juveniles (0.5 to 1g) and these have been stocked into grow-out ponds. Although there have been some issues in achieving average daily growth of at least 0.23g at the grow-out stages in mid-2018 and early 2019, nevertheless, a better measure of success is the success rate of crops and better survival rates. According to the authors, ideally, from a biosecurity perspective, an indoor nursery facility would have been preferable. A basic reason for this pond-type nursery concept was that prior to considering a more investment-intensive indoor nursery, it was imperative to standardise the operational protocol of the nursery operations, including water and feed management. In Part 1 of this article, the authors introduced the overall concept of an on-farm pond-type nursery system as well as the cost implications of such a system.

## Pond preparation

There are three basic steps in pond preparation. These include cleaning and disinfection of the pond; pumping and treating seawater; and 'water culture' in the ponds.

## Cleaning and disinfection of ponds

General cleaning with freshwater rinse is the first step followed by the application of 2.5% sodium hydroxide (NaOH). Here, the NaOH solution is sprayed on the entire surface of the pond liners and is allowed to stand for 3 days. This is followed by the application of chlorine and left in the pond for 1 day. Subsequently, the entire pond surface is washed with hydrochloric acid which remains in the pond for 1 day. The pond is then rinsed with freshwater followed by a soap wash and rinsing with freshwater once again. This is detailed in the flow chart for cleaning and disinfection of the ponds shown in Figure 1.

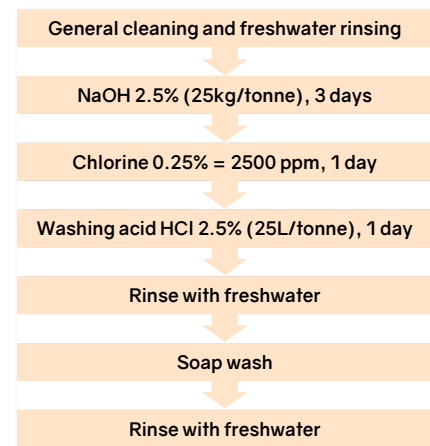


Figure 1. Steps in the cleaning and preparation of nursery pond for a new production cycle.



## Seawater treatment

The treatment of incoming seawater and water for the nursery ponds include the disinfection with 20ppm chlorine and dechlorination.

During the first filling of the pond water, chlorinated seawater from the reservoirs are allowed into the nursery culture ponds; dechlorination takes place in these nursery ponds. However, during the culture, the dechlorination process is completed in the reservoirs, before the water

is channelled into the nursery ponds. Seawater treatment could take about 5 days before complete dechlorination.

## Water culture

'Water culture' refers to a sufficient algal bloom development in the pond water so as to make it ready for stocking the post larvae. Water culture can take about 2 – 7 days after dechlorination and involves applications of agriculture lime, dolomite and mineral mix, followed by fermented rice bran and probiotics and aeration.

## Stocking of post larvae

The initial stocking density is 2 post larvae (PL10-15)/L. At this density, each nursery pond (1,800m<sup>3</sup>) can hold 3.6 million post larvae.

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### Water management

Water exchange is maintained at about 5%/day for the first week. This exchange rate is then increased to 10%/day and 20%/day during the second and third week respectively. From week 4 until harvesting of juveniles, water exchange is maintained in the range of 20%/day to 40%/day depending on pond conditions. Air blowers provide aeration at the rate of 5HP/pond and they will run continuously over 24 hours. The paddle wheel aerators are stopped for around 30 minutes after feeding. Therefore, the resulting running time for all the paddle wheel aerators reaches 18 hours/day. Table 1 describes these steps.

### Fermented rice bran application

Fermented rice bran juice is applied on a daily basis at the rate of 100L/pond resulting in a dosage of about 50ppm. Here, the concentration of rice bran and jaggery works out to be 5ppm each (Table 2).



Figure 2. Clockwise, harvesting and counting of juveniles for transfer to grow-out ponds.

Week	Water exchange (%)/ day	Aeration (per 1,000m <sup>2</sup> pond area)	
		Blower	Paddle wheels
		5 HP x 24 hours	4 HP x 18 hours
1	5	✓	✓
2	10	✓	✓
3	20	✓	✓
4	20-40	✓	✓
5	20-40	✓	✓
6	20-40	✓	✓

Table 1. Water exchange and aeration in the nursery ponds.

Items	Application per pond (2,000m <sup>2</sup> )	
	Quantity	ppm
Fermented juice mix	100L	50
Rice bran	10 kg	5
Jaggery	10 kg	5
Yeast	0.05kg	0.025
Probiotic	0.001 kg	0.0005

Table 2. Application of fermented rice bran.

DOC	PL stage	Water management				
		% water exchange	Fermented Juices (L)	Probiotics	Chemicals	Aeration (5HP PWA + 4HP Blower aeration (hours))
1-2	PL12	5%	50	PB1: 2L	dolomite 10kg	24
2	PL13	5%	50			24
3	PL14	5%	50		mineral mix 5kg	24
4	PL15	5%	50	PB2: 500g		24
5	PL16	5%	50		k-mix 2kg	24
6	PL17	5%	50			24
7	PL18	5%	50	PB2: 500g	dolomite (10kg) + agri-lime (10kg)	24
8	PL19	10%	50	PB 1: 2L	dolomite (10kg) + agri-lime (10kg)	24
9	PL20	10%	50			24
10	PL21	10%	50		mineral mix 5kg	24
11	PL22	10%		PB2: 500g	dolomite (10kg) + agri-lime (10kg)	24
12	PL23	10%	50		k-mix 2kg	24
13	PL24	10%			dolomite (10kg) + agri-lime (10kg)	24
14	PL25	10%	50		zeolite 5kg	24
15	PL26	20%		PB2: 500g	dolomite (20kg) + agri-lime (20kg)	24
16	PL27	20%	50	PB1: 2L	dolomite (20kg) + agri-lime (20kg)	24
17	PL28	20%			mineral mix 5kg	24
18	PL29	20%	50		dolomite (20kg) + agri-lime (20kg)	24
19	PL30	20%		PB2: 500g	k-mix 2kg	24
20	PL31	20%	50		dolomite (20kg) + agri-lime (20kg)	24
21	PL32	20%			zeolite 5kg	24
22	PL33	40%	50	PB2: 500g	dolomite (20kg) + agri-lime (20kg)	24
23	PL34	40%				24
24	PL35	40%	50	PB1: 2L		24
25	PL36	40%			mineral mix 5kg	24
26	PL37	40%	50			24
27	PL38	40%		PB2: 500g	K-mix 2kg	24
28	PL39	40%	50			24
29	PL40	40%+			zeolite 5kg	24
30	PL41	40%+	50	PB2: 500g		24
31	PL42	40%+		PB1: 2L		24
32	PL43	40%+	50			24
33	PL44	40%+			mineral mix 5kg	24
34	PL45	40%+	50	PB2: 500g	zeolite 5kg	24
35	PL46	40%			K-mix 2kg	24
36	PL47	40%+	50			24
37	PL48	40%+		PB2: 500g		24
38	PL49	40%+	50		zeolite 5kg	24
39	PL50	40%+		PB1: 2L	mineral mix 5kg	24
40	PL51	40%+	50			24
41	PL52	40%+			K-mix 2kg	24

Table 3. A summary of the daily schedule for water management from days of culture DOC 1 to DOC 41.

Particulars	Quantity (kg) or litre (L) per nursery pond	
	DOC 30	DOC 41
<b>Chemicals</b>		
dolomite	310	530
agri-lime	310	530
mineral mix	20	30
K-mix	8	12
zeolite	20	30
<b>Probiotics</b>		
Probiotic 1	8	12
Probiotic 2	4	5
<b>Fermented rice bran (L)</b>	<b>2,000</b>	<b>2,500</b>
Rice bran	200	250
Jaggery	200	250
Yeast	1	1.25
<b>Water Exchange (%)</b>	<b>500</b>	<b>900</b>

Table 4. Input requirements for water management.

DOC	ABW(g)	Feed as %BM	Feed types % distribution		
			Premium (PF)	Regular (RF)	Grow-out (GF)
1	0.0075	36	66.7	0	33.3
7	0.05	20	33.3	0	66.7
15	0.1	12.5	33.3	0	66.7
20	0.25	9	0	25	75
30	0.5	8	0	25	75
40	1	6	0	25	75

\*ABW average body weight; BM -biomass

Table 5. Feeding protocol using feed schedule NFS 1.

### Daily schedule for water management

Table 3 provides details on the schedule of water management. The input requirements for water management in nursery rearing for 30 and 41 days of culture are summarised in Table 4.

### Feed management

Standardising the feeding protocol is the first major challenge encountered in nursery operations. Three types of feeds are available in the market that could be used in nursery operations. We categorised feed into premium feed (PF), regular feed (RF) and grow-out feed (GF) based on the market price. Prices are approximately around INR1,500 (USD21), INR300 (USD4.2) and INR70 (USD 1.0) per kg for PF, RF and GF, respectively. The combination of all the three varieties of feed was aimed at optimising feed cost, without compromising too much on nutritional benefits. Trials were conducted to determine the most suitable feeding schedule for nursery operations taking into consideration both the performance and economic impact.

Experiments were carried out on three nursery feeding schedules: nursery feeding schedule 1, 2 and 3 (NFS 1, 2 and 3). NFS 1 comprised all the above three categories of feeds, ie., PF, RF and GF; NFS 2 used PF alone; and NFS 3 comprised RF and GF only.

After DOC 30, feeding schedules NFS 1, 2 and 3 resulted in a survival rate of 86.4%, 87.3% and 58% respectively (Figure 4). The best survival rate was achieved with NFS 2 and the worst was with NFS 3. However, NFS 1 also yielded good performance close to that of NFS 2.

In terms of cost of production, NFS 2 was the most expensive at 78 paise/ juvenile (USD 10.9/1,000 juveniles) as feed cost in nursery rearing, whereas the costs were 18 paise/juvenile (USD2.52/1,000 juveniles) for NFS 1 and 13 paise/juvenile (USD1.82/1,000 juveniles) for NFS 3. Based on the economics of feeding post larvae, it was decided to proceed with feed schedule NFS 1 as described in Table 5.

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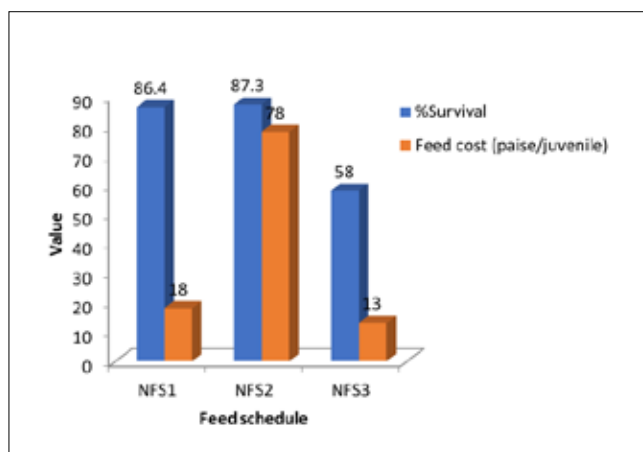
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**Figure 3.** A comparison of feeding schedules where NFS 1 comprised three feeds (GF+PF+RF); NFS 2 PF alone; NFS 3 a combination of RF+GF.

### Analysis of feed quantity and cost

Feed quantity and cost for an initial stocking density (ISD) of 3.6 million is detailed in Table 6. From the above data, feed quantity for an initial one million stocking density (ISD) is worked out as in Table 7.

### Analysis of final FCR

The feed conversion ratio (FCR) increased from 1.401 to 1.423 when the nursery feed for 30 DOC (in nursery) was added to the FCR for grow-out feed in 140 DOC. This was an increase of 0.022 in FCR which was translated to 22kg of nursery feed to produce 1 tonne of farmed shrimp. When the nursery DOC was extended to 41 days, the FCR increased by 0.044 meaning that 44kg of nursery feed were used to produce a tonne of farmed shrimp. This is explained in Table 8.

In other words, 22 to 44kg. of nursery feed would be consumed additionally for producing 1 tonne of shrimp, when a nursery phase is included. This was justifiable considering the 100% success rate, the nursery phase brings into the overall grow-out operations.

### Feeding schedule

Table 9 gives a summary of the feed schedule in the nursery at DOC 1, 10, 20, 30 and 40. For farmers wishing to start their own nursery, a detailed daily feeding regime can be requested.

### Harvesting of juveniles and transfer

After nursery rearing, the juveniles are harvested by using a small drag net (7m x 1.8m), and transferred with maximum care, to avoid stress, to a tank with oxygenated water. The juveniles are distributed into the polythene bags, oxygenated, inflated and tied with rubber bands. The ball-shaped bags with the juveniles are transported to the grow-out ponds, acclimatised and released into the ponds. The stock in ten bags is counted (for average count) from the allocated batch for each grow-out pond to have the correct estimate of the juveniles stocked. The whole process of transfer of juveniles is usually carried out in early morning hours, between 5.00 to 9.00 am.

### Cost of production for juvenile production

The production cost contribution by feed alone per juvenile is estimated to be 18 paise (30 DOC) and 26 paise (41 DOC). The production cost per juvenile is found to be 57 paise (30 DOC) and 64 paise (41 DOC). (Table 10).

The costs components indicate that feed contributes to 33.2% and 39.5% of the production cost in 30 and 41 days of nursery culture, respectively. Seed contributes to 61.3% (30 DOC) and 54.5% (41 DOC) of the production cost. The details are given in Figures 4 and 5.

Feed variety	30 DOC	41 DOC	Price (INR)	30 DOC	41 DOC
	Qty (kg)	Qty (kg)		Cost(INR)	Cost(INR)
Premium (PF)	234	234	1500	351,133	351,133
Regular (RF)	588	1002	250	146,937	250,386
Grow-out (GF)	1026	2267	70	71,826	158,724
Total	<b>1848</b>	<b>3503</b>		569,896	760,243
Paise/juvenile				<b>18</b>	<b>26</b>
DOC=days of culture					

**Table 6.** Nursery - Feed quantity and cost for an initial stocking density of 3.6 million PL

Feed variety	30 DOC	41 DOC	Price (INR)	30 DOC	41 DOC
	Qty (kg)	Qty (kg)		Cost(INR)	Cost(INR)
Premium (PF)	65	65	1,500	97,537	97,537
Regular (RF)	163	278	250	40,816	69,552
Grow-out (GF)	285	630	70	19,952	44,090
Total	<b>513</b>	<b>973</b>		158,304	211,179
Paise/juvenile				<b>18</b>	<b>26</b>

**Table 7.** Nursery - Feed quantity and cost for an initial stocking density (ISD) of one million post larvae depending on days of culture (DOC)

Days of culture (DOC) for grow-out		
FCR in grow-out	140	140
	<b>1.401</b>	<b>1.401</b>
add	DOC in nursery	
	30	41
<b>FCR (Grow-out + Nursery)</b>	1.423	1.445
Difference	<b>0.022</b>	<b>0.044</b>

**Table 8.** Explanation of differences in FCR.

DOC	PL stage	Stock	ABW (g)	Biomass (kg)	Feed as % BM	Total Daily Feed (TDF) (kg)
1	PL 15	1,000,000	0.008	7.5	36	2.7
10	PL 24	955,890	0.073	70.2	16	11.2
20	PL 34	909,156	0.243	221.2	9	19.9
30	PL 44	864,708	0.510	441.0	8	35.3
40	PL 54	822,432	0.965	793.3	6	47.6

**Table 9.** Summary of daily feed schedule in the nursery

Costs breakdown	Cost in INR	
	30 DOC	41 DOC
Pond maintenance	5,000	5,000
Chemicals and fertilisers	4,965	7,697
Probiotics	9,612	12,205
Fermented rice bran	12,750	15,938
Seed	1,050,000	1,050,000
Feed	569,896	760,243
Fuel and power	18,750	25,000
Facility repair and maintenance	10,000	10,000
Salaries and wages	9,000	12,000
Administrative expenses	90,00	12,000
Harvesting expenses	15,000	15,000
Direct operational cost: Total	1,713,973	1,925,082
Direct operational cost per juvenile	0.57	0.64
Operational cost: Total-cost of hatchery seed	663,973	875,082
Operational cost per juvenile (without cost of seed)	0.22	0.29
Feed cost per juvenile	0.18	0.26

**Table 10.** Breakdown of production costs for 0.1ha nursery at an initial stocking of 3.6 million post larvae (PL10-15).

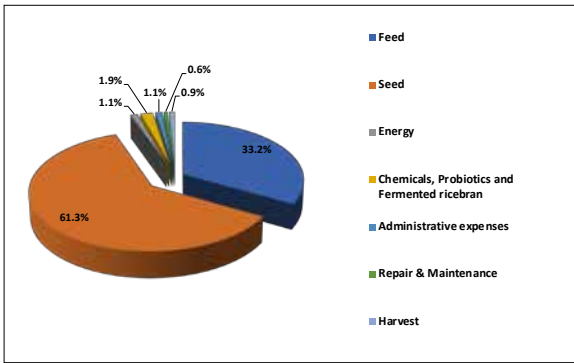


Figure 4. Contribution to production cost - nursery (DOC 30).

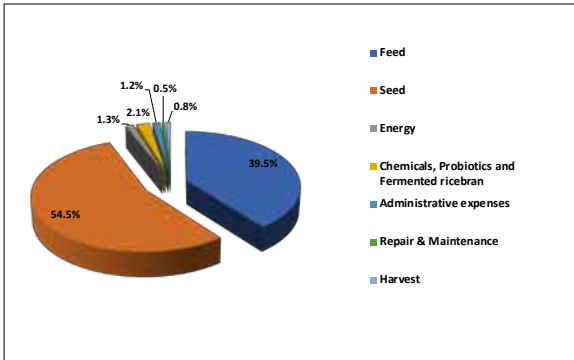


Figure 5. Contribution to production cost - nursery (DOC 41).

### Conclusion

Our experiences show that a nursery phase contributes to success in the grow-out operations. Keys to the success are stress-free harvest and transport, adequate water and feed management and the attention to biosecurity. An indoor, tank-type nursery could probably be better than a pond-type nursery from the perspective of biosecurity.



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# How to use farm care products effectively

With many farm care products in the market, knowing and understanding more about the products and application methods are vital.

By Soraphat Panakorn

I usually get the opportunity to visit shrimp farms in many countries, and I have noticed, a negative aspect in shrimp farming. Some farmers do not seem to know how to use farm and health care products effectively. In this article, my aim is to share my experiences and knowledge on farm care products. Every shrimp and fish farmer must be aware and understand the reason for the presence of various farm and health care products in the market and their precise functions.

Firstly, prior to using any farm or health care products, it is essential that there are regular updates on farm data such as water parameters, feed intake, weather conditions, average daily growth (ADG), shrimp moulting times and colour, which can all be used for diagnostic purposes. It is very important that we use all related data to evaluate the possible cause(s) to a problem and then formulate a hypothesis to confirm and ultimately find a solution to the problem. Simultaneously, the user must have a strong knowledge on the product before using it. These include technical information, properties, dosage and adverse effects. Otherwise, using the product can be a waste of resources. It is a mistake to depend on products to alleviate a problem when the cause could just be management-linked, such as overfeeding.

## Analyses of causes

Some examples of causative factors begin with simple malpractices such as overfeeding which leads to water with high loads of organic matter, low dissolved oxygen and the presence of toxic gases. Phytoplankton blooms may occur, and which may crash following heavy rains. Consequently, shrimp suffer from low dissolved oxygen (DO) and with shrimp exposed to hydrogen sulphide (H<sub>2</sub>S), they become weak succumbing to *Vibrio* infections in the hepatopancreas. Finally, the farmer may see white faeces floating on the pond surface. The farmer will then attempt to find a treatment to control white faeces or *Vibrio* infections.

In this case, the farmer should also treat related causes: concurrently increase water exchange, increase DO, reduce feed amounts, reduce organic matter and toxic gasses, treat *Vibrio* and improve the general health of the shrimp. Treatment can also be carried out step by step.

## Type of farm care products

Aqua farm/health care products can be divided into those for water adjustments such as lime and minerals, disinfectants, fertilisers and water probiotics. Those for animal health improvements are water probiotics, vitamins, minerals, gut probiotics and antibiotics. Using a product is not as simple as just adding it into the pond. It requires

**“Thus, I recommend the first step to diagnose the root cause of the problem with a laboratory analysis or a thorough scientific investigation”**

technical information and support from the supplier. It is advisable to avoid using such products when both information and support are not available. Some products cannot be used under certain conditions and when used will create certain side effects or some products cannot be used in combination.

## Curiosity is critical

The user should always be curious about a product, such as on product ingredient(s) or how it works or whether it is possible to use together with another product. Other questions include correct dosage, right time to use, what protocol to use and the side effect(s) if any. It is most important to ask if the product poses any danger to the user, animal or water. Another question is whether the product has an expiry date and where to get support and information. The farmers may ask why there should be so many questions. This is because if anything goes wrong, it is not just money lost but could lead to shrimp dying, poor harvests or a failed crop. Thus, I recommend the first step to diagnose the root cause of the problem with a laboratory analysis or a thorough scientific investigation.

## Choose a genuine and quality product

Before using farm/health care product, it is very important that you have a good, genuine and quality product in your warehouse. Throughout my 23 years of visiting shrimp farms globally, I can strongly affirm that around 40% of products seen in farms are not genuine or quality products. Table 1 gives some general guidelines on how to determine the status of the products.



Products with all important information and details printed on the packaging

**Table 1** General guidelines on how to determine the status of the products.

Item	Guidelines	Recommendations
Labelling	Labels should be complete-with product names, product ingredients, usage instruction, product properties, caution and treatment if exposure to user (Material Safety Data Sheet -MSDS is also considered in this case) government registration code, batch number, manufacturing and expiry date, producer address and contact number.	Investigate
Labelling	Labels with wrong spellings imply that if the company cannot spell words, i.e. if a company cannot get a label right, how will it pay attention to product quality?	Avoid
Company name and address	Google search for company info. Companies selling a fake product will also provide a fake address. In Vietnam, I found one product and after a google map search, the address was a small townhouse in a rural area. If you see this, will you believe in this product?	Avoid
Contact information	Call a contact number and ask on how to use the product. A real and standard company will provide the right answer as a technical service for all customers.	With caution
	I tried calling a company in Malaysia and it appeared that no one knows this product. Will you trust this company?	With caution

**Table 1 (cont'd)** General guidelines on how to determine the status of the products.

Item	Guidelines	Recommendations
Government registration	Check government registration code via its website. Many products are misrepresented. For example, I checked the code number from a disinfectant product named A, but turned out that it was a code number for a vitamin product named B.	Avoid
Discounts	Product that sells at very high discounts. A good company and good product cannot be sold at very low prices, unless they are fake products, expired genuine products or products procured illegally.	Avoid
Universal claims	There are products that claim a universal use. I read the label of one product found in China. The claim was that it can improve water quality, control bacteria, improve animal health, improve shrimp shell etc. This is impossible to get so many properties from only one product.	Avoid
Description	The label where the product description does not match the actual product. I found a product which said fine white powder, but the product was yellow in colour and lumpy. Not only was this product wrongly described but also had a quality control problem. If used, it might not give any benefit to farmers.	Avoid
Claims /Materials	If in doubt, users should send the product to laboratories for checking.	Investigate
Packaging	Packaging must be in a good condition, i.e. not leaking, not broken or dirty.	Pay attention
Product specifications	Learn how to check each product quality specifications, such as for H <sub>2</sub> O <sub>2</sub> we can use hydrometer to check the density. Use starch to check Iodine, use microscope and warm water to check microorganism product, use test kit to check product performance after application, use TCBS agar plate to check <i>Vibrio</i> after application of some disinfectant product, use shrimp to check how quickly growth is affected. When the feed mixed with some protein extract products etc.	Thorough investigation
Sales representatives	Check on company staff on whether they have technical knowledge on the product and on shrimp farming. Do not be tempted by some offer of entertainment. Suppliers must be trustworthy.	Investigate well
Checking information	Counter check all information that a company supplies via the internet or by consulting knowledgeable persons to confirm authenticity of products.	Avoid if in doubt
Fake products and products with "cure all claim"	Be careful of product that sells with very high cost and with claims of "supernatural power". Often, I found product claims with fake science and staff will disappear immediately once transaction is made.	Avoid
Fake products	Do not buy products from unknown suppliers. Many products that sell well are often fake and passed off as genuine products. In India, I found a product which externally looks like a genuine product but was a fake.	Avoid



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Products should be stored in well ventilated warehouses

## Storage

After you get your preferred products, the next step is storage. All products must be kept in cool and dry places. Many products such as vitamins, probiotic bacteria and some chemicals are sensitive to high temperatures. Thus, high roof warehouses that are rain-proof, free from rat infestations, well ventilated and placed on pallets are essential. For feed warehouse, it is strongly recommended to have humidity meters installed and proper monitoring.

## Learn how to use it properly

Each product has its specific use and protocol, for example iodine disinfectant products cannot be used under sunlight or need to increase dosages along with pH and alkalinity of water. Vitamin C is easily oxidised with oxygen and other minerals, so it needs to be coated with some ingredients after mixing with feed. The feed should be fed to shrimp immediately after mixing with vitamin C. Some minerals cannot be used together at the same time, such as potassium and calcium. Lime when used alone or at different times will give different outputs.

## Dosage is very important

Dosage is a measured amount of a product. Generally, we use ppm (parts per million) or mg/L. For example, if the instructions for product A is for 10ppm to be applied during the evening and broadcasted evenly while running the aerator(s) fully, the dosage is as shown below:

If the shrimp pond is 0.7ha with water depth 1.4m, this pond contains  $7,000 \times 1.4 = 9,800$  tonnes of water. Converted at 1 tonne = 1,000 kg or litre, the 9,800 tonnes equals to 9,800,000 kg or litres. 1 ppm = 9.8 kg or litres and therefore, 10ppm = 98kg or litres of product A.

It also means that the farmer must apply this product at the exact times as per the instruction on the label with 98kg or litres. If a lower volume is used, one cannot expect the product to be effective. If a higher dosage is used, the farmer should be aware of the safety level for the animal and whether the product can be used at a higher dosage.

## Activity of products

Every product has an application protocol stating the period of use



**Wrong labelling (from top left):** 1. China—a micro product that contain  $10^{11}$  CFU/kg at normal price; 2. China—minerals shown on label is not what is required by shrimp; 3. Thailand—label says improve shrimp hepatopancreas and kill both virus and bacteria; 4. China—one product to be able to eliminate all harmful substance in pond water; 5. China—mislabelling (alkali poison); 6. Malaysia - universal claims without website details.

to achieve optimal effects. The farmer must know how to monitor this properly. For example, some chemicals will work for 3 days, some for 5 days, some require thorough exposure to sunlight. With some products, without enough exposure to the sun, toxic residues will remain causing harm to newly stocked shrimp. Many water probiotics will last for 7 days after application but it can be better if applied for half the time at half the dosage such as every 3-4 days instead.

## Application techniques

Some products have different application protocols to achieve different requirements. For example, in the case of lime, if you need plankton to bloom, you must apply during the daytime. If you need to provide lime to shrimp, it must be applied at night when shrimp start to moult. Many vitamins and minerals that are used to top dress shrimp feed, must be mixed with water with only 5-10% of feed volume and coated properly on the pellets before application.

## Recheck performance

Many farmers ignore doing a performance check post-application. In most cases, they just feel that the situation is getting better and do not follow up with a post-application check. However, a close follow up can help to produce more effective results. For example, if shrimp mortality is from soft shell, the farmer will apply lime and key minerals and assume mortality will stop. But if they were to look closer, they might find that the live shrimp have blue shell. Trace minerals with the addition of chitosan are needed to mitigate the situation. If you miss this, it is possible to find some mortality again in the next moulting, or a plankton crash or just shrimp losing weight.

## Conclusion

It is the right of farmers to have all the information available on a product purchased or even intending to buy or use. The user must ask for technical support information on how to use a product effectively and the user must avoid any company which cannot provide such information and support.

I would like to stress that in order to survive during these difficult times in shrimp farming, the farmer needs to focus and use genuine and qualified products with the right application techniques. They also need to adhere to protocols and to follow up to check on results as closely as possible.

Fortunately, in Thailand we have an organisation where all companies agree to produce only good and quality products. This is pushed by the realisation that if farmers cannot survive, their business will also collapse. This organisation is TABA or Thailand Aquaculture Business Association.

Several Thai companies develop many brand-new innovative products to solve current and emerging problems with the technical co-operation of many professors from many universities and institutes in Thailand. At least twice a year, they conduct technical conferences focusing on the latest "hot issue" faced by farms and to develop solutions for each problem encountered.

In my opinion, this is the reason why Thailand's shrimp farms and healthcare products are reputable globally. As vice president of this organisation, I would like to welcome anyone interested to learn more on our innovative products and on our work to support a sustainable aquaculture industry. We are happy to share our knowledge with everyone.



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# Successful production of black tiger shrimp in Australia with new mode of delivery of probiotics

## Moving away from delivery via feed to manage bacterial pathogens

By Manuel Poulain, Olivier Decamp, Brad Callcott and Justin Holgate

Shrimp production in Australia is estimated at 5,000 tonnes during 2017-2018, according to official statistics. In Australia, as in all shrimp farming countries, the management of bacterial pathogens is critical. In 2015-2016, outbreaks of acute hepatopancreatic necrosis disease (AHPND) caused by strains of *Vibrio harveyi*, and white spot syndrome virus (WSSV) were recorded in Queensland. Epidemiology studies are ongoing but it has been suggested that WSSV entered the local environment via imported shrimp that had been used as fishing bait. The arrival of these devastating diseases in Australia has prompted farmers to re-examine and improve biosecurity procedures to better protect against further incursions of these diseases. It is well known that proliferation of *Vibrio* species in the farming environment and in the shrimp themselves is a major catalyst for mass mortality associated with these diseases. If we can control *Vibrio* abundance we can reduce the incidence and severity of these diseases.

A well-practised method of *Vibrio* control is via targeted microbial management both in the pond water and soil and in the shrimp themselves. INVE Aquaculture has been working for over 15 years on microbial management in shrimp grow-out, through a combination of biosecurity, quality nutrition, health boosters and probiotics. The approach focuses on the effective management of microorganisms and requires a combination of water treatment and feed treatment with high concentration probiotic mixtures.

Water treatment with probiotics helps to maintain a stable algal bloom, prevents the accumulation of organic waste, and the associated development of anaerobic zones, as well as the release of toxic molecules in the rearing water. Probiotics help to maintain optimal conditions for shrimp culture (Kumar et al., 2016) and make conditions less favourable for opportunistic *Vibrio* growth.

The management of *Vibrio*, especially those associated with shrimp gut colonisation (such as *Vibrio* strains associated with AHPND) is more complex and requires the displacement of *Vibrio* by probiotic strains that are delivered via the feed. The ability of Sanolife Probiotic (INVE) to displace *Vibrio* has been clearly demonstrated in mysis and post larvae (Silva et al, 2013) and juveniles. The reduced abundance of *Vibrio* and increased abundance of *Bacillus* inside shrimp was thus confirmed (Figure 1) (Hostins et al., 2017). Repeated tests in Vietnam confirmed the improved survival of shrimp when challenged with AHPND (Oanh et al., 2015). An additional benefit of these probiotics is their production of enzymes, such as protease, that improve the use of feed, and consequently, improving the growth rate of shrimp (Liu et al., 2009; De Souza et al., 2012).

## New mode of delivery

Coating probiotics at the farm is labour intensive and prone to human error. As a consequence, a new product was developed, Sanolife PRO-TAB, for the easy delivery of feed probiotics. Here strains of *Bacillus* are coated on slow-sinking wafers (5mm diameter and 1mm thickness) at a final concentration of  $2 \times 10^9$  CFU/g. These *Bacillus* strains were selected for their ability



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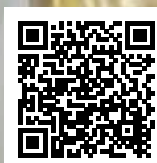
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to be metabolically active in a wide range of conditions (salinity, pH, dissolved oxygen). They can inhibit *Vibrio* strains such as those involved in AHPND, and produce enzymes that help the intake of nutrients. The high quality attractants in the wafers make them very attractive to shrimp (Figure 2) and this leads to the fast intake of the *Bacillus* probiotic strains. The benefit is the increasing presence of *Bacillus* in the shrimp gut and the reduced number of *Vibrio*. By displacing *Vibrio* from the shrimp gut, this product reduces the risk of disease associated with *Vibrio*, such as white faeces syndrome and AHPND. In previous field trials in Thailand and India, these wafers were also shown to significantly improve feed conversion ratio (FCR), growth rates and survival.

### Farm trials

It was decided to further evaluate the benefit of this product on FCR, growth rate and survival at the Pacific Reef Fisheries Pty. Ltd (PRF) shrimp grow-out farm in Queensland, Australia. This company has a hatchery, a farm and a processing plant. PRF has been successfully producing black tiger shrimp *Penaeus monodon* for decades, with an annual production of 1,000 tonnes. The trial was carried out in seven treatment ponds using Sanolife PRO-TAB and seven control ponds, starting in late November 2016. The average pond size was 8,500m<sup>2</sup>. The total area stocked for this trial represents about 12 ha, with about 8.5 million post larvae stocked. As shown in table 1, in the treatment ponds, the wafers were applied as a percentage of the feed, from 20% (days of culture -DOC 0-14) to 10% (DOC 15-28), 3% (DOC 29-56) and 1% (DOC 57-70). Details are given in Table 1.

Throughout the culture period, partial harvests were carried out from both treatment and control ponds. After an average of 155 days of culture, shrimp were harvested from all 14 ponds. Although this made the detailed analysis challenging, the high number of replicates allowed data to be summarised in Table 2.

### Improvements in production

The application of the probiotics as wafers in the first 70 days of culture led to the following improvements: survival increased by 21%; productivity increased by 19% and FCR reduced by 6%.

Although partial harvests make it difficult to analyse difference in growth between treatment and control ponds, an option was to compare the performance of the ponds before the first partial harvest that took place on DOC (Figure 2). It clearly showed that after DOC 50, the growth curves of shrimp in treatment ponds was increasingly steeper than that of shrimp from control ponds, with a difference in body weight reaching 9% after 107 days of culture. An additional point to consider is the timing of the partial harvest. The faster growth in

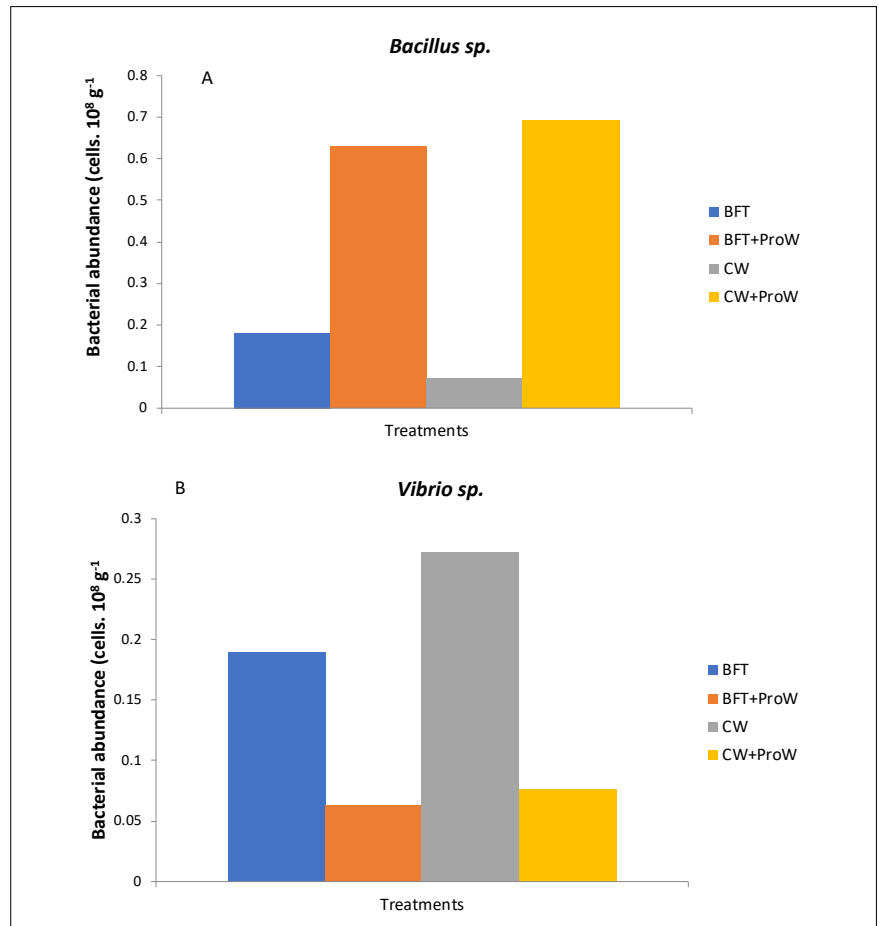


Figure 1. Specific bacterial abundance  $\pm$  standard deviation (cell 10<sup>8</sup>/g) of *Bacillus* (A) and *Vibrio* (B) in *Litopenaeus vannamei* gut in the BFT, BFT+ProW, CW and CW ProW treatments.

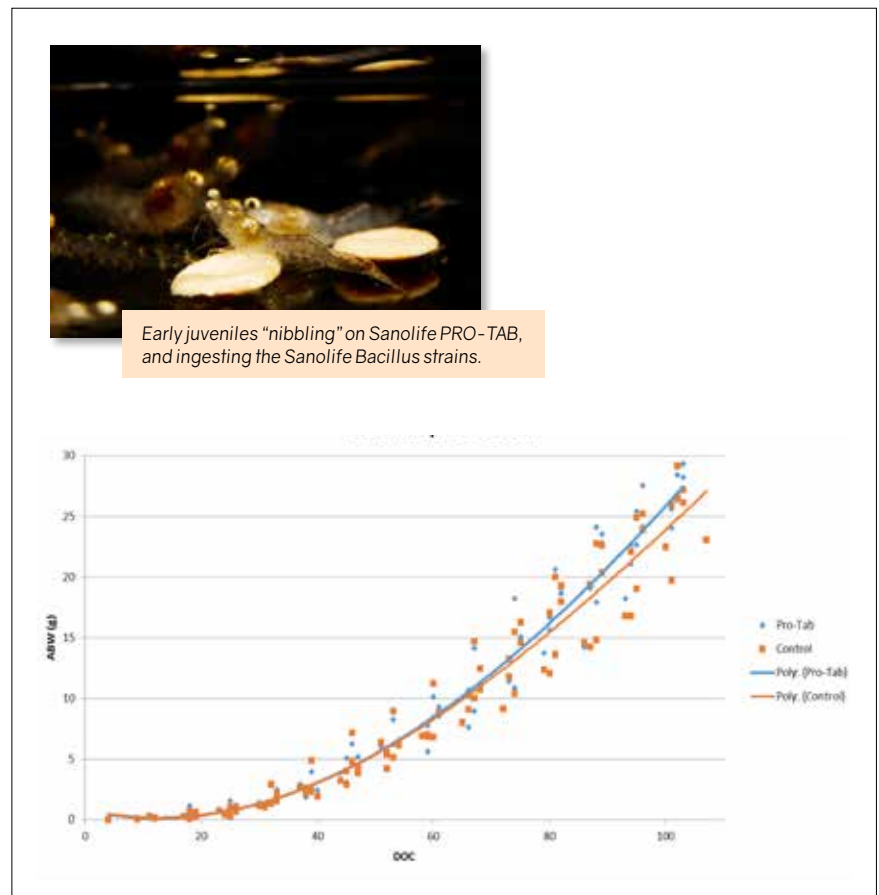


Figure 2. Growth curve of shrimp reared in treatment vs control ponds, during the first 107 days of culture. A trend line of polynomial order 3 was selected, with a R<sup>2</sup> value of 0.94.

the treatment ponds led to more frequent partial harvest in these ponds (28 versus 24 for control ponds). Also, the first partial harvest in treatment ponds occurred after DOC 108 whereas the first partial harvest in control ponds took place after DOC 117, 12 days later. As a consequence, biomass was harvested at earlier dates from treatment ponds than control ponds. For example, after 21 weeks of culture 48% of the total biomass from the Sanolife PRO-TAB ponds were harvested with partial harvest, compared to 38% for the control. Final harvest took place in week 22 and 23.

The combination of faster growth (as seen by the earlier partial harvest), increased survival (as estimated at the final harvest) and improved FCR led to a higher

DOC	Shrimp biomass (kg/ha)	PRO-TAB (kg/ha/day)
0-7	5.5	0.9
8-14	71	1.7
15-21	379	1.3
22-28	766	1.7
29-35	1,651	2.5
36-42	2,033	2.7
43-49	2,762	3.3
50-56	3,276	3.4
57-63	3,775	1.1
64-70	4,260	1.1

**Table 1.** Application rate of Sanolife PRO-TAB in treatment ponds

Treatment	Pond ID	Pond area (m <sup>2</sup> )	DOC at harvest	Harvest ABW (g)	Total biomass at harvest (kg)	Productivity (tonnes/ha)	FCR
Control	7	8,400	155	37	6,775	8.1	2.22
	10	7,600	155	38	8,590	11.3	1.88
	16	9,200	161	43	7,480	8.1	1.83
	18	9,300	160	37	11,840	12.7	1.76
	19	9,200	154	38	10,230	11.1	1.76
	87	8,500	147	41	6,310	7.4	1.83
	97	9,000	157	34	7,490	8.3	2.11
<b>Average</b>			<b>156</b>	<b>38</b>	<b>8,388</b>	<b>9.6</b>	<b>1.91</b>
Pro-TAB	6	6,000	149	36	7,140	11.9	1.77
	13	7,700	159	43	7,770	10.1	1.90
	15	8,600	160	36	11,900	13.8	1.69
	17	9,500	160	34	16,240	17.1	1.63
	20	9,000	156	42	7,560	8.4	1.85
	86	8,000	148	41	8,850	11.1	1.92
	98	9,500	152	34	7,200	7.6	1.83
<b>Average</b>			<b>155</b>	<b>38</b>	<b>9,523</b>	<b>11.4</b>	<b>1.80</b>

**Table 2.** Summary of results of 7 control ponds and 7 treatment ponds

profitability for the farmer: more harvested biomass produced by relying on reduced quantity of feed (115 kg less feed per tonne of shrimp produced).

This product fits into the holistic program being presented to farmers around the world, together with products for biosecurity (Sanocare PUR\*), health boosters (Sano S-PAK and Sano TOP-S) and water probiotics (Sanolife PRO-W).



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(Note: \* Sanocare PUR\* is not available in Australia).

# Optimising trace mineral supply in microdiets for marine fish larvae

Skeletal anomalies in farmed teleost fish, a key concern in marine hatcheries, can be reduced by elevating zinc levels in microdiets.

By Michael Viegas, Paulo Gavaia, Wilson Pinto, Jorge Dias and Luís Conceição

The mass production of high quality and healthy larvae and juvenile fish is a major issue for the aquaculture industry. At the larval rearing stage, problems are often associated with low larval and juvenile survival, stress and disease susceptibility, size dispersion, sub-optimal growth and high incidence of skeletal malformations. The underlying causes for some of these problems are poorly understood, although poor egg quality, uncontrolled environmental and nutritional factors, microbial ecology and the presence of pathogenic organisms are often identified as key elements.

The occurrence of skeletal anomalies in farmed teleost fish is a key concern in marine hatcheries, resulting in sizable biological and economical losses. The majority of skeletal anomalies have their onset during bone development in early larval stages, although some vertebrae fusion and related anomalies can also develop late in life (e.g. after smoltification in salmon). Skeletal malformations are a complex mixture of different bone disorders including vertebral and spinal malformations such as kyphosis, lordosis, scoliosis, and vertebrae fusion (Figure 1). Other deformities include neck-bend, compressed snout, bent jaw, harelip or front and downward protuberance of jaw, reduction of lower jaw, short operculum, and reduced or asymmetric fins.

Skeletal malformations can affect swimming ability, reduce capability to compete for food, impair growth rates, increase mortality and significantly affect animal welfare. The development and severity of skeletal disorders in larval and juvenile fish are linked to a poorly understood relationship between nutrition, environment and genetic factors.

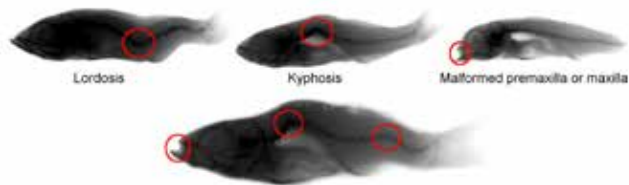
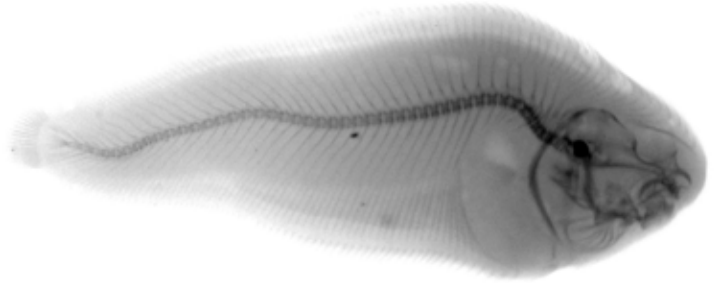


Figure 1. Examples of skeletal malformations in European seabass larvae at 70 days after hatching (DAH)



## Microdiets and bone development

Available literature data shows that virtually all microdiet components have an impact on bone development. Inadequate quantitative and qualitative supply of protein (amino acids levels, peptide profile of hydrolysates), lipid forms (triglycerides, phospholipids, fatty acids ratios), vitamins, minerals and trace elements have been associated to a modulation of bone formation and mineralisation. Major research efforts conducted by the industry and academia during the last decade have led to a significant evolution in the quality of commercial microdiets for larval fish. Although often presented as key nutrients for skeletal development, knowledge on the optimal supply of trace minerals in marine fish larvae is extremely scarce.

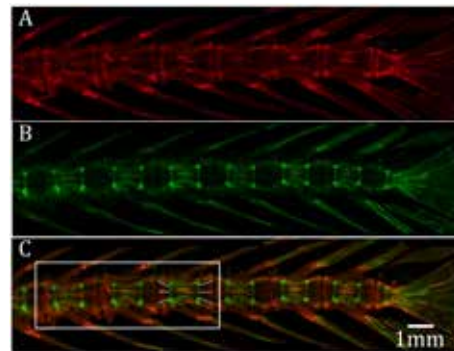


Figure 2. Dual staining method to estimate vertebral growth. A) Alizarin red-S staining at the end of the trial; B) Calcein staining at the start of the trial; C) merge of alizarin red S and calcein fluorescent micrographs allows for the estimation of mineral apposition rates (MAR; white lines) in Senegalese sole fed the various diets.

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A recent trial with Senegalese sole (*Solea senegalensis*) larvae (from 42 until 81 DAH) evaluated the effect of a combined supplementation with manganese (Mn) and zinc (Zn) at high (H) and low (L) levels. The basal feed formula was based on the commercial diet WINFlat (produced by SPAROS), upon which both minerals were supplemented in an organic form. After being fed with the experimental diets (in quadruplicate), dietary Mn and Zn supplementations were found to have little impact on the survival and growth performance of sole larvae. A dual bone staining methodology, used to assess the mineral apposition rate (MAR) in vertebrae (Figure 2), showed that neither mineral source (Mn, Zn) nor supplementation dose had a significant effect on MAR.

### Degree of malformations

The degree of severity of vertebral column malformations, divided into three anatomical regions (abdominal, caudal and caudal complex), was performed in 40 larvae per replicate tank (n=160 per diet). Malformations were classified with a score of 0 (no radiographic alterations) to 3 (presence of severe vertebral malformations that alter the gross morphology of fish). Overall data showed a low incidence of severe malformations (< 5%) among dietary treatments. While manganese supplementation levels had no effect on malformation scoring in any anatomical region of the vertebral column, sole larvae fed the highest supplementation

level of zinc presented a significantly lower malformation rating in the caudal complex region (Figure 3).

### Perspectives

The generation of new knowledge on the optimal nutrition at the fish larval stage and the implementation of novel methodologies to assess the multifactorial nature of biologic criteria (e.g. growth, skeletal anomalies, stress resistance) is key to the continuous improvement of high quality commercial microdiets for marine fish larvae.

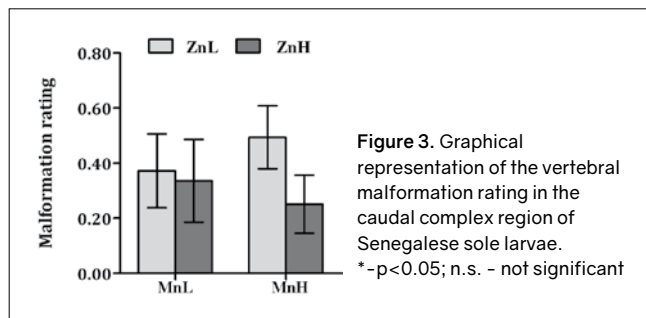


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# Scouting the most attractive chemoattractant for Pacific white shrimp

A recent study showed the relevance of krill meal as an attractant which promotes growth and its effectiveness is compared to several other marine protein sources

The recipe for economic success for Pacific white shrimp (*Litopenaeus vannamei*), the most widely farmed shrimp in the world, is maximum feed consumption combined with minimal feed waste. However, with feed often representing up to 50% of the total farming costs, ensuring that diets are nutritionally suitable and have high attractability, is a business necessity. Consequently, the choice of chemoattractants has become an important factor in fish meal-challenged shrimp feed formulations.

Published in the peer-reviewed Journal of the World Aquaculture Society, this new study, conducted by Alberto J.P. Nunes, Hassan Sabry-Neto and Severino Oliveira-Neto from Instituto de Ciências do Mar, Brazil (Labomar) and Aker BioMarine's Lena Burri, examines the performance of marine chemoattractants. Below **Dr Alberto Nunes** discusses the results of Labomar's latest head-to-head chemoattractant study.

## What was the driving force behind this study?

Lower cost protein sources derived from plant and rendered animal by-products lack essential nutrients and can suffer from poor attractability and palatability as well as antinutritional factors that can suppress feeding stimulus and reduce nutrient bioavailability. While a good feed attractant may help to overcome these issues as supported by a number of studies, we wanted to see if there may be significant differences in effectiveness between several marine feed attractants. Our study examined the most utilised sources such as fish, krill, shrimp and squid meals to ascertain which of these popular feed attractants is most effective in fish meal-challenged shrimp diets. The marine chemoattractants selected for this study were chosen based on previous studies, where they have shown their ability to elicit a positive feeding response in marine shrimp.

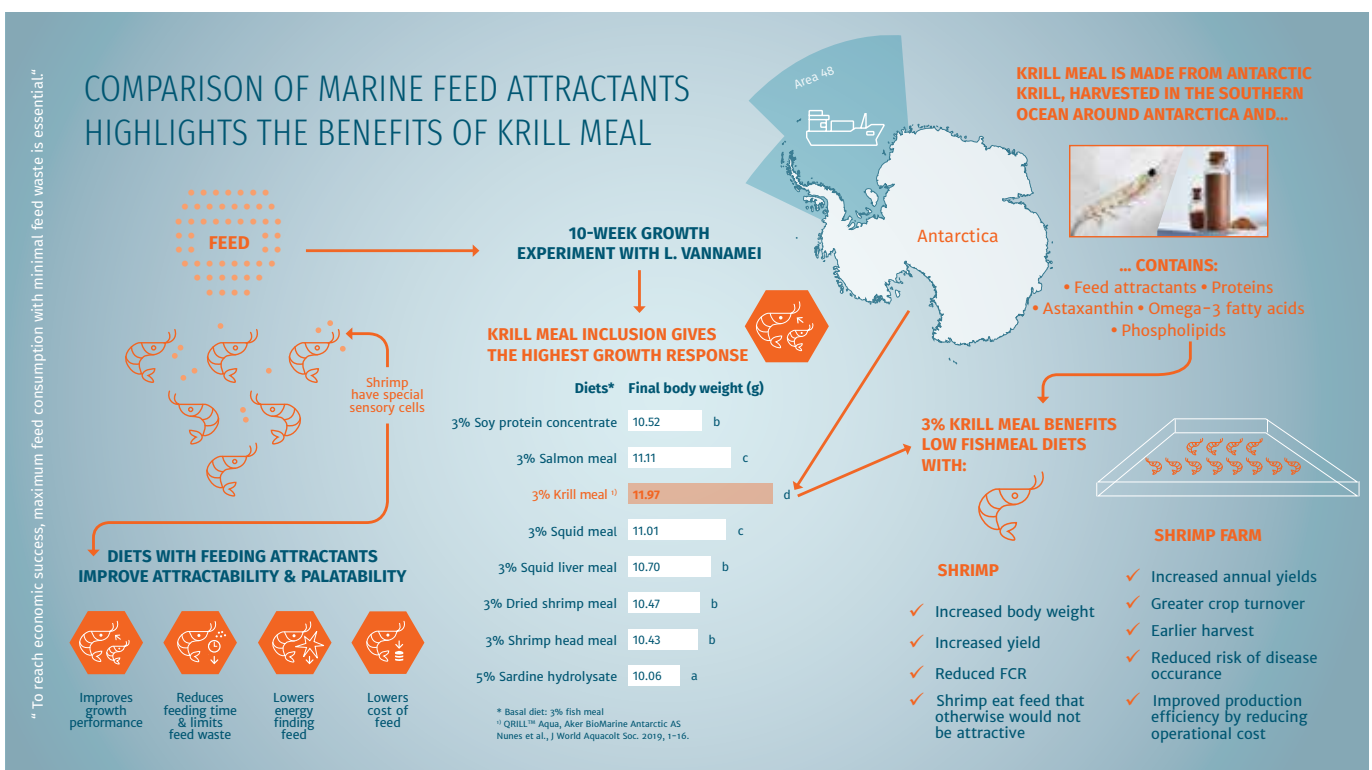
## Can you walk us through the basic parameters?

We designed a low fish meal diet with 3% fish meal which was supplemented with either 3% krill meal, squid meal, shrimp head meal, shrimp meal, squid liver meal, salmon meal, soy protein concentrate, or 5% liquid sardine hydrolysate. *L. vannamei* of 0.99±0.08g body weight was stocked at less than 100 animals/m<sup>2</sup> in 56 tanks of 1 m<sup>3</sup>. They were fed 10 times daily for 74 days. At harvest, the shrimp were counted, weighed, and their growth performance and feed efficiency determined. Survival reached 93.3±5.80% and was unaffected by supplementation.

**“Interestingly, the results of this study showed that feed attractability alone does not ensure an improved growth performance of the shrimp.”**



Noting that there are several marine proteins which are not supposed to be used in shrimp diets such as shrimp head meal and dried shrimp meal, Dr Alberto Nunes said, "This study becomes very relevant as we show that krill meal performed better than other marine protein sources."





### How was feed preference measured?

Feed preference was evaluated by feeding shrimp ( $10.87 \pm 1.82\text{g}$ ) in excess twice a day for 10 days in two separate feeding trays allocated in 50 tanks of  $0.5\text{ m}^3$ . There were 70 animals/ $\text{m}^2$  and seven replicates for each treatment and we had a 3-day acclimation period with a commercial diet. Left over feed were collected from the feeding trays after 1h of feed immersion, dried and weighed to determine their relative apparent feed intake (%). The study showed that shrimp preferred krill meal and shrimp head meal. Comparisons with diet supplemented with squid meal and squid liver meal showed the same tendency but did not reach statistical significance ( $p < 0.05$ ).

### A particularly interesting finding of the study is that feed attractability and improved growth performance do not necessarily go hand in hand.

Indeed, interestingly, the results of the study showed that feed attractability alone does not ensure an improved growth performance of the shrimp. When shrimp head meal was pitted against krill meal, shrimp preferred the shrimp head meal diet.

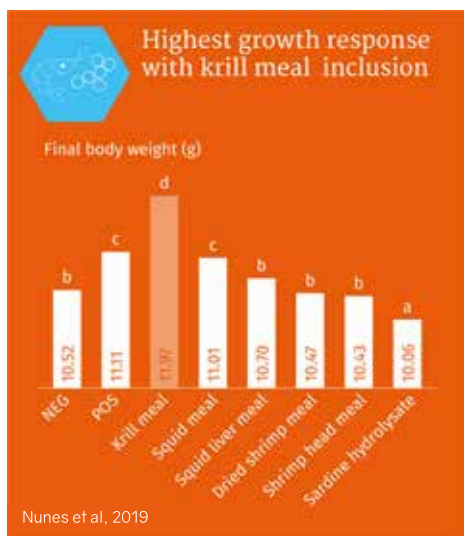
However, the feeding preference observations were not reflected in the final body weight in the growth study. After 74 days of rearing, the final body weights of the shrimp fed the diet supplemented with shrimp head meal were not enhanced beyond the negative control and krill meal diets. A reason could be that cadaverine, putrescine and tyramine were present in shrimp head meal and shrimp liver meal. The presence of these biogenic amines may have resulted in a higher feed intake, but actually compromised the nutrient quality of the feed.

### While the krill meal diet was second best when it came to feed attractability, it was actually the most beneficial when it comes to overall performance.

The growth enhancement advantage we observed with the krill meal diet is apparently a positive balance between a higher feed attractiveness and stimulation, and the supply of fresh key dietary nutrients. Similarly, previous studies conducted with both *Penaeus monodon* and *L. vannamei* have also demonstrated the ability of krill meal to stimulate feed ingestion and growth performance. The results showed that krill meal is the most effective growth enhancer in fish meal-challenged diets for white shrimp. The final body weight was highest for shrimp fed a krill meal supplemented diet ( $11.97 \pm 0.93\text{g}$ ), followed by salmon meal ( $11.11 \pm 0.77\text{g}$ ) and squid meal ( $11.01 \pm 1.17\text{g}$ ). In simple terms, a dietary supplementation with 3% krill meal is more effective than the same dose of any other chemoattractant we evaluated.

### Are there clear dietary and growth performance benefits to be gained from adding krill meal to shrimp diets?

Yes, the significantly increased growth rate provided by dietary krill meal inclusion can improve production efficiency by reducing a farm's operational costs. Earlier harvests and a greater crop turnover can increase annual yields. The risk of disease is also reduced, as shrimp spend less time in ponds.



#### Reference

Nunes AJP, Sabry-Neto H, Oliveira-Neto S, Burri L. 2019. Feed preference and growth response of juvenile *Litopenaeus vannamei* to supplementation of marine chemoattractants in a fishmeal challenged diet. *J World Aquacult Soc.* 2019;1-16. <https://doi.org/10.1111/jwas.12648>



Dr Lena Buri (right) with colleagues during Asian Pacific Aquaculture 2019 in Chennai, India; Chaiyot Rawekchom, Sales Director, Orill SEA Aker BioMarine - Thailand (left) and Princy Justin, Office & Sales Coordinator, Aker BioMarine India Pvt Ltd.

# An overview on the benefits and modes of actions of functional protein hydrolysates in fish and shrimp

Proof of concept in three key areas: palatability, nutrition and health

By Fabio Soller, Mikael Herault and Vincent Fournier

It is now very well established that the production of functional protein hydrolysates requires high expertise in the hydrolysis process and very specific analytical capabilities to guarantee standardised production of hydrolysate peptide profiles which give consistent performance in fish and shrimp growth.

Understanding the mode of action of functional protein hydrolysates is very important to better characterise the benefits of such functional ingredients and to help end users to better understand what they are buying and why. During the last 5 years, Diana Aqua has conducted many research studies to understand how dietary protein hydrolysates modulate animal behaviour and metabolism. This article will review the three main benefits of Aquativ hydrolysates for the aquaculture industry. The modes of action will be discussed, based on results from our latest findings.

Repeatedly, Diana Aqua has proven the potential of its Aquativ hydrolysates to improve shrimp, fish and feed performances; thanks to the combination of three key benefits: palatability, nutrition and health. The company has communicated (peer-review publications, articles in specialised journal, conferences) on several results of trials conducted in fish and shrimp to make the proof of concept of functional protein hydrolysates. Most of the relevant results were shared with customers and partners on the occasion of the Pepti'day held in Bangkok in March 2019 (Aqua Culture Asia Pacific, issue May/June 2019, pp 43-45).

## Palatability benefits of functional protein hydrolysates

The feeding behaviour of fish and shrimp is highly dependent on the modifications of biotic and abiotic factors. Any change in water quality, feed formula, or occurrence of disease will result in stress conditions for the animal which will alter its feeding behaviour. As a consequence, the challenge for the farmer is to avoid as much as possible these deviations and aim for a linear growth rate along the production cycle.

The application of palatability enhancers in the diet is a way to guarantee regular feeding behaviour and high feed intake. Among the numerous palatability products available in the market, functional protein hydrolysates have demonstrated their capabilities to stimulate feeding behaviour even in very stressful conditions. However, protein hydrolysates do not all achieve the same performance level in terms of feed intake improvement. Diana Aqua has invested a large amount of time and resources in biotechnological R&D facilities to develop the most potent functional protein hydrolysates, that bring in the right balance of compounds to stimulate fish and shrimp taste and smell senses.

Among these compounds, free amino acids and small peptides are produced in high quantities during the hydrolysis process. These compounds are perceived by fish and shrimp through their many taste and olfactory receptors located on their mouth, tongue, fins, barbells, skin and antennae (Derby and Sorensen, 2008). Once these compounds have triggered taste receptors, appetite metabolic pathways will be induced, resulting in an enhanced feed intake response (Figure 1).

When dealing with a hydrolysis process, the challenge is to produce protein hydrolysates from different raw materials (shrimp or fish) with the right level of free amino acids and peptides, and to be able to guarantee the same profile batch by batch. The freshness of the raw materials coupled with the right selection of proteolytic enzyme and duration of hydrolysis are key factors for success.

Trials conducted by our team in fish and shrimp showed that application of protein hydrolysates between 1 to 2% can improve significantly feed intake in cold water conditions or after handling or when diet is formulated with a low level of marine meal or with medication.

## Nutritional benefits of functional protein hydrolysates

Once the feed is detected and ingested by the animal, maximum assimilation is essential. A large variety of raw materials of different origins are used to formulate aquafeeds, particularly since fish meal has started to be replaced at high levels in more sustainable feed formulations. The quality of the dietary protein determines the fish and feed performance, as well as the environmental condition of the farm, and the amount of nitrogen released by the animals.

The quality of the dietary protein source is highly dependent on the process applied to manufacture the raw materials. More specifically, thermal processes (cooking and drying temperatures) will adversely affect protein digestibility if not well managed. It is common to find raw materials, including fish meal, with a protein digestibility as low as 80% although the best ones could reach values higher than 90%. In the case of functional protein hydrolysates, the proteins of the fresh raw material (fish or crustacean co-products) are hydrolysed using exogenous enzymes added during the manufacturing process. This hydrolysis step acts like a pre-digestion of the proteins mimicking what happens in the digestive system of the animals. The challenge is to define when to stop the hydrolysis process to supply fish and shrimp with the right peptide profile, that will ensure a near perfect protein digestibility (>95%) and very low nitrogen releases in the environment.

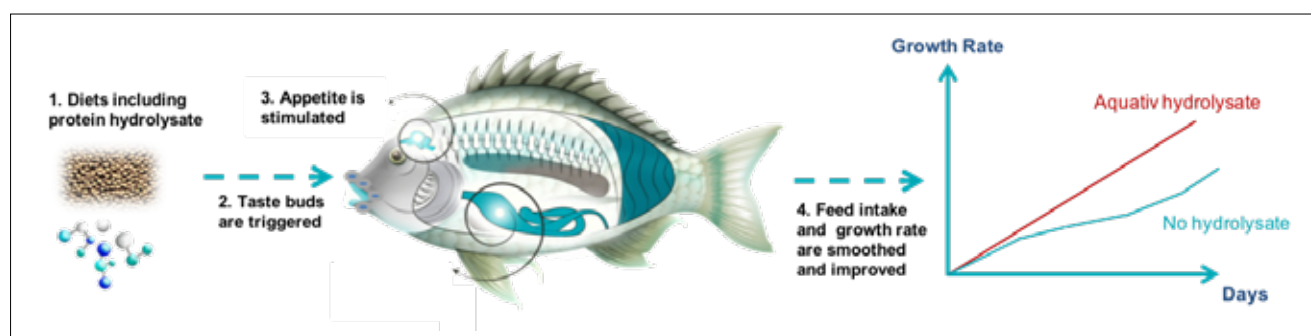


Figure 1. Palatability benefits of functional protein hydrolysates.

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Thanks to an adequate hydrolysis process, it is possible to produce the right balance of free amino acids, dipeptides and tripeptides, which are the only protein compounds allowed to cross the intestinal barrier after protein digestion (Karasov and Douglas, 2013). Application of functional protein hydrolysates in the diet will significantly increase the content of these highly digestible compounds and balance the protein and the peptide profile of the diet, particularly when fish meal is replaced at high levels and/or when low grade raw materials are used. Inclusion of the protein hydrolysate, even at low dosages, will significantly increase the richness and the diversity of di- and tri-peptides after diet digestion compared to a conventional diet. The absorption of nutrients will be accelerated and improved (Figure 2).

Several trials conducted in fish and shrimp have shown that diet digestibility could be readily improved by the dietary supplementation of only 1% protein hydrolysate. Dosage has to be fine-tuned depending on the dietary level of fish meal and age of the animal. Results from our trials (application advices available on request) show that larvae and juveniles require higher levels of highly digestible nutrients.

### Health benefits of functional protein hydrolysates

Functional feeds are becoming more and more popular in aquaculture. Such feed formulations include functional ingredients/additives that will support a better animal health through modes of action being more or less well described and being specific to each product and/or application. Among these candidate functional ingredients, protein hydrolysates have shown very interesting results in aquaculture and a lot of documentation is now available for fish and shrimp (Herault et al., 2014; Nguyen et al., 2012) and also for other vertebrates (Hou et al., 2017) and humans (Nasri, 2017).

Protein hydrolysates contain bioactive peptides that are chains of 2-20 amino acids derived from food protein that will influence positively the animal functions including health. A lot of peptides have been identified from raw materials of different origins, particularly marine ones, which have proven their potential to generate bioactive peptides.

Our team has identified more than 1,000 different peptides in shrimp and fish based Aquativ hydrolysates mostly coming from haemocyanin or collagen, two proteins very well known to encrypt bioactive peptides and to release them once cleaved (Robert et al., 2014; Robert et al., 2015). During the manufacturing of protein hydrolysates, the challenge is to select the right enzyme and the right hydrolysis process to release the bioactive peptides while not over hydrolysing them which will result in the loss of their potential bioactive performance.

Among the bioactive peptides identified in our protein hydrolysates, some have shown antimicrobial and antioxidant performance. Such peptides are usually involved in immunity enhancement and in reduction of oxidative stress, both contributing to increase the resistance of fish and shrimp to pathogens and to variations of environmental parameters. As an example, *in vitro* tuna protein hydrolysate has shown antimicrobial performance against *Edwardsella tarda*, *Yersinia ruckeri*, *Vibrio alginolyticus* and *Vibrio nigripulchritudo*.

Beside the direct disruption of pathogen cell wall by antimicrobial peptides, bioactive peptides may also modulate many metabolic pathways. They can activate the innate immune system and also have trophic and anti-inflammatory effects on intestine epithelium (Figure 3).

Some trials conducted in fish and shrimp with Aquativ hydrolysates have demonstrated that dietary hydrolysates improve significantly animal survival rates during disease challenges while enhancing the response of innate immune parameters such as lysozyme activity and immunoglobulin content (Khosravi et al., 2015; Gisbert et al., 2015).

At the molecular level, genes involved in the immune system were up-regulated in marine fish fed dietary hydrolysates while the ones involved in inflammation reactions were down-regulated. In many carnivorous fish species, gut health was improved when fed a diet including shrimp hydrolysate, especially in the case of very low fish meal content (Leduc et al., 2018; Fournier, 2014).

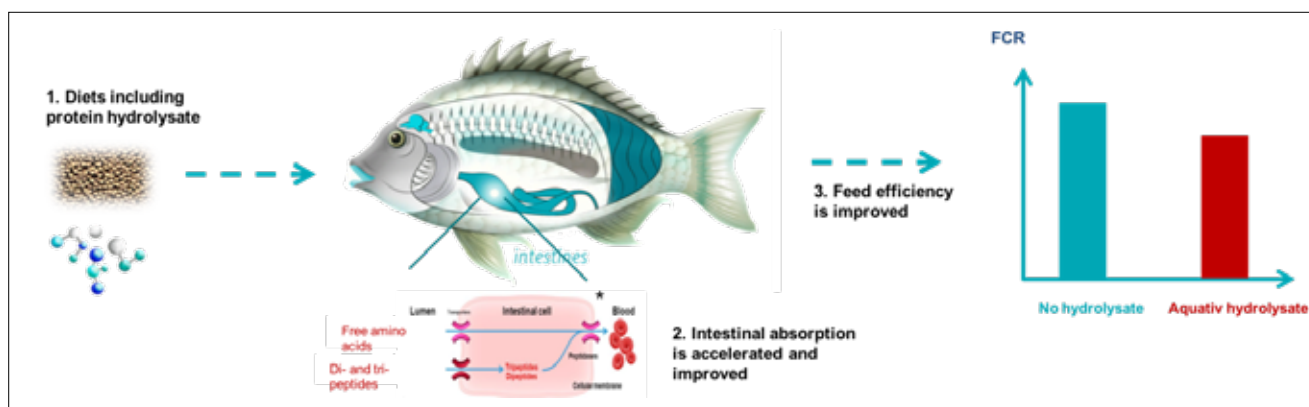


Figure 2. Nutritional benefits of functional protein hydrolysates (\*according to Berg et al., 2002. Biochemistry, 5th edition, New York, WH Freeman & Co Ltd).

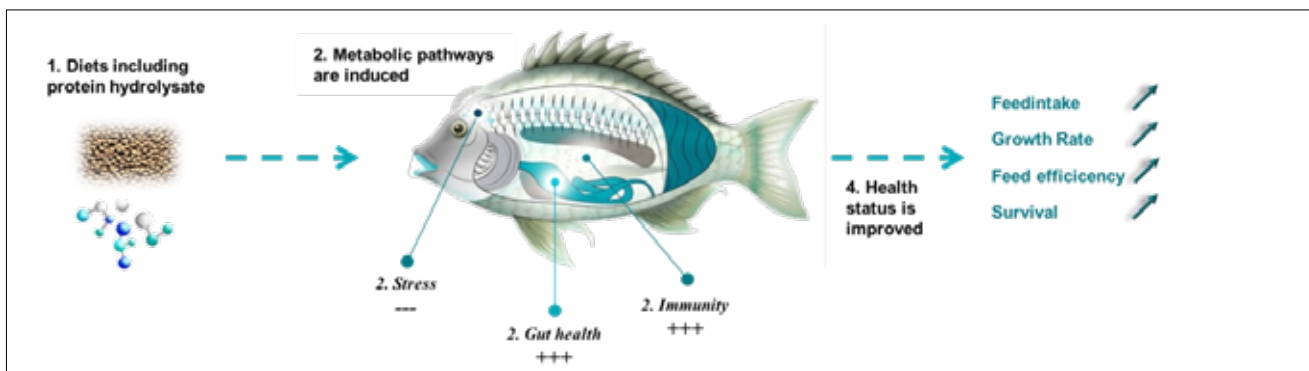


Figure 3. Health benefits of functional protein hydrolysates.

In the world of raw materials and functional ingredients, Aquativ hydrolysates are the only ones which combine three different benefits when included to aquafeeds, with improvement of feed palatability and digestibility as well as animal resilience to stress and diseases. Years of research allowed Diana Aqua to convert marine co-products into high value functional ingredients; with fine-tuning of the manufacturing processes, the company is able to produce products of the right balance of all three benefits. The performance of protein hydrolysates is controlled at every step of the development process, with an assessment of zootechnical performance in our fish and shrimp facilities combined with in depth characterisation of peptide profiles and response of animal metabolic pathways.

The holistic approach of product development, based on the diagnosis of raw materials and feed with regards to protein quality, industrial applications (dosage and method) and assessment of product performance in the targeted species, guarantees feed manufacturers the right solution adapted to their needs.

#### References

- C.D. Derby, P.W. Sorensen 2008. Neural processing, perception, and behavioral responses to natural chemical stimuli by fish and crustaceans. *J Chem Ecol.* 34 (7): 898-914.
- V. Fournier 2014. Crustacean protein hydrolysates for maintaining and/or promoting bowel health of cultured fish. *Worldwide Patent application WO2014114767A1*, filed January 24, 2014.
- E. Gisbert, V. Fournier, M. Solovyev, A. Skalli, K.B. Andree 2018. Diets containing shrimp protein hydrolysates provided protection to European sea bass (*Dicentrarchus labrax*) affected by a *Vibrio pelagius* natural infection outbreak. *Aquaculture* 495: 136-143.
- M. Herault, E. Motte, V. Fournier 2014. Marine protein hydrolysates as shrimp immune modulators. *Aqua Culture Asia Pacific Magazine July/August* 28-30.
- Y. Hou, Z. Wu, Z. Dai, G. Wang, G. Wu 2017. Protein hydrolysates in animal nutrition: Industrial production, bioactive peptides, and functional significance. *J Anim Sci Biotechnol.* 8:24.
- W.H. Karasov, A.E. Douglas. 2013. Comparative digestive physiology. *Compar Physiol.* 3 (2):741-783
- S. Khosravi, S. Rahimnejad, M. Herault, V. Fournier, K.J. Lee 2015. Effects of protein hydrolysates supplementation in low fish meal diets on growth performance, innate

- immunity and disease resistance of red sea bream *Pagrus major*. *Fish & Shellfish Immunology*, Volume 45 (2): 858-868.
- A. Leduc, C. Zatylny-Gaudin, M. Robert, E. Corre, G. Le Corquille, H. Castel, A. Lefevre-Scelles, V. Fournier, E. Gisbert, K.B. Andree, J. Henry 2018. Dietary aquaculture by-product hydrolysates: impact on the transcriptomic response of the intestinal mucosa of European seabass (*Dicentrarchus labrax*) fed low fish meal diets. *BMC Genomics* 19:396
- M. Nasri 2017. Chapter Four - Protein Hydrolysates and Biopeptides: Production, Biological Activities, and Applications in Foods and Health Benefits. A Review. 2017. *Advances in Food and Nutrition Research* 81:109-159.
- T.M.H. Nguyen, R. Perez-Galvez, J.P. Berge 2012. Effect of diets containing tuna head hydrolysates on the survival and growth of shrimp *Penaeus vannamei*. *Aquaculture* 324: 127-134.
- M. Robert, C. Zatylny-Gaudin, V. Fournier, E. Corre, J. Henry 2014. Transcriptomic and peptidomic analysis of protein hydrolysates from the white shrimp (*L. vannamei*). *Journal of Biotechnology* 186:30-37.
- M. Robert, C. Zatylny-Gaudin, V. Fournier, E. Corre, J. Henry 2015. Molecular characterization of peptide fractions of a tilapia (*Oreochromis niloticus*) by-product hydrolysate and in vitro evaluation of antibacterial activity. *Process Biochemistry* 50 (3): 487-492.



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# Commercial feeds for the Asian seabass in China

While feed millers are being challenged by raw material selection and adulteration of fish meal, farmers specify colour, fishy flavour, elasticity and less dust in feeds.

By Lu Bingyan, Dong Qiufen and Zhang Song

With the increasing rate of seafood consumption in China, we can predict that more high value species will be farmed to meet demand. For example, there has been a rapid rise in the production of California bass *Micropterus* spp, snakehead fish *Channa* spp and crayfish *Procambarus clarkii*. The Asian seabass, or barramundi, *Lates calcarifer*, is known as the golden-eyed seabass, because of the "golden colour" of its eyes. The tasty flavour of seabass makes it a potential to be another aqua 'super star' in China. In this article, we discuss the key points of commercial feed formulation for the Asian seabass in China, based on its nutritional requirements, culture model and feed market.

## Seabass in China

The Asian seabass has been cultured in China for several years. However, in China, we have three species categorised as "seabass" in China. These are the Japanese seabass, largemouth bass and Asian seabass (Table 1). Currently, farmers for the Japanese seabass to feed Asian seabass. While the volume of Japanese seabass and largemouth bass production tend to be stable, the volume of the Asian seabass has been increasing gradually. The production of all these 'seabass' is quite large in China and commercial feed is widely used. Therefore, a possible way to design a specific feed for the Asian seabass is by using commercial feeds for Japanese seabass and largemouth bass as references.



Asian seabass

## Features of seabass culture in China

The Asian and Japanese seabass are mostly cultured in the southern part of China, such as Guangdong, Guangxi and Hainan provinces. Largemouth bass can be cultured over a wider range because of its high tolerance to low temperatures. Generally, fish are mostly cultured in earthen ponds with a water depth 2-2.5m. Normally "seabass" feed has a crude protein (CP) content of around 40-45% and lipid content of 11-13%. Table 2 describes some culture practices and general performance of seabass farmed in ponds. In 2017 and 2018, the government banned numerous fish pens and fish cages due to environmental issues,



Harvesting Asian seabass in Guangdong province.

which means that in the coming years, pond culture in earthen pond will be the culture model for Asian seabass.

In China, the Asian seabass has better growth performance and better price than Japanese seabass, thus has greater potential for farming and the use of commercial feed.

## Commercial feed requirements

Results on several studies on the nutritional requirements of the Asian seabass are available. Normally, best growth is achieved with 45-55% CP feeds with the incorporation of the required essential amino acids. In the case of lipids, 15-22% is suggested with eicosapentaenoic acid and docosahexaenoic acid (EPA+DHA) at a level on 1.5 - 1.7% of diet.

However, Chinese farmers focus on feed appearance, palatability and growth performance. When it comes to appearance, priority is given to colour, dust levels, floating rate and elasticity. With palatability, consideration is given to flavour. Farmers have different standards in judging feed quality by colour; sometimes a yellow colour indicates good quality, sometime brown or dark colour also indicates the same. Meanwhile, a fishy flavour is required by farmers because they insist that is necessary to attract fish to consume the feed. The dust content must be low, and the floating rate must be over 99%. Otherwise, such feeds will easily be rejected by farmers. Last but not least, elasticity will be tested by pressing the feed pellet after soaking in water. Soft pellets with high elasticity are considered the best quality because farmers believe that such feeds have high digestibility and water stability.

**“Farmers have different standards in judging feed quality by colour; sometimes a yellow colour indicates good quality, sometimes brown or dark colour also indicates the same.”**




Name	Asian seabass	Japanese seabass	Largemouth bass
Class	Actinopterygii		
Order	Perciformes		
Family	Latidae	Lateolabracidae	Centrarchidae
Genus	<i>Lates</i>	<i>Lateolabrax</i>	<i>Micropterus</i>
Species	<i>L. calcarifer</i>	<i>L. japonicus</i>	<i>M. salmoides</i>
Appearance			

Table 1. Taxonomy of three kinds of 'seabass' in China

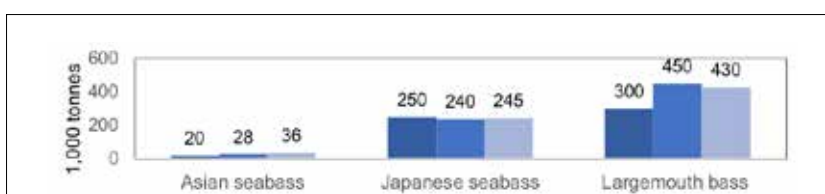


Figure 1. Production of Asian seabass, Japanese seabass and largemouth bass in China from 2016 - 2018 (1,000 tonnes)

	Asian seabass	Japanese seabass	Largemouth bass
Pond depth, m	2 - 2.5	2 - 2.5	2 - 2.5
Stock density, pieces/m <sup>2</sup>	12 - 15	14 - 16	10 - 15
Fingerling size, g	1.2 - 1.3	1.5 - 1.7	6 - 8*
Harvest size, kg	0.5 - 0.8	0.5 - 0.8	0.5 - 0.8
Days of culture	210 - 240	240 - 270	180 - 200
Feed details			
Protein, %	40 - 45	40 - 45	50 - 45
Lipid, %	11 - 13	11 - 13	10 - 15
Feed price, USD/tonne	1,400 - 1,500	1,400 - 1,500	1,500 - 1,700
Feed conversion ratio (FCR)	1.3 - 1.4	1.3 - 1.5	1.1 - 1.3
Feed cost, USD/kg fish	1.50 - 1.7	1.60 - 1.75	1.75 - 1.95
Fish price, USD/kg	3.62 - 3.93	2.35 - 2.50	4.82 - 5.13

\*Largemouth bass fingerlings are from nursery ponds, so the initial body weight is higher. Fry of Asian seabass and Japanese seabass are stocked into ponds directly and reared gradually.

Table 2. Pond farming data (in South China)

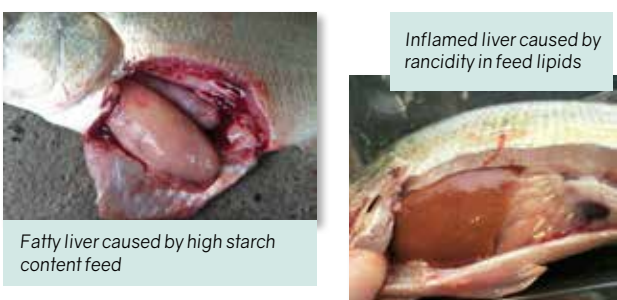


Once farmers accept the feed pellets based on the above features, palatability is the next most important requirement. Instances of refusing and spitting out feed pellets have been observed when Asian seabass were fed low quality feeds. Spitting may be caused by other reasons, such as adulterated fish meal, antinutritional factors ANFs in some plant protein sources and spoilt raw materials.

Farmers monitor fish liver health condition and growth periodically. Similar to other carnivorous fish, Asian seabass has a low utilisation of starch as an energy source. Fatty liver disease has been widely observed when carnivorous fish are fed feeds with a high starch content. Oxidative rancidity is another risk for Asian seabass as inflamed liver has been widely observed when fish is fed feed containing rancid lipid. As mentioned in Table 2, currently, in general, days of culture (DOC) of Asian seabass is 7 to 8 months with FCRs ranging from 1.3-1.4. This is the average performance now.

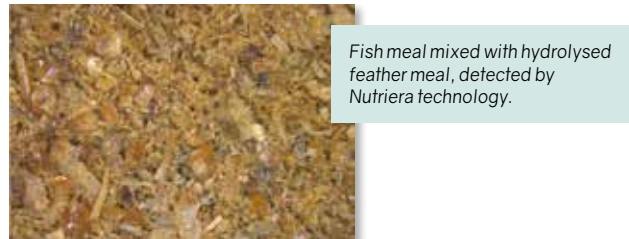
### Feed formulation strategy

Fish meal remains the first raw material for feeds for the Asian seabass. Because of sustainability issues and rising cost of fish



meal, there have been at least two impacts: firstly, more adulterated fish meal is sold in the market, for example the mixing of feather meal and fish meal, secondly, feed mills are eager to substitute raw materials to replace fish meal.

To address industry needs, Guangdong Nutriera Group has developed a systematic microscope technology solution to detect adulterated fish meal within 2 hours. Adulterated fish meal now has enough analysis data including crude protein, TVBN (Total Volatile Basic Nitrogen) and even the amino acid profile.



To address the challenge of formulating feeds amidst high cost of fish meal, Nutriera has developed a new feed formulation technology to improve nutrient bioavailability, fish health and at the same time allow for more plant raw materials to be included in feeds for the Asian seabass. Wheat gluten can be used as a source of protein in commercial feeds for Asian seabass. The viscoelasticity of wheat gluten can reduce the starch content in feed formulations and significantly improve the physical quality of the feed pellet. However, starch is necessary for feed processing and thus a non-specific risk for liver health will always remain. Our functional additives can be used in the feed to improve fish liver health and fish growth performance. Photos below show the fish liver condition before and after applying the whole series of Nutriera technology.



In summary, in order to design a commercial feed for the Asian seabass in China, the market requirement must first be considered. Nutrition, physical effects and growth performance will be key points in the evaluation of raw materials. Last but not least, functional additives and suitable vitamins and minerals will influence the feed cost and final performance.

#### Acknowledgement:

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Lu Bingyan, Dong Qiufen and Dr Zhang Song, are experts in aqua nutrition and aquaculture from Guangzhou Nutriera Group Co., Ltd which mainly delivers whole practical solutions for aquafeed mills to help them produce high quality aquafeed and create more value for the farmers. Email: qiufendong@gmail.com

# TARS 2019: Aquafeeds - Fit for Future

## Part 2: Growing the aquafeed industry in Asia, fish meal replacement strategies and nutrient requirement based diets

Part 1 of our report in issue September/October covered presentations on the state of the aquafeed industry in Indonesia, India and Thailand. It also covered the Hardtalk with C-suite executives of three leading feed companies. In this part 2, we report on the state of the industry in Vietnam, views from two feed users in Indonesia, growing the aquafeed business, fish meal replacement strategies and nutrient requirement based diets.



### Aquafeeds in Vietnam: What's next?



Prakarn Chiarahkhongman (left), Advance Pharma Co., Ltd, Thailand and Pradeep PJ, Leiber GmbH, India

Vietnam is a major player in Southeast Asian aquaculture and it is also a leading seafood exporter, mainly for the pangasius and shrimp. Aquafeed volumes are large at 3.9 million tonnes, with home-made feeds accounting for 25%. **Marc Campet**, ADM Animal Nutrition, Vietnam looked at recent developments and presented his views on what is next for the country's aquafeed sector.

Pangasius and shrimp feed production dominate the aquafeed sector in Vietnam. "Today, there is strong international participation in aquafeed production in Vietnam. We are probably reaching the over-capacity stage for the past 3 years, and yet we see new investments coming into Vietnam so this is a worrying trend."



**"There is a really wide range of species being farmed and this is really driving a constant evolution, which is leading to a high demand for new formulations."**  
- Marc Campet

Marc added, "We tend to see Vietnam as a leader in terms of aquafeed quality. But among the players, there is strong competition driven by pricing rather than quality. The tendency in Southeast Asia with over-capacity in feed production is also the scenario in Vietnam. There is a wide range of species being farmed, and this is really driving a constant evolution, which is leading to a high demand for new formulations."

### Distribution network

Most aquafeeds go through a distribution network between the feed mill and farmers, and distributors often support the farmers financially. All over Vietnam, farming is predominantly family-owned except for the pangasius which is now 80% consolidated. A strong consolidation in shrimp farming over the past 10 years is happening.

### An emerging nursery shrimp feed segment

Vannamei shrimp farming ranges from low density (<30 post larvae (PL)/m<sup>2</sup>), to the recently hyper-intensive (>200 PL/m<sup>2</sup>) and indoor production systems. This year, the drop in shrimp selling prices has been very challenging for all stakeholders, in addition to diseases. With partial harvesting, the farm structure is significantly moving from large outdoor ponds to much smaller ponds which sometimes are indoors.

The nursery phase which can be 2 weeks to 1 month, is a relatively new feature and a key phase for the farmer. "In the nursery,

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From left, Thayada Phlyhirun, TRF Feedmill Co., Ltd, Thailand; Dr Nguyen Duy Hoa, Cargill Vietnam Ltd; Marcel Boaventura, BernAqua, Belgium and P Maheswari, The Waterbase Limited, India.

In marine fish farming, while artisanal farms mainly use trash fish, industrial farms have moved to intensive farming using complete fish feeds. "A feature of the marine fish feed segment is the multispecies possibility which is changing the focus to R&D on feed development. Marine fish feeds comprise high-density nutrients. The average starter level of protein is around 50%. Slow-sinking extruded feeds are used for cage farming, and for ponds, floating feeds are used. The

stocking density is from 1-10 PL/L, with 10PL/L considered as quite a high stocking density. There is an emerging nursery feed market for PL10 to 1-2g juveniles in Vietnam, which is met by micro-pellet feeds starting anywhere at 500µ up to 1mm. Additionally, the trend is towards functional feeds and feeds with high digestibility in order to reduce ammonia and nitrogen levels in tanks. The average protein level of nursery feeds can be 40 to 45%."

At the farm level, there is a strong focus on controlling production cost leading to a feed evolution towards lower protein feeds. "While Thailand is looking at 30% protein or lower on a starter, in Vietnam we start at 40% protein which is still very high for the vannamei shrimp. So, there is a need to examine that, especially if we want to have more cost-effective production. There are also some interest among farmers on probiotic coated feeds, mainly to regulate gut microbiota."

### Fish feeds

Today, Vietnam is still producing the pangasius but at less than a million tonnes of fish per year. Pangasius farming itself has not significantly changed for the past 10 years, but small-scale, grow-out farmers are disappearing. However, fingerling production continues to be produced by small-scale farmers. The benefits of pangasius farming is at the value adding processing segment, while farmers struggle with low margins. In disease mitigation, the volume of pangasius vaccinated is probably below 5%, despite the efforts of local and international health companies.

"If we look at pangasius feed, it is strongly credit-driven and is mainly produced by local players. The protein level is around 30%. Feed conversion ratio (FCR) is between 1.3 to 1.5 and survival rate is around 70%. R&D on feed development has been very limited since 2000," said Marc.

small and specific feed market for industrial farms in Vietnam is limiting the number of players as well as competition," said Marc.


"There is an increasing demand for international certification, mainly from the industrial grow-out operations. If we look at the feed profile, over the past 5 years, there is a very significant drop in fish-in-fish-out (FIFO) ratio with 10 to 15% fish meal inclusion and use of co-product fish meal which is now taken into the FIFO calculation."

### Diversification fuels feed evolution

For the past 7 to 8 years, the snakehead is an alternative for pangasius farmers. This high value fish is sold in local markets. Feed protein levels are high at 40% which is basically a mix of grain protein and fish meal. Trout and sturgeon are farmed in north Vietnam. These are high-value species with a small feed market. Snail production is booming in central Vietnam as an alternative for shrimp farmers. Currently, snails are fed on trash fish, but for a more sustainable production, the trend is moving towards complete feeds to replace trash fish.


"In Vietnam, a drawback is the lack of communication between public R&D institutions and private stakeholders. There are a few feed mills investing in R&D capacity in order to be able to develop their own formulations and feeds for new species such as the snakehead."


Marc summarised, "We can drive aquafeed production by species' needs and/or by system specificity. Feed performance and technical support are becoming more and more in demand as well as functional feed for gut microbiota control. I believe that vaccination can be a really strong drive for the industry in Vietnam, especially if we can find an option to include vaccines in feeds."




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## Feed for thought: Farmers have their say

This year, **Rizky Darmawan**, PT Delta Marine Indonesia who participated at the Hardtalk with young shrimp farmers in 2018, and **Troy Keast**, Phillips Foods, Indonesia, enlightened participants on their experiences and wish lists for their farms in terms of feeds.

### Shrimp feeds and feed management

The PT Delta Marine Indonesia's farm on Sumbawa Island, comprising 2,500m<sup>2</sup> to 5,000m<sup>2</sup> ponds, concentrates only on the grow-out of *Penaeus vannamei* at stocking densities ranging from 100 to 180 post larvae (PL)/m<sup>2</sup>. It is a typical farm in Indonesia. In a newer part, 2,500m<sup>2</sup> ponds are HDPE-lined while older ponds are concrete ponds. Feeding is done manually, 5 times/day, or over 24 hours using auto feeders.

Rizky shared data on costs of production, calculated from previous cycles. Feed is a large part of production cost (55%) and feed trays are used to monitor feed usage. He manages feed inputs with a feed index of  $\pm 0.6$ , which helps the farm attain optimal feed utilisation, and avoid overfeeding and underfeeding. "We do not depend solely on FCR anymore as with auto feeders, we can bypass the conventional feeding rates."



**"We do not depend solely on FCR anymore as with automatic feeders, we can bypass the conventional feeding rates." – Rizky Darmawan**

"Occasionally there is topdressing of feeds to counter disease or improve feed digestibility. We still use feed trays in our farm. "On the choice of feeds, Rizky said, "We always want high quality feed and do not want any decrease in feed quality in our farm. We use a minimum of two brands of feeds for benchmarking. When there is a drop in performance of a particular feed brand, we will reduce the proportion of this feed used in the farm. As with every farmer, we want to reach our target average daily growth (ADG), look for competitive feed prices and technical support."

On KPIs, the farm strives for the following: 5g shrimp at days of culture (DOC) 40; growth in every sampling; ADG which correlates to the feed index indicating good feed performance; ADG 0.3g and FCR  $\pm 1.2$ . The most recent strategy is the use of lower protein



From Kemlin Industries, Ratchaniwan Jindapraphan, Thailand (left); Nguyen Ngoc Binh, Vietnam and Agus Suryadi, Indonesia (right)

feed. "The reasons are that we can get the same growth than using higher protein feed as most of us in Indonesia ferment the feed which make them more digestible. Lower protein feeds are cheaper and contain less nitrogen, helping us with pond water quality."

On his wish list are: early stage feed suitable to be used with autofeeders; functional feeds to help mitigate diseases; feeds which give good ADG, robustness in shrimp and no annual increase in feed prices. "Currently starter feeds are crumbles which pollute autofeeders and mess up the mechanism. Yearly with the increase in feed prices, and current low shrimp prices, profit margins are declining."

In summary, Rizky would like to see cheaper feeds in the market. "We want to see in the future that the shrimp farming industry is as mature as the salmon industry; right now, we can get FCR 1.2, but hopefully, in the future, we can get FCR 1."

### Marine fish feeds in Indonesia: A farmer's perspective

Phillips Foods Indonesia operates an Asian seabass *Lates calcarifer* or barramundi farm in north Bali. Troy, Director of Aquaculture and Sustainability is in charge of all operations, from egg to plate. The farm is integrated with broodstock, hatchery, nursery and grow-out. It also has processing facilities and its own restaurants.

"Our nursery stage is actually offshore; it is the most challenging stage but nutrition has been the easiest way to meet this challenge. Historically when we had problems at the farm, when all else fails, we hit it with nutrition."

Troy focused on vendor tiers in the supply of marine finfish feeds in Indonesia and commented, "The multinationals are poorly represented in Indonesia as marine finfish culture lacks the footprint to justify investment. As I see it, one uncertainty is regarding regulations which continue to handicap the industry and scare away investors," said Troy.

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Roundtable leaders for the breakout group on shrimp feeds, from left: G. Ramesh, Wenger, India; B. Ravikumar, Growel Feeds, India; Haris Muhtadi, CJ Feeds, Indonesia; Brett Glencross and Rizky Darmawan.



**“Historically when we had problems at the farm, when all else fails, we hit it with nutrition.” – Troy Keast**



**An alternate angle on sustainability**

“For me, the basis for a sustainable relationship is trust, honesty, integrity and authenticity.” His message to growers is, “Once you have established a relationship with an individual (these relationships can transcend corporations) or a vendor, the benefits are compounding—they get better and better as the years go by. You don’t jeopardise these relationships with flippant speculation. You remain loyal and when you come across a problem, you solve it together.”

“A top tier vendor is able to produce those feeds in Indonesia that my competitors are able to access overseas. The middle tier vendor is willing and capable to re-calibrate/formulate those feeds produced in country or import to meet customer requirements and the bottom tier vendor is in a race to the bottom to produce the cheapest feed possible.

Finally, Troy said, “We should also be doing whatever we can to press down on the phenomenon of decreasing protein prices, it is totally counter-intuitive and detracts from the goal of equitable value chains”

“I am a firm believer that basically, you get what you pay for. In the nursery, we address problems with high nutrition and very expensive feed. We use mortality rate, rather than survival as our performance indicator.”

**The ideal vendor**

Troy believes that an ideal vendor facilitates progress and has the vision to weigh up their potential customer, know where they want to go and know what this will require. Customers without a classical education needs to depend heavily on technical support, in the form of a technical manager supplied by the vendor, as in the case of Phillips Seafood. “Together we work through trials which are not bound by science or the analytical mind.



From left, M A Kabir Chowdhury and Md Akteruzzaman, AKM Ruhul Amin Sarker, DSM and Himangshu Bhowmik, Agata Feeds, Bangladesh



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## Growing the aquafeed business

The aquafeed sector is highly dependent on the aquaculture industry. In turn, the latter needs the former to grow. Throughout Asia, the aquafeed sector is highly competitive with many players and overall feed supply is greater than demand. In his presentation on growing the aquafeed business, **Dr Zhang Song**, Nutriera Group, Guangdong, China, discussed current and future trends for aquaculture in China and its effects on the aquafeed sector and vice versa.

"I believe that aquaculture will continue to play an important role in food production. We have the lowest FCR for fish at 1.1 or maybe less. In comparison, FCR is 2.0 to 3.0 for swine, and for the poultry, it is 2.2. For cattle, it is very high from 4.0 to 10.0," said Zhang.

Two key technologies continue to push aquaculture forward: hatchery production and commercial feed development. From producing feeds for carps, feed mills in China have been successful with floating and sinking feeds used for feeding the high value mandarin fish (farm gate price of USD14/kg) which were previously fed live fish. With this development, annual fish production is expected to increase from the current 300,000 tonnes with feed demand at 400,000 tonnes.



**"Farming creates a demand for quality feed, and efficient feed pushes the growth in farming."**  
- Zhang Song

## Aquafeed and seafood consumption

In China, seafood consumption is increasing with the rise in disposable income of the urban population. Retail seafood for the young generation is fast developing in China spearheaded by e-commerce. Besides these new trends in food distribution and demand, there are new requirements on seafood.

"The Chinese prefer to eat more seafood and place great importance on issues pertaining to health, nutrition and convenience. They also follow seafood trends. Pangasius (local and imported from Vietnam) is popular for the hotpot dishes. Other popular seafood are the grass carp, frogs and crayfish. China continues to import seafood and in the next few years, I think the trend will not change." Pangasius is also imported from Myanmar and future imports will likely also come from Bangladesh and India. Zhang also touched on the current situation on the Asian swine fever affecting the Chinese swine industry. With a shortage of domestic pork, consumers will turn to seafood, creating demand for imports from various countries.

However, there is the "transformation and upgrading of aquaculture and aquafeeds." China has targeted antibiotic-free aquaculture by 2020 and this is expected to change how the aquaculture and aquafeed sectors operate. The strict environmental scrutiny and protection of the environment will push feed mills to upgrade feed formulation and production technology and push farmers to improve management and farming protocols.

The market for aquatic farm-care products in China is growing with the market size of more than USD 7 billion/year. Zhang expects this to grow, creating a potential business for aquafeed producers. More local feed mills have started to produce and market their own farm-care products.



The BASF team, from left, Pearl Chen, Taiwan; Dr Chi Man, Hong Kong; Athisak Kliangpradit, Thailand; Daniel Wussow, Singapore; Yunanto, Indonesia and Wayoon Poonperm, Thailand.

"Farm care products can increase farm productivity, aquafeed volume and farming profit. In the farming of the grass carp, production is 22 tonnes/ha, but with farm care products, production can reach 28 tonnes/ha. In terms of feed volumes, without these products, it is only 33 tonnes/ha but with farm-care products, it can reach to about 40 tonnes/ha. With farm care products, moulting in Chinese mitten crabs can increase to 6-7 times from 4-5 times to reach a much bigger size, with a higher market price, in a shorter time."

Suitable feeds are also required for better farm productivity. Feeds for recirculation aquaculture systems will differ from the ones for pond or cage farming systems, due mainly to differences in feed nutrients, water stability and pellet physical characteristics. "In China, with product upgrades we improved FCR for tilapia farming from 3:1 in 1992 to 1.2:1 in 2018. For several feed types, we have moved from sinking to floating feed, and lately to functional feed. This has been done for various species," said Zhang. "Farming creates a demand for quality feed, and efficient feed pushes up growth in production."

## Functional feeds

"Functional aquafeed for better farming performance is the direction to go," said Zhang. "Nowadays in China, local feed mills have started to expand their product range. There are several functional additives: health care for liver and gut health with anti-stress properties; prevention against viral and bacterial pathogens; fast growth: low FCR; high density culture, hot season crop or high salinity culture; fillet quality; colour and flavour. For example, we have demonstrated how a functional feed used in combination with probiotics and a premix had effectively solved the pangasius yellow fillet problem."

His takeaway message was that, "Feeding is the most important stage in the farming of aquatic animals. Together we need to adapt and update farming technology to ensure the production of safe and high-quality seafood."



Candra Yanuartin, PT Sinta Prima (left) and Dachni Riantika, PT Novus International Indonesia

# Replacing fish meal and fish oil in aquafeeds

## Fish meal replacement strategies

Since the history of modern fish nutrition, fish meal has been the golden standard ingredient for aquaculture feeds, said **Martin Guerin**, Adisseo Asia Pacific PLC, Singapore as he presented on "Fishmeal replacement strategies: Just a question of protein?"

"It is a great raw material, delivering the right nutrients; it is very high in protein and essential amino acids as well as lipids of all types, including polyunsaturated and omega-3 fatty acids. It contains phospholipids which are very important for juvenile and larval nutrition and cholesterol which is important for shrimp nutrition. When processed and produced properly, it has very high digestibility. It is a very good source of minerals, fat-soluble vitamins and functional protein molecules such as attractants like free amino acids and peptides." However, price, production supply, sustainability, certification and social responsibility are pushing industry to replace or partially replace fish meal.

In addition, Martin said that the amino acid taurine is growing in importance over the past few years. "Today, nobody wants to formulate marine fish feed without taurine. Finally, there are all the peptides with antimicrobial, immuno-modulation, and antioxidant properties that contribute to immunity when you formulate with fish meal. So, what should we look for in terms of fish meal replacements? There is a gap in amino acids levels which needs to be compensated especially for two key essential amino acids: methionine (usually the first limiting amino acid in aquafeeds high in soybean meal) and lysine but also occasionally threonine, tryptophan and arginine," added Martin.



**"While additives offer a rich toolbox to the nutritionist to formulate with less or without fish meal, what we really need is to move away from trying to replace fish meal. We should instead try to formulate based on nutrients, so we need better knowledge on nutrient requirements and a better understanding how to use this knowledge under commercial conditions."**

**- Martin Guerin**



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Protein sources from poultry meal, insect meals to microbial proteins supply fat but they are very poor in omega-3 fatty acids, phospholipids and cholesterol. Plant proteins contain antinutritional factors, antigenic proteins and mycotoxins causing inflammation in the gut.

### Compensating nutrient gaps

As the industry is not able to find a one-solution ingredient to replace fish meal, additives can help to compensate those nutrient gaps. Today, there is supplementation with methionine, lysine, threonine and tryptophan. But to replace fish meal fat, in addition to adding fish oil (with its own supply and sustainability issues) or omega-3 rich algae (high priced and still limited availability), a strategy is to better utilise existing sources with emulsifiers like lysophospholipids or bile salts which can help to improve fat digestion, absorption and fat utilisation and thereby get a sparing effect on those levels of essential lipids and energy.

Lysophospholipids have a higher hydrophilic-lipophilic balance (HLB) value than lecithin which makes them better emulsifiers to emulsify oil into water. This is needed in the gut of fish and shrimp." Martin showed that, the European sea bass fed a low-fish-meal diet supplemented with lysophospholipids had a reduction in FCR over 75 days. This came with a better utilisation of energy from lipids, which also helps growth and protein efficiency ratio.

Bile salts are very powerful emulsifiers with HLB value of 25, working almost like a detergent. They are good co-factors of lipase and help lipase access the fatty acids of triglycerides through the lipid membrane of micelles and hydrolyse triglycerides into mono- di-glycerides or free fatty acids. Working with a pangasius integrator, a trial showed that after 124 days, there was a reduction in feed conversion ratio (FCR) when bile salts was added at 170ppm. This was through better energy utilisation, improved growth and protein utilisation by about 4%. The integrator also observed reduced deposition of viscera fat.

Bile salts are absent in the shrimp, but dietary bile salts work in shrimp to improve digestion of lipids and to replace cholesterol, a precursor of moulting hormone. This results in improved growth of shrimp. At least 0.2% of cholesterol in the diet is required and a deficit reduces growth. High plant protein diets require supplementation of cholesterol. Adding 0.15% bile salts to a high-plant diet with only 0.1% natural cholesterol improved growth to the same level as adding 0.15% cholesterol.

"Plant proteins lack the attractants found in fish meal which leads to slow feed consumption and high leaching of essential nutrients. This results in higher FCR and slower growth. Formulated marine hydrolysates consisting of short-chain marine peptides added to low fish meal diet at 2% inclusion improve feed intake and reduce nutrient loss by leaching. One-hour faster consumption with their use, allows shrimp to consume 10% more dry matter otherwise lost to leaching during such time. This helps saving on 10 to 15% of formulation cost, as the leaching concerns mostly high-value nutrients like amino acids and water-soluble vitamins and additives." explained Martin.

"Selenium is much higher in fish meal compared to plant proteins. Vannamei shrimp, fed low or high fish meal diets supplemented with a very stable and pure form of organic selenium showed a very nice improvement in growth as well as higher antioxidant activity." Growth of the low fish meal diet supplemented with 0.3ppm organic selenium was similar or better than the control high fish meal diet.

Martin discussed the negative effect on anti-nutrients from plant proteins such as phytate and non-starch-polysaccharides, how enzymes (phytase, carbohydrases such as xylanases and arabinofuranosidases) boost performance of 0% fish meal tilapia diets. Addition of such enzymes helped improved growth, FCR, and protein efficiency ratio (PER) of such non fish meal diets.

### Replacing fish oils in aquafeeds

Highly unsaturated omega 3s are essential fatty acids for development and growth of fish and shrimp. Common sources of eicosapentaenoic acid (EPA, 20:5 n-3) and docosahexaenoic acid (DHA, 22:6 n-3) are marine algae and phyto- and zooplankton. The requirement varies with species, whether freshwater or marine. In his presentation, **Dr Fuci Guo**, Corbion Biotec, Inc discussed alternatives to omega-3 HUFAs in aquafeeds and the rising demand.

"The European sea bass which is quite close to our Asian sea bass requires 1%. In monodon shrimp, the literature says 0.9% of DHA; for vannamei, it is 0.5% of EPA and DHA. These data are mostly coming from aquarium trials, so in a real commercial setting, it could be different," said Fuci.

For the past 15 years, European feed producers have reduced the omega-3 level in Atlantic salmon feeds by reducing fish meal from 50% and fish oil from 30% in 1990 to less than 10%, and replacing the fish meal and fish oil with plant proteins and plant oils, respectively. The FCR remained constant, 1.1-1.2, but the fish-in fish-out (FIFO) ratio has been reduced from 8 down to less than 1.

### Omega-3 PUFAs in algae

For fish oil, aquaculture is directly competing with human consumption. New sources of omega-3 PUFAs are definitely



**"The alternative is microalgae growing in the dark through fermentation where there is better control of all the parameters but the challenge is cost; making a product comparable to fish oil prices today," - Fuci Guo**

needed for a responsible aquaculture industry. There are options such as GM (genetically modified) canola oil which is not easily acceptable in many countries. "The alternative is microalgae growing in the dark through fermentation where there is better control of all the parameters but the challenge is cost; making a product comparable to fish oil prices today. However, using sugarcane as a renewable energy source allows for a large scale production in a factory in Brazil. This lowers production costs and is sustainable with a low carbon, water and land footprint."

### Responsibly restoring DHA

"In March this year, through BioMar, more than 350,000 tonnes of salmon feed have been incorporated with the non-GM algae *Schizochytrium* called AlgaPrime DHA. It has consistently high DHA levels at 28-30%," said Fuci. "In shrimp, a paper was published in 2018 which used cod liver oil as a source of fish oil and treatments of 25%, 50%, 75%, and 100% replacement. With a 100% replacement, growth is very similar to the control. Weekly growth showed the same scenario with partial replacement having better average daily growth (ADG) and feed conversion ratio compared to the control."



Ning Widjaja, Indonesia (left and Natalia Jorge Trevilla, ITPSA, Thailand



Roundtable on shrimp feeds

Feeding tilapia with algae-derived DHA can increase the tissue DHA level. In a trial with 7 diet groups with 1%, 3%, and 5% fish oil, fish oil was replaced with 1.75%, 5%, and 8% of algae meal containing 27% DHA. With 1-3 % fish oil, DHA in the fillet ranged from 260 mg to 330 mg. This was compared to 1700 mg to 2500 mg in salmon fillet.

“Interestingly, a group of Taiwanese scientists was looking at the inclusion of algae derived DHA for the cannibalistic grouper. With the inclusion levels of 2%, 4%, and 6%, they observed that the 2% inclusion rate showed a mortality of less than 5% over two weeks, compared to the control with 15% mortality due to cannibalism. Why should the grouper behave less aggressively when fed the DHA diet? They measured a few parameters; one of them is cortisol, the fish with high algae DHA was calmer and less stressed. Another parameter they measured was the brain 5-HT (hydroxytryptamine), an indicator to see how calm or aggressive an animal is. There was an increase which explained the lower level of aggression.

“In summary, we see that microalgae is a sustainable, scalable option and how the barriers of high costs and low volume have been addressed,” concluded Fuci.

## Benchmarking alternative protein ingredients

Fish meal has a supply range between 4.5-5.2 million tonnes and with the warm *El-Nino* current off the South American Pacific coast, supply can be down by 0.5 million tonnes. “Combine this large growing demand with a static and volatile supply chain, you get extremely volatile prices. Prices range from USD1,500-USD2,500/tonne but at prices over USD2,000/tonne, aquafeed producers will try to squeeze as much of it out of their formulations. Whereas at USD1,500/tonne, it

is still attractive to use,” said **Allan LeBlanc**, Calysta, USA in his presentation titled “Benchmarking protein meal alternatives for fish meal replacement in shrimp feed.”

In benchmarking essential amino acid levels in fish meal against alternative ingredients, it would be preferable to use digestible amino acid levels for all of these ingredients, but the literature shows huge variations from one study to another. Fish meal is high in lysine and sulphur amino acids and the next series of limiting amino acids generally threonine, histidine and tryptophan are all present in varying quantities.

### Benchmarking with lysine

Allan briefly reviewed available protein meal alternatives for fish meal replacements in shrimp feeds, comparing them with 75% CP (crude protein) fish meal as the gold standard which has 7% lysine as % of CP. “Within the methanotroph single cell proteins, Calysta’s 71% CP protein’s amino acid profile tracks quite closely to fish meal. Lysine is almost comparable and then tryptophan is actually available and in excess as are methionine and cysteine. From the essential amino acid profile, this is a great fit.”

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With the black soldier fly insect meal, the lysine level is close to that in 75% CP fish meal, but methionine and cystine levels are lower but still comparable. Depending on the source, one could see a significantly lower crude protein level. Many companies, including AgriProtein, are looking at further concentrating their protein ingredients. With fish meal analogues, the reference is a poultry by-product, blended with vegetable proteins and supplemented with methionine. It is, however, significantly short on lysine and leucine. With corn-based ingredients, there is purified corn gluten with high nutrient density and a high-protein product, but consistent across all the corn ingredients, we see really low lysine levels. A significant amount of lysine and tryptophan supplementation is needed to formulate a complete feed.



**“The industry should not focus on replacing fish meal but focus on the essential amino acid requirements for the species.”  
- Allan LeBlanc**

“Soy protein concentrate (SPC, 67% CP), like soybean meal is a success because it really does have high lysine levels (6.7%). However, the sulphur amino acids are deficient, requiring supplementation. The antinutritional factors are more prominent with soybean meal than soy protein concentrate, but they are definitely still present,” said Allan.

Fermented soy protein concentrates via solid-state fermentation degrade the indigestible phosphorus and saponins. While it produces short-chain organic acids, supplements can be added to stimulate the immune system, to help with fighting microbial infections in the gut and promote a healthy gut. But while soybean meal or the soy protein concentrate contains 7% lysine, after fermentation, it comes down to 3%. An interesting decision for any formulator to say – well, do I want to take that hit on the lysine and methionine and the cystine, but get some extras for it? And are those additives that you are effectively blending into a protein carrier worth the reduced protein value in the lower amino acid levels?” commented Allan.

Poultry by-product meals (PBM) are available containing 50% to 65% CP and with varying levels of ash. For the pet food and aquaculture sector, PBMs are high quality 65% CP meals but the amino acid profile is unbalanced and requires significant supplementation.

The message was, “The industry should not focus on replacing fish meal but focus on the essential amino acid requirements for the species. If we look at the NRC data for monodon shrimp, the methionine and cystine are suitably met by the content in fish meal, but levels of lysine, tryptophan, and threonine are all significantly in excess. Is there an opportunity to formulate with lower levels of those essential amino acids at a lower cost and deliver the same growth and the same performance that we are looking for?”

### The next generation aquafeeds

“In human nutrition, health institutes recommend a daily intake of 250 mg of EPA and DHA per diet. Both EPA and DHA are related to different functions in human health,” said **Dr Ester Santigosa**, DSM Nutritional Products, France, as she discussed how EPA and DHA from marine algae can be used to formulate a new generation of aquafeeds.

“A study in Scottish Atlantic salmon showed that between 2006 and 2015, the EPA and DHA in the fillet have decreased by 50%. A similar figure exists for barramundi between 2002 and 2013. There is also a 16% decrease in the content of omega-3 in Indian shrimp feeds between 2014 and 2016”, said Ester.

“With the stagnation in fish oil production and the increasing demand from aquaculture, we are proposing a sustainable marine oil free from contaminants obtained from a non-GMO *Schizochytrium* where EPA and DHA concentration is more than 50%. The benefit in terms of marine resources is that we can decrease the forage fish dependency ratio (FFDR) by 80%.”

### Requirements of EPA+DHA

In feed formulation, the focus is on minimum dietary requirement for health and growth. Using salmon as the model, a deficiency comes with increased levels in intestinal and visceral fat, hyper-vascularisation and the deposition of pro-inflammatory fatty acids. EPA and DHA at 1.7% of the diet is the minimum requirement for optimal growth and health under normal conditions. This equals to around 7% of EPA and DHA of the fatty acids of the diet. Higher levels are required for challenging environments.

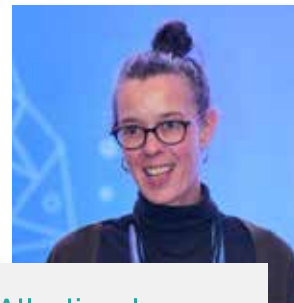
“With shrimp, data is lacking but there are some insights for the monodon and vannamei and separate requirement for EPA and DHA from the total fatty acids of the diet. Requirements range from 0.5 to 2% EPA and DHA in the diet of marine fish species” said Ester.

### From pellet quality to final product quality

In terms of R&D targets in assessing the marine oil, firstly, it was to ensure there was no pellet quality or palatability issues. The second step was to ensure digestibility and then finally that there was no quality difference in the final product.

In salmonid trials, the reference diet contained 10% of fish oil and for treatment diets, the same level of EPA and DHA provided by a combination of fish oil and algae oil and a 3% of algae oil diet. Results showed there were no differences in the quality of the feed and when fed for 8 weeks, there were no differences in terms of feed intake. The feeding trial had 4 treatments; fish oil control diet, 3% inclusion maintaining the same EPA and DHA levels as in the control diet and higher levels of 4.6% and 6% to ensure no negative effects in terms of health of the fish. After 3 months of feeding, there were no differences in the final body weight. There were no negative effects on the health parameters as assessed by external veterinarians.

For the digestibility trial, diets included a 10% fish oil control diet and treatment diets formulated with only vegetable oils and 3 inclusion levels of algae oil. With fish oil or the microalgae oil, digestibility was 99%. Deposition in fish flesh after a 5-week trial showed EPA+DHA in the fillet reflected the levels in the diet. “The more EPA+DHA included in the diet, the more we are finding in the fillet, indicating that fatty acids from microalgae oil were not used for energy, but is deposited in the muscle, even if provided at a higher level than the control 10% fish oil diet.” added Ester.



**“A study in Scottish Atlantic salmon showed that between 2006 and 2015, the EPA and DHA in the fillet have decreased by 50%. We believe there is a similar figure for barramundi between 2002 and 2013” - Ester Santigosa**

# Nutrient requirement based diets



Speakers at a Q&A session, from left: Martin Guerin, Dr Olivier Decamp, Dr Ester Santigosa, Allan LeBlanc, Dr Stephane Ralite, Dr Benedict Standen and Dr Fuci Guo

## Shrimp Feeds: Fit for new genetics and new culture systems?

In his presentation discussing shrimp nutrition—fit for genetics and culture systems, **Professor Brett Glencross**, University of Stirling, Scotland looked at what nutritional parameters can genetics and culture systems affect respectively.

The way genetics interacts with nutrition is due to four components; intake, requirements for maintenance, efficiency of utilisation and the overall growth potential. There is little data on these interactions in shrimp but available data suggest multiple points of interaction.

### Nutrition and genetics

On the nutrition-genetics interaction, Brett described one study which used a standard shrimp grower diet fed to an 8th generation selectively bred strain and the wild type (Glencross et al., 2013). Results showed a lower maintenance and lower basal energy demands," said Brett. "The same animals under the same conditions now fed a high nutrient density diet with 50% protein, 7% lipid compared to 40% protein, 6% lipid showed that shrimp with a higher-performing potential needed more nutrient-dense diets and had the capacity to eat more to meet those requirements. However, not all studies have shown clear differences in terms of nutritional responses to genetics."

In 2012 an American study (Gong et al., 2012) looked at different breeding lines from the same founder population, both fast-growing but selected for different traits like disease resistance or high growth, under super-intensive culture conditions. In that study there were no differences to the responses of the animals to different protein levels.

### Epigenetic responses

These are responses on top of the changes that are inheritable by DNA changes in terms of the way an animal can adapt to its environment. A recent study (Lage et al., 2018) included young larval shrimp, starved for 3 days and then fed for an extended period of time. Starved or not starved larvae were then exposed to different levels of protein in their diet. After the starvation period, no differences in survival or growth were observed. But once larvae were fed the low, medium or high protein diets after starvation, larvae that had been starved suddenly responded, later in life, to high nutrients and grew better at those on high nutrient supply. "So, clearly something allows an animal an adaptive response at an epigenetic level to allow it to adapt to changing dietary circumstances," said Brett.



**“However, not all studies show clear differences in terms of nutritional responses to genetics.”**  
– Brett Glencross

### Nutrition and culture systems

Different culture systems are emerging with various levels of intensity, from super hyper-intensive systems to laboratory and biofloc systems. How do these systems affect the nutrition? Brett described an experiment conducted by Dr Albert Tacon using an indoor flow-through laboratory clear water system and an outdoor zero-exchange culture green water tank system. "Fed the same diets, there was an overwhelming effect that system was far more dominant than the feed type (Tacon 2002). This begs the question, if the pond is so important to the nutrition of the animal, what is the contribution of green water or pond systems?"

This is not the pelleted feed but the natural productivity within the system. The contribution varies from as little as 7% to almost 90% to shrimp nutrition (Gamboa-Delgado, 2014). The average is about 52%. In a semi-intensive system, the response in terms of growth peaked at around 30 to 33% of the dietary protein whereas in a super-intensive system, it went as high as 37% or maybe even higher (Jatoba et al, 2104).

"However, not all responses are the same," said Brett as he compared results from several studies. A Chinese study (Xu and Pan, 2014) looked at the level of protein in a super high intensive biofloc system. Growth was not better beyond 30% protein. An Australian study (Glencross et al., 2014) compared the clear water laboratory system versus the green water tank system. In the green water system, the endogenous nutrient production was clearly contributing additional nutrition, masking differences seen between diets in the clear water system, but surprisingly those animals grew less than in the clear water system.

"When we increase the intensity of the farming system, we are relying more on the exogenous feed inputs and less on natural productivity. It is time to move towards precision nutrition. This is becoming increasingly important in the way we manage these animals."

### Scorecard on nutrient requirements

"During TARS 2014, I did a scorecard for shrimp nutrient requirements. The availability of quantitative data for each of the 45 different nutrients, minerals, and vitamins was 40/45. Today the score is 45/46 and additionally in the last 5 years, we have discovered other nutrients influencing the growth of shrimp. At the same time, we may have to relook at some of the older empirical studies as today what we know has grown considerably from the earlier experience," said Brett.

A classic case can be seen from a Chinese study published about 10 years ago which gave a nice linear curve for various levels of lipid or protein plotted against gain rate (g/kg). "Today, when we re-integrate that data and look at the protein-energy balanced approach, we get a much clearer picture of the response to the supply of protein with respect to energy intake," said Brett. "This is similar to the pig and poultry nutrition approach based on protein and energy supply which have been integrated for decades. It is also fundamental to understand quantitative essential amino acid requirements for growth and the protein: energy ratio," said Brett.

### Revisiting Requirements

Classical dose/response experiments have looked at using amino acid deficient diets, supplemented with graded levels of essential amino acids. Different performance metrics like growth, protein synthesis and food conversion ratio are measured. A classic example of the dose/response version was by Joe Fox et al. in the mid 90's which looked at the requirements for lysine and two different levels of protein in the diets.

Using a broken-line response, it reported that the lysine requirement was about 4.7% of the protein but with a factorial response, it could be argued that the optimal level of lysine was actually between 5.5% up to about 6.2% of the protein. The factorial approach depends on looking at the growth potential of an animal and the composition of that growth, and what it needs in terms of utilisation in nutrients, protein, and energy for supplying growth and also maintenance requirements.

By modelling protein, energy and amino acid demands, Brett showed that a 10g shrimp growing at a certain temperature with an average daily growth (ADG) of around 0.33g/day, needs about 1,494 J/day, equivalent to 55mg/day of protein of which lysine is about 3.7mg. Concurrent to their growth demands, the animals need about 2,000J/day just to stay alive, which is 45mg of protein to maintain its body of which lysine is 3.0mg. "When we take this approach, we estimate the lysine requirements for that animal is about 6.7% of protein, a bit higher than previously thought."

### Is it time to revisit the requirements?

Brett said, "Maybe not, but rather it is time to rethink our approach. Repeating nutrient requirement studies with new genotypes and new culture systems is too slow and too costly. Maybe a modelling approach is quicker and cheaper and can be optimised for ideal growth as well as adapted to the culture system's potential and inputs or even different environmental regimes.

## Creating value for aquafeeds

Aside from creating value for aquafeeds, **Associate Professor Orapint Jintasataporn**, Faculty of Fisheries, Kasetsart University, Thailand also discussed improvement of feed quality. "When we talk about feed quality, we refer to the nutrient requirement which relates to raw material inclusion. Different raw materials have different digestibility and when we look at plant materials, they contain antinutritional factors (ANFs) that will affect the digestibility, gut health, and immunity of the animal."

### Change in nutrient requirements

The inclusion of marine proteins in salmon feeds have decreased to 18.3% in 2013 from 65.4% in 1990 (Nofima, 2014). Marine proteins in shrimp feeds have seen a reduction by 30% to 7-10% and in freshwater fish feeds, it is present at 0-5%. However, in salmon feed, there was an increase in micro ingredients from 1.0% in 1990 to 3.7% in 2013. "When we change the inclusion rates of

**"We need to focus on digestibility, control ANFs and effects on the immunity to have the same feed quality as we had with high inclusions of fish meal."**

**- Orapint Jintasataporn**



raw materials, we usually try to balance the nutrient requirement by adding amino acids, fatty acids, vitamins and minerals. But it is more than just these micro ingredients, identified growth factors like the emulsifying properties of fish meal and active ingredients not identified yet, are the reasons for the high nutritive value of fish meal. Today, we term these micro ingredients, functional ingredients," said Orapint listing a range of additives in current shrimp feed formulation included at 0-5%.

In nutrition, among the three focus points is digestibility. When work on requirements was started some 20 years ago, high-quality fish meal with a digestibility of 90 to 95% was used. This is because fish/shrimp get almost everything it needs from fish meal: nutrients, amino acids, fatty acids, vitamins, and minerals. In comparison, plant protein digestibility was only 80 to 85%. "Today, it may seem that the commonly used nutrients are not enough, or the nutrient requirement has changed. Actually, it is the quality of the raw material that has decreased. Sometimes with plant proteins, we have some contaminations such as mycotoxins or high ANFs which decrease digestibility and affect gut health and immunity.

"In summary, we need to focus on digestibility, control ANFs and effects on the immunity to have the same feed quality as we had with high inclusions of fish meal. There are options: increase digestibility and control ANFs with additives, increase inclusion of protein or increase the nutrient concentration. Therefore, in the market today, we have premium feed with high concentration of nutrients or feed additives."

### n-6: n-3 ratios

In an example from the livestock industry, Orapint showed what happens with the replacement of fish oil with soy oil. "Dietary n-6: n-3 ratios of 1:1 or 5:1 suppress cytokines. But a ratio of 10:1, especially from arachidonic acid (ARA 20:4n6), induces a synthesis of pro-inflammatory prostaglandins. Eicosapentaenoic acid (EPA 20:5n-3) also induces synthesis of prostaglandins but is an anti-inflammatory molecule. This is the reason why by increasing the levels of n-3 you can reduce the inflammation which induces chronic stress in the animal's body."

### Nutrients for gut health

High levels of pathogens in the environment and poor water quality reduce feed intake and affect gut health. Under stressful conditions, activating the NF-κB induces synthesis of pro-inflammatory substances in the body and also increases lysozyme and destroys cells, leading to cell death. In normal conditions, mucus on the villi surface area is where the probiotics and pathogens inhabit. "Probiotics are the useful bacteria. But in a stressful condition, this layer decreases when mucus is less. So, the probiotics and the pathogens are really close to the villi's surface. The pathogens invade the epithelial cell and cause blood infection," explained Orapint.

Many herb extracts in the feed market such as extract of *Macleaya cordata* (sanguinarine) can inhibit the inactive NF-κB from being the active NF-κB. Zinc can also inhibit the inactive NF-κB and can prevent viral infections; when added continuously in feed, and zinc can accumulate at optimum to high levels. "Zinc is a trace mineral and cannot be added in large concentrations. On the other hand, by using the organic minerals, it is possible to include more

organic trace minerals such as zinc, copper, manganese amino acid complex, selenomethionine and selenium yeast. Interestingly, extract of artichoke can promote muscle yield in the tilapia by up to 4%, depending on the concentration and it can also decrease cholesterol and triglycerides."

The shrimp also has the NF- $\kappa$ B pathway and organic minerals like mineral amino acid complex, copper glycinate and zinc glycinate in the feed can promote immunity and control pathogen infections in the blood. Marine sulphate polysaccharides from brown, red and green seaweed have anti-inflammatory properties too and can control pathogens. The mode of action is by increasing the mucus on the villi surface and control the mycotoxin from entering blood circulation amongst others. "Many researchers found that the inclusion of marine sulphate polysaccharides, improves the survival rate, especially for shrimp post-larvae or fish fry," said Orapint.

### Antibiotic-free production

Creating value of the fish feed also means using alternatives to antibiotics to overcome infections. The challenge is the requirement of high concentrations of these alternatives. The efficacy of antibiotics to control for example *E. coli* is very low at less than 10ppm but for commercial antimicrobial peptides, it is around 100 to 200ppm and commercial essential oils, around 1,000 to 5,000ppm. Antimicrobial peptides are found in fish meal and they can control pathogens and improve growth. Fish and shrimp also produce antimicrobial peptides at very low concentrations and dietary sources are required to control pathogens, promote growth performance and immunity.

### Pre-requisites for aqua nutrition research

**Dr Kabir Chowdhury**, Jefe Nutrition, Canada says that for future sustainable aquaculture development, good quality research is key. In his presentation, Kabir walked the audience through steps in aqua nutrition research discussing some mistakes to avoid.

Critical points are: designing; preparing diets, feed and feeding management; faecal collection methods; sampling, sample collection and chemical analysis; and statistical analysis and interpretation.

"When we think about experimental designs, we need to think of the expected outcomes from the experiment; we need also to consider data analysis, the statistical design, and required parameters to achieve those outcomes," said Kabir.

He cited an example of a 2004 trial on bioefficacy of protected micro-encapsulated lysine compared to free biolysine, which was the control. The organic product is spray dried blood meal (SDBM) as a lysine source. The encapsulated biolysine, had three indicator parameters: weight gain, thermal-unit growth coefficient (TGC, which measures growth rate) and feed efficiency. "When we look at the weight gain, the bioefficiency of encapsulated lysine was 110%, with TGC it was 108%, but when you look at feed efficiency, it shot up to 143%.

"The question was which parameters should we use to compare treatments? Sometimes, companies choose best ones which show the best results, which may not be true. In the above example, which parameters are most important to choose to prove the efficiency of that lysine source? It is the deposition of lysine in the body which we should be choosing. Therefore, choosing the parameters as indicator parameters can change the results and outcome," said Kabir.

### Data collection and analysis

It is common to be wary of qualitative research because of costs, especially among small, medium-sized feed mills. But a simple growth trial, requires only small 100L aquarium tanks. Trials with 24 of 100L aquarium tanks can be in one small controlled room. "Simple systems can deliver good results as well," said Kabir adding, "When we do a controlled trial it is also very critical to do a field trial. A field trial is on a larger scale to understand the variations and other external factors. A controlled trial is on a smaller scale,

to understand dynamics of this specific product prior to field trial application."

### Before and during trials

Kabir listed some mistakes and gave some advice in conducting trials. In a 2011 trial, in one treatment, oil was not sprayed on the treatment feed and the lipid level was 6% less. Data for the whole trial was useless and money wasted. In another trial, there was 50% dust and in another, there was no 100% intake of the feed. Another critical point is that if the initial body weight is 10g, there should be a minimum of 300% increase in the final body weight for a justifiable experiment.

### Digestibility trials

There are several methods. The direct method is collection of all the faeces from force-fed fish which is very difficult. The indirect method uses an indigestible marker. The movement of different markers in the gut differs and sometimes, the markers will not move along with the digestas. The most commonly used markers in aquaculture today are chromium oxide and yttrium oxide.

An active indirect method is stripping, dissecting and collecting digesta from the hindgut, or using a vacuum to remove the digesta. The passive indirect method is screening and filtering, and indirectly collecting without disturbing the faeces via siphoning, netting or settling.

"However, the problem with the active method is that the physiological materials can come out. These are the advantages and disadvantages. It is critical to compare data; once a method is chosen, keep using the same method and not switch methods," said Kabir."

### Feeding trial (dose-response)

In a three-level dose-response study, often it may be difficult to find a linear response. "A 1942 paper showed that for a linear response with three data points, the highest data point should be less than 80% of the requirement to achieve the linear response. This is very interesting as the best FCR (not necessarily economically viable) we can get when we feed the animal is between 70% and 80% of the requirement," said Kabir.

### Statistical design and interpretation

Kabir recommended going beyond convention in statistical data interpretation. We can move away from growth, FCR and protein efficiency ratio. In an example, he discussed how a 2018 study on nutrient retention efficiency did not show any difference in growth performance but instead showed differences in nutrient deposition, nutrient retention, and enzyme activity in the hepatopancreas. "To interpret the data, a principal component analysis (PCA) was carried out which showed the enzyme was linearly increasing the hepatopancreatic enzyme activity as well as lipid nutrition efficiency.

Lastly, Kabir said, "Human factor is very critical. Properly trained staff are critical to minimise errors. We need to ensure that the feed we put in the tank is completely eaten by the animal. Wasted feed will skew results."



**"A field trial is completely different. It is on a larger scale to understand the variations and other external factors."**  
- Kabir Chowdhury

Next issue: TARS 2019 reports will continue with presentations in the session on Disease and Health Management

TARS 2020 will be on *Shrimp Aquaculture* and will be from August 19-20.

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## Stabilising water quality with pelleted feeds

In Andhra Pradesh, progress has been made with the partial replacement of DORB with pelleted feeds to produce large 4-5kg rohu.

The rohu *Labeo rohita*, an Indian major carp (IMC) is often farmed together with another IMC, the phytoplankton feeder fish, catla *Labeo catla* in polyculture systems, mainly to maximise the use of the pond stratum. Traditionally farming in large ponds, 50-80 acres (20-32ha) is common; the rohu is fed de-oiled rice bran (DORB) and 5% groundnut cake, placed in perforated bags at strategic locations in the pond. The small number of catla in the ponds, usually 5% of biomass depend on the phytoplankton in the ponds for growth.

Market demand is mainly for rohu fish weighing 1kg. Farmers stock 150-200g juveniles and it takes 8-12 months to reach this market size. There is also a niche market in Kolkata, West Bengal and in neighbouring Bangladesh for 4-5kg rohu which will require another 6-8 months of grow-out. This is an attractive market as larger fish fetch higher prices on per kg basis; prices for 4-5 kg fish can reach INR155/kg (USD2.21/kg) in comparison to only INR100/kg (USD1.42/kg) for the smaller 1kg fish.

"However, not all farmers can grow rohu to this large size. Keeping the fish longer in the pond is risky especially as grow-out will extend into the hot summer months. The chances of mass mortality from low dissolved oxygen is highest if ponds are not well managed. The usual practice is to continue stocking ponds and perhaps clean and dry out after 5 crop cycles or more. They need to do so before the monsoon rains. Imagine the layers of anoxic uneaten feed and fish waste on the pond bottom. With the huge stocks in large ponds, losses usually reach several crores (one crore = INR10,000,000 or USD140,100)," said Kenneth Chin, Bharat Luxindo Agrifeeds Pvt Ltd, Palakol Mandal, West Godavari, Andhra Pradesh.

### Partial replacement of DORB

DORB has been the traditional feed for IMC for the past 40 years or more. Farmers believe DORB stimulates the growth of plankton in the ponds while the catla helps to control pond phytoplankton and pond water quality. Pelleted feeds for the rohu have been in the market for several years but changing farmers mind-set is not easy particularly when pelleted feeds cost from INR26-33/kg (USD0.36-0.46/kg) as compared to DORB at INR15.4/kg (USD0.21/kg, CLFMA, November 2019).

An Indian study in 1990 gave a 30% crude protein (CP) requirement for the rohu. Since farmers could not accept the high cost of a 30% CP feed, Chin developed two feeds with different ranges: a lower 18-20% CP feed and another with a higher CP range of 28-29%. The protein source is 100% plant meal. "We then recommended the



Kenneth Chin (right) with Yeo Keng Joon, Director, Bharat Luxindo holding a 5kg fish from a 28-acre (11 ha) pond in Bondada Lanka, Andhra Pradesh. The harvest was more than 100 tonnes.

18-20% CP feeds to farmers stocking at less than 2,000 fish/acre and the higher range for ponds with >2,000 fish/acre."

### Adoption by enterprising farmer

For the last 10 years, adoption was slow despite various strategies by the sales teams. Chin said, "The next step was to encourage farmers to use pelleted feeds for at least 30% of their total feed requirements and wait for consistent results. Success came in 2019. We were lucky as we were working together with an enterprising farmer in Bondada Lanka who was very innovative in feed and farm management. He started by using 30% of pelleted feeds for his ponds in a previous cycle. When he saw a more stable water quality in his pond, in the last quarter of grow-out, he increased to 50% of pelleted feeds. In the next cycle, he used 60:40 (pelleted feed: DORB). Pelleted feeds are placed into perforated feed bags with DORB.

"In terms of feed conversion ratio (FCR), results with the last crop are not available yet but we can estimate that using 60% pelleted feed of 18% CP, it can be 2 to 2.5. With the higher CP feeds, FCR can be less than 2."

However, it also helped that the farmer used juveniles produced at the Bharat Luxindo's hatchery using broodstock which have been selected for growth. Two-inch (5cm) juveniles were sold to the farmer who cultured the fish in his nursery for 8 months prior to stocking into the grow-out ponds. "We decided to support farmers with quality juveniles as we realised that grow-out results may be significantly influenced by juvenile quality," said Chin.

# Ecological intensification of aquaculture in Indonesia

Improving systems in ways that farmers can easily adopt to achieve higher productivity



Leaders in freshwater aquaculture research, from left: Dr Bratapan, Research Institute for Aquaculture, Sulawesi; Dr Imron, Research Institute for Fish Breeding, Sukamandi; Dr Endhay Kusnendar Kontara, Research Center for Fisheries, Agency for Marine and Fisheries Research and Human Resources Development, Jakarta; and Dr Eri Setiadi, Aquaculture, Research Institute for Freshwater Aquaculture, Bogor.

Ecological Intensification (EI) is a concept derived from agriculture that addresses the double challenge of maintaining a level of production that is sufficient to support the needs of the human population and at the same time respecting the environment to conserve the ecosystem and human quality of life (Aubin et al., 2019). At the recent "Ecological intensification: A new paragon for sustainable aquaculture" conference, organised by IRD and RIFAFE held from October 28-30 in Bogor, Indonesia, the conversation was on how to apply principles of ecological intensification, particularly in Asian aquaculture and at the same time look for ways to cut costs of production and reduce environmental cost.

The national fish consumption in Indonesia in 2017 was 46.49kg/capita/year in 2017 (Widihastutu and Arthatiani, 2019). Small scale farming supply most of the freshwater fish sold in local markets. They also play an important role in food security in Indonesia. However, Indonesian freshwater fish farmers cite high cost of fish production, mainly due to high costs of feeds. Margins are small with low ex-farm prices. In October, prices for freshwater fish around Bogor were as follows: red tilapia, IDR 35,000/kg; black tilapia, IDR 28,000/kg; *Clarias* catfish IDR 23,000/kg for 8 fish/kg; pangasius IDR 26,000/kg and gourami IDR 45-50,000/kg (K. Sugama, pers. comm. 2019; Exchange: IDR 14,000 to 1 USD).

## Ecological-based aquaculture for Indonesia

In his discussion on an ecological-based aquaculture for Indonesia, Professor Rokhmin Dahuri, President of Indonesian Aquaculture Society (IAS) and Professor at Faculty of Fisheries and Marine Sciences, Bogor Agricultural University (IPB) noted that there are many challenges, from technical and social issues to climate change. He added that what is clear is that there is an insatiable demand for high quality products while the availability

of the natural resources needed to satisfy such a demand is decreasing or limited. "In aquaculture, we should be able to increase productivity, efficiency, competitiveness and sustainability". In 2018, the estimate on the production of the major freshwater fish totalled 3.9 million tonnes (Table 1)

Table 1 Production (tonnes) of major freshwater fish in 2015-2018\* (adapted from Rokhmin Dahuri, 2019).

Name	2015	2016	2017	2018*	Growth (2015-2018)
Tilapia	1,084,281	1,114,156	1,265,201	1,546,675	12.85%
<i>Clarias</i> sp.	719,619	764,797	1,095,969	1,339,795	23.94%
Pangasius sp.	339,069	392,918	319,966	391,151	6.52%
Common carp	461,107	497,208	312,954	382,579	-2.33%
Gourami	113,407	132,334	220,126	269,098	35.09%
Total	2,717,483	2,901,413	3,214,216	3,929,298	3.36%

Source: Ministry of Marine Affairs and Fisheries, 2019  
\*Estimates

Rokhmin listed the following as some challenges in Indonesia's aquaculture industry: ecosystem degradation; decreasing water quality; outbreaks of fish disease; excess carrying capacity; high costs of feeding accounting for 60-70% of production costs; difficult access to capital for small-scale farmers; uncertainty of spatial use of land and water where conflicts of interest occur with other users and climate change affecting reproductive patterns and productivity of fish farming systems.



Dr Ketut Sugama, Research Center for Aquaculture (second right) with Dr Bejo Slamet (left), Institute of Mariculture Research for Aquaculture and Fisheries Extension, Gondol, MMAF.

In terms of carrying capacity, he described the situation with freshwater lakes in Indonesia; Lake Wonogiri and Wadas Lintang in Java and Kota Panjang in Riau are below the carrying capacity. Farming in other lakes and reservoirs are already over the carrying capacity and these include the major lakes with freshwater cage farming such as Lake Toba in Sumatra and Lake of Cirata in Java. Rokhmin strongly believes that an ecological-based aquaculture may address the challenges associated with ecosystem degradation and decreasing water quality. But to overcome most problems and challenges, an integrated approach must be implemented for a sustainable aquaculture development.

The importance of monitoring and carrying capacity is also in sea cage farming said Hatim Albasri from CFR, Ministry of Marine Affairs and Fisheries (MMAF). Results of his study using the DEPOMOD software point out the importance of controlling net cage fish farming practices to minimise the total organic loading and to ensure a sustainable co-existence with other users such as the fish hatcheries in line with the ecosystem approach to aquaculture.

The use of ecosystem resources, such as plants (macrophytes or mangroves) in ecological intensification was emphasised by Dr Joel Aubin, INRA who showed results of field trials in Jambi on the co-culture of striped catfish, giant gourami and duckweed. This production model optimises land use and reduces eutrophication and impact on primary production. The potential of *Azolla* sp and duckweed as alternative feeds merged from studies on their digestibility by *Osphronemus goramy* presented by Samsudin Reza from RIFAFE. His study confirmed that digestibility of total protein and energy were over 60% in this species of fish.

Floating plants are a source of proteins and micronutrients and are well accepted by omnivorous fish. Helene Obry, IRD worked on the development of an innovation fish production system where *Azolla* sp substituted 30% of commercial feeds for tilapia, common carp and walking catfish. The integration of *Azolla* sp culture at the farm and co-feeding with *Azolla* pellets was introduced to fish farmers in Bogor Regency. They adopted the system despite a lower biomass gain than with conventional feeding. Other benefits were slight increase in survival rates, fish were more homogenous in size at harvest and the production cost was significantly reduced. Fish farmers accepted the longer production cycle.

Another interesting use of green ecosystem resources was outlined by Restiana Ariyati, Faculty of Fisheries and Marine Sciences, Diponegoro University, which shown shrimp reared in water with vegetable compost produced by white mangrove *Avicennia marina* grew significantly faster (2.7% per day) than the control (2.0% per day).

### More with less inputs

This was the message from Professor Marc Verdegem, Wageningen University, The Netherlands in his presentation on using the pond ecosystem for a more sustainable aquaculture. Since 75% of the global aquaculture production comes from pond ecosystems, therefore the focus should be on such ecosystems. Within the pond, productivity is dependent on soil fertility, i.e. poor fertility will produce poor results. In aquaculture, feed plays an important role and Verdegem said that only 20-40% is retained in the fish and 60-80% are waste products entering the pond environment. The wrong nutrient balance leads to poor food web, pollution and disease. Therefore, feed should be formulated not only by considering the requirements of the fish but also that of the pond ecosystem. "We talk about increasing production, but we should be considering reducing impact by 75% or at least by 50%. We need to think of sustainable ways of aquaculture. Aquaculture should not be beyond carrying capacity. We also need to improve farming systems in a way that the farmer can do easily."



Angela Mariana Lusiastuti (left) and Taukhid, RIFAFE.

## Integration of rice with fish or freshwater prawn

Rice cum fish farming is common in Indonesia. In 2017, fish production from rice-fish farming was 82,869 tonnes. Common species are common carp and tilapia and the system is well developed in Yogyakarta and Bali. In 2015 – 2016, MMAF began to extend this system with rice cum prawn farming to rice farmers. Raden Roro, Center for Fisheries Research, Jakarta

introduced the research on rice and prawn farming which was completed in 2017. She used a strain of fast growing genetically improved giant prawn *Macrobrachium rosenbergii* G1 MACRO II. The prawn was stocked in 1m wide and 50 cm deep trenches created around the paddy field which comprised 20% of the paddy area. As the freshwater prawn is territorial, the optimal stocking density in rice fields in Sleman Regency, Yogyakarta was 10 pcs/m<sup>2</sup> and survival rate was 67% as compared to 46% at the higher 15pcs/m<sup>2</sup> stocking. Prawns were sold at IDR 70,000/kg for size 30-50/kg and IDR 30,000/kg for size <30/kg. In the research on technical and economic performance of rice-cum-prawn (G1 MACROII) with some variations in practices, Bambang Gunadi, Research Institute for Fish Breeding, Subang, West Java obtained an average survival rate of 77%, FCR of 1.6 and productivity of 1.1 tonnes/ha, which was close to the productivity with monoculture at 1.3 tonnes/ha. He concluded that this integration was good for the farm business; two sources of revenue from the prawn harvest at USD94.62/m<sup>2</sup> and USD276/m<sup>2</sup> from the rice.

## Climate change

Two decades of climate change has affected agriculture and aquaculture. Vitas et al. (2019) did a risk assessment on 11 freshwater species in West Java. The results indicated that the highest risk level was with the striped snakehead and giant gourami. The African catfish is at a relatively low risk to climate change. Risk scores from high to low risk were presented: striped snakehead and giant gourami> mahseer>Asian red tail catfish>kissing gourami> silver barb> hard lipped barb and pangasius catfish>common carp> African catfish and tilapia. Across all species, larval rearing has a high risk to climate change. They added that at some point, it is very important to continue vulnerability analysis more specifically for each species at regional and national levels.

## Strategies to manage diseases

Extreme weather conditions with high rainfall brings back several opportunistic disease pathogens, reported Angela Mariana Lusiastuti, from the Research Institute for Freshwater Aquaculture and Fisheries Extension (RIFAFE), Bogor. Cases of fish deaths have re-emerged especially in public waters such as in Maninjau Lake and Cirata region, indicating signs of deteriorating water quality and over capacity of the environment. Over the past four years, fish mortality in lakes and reservoirs has been recorded regularly. Fish mortality peaked in 2016. A total of 4,725 tonnes of dead fish occurred which was 0.95% of the total production of freshwater net cages. The economic losses went up to IDR47.25 billion (USD3.3 million), calculated at a fish price of IDR10,000/kg (USD 0.71/kg).

Over the years, several regulations on surveillance and reporting have been implemented. Angela concluded that to reduce the risk of aquatic animal disease impacting the livelihoods of fish/shrimp farmers, the national economy, trade and human health, the National Aquatic Animal Health (NAAH) strategy should develop and maintain an up-to-date aquatic animal health management



From left, Maria Emilia Cunha (IPMA -Portugal), Samira Sarter (CIRAD-France), Hoang Nam Kha Nguyen (Faculty of Fisheries, Nong Lam University Vietnam), Domenico Caruso and Helene Obyr (IRD-France)

strategy in Indonesia that will be able to support the sustainable development and management of the aquaculture sector. It should make farmers more aware and be responsible for fish health management and improve their capacities on emergency response and contingency planning against diseases.

Plants are recognised as valid alternatives for eco-friendly management of disease and the study by Waode Munaeni from IPB confirms interest in herbal prevention of diseases in shrimp. Supplementation of powder *Eleutherine bulbosa* at 12.5 g/kg was able to provide a significantly higher immune response and survival rates when shrimp are challenged with *Vibrio parahaemolyticus*.

Taukhid from RIFAFE, said that 80% of intensive tilapia farms have reported *Streptococcus agalactiae* outbreaks and with no effective treatments, the financial losses are high. A RIFAFE and IPB team studied the safety and efficacy of bivalent and trivalent *S. agalactiae* vaccines on Nile tilapia. Bacterial isolates from a range of geographical areas in Indonesia were screened for immunogenic properties. Post vaccination, the first challenge was after a month, the second challenge, 3 months later and the third challenge after 5 months. The duration of immunity provided by the multivalent vaccine was 1-3 months. He concluded that the vaccines are safe when administered via the injection route and have properties to work synergistically against *S. agalactiae* biotype I & II. Both vaccines have rather low relative percentage survival (RPS). Improvement and refining of the vaccine quality will be required in order to gain better protection and extend the duration of immunity.

## Social perception and innovation

Both are strategic for implementing ecological intensification in small scale farms. A study realised in Bogor district showed that more than 62% of fish farmers are prone to endorse ecological intensification practises. In this regard, if correctly trained, the extension service may play a very important role, said Domenico Caruso from IRD. Fish farmer's training is essential for the uptake of innovation reminded Roel Bosma from Wageningen University. Milkfish and shrimp farmers in Demak, Central Java participating in the training days on Low External Input Sustainable Aquaculture (LEISA) learnt how to improve water quality. Farmers were taught how to produce and apply on-farm liquid compost on pond bottoms. The participants adopting LEISA significantly increased their gross margins due to higher yields: 3 times for the milkfish and 5 times for the shrimp.

### References:

Rokhmin Dahuri, 2019. Development of an ecological-based aquaculture for Indonesia sustainable aquaculture. Presented at the International Conference on Ecological Intensification: A New Paragon for Sustainable Aquaculture\* Bogor, October 28 2019.

Ecological intensification: A new paragon for sustainable aquaculture. International Conference, 28-30 October 2019, Bogor, Indonesia, Book of Abstracts, 188pp, IPB Press, Indonesia.

# Brokerages in Thailand and Vietnam

Matching business and technology between EU aquaculture stakeholders with those in Thailand



Brokerages link segments of the aquaculture supply chain. Over three days, from September 1-3, the EURASTIP project arranged a road trip for European aquaculture stakeholders to meet industry representatives in Bangkok, Thailand. This followed another series of visits and a brokerage event in Ho Chi Minh City, Vietnam during Vietfish 2019 held from August 28-30. These two gatherings of industry from Southeast Asia and Europe fulfilled a need to maximise business opportunities between Europe and Southeast Asia. Also participating in both events was a team from Bangladesh.

The main driver behind these brokerage initiatives is to work together through structured multi-stakeholder platforms through which commercial players within the aquaculture industry can prioritise the necessary research and innovation requirements to successfully develop sustainable aquaculture. This includes stronger commercial partnerships, closer links with researchers and well-informed policy makers. In Bangkok, the brokerage event was attended by participants representing 35 companies – 16 from Europe, 12 from Thailand and 7 from Bangladesh. The Thai group comprised Department of Fisheries-DOF, academia (Kasetsart University and Chulalongkorn University), research groups (BIOTEC, CENTEX and NSTDA); feed producers (Charoen Pokphand Foods and Thai Union), Thai Marine Fish Farmer Association and Fish Farmers Association and others (Fresh Studio Innovations Asia, Fair Agora Asia and VerifiK8).

In his welcome address, Philipp Dupuis, Minister Counsellor and Head of the Economic and Trade Section in the delegation of the European Union, noted that Europe's seafood budget was €77 billion for 2014-2020. Thailand exports 20% of its seafood to the EU, and after four years combating the IUU (illegal unreported unregulated) fishing, the yellow card was lifted in early 2019. Former DOF Deputy Director General, Dr Chamnarn Pongsri said that the Thai government has been focusing on best practices for sustainable and quality aquaculture production and on consumer protection. The seafood market is rapidly expanding in Thailand and aquaculture production is complementing this demand.

## 5-min pitches

Dr Sukrit Mimitkul, Vice Dean, Kasetsart University, Thailand described some digitalisation research in detecting moulting of the blue crab in soft shell crab farming. This is a fast-developing aquaculture segment but manual detection of moulting is labour-intensive. The moulting process is captured on camera as a change

in pixel density during moulting hours. For the team, the next stage is automatic alerts on smart phones.

Associate Professor Supawadee Poompuang, Kasetsart University described the next generation sequencing and genomics. The latter technology facilitated by lower costs at THB 1000/sample as compared to THB10,000/sample 10 years ago, is helping them develop disease resistant strains such as those from white spot syndrome virus (WSSV) and early mortality syndrome/acute hepatopancreatic necrosis disease (EMS/AHPND).

In Asian seabass *Lates calcarifer* farming, an issue is off-flavour which brings down prices. Boonsawang Farm owner, Suthi Mahalao described the protocols prior to harvesting to overcome this problem. Thailand's seabass producers can increase production and Dr Panisuan Chumnarnwead, Chairman Emeritus of the Thai Frozen Food Association wants to create an international market. Seabass steaks from 5kg fish could enter the white fish market, perhaps replacing Atlantic cod.

From the European side, LS Aqua, Belgium has developed a single cell protein to replace fish meal in aquafeeds. "The product has been tested in Ugent, Belgium and at the Research Institute for Aquaculture (RIA2), Vietnam," said Paula Sole-Jimenez, Business Development Manager. LS Aqua is the primary feed supplier of Belgian Omegabaars, one of the first fish farms in Europe not using fish meal. In Sweden, Anders and Marit Beronius manage a family owned rainbow trout farming business, Ävdalslax AB. They offer eyed eggs, fish (whole or filleted) and canned salted roe. János Szakali said that Vitafort Agro Asia Co, manages the economic development programmes offered by the Hungarian government. In Vietnam, it has a collaborative project on breeding common carp with Mavin Aquaculture using the expertise of the Hungary Aquaculture Research Institute (HAKI). Today there is an agro-business project in Laos.

Kamahu, France has been developing information technology-based solutions for aquafarming and CEO, Killian Delorme is encouraging participation from farmers or groups of farmers and has lowered the price for subscription. Paul Rosendorf, Oxyguard, Denmark introduced its hand-held series of instruments for the measurement of a broad range of environmental parameters with advanced features for field/spot measurements of different parameters including dissolved oxygen (DO), salinity, carbon dioxide (CO<sub>2</sub>) and total gas pressure. Some recent developments include a web interface with remote access to monitor DO, temperature, pH etc., and to control feed machines, pumps, lighting etc. Stephan Neumayer from Evonik's business line on active oxygenation, introduced eco-friendly oxygenation of ponds



Suthi Mahalao (middle), Professor Emeritus Morakot Tanticharoen (left).

Participants from left, Pamela Ernstberger (Pisces Learning innovations, UK), Oniket Alam (Fish Istana, Bangladesh), Dr Huang Jie (NACA, Thailand), Lucia Barreiro (Aquafeed.com), Anders and Marit Beronius and Stephan Neumayer.





At the panel session, from left, Dr Chamnam Pongsri, Professor Patrick Sorgeloos, Warren Turner, (Namsai Tilapia, Thailand) and Dr Padermsak Jarayaphan (Chulalongkorn University, Thailand)



At the panel session, from left, Dr Putt Songsangjinda (DOF, Thailand), Pham Viet Anh (GlobalGAP) and Professor Simon Bush.



Dr Andy Shinn, Dr Tom Baelemans (Ghent University, Belgium), Jan D'Hont (Aatechnics, Belgium), Paula Sole-Jimenez, Marius Nicolini (INVE Aquaculture, Thailand) and Dr Pakkakul Sangsuriya (BIOTEC, Thailand).

Europe imports between 65 - 70% of its seafood requirements, the majority of which comes from Southeast Asia. Both regions have a substantial interest to work together and develop sustainable solutions for global seafood security and safety. This is particularly so, in terms of technology innovation and resource efficiency, reduction of adverse environmental impacts and harmonisation of standards and markets.

The European Asian Aquaculture Technology and Innovation Platform (EURASTiP), launched in January 2017 is a three-year international development and support action, funded by European Commission DG Research and Innovation through the EU Horizon 2020 program. This is a new mechanism to create and reinforce international cooperation on sustainable aquaculture between Europe and Southeast Asia. The brokerage events/trade missions are some of the key activities to bring together aquaculture stakeholders and connect them to grow their business. The EURASTiP project is managed by the European Aquaculture Technology and Innovation Platform (EATiP) with the University of Ghent, Belgium acting as official coordinator.

The first brokerage event was organised in Brussels, Belgium in 2018. The goal was to bring together research and business experts within the shrimp sector from the EU and Vietnam to gain a better understanding of challenges faced in the shrimp value chain. A second one, held during Vietfish 2019, took a different approach; combining a formal brokerage seminar with field visits to both shrimp and finfish farming sites, alongside processing and by-product facilities. The aim was to increase understanding of breadth of the Vietnamese aquaculture industry, including



David Bassett (EATiP/EURASTiP project manager) (left) and Pau Badia (THAiTiP).

other species such as mud crab, of particular interest to the accompanying Bangladeshi delegation.

"In Vietnam, I think there is one expression that really hit home for all of us," comments David Bassett, EURASTiP Project Manager, "That was when the trade attache of the EU Delegation to Vietnam referred to an upcoming 'honeymoon period' for European/Vietnamese cooperation and collaboration in aquaculture. This reflects not only the important agreement of the EVFTA and the strength of commercial relationships already in place but also demonstrates the significant opportunity for existing relationships to be further developed and new opportunities to be exploited across the value chain. Our brokerage activity in Thailand demonstrated the strength of European/Thai relations in additional ways, such as the role of multi stakeholder platforms in combatting outdated negative perceptions of shrimp aquaculture and in acting as a conduit to influence policy makers in both regions. The level of engagement across a wide range of stakeholders was fantastic and it proved very stimulating for everyone involved to see ideas for future collaboration germinate there and then. Several participants have already returned to the region to exploit connections made during our visit and we know of at least three projects that are now in progress through contacts made by the EURASTiP initiative. It is a real return on investment."

with the addition of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). Antibacterial H<sub>2</sub>O<sub>2</sub> reduces viruses and bacteria thus improving water quality. Another product is peracetic acid, a strong disinfectant.

"In recirculation aquaculture systems (RAS), Landing Aquaculture would like to break the fish farming ceiling with land based controlled farming," said Rob van de Ven. The proposition is to share knowledge with no black boxes and to innovate to rebuild trust in aquaculture. Landing has a range of sizes of RAS systems, such as a 50- tonne system for shrimp production. Jesper Heldbo said that in Denmark, members of Aqua-Circle strongly believe in the scientific basis for new RAS ventures. More than 50 companies want to strengthen the aquaculture chain from farm to fork. Aqua Circle often provides inputs for government policies.

### Ambitions for Thailand's aquaculture

Thailand's aquaculture is 60% dominated by coastal aquaculture, mainly marine shrimp and bivalve production. The main freshwater fish species are Nile tilapia, walking catfish and gourami, and freshwater prawn *Macrobrachium* spp. Chamnarn said that currently the main constraint to production is the market and with demand, Thai farmers will adapt and produce. Professor Emeritus Morakot Tanticharoen, Senior Advisor to the President of NSTDA gave an overview on research and development plans for the aquaculture industry in Thailand as well as the funding available.

THAITiP is a multi-stakeholder technology innovation platform and one of its projects, explained Pau Badia, Secretary, is to give farmers the tools to improve their productivity and to help clubs, co-ops, and local government better understand and manage emerging disease outbreaks. He described the Shrimp Health Resources Improvement Project (SHRImp) which was funded by the Walmart Foundation and IDH - the Sustainable Trade Initiative and implemented by Sustainable Fisheries Partnership (SFP), Fish Vet Group Asia, FAI, XpertSea, the University of Stirling and THAITiP. The project is being implemented in three provinces: Chumphon, Rayong and Surat Thani. The aim includes supply chain inclusion and working with feed and processing segments. "We get farmers to join the project and encourage them to bring samples for disease analysis and to use innovative tools to give them a greater level of control in the production of their stocks," said Badia. "In the case of Asian seabass, the challenges with inbreeding are being handled with an ongoing genetics programme and they are trying to open new markets for this high quality white fish after having improved their culturing practices, its texture and its taste, during the past years."

### White fish markets for Thai seabass

Seabass farming has a colourful 40-year history; initially they were farmed mainly in cages in the Bangpakong River but with deteriorating water quality, farmers moved to land based pond culture. It took 16 years (since 1995) to move to 100% use of commercial feeds containing high levels of crude protein. Today, intensive culture of the seabass is the norm as farmers have learnt to control fish health and harvest quality. "An important practice is to get professionals to harvest so that we can maintain flesh quality," said Suthi.

Thailand's production of seabass has been a success with annual increases in production. The projection is 80,000 tonnes in 2019. Most of the fish are sold as live or fresh fish to restaurants and domestic markets. A respected buyer is Thai Airways for inflight meals. Suthi reiterated on the wishes of the segment to move to international markets and when this happens, farmers will increase production. "Our aim is to produce high quality fish, safe for consumers and in a sustainable way."

At the breakout session, Professor David Little, University of Stirling summarised the discussion on how to position the fish in international markets, taking into account that the main competitors for Asian seabass in Europe would be the European seabass and sea bream as well pollack, haddock and cod from wild fisheries. The strategy suggested was to introduce the fish to top chefs and strengthen the lineage between Europeans'



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positive holiday experiences of Thai food with what is on offer in supermarkets and restaurants when they return home. "Europe is sensitive to competition and it is important that partners in Europe see this as a win-win product and as another seafood option. Stressing seafood's value for health and differentiating its diversity and health credentials is important. Marketing fish as better than chicken is critical for the category to grow in volume and value. Marketing requires a good story; emphasising that Thai seabass is antibiotic-free and raised on family-managed farms that manage water quality and fish welfare to high levels is important with control in its farming for the European market," said Little.

## Current status and future prospects in the EU

Patrick Deboysier, Professor at the European College of Parma, Italy gave an overview on EU's import requirements and conditions. "The sanitary and phytosanitary (SPS) agreement is equivalent to that of WTO but the EU hardly pays any attention to these equivalences which basically implies that importers have to comply strictly to EU requirements," said Deboysier. There are 14 categories and to export, all these need compliances. There is a need to have residual monitoring plans. In his 10 minute presentation on the changing seafood market in the EU, Ralf Olsen, FAI Aquaculture, UK said that there is increasing attention and concern on where EU's imported food comes from; food brands want to address their impact on people, animals and environment and investors want retailers to show care for animal welfare. Trust and transparency are important for large retailers like Marks & Spencer (which markets 60,000 tonnes of seafood annually). They want to tell customers on the 3Es for sustainable food: Ethics, Environment and Economics.

Certification is the assurance of trust between buyers and consumers, but what are people thinking beyond certification? Professor Simon Bush, Wageningen University, noted that in the EU there is a range of private standards which are inclusive as compared to international certifications which are exclusive. The vast range of certifications is a complex minefield for stakeholders. Today, 1.33% amounting to 1.5 million tonnes of global production are certified. The major shift with farm assurance is that buyers are more engaged along the supply chain. New approaches include verified sourcing areas (such as promoted by IDH), which focus on area performances and sectoral improvements, and a devolution of greater responsibility to exporters.

## Addressing challenges in Asian aquaculture

The identified areas for discussion for the breakout sessions were: exploiting new market opportunities for the white fish; new insights in precision aquaculture; certification; circular economy; new trends in crustacean farming and diagnostic and health challenges in Asia. On precision aquaculture, Dr Richard Newton, University of Stirling, itemised some issues such as determining the biomass in cages and ponds. Some of the innovations used in salmon farming could serve as examples for industry in Asia,



A visit to the Royal Seafarm in Phetchaburi was part of the program. "The aim of the demonstration farm is to develop standard practices, commercialise them, work on marketing the products and transfer technology to farmers," said Dr Montakan Tamtin (left). This is the first zero waste farm in Thailand

such as precision feeding with less labour-intensive auto feeders, and monitoring and camera systems which will provide alerts. In new trends in crustacean farming, Professor Patrick Sorgeloos gave some examples such as the use of green water with tilapia in shrimp ponds, stabilising microbial populations and mitigating *Vibrio* disease outbreaks. An important development in China is organic rice farming integrated with mitten crab and crayfish rearing reaching a million hectares. "Producers in Vietnam have closed the cycle for mud crab by replacing rotifers with umbrella *Artemia* at early stage feeding; this paves the way for sustainable soft shell mud crab farming. This is timely and ready when markets for soft shell crab are created in the EU," said Sorgeloos.

## Diagnostic and health challenges in Asia

Dr Andy Shinn, FishVet Group Asia, Thailand listed some concerns. While the emergence of new diseases means that those involved in diagnostics need to keep up, an issue is sensitivity of diagnostics. It falls on researchers to reach sensitivity levels to capture the disease as early as possible. Shinn said, "It is not only diagnosing the early stages of infection and in presenting the bad news but also in providing practical action in controlling and managing infections and in implementing methods for mitigation. Again with biosecurity, it is emergency planning and to be ready with mitigation methods. Transparency means sharing of incidences of outbreak with neighbours and with pond site teams so that all are aware and can take the necessary steps. A good example is the tilapia lake virus (TiLV) which was undiagnosed for several years, but once diagnosed, farms are on a constant lookout."

There is the development of functional feeds and autogenous vaccines; the latter is bespoke vaccines based on a specific pathogen. A caution for the latter is to comply with national and international regulations. With combination vaccines, the concern is not to reduce the efficiency of each individual vaccine. Resistance development is a major concern which all stakeholders should be aware of. Lastly, the message with treatments is not only economics and benefits but also on food safety.



At the Royal Seafarm, salt, *Caulerpa* seaweed and mussel production (in net cages 3km offshore) methods were tested and have been promoted to more than 50 DOF-certified farms in Thailand. Phetchaburi is a leading salt producing province producing different grades of salt, with prices from THB80/kg to THB350/kg. Farming protocols for fish species which include milkfish, cobia, groupers and pompano, will be developed depending on seasons.

## Taiwan's advancement in smart aquaculture

Taiwan has long been recognised globally not only as an important fishing nation but also as one which has developed cutting edge technologies in aquaculture and leads in its commercialisation. Since the 1980s, it has developed a thriving commercial industry in the culture of many aquatic species which include many species of groupers *Epinephelus* spp., snappers *Lutianus* spp., cobia *Rachycentron canadum* and the yellowfin tuna *Thunnus albacares*. The Taiwan International Fisheries Seafood Show (TIFFS) is an annual event where researchers, academics, farmers, vendors and buyers of seafood products come together to update themselves on the latest innovations in aquaculture and seafood products and to network. International exhibitors include those from China, Indonesia, Papua New Guinea, the South Pacific Islands (Tuvalu, Palau) and Latin America.

This fifth edition was organised by the Taiwan External Trade Development Council (TAITRA) and My Exhibition Co. and was held from September 26-28, at the Kaohsiung Exhibition Center. This year, it attracted 180 exhibitors from 16 countries, with an estimated 7,000 visitors attending the three-day tradeshow. The show was divided into five areas: fishing equipment and technology (with a first-time display on leisure fishing tackle); aquaculture; seafood and value-added products; seafood processing and marine biotechnology. A seminar on "World aquaculture techniques and marketing outlook" was held on 27 September with international speakers from Israel, Japan and Mexico. This year's focus on the aquaculture industry is on "smart aquaculture: science and technology achievements".

### Green technology and smart aquaculture

Several Taiwanese companies have forged ahead to promote the use of artificial intelligence (AI) and Internet of Things (IoT) to automate routine farm protocols such as water quality monitoring and determination of fish/shrimp population in raceways and ponds. Some companies are working on green technology such as the use of solar energy to replace the use of conventional energy sources.

**Sun Rise E&T Corporation** was established in 1995 in the fish cage supply business with its cages being marketed to more than 50 countries worldwide. In 2010, Sun Rise invested in the solar buoyancy system business; with continued efforts in product innovation, it has shown its creativity and transformed its high-density polyethylene (HDPE) pipes and anchoring system for holding fish to capture solar energy. Sun Rise's HDPE pipes are used as the support

racks for the solar photo voltaic (PV) panels installed above the water surface. The HDPE pipes are light-weight and together with its anchoring system can resist the impact from strong currents and waves. Installation of PV panels above the water surface has its advantages and results in higher efficiency rate of the PV panels as the water helps to lower the temperature of the PV panels and reduces loss of water from evaporation. Eric Tung, Sales Specialist said "Our solar buoyancy system has been installed in Japan, Laos, Thailand and in Tao Yuan, Taiwan." Sun Rise is one of two companies worldwide that supplies solar racks for floating PV panels. "It has the distinction of being the only manufacturer that can adjust the PV panels to meet the light facing surface according to the solar light micro-angle," said Tung. [www.srise.com.tw](http://www.srise.com.tw)



Solar racks for floating photo voltaic panels at the Sun Rise E&T Corporation booth

The Council of Agriculture (CoA), Taiwan is pushing farmers to invest in smart aquaculture, to develop solutions to problems in the industry chain by involving industry-university research. **The Fisheries Research Institute**, Taiwan is involved with such an industry-university collaboration. The Institute first identifies the problems faced by the industry and then develops smart aquaculture technologies and labour-saving machineries and equipment that could address the problems faced by the industry. Professor An-Pan Cherng, National Ilan University explained the workings of the industry-university collaboration.



Fast detecting kit for multiple *Vibrio* spp. developed by the Fisheries Research Institute

"The Institute has developed an image processing system used in the transportation of fish fry. This invention can accurately count the number of fish fry in the holding facility and determine the amount of oxygen needed during



Professor An-Pan Cherng (left), National Ilan University, Taiwan with Mr Yu-Chun Wang (right), Assistant Researcher, Fisheries Research Institute (FRI)

transportation." The Institute has also developed a fast detecting kit for multiple *Vibrio* spp. With the use of visible light, the kit can provide results within 6 hours. [www.tfrin.gov.tw/mp.asp?mp=1](http://www.tfrin.gov.tw/mp.asp?mp=1)

**Fu-Chen Auto Technology Corporation** which had also exhibited in TIFSS 2018 (see Aqua Culture Asia Pacific, January/February 2019, Vol 15 No.1, p.57) introduced new products in this year's TIFSS. According to Sales Manager, Joan Ho, the company's subsoil improver works by maintaining the weak alkaline nature of the subsoil, thus lowering the activity of the sulphuric acid reducing bacteria, and results in the lowering of the production of hydrogen sulphite and growth of harmful algae. The frequency of water exchange is thus reduced.

A new invention on display at its booth is the shrimp/fish fry counting machine which scans the fry passing through the scanner, thus replacing the slow and tedious work of manually counting the number of fry in a container. Fu-Chen is also marketing an underwater camera which can capture the images of shrimp feeding underwater. This machine helps to prevent overfeeding in ponds and reduce feed wastage and minimise the accumulation of organic matter in the pond bottom. [www.Fuchen-Auto.com](http://www.Fuchen-Auto.com)



Scanner for counting fish/shrimp fry in the Fu-Chen Auto Technology Corporation booth

# Aquaculture America 2020



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Newly established in September 2018, **Mou-Hung R&D International Co.** specialises in developing new aquaculture aerator technology which is different from the traditional impeller paddlewheel. Vicky Shiao, Overseas Sales Manager said "The patented vortex-jet pump uses venturi tubes to generate micro-bubbles, which effectively increases the amount of dissolved oxygen in ponds. These micro-bubbles can also efficiently accelerate the degradation of harmful substances in the water." Oxygen is continuously circulated through water exchange from the top to the bottom of the pond, creating a healthier environment for the fish/shrimp culture pond. The new jet oxygen pump has a better ability to mix the water in the pond. The dissolved oxygen volume of the vortex jet oxygen pump is 2-4 times higher than that of the traditional water wheel. [www.mh-aerator.com](http://www.mh-aerator.com)



Vortex jet oxygen pump at the Mou-Hung R&D International Company

### Industry-university-institute platforms

Professor Ming-Wei Lu from the **National Taiwan Ocean University (NTOU)** highlighted the university's role in the Global Research and Industry Alliance (GLORIA). Centered on universities, GLORIA focuses on advanced technology fields to build industry-university-institute platforms for linking Taiwan with the global market and to provide industries with expertise and scientific research services. NTOU-GLORIA will serve as a platform to further bridge the academia and industry sectors aided by the assets from NTOU's resourceful alumni and partner institutions. The alliance aims to integrate the various stakeholders in the aquaculture industry and provides a platform for Taiwanese companies to break into international markets. "The goal of this alliance is to establish a blue Silicon Valley in Southern Taiwan and to promote Taiwanese R&D breakthroughs not only in Taiwan but also globally," said Professor Lu. Goals of GLORIA include: novel technology research; industry-university cooperation; technology transfer locally and internationally and participation in trade shows and seminars/conferences both locally and internationally to promote aquaculture achievements.

Successful projects include the culture of algae to produce n-3 fatty acids and other active compounds for health food and pharmaceutical products. The smart aqua-

PV programme employs the use of AIOT technology and biotechnology strategies to revolutionise aquaculture. Some projects under this programme include: advanced monitoring of environmental water quality by AIOT technology; use of vision-based biometric system to recognise fish species, measure body length, which is then converted into weight. This information is then used for precision feeding and online diagnosis system for fish diseases.

Professor Jenn-Kan Lu described the pilot Smart Aqua-PV greenhouse system in Tainan which is under construction and will be ready by the end of the year. Aquatic species cultured in this greenhouse will include tilapia, grouper and shrimp. "According to initial analyses, the 1-megawatt pilot plant in Tainan area would be able to reduce CO<sub>2</sub> emissions by about 15,000 tonnes each year and cut water consumption by 75% compared to that of a conventional fish farm." [www.gloria.ntou.edu.tw](http://www.gloria.ntou.edu.tw)



Microalgae research carried out by the Algae Academia-Industry Research Center, NTOU



Professor Ming-Wei Lu, NTOU briefed the press on the NTOU-GLORIA programme

### Breeding technology

Fenny Huang, General Secretary of the **Fish Breeding Association (FBA)**, Taiwan, interpreted by Sean Lan, USSEC Asia Marine Aquaculture Specialist explained that the association was established in 1996 with the intention of strengthening interaction among its members from both domestic and international aquaculture companies. "Membership is from all over the world and sales and procurement of aquatic products take place actively among members," said Huang. The Association's objectives and services include: providing seed breeding technology and information on the industry to members; supporting the industry to develop export markets and assisting the industry improve the breeding environment and marketing channel and helping the industry establish product quality and assistance to farmers interested in AI and IoT control systems and farm certification procedures. [www.fish.org.tw](http://www.fish.org.tw)



Fenny Huang (middle), Fish Breeding Association (FBA) explaining the objectives and functions of FBA. Sean Lan is on the left.

### Water quality monitoring systems

**MIC Meter Industrial Company (MIC)**, established in 2010 specialises in water quality monitoring using online systems with WIFI technology or microchip bluetooth Internet of Things (MBIoT). According to Jane Shih, General Manager, all parts of the MIC equipment are made in Taiwan except for the electrodes which are imported from either the USA, France or China. "Our company is the first to market a logistic purpose dissolved oxygen panel with bright LED display, where the readings can be clearly seen in the side mirror of the vehicle transporting the live fish/shrimp. When the dissolved oxygen level is low, the relay function in this set up can activate air compressors or mini aerators to increase the dissolved oxygen in the holding tanks," said Shih. MIC is also promoting a new ammonia probe with pH compensation, which can be operated online. Water monitoring systems from MIC are used in many countries including India, Egypt, Malaysia and the Philippines. [www.meterindco.com.tw](http://www.meterindco.com.tw)



Jane Shih, MIC Meter Industrial Company briefing on the water quality monitoring system. On the right, the MIC Aqua Guardian water quality monitoring system.



At the Aqua Culture Asia Pacific booth, buyer Tony Tan, Prime Group International, Singapore (left) with Too Teng Hoong, Malaysia

## The Best Functional Product in Chinese Aquaculture Feed Industry 2019

INVE Aquaculture's FRIPPAK range scooped the award for 'the Best Functional Product in Chinese Aquaculture Feed Industry 2019'. The accolade, which was voted for by producers and industry experts via online polls and industry experts votes, included candidates spanning China's entire aquaculture sector, covering the country's major farmed species.



Chai Yu, Area Manager China said, "We are delighted to receive this award for our FRIPPAK range. Our work is entirely focused on delivering products that benefit our customers, promoting the health of their animals and reducing dependency on live feeds.

"We think FRIPPAK is so favoured by producers because it is designed with them in mind. It offers the best balance between live feed and formulated diets, contains high levels of fresh and natural ingredients, has improved buoyancy and promotes higher survival rates and shorter production cycles." [www.inveaquaculture.com](http://www.inveaquaculture.com)

Members of the INVE Aquaculture team, which is part of the UK-based aquaculture specialist company, Benchmark, were presented the award at a ceremony in October in Zhengzhou city, China ahead of the opening of the 12th Symposium of World's Chinese Scientists on Nutrition and Feeding of Finfish and Shellfish and the '2019 Chinese Development Forum of the Best Value Aquaculture Feed and Nutrition', both of which took place in the same week.

The FRIPPAK range, which is designed for larval and post-larval production of penaeid shrimp, is engineered to reduce hatchery dependency on live feed, cutting *Artemia* needs by up to 50% without compromising survival, development and growth.



## EPA+DHA+ARA rich algae-oil wins the F3 Fish Oil Challenge



Receiving the award, Karim Kurnaly (centre) from Kevin Fitzsimmons (right)

Contestants of the F3 Fish Oil Challenge sold a combined total of roughly 850,000 kg of "fish-free" oil during the contest, equivalent to saving over 2 billion forage fish from use in aquaculture feed—the largest amount of fish ever conserved through a contest.

"We are pleased with the efforts made by all of the contestants to innovate and sell fish-oil alternatives for aquafeeds that don't rely on ocean resources," said Kevin Fitzsimmons, F3 Challenge Chair and Professor at the University of Arizona. "I know this is just the beginning for Veramaris and others to address a major bottleneck in the supply chain for aquafeeds to support healthy farm-raised fish and healthy oceans in the future."

Veramaris, a joint venture between DSM and Evonik, sold nearly 770,000 kg or roughly 90% of the total contest sales of its algal oil rich in EPA and DHA Omega-3 and ARA (arachidonic acid) produced at its pilot-scale facilities in Slovakia and the United States.

"We share in the ambition to support the continued sustainable growth of the aquaculture industry, as an efficient means to produce healthy food to nourish a growing population. Our breakthrough solution adds to the supply of healthy omega-3 nutrients and enables growth without increasing pressure on limited marine resources," said Karim Kurnaly. "I have to thank those courageous leaders within the retail, processing, salmon farming and feed industry for their collaboration and for taking steps towards ensuring a more sustainable future for aquaculture. It has been our pleasure to participate and we hope to amplify our mission with the recent opening of our new world-scale facility in Blair, Nebraska." [www.f3challenge.org/www.veramaris.com](http://www.f3challenge.org/www.veramaris.com)

The **Future of Fish Feed** announced today that Veramaris has won the F3 Fish Oil Challenge for selling the most "fish-free" oil for use in aquaculture feed. Veramaris CEO Karim Kurnaly received the USD200,000 prize during a special award ceremony at the Global Aquaculture Alliance's GOAL conference in Chennai, India.

The F3 Fish Oil Challenge is an incentive prize designed to help accelerate commercial-scale ingredients for aquaculture feed that meet the nutritional requirements of fish to produce healthy seafood for consumers without utilising wild-caught fish.

## Next generation of feed solutions for RAS

Building upon decades of research within feed for recirculation, **BioMar** has now chosen to increase its focus on feed solutions for this segment. BioMar states that land-based farming can improve efficiency and operational stability using even more advanced feed solutions.

**BioMar** has for decades been one of the driving forces behind the development of products for recirculation. As a response to the increased focus on how land-based farming impact water quality of creeks and rivers, BioMar started the development of the product range ORBIT back in the late 1980's. Today, this product range embraces furthermore high-performing products for land-based salmon farming.

"RAS for land-based salmon farming is an emerging segment within the aquaculture industry, and there is still a potential to be realised. The highly advanced technologies being used require highly advanced feed solutions and farming practices to enable a strong performance", said Carlos Diaz, CEO of BioMar Group. "As a strategic initiative, we have brought all of our RAS-specialists into a global task force. They are working together with global as well as local customers accelerating the next generation of feed solutions for RAS. We are building upon a very strong foundation being a leader within the RAS segment for many years, but the future requires that we bring even more specialised products to the market, supported across geographies".

The strategic objective for BioMar is to clearly deliver upon the company purpose of being an innovator within efficient and sustainable global aquaculture.

"We will very soon present new products to the market. This task force has as one of the main objectives to ensure we contribute to release the full potential of land-based farming. In order to create a sustainable food future, we need together as an industry to enable a doubling of our production capacity without increasing pressure on the environment, wild fish and agriculture. That is a challenge, we need to address together. We all have a responsibility for adding resources and increasing collaboration", added Diaz.

All members of the task force have been selected based upon local as well as global results within RAS. They are all recognised for their expertise have 15-25 years of experience working within aquaculture as products developers and trusted advisors for customers worldwide. [www.biomar.com](http://www.biomar.com)



## Vice President, Sales – Southeast Asia and India



**Zinpro Corporation**, the industry leader in performance trace mineral nutrition for livestock, poultry, aquaculture and companion animals, today announced that **Supunnee Jiarakhun**, D.V.M., has been promoted to vice president, sales – Southeast Asia and India. In this newly created leadership position, Supunnee will lead the Southeast Asia and India sales teams, support customer retention and satisfaction, as well as drive new customer acquisition. Supunnee will also support

company initiatives to expand Zinpro Performance Minerals® sales and business solutions to customers throughout these vital animal-production regions.

"Supunnee has worked hard throughout her career at Zinpro to grow our business in Southeast Asia and India and has not only

done so through new customer acquisition, but through building strong relationships with her customers," says Rob Sheffer, President, Zinpro Corporation. "Under Supunnee's leadership, and through her deep understanding of our customers, we will continue to grow by delivering unparalleled support and innovative solutions to our customers."

An 18-year employee, Supunnee had previously served as the company's regional business enterprise manager – Southeast Asia, responsible for all sales activities in the region. She has more than 30 years of experience in animal nutrition, feed manufacturing and consultancy and will continue to be based in Bangkok, Thailand.

Sheffer continued, "Supunnee is an exceptional leader and her commitment to our mission and core values will continue to drive our teams to success in Southeast Asia and beyond. This promotion recognises not only her commitment to our organisation but also her extraordinary leadership – she has the ability to develop, motivate and inspire teams to achieve business and professional growth." [www.zinpro.com](http://www.zinpro.com)

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## Plenary speaker and farm tour



**World Aquaculture 2020 (WA2020)** will be held in Singapore from June 8-12 2020 at the Singapore Expo Convention and Exhibition Centre. The event is organised by the World Aquaculture Society (WAS) and the WAS-Asian Pacific Chapter (WAS-APC) together with institutional support from Singapore Food Agency, Singapore Tourism Board and academic institutions in Singapore.

The theme of WA2020 is "Next Generation Aquaculture – Innovation and Sustainability will feed the World". Dr Matthias Halwart will be the plenary speaker. His presentation will be on "Aquaculture for Food Security and Sustainable Development". Dr Matthias Halwart heads the Aquaculture Branch of the FAO Fisheries and Aquaculture Department and oversees the implementation and development of its work programme. He serves as Technical Secretary of the intergovernmental FAO Committee on Fisheries (COFI) Sub-Committee on Aquaculture and Secretary of the Intergovernmental Technical



Dr Matthias Halwart

Working Group on Aquatic Genetic Resources of the FAO Commission on Genetic Resources for Food and Agriculture.

WA2020 will have a conference and trade show with several scientific sessions in areas of aquaculture of global interest. There will be pre- and post conference tours. The first farm tour will take participants from Singapore Harbourfront Ferry Terminal to Batam Island, Indonesia. Participants will enjoy and explore beautiful Batam Island while visiting Batam Mariculture Development Center. The mariculture production system includes broodstock management, algae production, hatchery, nursery, fish health laboratory and grow-out production system.

### More information:

Conference: Email: [worldaqua@was.org](mailto:worldaqua@was.org); [www.was.org](http://www.was.org)

Exhibition: [mario@marevent.com](mailto:mario@marevent.com) (Mario Stael), [www.marevents.com](http://www.marevents.com)

Deadlines: Abstract submission: December 1 2019

## AQUA CULTURE Asia Pacific in 2020

Volume 16 2020						
Number & Month	1 - Jan/Feb	2 - Mar/Apr	3 - May/Jun	4 - Jul/Aug	5 - Sep/Oct	6 - Nov/Dec
<b>Aqua Business</b> <i>Feature articles and contributions from industry players</i>	Experiences from industry and opinion articles covering role models, benchmarking, health management, SOPs, social investments, CSR, ancillary services, self-regulation etc					
<b>Issue focus</b> <i>Recent developments/ spotlight on emerging challenges</i>	Nursery Phase Developments	Health & Disease Management	Hatchery	Sustainable & Responsible Aquaculture	Demand & Supply Equilibrium	Aquaculture Education
<b>Industry Review</b> <i>Developments, outlook, demand &amp; supply</i>	Marine Shrimp	Marine Fish	Aquafeed Production	Tilapia	Aquaculture Start-ups	Caffish & Freshwater Fish
<b>Feeds &amp; Processing Technology</b> <i>Technical contributions from industry</i>	Fish meal Replacements/ Feed Enzymes	Feed Additives/ Omega 3 oils	Lipid Nutrition	Health Nutrition	Larval & Nursery Feeds	Processing Technology/Feed Safety
<b>Production Technology</b> <i>Technical information along the value chain</i>	Controlled Systems (hybrid/RAS)	Offshore and Industrialisation	Hatchery Technology	IOT/Innovations	Post-Harvest Technology/ Processing	Organic Aquaculture
<b>Marketing activities</b>	Market and product development, market access, certifications, branding, food safety etc					
<b>NEW Post Harvest Quality &amp; Processing</b>	Technical contributions from industry players on assuring quality at pond site to processing technology					
<b>Company/Product news</b>	News on activities at international, regional and local conferences and trade shows					
<b>Deadlines</b>						
<b>Technical articles</b>	16 Nov 2019	13 Jan	16 Mar	11 May	13 Jul	14 Sep
<b>Advert booking</b>	22 Nov 2019	24 Jan	27 Mar	22 May	24 Jul	25 Sep
<b>Show Issue &amp; Distribution at these events as well as local and regional meetings</b> <i>*Show preview</i>	<b>AquaIndia 2020</b> Kochi, India Jan 31-February 1	<b>VICTAM Asia and Animal Health &amp; Nutrition Asia 2020</b> Bangkok, Thailand March 24-26	<b>*World Aquaculture 2020</b> Singapore June 8-12	<b>TARS 2020: Shrimp Aquaculture</b> TBA, August 19-20	<b>Taiwan International Fisheries and Seafood Show (TIFSS 2020)</b> Kaohsiung, September 24-26	
	<b>Aquaculture America 2020</b> Hawaii, USA February 9-12	<b>VietShrimp 2020</b> Cantho City, Vietnam March 25 - 27 <b>Seafood Expo Global 2020</b> Brussels, Belgium April 21-23		<b>Viefish 2020</b> Ho Chi Minh City, Vietnam August 26-28	<b>Aquaculture Europe 2020</b> Cork, Ireland September 29-October 2	

# WELCOME

## Singapore - June 8 -12, 2020

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# Aquafeed Horizons Asia 2018 Program



Aquafeed Horizons 2020 will be held at BITEC, Bangkok, Thailand, on March 24, 2020, as part of the combined Victam Asia grain and feed expo / VIV Health & Nutrition Asia trade fair and forum.

Dr Albert Tacon will lead the 13<sup>th</sup> Aquafeed Horizons Conference and present the keynote presentation on *Current Issues and Challenges to Aquafeed Development and Use Within the Asian Region*. He will lead a full day of 12 presentations under the theme *Current Trends and Future Developments in Aquaculture Feeds*, which will focus on what aquafeed producers should know and practical steps they can take to ensure they are not left behind as the industry moves forward.

Albert is an aquafeed and nutrition expert and technical editor at Aquafeed.com and Technical Director, AquaHana, Hawaii. He is a consultant in aquaculture and aquaculture nutrition and feed. Other speakers will include Neil Aucterlonie, Technical Director, Chair, IFFO RS Acceptance Committee, Dr Hongyuan Cheng, Feed Research Institute, Chinese Academy of Agricultural Sciences, Michiel Fransen, Head of Standards & Science, ASC and other internationally recognized processing and nutrition experts.



Dr Albert Tacon

The new ASC Aquafeed Standard will be explained during the conference and the rest of the meeting will be devoted to practical formulation and ingredients and processing issues:

- **Nutrition and Ingredients**

The use of marine ingredients in aquafeeds  
Empowering the digestive process in aquafeeds  
Application of insect meals in aquaculture  
Standardised and documented botanicals  
Managing farm, feed and 5G: Are we ready?

- **Processing**

IoP: Leveraging people, process, and platforms to maximize aquafeed production  
Preparing the foundation for digital factories  
Use of process modelling as a tool to optimize aquafeed production  
Critical parameters of extruded micro aquatic feeds  
Single and twin screw extruders – pros and cons

Presentations at Aquafeed Horizons 2020 will be in English with Thai translation.

**More information:**

<http://feedconferences.com>

## 2019-2020

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](mailto:zuridah@aquaasiapac.com)

### November 19-22

LACQUA19  
San José, Costa Rica  
[www.was.org](http://www.was.org)

### November 20-22

12<sup>th</sup> Philippine Shrimp Congress  
Bacolod City  
Email: [bfarcoshrimp@gmail.com](mailto:bfarcoshrimp@gmail.com)

## 2020

### January 31- February 1

AquaIndia 2020  
Kochi, India  
[www.aquaprofessional.org](http://www.aquaprofessional.org)

### February 7- 9

22nd India International Seafood Show 2020  
Kochi, India  
[www.mpeca.gov.in](http://www.mpeca.gov.in)

### March 9-11

VIV MEA 2020  
Abu Dhabi, U.A.E  
[www.viv.net](http://www.viv.net)

### March 24

Aquafeed Horizons Asia 2020  
Bangkok, Thailand  
<http://feedconferences.com/>

### March 24-26

VICTAM Asia and Animal Health & Nutrition Asia 2020  
Bangkok, Thailand  
[www.victamasiasia.com](http://www.victamasiasia.com)  
[www.vivhealthandnutrition.nl](http://www.vivhealthandnutrition.nl)

### March 25-27

VietShrimp 2020  
Cantho City, Vietnam  
[www.vietshrimp.net](http://www.vietshrimp.net)

### April 7-9

Livestock Malaysia 2020  
Melaka, Malaysia  
[www.livestockmalaysia.com/](http://www.livestockmalaysia.com/)

### April 21-23

Seafood Expo Global 2020  
Brussels, Belgium  
[www.seafoodexpo.com](http://www.seafoodexpo.com)

### May 28-30

Livestock Philippines 2020  
Pasay City, Philippines  
[www.livestockphilippines.com](http://www.livestockphilippines.com)

### June 8-12

World Aquaculture 2020  
Singapore  
[www.was.org](http://www.was.org)

### August 19-20

TARS 2020: Shrimp Aquaculture  
[www.tarsaquaculture.com](http://www.tarsaquaculture.com)

### August 26-28

Vietfish 2020  
Ho Chi Minh City, Vietnam  
[www.vietfish.com.vn](http://www.vietfish.com.vn)

### September 24-26

Taiwan International Fisheries and Seafood Show (TIFSS 2020)  
Kaohsiung, Taiwan  
[www.taiwanfishery.com](http://www.taiwanfishery.com)

### September 29-October 2

Aquaculture Europe 2020  
Cork, Ireland September  
<https://aquaeas.eu/>



**STRONG BRANDS COMBINED IN ONE EVENT**

**March 24 - 26, BITEC, Bangkok, Thailand**



**400**  
exhibitors



**17.800**  
m<sup>2</sup> exhibition space



**9.000+**  
visitors



**100+**  
speakers



**70+**  
countries



**100+**  
media

**VICTAM AND ANIMAL HEALTH AND NUTRITION ASIA 2020**

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 ☎ +31 6 8379 9693  
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VNU EXHIBITIONS ASIA



[www.victamasiasia.com](http://www.victamasiasia.com) [www.vivhealthandnutrition.nl](http://www.vivhealthandnutrition.nl)





**Solve the pond water problem!**



**uni light**  
**PSB**



**Features**

- Uni-Light is a bunch of Photosynthetic Bacteria.
- Purifies the water quality
- 100% safe without negative effect
- Inhibit pathogen outbreak
- Improve FCR & Survival rate



**Composition:**

-*Rhodospseudomonas palustris*  $\geq 10^9$  cfu/ml.

Pond	uni light	VS	N
Density	220		220
DOC	90		90
Harvest Size	<b>15.85</b>		14.24
FCR	<b>1.17</b>		1.28
Survival (%)	<b>86%</b>		78.2%
Vibrio	<b><math>1.2 \times 10^2</math></b>		$3.8 \times 10^3$
Income	<b>\$227,159</b>		\$183,113
PSB Cost	\$574		0
Margin (%)	<b>56%</b>		43%



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