JULY/AUGUST2014
Volume 10 Number 4

AQUA CULTURE
Asia Pacific

Building trust in aquaculture

Hyper intensive shrimp farming in Vietnam

Biofloc technology in Indonesia

Biosecurity in aquaculture

EMS/AHPND: New PCR method and holistic approach

Vietnam's pangasius industry in 2014

MCI (P) 008/10/2013 PPS1699/08/2013(022974)

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Volume 10, Number 4 JULY/AUGUST 2014 MCI (P) 008/10/2013 ISBN 1793 -0561

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AQUA Culture AsiaPacific is published bimonthly by

Aqua Research

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3 Pickering Street, #02-36 Nankin Row,
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Printed in Singapore by
Print & Print Pte Ltd
3011 Bedok Industrial Park E
#03-2000, Singapore 489977

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- We strive to be the beacon for the regional aquaculture industry.
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- We strive to be the forum for the development of self-regulation in the Industry.

TARS 2014
The Aquaculture Roundtable Series
20-21 August 2014

TARS 2014 is on track in Phuket, Thailand from August 20-21, 2014 (see page 58)

TARS 2014 will focus on **Shrimp Aquaculture: Recovery • Revival • Renaissance**.
For updates, visit www.tarsaquaculture.com

From the editor

With a crisis, comes opportunity

Not long ago, British celebrity chef Hugh Fearnley Whittingstall raised the issue of trash fish in fishmeal sold to Asia's leading shrimp feed manufacturer, Charoen Pokphand Foods (CPF). Recently, UK's The Guardian Special Investigation – 'The Supermarket Slave Trail' alleged slavery in CPF's supply chain. For many in the industry, what happens in fishing boats may be too far away to impact aquaculture but this has. In their statement, CPF said that 'the issue of endemic slavery in Thailand's seafood supply chain affects all producers in Thailand as they all use by-catch to produce their fishmeal in the same way and do not currently have full oversight of the supply chain to the fishing boats.'

However, this does highlight a weakness in our value chain. There are two lessons here, that 'no man is an island' applies to aquaculture, and that the impact is not limited to CPF or to Thailand alone. This has opened up a Pandora's box as buyers in Europe openly gave their support to the news report and are putting pressure on suppliers. As a proactive measure, producers in other countries need to review their source of fishmeal used in aqua feeds and adopt sustainability and social responsibility. Coincidently, the challenge of building trust in aquaculture products and building social responsibility and ethics in aquaculture was discussed by Charlie Arnot in his plenary presentation at the recent World Aquaculture 2014 in Adelaide, Australia. He said that social responsibility and sustainability are primary issues shaping aquaculture and that the sustainable system is a balanced one which is ethically and economically grounded and scientifically verified. The Guardian report is an example of loss in public trust.

We are often reminded that the world needs more seafood and as the supply from wild catch declines, aquaculture is the only credible alternative to provide enough seafood to meet global demand. However, in this new era of food production, it is not only producing fish or shrimp at a low cost. There are other add-ons in the quest to have safe seafood production in a sustainable system. This new dimension where consumers question activities thousands of kilometres away is reminiscent of the sweatshops in Bangladesh's garment industry. At the same time, here in Asia, we are still trying to build the image of seafood from Asia. The pangasius industry in Vietnam is working to change the image with regards to poor regulation. At TARS 2013, Anton Rizki Sulaiman of Indonesia said that the industry has to be customer-focused, and it needs to listen and understand their real concerns, and find ways to engage customers.

In the aquaculture value chain, the focus is on downstream activities, such as sustainable production following regulations in the code of practices or certifications and processing of safe seafood for markets. Although upstream activities are important, many of us have assumed that labour issues in fishing boats are too far removed. In discussions with the industry, the general point of view is that this is the role of the government. A 2010 report by FAO suggested that pressure be put on governments on the use of child labour, following ILO conventions and international standards.

On the other side of the coin is the multiplier effect of aquaculture. According to a report in Shrimp and Fish News, a publication of the Bangladesh Frozen Foods Exporters Association (BFFEA), the aquaculture industry in Bangladesh employs 4.23 million farmers. Imagine the impact if the industry comes to a standstill following a single event which eliminates public trust. A good starting point is corporate social responsibility programs which links communities to aquaculture producers. The Regal Springs Group outsources a certain segment of its supply chain to the community to nurse tilapia fry into fingerlings (see report page 39). At the industry level, the Global Sustainable Seafood Initiative (GSSI) aims to have a global benchmarking tool to provide transparency between labelling and seafood certification programs. This tool may be useful for members of the Sustainable Seafood Coalition (SSC) and other seafood businesses by enabling them to compare different certification programs to help make sourcing decisions.

The key takeaway message here is that Asia's aquaculture industry has to be ready for any crisis and negative influences that impact its viability. We must be ready to engage with these demands and move from "good to great" (thank you- Jim Collins).

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Ethics and values in aquaculture

The cost of social licence vs social control

Charlie Arnot

During the recent World Aquaculture Adelaide 2014 (WAA14) conference, one clear message emerged; both sustainability and social responsibility are central to global aquaculture growth. Incoming president of the World Aquaculture Society Graham Mair said the global aquaculture industry has been growing in an environment of much greater social and environmental awareness compared to some of the other primary industries.

"As a result, social responsibility and sustainability are primary issues that are shaping this rapidly developing global industry," he said. "The conference opened with delegates being told that the world has to produce more food by the end of this century than what has been produced in total in the last 10,000 years. In fact one of our two plenary speakers, Charlie Arnot from the US-based Centre for Food Integrity, told us that to meet the challenge, the industry has to embrace new models of public engagement that build and maintain the public trust and social licence to operate."

"The fact that at least a quarter of the 80 sessions at the conference relate quite directly to sustainability and social responsibility, indicates the importance of these values across the whole industry, and that we are taking these issues seriously."

The conference and trade show with the theme – Create, Nurture, Grow was the largest gathering of international aquaculture professionals in 2014 with around 2,100 delegates from 165 countries.

Building trust in today's aquaculture

In the plenary presentation on 'Ethics, values and science- building trust in today's aquaculture', Charlie Arnot said that those involved in commercial aquaculture would like the freedom to operate and maintaining what they do best with a minimum outside interference. In today's aquaculture industry, this really requires us to earn and maintain the social licence. At the Centre of Food Integrity, social licence is defined as the privilege of operating with minimal formalised restrictions based on maintaining public trust.

Arnot compared the economics of social licence vs social control. "Operating with a social license is flexible and low cost. The social licence may differ between farms but the social expectation is that you demonstrate that you are always attempting to meet expectations consistent with the ethics, values and expectations of your stakeholders. Stakeholders include customers, employees, the local community, regulators, legislators and the media.

"Once you cross over to social control, either through a single event or a series of events that reduce or eliminate public trust, you will never go back. Social control is more rigid, higher cost with regulation, legislation, litigation and compliance; all of which adds costs to your operation."

There are some clear examples in aquaculture and seafood processing, said Arnot. "There is growing scepticism on food safety and use of technology. Some people see seafood as only from the wild and do not accept the application of technology in aquaculture. There is fear on genetically modified salmon or use of antibiotics and technology around health products. However, the most frightening and challenging for the seafood industry is fraud. If the level of fraud becomes more public, there will be an overwhelming demand for social control. For the industry, this is an unacceptable risk. It is critical that producers have a better system in managing and reducing fraud to ensure food safety."

Building trust

Arnot posed the question, 'what drives trust and what causes trust in food?' In seeking answers, the Centre did a meta analysis on 21 research works. Among the three drivers identified are influential others which could be family and friends and group with credentials such as dietician, doctors etc. The second element in building trust is competency.

"Business spend a lot of time talking about who they are and what they do. Competency is our technical capacity in science. We operate under the assumption that social decision making is logical and rational. If we give people the right type of information, they will come to our side of the argument. If this does not work, we get more science and we repeat this over again. The third is confidence. We used these to conduct a survey over three years. The results showed that if people do not believe that you share their values, none of the data that you share with them will be helpful.

"To be successful with a sustainable system, we have to build and communicate an ethical foundation for our activity and demonstrate our commitment to practices that are ethically grounded, scientifically verified and economically viable. There is nothing wrong to maximise productivity, but if the environment is protected, then you are doing more and using less."

Transparency and the social media

Research over the past four years clearly indicates that consumers increasingly go online to look for information to answer their questions about food. In today's age of the social media, food system stakeholders have to develop new models for authentic engagement. "In this dynamic new environment producers, processors and distributors are inextricably linked to their customers and NGOs interested in food issues. The research indicated an inverse relationship between the size of an entity and shared values. The conundrum is that as aquaculture becomes larger and more integrated and technologically advanced, it will be seen as less value centric and less consistent with values of aquaculture. This is the future challenge.

"In our research we saw that consumers understand and wants business to make money but they are concerned that business will take shortcuts such as with food safety and put profits ahead of public interest. Companies need to find ways to engage consumers.

"In conclusion, there are three things you can do; begin your public engagement using shared values, use independent scientific support to build credibility but use accessible language to make your message relevant. The public wants information from academics but not academic information and commit to engaging early, often and consistently. Transparency is no longer optional."

AP3: A new and improved PCR method for a detection of AHPND bacteria

This has been shown to be superior to the AP2 method and once again the sequence is given out free in an effort to control the spread of the disease.

In December 2013, a group of Thai and Taiwanese scientists released information on the primers and PCR protocols to detect the bacteria causing acute hepatopancreatic necrosis disease (AHPND), or commonly known as early mortality syndrome (EMS). The protocols were named AP1 and AP2 methods.

On June 18 at the 6th International Shrimp Industry Development Forum in Zhanjiang, Guangdong, China, Professor Tim Flegel, Mahidol University, Thailand announced information on a new and improved PCR method, called AP3.

"This method has given 100% accuracy in detection of AHPND bacteria and is thus an improvement over the method we released for free in December 2013."

This method is based on the gene sequence of a protein discovered in a sub-fraction of cell-free culture broth from isolates of *V. parahaemolyticus* that cause AHPND, but not from *V. parahaemolyticus* or other bacteria that do not cause AHPND.

The researchers said that the cell-free preparation caused the typical signs of acute AHPND (massive sloughing of hepatopancreatic tubule epithelial cells) when administered to shrimp by reverse gavage. It contained two prominent protein bands of 58 and 12 kDa.

The primers were designed to amplify the complete gene sequences for these proteins from AHPND bacteria. After sequencing of the resulting amplicons, primers were designed for PCR methods to detect each of these protein genes. Preliminary tests with a few isolates of AHPND and non-AHPND bacterial isolates showed that both methods gave positive results for all the AHPND isolates but that the 58 kDa protein alone also gave positive results for some non-AHPND isolates. Thus, further tests were carried out using the PCR method for the 12 kDa protein only. The 98 bacterial isolates tested consisted of non-AHPND (35) and AHPND (49) *V. parahaemolyticus* isolates (total 84) confirmed by bioassay and 14 other isolates of bacteria commonly found in shrimp ponds including other species of *Vibrio* and *Photobacterium*.

Results for all 49 AHPND isolates were positive with the test while results for all the remaining isolates were negative. This gave 100% sensitivity, specificity, positive predictive value and negative predictive value for the new method when compared to 100% sensitivity, 97.7% specificity, 97.4% positive predictive value and 100% negative predictive value for the previously recommended AP2 PCR method that was evaluated using a similar set of 80 bacterial isolates.

AP3 primer method

The isolate that gave a false positive test result in the test with the AP2 method was included in the test of the new method and it gave a correct, negative test result. From these results, they recommend that their previously announced AP1 and AP2 primer methods be replaced with this new method named as the AP3 primer method. Similar to the AP2 method, this tool for detection of AHPND bacteria was freely dispersed for it to be applied as soon as possible in an effort to control the spread of this new disease.

The team advised those who have previously identified *V. parahaemolyticus* isolates which gives positive PCR test results with the AP2 method but have not yet carried out bioassays with shrimp, to carry out additional testing with AP3 method before doing so. Similarly as with AP2, they do not recommend adaptation of this method to nested PCR. The 1-step PCR method is sensitive enough with DNA extracts from bacterial isolates.

It was also recommended that a preliminary enrichment step be done for samples from shrimp tissues, faeces, whole post larvae, suspected carriers and pond sediment.

Full details on this press release and PCR sequence is available at these websites: http://www.enaca.org/modules/news/article.php https://www.shrimpnews.com/FreeReportsFolder/NewsReportsFolder/ThailandNewPCRDetectionMethodFlegel.html More information: National Centre for Genetic Engineering and Biotechnology (BIOTEC) E-mail: udomrat.vat@biotec.or.th (Udomrat Vatanakun)

News in Brief

First shrimp farm enters ASC assessment

In Vietnam, shrimp producer, Quoc Viet is the first farm to be assessed against the Aquaculture Stewardship Council (ASC) shrimp standard for well-managed and responsible farms. Quoc Viet supplies to customers in the US, Japan, the EU, Australia, Canada, Korea, Southeast Asia and other countries. In 2013, the company supplied 15,000 tonnes of shrimp. It aims to increase this to 20,000 tonnes in 2014. The family-owned business, based in Camau, has been working with WWF Vietnam to support small scale shrimp farms in improving their operations towards achieving the ASC certification.

"As a family business it is fundamental and right that our farming systems are operating responsibly with minimal environmental and social impacts," said Ngo Quoc Tuan, vice president of Quoc Viet.

The ASC Shrimp Standard was finalised earlier this year following an extensive period of development involving many stakeholders globally. The assessment of Quoc Viet's farm against the ASC shrimp standard will be carried out by an independent third party certifier, Control Union.

Peru fishmeal prices higher with El Nino

Fishmeal prices in Peru climbed further to USD1,800/tonne in mid-June, as increased water temperatures hit anchovy catches, according to Undercurrent News. US National Oceanic and Atmospheric Administration (NOAA) reported that the chance of El Niño occurring is 70% during the Northern Hemisphere summer and reaching 80% during the fall and winter. El Nino - a warming of sea-surface temperatures in the Pacific - can trigger both floods and droughts in different parts of the globe, curbing food supply.

In May, the predicted risk of an El Niño hitting the waters off South America changed from 50% to more than 65%. Even when Peru's anchovy season was brought forward to April, anchovy catches were still hit by warmer sea temperatures linked to the possible presence of El Nino. Also, mini-bans, due to high juvenile levels, have affected catch volumes. The current catch is poor at 2.53 millon tonnes, considering that the season finishes by end of July. Usually in other years by this time, Peru would have already caught around 50-60%, according to a large Peruvian producer.

IFFO's stance on human rights in the Thai fishing industry

There is concern following recent articles in the media about the fishing industry in Thailand using forced labour on board boats. Some of the catch enters fishmeal production which is an ingredient in farmed shrimp feed; the shrimp being exported to several international markets and major retailers. IFFO, the international 'not for profit' organisation that represents and promotes fishmeal, released a statement that "IFFO members do not, under any circumstances, condone forced labour or the abuse of human rights. The IFFO Responsible Supply (RS) standard, an independently governed and audited certification scheme for fishmeal and fish oil producers, is primarily an environmental standard and does not yet include social clauses in its scope. However, it is being amended to include a requirement to observe national labour laws in fishmeal and fish oil factories. If a certificate holder is found to be in breach of labour laws, its certificate could be suspended. Thai companies, including IFFO members, are working towards achieving the IFFO RS standard and are implementing Fisheries Improvement Projects, which are a key step to improved environmental and social standards in the Thai fishing industry. IFFO is also a participant in the Ethical Trade Initiative program on labour standards in the Thai shrimp farming sector."

Japanese eel on IUCN red list

The International Union for Conservation of Nature (IUCN) added the Japanese eel *Anguilla japonica* to its Red List of Threatened Species in June. This means that the species is in the endangered list. SeafoodSource.com said that to avoid a CITES listing, which usually follows, Japan announced a 20% reduction in the harvest of elvers and will request the same action from China and Taiwan, which farm for the Japanese market. Japan imports 80% of eel products consumed.

Japan's National Research Institute of Aquaculture of the Fisheries Research Agency has succeeded in closed-cycle breeding in 2010 and this may culminate in commercialisation of the technology, but the cost is still prohibitive, and the methods unworkable on a large scale. There is also pressure on other eel species; the European eel *Anguilla anguilla* entered into Annex II of CITES. Since 2009, exports outside of the European Union are banned but trade within the EU and between non-EU countries are allowed. Interest is also in lesser-known river eel species from Southeast Asia, such as shortfin eel *Anguilla bicolor* from the Philippines and Indonesia, which could replace the Japanese eel. Japan consumes approximately 70% global eel production, while China is the leader in eel farming.

No EMS/AHPND in India

A paper (in press) strongly suggests that the mortalities reported in India during October and November 2013 were due to vibriosis rather than acute hepatopancreatic necrosis disease (AHPND). The authors from the Department of Fisheries Microbiology, College of Fisheries, Mangalore used pure cultures of *Vibrio parahaemolyticus* obtained from the haemolymph of moribund shrimp following a disease outbreak and mass mortality on the east coast of India during October to November 2013. The bacterium could not be found in the haemolymph of healthy animals from farms on east and west coasts of India. All the cultures were negative for the virulent genes associated with human pathogenic strains of *V. parahaemolyticus*. All the isolates were negative by PCR for the genomic region considered specific for *V. parahaemolyticus* strains associated with AHPND, but were positive for *V. parahaemolyticus* T3SS1. The isolates showed genetic diversity as indicated by random amplification of polymorphic DNA (RAPD). Challenge studies with representative isolates by immersion did not cause mortalities or histopathological changes in the experimental shrimp. (shrimpnews.com).

Challenges from climate change

Australian aquaculture producers will need to find ways to adapt to rising temperatures, said Dr Alistair Hobday, CSIRO's research scientist at the World Aquaculture 2014 in Adelaide in June. In ABC News, he said cases around Australia show that warming waters have led to declines in salmon production and declining oxygen in tuna pens. According to CSIRO, temperatures have risen by one degree Celsius in the past century and by more than 2 degrees Celsius in the south east and south west of the nation. The prediction is 2-3 degrees Celsius by 2050, a rate faster than the rest of the world. Hobday thinks that some aquaculture industries will need to move to other states with more suitable temperatures.

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A new model for shrimp production in Vietnam

By Carlos Massad, Marc Campet and Gustavo Pineda Mahr

A model hyper intensive culture system that uses a new strain of vannamei post larvae, probiotics and low protein feeds in small ponds, shows promise for an industry battling the early mortality syndrome.

The current mortality rate, of post larvae and juvenile shrimp, is a constant threat to farmers and is too high to yield attractive profits. In countries where early mortality syndrome (EMS) is prevalent, up to 80% of shrimp die usually after one month in grow-out ponds. Later in the cycle, EMS causes emergency harvests, which not only disrupt harvest schedules but also overall marketing.

In Vietnam, the challenges facing shrimp farming have been thoroughly analysed. Blue Genetics Vietnam (BGV), in cooperation with Ocialis Vietnam (a feed company) and Acuacultura Mahr (a shrimp genetic improvement company based in Mexico) have created an efficient, bio secure system for production of shrimp in disease-affected zones. The model achieves optimum growth efficiency in a bio-secure environment through the use of quality feed, a hyper intensive production system and cutting-edge genetic selection.

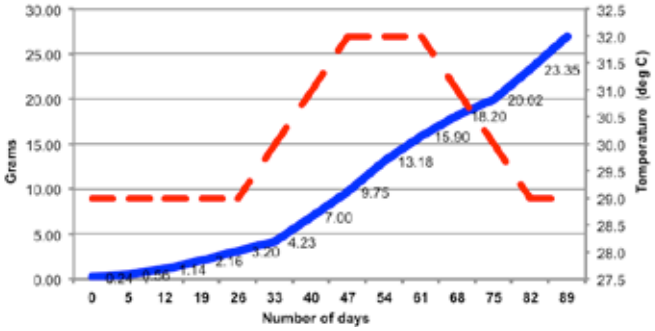
Genetics selection

Aquaculture as a whole lags behind the progress achieved with genetics in chicken and pigs. Salmon is the most advanced in the aquaculture industry. However, it is still well behind other animal-protein production systems. Further, there are several shrimp genetic selection programs in the world but they still lag behind salmon aquaculture, despite the fact that shrimp have a much higher overall market value. The situation is directly related to the level of genetics used in the industry. Genetic selection for marine shrimp is most advanced in *Penaeus vannamei* but is still relatively new when compared to livestock production.

In shrimp genetics, the industry norm uses old technologies where the gains have been shown to be 3-5% per generation. The breeding program conducted at Blue Genetics is the first to implement shrimp DNA parentage assignments on a commercial scale, resulting in 15% positive growth gain per generation. In 2013, Blue Genetics introduced a new strain of vannamei shrimp, where DNA markers were used to identify each family and give the possibility of a very high selection pressure. Using this technology Blue Genetics can select the best 3% of the population without fear of inbreeding, because they know the origin of each shrimp. In the ponds, Blue Genetics is able to identify the family to which the best performers belong. This has the ability

to maximise the potential of every family in different production environments without compromising the health status of the lines.

Figure 1: Growth at stocking density of 100 PL/m^2



Production model

This hyper intensive production system utilises probiotics to grow shrimp at a stocking density of 400 post larvae (PL)/m^2, yielding a production of 44 tonnes/ha of 12g shrimp per cycle. Production is bio secure, low in water exchange and achieves market sized shrimp in 100 days. Estimated production costs should be less than USD 3.00/kg based on the farming conditions of Southeast Asia.

During the development of the probiotics for this farming system, bacteria were identified with the following functions: active roles in exclusion by competition, denitrification and a source of protein. The work included the isolation of more than 127 families of which 75 families were already identified through the GENEBANK. Further, it comprised bacteria from 20 different genera and 27 different species.

The advantages of the hyper intensive system far outweigh the disadvantages. The system allows for a reduced pond area but there is a high initial investment of USD 60,000 per 2,500 m^2. The standard requirement for aeration for these ponds is 100 HP/ha for a biomass of 40 kg which means higher energy costs (diesel) with the increased requirement for aeration. The short grow-out period enables 3-4 crop cycles per year but in turn this requires a high level of experience in farm management. The high stocking density requires good water quality and high oxygen demand for the shrimp.

A huge advantage is the very high yields, as high as 44 tonnes/ha/cycle with high survival rates at 85%. Additionally there were reduced levels of stress and no occurrences of diseases, such as white spot syndrome virus (WSSV) and EMS. The thriving beneficial bacteria in the pond provide some protein; therefore, the protein content in the shrimp diet can be reduced by as much as 25%. This also reduces the amount of nitrogenous wastes input into the system. Furthermore, by using a low protein high quality feed with low Fish-in Fish-out (FIFO) ratios, feed costs are also reduced.

Individual quarantine tanks for use prior to transfer to broodstock unit. Here each individual shrimp awaits the result of the disease screening.

Table 1: Features of the hyper intensive system in Vietnam

Advantages	Disadvantages
Reduced pond area, smaller at 2,500 m^2	High initial investment (USD 60,000 per 2,500 m^2)
High stocking density (300-400 PL/m^2)	High cost (diesel)
Short grow-out cycles per year (3-4)	Requires experienced management
High yield (up to 44 tonnes/ha/ cycle)	Control on water quality
Higher survival rate (85%)	High oxygen demand
Reduced stress on shrimp	
Lower feed costs (25% protein)	
Low water exchange (10-12% per day)	
Low environmental impact	
Reduced disease outbreaks	
Lower feed conversion ratio (FCR)	

A 2-phase system

The system has two phases. In the 2,500 m^2 ponds, the 30-day nursery phase was stocked with 1.1 million post larvae at a stocking density of 470 PL/m^2. Survival rate was 85% and the post larvae at size 1-2g, were transferred to the grow-out ponds also of 2,500 m^2. In the grow-out ponds, stocking density was 400 PL/m^2 and survival rate after 70 days was 80% of 12g shrimp.

Trials were conducted to test the relationship between stocking density and harvest size, and it was shown that stocking at 284PL/m^2 produced 16g shrimp after 90 days of culture (DOC). At the same DOC, harvest sizes were reduced to 15g shrimp at a stocking density of 304 PL/m^2 and 360 PL/m^2 and to 12g when the stocking density was increased to 436 PL/m^2. The biomass produced was significantly higher when stocking density increased from 304 PL/m^2 to 360 PL/m^2. Only a marginal increase in biomass was observed when the stocking density was increased to 436 PL/m^2 from 360 PL/m^2 (Figure 2 A and B).

Comparison with current production models

Over a period of 36 months (May 2012 to May in 2014), this production model has produced 12 crop cycles. How does this production model compare with the commercial models now in place in Vietnam? These differences are tabulated here. It is important to note that the survival and growth rates are above the industry standard at an average of 80% and 1.5 g/week respectively. The big difference in this system, from the industry viewpoint is in the yield, which is almost 11 times that of commercial ponds stocking at 100 PL/m^2 and producing only 3.6 tonnes/ha/cycle. The feed conversion ratio (FCR) of the industry standard is also high at 1.5 to 2.5.

The economics of this production model was calculated in Table 3. Income generated was USD 1.92/kg at a projected price of USD 5/kg. However, during this time of higher shrimp prices, the income generated rose to UD 4.92/kg at a sale price of USD 8.00/kg.

Ultimately, the combination of three components: genetic selection, quality but low protein feeds and hyper intensive production system with probiotics is a new model for the shrimp industry to adopt. This is a bio secure production system using good strains of shrimp, demonstrating a shrimp growth rate of 1.5 g/week with a FCR of 1.4.

Figure 2: Growth and biomass at different stocking densities

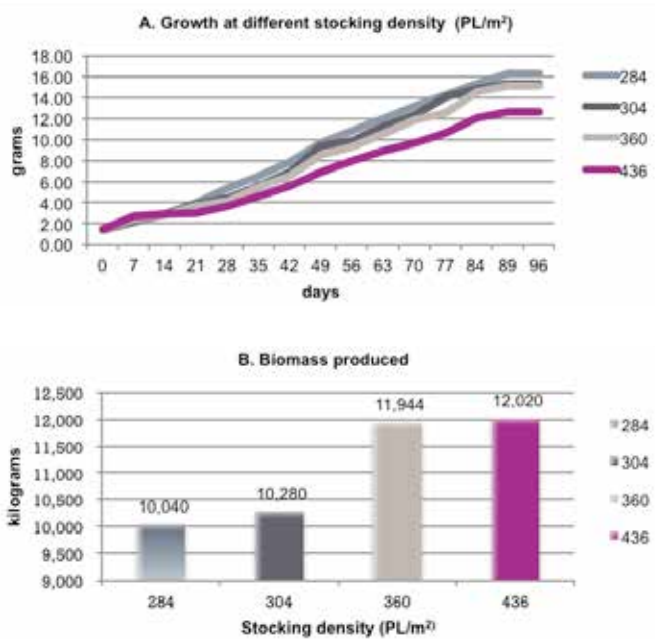


Table 2: Comparison with current production models in Vietnam

Hyper intensive systems	Current systems
Smaller ponds, 2,500 m^2	Large ponds, usually 4,000 m^2
High stocking density at 300-400 PL/m^2	Lower stocking density at average of 100 PL/m^2
Short grow-out cycles with 2 phase system for size 100/kg at DOC 83	Long grow-out cycle of DOC100 days or more for 100/kg.
Yields up to 40 tonnes/ha/cycle when survival rate >80%	Usually 1 to 4 tonne(s)/ha/cycle when industry rate for survival is only 30%
Growth rates at 1.5g/week	Growth rates at 1.3g/week
FCR at 1.38 to 1.57	FCR at 1.5 to 2.5
Disease outbreaks are reduced and controlled	High degree of disease outbreaks and uncontrolled
Lower feed costs at USD 1.10/kg for 25% CP feeds	High feed costs at USD 1.2-1.3 for 38% CP feeds
Low environmental impact	

View of a hyperintensive pond with airlift units to aerate and produce water currents within the pond

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A Proven Alternative to Natural *Artemia*

"EZ Artemia has demonstrated higher survivals and animals having well-marked digestive tracts… we have replaced 100% *Artemia* in 2011." – Mexico

"We just conducted trials replacing live *Artemia* in PL transport… we intend to start using it in our larval rearing." – Brazil

"EZ Artemia can replace 100% *Artemia*…." – Vietnam

"With the use of EZ Artemia, overall survivability greatly improved, water quality is good as we observed minimal leaching. Also, molting was early. EZ Artemia performed well." – Philippines

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Table 3: Cost of production calculations

Items (% of total cost of production)	Expenses (USD)	Cost per unit kg in USD
Feed (57%)	19,140.00	1.10
Post larvae (14%)	4,700.00	0.81
Labour (8.5%) + staff feed costs (1.2%)	2,868.00	0.34
Energy & gasoline (10.4%)	3,419.00	0.41
Gasoline (0.2%)	59.00	0.01
Maintenance (1.5%)	490.00	0.06
Feeding employees (1.2%)	412.00	0.05
Probiotics (7.4%)	2,500.00	0.30
Total	***33,588.00***	***3.08***
Total harvest (kg)	12,000	
Projected price/kg	USD5.00	
Cost/kg/produced	USD3.08	
Income/kg/produced	USD1.92	
Profit	**USD23,040**	

Harvest from the hyperintensive pond

The article is based on a presentation at Asian Pacific Aquaculture 2013 held in December 2013, Ho Chi Minh City, Vietnam

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Biofloc technology in shrimp farming: success and failure

By Poh Yong Thong

Indonesia may have the highest number of farms using biofloc or semi-biofloc technology, but what are the results?

Despite the many benefits of biofloc and semi-floc technology, they are successfully employed in only about 20% to 25% of the shrimp farms today, with the majority of them in east Java and Bali and a few other scattered areas. The low success rate of application underpins the difficulty of understanding and utilising biofloc technology. This article discusses the basics of biofloc technology in shrimp aquaculture, current applications as well as recent developments.

Understanding the technology

A biofloc floccule is a miniature, loosely held collection of materials (uneaten feed, faeces, detritus and other particles) and attached organisms (bacteria, protozoa, nematodes, phytoplankton and fungi) kept in suspension by strong agitation of water in a pond or tank. It has a gross size of about 0.1 to 3 mm.

The easiest way to visualise a speck of biofloc is an assemblage of sky divers joining hands in mid-air. It can also be visualised as a *sepak takraw* woven rattan ball with empty space in it (Figure 1). The individuals in a biofloc aggregate together by the secretion of bacterial slime. Bioflocs are highly porous and water can pass through them. The advantage of aggregation into a biofloc is a slower sinking rate and therefore increased opportunity for deriving nutrients from the water column.

Figure 1

A. A speck of biofloc, courtesy of Mohd Afiq *B. An assemblage of sky divers*
C. A sepak takraw rattan ball

Evolution of the biofloc system

Due to intense feeding in an intensive culture system, the excessive nutrients in a high stocking density pond produce an algal system which results in a phytoplankton dominated community. This system depletes carbon dioxide during the day via photosynthesis, thus raising the pH of the water. It produces carbon dioxide during the night through respiration, hence resulting in lower oxygen level and lower pH of the water. The phytoplankton system produces a diurnal pH swing with high pH when there is strong sunlight and low pH at night.

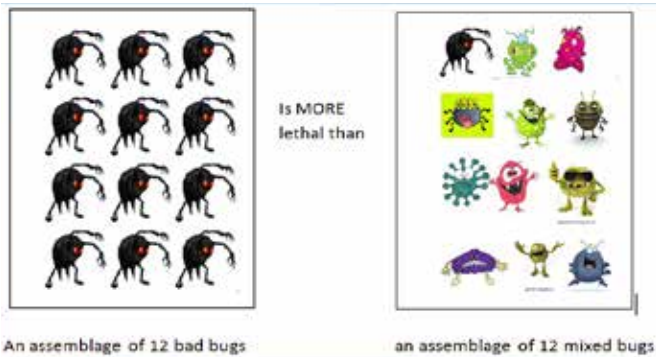
As ammonia becomes toxic at higher pH and hydrogen sulphide tends to be more lethal at lower pH, the diurnal swing of high pH during the day time and low pH during the night results in spikes of ammonia during the day time and increased toxicity of hydrogen sulphide during the night. This results in the detrimental stress factor in aquaculture, causing insurmountable diseases and crop losses. The aquaculturist then incorporates a recirculation system to mitigate the excessive nutrients; however, the recirculation system incurs costs and takes up valuable space.

Not long ago, waste water treatment technology found that organic particles suspended in the pond or tank by vigorous aeration results in the formation of floccules which are made up of bacteria, algae, protozoa, nematodes and detritus. The aggregates have slower sinking rates and are capable of assimilating the organic wastes in the water, creating a self purifying system. The dominant species in the floccules are heterotrophic and do not create the deleterious diurnal pH swings of the phytoplankton dominated community. This type of system is highly beneficial to aquaculture. This gives rise to biofloc technology or BFT in short.

Advantages of a biofloc system

The biofloc is an assemblage of more than 750 OTUs (Operational Taxonomic units) microbiotas (Jang and Kim, 2014). The diverse microbiota prevents the domination of any singular pathogenic species. Some of these microbiotas are able to elicit the non-specific immune response of the shrimp (Figure 2)

Figure 2



Julie Eskahari et al (2014) reported higher phenoloxidase activity (an immune indicator) in response to carbon loading in a biofloc system. Avnimelech (2012) showed significantly lower infection of tilapia by *Streptococcus* in biofloc compared to clear water system. It is widely recognised that many of the deadly shrimp diseases such as white spot syndrome virus (WSSV), infectious myonecrosis virus (IMNV) and early mortality syndrome (EMS)/ acute hepatopancreatic disease (AHPND) find it harder to infect shrimp grown in a biofloc system. Wasielesky et al (2013) showed that biofloc can be successful in preventing WSSV in Laguna in southern Brazil.

It is widely acknowledged that biofloc can help prevent the occurrence of aquaculture diseases. In early December 2013, a workshop was conducted in Ho Chi Minh to discuss the role of biofloc in the suppression of EMS/AHPND, causing USD1.26 billion losses in

2011 to the shrimp industry in Vietnam and USD 5 billion losses per annum worldwide.

Due to the vigorous aeration and agitation necessary for a biofloc system, many of the solids from shrimp faeces and uneaten feed are kept in suspension, thereby reducing sludge accumulation and sedimentation. A lethal concentration of 10^8 CFU/ml of *Vibrio* can be encountered in the pond water-sediment interface if sludge is left to accumulate. Tung and Le Poul (2014) suggested that it is best to remove solids two hours after every feeding. Almost 80% of the intensive shrimp ponds in Indonesia have a built-in sludge removal system.

Some Indonesian farms even deploy divers connected by a hose to an air compressor to siphon the sludge. Experiments were conducted in Thailand that showed shrimp placed into a net hapa elevated from an EMS/AHPND infected pond bottom did not become infected with EMS/AHPND. The absence of heavy sludge in the Indonesian shrimp ponds

One example of a central sludge discharge system widely used in Sumbawa in Indonesia

may be the reason why they are not infected by EMS/AHPND, despite its proximity to EMS/AHPND infected Malaysia.

Microbiotas in a biofloc scavenge on the particulate and dissolved wastes. For example, the nitrifying bacteria in the biofloc remove ammonia, one of the most harmful by-products of intensive feeding. This is akin to a huge in situ bio filter continuously purifying the water. As the biofloc removes the organic wastes from the pond water, very little or no water needs to be exchanged in the pond, helping firstly to conserve water (a scarce resource in many areas) and secondly to boost the biosecurity of the pond since very few pathogens can be introduced into the pond during water exchange.

Furthermore, since bacteria and not phytoplankton dominate the biofloc, the lethal opposing effect of high pH during the day and low pH during the night is neutralised. The pH stays stable. This in turn prevents ammonia spikes due to high pH when there is strong sunlight and hydrogen sulphide elevation due to lowered pH at night. Some aquaculturists prefer a pH fluctuation of 0.3 over a day. This minimal magnitude of pH swing is an indicator that the biofloc comprised some phytoplanktons which are beneficial for removing some of the nitrate (whose denitrifying process is optimal only in an anaerobic condition).

All biofloc systems require high dissolved oxygen (DO) of at least 4.5 ppm due to the additional requirement by the microbiotas and the need to physically keep the biofloc in suspension. The higher DO level is congenial to the health of the shrimp and microbiotas.

Avnimelech (2012) estimated that only about 25% of protein in a shrimp or fish feed is assimilated by the shrimp or fish. The remaining 75% may be recycled by the biofloc which in turn can be consumed by *Penaeus vannamei* and tilapia. Therefore, feed conversion ratios (FCRs) are much lower in a biofloc system. Trials are being carried out to harvest biofloc and to incorporate them into feeds. Thus a biofloc system further helps to stretch the two limiting raw materials for aquafeed, namely fish meal and fish oil.

It has been shown that a biofloc system can produce more shrimp per unit area of more than 25 tonnes/ha compared to conventional shrimp farming, many of which produce less than 15 tonnes/ha. Because of this, BFT is contributing to the conservation of valuable land area for more shrimp production.

View of a BFT pond

Active healthy happy shrimp in a feed tray in a biofloc pond

Disadvantages of a biofloc system

The most obvious disadvantage is the need for high oxygenation and hence high energy cost in order to keep the shrimp as well as the microbiotas in optimal condition. Any prolonged power failure in the scale of minutes is highly lethal to the biofloc system.

A biofloc system is slow to develop as it may take more than 4 weeks for the nitrifying bacterial community to establish. Avnimelech (2012) suggested seeding a pond with 100 kg/ha of good biofloc pond soil or pumping biofloc water from an established biofloc pond to kick start the new pond. McIntosh (2014) suggested an inoculation of shrimp ponds with biofloc to beat EMS/AHPND which can manifest itself as early as below 15 days.

Nitrate tends to build up due to a paucity of phytoplanktons to assimilate them. The highly oxygenated state is also antagonistic to the anaerobic denitrifying system which removes nitrate. The alkalinity and hence pH tend to drop due to the process of the intensive bacterial nitrification. Significantly higher skills and better equipped laboratories are thus necessary for operating a biofloc system. Parameters such as floc volumes as measured by an Imhoff cone, as well as oxygen, pH, alkalinity, ammonia, nitrite and nitrate, need to be constantly monitored.

C:N ratio

Bacteria thrives in a media with a carbon-to-nitrogen (C:N) ratio of about 15:1. As a major portion of the biofloc is bacteria, a C:N ratio of close to 15:1 is necessary to sustain the biofloc. In the majority of

shrimp culture the shrimp feed have a crude protein of above 35%. In a feed with crude protein of 35%, the C:N ratio is less than 9:1. In another words, there is too little carbon and too much nitrogen.

Thus, many farmers have to add carbon through carbon rich materials such as molasses, grain pellets, flour or calcium carbonate. Belize Aquaculture at one stage used a shrimp feed with a protein content of only 21%. A feed with crude protein of 21% has a C:N ratio of 15:1.

Shrimp feed with C:N ratio of 15:1 used in Belize Aquaculture for biofloc ponds

Calculating the C:N ratio

For those who are interested, the C:N ratio of a feed is generally calculated as follows: Regardless of the protein content, the carbon content of a feed is always taken to be 50%. To get the C:N ratio, one has to find the N%. This is done by dividing the protein by 6.25. For example, for a shrimp feed with a crude protein of 21%, the N content is 21 divided by 6.25 = 3.36%. Thus the C:N ratio of the feed is 50 divided by 3.36 = 14.88:1 or close to 15:1.

Dr. Nyan Taw, one of the pioneers on biofloc systems for shrimp with an Imhoff cone

Starting a biofloc system

In general, in a highly oxygenated and agitated system with sufficient organic matter input, some forms of biofloc will develop after 4-6 weeks. But its sustainability cannot be ensured. Normally, alkalinity and pH begin to drop and nitrate begins to accumulate. With so diverse a variety of microbiotas in the biofloc, many different kinds of biofloc can be obtained. More scientific knowledge and findings are necessary to fully understand the biofloc system and keep it sustainable.

In 2001, McIntosh (in Chamberlain et al. 2001), presented an account of biofloc development. First there is the conventional development of the algal growth, a few days after fertilisers and feed are added. Then the algae bloom and crash occurs at around 3-4 weeks. Thereafter, excessive foam accumulates on the water surface due to dissolved organic material and insufficient bacterial community to degrade it. Subsequently the water turns brownish due to the development of the nitrifying bacteria; foams disappear and biofloc dominates. It may take a few weeks to reach this stage, depending on the organic material input and the agitation from the aeration.

Thus, Avnimelech and McIntosh (2014) suggest inoculating either with matured biofloc water or biofloc pond bottom soil or culture to quickly kick start the biofloc formation. This is one method to control AHPND/EMS which can occur as early or less than 15 days.

Difficulties of BFT: many have failed

If biofloc is beneficial, why is it not widely used in shrimp aquaculture? Some early biofloc workers pointed out that biofloc is inherently chaotic, very sensitive to initial conditions such as water chemistry, light intensity, site specific and because of the diverse microbiota population dynamics; as such, the system is highly variable. Many experienced farmers tried BFT but gave up. The intensity of sunlight, is beyond the control of the farmers in an unsheltered pond. There is also the accumulation of nitrate due to lower quantity of phytoplankton consuming them and the highly oxygenated state which is antagonistic to denitrifying bacteria removing the nitrate. The drop in pH and alkalinity due to nitrification and the need to add sufficient carbon are all factors that need to be monitored closely compared with conventional methods of shrimp farming. Loc Tran (2014) attempted the control of EMS/AHPND by biofloc but lamented that it was not easy to manage a biofloc system.

Potentials of BFT

A full biofloc system uses a maximum of 15 ml of settled floc particles from a 1 litre water sample. It requires skills to manage. A semi-floc as practiced by many farmers have evolved. This semi-floc uses a maximum of 5 ml of settled floc particles from a 1 litre water sample. This is documented by Huda et al. (2013). The system has 30-40% algal communities and 60-70% heterotrophs. It requires some minimal water exchange. Some farms are getting good harvests continuously from this system. In a semi-floc system, the diurnal pH fluctuation is only 0.3. This system reduces the spikes of ammonia and hydrogen sulphide but allows partial removal of nitrate, requires minimal water exchange and improves FCR.

Designer biofloc

Schryver et al. (2012) showed that different carbon sources (sugar, shrimp feed, molasses, wheat bran, acetate, glycerol and glucose) can affect the nutritional composition of the biofloc. They further showed that light intensity increased the lipid content of the biofloc. In addition, they showed that PHB (poly-beta-hydroxybutyrate) which is a biofloc antimicrobial product, can be induced. Thus by manipulation, a biofloc with specific functions can be produced. The four determinants of biofloc composition are thus: light, feeding intensity, C:N ratio of the inputs, and the rate of sludge removal.

Conclusion

It is apparent that BFT offers many advantages for shrimp aquaculture. As the remaining knowledge gaps are gradually filled, BFT will without doubt contribute tremendously to aquaculture production through simply harnessing the power of nature, resulting in heightened efficiency, sparing valuable fish meal and fish oil, and reducing the use of precious water and land.

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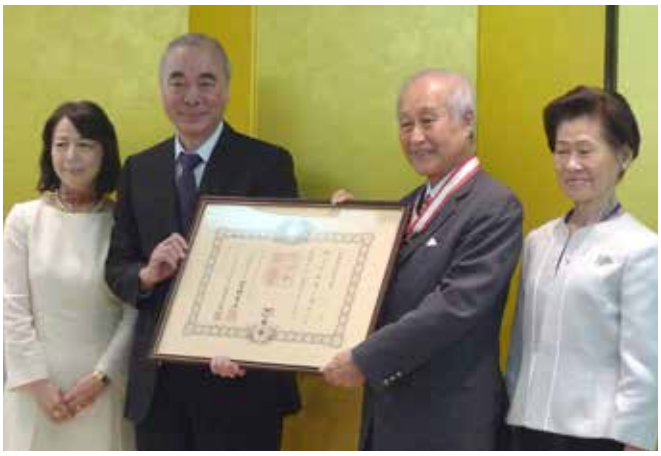
Order of the Rising Sun for 'Father of shrimp farming'

I Chiu Liao of Academia Sinica, Taiwan's top research institution, was presented with the Medal from the Japanese Government in line with bilateral exchanges in the aquaculture industry.



Sumio Tarui (left) presents 'The Order of the Rising Sun, Gold Rays with Neck Ribbon' to IC Liao.

On June 9, 2014, Prof Liao received a citation from the Japanese representative to Taiwan, Sumio Tarui and was later awarded the Order of the Rising Sun, Gold Rays with Neck Ribbon, by the Japanese deputy representative Izuru Hanaki.

The ceremony was held at the Taipei office of Japan's Interchange Association. Tarui praised Liao's efforts over many decades to promote aquaculture exchanges between the two countries. He hoped that Liao would continue to play a part in academic exchanges in the field. To date, only 30 individuals in Taiwan have had the honour to receive this medal.

"I am the only one in the field of aquaculture. I have long been promoting academic exchange between Taiwan and Japan, particularly in the area of aquaculture research. I have also developed technological studies on artificial breeding of several shrimp and fishes and made significant contribution to the global aquaculture industries. All these achievements are the basis for this award today," said Liao.

Liao's initiation into aquaculture began during his masters and doctorate research at the University of Tokyo, working on the kuruma shrimp *Penaeus japonicus*. Upon completion of his doctorate, he become a post-doctorate fellow with the pioneering researcher and entrepreneur of prawn culture, Prof Motosaku Fujinaga.

"In a short period of three months, I learnt the practical aquaculture techniques from Prof Fujinaga and established the basic essentials for my future research. When I returned to Taiwan in 1968, I made an important breakthrough when I developed a technique on the artificial breeding of the black tiger shrimp *P. monodon*.

"Taiwanese farmers have practised aquaculture for more than 400 years, which was then still an enterprise at the mercy of God. Imagine, production was very dependent on the climate. Seafood, particularly the black tiger shrimp, appeared only on the dining tables of the rich. After this breakthrough, the shrimp became a regular dish on the dinner table of everyone in Taiwan."

This breakthrough, nicknamed as 'the industrial revolution' in the history of aquaculture in Taiwan fundamentally remodelled Taiwanese aquaculture. The extensive aquaculture, practised for the last four centuries, metamorphosed into intensive aquaculture and pushed the shrimp culture industry to a new era. Taiwan had become the 'Kingdom of Shrimp Culture', with the highest annual yields and exports in the world. Shrimp was not only for local consumption but also for the export market which at its peak, was USD 0.47 billion and Taiwan contributed 51% of the total exports.

"All these breakthroughs are valuable techniques and could have been my personal wealth, worth of billions of dollars," admitted Liao. "However, I have insisted, just as Prof Oshima who taught me half a century ago, that the results of these breakthroughs should directly benefit the thousands of farmers. My determination has therefore advanced the aquaculture industry of Taiwan. This is one of my personal achievements that I will always cherish."

Liao also played an important role in the artificial breeding of the mullet in1969, completed the life culture of mullet in 1977 and then completed the culture of milkfish in 1978. These breakthroughs have placed the artificial breeding techniques as world records and resulted in the rapid and prosperous development of the mullet and milkfish culture industries. This was achieved at the Tungkang Marine Laboratory (now known as Tungkang Biotechnology Research Centre) which he set up in 1969 and remained as director until 1987. This centre is synonymous with Taiwan's achievements in aquaculture.

"Just before my retirement, I had acquired an additional budget of over NTD1.7 billion for the construction of National Aquatic Species Banks in the Lukang, Tainan, Tungkang, Taitung, and Penghu branches. These species banks will be the foundation for the future sustainable management of aquatic fisheries in Taiwan," said Liao. Liao is now Lifetime Distinguished Professor at the National Taiwan Ocean University since 2004. As a university professor he said that he can continue his contribution to fisheries research and education in Taiwan.

IC Liao explaining to young colleagues and students on maturity of P. monodon spawners. Photo taken at Tungkang Marine Laboratory, circa 1986.

Holistic approach to combat EMS/AHPND

by Corteel Mathias and Olivier Decamp

The *Vibrio* bacteria in shrimp: how a common pathogen in shrimp farming became the leading character in the EMS story

During the past year, evidence has accumulated on how the ongoing outbreak of early mortality syndrome (EMS) or more precisely acute hepatopancreatic necrosis disease (AHPND) is caused by a specific strain of the *Vibrio parahaemolyticus* bacteria. That this newly emerged disease is caused by a well-studied bacterial species wide-spread in shrimp aquaculture for decades, came somewhat as a surprise. Indeed, a vast body of knowledge exists on *Vibrio* in aquaculture, and in other related fields, namely on *V. fisheri* and *V. harveyi*, and the human pathogens *V. cholera* and *V. parahaemolyticus*.

For more than 40 years, *Vibrionaceae* has been consistently identified as one of the dominant families in the natural intestinal flora of wild and farmed penaeid shrimp. As *Vibrio* has a natural place in the microflora of penaeid shrimp, it can by no means be considered automatically as an obligate pathogen. However, shortly after shrimp farming intensified, reports of disease and mortality in shrimp caused by *Vibrio* began to spread. *V. harveyi* was one of the first and most frequently identified culprits, later joined by *V. parahaemolyticus* and others. The disease was baptised 'vibriosis', and one of its most typical disease signs was an increased luminescence. Since then, a lot has been written about virulence of *Vibrio* in shrimp.

Mass mortality of shrimp: Is V. parahaemolyticus the cause?

Virulent *Vibrio*

It is known that virulence genes are spread among *Vibrio* via horizontal gene transfer. Plasmids or temperate bacteriophages transfer genetic material from bacteria to bacteria, leading to a virulence switch and the production of toxins. This is relatively well-understood from human epidemics of *V. cholera* and *V. parahaemolyticus* and also in marine luminous *Vibrio*, such as *V. harveyi*.

The types of toxins, how the genes are transmitted among *Vibrio* and how they cause clinical signs have been extensively described for humans and shrimp. In fact, several publications have already reported on necrosis of hepatopancreas cells and midgut cells of shrimp by toxigenic *Vibrio* isolates, mainly *V. harveyi*.

As such, we may ask whether the recent EMS/AHPND outbreak truly presents a totally new case, or whether this bacterial pathogen follows the classical concepts which have been described in the past. Proper identification of the causative agent according to modern standards and the nature of the virulence factor (probable toxin) will answer this question.

Most *Vibrios* which cause disease and mortality in shrimp have been labelled as opportunistic/secondary pathogens, which take advantage of unfavourable environmental conditions to overwhelm shrimp hosts with compromised immune systems. This is observed when culture conditions are sub-optimal and stressful. Several specific strains of *Vibrio* sp were identified as primary pathogens, capable of killing shrimp in hatcheries and grow-out ponds even under optimal conditions, and these have become a major source of concern.

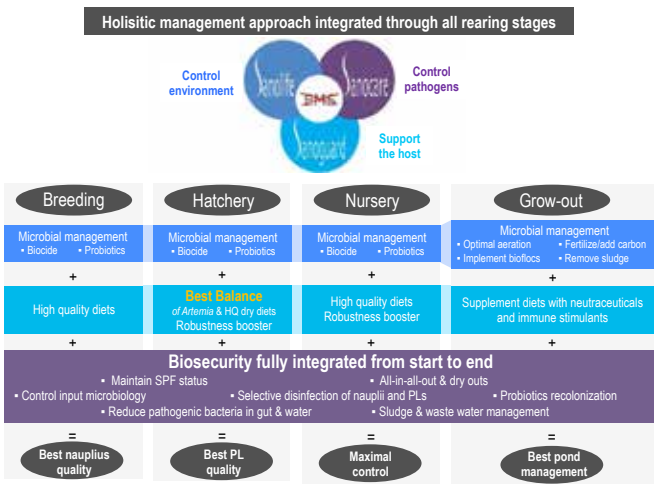
It has been stated that EMS/AHPND is caused by a newly emerged, primary pathogenic *V. parahaemolyticus*, capable of adversely affecting perfectly healthy shrimp no matter how much has been the effort in the management of the farm. The fact is however, that the distinction between primary and secondary pathogens is artificial. In both cases, there is a classic interplay of bacterial virulence and infection pressure, host defence and environmental influences which ultimately decide in which direction the balance tips. In all cases published so far, high doses of *Vibrio* had to be inoculated to reproduce disease under laboratory settings.

The recent publication by the research group of Dr Timothy Flegel and Dr Chu-Fang Lo, one of the few publications which have appeared on the etiology of EMS/AHPND apart of that by the group of Dr Donald Lightner, has strengthened our existing views on this matter. It is becoming clear that there is not one epizootic, hypervirulent strain of *V. parahaemolyticus* which is causing EMS/AHPND, but that there have to be several strains and species involved with variable clinical presentations and virulence mechanisms. Moreover, the authors are pointing out that shrimp health status and gut microflora may impact disease outcome and that affected shrimp might recover under suitable management conditions.

A holistic management approach

The available information and experience on *Vibrio* has allowed us to design a holistic management approach which can successfully minimise the damage the bacteria inflicts on cultured shrimp. The approach of our company, INVE Aquaculture has always been holistic. First and foremost, basic good practices have to be established in the management of the aquaculture systems to provide an optimal and stable environment. Secondly, the host health is reinforced by optimising nutrition and supportive supplements for the immune system. Thirdly, on the level of infectious agents, we aim to reduce

Figure 1. Holistic management approach integrated at all rearing stages



LARVIVA

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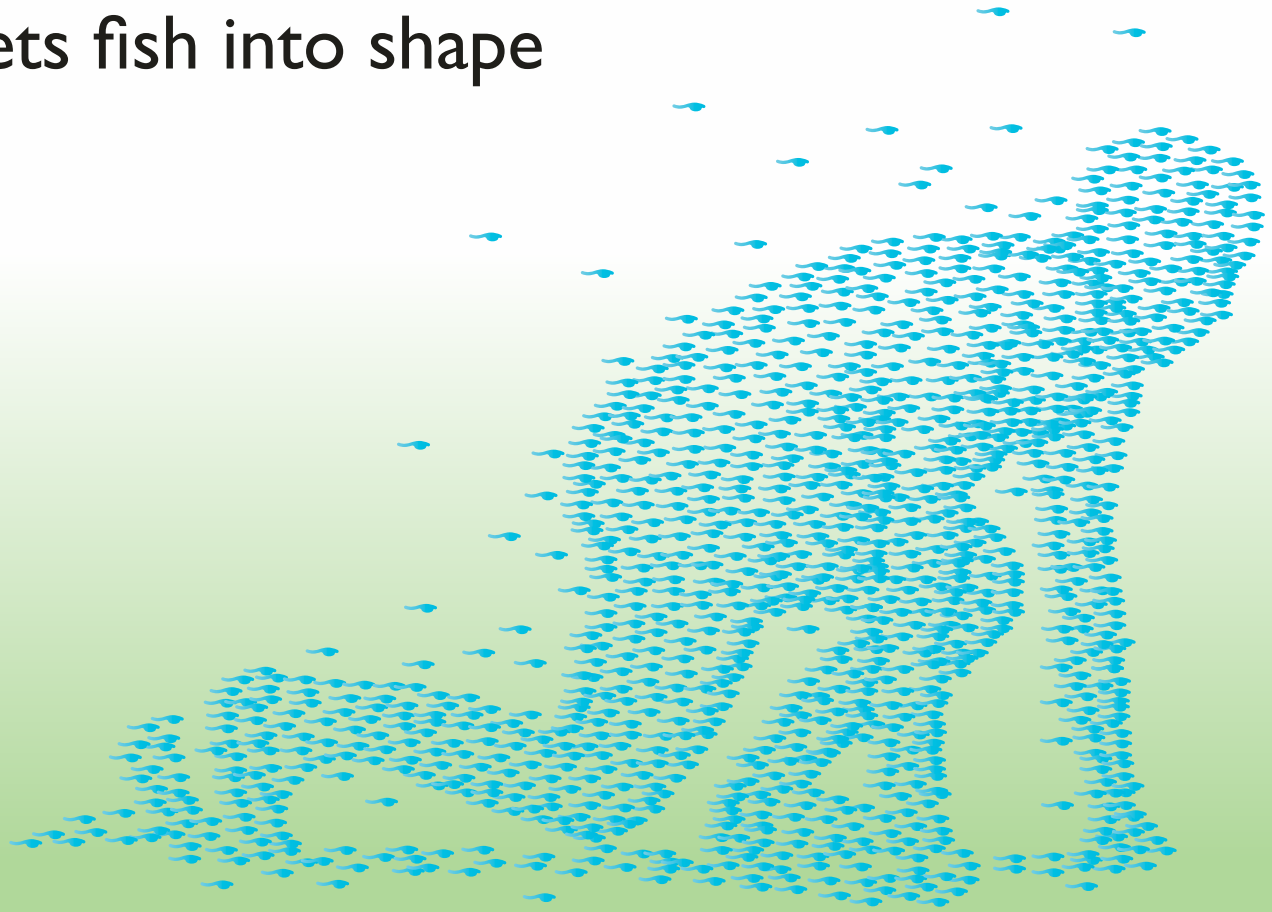
gets fish into shape



Reduces deformities in larvae and fry

LARVIVA ProStart™ is the first early weaning diet with a unique probiotic approved by the European Food Safety Authorities for its documented effect in reducing the occurrence of vertebral deformities in fish larvae and fry.

BioMar

the presence of viruses and virulent bacteria, while preventing opportunistic bacteria from getting a chance to overwhelm the hosts. To the best of our current knowledge, this integrated plan is so far the only way to restrain EMS/AHPND.

Breeding

A good breeding centre can only be operated under strict quarantine, with a surveillance program to maintain specific pathogen free (SPF) status. A team of experts has to plan and execute a long term program of selective breeding for desired traits, while keeping inbreeding under control. In the context of EMS, broodstock has been implicated as the cause of the problem, both that injudicious breeding which can lead to wide-spread inbreeding or that broodstock can be carriers of the EMS-causing bacterial strains.

Hence, we strongly advocate for disinfection of nauplii and materials used in the hatchery and farm in order to obtain real quarantine. In this context, further improvement of formulated diets for broodstock can allow the elimination of the risk of pathogen transfer via natural feeds.

Hatchery

As soon as shrimp larvae begin to feed, optimal nutrition becomes the main corner stone to ensure the best chances for survival and growth. Intuitively, most hatchery managers know that this is a complex process orchestrated by natural microbiological processes, and the administration of artificial feeds and live feeds (algae, *Artemia*).

Our protocol aims to have as much control as possible over these factors by using probiotic bacteria, with the best balance of quality-controlled *Artemia* and dry diets. Together, this results in stable and controlled conditions, which renders the use of antibiotics unnecessary. Robustness of the post-larvae grown using this hatchery protocol is maximised by supplying specific health boosters, allowing

Figure 2. The best balance between artificial diets and *Artemia*

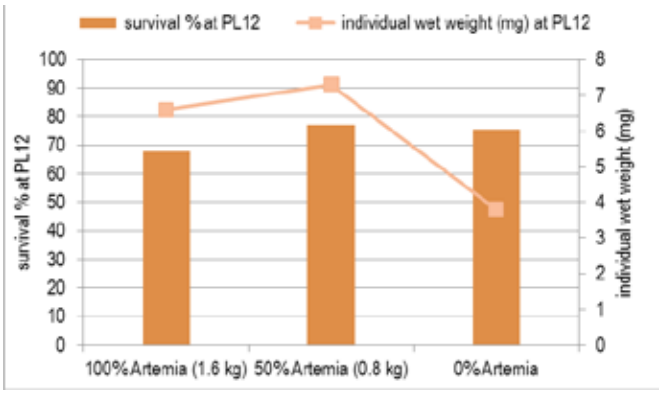


Figure 3. Reduction of *Vibrio* load by plant extracts during transport

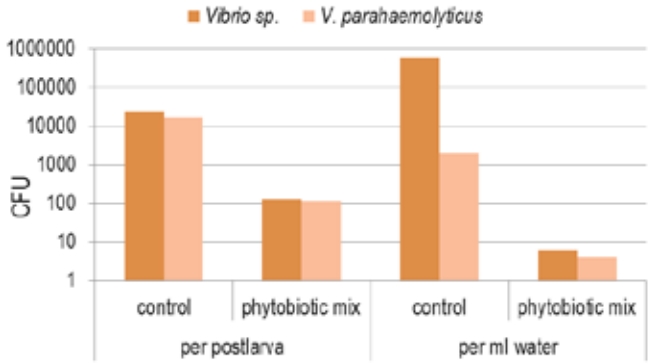
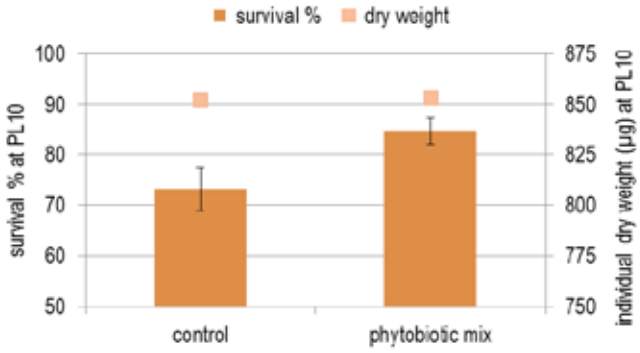


Figure 4. Enhanced survival during the hatchery cycle by applying plant extracts



them to cope better with stressors encountered during transport and when released in new environments. This can be evaluated objectively by recording their consistently better performance in stress tests.

Recently, we have enhanced even further this stress resistance by applying a mixture of plant extracts during the hatchery cycle and in the transport water of post larvae. These specially selected plant molecules are not lethal to shrimp larvae, but boost their defence systems by inducing the production of heat-shock proteins. Additionally, they have a pronounced selective bactericidal effect, specifically against gram negative bacteria such as *V. parahaemolyticus*. As a result, post larvae with a superior quality can be delivered to grow-out ponds or nurseries.

Nursery

The practice of nursing post larvae to a larger size before stocking into ponds has been strongly encouraged since the onset of the EMS epizootic. Although some have stated that this avoids early mortalities in ponds, others have reported that the practice does not result in any improvement. As information is being gathered, the explanations for differences in the effectiveness of using a nursery step has been emerging.

First and foremost, a good nursery requires a high investment. It has to be physically separated from the grow-out area and very strict biosecurity measures have to be in place. Due to the fear of EMS, many farmers have been making the mistake of leaving the shrimp for too long in the nursery, ignoring the carrying capacity of the system.

Furthermore, it has become clear that using cheap grow-out feeds undermines the success of a good nursery. The use of hatchery-grade diets does not only meet the nutritional requirements of young shrimp, the difference in ingredients also has a drastic effect on the microbial flora growing in the shrimp and on the faeces. Finally, robustness of the fry stocked at high densities should be maximised through addition of health boosters.

A good nursery protocol, be it in raceways or ponds, allows for better control and stabilisation of growth conditions, shorter cycles in open ponds, and more crops per year. But above all, in any shrimp nursery, well-trained staff and a good understanding of water management cannot be replaced by products with exaggerated claims or with the use of antibiotics.

Grow-out

The process of transferring shrimp from the nursery to the grow-out ponds offers a second opportunity to selectively disinfect against *Vibrio* and to boost the stress resistance of the shrimp. We see a big potential to optimise net profits from a shrimp crop with this practice, as even before EMS became a problem, the majority of shrimp mortality occurred during the first weeks after stocking.

Pond preparation should not be underestimated for grow-out and the same principles as for nursery should be applied, with attention to biosecurity and stabilising the chemistry and microbiology of the intake water. Applying disinfectant during pond preparation reduces the risk of horizontal transfer. However it is not sufficient and as a stand-alone treatment it might increase disease risk, as fast growing microorganism will fill up the empty niches.

What we support is a matured microbial ecosystem with a wide bacterial diversity. This microbial community will prevent *V. parahaemolyticus* from becoming one of the few dominant species. Therefore, a subsequent treatment with probiotic bacteria prevents opportunistic pathogens from blooming, colonising and invading the shrimp.

As we are dealing with an open system, algae play an important role in grow-out ponds. High quality fertilisers should be applied, in combination with a carbon source, in order to obtain the right C:N:P balance. After several weeks, depending on the stocking density, the organic load in the water will rise, and the algae phase will shift to the phase dominated by heterotrophic bacteria.

In this phase, three points are critical: aeration, pH and sludge management. The aerators have to be installed properly, so that they mix the whole pond (particularly important for biofloc systems), and maintain oxygen levels above 4 mg/L at all times.

The pH of the water has to be buffered by adequate amounts of alkalinity (>150 mg/L) and should not be allowed to fluctuate. Excess sludge has to be removed by regular siphoning. In the context of sludge management, many parallels can be made between the field of waste water management and the biofloc concept in aquaculture. In order to have as much control as possible over the dynamics of the spontaneous generation of bioflocs in the ponds, addition of selected *Bacillus sp.* and substrates is one of the few tools available to farmers.

Effluent from a well-managed pond (left) meets that of a poorly-managed pond (right, black) in a drainage canal.

Ponds have to be siphoned regularly to remove substrates for V. parahaemolyticus, such as chitinous moult skins.

The control strategies of *V. cholera* and *V. parahaemolyticus* from the point of view of human epidemics, center largely on waste water management, namely separating sewage and water sources. The cross-contamination of outlet water from shrimp farms to the inlet of the same or other farms has been a problematic issue for a long time already. With EMS/AHPND, this is more than ever a point to which farmers should pay particular attention. In order to prevent further spread and increase of the infection pressure in the environment surrounding shrimp farming areas, we advocate a proper treatment of pond water and sludge even after the crop has died due to an EMS outbreak.

Even if the environment of the shrimp is optimally managed, ubiquitous bacteria such as *V. parahaemolyticus* and *V. harveyi* might still have an opportunity to cause disease in shrimp. A major issue is that in grow-out, the feed constitutes a big part of the operation costs. Pressure on prices results in saving on ingredients, which leads to deficiencies in vitamins, oligo elements and bio-available ingredients. This is why grow-out diets have to be supplemented with nutraceuticals, enzymes and immune stimulants, which allow the shrimp to strengthen their natural barriers such as the cuticle, and to build up more reserves in energy and innate immunity to fight off invading bacteria.

Conclusion

The EMS crisis is a serious challenge for the shrimp farming industry and the supporting sectors. It is our firm belief that further integration and professional farm management are the way out of this crisis and to a sustainable future.

In our opinion, one single miracle cure product does not exist and certainly not a one-shot product which attacks *V. parahaemolyticus*. Opportunistic bacteria with transferable virulence genes have always been and will always be around in shrimp farming. The use of antibiotics or disinfection protocols without immediate recolonisation by probiotics is doomed. Our vision is that only a holistic approach, optimising environmental and post larvae quality, can successfully manage shrimp culture microbiology and curb EMS.

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Olivier Decamp

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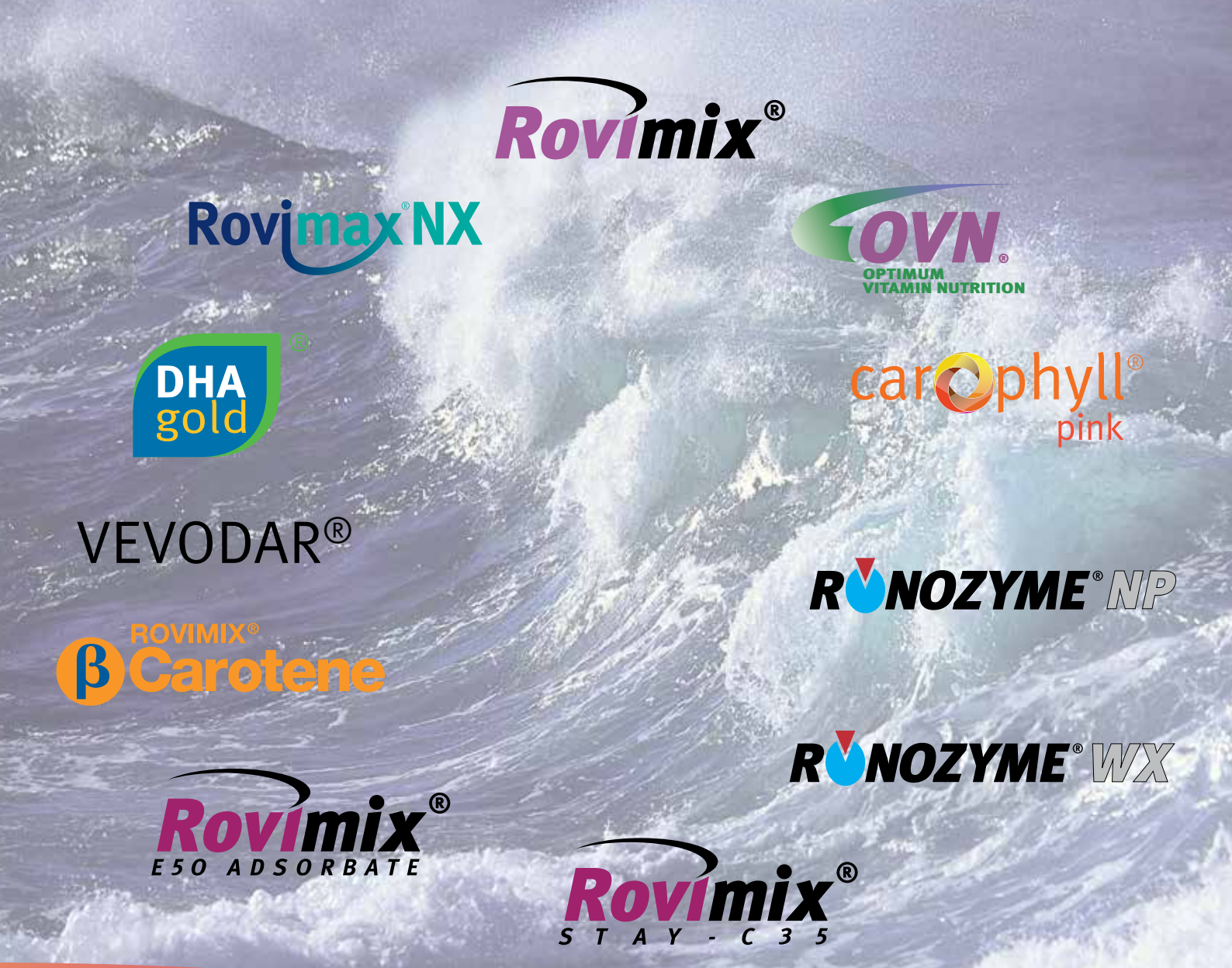
More information concerning EMS/AHPND, references to scientific publications and health products can be requested from the authors.



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Snakeskin gourami in the Mekong

By Nguyen Tan Duy Phong

Feeds specific for the species and improvements in hatchery techniques will help to expand production

The snakeskin gourami *Trichogaster pectoralis* is native to the river systems of Thailand, Laos, Cambodia, Indonesia and Vietnam. As an air-breather, it can survive well in waters with low dissolved oxygen and high organic loads. This makes the fish an attractive species to farm (Xuan, 2000). In addition, the snakeskin gourami has a high meat yield and traditionally is a favourite dried fish item in Vietnam.

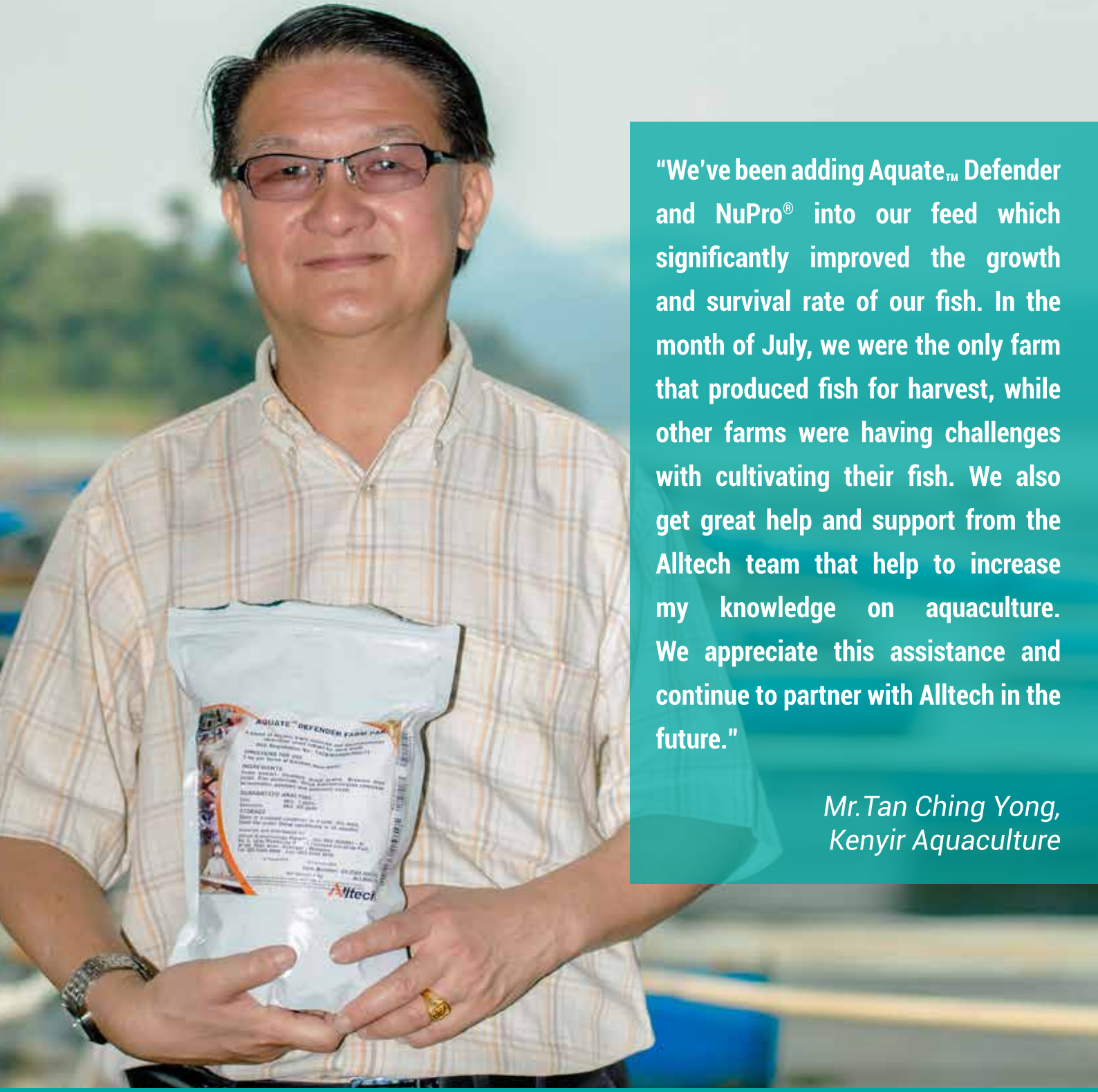
In 2010, commercial farming of snakeskin gourami developed rapidly in Dong Thap province, about 130 km south of Ho Chi Minh City. Farmers alternated its culture with rice during the rainy season and with other fish species in inland areas. Among farmed freshwater fish, snakeskin gourami commands the highest price; typical ex-farm prices in 2014 range from USD 2.5-3.5/kg compared with USD 1.0-1.2/kg for the pangasius catfish or USD 1.5-1.6/kg for red tilapia. Production of the snakeskin gourami at a stocking density of 30-50 fingerling/m^2 generally yields 15-20 tonnes/ha/crop. The average fish size at harvest ranges from 8 fish/kg to 5.5/kg, but typically 7-8/kg. Some typical parameters for intensive snakeskin gourami culture management are listed in Table 1.

The snakeskin gourami fingerling at 5g

Breeding techniques

The broodstock supply is easily available from snakeskin gourami farms, but there is a seasonal variation with quantities and prices. Broodstock achieves good maturity stages during April to July under natural conditions. Most hatcheries prefer to buy their broodstock from grow-out farms. The minimum broodstock size in Dong Thap province is about 6 fish/kg. Many snakeskin gourami grow-out farmers maintain broodstock and produce their own fingerlings. Others purchase fingerlings from hatcheries.

"Farming. It's what we do."



"We've been adding Aquate™ Defender and NuPro® into our feed which significantly improved the growth and survival rate of our fish. In the month of July, we were the only farm that produced fish for harvest, while other farms were having challenges with cultivating their fish. We also get great help and support from the Alltech team that help to increase my knowledge on aquaculture. We appreciate this assistance and continue to partner with Alltech in the future."

Mr.Tan Ching Yong,
Kenyir Aquaculture

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A one ha grow-out in Dong Thap province, Mekong delta.

In the breeding process the basic requirement is that a pair of fish must be able to enter the spawning container. Both males and females are placed in a tank of 500 L with 40 cm water depth at a density of one fish per 20 L. Farmers then cover these tanks with lotus leaves.

Hormone injections are generally used to prepare the fish for spawning. Brooders were injected at a 30-45° angle at the dorsal fin and the dosage is 5000 IU of HCG or human gonadotropin hormone. Male broodstocks are injected with a third of the dose given to female broodstock. The ratio of male to female is usually 1:1. Spawning usually starts 15-20 hours later. Eggs were transferred to another tank for incubation.

The water preparation for incubation includes treatment with potassium permanganate ($KMnO_4$) at 3 ppm and aeration was provided for 2- 3 days. When water temperature is at 28-30 °C, the eggs will hatch in about 22-24 hours. Larvae are approximately 3 mm in length and are free swimming at 3 days post hatch. They are transferred to rearing ponds ready with zooplankton blooms or artificial plankton feeds. Stocking density is often around 10,000,000 larvae/ha. The larvae are reared to 250-300 fish/kg in approximately 60 days. After this time, they are harvested and graded according to size and can be sold as fingerlings or stocked directly into grow out ponds.

Pond managerment

The typical intensive grow-out pond is about 5,000-20,000 m^2 in size with depths ranging from 2-2.5 m. Ponds for snakeskin gourami culture are prepared for stocking by draining and drying the pond bottom and in some cases by tilling and liming (7-10 kg/100 m^2) before filling water through a cloth filter to a depth of 1.0 m. Farmers use DAP (diammonium phosphate) at a rate of 2 kg/1,000 m^3 to fertilise the ponds. Grow-out ponds are either stocked with fingerlings of size 200-300/kg at a density ranging from 20-40/m^2 or they are stocked with larvae (3 days post hatch) at a density of 10,000,000/ha. Stocking is usually carried out during March or April. During the culture period, water exchange is gradually increased as follows; first month 0%; second month 10-15% and third month 15-20%. About 10-30% of the pond water is replaced weekly after the third month, and every two days in the last month.

Sampling of the snakeskin gourami is carried out twice a week in the last two months. The purpose is to estimate the average size for harvest or for culture management. If growth performance is not as scheduled, feeding will be increased or water pond environment improved.

The most popular disease affecting the snakeskin gourami is the red spot disease which is due to *Aeromonas* bacterial infection. The gross clinical signs are haemorrhages, on the head, mouth and base of fins, swollen abdomen and pink to yellow ascitic fluid in the peritoneal cavity. The best preventative methods are reducing stocking density and maintaining high-quality feed. If this infection becomes an outbreak, feed is immediately reduced and treatment will be with antibiotics.

Feeding

Farmers in Dong Thap prefer to use tilapia feeds to feed the snakeskin gourami. In the first month, they use 42% crude protein (CP) feeds and then switch to starter tilapia feeds (35-30% CP) for the rest of the culture period. Generally, the starter feed is given 5-8 times/day and other feeds at 3 times/day at 0800, 1300 and 1700 h daily during the rest of the grow-out stage. Commercial feeds are of various sizes (up to 3 mm diameter) and cost approximately USD 0.8-1/kg. Feeds are broadcasted by hand for 15-30 minutes at fixed areas of the pond using boats. When weather conditions suddenly change (wind, rain or cold), fish will reduce or even stop feeding. In order to prevent excessive and underfeeding, feeding rates must be adjusted following weather conditions. Many farms also provide supplements such as natural food, probiotic and soybean meal to improve fish health. The use of a feeding program based on fish growth patterns is shown in Table 2.

Table 2: Feeding program for snakeskin gourami culture in Dong Thap, Viet Nam

Fish weight (g)	Crude protein (%)	Particle size	Feeding rate (%)
<0.1	42	<1 mm	10 – 15
1 – 4	40	1.0 – 1.5 mm	8 – 10
4 – 40	40	1.5 – 2.0 mm	3 – 6
40 – 100	30	2.0 – 3.0 mm	2 - 3
100 – 150	30	3.0 mm	2 - 3

Harvest

This is approximately 7-8 months after stocking when fish reach harvest sizes of 120-140 g. There are several methods for harvesting; by draining during low tides or using a cast net. Harvesting of a one ha pond generally requires 4-5 days. With good prices, farming of the fish offers attractive returns and continues to attract new investors (Table 3).

Table 3: A comparison between two models of snakeskin gourami culture

Parameters	Larvae to harvest	Fingerling to harvest
Culture area (ha)	0.5 – 2	0.5 – 2
Pond depth (m)	1.5 – 2.5	1.5 – 2.5
Size of fish	3mm	200 fish/kg
Density (fish/m^2)	1000	20 - 40
Culture duration (days)	180 - 240	150 - 180
Body weight at harvest (g/fish)	120 – 140	120 – 140
Survival rate (%)	1 - 2	80 – 90
FCR	2.0 – 2.2	1.9 – 2.2
Price (USD/kg)	2.37	2.37
Yield (tonnes/ha)	15 – 20	20 - 30
Feed cost (USD/kg)	1.37 – 1.52	1.33 – 1.42
Chemicals cost (USD/kg)	0.05	0.05
Seed cost (USD/kg)	0.05–0.14	0.24 – 0.33
Others (USD/kg)	0.14	0.19
Production cost (USD)	1.61–1.85	1.80 – 1.99

Marketing

Fish is sold to markets in Ho Chi Minh City or exported to Cambodia. Salt dried gourami are supplied to consumers, retailers, restaurants and are also exported. The current trend favours bigger size fish. Prices show a seasonal variation and depends on geographical location.

Although, the intensive culture of snakeskin gourami culture is able to adjust to market conditions, there is a need for more commercial hatcheries for seed production. In the case of breeding techniques, more needs to be done to improve spawning, egg quality and feed for the grow-out phase.

Harvesting

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Marine protein hydrolysates as shrimp immune modulators

By Mikaël Herault, Emmerik Motte and Vincent Fournier

Are functional feeds a part of the answer to sustainability of the shrimp aquaculture industry?

Shrimp aquaculture production recently exceeded fish production in global fisheries supply. In return, due to rapid intensification, shrimp industry is now facing critical issues, which may jeopardise its sustainability. Some of the more challenging issues are the depletion of marine resources, the deterioration of the environment and the dramatic production losses resulting from the cyclic emergence of disease outbreaks.

However, shrimp are known to be tolerant to several viruses, as asymptomatic carriers. In addition, most bacterial strains involved in bacterial shrimp diseases are widely present in the environment and remain harmless under normal conditions. This is the case for *Vibrio* species such as *V. alginolyticus, V. harveyi* or *V. parahaemolyticus*. According to Tran et al. (2013), the latter is now identified as the indirect cause of mass mortalities associated to EMS (early mortality syndrome) or AHPND (acute hepatopancreatic necrosis disease). There is currently no generally approved treatment, or practice, which can be implemented to prevent EMS from occurring. Inbreeding, high water pH, feed pollution etc have however been identified as aggravating factors. Besides the implementation of better husbandry and genetic improvement practices, nutrition is the third most important way of improving shrimp culture sustainability, especially through the design of functional feeds.

Several studies refer to the use of beta-glucans, LPS (LipoPolySaccharide), pro and prebiotics, algae and plant extracts as potential shrimp immune modulators (Zhang and Mai, 2010). Fewer studies have been reported on the use of marine protein hydrolysates (MPH). These studies have shown that their palatability, nutritional and health benefits have positive advantages in the culture of several terrestrial and aquatic species. Health benefits shown by MPH are due to their natural high contents in small soluble nitrogen nutrients such as free amino acids and their derivatives (taurine for instance), nucleotides and peptides. These bioactive nutrients have documented anti-oxidative, anti-stress, anti-microbial and/or growth hormone like activities.

The purpose of this trial was to assess the growth and immune benefits of different MPH in white shrimp, when supplemented in a commercial diet.

Experimental trials

Trials were conducted in thirty 400 L tanks (Figure 1), with each tank individually fitted with water supply and aeration devices. Environmental parameters remained within requirements for the Pacific white shrimp *Penaeus vannamei* with an average water temperature of 26-27 °C, dissolved oxygen (DO) of 4-5 ppm and salinity of 35 ppt. Water renewal rate was a minimum of 10% per day; feeding wastes and faeces were removed daily. Specific pathogen free (SPF) certified juveniles (average weight 1.2 g) were randomly stocked in each experimental tank (n=50) and acclimated for 1 week on a commercial diet (a standard shrimp diet commonly found in Ecuador with 28% of crude protein).

Experimental diets consisted of the commercial diet supplemented with either 5% fish hydrolysate (FH), 5% squid hydrolysate (SqH), 3% krill hydrolysate (KH) or 2% shrimp hydrolysate (SH) on a w:w basis. Proximate and peptide profiles of supplemented hydrolysates are illustrated in Table 1.

Experimental facilities

Table 1: Nutritional and peptide size profiles of supplemented hydrolysates

	FH	KH	SqH	SH
Dry matter (% of product)	26.50	58.18	43.81	96.01
Crude protein (% of product)	15.50	44.85	23.16	64.90
Crude fat (% of product)	3.60	1.56	13.45	10.81
Ash (% of product)	6.50	11.59	5.24	10.33
Soluble nitrogen (% of crude protein)	84.73	96.28	80.00	90.02
Peptides < 0,5kd (% of soluble protein)	90.14	63.98	32.08	82.67
0.5kd < Peptides < 1.0kd (% of soluble protein)	5.26	15.95	10.60	8.84
1kd < Peptides < 5kd (% of soluble protein)	4.19	17.74	48.15	7.76
5kd < Peptides < 10kd (% of soluble protein)	0.26	2.03	4.77	0.58
10kd < Peptides < 20kd (% of soluble protein)	0.08	0.26	2.74	0.11
Peptides > 20kd (% of soluble protein)	0.06	0.04	1.66	0.04

FH- fish hydrolysate, KH krill hydrolysate, SqH-squid hydrolysate and SH- shrimp hydrolysate

Dosages of hydrolysate used were adjusted to provide similar amounts of crude protein. The commercial diet, used as the control diet (COM), was initially crumbled and re-pelleted to allow the incorporation of the hydrolysates. Each experimental diet was randomly allocated to six replicates.

Shrimp were fed 4 times a day using a commercial feeding table as an indicative reference. During this study, we only focused on growth and health benefits resulting from the MPH supplementation. Feed wastes were therefore not collected and feed conversion ratio (FCR) was not calculated.

During the 8 weeks feeding trial, shrimp were sampled every second week for mean weight assessment.

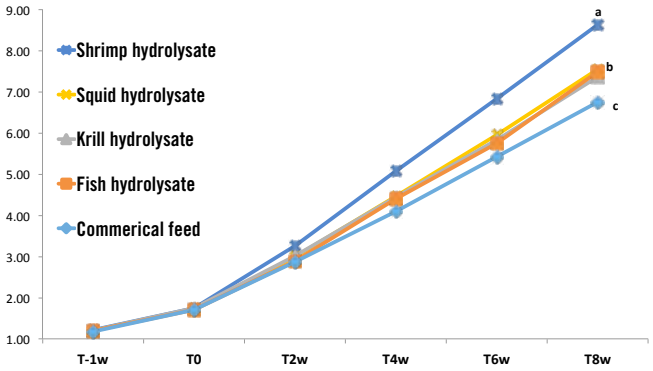
At the end of the feeding trial, shrimp were injected with either a 20 µL saline solution (n=12 shrimp per experimental diet) or a 20 µL suspension of *V. harveyi* at 10^6 UFC/mL (n=24 shrimp per experimental diet). At 3 hours post induction, haemolymph was sampled for the assessment of plasma antimicrobial activity. For each experimental diet, 12 shrimp were sampled before induction, as a control.

Plasma samples were collected after haemolymph micro-centrifugation. Plasma samples were incubated with a suspension of *V. harveyi* (with an optical density (OD) = 0.5 before a 1:10 dilution) and 200µL of growing medium. After an hour of incubation, plates were read for OD for the first time (T0), before a second reading 4 hours later (T4). All plasma samples were analysed in triplicate and compared to blank samples consisting of bacterial suspension incubated with growing medium but without plasma. Plasma antimicrobial activity was defined as the percentage of bacterial growth inhibition resulting from the plasma activity = 100 – 100 x (ΔOD samples/ΔOD blanks). All results were statistically analyzed by ANOVA followed by student t- test.

Better growth performance

There was no mortality observed during the feeding trial. After 56 days of feeding trial, FH, KH and SqH supplemented diets resulted in heavier shrimp (+11% on average) and higher growth rates (+14% - p<0,001; Figure 1). SH supplemented diets resulted in the best growth rates with an increase of 37% of the weekly growth rate. This increase was already significant only 2 weeks after starting the feeding trial.

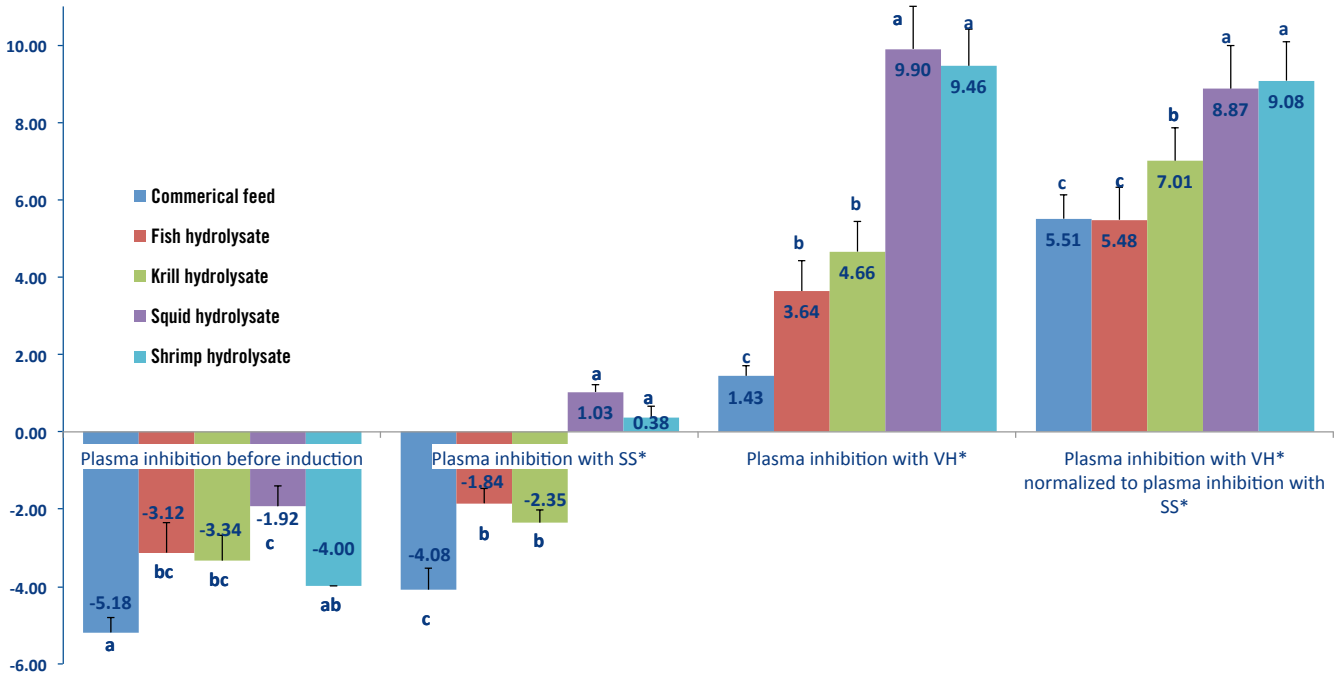
Figure 1. Shrimp mean weights (g) during 8 weeks feeding trial



MPH have been shown to enhance growth of many farmed species. Growth enhancement is usually related to MPH inherent properties, which make feeds supplemented with MPH highly palatable and digestible. Spared energy from homeostasis and feed digestion process are most likely re-allocated to growth process.

Once the feeding trial had been completed, shrimp were sampled for the plasma antimicrobial assay.

Figure 2. Shrimp plasma inhibition before and after induction (in % of OD) with either saline solution (SS) or *V. harveyi* suspension (VH)



*SS : Saline solution
*VH: *Vibrio harveyi*

Shrimp plasma antimicrobial activity was found to significantly increase ($p<0.01$; Figure 2) with all dietary MPH, before or after inductions, when compared to the control diet. While plasma antimicrobial activity was non existent before induction, injection of saline solution was enough to stimulate plasma inhibition of bacterial growth, most likely through the healing process of the injection site. This process was visibly enhanced by dietary supplementation of MPH.

As expected, the immune response resulting from *V. harveyi* induction was much higher than the one observed after an induction with saline solution. Dietary MPH supplementation significantly improved this immune response as was seen by the comparison with the control diet. We normalised plasma inhibition results to reduce the impact of the injection process on shrimp immune response. Once this normalization process was done, relative plasma antimicrobial activity remained significantly higher for all supplemented diets, but the diet FH. The most effective MPH were diets SqH and SH (+65%). These results show that all MPH most likely act at different stages and levels of shrimp immune process. Before bacterial infection, they may increase shrimp plasma levels into 'non specific' antimicrobial compounds while after bacterial induction, some MPH, including SqH and SH, seemed to stimulate an immune response through the production and release of high levels of non specific and/or specific antimicrobial compounds.

Perspectives

Results of this study suggest that MPH could be a cost and nutritionally effective alternative to antibiotics or other health additives when dealing with opportunistic pathogens. Besides enhancing shrimp productivity through higher growth rates, MPH could improve shrimp health and resistance to opportunistic infections. By supplementing shrimp commercial diets with MPH, it is therefore possible to design functional or bioactive feeds, which could be helpful in this context of sanitary concerns. Last but not least, reducing the rearing periods by increasing growth rates will also allow shrimp farmers to reduce the risk of facing an acute disease outbreak before harvesting. Further investigations have to be made to get a mechanistic understanding of the immune system activation induced by dietary hydrolysate.

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Fishmeal and fish oil shortage: consider algae

By Alex Tsappis

Global aquaculture production continues to flourish despite the short supply of fishmeal and fish oil. The emergence of new raw materials calls for a better understanding of the needs for specific amino acids and on the protein content of feed that can be reduced. Fortunately, the availability of data on micronutrient requirements have increased raw material choices for aquatic animal feed formulation and aquaculture should soon be able to use genetically modified plant-based highly unsaturated fatty acids, principally the omega-3 fatty acids, EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) as well as high quality alternative such as DHA rich microalgae. At present, around 30% of the world's algae production are used for animal feed production, primarily in aquaculture.

Fish oil, derived from capture fisheries, is the most common and major source of EPA and DHA. Fish oil in animal feeds ensures a healthier final product for the consumer. However, due to limited availability, sustainability issues, contamination risks, inconsistency and the increasing price of fish oil, some farmers are opting to use cheaper alternatives high in omega-6, for example vegetable oil, cotton seed oil and sunflower oil. These alternatives often are lacking in omega 3 fatty acids as well as EPA and DHA.

Transformation for human nutrition market

In the last 12 years, the global fish oil industry has gone through a dramatic transformation and is now a product less available for the animal feed industry. During this time, prices have increased. This is partly due to the increasing market demand of omega-3 fatty acids (EPA and DHA) in the human supplement market and the fact that marine resources are depleting. It now appears that there will not be enough fish oil available for the animal feed industry notwithstanding rising prices. It has been predicted that eventually the omega-3 fatty acids will be sold for the human nutrition industry for a higher price.

It is also predicted that there will be an increase in fish oil prices over the next few years, and its shortfall is becoming increasingly imminent for the global aqua feed industry. Farmed salmon previously sold for their nutritional properties are now being re-evaluated due to the decreased levels of omega-3 fatty acids being found in the fillets. Increased competition from the direct human consumption market for pharma applications and functional foods minimise high quality fish oils for the global feed industry.

Nutritional innovation

This is imperative to reduce the dependence of aquaculture on fish meal and fish oil. A priority is that feed ingredients are produced under recognised certification standards to ensure responsible sourcing and improved sustainability of global aquaculture. These standards would improve production practices and position microalgae as a sustainable alternative to fish oil.

Companies are examining opportunities to provide a high quality sustainable alternative to fish oil through heterotrophic microalgae production. Microalgae are grown under strictly-controlled conditions without producing any environmental pollutants. The Marine Ingredients Organisation (IFFO) sees microalgae as the most promising and sustainable alternative source to replace EPA and DHA in fish oil.

R&D in algae production

Algal oils are now being commercialised as sustainable alternative sources to fish oils. They have been shown to be nutritionally equivalent and can successfully enrich larval feeds and replace fish oil in fish diets. Microalgae are required in larval nutrition, and are either fed directly in the case of molluscs and penaeid shrimp, or indirectly as live food for small fish larvae.

Alltech has focused its research efforts on algae for the past five years, and has purchased one of the largest heterotrophically grown microalgae facilities in 2010. The 100,000 square foot (9290.3 m^2), state-of-the art facility in Winchester, Kentucky, uses proprietary algal technology to process heterotrophic algae because of its nutritional benefits.

Recently scientists conducted two trials to determine the effects of heterotrophically-grown, microalgae on Nile tilapia and rainbow trout. Researchers found that the microalgae *Schizochytrium limacinum* can be fermented to produce a finished product containing 50% lipid and 14% DHA. This product increased the DHA content in tilapia fillet and numerically improved weight gain, while no negative growth was observed (Figure 1).

In these trials, the effects of four treatment diets containing various levels of the algae product ALL-G Rich (Alltech, USA) were fed to tilapia (initial weight 9.7-9.8 g).

In another study, algae were added to 90 rainbow trout diets from Trout Lodge Sumner, Washington, as an energy source, replacing fish oil and soybean oil. Results showed an increased weight gain indicating that this algae is a suitable replacement for fish oil and fish meal. The addition of the 14% DHA algae also led to higher DHA content in the rainbow trout fillets. By providing a clean and consistent source of DHA

Figure 1. Impact of ALL-G Rich on Tilapia

Treatment	Average fish weight (g)					DHA
	Week 0	Week 3	Week 8	Week 10	Week 13	(mg/100g)
No Algae	9.8	15.4	25.3	28.6	33.1	176
0.2%	9.8	15.8	25.9	29.1	36.7	178
0.4%	9.7	16.0	25.4	28.3	34.3	227
0.8%	9.8	16.0	26.4	30.2	35.9	293
P value	0.95	0.61	0.69	0.65	0.38	0.001
Source: Filer, 2012						

Figure 2. Impact of algae on rainbow trout fed diets with 15% algae (ALL-G Rich) for 14 weeks

Treatment	Average fish weight (g)				
	Week 0	Week 5	Week 7	Week 10	Week 14
7% FO/25% FM	6.0	20	29	52	97
15% FO/18% FM	6.0	21	30	53	111
	Week 5	Week 7	Week 10	Week 14	DHA (mg/100g)
7% FO/25% FM	14	22	45	91	1700
15% FO/18% FM	15	23	47	105	3,000
FO-Fishoil, FM –Fishmeal; source Filer, 2012					

omega-3 fatty acids and high quality protein, researchers found that the heterotrophic microalgae offer more nutrition components to a diet than algae produced through the autotrophic method.

Over the past ten years, the aquaculture industry has seen the price of fish meal and fish oil almost quadruple due to overfishing and the growing consumer demand for protein. While these changes have caused a dramatic nutritional decline in the essential omega-3 fatty acid, DHA, in farmed fish globally, this leaves the door open for high quality alternative such as DHA-rich microalgae.

Alex Tsappis is Applications Nutrition Specialist at Alltech.

New Turkish feed company to focus on feed efficiency, technical service and sustainability

Ahmet Tuncay Sagun (fourth right) and Torben Svejgaard (third right) with the Sagun and BioMar team. Third from left is Carlos Diaz, vice president of BioMar Continental Europe, BioMar Americas and Business Development

In May, the BioMar Group, a leading international company on fish feed, and Turkey's Sagun Group, a company involved in aquaculture, fish processing and trading, announced the set-up of the Joint Venture fish feed company.

Turkey is the second largest aquaculture nation in Europe after Norway. Its annual volume of seafood production is around 635,000 tonnes. Aquaculture, mainly of the European seabass *Dicentrarchus labrax*, seabream *Sparus auratus* and rainbow trout *Oncorhynchus mykiss* contributed around 230,000 tonnes of annual fish production in recent years. Globefish (2014) reported that based on the output of marine hatcheries it is estimated that the production of seabass and seabream in Turkey for 2013 would have exceeded 100,000 tonnes, with 70-75% exported and the remaining 25-30% channelled to domestic markets. In order for the Turkish aquaculture industry to remain competitive, there is a growing need for new, more efficient, sustainable, and environmental friendly diets and production methods.

At the Turkish Pavilion during the Seafood Expo Global in Brussels, the signing of the Memorandum of Understanding between Ahmet Tuncay Sagun, president of the Sagun Group, and BioMar Group CEO, Torben Svejgaard marked a new start in the Turkish seafood industry where markets are expected to grow with the consolidation of these two companies. It also marked the tenth anniversary of the Turkish Pavilion at this annual seafood exposition.

Svejgaard said, "We have witnessed the growth in aquaculture production in Turkey and envisage a tremendous growth potential in fish farming. It also has a growing domestic fish consumption as well as good access to export markets for both fish and fish feed. We are extremely pleased to enter this agreement with the Sagun Group which is a big step forward to improve the efficiency of fish farming in Turkey."

"The Sagun Group is a solid company with a long history of 50 years in Turkey's seafood business. It has an excellent local network and is also well known internationally. More importantly, is that the group is also farming fish. We can combine our international expertise with their local base. In the last 3-4 years, BioMar has been seriously focusing on new areas. First was a feed mill mainly for tilapia feed production in Costa Rica. Now as we have the right partner, we will have a feed mill in Turkey. Production will be mainly for the feed market in Turkey and also that of neighbouring countries in the east such as Iran. We already have a BioMar feedmill in Greece, which will serve feed markets in Greece.

As to what will BioMar bring to the table, Svejgaard said, "BioMar has 52 years of experience in trout feed and farming technology. We will be bringing this knowledge to Turkey especially the technology on aquaculture recirculation systems. Although our expertise in sea bass and sea bream farming has a shorter history, we believe that we have the R&D expertise to help Turkish producers. We will bring some of the concepts which we have developed for the salmon industry. We will not be applying these directly but use the concepts and thinking, such as diet formulation with no fixed energy and protein levels. This is our performance feed concepts. Turkey's feed industry is going in the direction of sustainability, efficient production and food safety systems. BioMar will play a role towards these needs in Turkey's aquaculture industry but for some this may be too early but for others, it is already a requirement."

"BioMar is well-known for delivering high performance fish feed with a sustainable profile, and it has an outstanding technical customer service. This will be a key contribution of the new company to the Turkish aquaculture industry," Mr Sagun said at the occasion of the signing ceremony.

Ahmet Tuncay Sagun (left) and Torben Svejgaard

Sagun sea farm cages in the Aegean Sea, close to Izmir.

According to Mr Sagun, BioMar is a perfect match for the Sagun Group, "The know-how of BioMar in areas like fish feed development, sourcing, and feed manufacturing will benefit both the Sagun Group and other fish farmers in Turkey. BioMar is the leading supplier of high performance feed for sea bass, sea bream, and trout in Europe, and we are proud to enter into a collaboration agreement with BioMar on equal terms. We believe this joint venture will help to develop and strengthen the whole aquaculture sector in Turkey."

The BioMar Group is one of the leading suppliers of high performance fish feed to the aquaculture industry. Currently BioMar operates 11 fish feed factories in Norway, Chile, Denmark, Scotland, Spain, France, Greece, and Costa Rica. Roughly one out of five farmed fish produced in Europe, Chile and South and Central America are fed with BioMar fish feed. Worldwide the BioMar Group supplies feed to around 60 countries and to more than 30 different fish species. The group is fully owned by the Danish industrial group Schouw & Co, which is listed in the Copenhagen Stock Exchange.

The Sagun Group is a privately held company operating eight processing facilities, fish farms, fishing fleets and a fish market in Turkey. The main business areas are aquaculture and fish processing as wells as exportation and importation of fish. Products are sea bass, seabream and trout as fresh and frozen fillets, gutted and whole fish. The group is well known both domestically in Turkey and in export markets across the world with a range of strong consumer brands. Ahmet Tuncay Sagun is also the owner of the group and is the third generation running the family company.

An improved frog feed industry

By Tang Xuemin, Ju Peng and Xiao Jianguang

China's feed and frog aquaculture industry players met at the 2014 Hinter Symposium on Nutrition and Feed Technology of Fish and Shellfish

Frog aquaculture in China is a small industry, relative to that of fish and shrimp aquaculture. However, its farming is increasing in several provinces such as in Guangdong, Fujian, Zhejiang, Jiangsu, Hainan, Anhui and Hunan. Nevertheless the yield is high at up to 750-900 tonnes/ha. China is a leading producer of farmed bullfrog (*Rana catesbeiana*) at about 0.22 million tonnes/year and tiger frog (*Rana tigrina rugulosa*) at 5,000 tonnes/year. Other Asian frog producers are Vietnam, Malaysia, Thailand, Turkey and India.

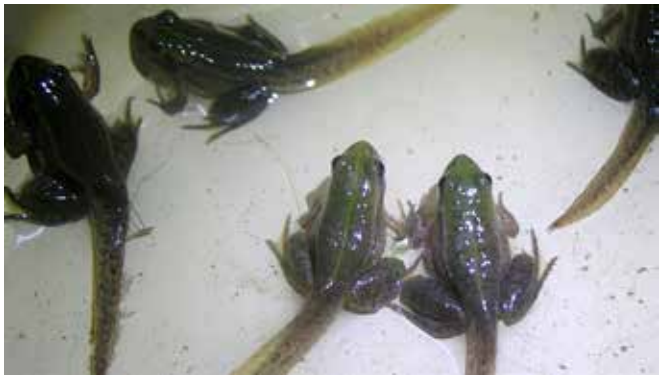
The culture cycle for the frog, in particular the bullfrog, can be divided into three stages: tadpole, juvenile and grower frog. In the tadpole period, it breathes with gills and completes the metamorphosis process within 55 - 70 days.

The frog feed industry in China

In the last few decades, frog aquaculture has been growing rapidly with developments in culture technology. Product demand has been rising steadily with higher consumer incomes. Feed production is now a booming business to meet market demand. In China, an estimated 0.23 million tonnes of frog feed, mostly with feed conversion ratios (FCR) of 0.9-1.2, were produced in 2013, all by local companies. Compared to fish or shrimp farming, frog aquaculture is easier and has a lower requirement for infrastructure. Any water bodies and ponds with a high depth to prevent frogs from escaping can be utilised for frog culture. It is also easy for farmers to learn how to culture frog from A to Z. However, at present, frog farmers are facing some challenges: from how to improve the survival rate, to effectively reduce the feed costs and to actively avoid frequent market price fluctuations.

Challenges in the industry

Frog aquaculture was the focus of the 2014 Hinter Symposium on Nutrition and Feed Technology of Fish and Shellfish (and Frog) held in Xiamen, China from 10-11 April. It was organised by Guangzhou Hinter Biotechnology, Guangdong Haid Animal Husbandry and Fisheries Research Centre of the Haid Group. The co-organiser was Wuhan Mingbo Electrical Equipment. The symposium attracted more than 200 people including representatives from more than 10 provinces in China, industry from Vietnam and Philippines and academia from Xiamen University and Jimei University. They discussed the development plans for frog farming.



Juveniles stage

The team from Guangdong Hinter Group Co., Ltd. gave presentations covering farm operations and management, feed formulations, and quality control in frog feed manufacturing. They also discussed the newest frog culture technology. One presentation looked at the two different culture models for bullfrog farming in Guangdong and Fujian provinces (Table 1).

This showed that once the selling price drops to less than USD 1.8/kg or when the cost of production exceeds USD 2/kg (which is quite possible when survival rates are low and FCR is high), the farming will not be profitable. Questions posed by the symposium participants were: what would be the right way to develop the industry and how to optimise feed formulation, improve FCR and survival rates, and develop a quality control system.

In his presentation on 'Development status and production trends in the frog aquaculture industry', Dr Yang Yong, president of Guangdong Hinter Group pointed that "it is important to consider your company's

Frog farm in Guangdong province

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Table 1: Two different bullfrog farming models in Guangdong and Fujian provinces, China*

Location	Guangdong province	Fujian province
Tadpole farming season	February to May	May to June
Tadpole farming density	6-12 million/ha	6 million/ha
Juvenile bullfrog farming time	June to August	July to August
Juvenile bullfrog farming density	250-400 pcs/m^2 initially, to 200-300 pcs/m^2 in the middle and later period of farming.	150-250 pcs/m^2 initially, to 150-200 pcs/m^2 in the middle and later period of farming.
Water depth	80-100 cm	10-20 cm
Harvest time	December	April to June next year
Harvest size	≥250 g	≥250 g
Average yield	225-300 tonnes/ha	150-225 tonnes/ha
Total farming costs in 2013 (USD)	395,901/ha(computed with a yield of 225 tonnes/ha)	253,279/ha(computed with a yield of 150 tonnes/ha)
Marketing price in 2013 (USD/kg)	2	2.3
Farm income (USD)	456,147/ha(computed with a yield of 225 tonnes/ha)	349,180/ha(computed with a yield of 150 tonnes/ha)
Net income (USD)	60,246/ha	95,901/ha
FCR	1.05	0.9-1.2
**The market price is not fixed and is time and area dependent*		

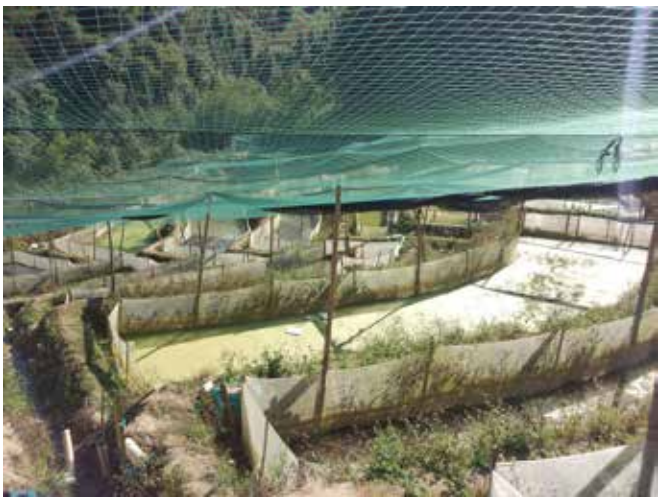
capability and resource availability before deciding to diversify in the aquaculture production chain." Dr Zhang Song, vice-president, focused on the control points in the preparation for frog feed formulas and the main factors influencing processing, raw material quality control and effective substitutions to enhance feed formulation.

Dr He Fen, technical service director gave some practical methods for the quality control of fishmeal, a subject of interest to many aqua feed producers in the audience. Technical manager, Huang Hao introduced information which showed that acid value, peroxide value and Kreis qualitative analysis could be successfully applied to oil quality control. "Kreis qualitative analysis could be done in 10 minutes," said Huang.

Guangdong Hinter Group has a range of premixes for aqua feeds. One of them, Digestion-care Premix has functional properties. Culture trials have confirmed its advantages on frog culture and it could be a reliable choice to address the challenging issues faced by many farmers. The Hinter team is of the opinion that the presentations at this seminar injected a 'new vitality' for the further development of the frog industry in China as well as in the region.

This annual seminar series is now in its eighth year but for the first time, there was a specialised meeting for a less-known culture species within the large aquaculture industry in China. It brings the fish nutrition and feed technology of Hinter to a new level. With the rapid development in aquaculture, this has become a new trend - to focus on farmed species and create a special niche market.

Yang Yong said, "The road ahead will be long and our climb will be steep but Hinter will persist on with integrity, professionalism, innovation, win-win values and sustainable contributions in the development of aquaculture."



Frog farm in Fujian

Dr Yang Yong (right), president of Guangdong Hinter Group Co., Ltd. with Professor Wang Zhiyong (left), Fisheries College of Jimei University.

Tang Xuemin

Ju Peng

Xiao Jianguang

Tang Xuemin is technical director assistant, responsible for brand building and promotion and technical data output. **Ju Peng** and **Xiao Jianguang** are sales managers providing integrated solutions to aquatic feed millers in the Philippines and India and aquatic feed millers in Guangdong and Fujian provinces, respectively. They all attached to Guangdong Hinter Group, China. Email: tangxm@haid.com.cn

Not all tilapia are created equal

Expansion of premium tilapia production while building communities at the world's largest integrated tilapia producer

The 25-year old integrated tilapia enterprise, Regal Springs which operates farms in Indonesia, Mexico and Honduras continues to demonstrate its uniqueness in the sustainable farming of tilapia for global markets. Marketing is very important for the company, and at the Seafood Expo Global 2014, Regal Springs espoused that 'not all tilapia are created equal.'

In a quick overview of marketing and developments, Magdalena Lamprecht Wallhoff, director of Global Sales, Marketing & Social Investment said that the farm in Mexico has the best potential for growth as Regal Springs has the permit to expand production tremendously to 70,000 tonnes.

In 2013, it had already achieved 20,000 tonnes of tilapia production and this will increase to 24,000 tonnes in 2014. However, more production is not expected from Indonesia and Honduras and will remain at 55,000 and 30,000 tonnes, respectively. In Indonesia the company inaugurated its new processing plant in Semarang, Java on June 20. Lamprecht Wallhoff's family started Regal Springs from a small tilapia farm in 1988 in Wunut, Java.

"Mexico is our current focus. Indonesian production goes to Europe and the USA as frozen fillets. Mexico and Honduras supply fresh products but both have the capacity to freeze when required."

Lamprecht Wallhoff added that the company has 50-60% of the US fresh tilapia market which is supplied from the farm in Honduras. The rest comes from producers in Costa Rica, Ecuador and Columbia. Competition is from Chinese tilapia producers but Lamprecht Wallhoff

Picture courtesy of Regal Springs

said, "We have core customers who regardless of the supply situation in China are always with us. Others come to us when Chinese supply drops.

"Farming tilapia at all three farms is standardised. Tilapia is farmed in floating cages which results in improved taste and quality which is very crucial for us. We are different from many other producers as we only do cage culture in clean and deep waters. Lake Toba is a crater lake and the water is actually blue. The main criterion is water resources.

"Remarkably, disease management is not a big problem but we do have vaccines for our fish. We have been farming tilapia for so many years and have developed the precise protocols from breeding to grow-out. We are sustainable and have zero waste."

She added, "In general, there is a vast potential for tilapia farming around the world. Each country has its potential and challenges."

Premium producer

For her next target, Lamprecht Wallhoff would like to see tilapia from Regal Springs competing alongside premium whitefish and differentiated from other tilapia products.

"Today we are premium in quality and price. In Europe, the industry recognises us to be an excellent seafood but the consumer does not. Therefore, there is a lot of work to be done to show consumers what we do and what we can offer."

Regal Springs was the first tilapia producer to be certified under the Aquaculture Stewardship Council (ASC). It worked with the WWF Aquaculture Dialogues in the development of tilapia standards.

Working with communities

The tagline of the company is 'producing premium tilapia while building communities.'

Among its peers, Regal Springs has gained recognition as a company which works closely with communities. As such, often it has been approached to participate in joint ventures and by several international organisations to start development projects on farming tilapia to provide protein and additional income for rural communities.

"This acknowledgement is for our work with local communities. Our success depends on maintaining the health of the waters which we operate in and of the people who work with us. We work with our communities to prevent deforestation that could result in land erosion and introducing unhealthy levels of organic matter into the waters. We conduct extensive water monitoring on-site and use floating feed to maintain ecobalance and eliminate contamination of the lakes and reservoirs. We further provide and support education, health care clinics and local businesses inthe local communities."

Magdalena Lamprecht Wallhoff

Aquafinca in the Honduras provides extensive medical and health resources. Employees and their families have access to a full time physician and a group of nurses along with a pharmacy, ambulance, health insurance and preventive health education free of charge.

PT Aquafarm Nusantara in Indonesia, has been working with local communities. It provides the local community with free fry who raise them in rice paddies until they are large enough to enter floating cages. The rice farmers are paid for the fish adding to their income. In May 2014, they provided 580,000 fingerlings to small holder farmers in Sumatra.

Regal Springs farms collectively employs 8,000 people from the local communities. As a company expansion is on the horizon, empowering fish farming communities with economic and social development is one of their incentives as an alternative to non-profit aid.

Biosecurity in aquaculture

By Leonardo Galli, Don Griffiths, Pikul Jiravanichpaisal, Nattawadee Wattanapongchart, Oranun Wongsrirattanakul and Andrew Shinn

Part 1: International considerations

This is the first of a series of three articles that focuses on biosecurity in aquaculture. Far from pretending to be guidelines, the aim of this article is to provide baseline information for the aquaculture community regarding the importance and complexity of aquatic biosecurity that must involve producers and governmental authorities working together as a unit.

Biosecurity, in its simplest term, can be defined as the set of procedures undertaken to prevent, control and eradicate infectious diseases in organisms. This is a basic definition applied to many agricultural industries. With the emergence of new technologies, however, this definition has been modified and adapted for different circumstances, for example, those related to bioterrorism, genetically modified organisms and laboratory animals.

Biosecurity, however, can be seen as a tool, as a mechanism developed to assist and protect agro-industries. Biosecurity in salmonid aquaculture has been in place for several decades. In the shrimp culture industry, however, it was not until the outbreaks of Taura syndrome virus (TSV) in the Americas and white spot syndrome virus (WSSV) in Asia in the early 1990s that the need for rigorous biosecurity practices was highlighted.

In safeguarding the health of any aquatic population, one must consider the threats from pathogens which may be well characterised or new, endemic or exotic, and the exposure to these can either be prevented or minimised. Safeguarding the health of aquatic animals can be done through the use of an array of physical and hygiene practices at the national, aquatic system and/or farm level. There is also a parallel requirement to ensure that the disease management or intervention practices that are used are applied in an ethical, sustainable manner with no detrimental impact to the farmed population, the environment or to the end consumers of the final products. Within a robust biosecurity framework, each of these prerequisites requires strategic and integrated policies involving key stakeholders at various levels: farms, industry and governments.

Biosecurity at different levels

Biosecurity should be looked at as a whole. Even if, for example, a shrimp producer has good management practices and a biosecurity program in place, this might not be enough to avoid contamination of the production area. If there are no biosecure hatcheries supplying 'clean' post larvae, then the risks of introducing new pathogens into

The Fish Vet Group Asia Limited team, front row, from right, Don Griffiths, Nattawadee Wattanapongchart, Pikul Jiravanichpaisal, Wimonthip Jarupheng, and Oranun Wongsrirattanakul. Back row, Andrew Shinn (left) and Leonardo Galli

a system are always high. The same principles apply to a biosecurity program at the country level.

The sanitary status of neighbouring countries must be considered at the moment of establishing international trade. Taking all of these into consideration, comprehensive biosecurity programs should have different levels of regulation: international level, national level and producer level.

This article will focus on biosecurity at the international level whilst biosecurity at the two other levels will be addressed in subsequent issues of Aqua Culture Asia Pacific.

Biosecurity at the international level

This level of regulation centres on the competency of national governments and the rigour by which legislation, surveillance (where appropriate) and testing are upheld. The main objectives are to develop a system to protect the industry under consideration. It is also to establish rules and mechanisms of trade between countries producing similar products. The enforcement of national legislations between trading nations will help to prevent the imports of contaminated shipments of aquatic products and to minimise the illegal transboundary movement of stock.

The first step is for the country importing the aquatic products to establish their own sanitary status regarding the aquatic species. Part of this should involve a national screening program of wild and cultured populations for specific pathogens of concern. The World Animal Health Organisation (OIE; http://www.oie.int/), for example, has an Aquatic Code with a list of notifiable diseases for each aquatic species. Following surveillance, certain countries may be able to demonstrate and declare that they are free of a specific pathogen.

Zoning and compartmentalisation

If, however, a pathogen is found to be present within a country, it is critical to define where they are found and whether there are areas that are pathogen free. If these areas are delineated by geographical barriers, then these can be considered as zones and the group of animals within it constitutes a subpopulation. In other situations, the appropriate application of management practices may produce a subpopulation that is free of the pathogen. These characteristics are the basis of what is called zoning and compartmentalisation - the first being when the subpopulation is limited by a natural or artificial geographical barrier, and, the second when the subpopulation is confined to a facility with special management practices in place.

In each case, the competent authorities of each country have the authority to designate zones or compartments based on health surveillance assessments of each subpopulation. Once a zone or a compartment is established, the competent authority must specify the surveillance system used to characterise the subpopulations, the method by which each subpopulation is identified and, the traceability system in place to permit each subpopulation to be tracked back to its point of origin.

Once zones and compartments are defined, then trade agreements can be established between countries. Importation of any commodity, however, runs the risk of introducing a pathogen into a country. In order to minimise the risk, an importing risk analysis (IRA) can be used as a decision making tool. In general terms, an IRA is a procedure based on risk identification, risk assessment, risk management and risk communication. The IRA can be used by the importing country to impose import conditions or even to refuse.

Leonardo Galli, technical director, is a veterinarian from the University of Uruguay and has managed many shrimp hatcheries, farms and R&D departments in Ecuador, Brazil, Saudi Arabia, Mozambique and Malaysia.

Don Griffiths, operations director has extensive fresh, brackish and marine aquaculture experience with major aquatic species including tilapia, pangasius, shrimp, seabass and Chinese and Indian carps in Asia (Bangladesh, Cambodia, Indonesia, Laos PDR, the Philippines, Sri Lanka, Thailand, Timor-Leste, and Viet Nam). Email: don.griffiths@fishvetgroup.com

Pikul Jiravanichpaisal, PhD is senior scientist with more than 20 years' experience working on crustacean microbiology, histopathology and immunology. She is a pioneer in researching the intestinal immunity of crustaceans including shrimp and crayfish.

Nattawadee Wattanapongchart is business administration manager for the Fish Vet Group Asia.

Oranun Wongsrirattanakul is laboratory assistant and will be trained to provide audit services for shrimp and tilapia hatcheries, nurseries and grow-out farms for Thai DOF GAP certification.

Andrew Shinn is senior scientist and has a PhD in veterinary aquaculture from Stirling University. He has 25 years' experience in aquatic parasitology, as lecturer at the Institute of Aquaculture, Scotland.

Vietnam's pangasius industry in 2014

By Zuridah Merican

The export value of pangasius reached USD 1.76 billion and within the next two years, Vietnam plans to maintain production volumes and improve product quality and push for sustainability of the industry

Ponds (picture courtesy of Le Xuan Thinh VNCPC)

The pangasius industry in Vietnam is a super-productive sector which occupies only 6,000 ha of pond area and yet produces 977,000 tonnes (MARD, 2014) of fish in 2013. Pangasius is exported to 135 countries, predominantly to the European Union and the US. Pangasius export which totalled USD 1.76 billion was a substantial contribution to annual seafood exports of USD 6.7 billion in 2013.

However, stakeholders in Vietnam are of the opinion that the uncontrolled growth has brought many problems; these include an oversupply and reduced export prices, from USD 3.76/kg in 2000 to less than USD 2.2 in 2012. In addition, exports to the US continue to face antidumping duties which were first imposed on Vietnam a decade ago. During a meeting in October 2013, stakeholders expressed the need for some reform measures, including a production quota to match supply with market demand, and a national program to produce quality juvenile fish, control on feed quality and on quality of exports of frozen pangasius products. Vietnam is still the global leader for pangasius exports but its lead at 99% for several years has been reduced recently to 85%, with competition from exports from Bangladesh, Thailand and Indonesia (Dung Minh, 2013).

In June, at the Malaysia International Seafood Exhibition, Dr Nguyen Huu Dzung, vice president, Vietnam Association of Seafood Exporters and Producers (VASEP) reiterated on the need to work towards sustainable pangasius production. This is not a new initiative as both the private and public sectors have been working on improving the sustainability of the industry since 2000. In 2005, five groups of stakeholders (processor, farmer, hatchery, feed producer and health service company) joined to form Agifish Pure Pangasius Union. This set the standards for quality pangasius production. Next was the 'Panga Trace' program of Vinh Hoan, in cooperation with Anova Seafood, a major Dutch importer. Since 2006, the focus has been on certification, initially with GlobalGap and later with Aquaculture Stewardship Council (ASC) following standards derived from the Pangasius Aquaculture Dialogue (PAD). As a result of the cooperation from ASC, there are now 20 ASC certified farms with 13 farms audited in 2013.

Feeding fish (picture courtesy of Ngo Tien Chuong, WWF Vietnam)

There are more plans for the future. There is a government circular (36/2014/ND-CP dated 29 April 2014) on the pangasius industry management. Some technology improvements will be implemented through the Vietnamese - Danish Aquaculture Technology Excellence Center or VIDATEC. This will combine the best of Danish technology and know-how, to ensure that the rapidly growing and ambitious aquaculture industry in Vietnam will have an edge to access the global pangasius market. Dzung said that this is to double production in the same farming area but with reduced discharge of nitrogen and phosphorus in effluents as well as reductions in the use of water for farming. Industry will work with Pharmaq, a global pharmaceutical company on vaccine development. In exporting to Europe, VASEP has signed an agreement for a European distribution centre in Zeebrugge, Belgium and will introduce an electronic traceability system called TraceVerified.

Thrust for Sustainability

During the Seafood Expo Global in Brussels, the Vietnam Directorate of Fisheries (D-Fish) and VASEP announced SUPA or 'Establishing a Sustainable Pangasius Supply Chain in Vietnam' project which will

Sabine Gisch-Boie (right) with project members at the SUPA booth, from left, Le Xuan Thinh, VNCPC, project leader SUPA project, Ngo Tien Chuong, WWF Vietnam, Duy Phan, sales representative, Caseamex (centre), Dang Thi Thuong, farm director, Vinh Hoan Corp.

Handling live fish (picture courtesy of Ngo Tien Chuong, WWF Vietnam)

run from 2013 to 2017. This EU co-founded project targets that by 2020, the pangasius production, processing and exporting sector will achieve product safety, and will also be environmentally, economically and socially sustainable.

The EU as a whole is the largest importer of pangasius. As the current supply of wild caught fish in the EU will only be enough at the current levels of consumption, future supply is dependent on aquaculture. This means that the EU will need to import fish to meet demand and that if it wants 'sustainably produced' seafood to be consumed in the EU, it has to help suppliers meet this requirement. The EU alone imports 22% of pangasius fillet production from Vietnam. The EU market will grow from a population of more than 501 million 2010 to a forecasted 522 million in 2030. The per capita consumption is projected to increase from 22 kg in 2010 to 24 kg per capita in 2030.

Vietnamese pangasius producers view the EU market as attractive. However, EU retailers are constantly concerned on the environmental and social impacts of pangasius farms and processing facilities.

The path to improvements is being led by the Vietnam Cleaner Production Centre (VNCPC) in collaboration with WWF and VASEP. At the end of the project in 2017, the aim of the SUPA project is to ensure that at least 70% of the targeted pangasius producers and 30% of feed producers, hatcheries and small independent production companies are actively engaged in cleaner production. The aim is also to ensure that 50% of targeted processing companies are able to provide sustainable products with ASC standards to the EU and other markets.

The SUPA project aims to promote sustainable certification (ASC), implement cleaner production to minimise waste, use of chemicals as well as energy. It will also train farmers, producers and government officials on certification and market requirements, conduct research through a model farm which will carry out tests on new techniques and promote responsibly farmed pangasius for the EU and other markets.

The strategy is to work with a network of both large and small players. The members are Caseamex, Vinh Hoan, South Vina, Godaco and Hung Vuong. In the current industry, Vinh Hoan is the major producer and exporter followed by Hung Vuong. The group focuses on sustainable production methods throughout the supply chain, from hatchery to processing. Each company or small farmer will be required to be more responsible for the environment at each step.

At the SUPA (Vietnam Pavilion) Seafood Expo Global, Sabine Gisch-Boie, project leader WWF Austria said, "We work together with ASC but the success will also depend on how we look at the markets. There should be a balance where with ASC certification, producers should be adequately rewarded after the effort and resources they have put into the production chain. We want retailers and consumers to acknowledge quality improvements and ASC certification. Environmental sustainability is a prerequisite of some markets such as the Netherlands, Austria and Germany."

WWF Austria is responsible for market promotion work within the SUPA project and has conducted a study on the potential of sustainably produced pangasius in the EU markets. Several retailers from Germany, Spain, UK, the Netherlands and France, interviewed said that besides food quality and safety, their requirements are also social and environmental regulations. In order to improve the image of a sustainably produced pangasius , a top European importer suggested that good stories are needed. The role of SUPA is to create positive stories from sustainably certified producers and to showcase that pangasius producers are serious in improving their production to meet standards imposed by the EU and other countries.

Rise and fall of Vietnam's pangasius in EU markets

By José Fernández Polanco

A market analysis on the influence of importers in its pricing and popularity

Marketing pangasius from Vietnam

The history of the Vietnamese pangasius in the European markets has several interesting issues from the point of view of market analysis. In the last ten years, the pangasius went from being an unknown marginal product to one of the most popular species consumed in the European Union (EU). After its heyday, it became the target of irate and unfair campaigns to discredit the fish, which decreased its popularity and price for final consumers.

The case of pangasius provides some important references for producers in developing countries which are targeting global markets. It does not matter how good and serious producers are, the keys for marketing success or failure lie in the hands of distant operators who are more concerned with their overall profits than in sustaining the image of a particular fish.

Arrival and market penetration (2002 – 2007)

At the beginning of the new century, pangasius exporters were successfully targeting the US market; all signs indicated the potential of consolidation and growth in an interesting and profitable market. The fish was very popular in supermarkets and restaurants, but at the same time, issues of mislabelling and cost competition arose with serious complaints from local channel catfish producers. The opposition from the local industry ended in an anti-dumping ban which went into effect in 2002, temporarily closing the doors of the US markets for Vietnamese pangasius.

Whilst the entry into the US market was being restricted, production however in Vietnam's Mekong Delta was increasing at a fast pace . Pangasius processors and exporters had no other choice but to seek alternative markets. The EU was identified as not only having the potential of replacing the incomes from the US exports, but its higher rates of fish consumption and a stronger currency gave rise to the anticipation of improving market returns in both quantities and values. Fillets of frozen pangasius soon arrived massively into the European markets.

Imports of frozen fish fillets from Vietnam were around 2,000 tonnes in 1999. Germany, with import volumes of about 600 tonnes per year, was the leading market, followed by the Netherlands, Belgium and France. By 2002,imports had risen but they were still a modest 5,600 tonnes. Germany, Netherlands, Belgium and France continued to be the main markets with a newcomer, Spain. Import volumes in 2003 reached 10,200 tonnes and increased to 43,400 tonnes in 2005. Imports of pangasius grew by 100% every year in the period following the anti-dumping ban in the US. The replacement of the US market with those in the EU was extremely successful, in terms of quantities. However, prices were decreasing from an average €3.54 (CIF) in 2002, to €2.35 in 2005.

There are several reasons for the fast penetration and success of pangasius in Europe. Convenience, absence of bones, smooth taste and the cheap price were the most common advantages. However, in addition to these were the gross margins from import to retail of over 300%, a reason by itself strong enough to fuel the expansion in import volumes.

Asymmetry of information

These high margins were attributed by economists as asymmetry of information. In contrast to the US, where the channel catfish is well known, the vast majority of the EU consumers have no idea what a pangasius looks like. They have very minimal knowledge of the fish,

how it is harvested and where it comes from. Added to this are issues of fraud such as mislabelling in the selling of defrosted fillets as fresh by some dishonest retailers. Consequently consumers do not have enough fundamentals to assess the value of the product.

The prices paid by consumers were considerably high compared with the cost of imports. In Spain, the price of one kilogram of pangasius fillets reached a high of €11.9 in 2007 whilst the average was around €7/kg, which was also the average price paid for other fish products in the same year. This meant that a Spanish consumer would not consider the price paid for the pangasius as expensive, since it was the 'normal' price for a popular fish. This allowed retailers to accrue large profits. Furthermore, the price in Northern European countries was even higher with much larger profit margins for importers.

Figure 1: European imports (tonnes/year) and price/kg for pangasius fillets from Vietnam (Jan-Dec 2002 to 2012)

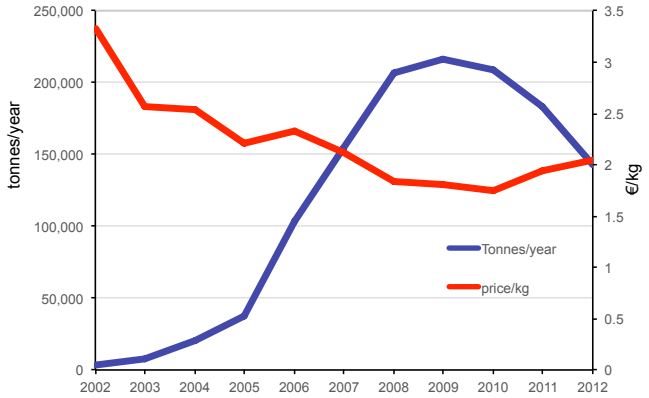


Figure 2: Mislabeling pangasius with flounder fillets.

Source: Research Group in Economic Management for the Primary Sector Sustainability, University of Cantabria, Spain

Figure 3: Presentation of pangasius at Spanish seafood markets

Retail formats: Traditional, Supermarkets & Large Surfaces.
Presentation. 100% Fillets, frozen or defrosted, packed or unpacked.

Source: Research Group in Economic Management for the Primary Sector Sustainability, University of Cantabria, Spain

Turbulence and discredit (2007 – 2010)

This lack of accurate information and consumer's knowledge on the pangasius was the main factor explaining the large margins obtained by traders and also one of the main drivers in the expansion of pangasius into the EU. However, it also opened the door for campaigns to discredit the product. Imports of frozen fillets from Vietnam reached 156,400 tonnes in 2007, and peaked to 226,900 tonnes in 2009. Prices, on the other hand, kept going down to a historic low of €1.62/kg in 2010.

During these years, local producers of several different species competing with the pangasius, aggressively reacted against the pangasius by disseminating information to discredit the fish to both consumers and traders. These campaigns were focused on presenting pangasius fillets as unsafe products which were arriving polluted or infected into the EU. The fact is that pangasius imports from Vietnam never had an official alert or recommendation against its consumption, or a ban of any kind in the EU. However, the groups behind these campaigns did not cease and even intensified their attacks. Since the pangasius fillets entered for the first time in the EU markets, this was the only extensive information received by consumers, who had no other sources of positive and favourable information.

The years of decline

It is not clear whether the campaigns to discredit the pangasius carried out between 2007 and 2010 affected the reputation of the fish. Despite a decrease in imports after 2010, many European consumers did not have any problem with eating pangasius. Public confidence in the domestic food safety control systems may have helped avoid consumers' panic. However, many consumers began to realise that pangasius was a farmed and imported product, and this negatively affected the price they were willing to pay.

With consumers willing to pay less, it was now difficult to sustain the large margins obtained during the early years of expansion. Moreover, in 2010, the Vietnamese industry entered into a financial crisis which motivated a rise in prices in 2010 and 2011; contributing to further decreases of the profit margins of the EU traders. Retailers began to lose interest in the pangasius as they were finding it more difficult to sell, which further depressed their profits. Prices decreased again in 2013.

At the same time with the decline in pangasius imports, tilapia imports, mainly from China, Indonesia and Thailand as well as Vietnam, have been increasing in the last two years. The pangasius will not disappear from the EU market, and still holds a considerably relevant market share. However, it does seem that it will now have to jostle for its piece of the market with other tropical species, which are fast filling any gap left by the pangasius.

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Certification bodies reduce duplication

A collaboration with FOS Aquaculture offers consumer labelling for more than two million tonnes of aquaculture products

From left, Kristian Moeller, Heiddis Olafsdottir, Paolo Bray and Trygve Berg Lea.

The global certification organisation, GlobalGAP holds two major press and news conferences a year. At the Seafood Expo Global (formerly European Seafood Expo) in Brussels, Belgium on May 7, Dr Kristian Moeller, managing director, announced several new initiatives and developments. The highlight at the event was a collaboration with Friend of the Sea-FOS Aquaculture. GlobalGAP certified aquaculture farms will only need to be assessed against a few additional sustainability criteria to become eligible to use the international consumer sustainability FOS label for aquaculture.

This recognition reduces duplication of farm audits considerably. In return, FOS certified farms will be able to add the GlobalGAP audit with the next annual re-certification audit. This offers consumer labelling for more than two million tonnes of aquaculture products.

Friend of the Sea (FOS) is an international non-profit certification scheme for products from sustainable fisheries and aquaculture. Those originating from aquaculture are reared with respect of critical habitat, with no use of anti-foulants, genetically modified organisms (GMOs) and growth hormones. Over 350 companies in more than 50 countries have relied on Friend of the Sea to assess the sustainability of their seafood origins. Audits are run on site by accredited independent certification bodies, and they are based on the best and most updated available scientific data.

Paolo Bray, director, FOS, Italy spoke on the 'Friend of the Sea aquaculture certification'. He said that in the past 10 to 15 years, there have been complaints from the public that there is a proliferation of certifications.

"With the signing of the agreement, we prove that we can collaborate positively towards a reduction in the number of labels. There will be savings with the reduction in double auditing and increase transparency and traceability throughout the whole production chain."

Consumers will be able to recognise seafood products covered by the collaboration as they carry the FOS label and the claim: "Responsibly farmed" with a GlobalGAP farm number: "GGN 1234567891092". The tracking system of GlobalGAP will be integrated into the FOS website. The benefits of this collaboration is that FOS is already visible for aquaculture and fisheries.

Aquaponics tilapia and open ocean cobia

GlobalGAP has now added tilapia produced in aquaponics and cobia produced in open ocean submerged cage systems to its growing list of certifiable species and systems. Combined with its full production chain verification program, this expansion moves it one step closer to becoming a full-range solution for responsibly farmed seafood. To date, there are 29 countries with GlobalGAP certified operations worldwide covering 16 different species. The aquaponics tilapia farming is in Selovita, US.

Heiddis Olafsdottir, Europe Region, Open Blue Global Services, Canada detailed some features at the open ocean farm in Panama for the production of cobia in submersible cages. The farm is seeking GlobalGAP certification. She said some attributes of farming in deep waters include effective waste dispersal and low nutrient footprint as dissolved nitrogen and phosphorus from fed fish are quickly assimilated into trophic webs via phytoplankton and associated grazers. The high levels of oxygen ensure that feed conversion efficiency is high. In addition, the pathogen load is low and disease outbreaks are rare. A monitoring study by the University of Miami, USA showed no detectable increase in nitrite and nitrate or ammonium levels downstream of farm.

Olafsdottir added that there is full traceability in the integrated operation and the cobia produced is sashimi grade marketed to three supermarket chains in North America. The company is targeting exports to the European markets for frozen fillet by 2015.

Feed industry committed to sustainability

The Norwegian National Technical Group for GlobalGAP Aquaculture and Aquafeed has initiated a working group on Responsible Operations Standard for Feed Manufacturers. The goal is to involve more stakeholders in this development. Coordination with other certification schemes for compound feed is taking place to provide more efficient solutions for the industry. To date, there are 23 countries with GlobalGAP certified compound feed worldwide.

On behalf of the National Technical Working Group, Trygve Berg Lea, international product manager, Skretting, Norway said, "Key manufacturing standards are already strong on the feed safety side. The Responsible Operations Standard for Feed Manufacturers will address basic issues on sustainability that suppliers face along the value chain; labour practices, human rights and the environmental impact of operations such as use of energy and packaging. We would like this to be a voluntary add-on to the existing standards."

More information: www.globalgap.org

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While modern aquaculture has been around for the past 40 years, it has not developed at the speed expected of an industry that has the enormous responsibility of creating an alternative source of seafood to the dwindling capture fisheries. Among the major contributing factors are the lack of direction, coordination and technology development to propel the industry into the next century. The **Aquaculture Roundtable Series (TARS)** aims to address these challenges by providing a platform for the public, private sector, academia, government and non-government organizations to share new knowledge, deliberate on critical issues, and identify a clear strategy to ensure the sustainability and profitability of the industry. **TARS** is a stakeholder driven effort to facilitate the sharing of information, reduce redundancy and improve efficiency. It is designed as a series of roundtable sessions to focus on specific sectors of the industry. TARS 2014 will bring into focus the **Recovery, Revival and Renaissance** of Asia's **Shrimp Aquaculture** industry.

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Working together for certification

A leading Vietnamese shrimp processor, a seafood trader in Europe and WWF Vietnam are working together to drive improvements in farming practices of small scale shrimp producers.

The panel, From left, Rens Elderkamp, Ngo Quoc Tuan and Ngo Tien Chuong

During the Seafood Expo Global in Brussels, the Aquaculture Stewardship Council (ASC) with the World Wildlife Fund, Vietnam (WWF), Quoc Viet, a leading Vietnamese shrimp processor and trader Anova Seafood showed how working together brings significant improvement in shrimp aquaculture practices.

The discussion centred around the ASC program, its progress and the role of supply chain partners in aquaculture improvement projects. The example was WWF Vietnam's work in supporting small scale shrimp producers in improving their operations to achieve ASC certification.

The panel comprised Ngo Tien Chuong, program coordinator-Aquaculture, WWF Vietnam; Ngo Quoc Tuan, vice president, Quoc Viet and Rens Elderkamp, senior sourcing/account manager – Frozen, Anova Seafood.

The session was facilitated by Daan de Wit of IDH (Sustainable Trade Initiative). IDH is working in partnership with WWF Vietnam to support the small scale farmers. Elies Arps, senior advisor Sustainable Markets WWF Netherlands, provided an overview of the shrimp improvement project. Around 70% of the shrimp production in Vietnam comes from small scale producers.

Quoc Viet works with the small holders in the WWF Vietnam project. "It is important to Quoc Viet to ensure its shrimp is responsibly produced." said Ngo Quoc Tuan. "By working with WWF Vietnam and the small holders towards ASC certification we will be able to assure our customers that their product has come from a trusted and reliable source."

Rens Elderkamp also explained how sustainable sourcing is at the heart of Anova Seafood. "Aquaculture is the future," he said. "We need to be able to meet the future demand for seafood but it must be done responsibly – we do not see this as a choice."

Ngo Tien Chuong of WWF Vietnam highlighted the importance of support programs in areas where small scale farmers have little to invest to make the necessary changes to improve their operations and meet the environmental and social requirements in the ASC standard.

"Through this project we can help farmers improve their operations and capacity and when they have met the ASC standards they are proving that they have measurably reduced any adverse impacts on the environment and local communities," said Chuong. "The farms are rewarded when they are linked to companies in the market that value ASC certification."

Chris Ninnes, ASC's CEO commented that the work of WWF Vietnam is an example of how cooperation with and amongst seafood industry can lead to improvements in aquaculture practices including small scale producers. "Due to concerns on environmental and social issues connected with shrimp farming, there is a growing market for responsibly produced and certified shrimp. To meet this demand it is important that the industry manages its practices responsibly."

"We now have 73 certified farms in our program and 1,053 ASC certified and labelled products in the market, this is a great start for a young program and clearly signals the interest of the market for responsibly farmed seafood. We certainly expect more farms to engage and make the necessary improvements needed to demonstrate that their production meets this growing demand for responsibly farmed seafood. Shrimp farms have been able to enter ASC assessment since the shrimp standard and audit manual were finalised in March 2014."

To improve their operations, IDH established a Farmers in Transition (FIT) fund to encourage and support the production of responsibly farmed shrimp. The program partners with retail, food service and supply chain companies to support producers in improving their farming practice and actively engages governments, industry and other stakeholders in the countries of production.

Shrimp farmers who would like to achieve ASC certification can apply for FIT co-funding from IDH.

For more information: ASC, www.asc-aqua.org IDH programs, email: corsin@idhsustainabletrade.com (Flavio Corsin)

ASC's shrimp standard

The standard and audit manual were finalised in March 2014. Certifiers were trained on the standard in December last year. Following this, shrimp farms have been able to enter ASC assessment. In June, Quoc Viet become the first farm to be assessed. The standard is available at http://www.asc-aqua.org/upload/ASC%20Shrimp%20Standard_v1.0.pdf

Leading aquaculture health provider is now in Asia

Cutting the ribbon, from left, Don Griffiths, operations director for Asia with Ben Raby, deputy director UK Trade and Investment and Peter Southgate, Benchmark and FVG UK director.

International aquaculture health company FishVet Group (FVG) launched its state-of-the-art aquaculture diagnostic facility in Bangkok, Thailand on June 18. This joins its other centres in Scotland, USA, Norway and Ireland.

Established in the UK in 1995 to provide veterinary health services for fish farming operations throughout Scotland, FVG has expanded to become the world's largest dedicated aquaculture health provider with a global team of over 50 veterinary surgeons, aquatic health diagnosticians, biologists and environmental scientists.

In Asia, the Group has a team of highly skilled aquatic health specialists, with extensive experience of the region and species-specific expertise of shrimp, tilapia, pangasius, all major carps and other key aquatic species. The team is based in facilities which includes over 300 m^2 of fully equipped, purpose-built laboratories which house advanced diagnostic tools including qPCR and digital histopathology capabilities. This allows FVG to provide rapid aquatic disease diagnostics and total aquaculture health services from farm to laboratory. A unique provision at the Bangkok laboratory is a digital scan scope that automatically scan slides, giving high resolution digital images that can be shared by email for second or third opinions by any member of the global team.

Speaking from the UK, FishVet Group Ltd managing director, David Cox, said: "We are delighted to be launching FVG in Asia. The aquaculture industry throughout the region is ambitious and fast moving, and our expansion there is demand-led. Earlier this month, the UN's Food and Agriculture Organisation (FAO) highlighted the increase in consumption of farmed fish with intake forecast to rise 4.4% in 2014.

"The accelerated growth of aquaculture industries brings many challenges, the most serious of which is the rise in disease. The Asian shrimp industry has been hit by early mortality syndrome (EMS), while Chile's salmon industry has been dealing with the impact of the ISA virus. European oyster prices have surged due to production declines in France, which has been hit by a herpes virus.

"Positioning a highly experienced technical team in Thailand will allow us to support the pace of growth in aquaculture in the region through the provision of rapid-response on-farm clinical services and world-class aquatic veterinary diagnostics."

At the launch, FVG Asia operations director, Don Griffiths said, "World aquaculture production is currently in excess of 80 million tonnes and Asia produces over 90%. At least an estimated 20% of world aquaculture production, however, is lost to disease. By supporting aquatic health, FVG will contribute both to food security and to supporting livelihoods."

Thailand was chosen as the new base for FVG's Asian operation as Bangkok is home to several recognised centres of excellence in aquaculture, namely the Center for Excellence for Shrimp Molecular Biology and Biotechnology (Centex) at Mahidol University, Kasetsart University, Asian Institute of Technology, the Department of Fisheries' Inland Aquatic Animal Health Research Institute as well as several leading feed and pharmaceutical companies.

FishVet Group (FVG) is an aquaculture health business owned by Benchmark Holdings plc. The company also provides environmental, biosecurity, educational and auditing services, and works extensively with government and non-government organisations, fish and shrimp hatcheries and farms, fisheries, regulatory authorities, academics, pharmaceutical, feed companies and retail chains.

Benchmark Holdings plc is a sustainable food chain business with three divisions: Animal Health which researches, manufactures and markets medicines and vaccines particularly for aquaculture, Sustainable Science, focuses on sustainable development in the food industry and Technical Publishing provides technology transfer through online publishing and education. It operates internationally with offices in the UK, Ireland, Norway, USA, Brazil, China and Thailand and currently employs over 200 people.

Peter Southgate (middle) with Dr Cherdsak Virapat, director general, Network of Aquaculture Centres Asia Pacific (NACA, left) and Dr Putth Songsangjinda, director, Marine Shrimp Culture Research and Development Institute, Department of Fisheries.

From Scotland to the World

In the early 1990s, three fish veterinarians Tony Wall, Mark Jones and Peter Southgate saw the need for a unique veterinary service for the salmon industry in Scotland. At that time, whilst salmon farming was expanding, its growth and the health of its stocks were impacted by sea lice and furunculosis. They then founded FishVet Group in Inverness, Scotland as a private practice providing diagnostic services to the industry.

"What we could provide was independent advice. At that time, farms mainly depended on veterinarians from feed companies and the diagnostics and health care from aquaculture pharmaceutical companies would be centred around their products. Farmers needed quick responses to their disease problems and solutions which were not aligned to specific products" said Peter Southgate, director at the launch ceremony.

"Gradually we expanded into an environmental group carrying out environmental impact monitoring to regulations, water quality, environmental assessments and audit services where we work with retailers such as Tesco and Marks and Spencer to ensure that their worldwide suppliers including those in farms in Asia comply with code of practices, fish welfare etc."

In 2005, with plans to broaden services overseas, the Fish Vet Group joined Benchmark Holdings, a synergistic move as the latter shared a similar philosophy - to ensure a safe and secure sustainable food supply. Together a larger team was created to develop the business.

"We became a professional outfit," said Southgate. "Our core business is still providing clinical services. Joining Benchmark, however, provided the strength and resources to expand our professional services and to provide a total aquaculture health package predicated very much on animal welfare and sustainability. It also enabled FishVet Group to fulfil ambitions to develop products to support the industry, in particular in the area of disease prevention with the production of new biocides and vaccines such as vaccines for sea lice. While our initial strengths were in salmonid production in Europe, Scandinavia, USA and Canada we have built teams with a wide range of expertise in all aquaculture species and systems."

"Asia has its own share of diseases and welfare challenges. Many years ago, in Scotland we also faced 50% mortality through disease as farms were small and generally, the understanding of fish welfare was poor. This has changed. As we can see, it is possible to improve as long as we can identify the problems.

"Today we have fulfilled our ambition to have a Fish Vet Group branch in Thailand, at the centre of global aquaculture and to support the production of safe and sustainable aquaculture products."

(More information: www. asia.fishvetgroup.com; www. bmkholdings.com Email: don.griffiths@fishvetgroup.com
Related article: Biosecurity in Aquaculture. Part 1: International considerations, p 41.

FIAAP, VICTAM & GRAPAS ASIA 2014

This international feed industry event was held from 8-10 April in Bangkok, Thailand. There were 219 exhibitors from 29 countries. This was a larger show than the previous one in 2014; the net exhibition floor area was almost 16% larger and had 32% more exhibitors.

Over the three days, there were 6134 visitors 63 countries to the shows; 28% were from outside Thailand, a slight decrease on the 6198 visitors attending the 2012 event. Almost 30% of the visitors to the exhibitions were of director level. The majority of the visitors, came from the animal feed, aqua feed and dry petfood production sectors. These visitor figures have been independently audited by an UFI approved auditor that was appointed by TCEB (Thai Convention & Exhibition Bureau).

Organisers attributed the lower figures to the following: civil unrest in Thailand although in Bangkok, it was well away from BITEC, the hotels and the business areas, general elections in Indonesia and India held at the same time and the disappearance of the Malaysian Airlines plane. A post- event survey completed by 99 exhibitors indicated that 93% would be exhibiting again at the event in 2016. Respondents scored 8.5 out of 10 for general organisation of the event.

The event was a perfect platform for exhibitors to launch new products and services to the market. Some of these were awarded the highly coveted Innovations Awards. FUMzyme, a purified enzyme from Biomin to detoxify mycotoxins in animals won the FIAAP Animal Nutrition Award. The runner up was Kemin with its multi-enzyme product. The Aquafeed Innovation Award was won by Norvidan for their NODS - Norvidan On-line Density System.

Advances in processing and formulation

This was the ninth Aquafeed Horizons Asia conference organised by Aquafeed.com. Suzi Dominy, reported a good turnout for the conference which features presentations covering processing, ingredients and formulation. The conference was opened by Dr Juadee Pongmaneerat, senior expert in Fishery Product Quality Inspection at the Thai Department of Fisheries who said that the needs of the aqua feed industry in Thailand range from improving feed conversion ratios, feed quality, feed traceability to market and trade issues such as with the use of fishmeal.

Joseph P. Kearns, Wenger Manufacturing, Inc., USA discussed the single use or multiple purpose extruder designs and the options which allow for a wide range of products to be made on the same equipment. He discussed how to select a machine, manage options as well as determine which system or option suits the need. In his presentation on high capacity and cost efficient aqua feed production, Finn Normann Jensen, Andritz Feed and Biofuel A/S, Denmark discussed the pros and cons of high capacity lines (15-25 tph) based on worldwide experiences. Jensen said that in Asia, among the challenges in aquatic feed production is plant efficiency, formula as well as process cost reductions, food safety, feed ingredients and process traceability.

In his presentation, Dr Cristian Atienza, Bühler, Switzerland explained how density and SME controllers can help make floating, slow sinking and sinking pellets. The presentation on drying technology by Justin Hamm, Bühler Aeroglide, USA gave an opportunity for participants to learn how to optimise the drying process to positively impact moisture uniformity, feed quality and performance.

Presenters in the second session covered developments in functional feed additives and use of protease in aquafeeds. Dr Peter Coutteau, Nutriad International NV, Belgium discussed the challenges in the control of *Vibrio parahaemolyticus*, the bacteria associated with the early mortality syndrome in shrimp farming in Asia. With new documentation available, Quorum Sensing (QS) is a new tool to tackle the syndrome and he discussed the use of synergistic blends of natural antimicrobial compounds which can function as powerful interrupters of bacterial QS signaling in a typical aquaculture pathogen. Professor Wing-Keong Ng, Universiti Sains Malaysia, described feeding trials where a prototype organic acid developed in Malaysia was added into diets for the freshwater prawn, marine shrimp and tilapia. Dr Matthew Briggs, Ridley AgriProducts, Australia described results of laboratory and commercial trials of a novel bioactive feed ingredient Novacq™ fed to the marine shrimp *Penaeus monodon*. The feed ingredients was developed by CSIRO, Australia.

Use of protease, said Dr M A Kabir Chowdhury, Jefo Nutrition, Canada, can help in digestibility of poor protein sources. It will improve intestinal health of the animals, ensure better growth and will increase digestible protein contents in the feed. According to Dr Richard

The Wenger team, Marc Wenger (left) and Joseph Kearns (centre right), Wenger USA, Rock Chen (third left), Wenger Asia Co. Ltd, and Cliff Zhou (right) , manager Service China and visitors, Chen Yen Song, managing director, Grobest Corp. Ltd (second left) and Supak Chaikachorn, general manager of Grobest tilapia farm (second right).

The DSM team and visitors, from left, Dr Jacques Gabaudan, DSM, Aquaculture Centre Asia Pacific, Thailand, Vo Phu Duc, director, Vinh Hoan Collagen 5 Corp, Vietnam, Robert Redman, general manager, DSM, Thailand and Thomas Wilson, vice president, Thailuxe Feeds, Thailand.

Biomin's Dr Pedro Encarnação, director Business Development - Aquaculture (right) and Dr Jan Vanbrabant, CEO, Asia Pacific with the FIAAP Animal Nutrition Award

The Aquativ-SPF Diana team and guests from Hoc Po Feeds, Philippines, from left, Nguyen Anh Ngoc, SPF Diana (Thailand) Ltd, Princes Joy A Del Rosario, Kristine Cordova, Romy Tambunan, Aquativ Indonesia, Paul Seguin (SPF Diana, Thailand) and Kathleen R Marcos.

Smullen, Ridley AgriProducts, Australia, for too long feed producers meet farmers demand for cheap feeds with lower specification raw materials and adjusting formulations. However, the net value of the feed is in the final cost of shrimp production. Commercial farm trials carried out over 3 years with marine shrimp *Penaeus monodon* fed optimal feeds (which costs more than regular feed used by the farms) showed improvements in weight gain of at least 10%. Feed conversion ratio improved and in particular, to as low as 1.15 when the industry began to farm post larvae from domesticated brood stock.

VICTAM and FIAAP

Victam is Asia Pacific largest show for the production and processing of animal feed, petfood and aqua feed. Similar to previous years, it featured the leaders in this sector. Wenger featured their new innovation, the Wenger TX-3000 twin screw extruder. Joseph Kearns, Aquaculture Process manager, said that this raises the bar on high capacity small diameter aquatic feed production via twin screw extrusion. At the Extru-Tech Inc booth, Dr Enzhi Michael Cheng said that the one tonne per hour (tph) to 17 tph single screw extruder with a double shaft conditioner is more efficient and has less wear and tear on parts. Extru-Tech also has a small extruder with outputs from 50-300kg depending on products for research or trial purposes. At Buhler's large booth, the complete equipment for aqua feed production was led by the CompacTwin™ twin-screw extruder.

FIAAP is the show for the latest in additives and ingredients. Products with applications in aquaculture include phytogenics, such as Biomin® P.E.P. 125 which was tested in the pangasius catfish, among others. Dr Eckel has a new product. Hydrolysates of poultry origin are available from Soleval as well as from Ge Pro under the GoldMehl range. Aquativ, part of the SPF Diana Group has marine based hydrolysates (p28-30). For aquaculture, members of the Korean Feed Association marketed probiotics (Marine Labs, CTCBio and Biopro, Daeho Co Ltd), phytase 5000 (E&T Co Ltd), pellet binder (Aquapulip®, Hanpel Tech, Co Ltd) and fishmeal from tuna (Woojinfeed Ind, Co Ltd).

The latest from DSM Nutritional products is DHAgold™ a source of DHA omega-3 fatty acids derived from dried algae. This innovative feed ingredient improves sustainability by allowing aquaculture to employ fewer fish-based products while maintaining healthy DHA omega-3 levels. This is aside from the yeast based Rovimax Nx to strengthen the immune system. The team from Empyreal, part of the commercial milling business of Cargill marketed Lysto as the 'new power in protein'. The product has been in the market for the past 12 months. It is derived from corn and has 75.8% crude protein.

FIAAP, VICTAM & GRAPAS ASIA 2016 is tentatively scheduled for 17 -19 February 2016 in Bangkok, Thailand

Tyson Animal Nutrition Group, from left, Boon Tan, from the World Trade Center, director, Asia Trade Development, Jeannie Ozlanski, associate product manager, Chuck Malone, director, Sales and Procurement and Mark Occhipinti, manager, Meals and Fat Sales. Tyson is focussing on the aqua feed industry for its chicken and feather meals and fats as alternatives to marine sources.

From left, Allen Ming-Hsun Wu, Regional manager, Nutriad Asia Pacific with Kevin Huang, Daniel Chen and Chan Chi Chen, Go Far International Co Ltd, Taiwan.

Special hydrolysed feather meal with very high digestibility

The Soleval team, from left, Damien Duchenne, Christian Roques and Romain Fillières

In June 2013, the European Union lifted the ban on the use of poultry and pork by product meals in aqua feed. This move has opened markets for European companies such as **Soleval**. At FIAAP Asia 2014, the Soleval team promoted HyPro™ Aqua HDFM 90, a special hydrolysed feather meal with 83% invivo digestibility. As it has a low level of ash (<3%), high protein content (>85%) and is a source of high energy, it is being marketed as a replacement for fish meal. In comparison, poultry meal has 65% crude protein and fish meal 70%. The product is produced from raw material collected from registered and certified slaughterhouses and Soleval plants are certified ISO 22000 by Bureau Veritas.

"The value of this ingredient is in its very high true invivo digestibility. It is comparable to poultry meal but on top of this, it has circa 20 points of more protein content. This combination of a very high protein content and a very high digestibility makes our HyPro™ Aqua HDFM 90 an ingredient definitely superior to traditional standard feather meal. The naturally high level content of sulphur amino acids, cysteine and methionine at 5.5%, enhances flavour and palatability and the smaller peptides serve as attractants. HyPro™ Aqua has low levels of biogenic amines and is free from contaminants. In diets, we suggest this as replacement for fish meal, soy protein concentrate and corn gluten," said Christian Roques, sales manager, Finished Products Nutrition. "The target now is aqua feeds in the Chilean and Mediterranean markets which are mainly for salmon, sea bass, sea bream and rainbow trout and for the Asian markets, for the shrimp, pangasius and tilapia.

"Aqua feed producers are constantly looking for high quality protein sources. The market for suppliers is very competitive as pet food producers also vie for the same products. One day we will find an equilibrium. Nowadays, we can see that the animal protein meals (feather and poultry meals) compete in the same market as fish meal and soybean meals. Although plant meals have high crude protein levels and are highly digestible, the disadvantage is the presence of anti-nutritional factors or ANFs. At this show, we have seen a strong interest from aqua feed formulators and nutritionists in HyPro™ Aqua," said Romain Fillières, director R&D and Technology.

"We are running trials in shrimp and tilapia here in Thailand. These cover growth and digestibility and results will be available at the end of 2014."

Soleval is a division of Akiolis Group, in turn a subsidiary of the international group Tessenderlo. This is the second exhibition for Soleval in Asia.

Phytogenic additives

For the past 20 years, since 1994, Germany based feed additive company **Dr Eckel GmbH**, has been developing acidifiers, and pre- and probiotic products for the swine and poultry industries. Since 2006, when the use of antibiotic growth promoters was prohibited in the European Union, the strategy was then to further develop phytogenic products with anti-inflammatory effects and some of these products were found to have similar benefits in fish. At FIAAP Asia 2014, Angela Kuhn, Global Sales, explained the products available for aqua feeds.

"In fish, we also have a problem with inflammatory effects on the gut when we try to replace ingredients derived from marine fisheries with alternatives such as plant meals and oils, including soybean meal and soya oils. With this in mind, we took our phytogenic concept further with our latest innovation Anta®Ox FlavoSyn."

This new product shows the strong synergistic effects of various flavonoids in contrast to just one type of flavonoid. The synergistic acting natural antioxidants prevent inflammation and oxidative stress leading to better growth performance. It was nominated for the FIAPP 2014 'All About Feed' innovation award.

"The product has been tested on salmon in order to improve critical periods such as the transition phase from freshwater to marine environments. Another aqua feed product is the phytogenic product Anta® Phyt Aqua. This is a combination of natural plant extracts, essential oils and herbs and additionally, a prebiotic complex. It has been fine tuned for aquatic species. The work in carps showed that final weight improved by 5% and daily weight gain by 11%. The feed additive supports nutrient absorption and a healthy gut flora."

In the case of organic acidifiers, Kuhn said that the effects shown in swine are also seen in fish. Subsequently trials with shrimp, tilapia and pangasius have proven this and the microencapsulated product called Latibon®Plus ME, has been successful in shrimp farms in various countries. It is now registered for sale in Indonesia.

"Our role is to carry out trials and conduct seminars with our products. In the Philippines, our initial success with the use of the organic acidifiers in shrimp and tilapia farming has partially translated to a change in feed formulations after working closely with feed mills," said Kuhn.

"Currently we are working with selected universities in Thailand, Vietnam and the Philippines to continue our trials. In addition, we now have an official research grant to further invest in products developed specifically for aquaculture," added Kuhn.

Angela Kuhn (right) with Marc Denker (left) and Wouter Vullings at the Dr Eckel booth

MARK YOUR CALENDER

"DEFINING QUALITY IN SEAFOOD"

29 - 31 OCTOBER 2014
BALI NUSA DUA CONVENTION CENTER, INDONESIA

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The Exhibition

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The Seminar for Micro/SME

Seeing Quality as Business Investment

To produce qualified seafood products, comes with a cost that is sometimes unbearable. the list does not stop on a savvy tech processing cost; it goes way up and finally a question is asked: do you really need to add the list with certification? This session will switch your perspective of "cost" into "Investment".

Trick & Serve: Food Science & Savety

Apart from the competitive price and how it presents buttery delicate taste, escolars consist of wax esters that can cause gastrointestinal symptoms. It has been known that the fish are safe to eat if they are consumed in portions smaller than six ounces, but are there any other methods to produce safe-consumed escolar? Fine out more on how you could turn this tricky fish into a safe promising business.

Get Into The Marketing Chain

The initiation to seafood business and entering the market is a session for Micro and SME to provide comprehensive understanding operations best practice of Micro/ SME, especially facing the globalization and Free trade. The session expects to encourage the micro/ SMEs effectively and efficiently operate in seeking productivity and margins.

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Director of R&D to enhance Zeigler's lead

Dr Craig L Browdy has joined Zeigler Bros Inc as the director of Research and Development since May 2014 to further strengthen the company's product and technology development programs. With greater emphasis on R&D, Zeigler anticipates maintaining its continued leadership in the development and commercialisation of feeds and technologies to support expansion of profitable aquaculture systems worldwide. Tim Zeigler, vice president, Sales and Marketing explained: "Scientific innovation has always been at the heart of our corporate culture, and we see continuing investment in this area as a key component of our future growth strategies".

Browdy has over 30 years' experience in aquaculture, managing commercial, academic and government research programs. A past president of the World Aquaculture Society, Browdy's research has focused on the application of aquaculture technologies to improve availability of seafood resources. His work has applied basic science and innovative technology development to commercialisation of new products, advancement of production systems, and improvement of fish and shrimp health and nutrition. "I'm looking forward to working with the Zeigler team to further the development of aquaculture and to make contributions to the application of effective products and technologies for Zeigler customers worldwide," said Browdy.

Zeigler is a technology-based feed manufacturer, with a strong emphasis on customer satisfaction and nutritional innovation for all stages of aquaculture development. The company reaches global markets through its franchising program and worldwide distribution network. In 2013, it was awarded for its excellence in exporting by the US Department of Commerce. Zeigler has a dedicated team specialising in aquaculture production, feed processing, nutrition, biology and international logistics. Knowledgeable and passionate employees are absolutely essential to the company's highly diverse and unique product offerings. More information: www.zeiglerfeed.com

New Asia Pacific manager at the new Singapore hub

Guillaume Drillet (left) and Jørgen Erik Larsen at World Aquaculture 2014 in Adelaide, Australia.

The DHI Aquaculture Business Partnership (ABP) has transferred its regional hub from Malaysia to Singapore, where DHI recently developed its regional Research Centre and Environmental Laboratories in the Clean Technology Park. APB supports socio-economic and environmentally sustainable aquaculture production worldwide. **Jørgen Erik Larsen** will continue to manage the activities globally with a strong focus on the Americas, while **Mads Birkeland** will continue in his position as the Europe/Middle East Manager.

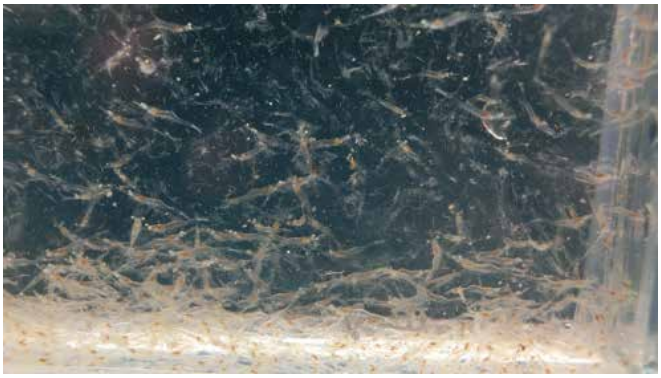
Dr Guillaume Drillet has been appointed the new Aquaculture Business Area manager for Asia Pacific. He'll be responsible for co-ordinating DHI's core activities in the region; environmental impact assessments, site selection studies, water quality monitoring, laboratory services, hydrodynamic studies, water treatment and environmental studies which includes ecological modelling and regulatory testing (ecotoxicology and third party verification).

As a scientist trained in Denmark, Florida (USA), Scotland, France and Singapore, Drillet has accumulated vast experience in plankton ecology, aquaculture, ballast water invasions and fisheries – both in the private and public sectors. Prior to this new position, he was responsible for building the capacity of the DHI Ballast Water Centre in Singapore. He has also worked with Akvagroup and FishLab in Denmark. More information: gdr@dhigroup.com

Controlling diseases in shrimp

A collaborative effort has resulted in an innovative protocol to control shrimp diseases.

Vannamei at DOC 30 weighing an average 9-10g using the proprietary Nupola protocol.



Massive PL10 molting after immune priming for cleaner, healthier exoskeletons. Highly active vannamei shrimp post larvae are subjected to a series of immune priming at the hatchery and nursery stages.

Together, Shizenature Pte Ltd and Singapore Biotrade have established a novel and effective application to control shrimp diseases, in particular the early mortality syndrome (EMS) at both the pond and hatchery stages. The successful protocol has been called Nupola.

The key success factor is the use of a combination of several fermented fractions and extracts at the nursery stage for 14 days. The Nupola protocol was found to be very effective in stopping the appearance of current diseases at post larvae stages PL1 – PL10. However, to be effective, it still requires good farm practices.

The protocol focus on stimulating the cellular immunity of shrimp to fight off pathogens. One key mechanism involves increasing oxidases and peroxidases to a higher level. The strategy alternates between immune priming and growth activation. The latter allows the shrimp to overcome energy metabolites depleted from the first initial immune boosting. Both growth and immunity cannot occur concurrently for optimal cellular growth. This approach using the company's proprietary fermented mixes and culture protocol has been successfully achieved in selected farms. Depending on the feeding patterns and farm pond conditioning, achievable growth rates vary between 15 and17g at 60 days of culture (DOC 60).

The entire objective is to reduce as much infection before pond stocking by significantly enhancing the immune reaction and priming. In some extreme cases, heavily infected post larvae have been wiped out within a day or two right after the first treatment. This approach saves time and money as the farmer is able to focus on good quality post larvae rather than face crisis or losses at a much later DOC. However, the company cautions the importance of adhering to the new unconventional procedures. In addition, there is an absolute need to still maintain good farm and hatchery practices.

More information: Email: shizenature@yodenza.com, arthur@gutacean.com

Exclusive animal drug status in the USA

In May, Axcentive Sarl, with its headquarters located in France announced the imminent award of a New Animal Drug Application (NADA) approval for the use of Halamid® in aquaculture in the USA. The approval will be granted by Food and Drug Administration (FDA) Center for Veterinary Medicine.

The approval covers 3 label claims: control of mortality in all freshwater-reared salmonids due to bacterial gill disease, walleye due to external columnaris disease and all freshwater-reared warm water finfish due to external columnaris disease. The product will be marketed in the US as Halamid® Aqua and is available in 25 kg drums and 5 kg buckets

Paul Raadsen, executive director at Axcentive said, "A key factor in the success of this project has been the cooperation between many agencies and organisations such as the Federal-State Aquaculture Drug Approval Partnership Project, the Aquatic Animal Drug Approval Partnership Program, the Upper Midwest Environmental Sciences Centre, the National NADA Coordinator (currently Roz Schnick Consulting, LLC) and Axcentive,"

The sponsor, Axcentive Sarl, funded a part of the studies done by other research institutes, completed the requirements for toxicology, environmental safety, microbial food safety, and chemistry, manufacturing and controls. After many years of effort, the company completed the requirements for all major and minor technical sections which led to the final submission and approval of the Administrative NADA.

Raadsen added, "This is an important approval for the US aquaculture industry. Halamid® Aqua will be the second waterborne drug approved for disease claims for finfish in almost 30 years. It will be the third aquaculture drug with an original approval covering multiple label claims for use in a variety of finfish species as well as the fourth aquaculture drug to gain NADA approval under the Minor Use and Minor Species Animal Health Act, entitling us to seven years of exclusive marketing rights for the approved label claims."

Axcentive, the outcome of a management buy-out of Akzo Nobel's Sulfo products group, provides specialty products based on sulfonamide chemistry. Its products are used in disinfectants, pharmaceutical synthesis and specialty coatings additives. The company supplies products worldwide under the Halamid, Ketjenflex and Ketjensept brand names. More information: info@axcentive.com

INDONESIAN AQUACULTURE 2014

Jakarta, Indonesia, 26 – 29 August 2014

Following the success of Indonesian Aquaculture (INDOAQUA) 2012 in Makassar in South Sulawesi, organisers of this biennial event have scheduled INDOAQUA 2014 in Jakarta. It will be held from 26-29 August at the Atlet Century Park Hotel. The theme is "Aquaculture Business and Food Security". The event comprises a technical conference and trade show. The conference program will have presentations from invited speakers as well as contributed papers organised into several sessions.

INDOAQUA 2014 is hosted by the Directorate General of Aquaculture (DJPB), Ministry of Marine Affairs and Fisheries, Republic of Indonesia. The aim is to address the current aquaculture issues and contribute to economic growth of the industry in Indonesia. Organisers said the biennial event will be the venue to learn the latest technology in aquaculture in Indonesia and it will also be the opportunity to invest in the Indonesian aquaculture sector. The policy direction of DJPB is 'Aquaculture Industrialisation based Blue Economy'. The target is not only to expand production volumes but also production of quality and high value added products. It also wants the industry to be more competitive and ready for the ASEAN Economic Community (AEC) in 2015. The leading commodity species are shrimp, seaweed, catfish and milkfish.

For more information, Shirley Ivone +62 813 158 62409 Hani Wijianti +62 812 810 96338 Email: indoaqua2014@yahoo.com/ indoaqua2014#@gmail.com

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Right on track for TARS 2014

In a press release, Corporate Media Services and Aqua Research, organisers of the fourth Aquaculture Roundtable Series (TARS 2014) affirmed that the event is set to take place in Phuket, Thailand as planned from August 20-21 2014. Dr Zuridah Merican, Conference Chair and Editor of Aquaculture Asia Pacific magazine said," Although the main concerns have been in Bangkok and the event is in Phuket, nevertheless we have been monitoring the situation in Thailand. Our contacts in Thailand have assured us that despite the military takeover, businesses and MICE facilities such as convention and exhibition centres and hotels have been operating as normal. At no time, did this affect our planning for TARS 2014."

She added that Thailand's military junta lifted the curfew on June 13 and all businesses and services, and tourist travel throughout Thailand are back to normal operations over the last three weeks. This demonstrates the country's commitment to promote its tourist sector and ensure the safety of all visitors to the country.

In its fourth successive year, TARS 2014 will focus on ***Shrimp Aquaculture: Recovery • Revival • Renaissance***. The two-day meeting will address current issues threatening the long-term sustainability of Asia's shrimp aquaculture industry, namely disease challenges, marketing, culture technology and practices, nutrition and health interactions, as well as rising prices, production and supply shortfall. TARS 2014 promises a comprehensive agenda of shrimp aquaculture 'state-of-the-science' plenary presentations by a host of international experts, and thought provoking, interactive breakout sessions with industry participation, that are hallmarks of this critical series.

TARS 2014 is supported by the Department of Fisheries, Thailand. Industry sponsors include INVE Aquaculture, Biomin, Jefo, Alltech, DSM, Nutriad and Biomar.

More information: www.tarsaquaculture.com

Commercial director in Singapore

Kemin Europa NV has announced the appointment of **Mathieu Cortyl** as from July 7, 2014.

Mathieu Cortyl obtained his masters degree in general agriculture with a specialisation in animal nutrition in 1989. His first assignment was in a feed additives company in Switzerland, where he worked as a nutritionist in charge of technical matters. He then joined one of the major French feed mills as responsible for their swine operations. Since 2001 when he moved to Singapore, he has been dealing with technical, marketing, and sales issues in the feed additives sector, in the Asia and Pacific regions.

"The two commercial directors Cortyl and Dr Robert Iniarski will work closely together to realise the ambitious growth plans of the company in the EMEA region," says Dr John Springate, president Kemin Europa NV. More information: Website: www.kemin.com

September 2-4, 2014, Hong Kong

Seafood Expo Asia show is set to return to Hong Kong on September 2-4, 2014. Formerly known as the Asian Seafood Exposition, the exhibition will take place at the Hong Kong Convention and Exhibition Centre, will provide buyers and suppliers of seafood with a platform to network and explore new business opportunities in markets internationally and throughout Asia.

Now in its fifth year, Seafood Expo Asia is a major trade event for the seafood community. The 2013 edition attracted more than 7,500 seafood professionals from 75 countries. In 2013, over 170 suppliers exhibited their live, fresh, frozen and packaged seafood products. Visitors represent a mix of industries including but not limited to importers, exporters, distributors, chefs, and buyers from large foodservice and retail establishments.

Mary Larkin, Group vice president of Seafood Expositions for the organiser, Diversified Communications said, "Hong Kong is a primary trading hub where buyers make large purchasing decisions for seafood products that are shipped to China and other parts of the world. Due to the territory's central location, free port status and position as a regional purchasing and distribution centre, Hong Kong serves as an important re-export hub for seafood products in Asia."

Larkin added, Hong Kong today remains one of the world's largest per capita consumers of seafood. Figures reported by the USDA Foreign Agricultural Service show that Hong Kong's market for seafood is valued at approximately USD 2.68 billion, whilst research from the Hong Kong Tourism Board indicates that 30-40% of all seafood imported into Hong Kong is re-exported to other countries. FAO data also reveals that more than 500,000 tonnes of seafood is consumed in Hong Kong annually averaging 71.6 kg/capita, 3.9 times higher than the global average. Imports make up 95% of the value of all aquatic products in the territory where culturally the population continues to show a strong preference towards fresh fish and seafood. Some 75% of local requirements for seafood are purchased as fresh or chilled products.

"Hong Kong is the gateway for trade and an ideal entry point to mainland China," said Larkin. "With middle class incomes on the rise, China's appetite for seafood is rapidly shifting and increasing as consumers become more conscious of quality and taste. Many exhibitors at Seafood Expo Asia are therefore companies from across the globe wishing to cater to a Chinese market where consumption is expected to climb from the current 12kg/capita to 36kg/capita by 2020."

Due to growing demand in China for premium seafood, there will be a particular emphasis on premium species such as lobster, crab, abalone, scallops, oysters, sea urchin, mussels and caviar. Many hotels and restaurants across the region offer premium seafood as part of their menus and it is anticipated that these products will continue to be popular. The exposition takes place alongside Restaurant & Bar Hong Kong. This will give Seafood Expo Asia instant face-to-face access to more than 14,000 high volume catering, restaurants, supermarkets, importers, distributors and wholesalers from Asia-Pacific all in one location. More information: www.seafoodexpo.com/asia
For qualified seafood professionals, Seafood Expo Asia is free to attend by visiting http://www.seafoodexpo.com/asia/reg.

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

Our editorial calendar reflects the new and existing issues in aquaculture in Asia Pacific which we see as most relevant to the industry. We will continue to present trends and update you with technologies to help the aquaculture industry in Asia Pacific move to the next level.

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Number	1 – **January/February**	2 – **March/April**	3 – **May/June**	4 – **July/August**	5 – **September/October**	6 – **November/ December**
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Industry Review *Trends and outlook, demand & supply*	Marine Shrimp	Tilapia	Aqua Feed Production	Catfish	Marine fish	Freshwater Fish/Prawn
Feeds & Processing Technology *Technical contributions from feed industry*	Functional Feeds Hatchery/Nursery Feeds	Fishmeal & Fish Oil Replacements & Novel Feed Ingredients	Extrusion & Processing Technology	Feed Enzymes, Additives & Probiotics	Feed Safety & Hygiene Processing & Environment	Nutrition & Formulation
Production Technology *Technical information and ideas*	Blue Revolution/ New Culture Technologies	Disease Biotechnology	Recirculation Aquaculture Systems	Sustainable & Responsible Aquaculture	Genetics in Fish/Shrimp	Aeration Technology & Waste Removal
Aqua business Feature articles	Experiences from industry and opinion article covering role models, benchmarking, health management, SOPs, social investments, CSR, ancillary services etc					
Markets	Developments in markets (live fish, product development, market access, certifications, branding, food safety etc)					
Company/Product news	News from industry including local and regional trade shows					
Deadlines for Technical articles	**November 10, 2014**	**January 26**	**March 30**	**June 1**	**July 27**	**September 28**
Deadlines Advert bookings	**November 17, 2014**	**February 2**	**April 6**	**June 8**	**August 3**	**October 5**
Show Issue & Distribution at these events as well as local and regional meetings ****Show preview***	**Aquaculture America 2015** February 19-22 New Orleans, USA	***Aquatic Asia/VIV Asia** March 11-13 Bangkok, Thailand **Global Seafood Expo 2015** April 21-23 Brussels, Belgium	***World Aquaculture 2015** May 26-30 Jeju, Korea	**The Aquaculture RoundTable Series (TARS 2015) - TBA** **Vietfish 2015** TBA Ho Chi Minh City, Vietnam	**20th China Seafood & Fisheries Exposition 2015** November China (TBA) **10th Philshrimp Congress,** General Santos (TBA)	

21st Annual Practical Short Course on Aquaculture Feed Extrusion, Nutrition and Feed Management

September 21-26, 2014, USA

A one-week Practical Short Course on Aquaculture Feed Extrusion, Nutrition and Feed Management will be presented on September 21-26, 2014 at Texas A&M University by staff, industry representative and consultants.

This program will cover information on designing new feed mills and selecting conveying, drying, grinding, conditioning and feed mixing equipment. It will also review current practices for preparing full-fat soy meal processing; recycling fisheries by-products, raw animal products, and secondary resources; raw material, extrusion of floating, sinking, and high fat feeds; spraying and coating fats, digests and preservatives; use of encapsulated ingredients and preparation of premixes, nutritional requirements of warm water fish and shrimp, feed managements and least cost formulation. There will be practical demonstrations of sinking, floating, and high fat aquafeed on four major types of extruders (dry, interrupted flights, single and twin screw), using various shaping dies. Other demonstrations include: vacuum coating and lab analysis of the raw material for extrusion.

Reservations are accepted on a first-come basis. More information: Email: **mnriaz@tamu.edu** (Dr. Mian N. Riaz) Web: **http://foodprotein.tamu.edu/extrusion**

2014

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

July 31-August 1
PAES Recirculating Aquaculture Technology Workshop
Apopka, Florida, USA
Email: PAES.General@Pentair.com
Web: www.PentairAES.com

August 6-8
Vietfish 2014
Ho Chi Minh City, Vietnam
Email: tienloc@vasep.com.vn
(Nguyen Tien Loc)
Web: www.en.vietfish.com.vn

August 20-21
TARS 2014 Shrimp Aquaculture
Phuket, Thailand
Email: conference@ tarsaquaculture.com
Web: www.tarsaquaculture.com

August 22-24
10th International Conference on Recirculating Aquaculture
Roanoke, Virginia, USA
Web:www.recircaqua.com

August 26-29
Indonesian Aquaculture 2014 (Indoaqua)
Jakarta
Email: indoaqua2014@yahoo.com/ indoaqua2014#@gmail.com

September 2-4
Seafood Expo Asia
Hong Kong
Web: www.asianseafoodexpo.com

September 3-5
9th Shanghai International Fisheries and Seafood Exposition
Shanghai, China
Email: international@sifse.com
Web: www.sifse.com

September 21-26
21st Annual Practical Short Course on Aquaculture Feed Extrusion, Nutrition and Feed Management
Texas A&M, USA
Email: mnriaz@tamu.edu (Dr. Mian N. Riaz)
Web: http://foodprotein.tamu.edu/extrusion

October 7-8
Aqua Fisheries Myanmar 2014
Yangon, Myanmar
www.veas.com.vn

October 14-17
Aquaculture Europe 2014
Donostia–San Sebastián, Spain
Web: www.easonline.org

October 29-31
Indonesia International Seafood and Processing Expo 2014 - IISP2014
Bali, Indonesia
Email: info@iisp2014.com
Web: www.iisp2014.com

November 5-7
China Fisheries and Seafood Expo
Qingdao, China
Email: jennie8888@seafare.com (Jennie Fu)
Web: www. chinaseafoodexpo.com

November 4-7
Latin American & Caribbean Aquaculture 2014,
Guadalajara, Mexico
Email: mario@marevent.com
(Mario Stael for trade show)
Web: www.was.org

November 6-8
Aquamar International Mazatlan
Sinalao, Mexico
Web:www.aquamarinternacional.com

November 24-28
9th Symposium on Diseases in Asian Aquaculture (DAA9)
Ho Chi Minh City, Vietnam
Web: www.fhs-afs.net

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Eric Barratt
Sanford Fisheries Ltd.

November 5-7, 2014

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For more information contact Jennie Fu
jennie8888@seafare.com

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TARS 2014
The Aquaculture Roundtable Series

SHRIMP AQUACULTURE: RECOVERY • REVIVAL • RENAISSANCE

20-21 August 2014, JW Marriott Resort & Spa, Phuket, Thailand

PROGRAM

Day 1, August 20, 2014

0715 – 0755 Registration

0810 – 1010
Session 1: State of Industry & Marketing

- **State of the Shrimp Aquaculture Industry in Asia**
  Daniel F Fegan, *Regional Technical Manager, Aquaculture Cargill Animal Nutrition, Thailand*
- **Market Driven Production: Global Perspectives**
  Hervé Lucien-Brun, *Aquaculture Specialist, France*
- **Effect of EMS on Thailand's Shrimp Industry: A Country Perspective**
  Panisuan Jamnarnwej, *President Emeritus, Thai Frozen Foods Association, Thailand*
- **Farming Vannamei Shrimp the Black Tiger Way – Industry Perspective**
  Manoj M Sharma, *Director, Mayank Aquaculture Pvt Ltd, India*

1010 – 1030 Morning Break

Session 2: Learning and Surviving Diseases

1030 – 1200
Part 1: Challenging Times

- **Update 2014 on Current Asian Shrimp Disease Threats Including EMS/AHPND**
  Tim Flegel, *Director, Centex Shrimp, Faculty of Science, Mahidol University, Thailand*
- **Identification and Validation of Molecular Markers for Genetic Improvement of Shrimp**
  Chu-Fang Lo, *Dean and Chair Professor, Institute of Bioinformatics and Biosignal Transduction, National Cheng Kung University, Taiwan*
- **Does Specific Acquired Immunity Exist in Shrimp? Moving Dscam Research from Benchtop to Pondside**
  Han-Ching Wang, *Associate Professor, Institute of Biotechnology, College of Bioscience and Biotechnology, National Cheng Kung University, Taiwan*

1200 – 1230 Q & A Session

1230 – 1400 Lunch

1400 – 1500
Part 2: Our Future

- **Developing a Robust Shrimp via Genetic Selection – The Theory and Practice**
  Thomas Gitterle, *Breeding and Genetics Director, SyAqua Group, Thailand*
- **Fighting Pathogens: Choosing from a Range of Molecular Mechanisms**
  Tim Goossens, *R&D Engineer, Nutriad International, Belgium*

1500 – 1520 Afternoon Break

1520 – 1720
Session 3: Culture Technology and Practices

- **Improved Shrimp Hatchery Techniques, Post-larval Quality and the Link with Grow-out Performance**
  Roeland Wouters, *R&D Engineer, INVE Technologies, Belgium*
- **Country Perspective: Proactive Management to Keep Diseases Away**
  Soraphat Panakorn, *Technical Sales and Support Manager, Novozymes Biologicals, Thailand*
- **Three Phase Culture: Benefits Beyond EMS/AHPND**
  Fernando Garcia Abad, *Aquaculture Business Development Director, Epicore BioNetworks Inc., USA*
- **Revisiting Probiotics in Shrimp Culture: From 'Do They Work?' to 'How Do They Work?'**
  Pedro Encarnação, *Aquaculture Technical Director, Biomin Singapore Pte Ltd, Singapore*

1720 – 1750 Q & A Session

1830 – 2000 Cocktail Reception & End of Day 1

Day 2, August 21, 2014

0800 – 0930
Session 4: Nutrition and Health Interaction

- **Developing the Ideal Feeds for Shrimp: Gap Analysis**
  Brett D Glencross, *Principal Research Scientist/ Stream Leader for Aquaculture Feed Technologies Research, CSIRO, Australia*
- **Nutrition and Disease Interactions: Learning from a Holistic Approach in the Marine Fish Industry**
  Camilo Pohlenz, *Product Development, BioMar Americas, Costa Rica*
- **Enzymes in Shrimp Nutrition: Is the Future Here?**
  M A Kabir Chowdhury, *Product Manager-Aquaculture, Jefo Nutrition Inc., Canada*

0930 – 1000 Q & A Session

1000 – 1020 Morning Break

1020 – 1300
Interactive Breakout Group Discussions

Shrimp Aquaculture: Recovery • Revival • Renaissance

With the plenary presentations serving as the backdrop, the interactive breakout session will facilitate open dialogue and interaction among the delegates present. Led by team leaders, participants will break into 4 main groups to deliberate on challenges facing Asia's shrimp aquaculture, identify priority areas for improvement and recommend key strategies to ensure the long-term sustainability and profitability of Asia's shrimp aquaculture industry. Leaders from each group will present a summary of the output during the report session.

The choice of the breakout groups are:

- State-of-the-Industry and Marketing
- Learning and Surviving Diseases
- Culture Technology and Practices
- Nutrition and Health Interaction

1300 – 1430 Lunch

1430 – 1755
Report Session (incorporating afternoon break)

1755 – 1800 Closing and See You at TARS 2015

PROGRAM HIGHLIGHTS

State of Shrimp Aquaculture Industry in Asia

Daniel F Fegan

Aside from new and persistent disease problems, the industry faces many other issues ranging from rising ingredient, feed and production costs, and financial constraints to ensuring food safety and environmental sustainability…

Effect of EMS on Thailand's Shrimp Industry: A Country Perspective

Panisuan Jamnarnwej

The selling points for Thai shrimp are: availability, reliability, affordability. Along with reduced Thai shrimp production, EMS created another big problem – uncertainty. While we are still looking for the cause of EMS, the effect is already reshaping the industry…

Market Driven Production - Global Perspectives

Hervé Lucien-Brun

The key to successful production is to focus on demand and supply. Often, the producers do not have a clear idea of what the demand is. To optimise their margins, producers need to analyse their destination markets carefully. They should know the production situation in other shrimp producing countries as well…

Developing the Ideal Feeds for Shrimp - Gap Analysis

Brett D Glencross

Despite the growth of *Litopenaeus vannamei* farming in Asia there has not been a commensurate investment in generation of critical knowledge on nutritional requirements for shrimp. Analysis of the nutritional knowledge gaps between each shrimp species shows a continued reliance on that original data for *Penaeus monodon* in the 1990s. Despite these gaps there is perhaps justification not to repeat everything done earlier, but rather build on what we know and explore new frontiers…

Enzymes in Shrimp Nutrition: Is the Future Here?

M A Kabir Chowdhury

There is also an interest in the use of various alkaline proteases and lipase to improve protein and lipid digestibility. We need to maximize use of feed resources not only for better profit, but also for better animal health and to reduce environmental pollution…

Revisiting Probiotics in Shrimp Culture: From 'Do They Work?' to 'How Do They Work?'

Pedro Encarnação

As we learn more about pond ecosystems we can better understand the modus operandi of probiotics and how they should be used as a tool in shrimp farming. A closer look at differences between strains of bacteria, will explain how they work and should be applied in pond environments, hatcheries and feed, and what the farmer should expect from probiotics…

Three Phase Culture: Benefits Beyond EMS/AHPND

Fernando Garcia Abad

With the presence of new diseases and adverse environmental conditions, the industry needs to change and use new tools. As different strains of Vibrio are stage specific pathogens, the use of raceways may be an alternative tool where farmers can focus on keeping the Vibrio excluded in a smaller space...

Country Perspective: Proactive Management to Keep Diseases Away

Soraphat Panakorn

The implementation of a proactive management system, adoption of knowledge-based farm practices, and improvement of worker skills are essential components to achieve success in shrimp farming…

Update 2014 on current shrimp disease threats in Asia including EMS/AHPND

Timothy W. Flegel

Even within a single disease outbreak, AHPND bacteria vary in virulence, indicating a possibility of high genetic variation. Metagenomics study showed high proportions of three bacteria associated with shrimp in AHPNS ponds than in normal ponds which also cause high shrimp mortality without AHPND pathology. The rapid regional spread of AHPND and prevalence of a microsporidian suggests that the current situation in Asia may have resulted from industry wide decrease in rigour of biosecurity measures…

Fighting Pathogens: Choosing from a Range of Molecular Mechanisms

Tim Goossens

EMS outbreaks highlight the need for multifaceted sanitary programs, combining biosecurity protocols at the hatchery and farm to avoid the entry of pathogens, microbial control measures aimed at steering the microbial ecosystem in the pond, and shrimp gut for maximum growth and survival...

Identification and Validation of Molecular Markers for Genetic Improvement of Shrimp

Chu-Fang Lo

Although traditional genetic selection is time-consuming (and progress may be limited for some traits), it is expected that molecular-marker assisted selective breeding, would greatly hasten genetic improvement…

Does Specific Acquired Immunity Exist in Shrimp? Moving Dscam Research from Benchtop to Pondside

Han-Ching Wang

Our goal is to mitigate threats of infectious disease. There is increasing evidence that shrimp and other arthropods exhibit immune specificity and immune memory…

Developing a Robust Shrimp via Genetic Selection – The Theory and Practice

Thomas Gitterle

Conditions in production ponds favour disease development. When elimination, eradication or control of culture conditions is difficult, selective breeding for host resistance to the pathogen may be an attractive option for disease control…

Improved Shrimp Hatchery Techniques, Post-Larval Quality and The Link with Grow-Out Performance

Roeland Wouters

Larviculture performance, PL quality and PL costs can significantly improve by applying state-of-the-art hatchery management, in particular, through nutrition and health protocols. Good PL, in turn, reduces mortality during stress, transport and stocking of post-larvae in nursery facilities or ponds…

Industry Perspective: Farming Vannamei the Black Tiger Way

Manoj Sharma

The vannamei shrimp does not seem as resilient by virtue of diseases especially EMS. At Mayank Aquaculture, we have seen lowering density and production of 40-50g shrimp as encouraging, most profitable and sustainable…

Registration is limited to 200 and participants will be asked to select their preferred break-out group.
Walk-ins are not encouraged. Register online at www.tarsaquaculture.com Email conference@tarsaquaculture.com