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AQUA CULTURE

Asia Pacific

Hybrid Snakehead in China

Combating EMS in Malaysia

Farming Vannamei Shrimp in Myanmar

Methionine in Aquafeeds

Production and Marketing Challenges for Asia's Finfish

Show Preview of Asian Pacific Aquaculture 2013 in Vietnam

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From the editor

The year in review – cause and effect

In June 2013, after almost three years of battling the early mortality syndrome or EMS, the shrimp aquaculture industry learnt of *Vibrio parahaemolyticus*, the causative agent The bad news, however, is that the discovery did not present solutions for the farmer as to how to overcome the disease. At the GOAL meeting in Paris, Dr Donald Lightner said that research at the University of Arizona is ongoing to develop a sensitive polymerase chain reaction (PCR) test to allow rapid detection of the disease in broodstock, post larvae and juveniles. The test is expected to be commercially available soon.

Until then, notwithstanding reported incidences, farmers will just have to be wary of EMS. The prolonged uncertainty has had a negative side; any mass mortality is simply attributed to EMS rather than going through a diagnostic process to determine the cause and reviewing management practices. However, we do see that the industry is starting to self-regulate. Thailand is pushing for hatchery and broodstock supply groups to relook their protocols and pay more attention to production of quality post larvae with emphasis on using enrichment diets. Some hatcheries have begun to guarantee their post larvae and replacing post larvae if mortality occurs within a specified period in ponds. This is reminiscent of the early days of commercial shrimp farming with the black tiger shrimp in Asia.

In 2013, EMS hit Thailand, in full force, bringing in plain view, the major impact of a short supply. At the GOAL meeting, Robins McIntosh, while describing the potency of EMS said that recovery from the disease in Thailand will be complicated and is likely to require two to three years. Since early 2013, domestic shrimp prices have been rising to almost 35%, as in Malaysia. High raw material costs made it impossible for some processors to be commercially viable leaving only integrated operations. It was only in the mid-year, that international shrimp prices crept up to match domestic prices. For the first time, size for size, vannamei shrimp prices have beaten those for the black tiger shrimp on an ex-farm basis. The global shrimp industry has never seen such high prices in recent years.

In fish farming, we can see the spillover effects of EMS. In China's Hainan province, shrimp farmers switched to tilapia, bringing down prices to below cost of production in 2012, and triggering a massive move of cheap tilapia into the US. In 2013, wary of over production and lower margins with higher feed costs, tilapia farmers have stopped production. Tilapia supply will be 40% lower, according to industry sources. For those still in the business, US prices have risen by as much as 17%. In southern China, shrimp farmers have the option of switching to carp farming where there is a local demand. At the Rio meeting on tilapia, it was reported that China is exporting its tilapia to African countries.

After failing several crops, some shrimp farmers switched to the Asian seabass. This brought down prices for live or chilled pond raised seabass. Seabass farmers often complained of low margins with high production costs and a volatile market. This impact on prices is also a consequence of an industry which depends highly on local live and chilled markets. Cage reared seabass is not affected as it is marketed as ocean reared and sold at higher prices. At TARS 2013 (The Aquaculture Roundtable Series 2013), which focused on finfish aquaculture, we learnt how producers in Asia continue to target live and chilled fish markets. Expansion can only occur when producers work together and push for generic marketing to increase demand and work at reducing economies of scale.

Vietnam's pangasius industry continues to battle the US antidumping duties, now in its ninth year. The industry has protested over the latest move by the US Department of Commerce to use a different reference country which they contend led to higher antidumping duties. At the same time, the industry has made progress for a sustainable supply chain with almost 50% of production areas certified to various standards.

Despite the adversities in 2013, the shrimp industry continues to be buoyed by the attractive high prices. This will be the key driver for many to look for a solution to EMS, but do we have to have to wait for another 2-3 years?

Zuridah Merican

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Phase III of Aquatic Quarantine Facility in Chennai launched

During a visit to the Aquatic Quarantine Facility (AQF) at Neelankarai, Chennai, India, Dr Donald V Lightner inaugurated Phase III of the centre and gave it the thumbs up as a 'World Class Quarantine Facility' in an interview to press.

Lighting the Inaugural Lamp in the presence of Leena Nair.

Dr Donald V Lightner is the well-known shrimp pathologist from the referral laboratory of the World Organisation of Animal Health (OIE), University of Arizona, USA. AQF is the quarantine facility for screening the six OIE listed pathogens - white spot syndrome virus (WSSV), infectious hypodermal and haematopoietic necrosis virus (IHHNV), infectious myonecrosis virus (IMNV), taura syndrome virus (TSV), necrotising hepatopancreatitis bacteria (NHPB) and yellow head/ gill associated virus (YHV/GAV) in *Penaeus vannamei* broodstocks. Lightner was impressed with the concept of placing under quarantine relatively small number of animals in each tank and cubicles under high biosecure conditions. With the commissioning of the final phase, the quarantine infrastructure of AQF has expanded to 20 cubicles.

This final phase with 13 cubicles was inaugurated on 4 September 2013 in the presence of distinguished guests comprising Dr B. Meenakumari, deputy director general of fisheries, Indian Council of Agricultural Research (ICAR), Leena Nair, chairman Marine Products Export Development Authority (MPEDA) and president Rajiv Gandhi Centre for Aquaculture (RGCA), Dr Shaun Moss, acting president of Oceanic Institute, USA and Dr E. G. Silas, chairman of the scientific advisory committee of RGCA. Also present was shrimp domestication expert Steve Arce, officials from the Animal Quarantine & Certification Services (AQ&CS), scientists from aquaculture research organisations, shrimp entrepreneurs and hatchery operators.

AQF is a state-of-the art quarantine facility created and operated by RGCA, the R&D arm of MPEDA. The facility began operations with the introduction of vannamei shrimp culture in India in 2009 with four cubicles for the quarantine of imported broodstock in Phase I. This was later expanded in a phased manner following requirements as vannamei shrimp farming expanded in India. The second phase, comprising three cubicles was funded by National Fisheries Development Board (NFDB) and began operations in mid-January 2013. The third and the final phase comprising additional 13 quarantine cubicles was funded by ASIDE (Assistance or State for Infrastructure Development for Export).

The AQF facilitates quarantine services by AQ&CS under the Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture. The facility is well equipped with a PCR (polymerase chain reaction) laboratory with highly sensitive US FDA approved thermal cyclers and supporting machineries to determine the SPF status of imported broodstock. SPF assurance is a guaranteed option by which one can mitigate the risk of known pathogens associated with the introduction of this exotic species.

The PCR laboratory screens for the six OIE listed pathogens and confirms the SPF status of the imported brooders. The broodstock on confirmation of its SPF status and after 5 days quarantine followed by issuance of clearance certificate from AQ & CS are then delivered to the importers. In this way, AQF plays a crucial role not only in mitigating unintentional spreading of any known pathogens associated with the import of these broodstock, but also in upholding the sustainability of the vannamei industry of the country.

The AQF operates on rigorous biosecure measures. The standard operating procedures (SOP) for the centre was developed by government bodies/organisations including the Coastal Aquaculture Authority (CAA), Central Institute of Brackishwater Aquaculture (CIBA), MPEDA, AQ & CS, NFDB and MOA to ensure that the industry in India will be free of threats of diseases faced by the vannamei farming sectors of other Southeast Asian countries. The technical activities of the facility are managed by a core group of committed aquaculture and biotechnology professionals, many of whom were trained by world renowned shrimp pathologists such as Lightner and Dr Linda Nunan of University of Arizona, USA and Dr Tim Flegel, Mahidol University, Thailand.

The facility has won world acclaim for its quality quarantine services. Furthermore, AQF has been able to maintain a seamlessly consistent high quarantine survival of 96% since its inception. The operation of the facility renders the stakeholders to quarantine their imported broodstock throughout the year.

Inside a cubicle at the centre

Vietnam to expand seafood production

Roadmap will be led by industrialised aquaculture at 65% of total production

The Ministry of Agriculture and Rural Development has ratified a master plan to rapidly expand seafood production and exports through 2020 and 2030. In a report published in Vietfish International (issue September/October 2013), the roadmap will see Vietnam's fisheries sector producing 7 million tonnes of seafood, comprising 65% of farmed and 35% captured products by 2020. Around half of Vietnam's fisheries workers will be trained and the average per capita income in the sector will triple in the same period. Between 2020 and 2030, production will rise to 9 million tonnes with an export turnover of USD 20 billion.

In aquaculture, priority will be given to industrial farming of key export species and integration of production with marketing and distribution. The target is to farm 4.5 million tonnes of aquatic species in an area of 1.2 million ha by 2020. Industrial scale farming area of key species is projected at 190,000 ha, including 80,000 ha of black tiger shrimp and 60,000 ha of vannamei shrimp, 10,000 ha of pangasius catfish and 40 ha of molluscs. By 2020, the production is expected to reach 700,000 tonnes of marine shrimp; 1.8-2 million tonnes of pangasius catfish; 150,000 tonnes of tilapia; 35,000- 40,000 tonnes of giant freshwater prawn; 200,000 tonnes of various marine fish; and 400,000 tonnes of molluscs (see Table 1). By 2020, the sector is expected to be industrialised and by 2030, modernised.

Table 1 Production targets for aquaculture production by 2020 and projected growth rates

Species	Volume in tonnes	Growth rate %
Black tiger shrimp *Penaeus monodon*	340,000	0.02
Whiteleg shrimp *Penaeus vannamei*	360,00	11.22
Pangasius catfish *Pangasius hypophthalmus*	1,800,000-2,000,000	4.80
Tilapia *Oreochromis* spp	150,000	13.90
Giant freshwater prawn *Macrobrachium spp*	35,000-40,000	15.00
Marine fish	200,000	11.10
Molluscs	400,000	11.50
Seaweed	138,000	21.70
Lobsters	3,000	7.18

Several strategies to meet these goals were outlined. In the case of aquaculture, efforts will be made to improve seed production technologies, complete farming procedures of key species, and develop a monitoring and alerting system of environment conditions and disease. National Seed Production Centres and concentrated breeding areas will be reinforced to ensure production of quality seed. Seafood processing facilities will also be upgraded to meet food safety and environment requirements. In marketing of seafood, the target markets will continue to be the EU, Japan and the US for frozen shrimp and catfish. Of particular significance is the plan to expand the processed seafood volume for domestic consumption to 950,000 tonnes by 2020. This will include 310,000 tonnes of frozen seafood and 246,000 tonnes of fish meal.

Marine shrimp and the pangasius catfish comprise the major export products of aquaculture. In 2012, there was an estimated 1.19 tonnes of pangasius produced from 5,600 ha of farms. Despite the swings in production and marketing hurdles in recent years, the outlook is positive as production from almost half of the farming area is now certified by various certifying bodies.

In the case of marine shrimp, 190,000 tonnes of the vannamei shrimp was produced in 2012 from 38,000 ha of ponds, according to government data. Vietnam is a leader in black tiger shrimp farming but its farming has been affected by early mortality syndrome (EMS), just as that of vannamei shrimp. The Mekong Delta is well known for organic black tiger shrimp production. Some of the criticisms on the state of shrimp farming have been on the supply of poor quality post larvae and inadequate attention on disease and poor culture management. Nevertheless, there are positive developments such as the establishment of hatcheries to produce high quality post larvae and increased education on disease management.

More information on the seafood industry in Vietnam will be available at the forthcoming Asian Pacific Aquaculture Conference and Trade Show, to be held from 10-13 December 2013 in Ho Chi Minh City (see pages 52-57).

China is now net shrimp importer

Peeled deveined 100/kg size retails at CNY60/kg

At the 2013 China Fisheries and Seafood Expo, held from 5-7 November in Dalian, Dr Cui He, executive president of China Aquatic Products Processing and Marketing Alliance - CAPPMA confirmed that in 2013, China became a net importer of shrimp. Almost 50% of local production is for domestic consumption. A major producer in China has estimated a production of only 500,000 to 600,000 tonnes in 2013, down from the 1,000,000 tonnes production before 2012.

At the show, Chinese buyers were mopping up available shrimp from exhibiting companies from India, Indonesia, Malaysia, Thailand, Ecuador, Peru and Venezuela. However, exporters said that despite the low supply in global markets, offer prices for shell on frozen shrimp from Chinese buyers were still below international prices. In shrimp news.com, it was reported that Liu Jian, general manager of Zhanjiang Evergreen Aquatic Science and Technology, a fully integrated shrimp farming company in Guangdong, said that China's shrimp exports could fall again by 40% in 2014. Furthermore the strengthening of the Chinese currency against the dollar makes shrimp exports less attractive and imports more attractive, according to Liu. Evident at the show and confirmed by Liu is a trend by domestic producers towards value adding shrimp products. Domestic consumption is moving beyond just shell-on shrimp.

News in Brief

ITC says NO in shrimp CVD

Soon after the US Department of Commerce (DOC) slapped the countervailing duties (CVD) on shrimp imports from seven countries: China, India, Thailand, Malaysia, Vietnam, Indonesia and Ecuador, the US International Trade Commission (ITC) ruled against imposing duties on these countries. This decision ensures American consumers will continue to have access to healthy, affordable shrimp. John Connelly, president of the National Fisheries Institute (NFI), a leading trade association for the seafood industry said, "We are pleased the Commissioners recognised that imported shrimp has not caused harm in the American shrimp markets. NFI believes strongly that different shrimp serve different markets and highlighting a shrimp's positive characteristics is the best means to grow a business." It added that the case is now over, and exporters and importers will be able to resume doing what they do best, which is supplying healthy, nutritious and safe shrimp to US consumers at fair and reasonable prices.

Multi-species aqua farm by 2016

In Oman, Lim Shrimp Organization and Arabian Marine Development, LLC, will jointly develop and operate the Qurun Aquapolis, a 700 ha, multi-species, integrated aquaculture farm, 300 km South of Muscat along the Arabian Sea. The funding is from Bank Sohar, the third largest bank in Oman, backed by the Omani Wealth Fund, the Omani Pension Fund and the Omani Investment Fund. In the report at shrimpnews.com, the species to be cultured will include black tiger shrimp *Penaeus monodon*, Indian white shrimp *Penaeus indicus*, sea cucumbers *Holothuria scabra*, *Salicornia*, an edible, salt tolerant plant, oysters and other bivalves. When fully operational, the farm will produce approximately 4,500 tonnes of shrimp annually. The project will cost USD 100 million and is scheduled for completion in 2016. The project will have its own feed mill, processing plant, cold storage facilities, hatcheries as well as desalination plant and standby power plant.

Large BT industry in Australia

The subsidiary of the listed CO2 Group, Western Australian Resources Limited (WARL) has acquired Marine Farms' aquaculture site in Exmouth Gulf, Western Australia. This purchase is a key step for the company's Project Sea Dragon which plans to produce 100,000 tonnes/year black tiger shrimp in northern Australia. Project Sea Dragon's integrated production model will cover 100,000 ha and include a 200,000 tonnes per year feed mill, hatchery and breeding centres to produce up to 100 million post larvae/week, and grow-out farms which will supply 500 tonnes/day of marketable shrimp for the processing plant. This acquisition of an existing aquaculture site with an existing aquaculture permit enables an early start on the breeding program. Facilities will be upgraded and converted to a broodstock facility and will be used to hold, rear, breed and test animals for disease status prior to introducing them into production systems.

Immunostimulant for black tiger shrimp

Researchers at Thailand's National Centre for Genetic Engineering and Biotechnology (Biotec) have been investigating the effects of bacterial lipopolysaccharide (LPS) as feed supplement to improve immunity of the black tiger shrimp *Penaeus monodon*. LPS was coated to commercial feed pellets and given to shrimp. The immunity was tested by exposing shrimp to pathogenic bacterium *Vibrio harveyi*. The results showed that while the LPS containing diet did not have an effect on growth rate, it resulted in significantly higher survival rates when exposed to *V. harveyi* than the normal diet. The LPS supplement also showed induction of some crucial immune-related transcripts such as ALF3, C-lectin and mucin-like PM in shrimp digestive tracts. These findings suggest that LPS was able to activate the immune system at the molecular level in the digestive tract of the host, and to enhance disease resistance in the black tiger shrimp. LPS supplement is therefore a promising candidate to increase disease resistance in black tiger shrimp farming. The result of this work was published in the Developmental and Comparative Immunology journal.

Marketing the cobia

The farming of the cobia is in China, Taiwan, Bahamas, Belize, the Dominican Republic, Mexico, Philippines, Puerto Rico, USA, and Vietnam. However, a major bottleneck is marketing the fish. In seafoodsource.com, Brian O'Hanlon, founder and CEO of Open Blue Sea Farms, which is farming the cobia in submerged cages in the open sea off Panama has an aggressive approach to marketing the species. Open Blue is currently selling HGT (headed, gutted, tail-off) fish from Panama to the foodservice market in the United States. Next will be Europe and Asia by 2014. O' Hanlon said, "Cobia is a great, high quality white fish. The upscale segments of the market desperately need a high quality white fish that is farmed consistently. We are not competing with the other white fish such as the tilapia and catfish." His key selling point is that Open Blue Sea cobia comes from a farm that is fully integrated and traceable from egg to market, and that is highly responsible from a social and environmental perspective, in comparison to cobia from small farms in other countries. In 2013, Open Blue Sea Farms, founded in 2007 expects to harvest 1,100-1,200 tonnes of cobia. The company is on track to produce 2,000 tonnes in 2014.

Independent and strong growth

EWOS, the world's leading salmon feed supplier has new owners, Altor Fund III and Bain Capital and is set for strong growth. "EWOS has a strong global market position and our key strength is our considerable knowledge of nutrition, production and logistics, especially through our R&D Company EWOS Innovation. We are set to use this strong platform for further growth", said CEO Einar Wathne of EWOS. As an independent company, EWOS will be seeking to recruit new employees to fill various functions at a group level. A new board of directors has also been appointed with representatives of both Altor and Bain Capital. "Feed production is becoming more and more advanced. Restricted access to raw materials, new regulatory demands and continued need for a healthy fish will require a knowledge-based feed industry," said Wathne. "EWOS is uniquely poised to lead this shift."

Fighting EMS shrimp disease in Mexico

Cargill's animal nutrition business, a global feed and nutrition company will conduct a two-day workshop on November 12-13 in Ciudad Obregon to explore strategies to help customers deal with the early mortality syndrome (EMS) or Acute Hepatopancreatic Necrosis Disease (AHPND). In August, AHPND was confirmed at shrimp farms in the states of Sonora, Sinaloa and Nayarit in Mexico. Shrimp producers' associations in affected states now project a 65% volume of shrimp produced in 2013 compared to 2011 because of the outbreak.

"We hope that a partnership between researchers, industry and government can help develop some holistic solutions to this destructive disease," says John Peppel, senior vice president, Cargill Animal Nutrition. The aim of the workshop is to understand how EMS is triggered, identify available diagnostic tools for the disease and identify methods to stop the bacteria from spreading any further, says Gerardo Quintero, managing director, Cargill Animal Nutrition, a leading supplier of shrimp feeds in Mexico. During the workshop, shrimp disease pathologist, Prof Donald Lightner, University of Arizona, USA will describe the base diagnosis of the disease and health committee representatives from shrimp producers' associations will describe the epidemiology of the disease including how the problem moved from one area to another and mortality rates. Researchers from domestic universities will present their latest findings on how to identify the bacteria using molecular tools.

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Combating EMS

As he travels around Malaysia visiting shrimp farms, Karunanithi Muthusamy has some suggestions which can reduce the impact of EMS and allow the culture to continue up to 70 DOC.

Due to early mortality syndrome or EMS, vannamei shrimp production in Malaysia has declined by as much as 60% since 2011. However, with a steady local demand but a general supply shortage, prices have shot up by as much as 70%. Currently, Malaysian farmers who have been able to minimise crop mortality up to 70 days of culture (DOC) are happy. A harvest at less than 60 DOC would yield a minimum shrimp count of 100/kg of 10g shrimp which can still easily fetch MYR 23/kg or USD 7.2/kg (17 October, 2013). It is a seller's market as shrimp buyers are willing to pay more to secure supply. Before EMS came about in Malaysia, the average cost of production for size 100/kg was less than MYR 7/kg. Cost of production is now much higher at MYR 10/kg and profit margins are good as prices are at their historical highs.

Several groups have been conducting research to find the causative agent for this syndrome. However experts are still debating as to the actual cause. Dr Donald Lightner (University of Arizona, USA) said that the causative agent for EMS is *Vibrio parahaemolyticus* whilst Dr Chalor Limsuwan (Kasetsart University, Thailand) claims that only with infection of post larvae with *Vibrio harveyi* can he replicate the same disease symptoms as in EMS. As investors and farmers, we would like to know the causative agent, but we do not have the luxury of waiting for these results. We know that the etiology is a type of bacteria. We then move forward with trying to minimise the impact of the disease by looking at improvements in culture practices. We will use scientific findings as a guide.

Inbred post larvae

Over the past 5 years there has been a push to produce post larvae with superior growth rate. Usually, this is done by selecting strains or families of shrimp that exhibit these qualities and they are then selectively bred to produce even faster growing offspring. It is suspected that when we focus on only certain traits, there may be a negative effect on other desirous traits such as disease resistance. Limsuwan and his team at Kasetsart University think that inbreeding of these fast growing shrimp could be contributing to the EMS outbreaks, because these shrimp are weak and easily susceptible to diseases. Reports from hatcheries also indicate that broodstock that have been ablated for spawning are now dying prematurely, sometimes even during the spawning process. Previously, an ablated broodstock could spawn several times before they were retired. Limsuwan recommends natural spawning without eye-stalk ablation to produce shrimp that may be slower- growing but are healthier and stronger.

Karunanithi with Andy Goh, CCK farm in Telaga Air, Kuching. The harvest was 10 tonnes/0.6ha

At the hatchery

During the hey days of the black tiger shrimp *Penaeus monodon* farming, hatcheries provided quality control (QC) documents which contained detailed and prompt reports on the quality of the post larvae they were supplying. However, in subsequent years, farmers shifted to farming white shrimp *Penaeus vannamei* when white spot syndrome virus (WSSV) destroyed crops of the black tiger. With this shift to using post larvae from specific pathogen free broodstock, this practice seems to have disappeared and QC documents were done away with. In this article, we show why we recommend that hatcheries resume this practice and provide QC documents to farmers.

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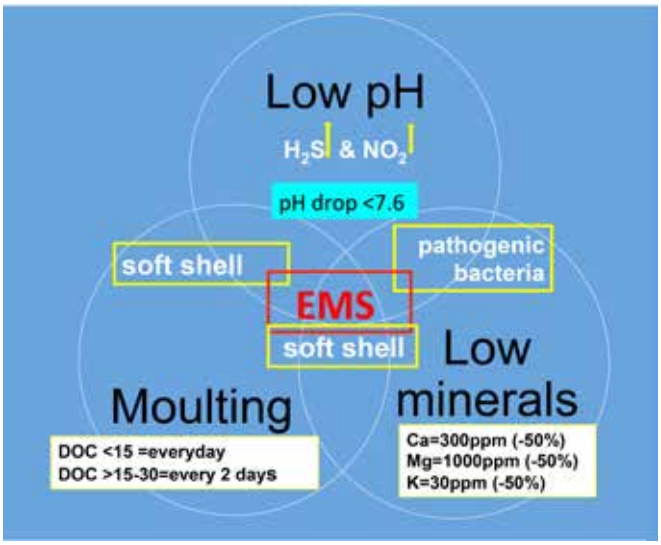
At the hatchery, QC should include a minimum of 13 suggested criteria as shown in table 1. We recommend our customers to stock post larvae of more than 12 days (> PL12) because the hepatopancreas and gills are well developed at this stage.

Table 1 Suggested QC and post larvae selection criteria.	
1	Clean and clear eyes
2	Spines (Rostrum) > 4
3	No damage or deformities to appendages
4	No filamentous algal attachments to body, gills, antennae and tail. All appendages must be clean.
5	Meat: Gut Ratio = 1:4
6	Hepatopancreas (HP) size > 0.08 mm
7	Well developed HP tubules.
8	Have high amounts of lipid cells, size, colour, elasticity or stiffness of tissues in HP (before harvesting at hatchery)
9	Last post larval segment should be long and thick
10	No fouling organisms *(Zoothanium /Vorticella)*
11	Zero Vibrio count in body, water and HP.
12	PL12 at 470 to 422 pcs/g
13	Zero salinity and formalin stress test
The minimum criteria is to meet at least 80% of the above	

Why do we recommend these steps? We have noticed that inferior post larvae quality has played a part in almost 80% of EMS occurrences in Malaysia. We also suspect that the stocking density of eggs, zoea, mysis and post larvae are beyond the optimum in hatcheries. We believe that this actually is stressful for the post larvae which may be able to survive in the hatchery due to its controlled conditions.

Figure 1: EMS triggers



Commercial hatcheries should invite farmers to visit and check post larvae quality, perform freshwater immersion tests and formalin stress tests at hatcheries and later at the farm during stocking and compare the differences for a better understanding on the post larvae selection criteria. Before stocking, hatcheries and farms should communicate to exchange technical information. Hatcheries and farms need to work closer together to prevent the outbreaks of disease.

However, once the post larvae are transferred to grow-out ponds, various changes in pond parameters such as low minerals during early days of culture, unstable plankton transparency, low dissolved oxygen, variations in temperature, pH, salinity and unpredictable weather conditions could result in the already stressed post larvae to quickly succumb to infections. Certain grow-out practices recommend that pH of the water should be maintained at lower than 7.6. This is not ideal for shrimp culture and may promote the growth of pathogens. At the same time, hydrogen sulphide (H_2S) becomes more toxic at low pH. Coincidentally, when the shrimp are less than 30 DOC, they moult very frequently in order to grow quickly. This is a very vulnerable time for the shrimp. This means that the requirement of minerals in the water is extremely important, it has to be maintained at the optimum or slightly higher. When the minerals fall below 50% of the recommended amount and the shrimp have soft shell, then the likelihood of EMS occurring is higher. It is important that we maintain pH between 7.8-8.1 and use additional mineral products when necessary (See figure 1). Another essential practice is to improve the immunity of the post larvae to a healthy level such as by supplementing with immunostimulants, multivitamins and minerals.

A recent partial harvest at CCK farm on 7 October 2013

At grow-out

In my opinion, we need to approach the problem with the idea that post larvae in the pond are under constant attack by bacteria such as *Vibrio* spp., bacteriophages, *Pseudomonas*, *Ralstonia* and *Rhodococcus*. Post larvae succumb easily to diseases when they have poor immunity.

Combining scientific information and through our work with farmers, we feel that EMS is caused by multiple links between pathogens (for example from *Vibrio parahaemolyticus* and *V. harveyi*) which release toxins in combination with unidentified toxins from blue green algae as well as the presence of H_2S. In combination with Vibriosis, the conducive factors for EMS are low water pH (< 7.6), low mineral content during early DOC, over feeding during the first 30 days of culture and the presence of H_2S. These combined factors could directly contribute to the EMS attacks especially targeting weak shrimp such as moulting shrimp (as indeed soft shell shrimp is a symptom of EMS).

In earthen ponds, pathogens usually thrive in the organic material or black soil usually a few inches below the pond bed which has low pH (<5.5) and low temperature (< 20°C). In fully lined HDPE ponds many farmers are not aware of anaerobic conditions underneath the liner whereby there is accumulation of toxic H_2S gas which is also known as the 'silent killer'. In older HDPE lined ponds during culture, this toxic gas slowly leaches through the fine holes in the HDPE lining to the water and causes stress to the shrimp.

In line with addressing these problems, our approach is to focus on 'back to basics' where ploughing of soil during pond preparation is encouraged to increase the soil pH and soil temperature and to eliminate H_2S. We also focus on maintaining good water quality throughout culture, managing feed to prevent overfeeding and monitoring closely the mineral content of the water. Based on this approach, we try to provide a solution both for the rejuvenation of the soil and proper care of the pond water that help to prevent a full blown attack of EMS. We are happy to report that currently many of our customers have been able to continue farming without any incidence of EMS up to 70 DOC.

Table 2 Some indications before the onset of EMS

1. Sudden drop in mineral level (Mg, Ca & K) and pH <7.6			
Minerals	Optimum level ppm)	Reduced level (ppm)	Usual DOC
Calcium	300 to 400 ppm	<200 ppm (±60%)	<30
Magnesium	800 to 1000 ppm	<500 ppm (±60%)	<30
Potassium	10-15% of calcium	<5 to 10% of calcium (±50%)	
2. DOC versus moulting			
Days of culture (DOC)	Moulting	During early DOC, shrimp moult frequently as they are growing fast. It is essential that we maintain optimum mineral levels for this purpose (see above for optimal mineral levels)	
1st stocking to 15	Everyday		
15 to 30	Every 2 to 3 days		
30 to 45	Every 3 to 5 days		
45 to 75	Once in 7 days (every week)		
75 to 90	Every 10 days		
90 and above	Every 2 weeks		
3. Other indications			
Transparency < 30 cm.		PH variation > 0.3/day	
Low DO (< 5PPM) during <35 DOC.		Prolonged white faeces	
Lack of technical action during rainy days			

Gut pH

We have also observe the importance of gut pH. Fluctuations in gut pH affect the optimum function of the hepatopancreas. Normally the shrimp gut have neutral pH around 7 (Maurice, 2013). As we all know *P. vannamei* feeding behaviour is more aggressive than *P. monodon* and many toxic substances including *Vibrios* and toxic blue green algae can enter the gut system and may cause an increase in pH (>7). This may lead to improper digestion, inefficient nutrition absorption and storage of essential nutrition in the hepatopancreas. Hence to eliminate such *Vibrios*, it is recommended to add probiotic additives, such as Pond Plus (Novozymes) or yeast based additives to lower gut pH.

Keeping EMS under control

Following our recommendations and protocols, the majority of our customers' farms on Penang Island have not encountered EMS recently. On the mainland, a few farms in Nibong Tebal in Penang are now reporting successful harvests. In the southern region, there are farms in Pekan, Johor Bahru, Pontian and Kota Tinggi that are reporting good harvests. In Sarawak only one farm has been able to overcome EMS and recently achieved an average production of about 10 tonnes/0.6 ha. In Sabah two farmers in Kudat, have not experienced any EMS. One has been able to achieve a production of 7 tonnes/0.5 ha and the other has already achieved 20 tonnes/0.6 ha. There are also two farms in Kunak with no EMS with an average production of 6 tonnes/0.5 ha.

Many farmers reported that occurrences of EMS are highest during high tide and full moon periods. Below, we suggest that farmers adopt these key practices 3 days before and 2 days after every high tide and full moon days to prolong culture up to 70 DOC. The first step is to reduce feeding to only 30 to 50% of actual feeding rate. All water quality parameters must be at optimum levels, in particular, the minerals. The daily fluctuation of pH should be <0.3 units and morning pH at >7.8 and evening pH at < 8.1. A stable plankton transparency of 30 to 35 cm from stocking until at least 70 DOC should be maintained. Monitor *Vibrio parahaemolyticus* and *V. harveyi* in HP by individual media culture.

In case of EMS

When shrimp show signs of dying, the farmer should take the following steps immediately. The first step is to switch on aerators for 5-8 days on the first day when shrimp show signs of dying. This is followed by cessation of feeding for 5 to 8 days, depending on the mortality numbers. The next step is to apply water disinfectant (such as Remedor Aquatic, Bayer) to reduce *Vibrio*, viral and fungal organisms. The fourth step is to apply lime ($CaCo_3$) to maintain pH> 7.8 (in the morning) and < 8.1 in the evening. Daily pH difference should be less than 0.3 and total and bicarbonate alkalinity should be increased to more than >130/130ppm. Finally, apply mineral products such as Exel Aqua Basic (EAB, Bayer) to maintain optimum mineral levels at night.

On the second day, the recommendation is to apply beneficial bacteria at double dosage to improve water quality. This is followed by the monitoring of all water quality readings and the application of necessary products. The same is done on the third day. On the fourth day, it is recommended to apply soil based probiotic (Pond Dtox, Novozymes) at double dosage and monitor all water quality readings and take the necessary action. Feeding is resumed when there are no dead shrimp in the feeding tray. It should start with 30% of the usual feeding amount and slowly increasing to 500g/100,000 post larvae. Feeds should be mixed with feed additives such as gut probiotics, minerals, immune boosters and lipid enhancers.

We would like to think positively that there is light at the end of the tunnel. We feel that farmers are able to manage their ponds very well these days. With the help of good quality post larvae there is a very good chance that most farms will be able to overcome the EMS problem. We feel that 2014 would be a very positive year for shrimp farming in Malaysia.

Karunanithi Muthusamy is technical support manager at Syndel Asia Sdn.Bhd, Malaysia. He has over 25 years of experience in farming and technical support for farmers in Malaysia, Indonesia and Papua New Guinea. He is passionate on helping the shrimp industry, despite challenges with different farm conditions and ideas on culture methods. Email:karu@syndelasia.com; More information: www.syndelasia.com

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Shrimp farming in Myanmar

By Nyan Taw and Soe Tun

With potential areas for shrimp farming along the Rakhine coast and a new government policy, vannamei shrimp farming is making inroads in Myanmar.

Myanmar has a long coast line stretching over 2,800 km with networks of islands from the Rakhine bordering Bangladesh to Taninthayi, which is near the border with Thailand. The Irrawaddy Delta, with many rivulets crisscrossing and discharging into the Andaman Sea, also has existing aquaculture activities for shrimp and fish. These areas have as yet untapped potential for aquaculture activities both for shrimp and fish farming.

Shrimp farming was initiated decades ago (Taw, 1996a &b, 1997; 1982; Taw et. al 1984; Htin & Taw 1985). Black tiger shrimp *Penaeus monodon* culture was first started with semi-intensive three stage farming system using post larvae collected from the wild funded by an ADB (Asian Development Bank) loan in 1976 at Bogalay, Irrawaddy Delta. Later, a much larger scale ADB Inland Fisheries Development Project to develop inland fisheries including farming of the black tiger shrimp was implemented in 1983. In 1997 a FAO project to develop shrimp backyard hatcheries to support shrimp farming was again initiated, where possible locations for hatcheries and farms were identified (Taw 1996a&b;1997a&b). Due to these initiatives shrimp farming in Myanmar took off but due to lack of infrastructure the development was very slow.

Current farming status

Black tiger shrimp has been cultured in traditional or traditional plus farms at Maungdaw along the Narf River bordering Bangladesh since before 1980s. The cultured area was estimated to be about 6,000 ha. Shrimp production from the area was estimated at around 30,000 tonnes/year. Due to poor infrastructure within Myanmar, shrimp produced were traded to Bangladesh for processing and export. A few hatcheries are presently in operation supplying the traditional plus shrimp farms. There are also potential sites as identified by FAO and ADB surveys along Rakhine coast such as Yethataung, Sittwe, Kyaukpyu, and Thandwe, both for hatcheries and farms.

In Myanmar, three zones were set aside for shrimp farming: Kyauktan (a few kilometres south of Yangon), Chaung Tha and Ngwe Saung at Pathein (the coastal area east of Yangon). Wetkite, a coastal area south of Yangon, is another potential area where a few intensive shrimp farms were operating. In 2006, the white shrimp *Penaeus vannamei* was permitted for farming in Myanmar and thus many

Kyauktan shrimp farm P. vannamei trial ponds with soft shell crab intensive farm in the background (blue colour roofing)

hatcheries and farms switched to this shrimp. However, again due to problems such as the lack of infrastructure and banking system, and the white spot syndrome virus (WSSV), the development was slow.

Since 2001, there are over 12 companies operating intensive shrimp farming, mainly in the three zones. The estimated production from the three zones was at 31,000 tonnes in 2012. To support the farms, 13 hatcheries are in operation mainly along the west coast from Ngwe Saung to Maungdaw, Rakhine in the north.

Processing and cold storage

According to the Department of Fisheries, a total of 120 processing plants exist in Myanmar throughout the coastal region from Rakhine down south to Mergue. These facilities also process sea caught shrimp, freshwater prawns *Macrobrachium rosenbergii* and fish. There are 12 processing and cold storage facilities in Yangon area and one in Pathein which are certified by the EU.

New interest

There has been renewed interest in shrimp farming arising from a new government policy. A trial using semi-biofloc technology was

implemented successfully at Kyauktan shrimp farming zone located within a soft shell crab farm. Admittedly, it was a high risk venture as crabs are known to be carriers of WSSV. However, there was no choice as it was the only available location with good, clean earthen ponds with a stable power supply.

The farm is located just over an hour's drive from Yangon. Three culture ponds sharing one reservoir, with a total of six culture ponds were operated with very tight biosecurity. Semi-biofloc technology was applied according to protocols established by Taw (2012 & 2013). The stocking was done in March 2013. Specific pathogen free post larvae were imported from Thailand. Locally produced shrimp feed was used for the trials. Culture details and performance of the ponds are shown in Table 1. The target set was a harvest of 5 tonnes/pond (8.0 tonnes/ha) of small size shrimp (10-14 g) with feed conversion ratio (FCR) of 1.3. The performance was better than the target. Only one pond had some problems because of a power outage during partial harvesting. This led to a lower production and a higher FCR in comparison with other ponds.

Table 1. Production performance of the *P. vannamei* farm trials at Kyauktan shrimp farming zone

Pond no (All of 6,400 m²)	Aeration energy (hp)	Stocking density (m²)	Survival (%)	FCR*	Partial	Harvest			Production (kg/ha)	Carrying capacity (kg/hp)
						DOC	Production (kg)	MBW (g)		
A 1	16	91			1	90	2,643	10.0		
					Final	107	3,826	14.5		
			90.7	**1.23**	**Total**		**6,469**		**10,107.8**	**631.8**
A 2	16	83			1	90	2,760	10.0		
					Final	102	2,005	13.0		
			71.2	**1.17**	**Total**		**4,765**		**7,445.0**	**465.3**
A 3	16	93			1	89	2,430	10.0		
					Final	107	3,451	14.6		
			82.6	**1.26**	**Total**		**5,881**		**9,189.0**	**574.2**
B 1	16	98			1	82	2,570	10.0		
					Final	97	3,226	13.5		
			82.3		**Total**		**5,796**		**9,056.0**	**566**
B 2	16	95			1	83	3,026	9.2		
					Final	110	3,750	15.0		
			91.2	**1.34**	**Total**		**6,776**		**10,588.0**	**661.8**
B 3	16	98			1	84	1,700	9.4		
					2	97	2,328	12.7		
					Final	105	3,174	15.5		
			94.3	**1.27**	**Total**		**7,202**		**11,253.0**	**703.3**

*FCR –Feed conversion ratio

Sampling shrimp

References are available on request from the author

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Shrimp handling methods

By Alex Hing

Equipment to harvest and transfer shrimp are option for farms to increase operational efficiency with least damage to shrimp.

Commercial shrimp farms use a variety of techniques to harvest and transport shrimp from ponds and raceways. Handling methods can affect shrimp health, biosecurity, and occupational health and safety, as well as operational efficiency and profitability.

Various harvesting techniques, such as sluice net operation, cast netting, complete draining of ponds, and hand harvesting, are used at different stages to harvest shrimp from a farm. Complete pond draining may not be practical and manual methods that involve nets, mesh bags, or baskets may damage shrimp during the harvest. These methods also require employees to lift heavy containers, which can result in injury.

Recently, modified mechanical pumps have been proven effective at harvesting shrimp from ponds and raceways (Ohs et al, 2006). Commercial farms that are using mechanical pumps find that they reduce the time and labour required to harvest shrimp. Pumps virtually eliminate damage to shrimp and maintain product value, increase productivity and reduce harvesting time and stress to shrimp.

Figure 1. Shrimp harvest using an electric-powered shrimp pump at a farm in Malaysia.

Shrimp handling requirements

The reasons for handling shrimp at an aquaculture facility or farm can include transferring stock from one location to another, splitting stock between multiple units, grading and culling, counting, and harvesting.

Shrimp handling equipment may be permanently fixed or may be mobile and used at different sites. Where equipment is not fixed, biosecurity needs must be addressed and mechanisms for setup and dismantling of equipment, plumbing, and electrical supply will need to be considered.

The typical process for efficient shrimp handling includes:

- Crowding shrimp in a culture unit towards a pump intake
- Pumping the shrimp up to a platform
- Dewatering the shrimp prior to counting, grading, or harvesting
- Reintroducing water to facilitate gravity-distribution via a rigid pipe, flexible hose, or combination thereof.

In a pond system, the typical process includes:

- Partially draining the pond to shorten time of harvest. A gate valve or standpipe can be used to regulate the amount of water being drained. The gate valve or standpipe should be covered with a screen to prevent shrimp from being flushed out of the pond during draining.
- Equipment checks should be conducted to ensure that gas-powered pumps have sufficient fuel, pump belts have the proper tension and attrition, and pneumatic tyres are properly inflated.
- After equipment inspections, the shrimp pump suction hose should be placed in the pond for harvesting. The shrimp are gathered or crowded toward the suction hose with a seine net.
- A dewatering box or tower and holding tanks should be placed next to each other and near an adjacent pond or on the levee of the retention pond where the water is being discharged. Water leaving the dewatering system can be diverted into an adjacent pond and reused.

A video showing the use of a shrimp pump for harvesting can be watched on the YouTube website (http://www.youtube.com/watch?v=S23NdKJYBuo). In Malaysia, Blue Archipelago Berhad has been evaluating the use of a shrimp pump for harvesting (Figure 1). The pump has minimised the handling and damage of shrimp from the pond to the shrimp containers and has increased productivity.

Types of pumps

Submersible impeller pumps

These pumps use a hydraulically-driven single or double vane impeller (Figure 2). They are lowered into raceways, ponds or tanks, and when connected to a flexible hose, can pump shrimp over long distances with a vertical lift of about 5 m (15 ft). A flexible hose allows for easy setup. Adjustable speed enables the delivery rate to be controlled and is gentle on the stock being harvested. They are relatively inexpensive to buy and operate; however, they can be awkward to use as they must be submerged in the pond, tank, or raceway.

Cart-mounted impeller pumps

Widely used for fin-fish species for several years, this style of pump is becoming a favourite with shrimp farmers. Cart-mounted pumps with pneumatic tyres move easily over variable terrain, and with a built-in priming system do not need to be lowered into the water (Figure 3). Cart-mounted pumps are used to move or to deliver shrimp for grading, counting, dewatering, and loading onto transport trucks. Some models include remote controls and various power configurations to suit most operations.

Figure 2. *Submersible impeller pumps can be used in raceways and in ponds.*

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Cart-mounted pumps offer simplified setup, easy maneuverability and self-priming. Only one suction hose needs to be placed in the water. A single vane impellor gently pushes shrimp to the discharge hose. The shrimp remain in water at all times, which reduces stress and maintains good product quality. Shrimp and water move along the discharge hose to the transfer point. Pumps may include variable speed control and quick-connect hose fittings.

One person can operate and move a cart-mounted pump and can harvest up to 10 tonnes/hour. Continuous harvesting increases production efficiency and minimises damage to shrimp. The only disadvantage may be the initial capital cost, which is offset by quicker harvests, improved yields of high-quality shrimp and reduced labour costs.

Shrimp pumps

The size range of the shrimp will determine the pumping options. Some modern pumps can be fitted with reducers for use with different diameter hoses. Only one pump is required to handle a range of shrimp size, and smaller hoses can be used in small tanks or enclosures with limited water volume. Operators can safely move shrimp ranging from post-larval size to under 10 size range or larger.

Figure 3. *A cart-mounted, gasoline-powered shrimp pump gives farmers the flexibility to harvest shrimp anywhere on their farm.*

Pump capacity

Shrimp may be transferred over long distances, and although pumps can safely move stocks horizontally over 1,000m (3,280 ft), this requires long lengths of piping or hose, which can be expensive and cumbersome. Locating grading and dewatering stations centrally will help limit these distances.

Shrimp pumps also have vertical lift limitations, and as the lift height increases the horizontal pumping capacity decreases. The pump should be positioned close to the pond being pumped and the suction hose kept short as most shrimp pump impellers are designed to push water. On level ground, the highest lift might be to a centrally located dewatering station prior to loading a transport truck, but if the ground is terraced, a shorter pumping distance is better. Flow velocity should be such that shrimp cannot swim back into the pump. Some impellor pumps operate at speeds that would injure or kill shrimp re-entering the impellor chamber from the discharge side.

Figure 4. *A cart-mounted, electric-powered shrimp pump offers farmers another option if a gas-powered pump is not ideal.*

Power supply

Electric pumps (Figure 4) use motors ranging upwards from 5 hp (3.75 kW) and will require dedicated electrical circuits of appropriate voltage and phase. Where the impeller speed is controlled with a variable frequency drive (VFD), clean power must

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be available in order to eliminate voltage loss in extension cables. Short cable runs will prevent this. Appropriate receptacles must be located throughout the facility.

For outdoor operations, where good power is not available, gasoline-powered or hydraulic-powered pumps are preferred (Figure 3). Gas-powered pumps work well at facilities that do not have power or in situations where a pump is shared between sites with different power supplies.

Dewatering stations

The dewatering station should be a raised platform and comprise a dewatering box with screen, inlet pipe pitting to connect the hose coming from the pump, return water connection to send water back to the pond and an outlet fitting where the shrimp exit the dewatering box.

After the shrimp have been dewatered, their onward journey is by gravity. This distance may be quite short as in a harvesting application where they will immediately enter an ice slurry, however, if they need to travel a longer distance, additional water may need to be added. For long distance transport by gravity, rigid pipe should be used with the appropriate slope.

Summary

Shrimp handling is integral to many key operations in pond rearing and other culture systems. Shrimp pumps allow farmers to reduce heavy labour and to minimise the potential for injury from lifting heavy crates. Farmers become more efficient and have the ability to harvest significantly more shrimp in less time and to deliver high-quality shrimp to processors. Successful shrimp harvests maintain the quality of the product and ensure satisfied customers.

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Availability of amino acids in aqua diets

By Andreas Lemme, Cláudia Figueiredo-Silva, Christoph Kobler and Stefan Mack

Part 2: The methionine case

In this comparison of free amino acids sources, the hydroxy analogue of methionine is considerably less efficiently used by aqua species than DL-methionine which can be verified in a simple trial.

The ranking of ingredients according to their nutritional value is important for achieving consistent animal performance and cost-optimised feed formulas. In part 1 of this article (issue September/October 2013), research presented demonstrated that free amino acids are 100% digestible in aqua species. Moreover, evidence was provided that free amino acids are as efficiently utilised for growth and metabolic functions as amino acids from intact proteins.

This above information is crucial for an appropriate assessment of the nutritional value and – as a consequence – of the economic value of amino acid sources. Knowledge about these facts increase the flexibility in feed formulation enormously. However, when comparing free amino acid sources, methionine appears to be a special case as two product categories are available in the market. In addition to the above DL-methionine having a purity of ≥99%, there are two products containing the DL-hydroxy analogue of methionine (HMB, DL-2-hydroxy-(4-methylthio) butanoic acid).

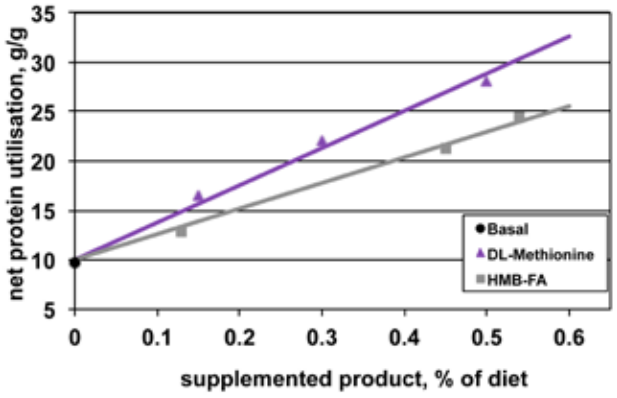
In this chemical compound the amino group (NH2+) is replaced by a hydroxy group, thus, HMB chemically not being an amino acid but a precursor. HMB is commercially available either as liquid free acid with a purity of 88% (HMB-FA; 12% water) or as dry calcium salt with a purity of 84% (HMB-Ca; 14% calcium). While HMB-FA has a pH of about 1-2 (strong acid) and contains about 65% monomeric (single molecule) HMB and 23% di- and oligomers (short chains of 2 or more molecules) of the HMB molecule, HMB-Ca has a pH of about 11 and contains only HMB monomers.

The nutritional value of this methionine precursor and its respective replacement ratio to DL-methionine is a matter of discussion among nutritionists from both industry and academia. This goes back to the differences in chemistry and related properties. For example, DL-methionine has a solubility of 33g/l (freshwater, 20°C) whereas as much as 80g of HMB-Ca dissolves in water under identical conditions. In addition, DL-methionine is absorbed by a very efficient Na^+-dependent carrier system whilst HMB molecules are absorbed by another, less efficient H^+-dependent system (Maenz and Engele-Schaan, 1996a; Mitchell and Lemme, 2010). It has been reported that HMB is not absorbed by diffusion (Maenz and Engele-Schaan,

1996b). These studies were done with broilers but clearly suggest that differences in chemical and physiological properties result in differences in bio-availability of HMB compared to DL-methionine.

NRC (2011) in reviewing and compiling published literature came to the conclusion that *'the biological efficacy of HMB for fish is about 75-80% that of DL-methionine on an equimolar basis.'* Translated to an HMB content of 84% in HMB-Ca, the commercial product would be between 63 and 68% as efficient as DL-methionine on a weight to weight basis suggesting that 1000g of HMB-Ca can be replaced by 630-680g of DL-methionine without negatively affecting performance of fish. Analogously, liquid HMB-FA with an HMB content of 88% in the commercial product would be 66-71% as efficient as DL-methionine on a weight to weight basis according to NRC (2011). The methodology of choice to determine this bio-availability relative to DL-methionine is a simultaneous dose-response trial in which graded levels of both sources are supplemented. Similar to the slope ratio analyses described in part one of this article, slopes are compared and relative difference of slopes is the basis for the replacement ratio. Figure 1 illustrates this approach using data published by Li et al. (2009). In this trial graded levels of either HMB-FA or DL-methionine were fed to juvenile hybrid striped bass over a period of six weeks. Responses to both products were linear and slope ratio analysis revealed HMB-FA to be 69% as efficient as DL-methionine on product basis (weight to weight).

Figure 1: Bio-availability of HMB-FA compared to DL-methionine determined in a slope ratio assay on net protein utilisation with juvenile hybrid striped bass (data obtained from Li et al., 2009)



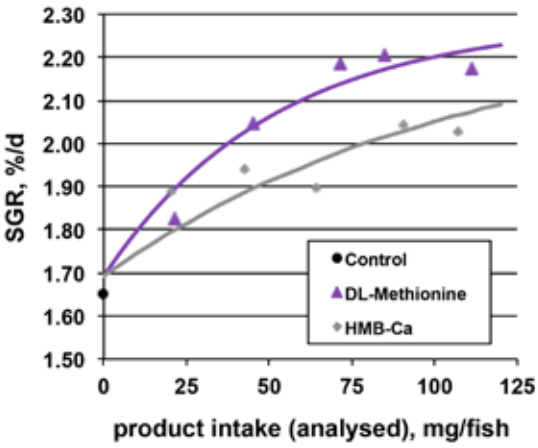
$y = 10.0 + 37.7\ DL\text{-}Met + 26.0\ HMB\text{-}FA$

Relative bio-availability

DL-Methionine:	100%
HMB-FA:	69%
	(conf. Interv. 58-79%)

Responses like those described by Li et al. (2009) have been confirmed for many aqua species (NRC, 2011; Lemme, 2010; Lemme et al., 2012). In a more recent trial with common carp graded levels of either DL-methionine or HMB-Ca were fed for eight weeks. Carp responded significantly to both methionine sources and responses were of asymptotic rather than of linear nature. Therefore, responses were analysed by multi-exponential regression. Again, the principle for determination relative bio-availability is comparing the steepness of the response curves to both products. Taking specific growth rate as response criterion, HMB-Ca was 48% as efficient as DL-methionine to achieve the same performance in this experiment (Figure 2).

Figure 2: Bio-availability of HMB-Ca compared to DL-methionine on specific growth rate and Met+Cys retention in common carp determined by multi-exponential regression (data unpublished, Min and Lemme (2012)

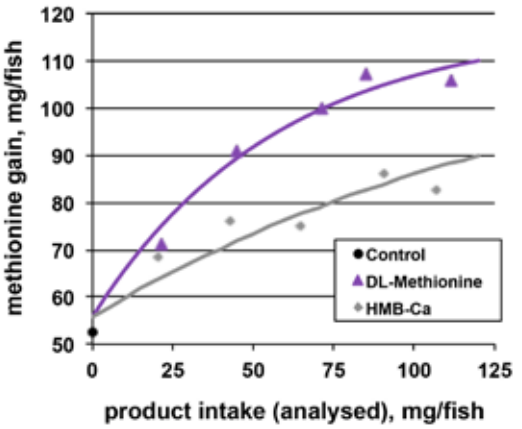


$y = 1.692 + 0.594 * (1 - e^{(-0.0195 * DL\text{-}Met + 0.0093 * MHA\text{-}Ca)})$

$R^2 = 0.78$ (replicate basis, n = 44)

Relative bioavailability:

DL-Methionine:	100%
HMB-Ca:	48%
	(conf. interv.: 31 - 64)



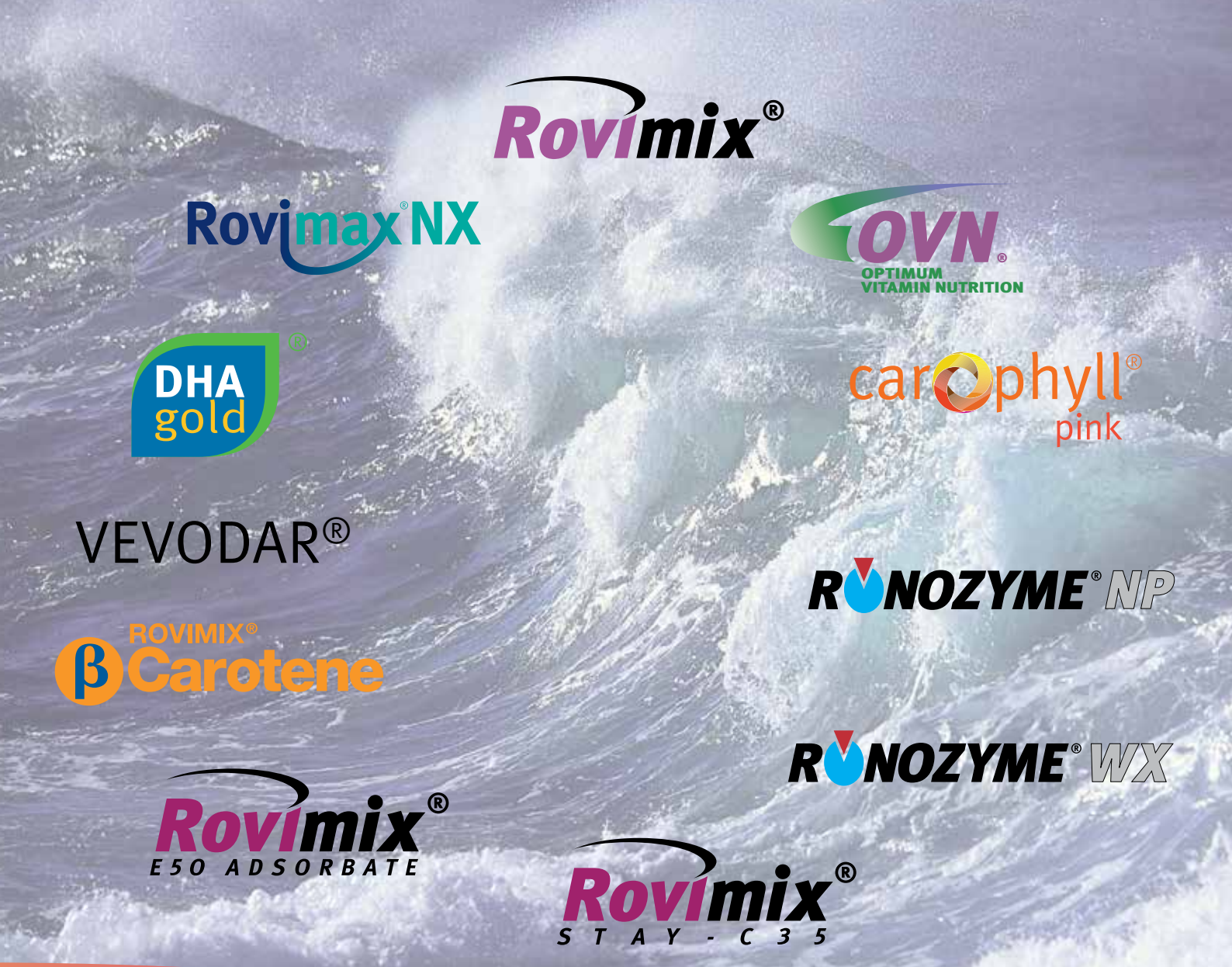
$y = 55.83 + 61.92 * (1 - e^{(-0.0174 * DL\text{-}Met + 0.0067 * MHA\text{-}Ca)})$

$R^2 = 0.80$ (replicate basis, n = 44)

Relative bioavailability:

DL-Methionine:	100%
HMB-Ca:	39%
	(conf. interv.: 24-53)

Moreover, retention of Met+Cys in body protein was determined as well and when regressing Met+Cys gain against respective product intakes, multi-exponential regression revealed HMB-Ca about 39% as efficient as DL-methionine. These results suggest that a considerable portion of the HMB-Ca was not available to support growth and protein deposition when compared to the response to DL-methionine. For both criteria, the slopes were significantly different from 84% which is the HMB content of HMB-Ca.



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For the nutritionist running a least-cost formulation software, the conclusion is that he ascribes HMB-Ca a Met and Met+Cys value between 63 to 67% (NRC, 2011) although few studies suggest even lower numbers (Figure 2, Lemme et al, 2012, Lemme 2010) in order to correctly reflect its nutritional value against alternative methionine sources and their respective cost in the feed formula.

Simple field test

This allows for confirming scientific findings with respect to the relative bioavailability of different methionine sources. Few nutritionists are familiar with the slope-ratio assay or multi-exponential regression approach to determine the relative bio-availability of nutrient sources. This methodology has been proven as a valid approach (Sauer et al., 2008; Elwert et al., 2008), but still sometimes uncertainty on the applicability remains. Those who wish to test and challenge the above suggested nutritive value of the HMB sources (liquid HMB-FA or solid HMB-Ca) against DL-methionine can do simple studies to get confirmation.

The simplest approach is to produce an aqua feed using an HMB source in order to meet nutrient specifications. Then a second, identical feed is produced in which the HMB product is replaced with DL-methionine at 65% of the quantity of HMB product. Both diets are used in a feeding trial and if the proposed ratio is valid, no differences in fish performance will be observed. Moreover, this test has no restriction to production conditions and feed composition. That means, it can also be performed at marginal Met+Cys supply which is actually the more sensitive and accurate approach to challenge relative bio-availability of different methionine sources. Finally, the experimental design would be stronger if a third, unsupplemented treatment is included to demonstrate that supplementation of methionine was required at all to improve performance of fish.

The references list is available upon request from the authors.


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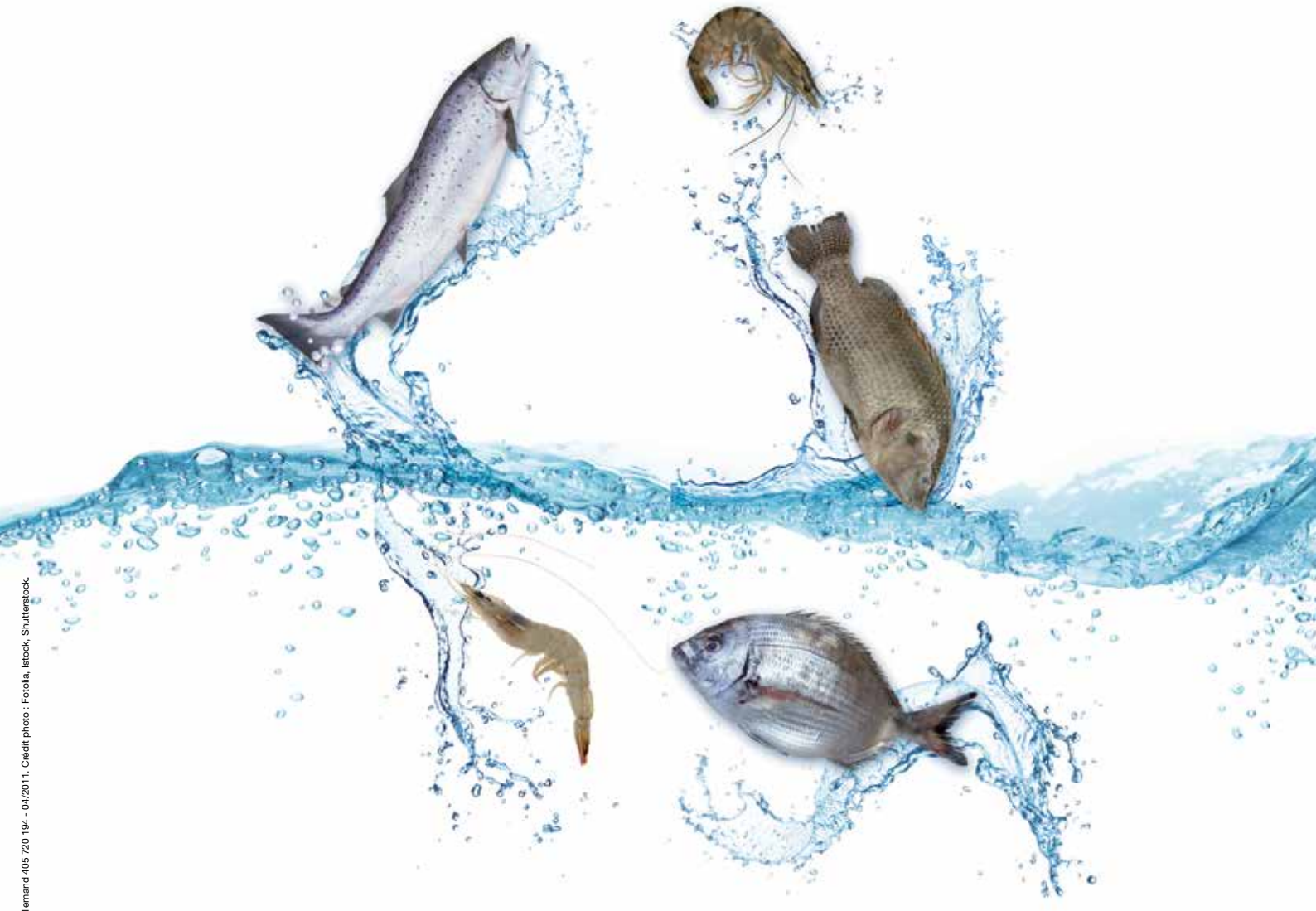

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Developing feeds for recirculation systems in fish farming

R&D on performance feeds for recirculation systems to sustain fish farming in Europe

As concerns on the environmental impact of intensive production systems intensify, recirculation aquaculture system (RAS) with minimum ecological impacts is an alternative. RAS also reduces water usage and improves waste management. In Europe, RAS fulfil the dual role of food production while sustaining natural resources. It has been developed in response to mitigating adverse environmental impacts in countries with limited access to land and water. The new EU water management directive (2000/60/EC 23rd Oct 2000) called for sound environment friendly aquaculture production. At present, only a small volume of aquaculture production is from RAS systems. But there is great potential to use such systems for the culture of seafood in areas that are in the vicinity of urban markets (Martins *et al*, 2010).

From the end of the eighties and until earlier this year, fish farming in Denmark has been regulated by fixed feed quotas to reduce pollution, and farming activity consequently declined or stagnated for several years until the industry started a shift from classical fish farms to recirculation fish farming systems. Ten years ago, investments into RAS began and today most trout farms use either indoor fully recirculation systems or open culture that are either semi or fully recirculation systems. Today a major policy shift paves the way for a future expansion of aquaculture production in Denmark. The current strategy is to increase fish production by 50% from the current 40,000 tonnes but with a 25% per unit lower environment impact. These policies will involve an increase use of feed with the use of full recirculation systems for both freshwater and seawater farms.

"Danish fish farmers are now allowed to use as much feed as they like in recirculation systems as long as regular measurements show that the quality of the outlet water from their farms are within the permissible values for nitrogen (N), phosphorus (P) and organic matter. This allows farmers to maximise production while the impact on the surrounding water environment is kept at an absolute minimum, but that requires a feed specially adapted to recirculation systems," explained Ole Christensen, general manager of BioMar A/S, Denmark. He believes the recirculation technology has a great future because it gives farmers good control of all production parameters and can be located anywhere. "In the years to come, we expect more and more recirculation systems will be in use, both here in Europe and elsewhere."

Henrik Aarestrup, international marketing manager, said that "Producers are keen to know the special feed requirement in RAS. In addition, whilst we have many technological innovations in RAS in recent years, there is still a lot to learn and improve in terms of feed and farm management."

Feed R&D

At the forefront of BioMar's R&D program, the feed trial unit in Hirshals, Denmark is targeted to meet the changing demand for raw materials and feeds for RAS. The feed centre is located within the compound of the North Sea Science Park under the Danish Technical University. In conjunction with the conference and workshop on RAS, DanFish and DanAqua, BioMar organised visits for the press and farmers from other countries such as Chile, Russia and Norway to this centre.

Jørgen Holm, R&D manager for BioMar Continental Europe, said,

Stripping the trout for digestibility trials. Holm said that the team adapts to the different nature of faeces from seabream and seabass. The former has liquid faeces which cause an overestimation of digestibility and the latter, short intestines which does not allow for the stripping method.

"R&D is essential for us to support sustainable growth of the industry. The challenge for a global fish feed company like BioMar is that we have to deal with numerous species, different environments, seasonal variations and temperature fluctuations. We have in our R&D team 38 specialists working in different groups on raw materials, nutrition, process technology and fish health. In addition to our trial facilities, we have at the Tech Centre in Brande, Denmark, a mini factory which can produce feeds up to 25 kg batches for research purposes.

"Feed development requires a lot of basic information, data analysis and a good database. We have a six–step approach in feed development and raw material assessment where we look closely at apparent digestibility of nutrients, whole body analysis of fish composition during the production cycle, digestible protein-to-digestible energy ratios (DP: DE) for optimal growth performance, energy sources and amino acid requirements. We then develop models based on the six steps. In comparison with recipes based on crude raw materials, here we work with true digestibility for cost effective feeds. In the case of fish meal, we add micronutrients to improve feed performance. There is a biological cost in using feeds with low quality fish meal. Feeds with a good feed conversion cost more so we need to educate farmers on weighing costs against performance. Health and nutrition can be improved by using different additives, including enriched lipids and probiotics such as Bactocell from Lallemand which in turn requires us to use processing alternatives such as micronised raw materials and low temperature extrusion.

From left, Neils Alsted, Henrik Aarestrup, and Kim Schøn Ekmann

Trial centre

The FTU (feed trial unit) in Hirtshals is 100% BioMar owned and has been used to conduct trials since 1992. There are nine separate recirculation systems. Annually, it can run approximately 5 challenge and 35 feeding trials. Aside from the experimental tanks, the centre has a four-tank quarantine unit and a four-tank holding unit for fish waiting to be used in trials. Feed performance and digestibility trials are conducted on a variety of fish species, life stages, temperatures and filtration systems. In addition, experimental tanks are also used to run trials for benchmarking competitor feeds.

The trial facilities have been gradually modernised and the first true recirculation system at the FTU was set up 13 years ago. All trial units have access to both fresh and sea water, and the latter is pumped directly from the coast at Hirtshals. The salinity range can be adjusted from 0 to 35 ppt. Water temperature can be controlled in each individual system, and temperatures can be maintained between 6 and 30˚C year-round. The filtration is mechanical, followed by biological and trickling filter and oxygenation. Experimental tanks are very similar throughout this FTU as well as in other FTU's of the company, thus allowing all BioMar R&D teams to have a standard experimental protocol. The groups of tanks are in multiples of three, so that each treatment can be replicated three times. Tanks are identical, aside from size. Each has waste collectors and oxygenators so that the trial can continue in adverse conditions.

"Raw material evaluation is an important part of the R&D work. We test digestibility at different inclusion levels using yttrium oxide as the digestibility marker. This is preferable to chromic oxide which has the tendency to accumulate in the fish stomach. The disease challenge tests in the Hirtshals' facility are limited to bacterial based challenges. When we do these challenges, we shift to a flow through system," said Holm.

Feeds for recirculation fish farming

The special requirements for feed for RAS, was explained by Kim Schøn Ekmann, researcher at Hirtshals in a presentation at the Farmers' Afternoon session of the Second Workshop on RAS. The workshop in Aalborg, was jointly sponsored by BioMar, Danish pump supplier, Grundfos and Nordic Council of Ministers.

"Feeds are of paramount importance in recirculation systems and should have the following criteria: high performance, producing stable faeces structure for easy waste removal; reduced nitrogen discharge on bio filters and production of optimal fish growth and high quality fillet.

Jorgen Holm. In the background are tanks used for larger fish.

"Since 2004, we have been conducting trials on bio-filter responses to diets as well as pH regulation. A stable faeces structure will facilitate easy removal by faecal traps and/or mechanical filters. We also research on faeces quality, i.e. how the raw material affects the cohesiveness of faeces. The main concept revolves around DP: DE ratios. An optimal DP: DE using as little protein as possible will reduce discharge of nitrogen. The optimisation of amino acids will reduce the breakdown of amino acids and reduce the load on the biofilters," said Ekmann.

On the choice of raw material, Ekmann explained, "The faecal stability, digestibility and diet performance also depend on raw materials. For feeds specifically for RAS, raw materials must have high digestibility and they must not negatively affect the faecal physical structure. The profile of protein and amino acids is especially crucial as it will determine the loss of protein during fish production. Wasted protein is released as ammonium (NH_4^+) which biofilters convert to nitrate (NO_3^-) or nitrogen. This is a typical bottleneck in recirculation systems."

Ekmann added that they are limited in the number of raw materials to use for such feeds and unsuitable raw materials are removed from their matrix. In the case of plant proteins, unprocessed vegetable proteins are avoided such as unprocessed soy. "Land animal proteins have lower protein digestibility in comparison to plant concentrates. However, a lower digestibility means lower prices and as the target is to remove faecal material, sometimes the choice is with the user.

"Ammonia is the main by-product of the metabolic process and if the biofilter cannot cope with the ammonia released, toxic conditions will occur. But reducing the amount of protein in feed will affect growth performance. We overcome this by using extremely high digestibility and very precise amino acid optimisation."

In 2011, BioMar launched the ORBIT feed concept for RAS – for trout a 42:31 protein-to-lipid ratio was used. This fulfils multiple objectives: up to 3% improvement in protein digestibility, up to 20% improvement in phosphorus digestibility, up to 21% lower ammonium excretion per tonne of fish produced, up to 41% lower nitrogen excretion via faeces per tonne of fish produced and up to 51% lower phosphorus excretion via faeces per tonne of fish produced, no significant reduction of phosphorus released via urine and confirmation of feed performance. This has been confirmed in both laboratory and commercial trials.

"Small floating particles of faecal origin are also absent in the water. These are detrimental to fish and biofilters as they might clog the gills of fish and biofilters. Faeces of fish fed with ORBIT can easily be removed via a sludge cone to give a reduced environment impact compared to traditional feed types," said Ekmann.

Niels Alsted, executive vice president of BioMar, said, "The best way to remove solid wastes is to remove them before they enter the fish. The developments in recirculation technology force us to change the diet. This feed line designed for the trout is now marketed in the Baltic region where recirculation fish farming is a significant aquaculture technology. The expectation is that the model will be extended to other species and introduced in other markets as well."

Table 1. Comparison on diet analysis between the traditional, RAS diet and Sustain line for the rainbow trout (source Ekmann).

Analysis	Traditional Feed	Standard recirculation diet	Sustain recirculation diet
Protein (%)	46.9%	42.1%	42.1%
Lipid (%)	31.1%	31.3 %	31.3 %
Ash (%)	8.6%	5.7%	5.4%
Water (%)	5.5%	8.4%	7.6%
Phosphorus (%)	1.21%	0.94%	0.98%
Notes		Phytase treated	Phytase treated. Optimised according to Concept 121 (one-to-one)

All tanks are fitted with waste collectors

"This fits perfectly into our Biosustain approach for sustainable fish farming and optimal use of resources and reduced emissions to the environment. We do this with good manufacturing practices, nutrition and food safety. We work closely with suppliers to have raw material inputs meeting our requirements such as nutritional and physical characteristics, process ability and low variability."

Reference

C.I.M. Martins, E.H. Eding, M.C.J. Verdegem, L.T.N. Heinsbroek, O. Schneider, J.P. Blancheton, E. Roque d'Orbcastel and J.A.J. Verreth, 2010. New developments in recirculating aquaculture systems in Europe: A perspective on environmental sustainability. Aquacultural Engineering November 2010, Volume 43, Issue 3, Pages 83-93.

BioMar

In 1962, a group of Danish fish farmers founded BioMar. Via organic growth and acquisitions, the company today is a leading aquafeed producer with 11 factories in 8 countries and R&D trial facilities in Denmark, Chile, Costa Rica and Greece. Since its inception, BioMar is uniquely a producer of aquaculture feeds. It does not have farming activities. Feeds are for the full life cycle of fish, from fry to plate and markets are global. Turnover in 2012 was 1.1 billion Euro from sales of 1 million tonnes of feeds. Feeds are produced for more than 30 species but feeds for the salmon, trout, European seabass and seabream are most important in terms of volume. BioMar's market share ranges between 25-30% of the market for aquaculture feeds for salmon, trout, European seabass and seabream in Europe and trout, salmon and coho in South America. In addition to this the company is active in shrimp and tilapia feeds, with a newly installed factory in Costa Rica serving the Central American markets. In the next five years, the company plans to expand production to 1.7 million tonnes. A new R&D centre in South America is now dedicated to expanding feed development for warm water fish species as well as shrimp feeds.

Hybrid snakehead fish farming in China

By Dong Qiufen, Peng Zhidong, Mei Gaoshang, Zhang Song and Yang Yong

Farming of the fish has expanded but with a dependence on local live fish markets. Prices fluctuate with supply and industry looks forward to steady prices with fillet export and better marketing.

The snakehead fish from China is considered as an exotic predator and invasive fish to the US aquaculture industry. Since the first appearance of several snakeheads in a pond in Crofton in Maryland in June 2002, they have been frequently sighted in the US. On the contrary, snakeheads are highly valued as a food fish in China and some other Asian countries.

China is a country with a long history in traditional herbal medicine, and for centuries, the snakehead fish is listed for its pharmacological properties in promoting muscle growth, hematopoiesis and some other physiological activities of the human body. Added to this, the fish is tasty. This and its high flesh yield make the snakeheads an important commercial fish of high market value in Chinese aquaculture.

The snakehead fish is widely distributed in China, with the exception of the highland areas. There are more than seven snakehead fish species reported in China, but only three of them, *Channa maculate*, *C. asiatica* and *C. argus* are farmed. *C. maculate* and *C. asiatica* are mainly distributed in south China and *C. argus* are found mostly in the central and northern provinces. Lower supplies from overfishing of the snakehead some 30 years ago resulted in higher prices. This also encouraged its intensive farming. With a developing snakehead fish farming industry, a hybrid species which is a cross between female *C. asiatica* (♀) and male *C. argus* (♂) was developed successfully in Shunde, Guangdong in 1994.

Expansion in farming

After nearly 10 years of promotion and good farming practices, the hybrid snakehead fish have overcome its negative 'ghost fish' image and has become more popular in China. Currently, more than 90% of hybrid snakehead farming areas are in the south. Recently, hybrid snakeheads were introduced to the central and north of China. With the expanding China's domestic market, snakehead fish production is increasing with a total annual production of more than 350,000 tonnes, comprising 170,000 tonnes in Guangdong, 100,000 tonnes in Zhejiang, 35,000 tonnes in Shandong and 12,000 tonnes in Guangxi and other provinces. This interest in snakehead farming coupled with good marketing strategies have spurred the development of supporting industries, such as seed stock and formulated feed.

Seed

Since the 1980s, wild caught snakehead fish fingerlings were stocked intensively in ponds and cages in Shunde, Guangdong. In 1987, the first batch of *C. asiatica* from Hong Kong was introduced to Shunde and showed good growth performance. Within a 6-month culture period, this Hong Kong stock gained an average weight of 1 kg, which was twice that of the local variety. To overcome the problem of inbreeding, in 1994 scientists carried out work on hybridisation of the snakehead. Finally the hybrid snakehead (female *C. asiatica* ♀ x male *C.argus* ♂) performed best with fast growth, less reliance on trash fish as feed and stronger adaptation capacity to changing weather conditions in China.

Now, there is an ongoing work in Shunde to develop another hybrid snakehead fish from male *C. asiatica* (♂) and female *C. argus* (♀). However, this new hybrid species does not perform better than the 1994 hybrid, it requires more sophisticated breeding technology to produce better growth traits.

Guangdong leads in hatchery production

As the winter is cold in most areas of China, Guangdong is the most suitable province for hatchery production of seed stock. But even in Guangdong, the lowest temperature can be as low as 10ºC, when the snakehead just hides in the soil without feeding. There are more than 100 private sector hatcheries and nurseries for hybrid snakehead fry production in Guangdong province, and the yearly output is more than 1 billion fry. The market for fry is the intensive farms in Guangdong. Some fish seed traders sell the fry to some other provinces in east and north China. In 2007, the Fisheries Research Institute of Academy of Agricultural Sciences of Hangzhou, Zhejiang province successfully developed a hybrid snakehead fish hatchery similar to that in Guangdong. This solved the problem of transporting seed stock from Guangdong to Zhejiang province which is more than 1,000 km away.

Figure 1: Commercial snakehead hybrids

C. asiatica ♀x *C.argus* ♂

C. asiatica ♀x *C.argus* ♂

C.argus ♂

C. asiatica ♀

Farming trends

With global warming, the hybrid snakehead fish fry are now available from April to July, but rainy weather conditions can significantly influence fish farming activity. Farmers also stock snakehead fish ponds according to market demands, a good price this year will lead to more fish output some six months later.

Hybrid snakehead fish is usually farmed intensively in ponds and fed with extruded feeds. As the availability of water is limited and its usage is restricted, farmers farm the fish without any water exchange or limited water exchange. In such situations, farmers have mastered the technology to maintain good water quality with minimal water exchange - a result of years of farming experience. To control and maintain water quality, they stock some carps, such as bighead carp and common carp together with snakehead fish. In such polyculture

systems, the stocking density for bighead carp and common carp is about 0.2 fish/m^2 and 0.4 fish/m^2 respectively, and that for snakehead is 13-20 fish/m^2. The snakehead is an air breather and can live without water for more than 7 days, if the skin is moist enough. Aerators are used in the ponds to provide oxygen for the carps.

The seasons in China allow for three different harvests. The first crop of hybrid fish involves stocking fingerlings before May, and harvesting from September the same year with a farming period of not more than 6 months. The harvest size is usually from 500 g to 750 g. In this first crop, the weather in Guangdong is cold and survival rate is low, and stocking density is higher than other two crops at about 20 fish/m^2 (1500 fish/kg).

However, from March to May, it is still cold and rainy in Guangdong and a different culture management is deployed. The second crop of fish is stocked about 2 months after the first crop and fish is harvested from November to April the following year after a farming period of 7 to 12 months. The harvest size is more than 700 g. Here the production is larger when the stocking density 15 fish/m^2, as after May the weather is hot and stable with high fish survival rate. Fish also grow slowly over the winter season with no feed intake.

The third crop is stocked after June and harvested in June the following year. The farming cycle is 10 to 15 months and harvest size is about 800g. The stocking density is about 13 fish/m^2. The risks to diseases are high because of the frequent weather changes from winter to spring and then to summer during the farming period. The advantage is the better chance of selling fish with a good price in June, when usually there are not enough of commercial size fish in the market.

Table 1 Snakehead fish farming in China in 2011

Parameters	Snakehead	Silver carp	Crucian carp
Culture area (m^2)	2735		
Pond depth (m)	2.5		
Size of juvenile fish (fish/kg)	1500	30	95
Stocking density (fish/m^2)	20	0.28	0.73
Feed conversion ratio (FCR)	1.09	-	-
Feed frequency (times/day)	2 to 3	-	-
Feed rate (%BW)	3 to 5	-	-
Culture duration (days)	190		
Body weight at harvest (g/fish)	700	1150	210
Survival rate (%)	70%	87%	46%
Yield (kg)	26,732	650	195
Price (USD/kg)	1.08	0.64	0.52
Gross income (USD)	58,836		
Production cost (USD)	44,190		
Net income (USD)	14,646		
Unit production (kg/m^2)	9.77	0.28	0.07
Unit profit (USD/m^2)	5.36		
B/C (%)	33.14%		

Note:
1. Fish prices were collected on 2 December 2011. The exchange rate of USD and CNY was 1:6.37
2. Snakehead fish price on 15 August 2013 was 7.8 CNY/500g (2.55 USD/kg), the exchange rate of USD and CNY was 1: 6.11.

Harvesting

Feed

In the past, the snakehead fish was fed trash fish in China. However, since 2000, as extruded feeds for other fish species become available, farmers in the south showed some interest in using extruded feeds. They have already found it disadvantageous to feed the fish with trash fish which was more labour intensive. Feed conversion ratio (FCR) was high and with bad water quality, the frequency of diseases was higher and survival rate lower. Cost of production was higher with lower profit margins. Several feed mills then promoted the use of extruded feeds for *C. asiatica* to feed the hybrid fish, but could not achieve good culture results, resulting in the loss of confidence in some farmers in the use of extruded feeds.

Extruded feeds

Guangzhou Haiwei Feed Co., Ltd and Shunde Baian Feed Co., Ltd are two of the early producers of extruded feeds specific for the snakehead fish. With nutritional improvements to the feed and more promotional efforts by the feed mills, farmers gradually accepted extruded feeds. In 2002, the extruded feed market for snakehead fish was just about 200 tonnes, but reached 3,000 tonnes in 2003, 20,000 tonnes in 2005, 70,000 tonnes in 2009 and 220,000 tonnes in 2012. Except for some farming of *C.argus*, using trash fish in the north of China, most farmers now prefer to use extruded feed.

Currently in Guangdong and Guangxi, there are more than 30 fish feed companies producing feeds for the snakehead fish. This resulted in an oversupply and fierce competition among producers. The feed price varies from USD 1.51/kg (39% crude protein) to USD 1.64/kg (44% crude protein). Feed performance and FCR vary with brands. In the past few years, with the price of fishmeal increasing, some small fish feed producers are likely to incorporate other animal sources of protein, such as poultry meal and blood meal, ultimately reducing the quality of the feeds. But the larger feed companies have upheld their reputation for quality with fishmeal added at more than 30% in the formulation. The feed of Guangzhou Haiwei Feed Co., Ltd of Guangdong Haid Group has an FCR of 0.9-1.2 and that of other feed brands range from a high FCR of 1.4 to the lowest at 1.0.

In addition, with better quality seed stock, good farming management and extruded feeds, the current rate for skeletal malformations in the snakehead fish is very low in China, sometimes even completely absent. Previously, this has been attributed to poor quality fingerlings, farm mismanagement and unbalanced feed nutrition. With several years of experience in developing feed for the snakehead fish, Guangzhou Hinter Biotechnology Co., Ltd is proud to have played a role in promoting snakehead fish farming with extruded feed. The company has the Hinter A701 premix for snakehead fish which can reduce fish malformation, increase growth and resistance to diseases. The Hinter aquaculture nutrition and farming service team has helped many feed mills and fish farmers.

Extruded feed for the snakehead fish from 44-39% crude protein

Feeding the fish with extruded feed

Marketing

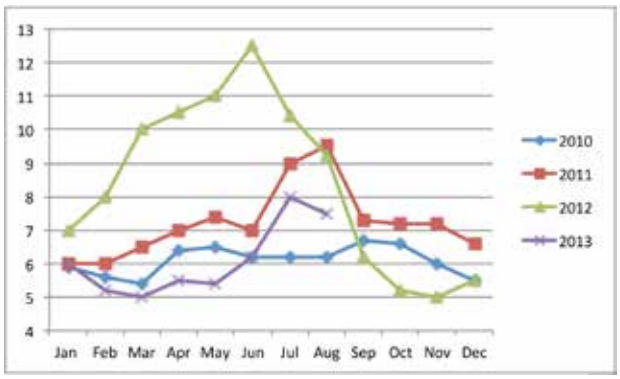
Guangdong is the largest producer of snakehead fish with more than 1,300 ha of farming area. More than 80% of the production is sent to Shanghai, Zhejiang, Hubei and some other northern provinces. The Chinese prefer to consume live fish and as the snakehead is an air breather, the fish is easily transported over more than 2,000 km without affecting survival rate. The price of the live snakehead fish is 30% higher than chilled fish.

Usually both farmers and fish traders can easily profit from snakehead fish farming, although it is still a high risk industry because of price fluctuations. The profit margin at the farm level is around 33% (Table 1) and at the retail levels, margins can be 10 to 30%. Since profits have been very high in the past, it has attracted many newcomers investing in snakehead fish farming. This resulted in an oversupply and reduction in prices. Fish prices were very low with a large production in 2010 but rose in 2011 and hit the highest point in 2012 but dropped down again in early 2013 (Figure 2).

As the fish is produced for the local market only, little has been done to control the quantity of snakehead fish farming. In China, there is no accurate data to show farmers how to control farming quantity.

The fish farming quantity shows a significant negative correlation with fish prices of previous years. In 2010, fish price was low and the output declined in early 2011 by 20% and this prompted a higher price

Figure 2: Snakehead fish prices in Guangdong from 2010 to 2013



Note: In 2012, from January to August, the average weight of snakehead was 0.65-0.9 kg/fish and from September to December, the average weight of snakehead was 0.55-0.9 kg/fish (Adapted from www.fishfirst.cn)

in 2011. When the total fish quantity increased by 25% in late 2011, prices dropped at the end of 2012. Following this trend, it is predicted that fish output should decrease by about 40% in 2013, and the price in late 2013 will be better than 2012.

Outlook

The snakehead fish has become an important food fish in China but there are some urgent issues which require attention.

Seedstock

There are many private sector hatcheries and nurseries for hybrid snakehead fish, but all these lack a standard management protocol. The high profits of hybrid seed production have encouraged some low quality fingerlings, because some producers just care about quantity rather than quality. The good news is that some reputable groups have started breeding programs such as BaiRong Fish Seedling and Nanhai Keda Hengsheng. These larger groups have good reputation with good management system, technology and other available resources.

Diseases

With changing climatic conditions and limited water supply, the fish easily succumb to diseases. Putrid skin disease is common and farmers need to be able to anticipate and prevent this from affecting fish survival and prices. There are many animal health companies with chemicals and treatments to maintain good water quality and to treat diseases. Most of them also provide technical services to farmers.

Food safety

With strict legal regulations, banned medicines are seldom used in aquaculture. However, it is still necessary to raise farmers' awareness on the environmental impact and to keep to a sustainable aquaculture protocol and produce safe fish.

Marketing

As fish prices fluctuate every year, the industry needs a fish trade association as well as a marketing system to ensure its profitability. More assistance and guidance from the government are sought in fish marketing communication and to ensure that there is no oversupply. The meat yield for the snakehead is high at 63% which is 3 to 5% higher than tilapia and channel catfish and thus has a potential for the export of fillet. This will add to China's seafood exports which are now mainly focused on the tilapia and shrimp. In Zhejiang province, some leather producers are trying to use the fish skin to produce commercial products, such as handbag and handicrafts.

When some of these problems are resolved, the snakehead fish industry is expected to develop positively. In addition, the success in snakehead fish farming and experiences from China are good examples for the development of the same industry in other Southeast Asian countries. The Hinter international service team is sharing their knowhow on snakehead fish farming in Vietnam, Myanmar, Cambodia and other countries.

Hybrid snakehead fry





From left, **Dong Qiufen, Peng Zhidong, Mei Gaoshang, Dr Zhang Song** and **Dr Yang Yong** are experts in aquaculture nutrition and health from Guangzhou Hinter Biotechnology Co. Ltd. Hinter mainly delivers total practical solutions for aquafeed mills to help them produce high quality aquafeed. Email: qiufendong@gmail.com (Dong Qiufen).

TARS 2013
The Aquaculture Roundtable Series
21–22 August 2013

Taking Asia's finfish aquaculture to the next level of development

Part 2. The challenges in production, marketing and sustainability

TARS 2013 focused on the finfish aquaculture sector: Industrialisation and Sustainability. Asia's finfish aquaculture industry comprises mainly of small and medium scale farms, using a diversity of production methods at varying levels of intensification. Consolidation, integration and industrialisation are changing the industry profile albeit gradually to meet the demands of global markets. It also needs to address sustainability of the industry from an economic, social and environmental perspective.

At this meeting, 17 global experts discussed the state of the industry in several areas: genetics, intensification and controlled hatchery operations in Asia and Europe, as well as health management, production models, health and environment, feeds and feeding, and marketing and sustainability. The plenary sessions set the stage for the breakout group discussions, namely: *Breeding and Hatchery Management; Production, Health and Environment; Feeds and Feeding; and Marketing and Sustainability.*

Part 1 of the TARS2013 report in issue September/October, carried extracts of the plenary presentations in the sessions on breeding and hatchery management as well as on feeds and feeding and the summary of the output from the respective break-out groups.

Panel discussion on production, health and environment, from left, Dr Ooi Ei Lin, Novus, Thailand, Man Heng Soo, Active Bio-Culture P/L, Australia, and Dr Fuci Guo, Alltech, Malaysia.

Here in part 2, we continue with the plenary presentations covering production, health management and environment as well as marketing and production sustainability. The report also includes challenges

and strategies suggested by participants in the production, health and environment (PHE), and marketing and sustainability (MS) break-out groups.

Production models and challenges

Over the last 40 years, **Bjørn Myrseth**, CEO Vitamar, Norway has gathered extensive experiences with fish farming as an investor and developer of fish farms in Scotland, US, Canada, Chile, Greece, Spain and Norway. His experience with tropical fish has been with the cobia in Belize and Vietnam. His presentation on '*Production models, successes and failures, value chain and consolidation, investor outlook*' included his view on how Asian fish farming can move forward.

"What can we learn with the failures in Chile and success in the Faroe Islands with Atlantic salmon production? In the Faroe Islands, what is important is the certification of smolt. Only one year class of salmon per site and per fjord is permitted; there must be a good distance between farms, and fallowing for 3-4 months after every harvest is mandated. This is an excellent model with hardly any mortality. Production costs used to be USD 3-4/kg and now is USD 2.50/kg because of less disease and better growth. Stock, certification and disease prevention are keys to sustainability and should be introduced elsewhere. In contrast we have in China, farms that are only 2-3 km apart. I see this as a big challenge here in Asia as preventing the industry in moving forward," said Myrseth.

Innovation led

"The success in the Norwegian salmon industry is due to innovation. The initial trial and error methods were expensive but they could do this because prices were high. Innovation was led by feed companies, universities and research institutes, equipment suppliers and farmers, with financial support from the 0.35% levy on all salmon exports. The fund which reached USD 40 million was from farmers and they decided on how the money should be spent.

Bjørn Myrseth (left) with Dr Darryl Jory, Pentair Aquatic Eco-Systems, Inc., USA.

Christopher Co, Overseas Feeds Corp, Philippines

Aqilah Haji Junaidi, Department of Fisheries, Brunei

Laura Khor Li Imm, KS Aquaculture, Malaysia

"Today, with low prices we cannot afford to do so much innovation but marketing, and disease prevention via legislation and vaccination have brought down costs of production to around NOK 20/kg or USD 3.26/kg in 2011 from NOK 68/kg in 1985. Genetics and the use of healthier fish had reduced production costs, increased demand and productivity from 30 to 402 tonnes/man output helped. Since 1979, there has been a levy of 0.75% on export value which is used for generic marketing for the salmon. In the European seabass and seabream industries in the Mediterranean, the same has not occurred because of industry resistance."

He added that in salmon farming, integration has resulted in the reduction from 800 companies to 100 today and in ten years, there may only be 40-50 companies. "The trend is more focused with better quality control. The government has set a lot more controls. The values of sites and licences have become more valuable which are passed to the next generation."

Investment options

Myrseth said that investors usually look at start-ups and companies with positive cash flow and growth. In Norway, listed companies are most popular. Investment options are not necessarily just in the production segment but also in supporting activities such as feed, vaccines, equipment and services. He added that to attract investors, farms need to have the paper work in order. What is most important is the biomass. Some investors may wish to carry out environmental audits. He concluded that, "Asia, in particular those areas 10 degrees north and south of the equator, outside the typhoon areas, have better development potential. The challenges are in juvenile fish quality, genetics, disease management, more efficient production, processing and distribution such as in the case of the seabass. Asia needs better legislations for disease prevention, R&D and infrastructure developments. Asia can learn from the mistakes elsewhere and by doing so, can still be the winner."

Industry reviews

Industrialisation in marine fish farming

In the presentation, *Industrialisation and sustainability in marine fish production in Asia,* **Misai Tsai**, PT Lucky Samudra Pratama, Indonesia discussed mass production, farm and health at his farm in Kongsi Island in Indonesia's Thousand Islands Archipelago. PT Lucky Samudra Pratama was started in 2000 for seafood processing. When supplies of wild catches declined, it moved upstream with the farming of marine fish, mainly pompano. Today it has diversified to include the production of red snapper and barramundi.

"The aim is to reduce production costs instead of raising prices," said Tsai. His initial search was for a species suitable for mass production. The criteria used included domestication, mass production, selective breeding and feed conversion ratio (FCR). The target FCR was 1:1. As the key factors for success are good location and good farm management, Tsai discussed how these were applied in the farm.

A good environment is important and Tsai used his engineering background to identify suitable sites which include areas with no history of pollution and diseases, and places with a constant current which will save on energy usage and a stable temperature to give a lower FCR. "Analysis of water currents is crucial. A yearly current survey should be carried out to prevent problems. The best current speed is between 8 m/min and 16 m/min as one lower than 4 m/min means that we must monitor dissolved oxygen (DO) closely. Current speed over 20 m/min means that it is too strong for feeding. The positive advantages of upwelling are: fewer incidences of strong wave occurrence which minimise damage to cages, constant current flow to increase DO, and nutrient rich waters with stable temperature - all of these factors are conducive to fish growth."

Next is a target FCR. "Our initial trials on feed were on training the fish to eat and studying fish feeding behaviour. In feeding marine fish, it was not possible to use dry feeds with 10% moisture. We began to produce our own feeds with 20% moisture; using 30% trash fish and 60% fishmeal powder and some additives against stress.

"Good farm and health management requires good record keeping and feedback system. Twice a month we check the condition of the stock. We monitor the health status of the fish by checking the digestive organs as well as for infestations with parasites, bacteria and viruses," said Tsai.

"We set up standard operating procedures (SOP) for health management. We begin with observation, problem detection, analysis and cause of disease, setting up SOP and implementing a health management program. We have solved the infestation with *Benedinia* parasite in this way and changed the net cleaning schedule to break the lifecycle of the parasite."

Tsai's message was, "Once we have these in place plus certification, it will be easy to break into international markets."

Joep Kleine Staarman, Barramundi Asia, Singapore

Hendi Bn Udung Arifin, PT Luxindo Internusa, Indonesia

Padmanabhan Saravanan, Temasek Polytechnic, Singapore

H-L Yang

Sustainability in tilapia farming

The focus on industrialisation continued with the presentation on PT Aquafarm Nusantara (PTAN), Indonesia. As a subsidiary of the 25-year integrated tilapia enterprise, Regal Springs (which operates farms in Indonesia, Mexico and Honduras), PTAN is a unique example of industrialisation with sustainability in the Asian region. Marketing is very important for the company and it has its own marketing and sales teams in the US and Europe for the Regal Springs brand. It works with the WWF Aquaculture Dialogues to establish guidelines for certified sustainable tilapia.

In sustainability, it is critical to look after the water body and monitor water quality closely. Lake Toba is a major tourist destination and also the icon of the local community and must be conserved at all costs. For industrialisation, the requirement of all sectors of the value chain must be considered. The company has its own genetic stocks, hatcheries, cage culture, processing and sales, and distribution. Industrialisation requires genetic selection and PTAN uses three breeds including the GIFT, Singapore Red and IBW.

The hatchery and nursery operations in Serdang Berdegai and cage farming operations in Lake Toba were described. Cage design is similar to circular cages found in Europe. Cages are 18m in diameter and 6m deep and arranged linearly in five locations. The cages are sited 200m from the shore, with water depths of at least 40m and located away from agriculture activity and local water transportation routes. Fingerlings of 20g are stocked at 60 fingerlings/m^3. Nets are placed over cages during the early stage of grow-out to prevent predation from birds. Each crop has a 210 day cycle and production is 90 tonnes/cage.

Fish are processed as frozen fillets and targeted for the international markets. Scales are processed into collagen; skin is transformed into fashion goods, fish fat is collected for biofuel production while head and carcass are converted into fish meal. All in all, this ensures minimisation of waste and maximised utilisation of the fish.

Sustainable grouper aquaculture

Ten years ago, Taiwanese **Dr H-L Yang**, now CEO Merit Ocean Biotech, moved from research in bio medicine of mammals to fish health research. When he decided to go into aquaculture, he chose to work on the grouper a difficult species to farm but of high value and popular in Asia and the Middle East. At this meeting, he presented his pioneering work in developing oral vaccines for the grouper, development of a NNV-free SPF larvae rearing system and production of PI-SPR grouper fingerlings.

"I chose the grouper because it needs technology to upgrade its aquaculture from a high risk species to an industrial production model with standard operating procedures (SOP) and prevention of diseases, rather than treatments, for sustainable farming.

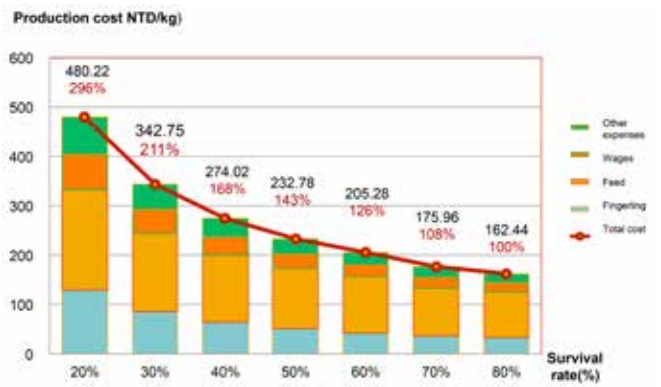
At the hatchery stage, Yang said the key problems are viral diseases, erratic biological parameters in rearing and inferior nutrient and quality of starter feeds. The most serious problem is viral nervous necrosis (VNN) caused by nervous necrosis virus (NNV) that has multiple pathways of transmission. Infection with NNV can be found in hatchlings to 2 inch size fingerlings (60 dph, day post hatch) for orange spotted grouper and up to the 3rd year in giant grouper. In addition, there are disease outbreaks caused by Iridovirus, *Vibrio* spp, *Aeromonas* spp, *Streptococcus* spp and various parasites at the grow-out stage.

Misai Tsai (right) with Sofjan Alisjahbana, PT Fega Marikultura, Indonesia

"NNV is present in the waters throughout Asia, in Taiwan and China to the Mediterranean Sea. Almost 95% of farmed brood stocks in Taiwan are NNV carriers that do not exhibit disease symptoms. Almost 95% of fertilised eggs are also found to have NNV. NNV causes high mortality at larval stages and total loss of the stock. As it is a simple RNA virus, it is easy to detect by polymerase chain reaction (PCR). But once it is in a hatchery, it is difficult to eradicate. Even commercial live starter feed produced outdoors can carry the virus.

"Six years ago, we developed a subunit vaccine with NNV coat protein expressed in *E. coli* but the challenge was immunisation using the conventional injection. We then developed an NNV oral vaccine for larvae by encapsulating NNV coat protein into *Artemia* and larvae were immunised around 20 dph. An injective multi-valent vaccine of NNV, *Vibrio* spp and *Aeromonas* was developed to counter diseases often found at the grow-out stage."

Figure 1 Reduction in production cost with higher survival using SPR fingerlings (Note: cost of production was calculated based on the formula in the MS thesis of Fu Pei-Hon, 2007 National Ocean University; Courtesy of Dr H-L Yang)



Controlling NNV

"We then designed an indoor virus free hatchery using recirculated water to produce NNV SPF live feed and fingerlings as well as developed a SOP for the grouper hatchery. We studied the optimum rearing condition and nutritional requirements. This technology was transferred to the company Merit Ocean Biotech. The next bottleneck was to convince farmers to use vaccine. Therefore we decided to do the vaccination for them. We have PI-SPR (Pre-immunised specific pathogen resistant) fingerlings which stabilised production, with reduced use of antibiotics. In addition we have farmer assistant services which include checking farms to ensure that they are ready to receive the PI-SPR fingerlings and training farmers to maintain optimal farming environment. Next we targeted the use of our model hatchery to rear other species of grouper," said Yang.

"In the past one year, we have seen excellent results. Over 90% of our shipments of fingerlings to 30 farms each utilising 15,000 to 35,000 fingerlings show survival rates of 75-85%. We have shown that by increasing survival we can reduce costs of production of orange spotted grouper; from NTD 480/kg (USD16.4/kg) at 20% survival rate to NTD 162/kg (USD 5.5/kg) when survival increases to 80%."

Managing fish health

The way forward in open water systems

Finfish aquaculture in Asia is characterised by a diversity of species farmed in open systems with low survivals. Managing health is a specialised area of aquaculture which accounts for 36% of the main problems. **Norman Lim**, Merck Animal Health, Singapore has this to say on the industry. "A macro-ecological study showed that the frequency and severity of disease outbreaks are more often prevalent in tropical conditions closer to the equator. This means that we need more resources to understand the epidemiology of diseases. With culture intensification comes diseases, and in Asia, there are 6 to 10 diseases for each species cultured. Almost 55% of the diseases have a bacterial etiology. Disease is a business cost arising from mortality. However, investments can be made on preventive measures such as biosecurity and vaccination programs to reduce such risks. "

Lim's presentation on *Managing fish health in tropical open-water systems –the way forward* focused on how to manage tropical open-water systems. He used the example of salmon in Norway where with larger cages and higher volumes, production rose to 597,000 tonnes in 2006 from only 173 tonnes in 1973. In the beginning, attention was on seed and feed and in later years, the building blocks of success moved to include husbandry and disease management.

"Similar to what we see in Norway, intensification of fish farming in Asia will result in more frequent disease outbreak. In a new farming

Tim Goossens (left) and Norman Lim

From left, Dr Karim Kumaly, DSM Nutritional Products, Singapore, Thad Simons and Francisco Gomes, Novus International Inc, USA.

system, infections usually need 2 to 5 years to establish before becoming a problem. It is crucial for each investor to fully understand the disease risk and associated costs and to commit financial resources to deal with this."

The critical need and key components of biosecurity were discussed. This is to reduce risk of disease introduction, minimise outbreaks on-farm or to new areas and to promote fish health. In the case of the tilapia, Lim showed that *Streptococcus* is a major threat from pre grow-out to grow-out stages. In the production system, the recommendation focuses on exclusion, prevention and control and treatment as the production chain moves from brood stock to hatchery, nursery, pre grow-out and finally grow-out. For example at the brood stock and hatchery stages, it should be pathogen exclusion, and at the nursery, prevention with the use of vaccinated specific pathogen free seedstock (V-SPF) which is a mode of pathogen exclusion.

Another aspect is the power of immunity and how to harness this. This starts with vaccinated stocks and immunity is built upwards, fish by fish within a cage and gradually expanding to other cages and then immunity at the farm level.

Lim's message to industry is that they need to seriously address the issue of diseases. "You cannot run away by moving to a new location or reducing stocking intensity. The point is to use the fundamentals of good farming practices and adapt them to the local situation.

"Finally, there are no magic tricks. Vaccination is not a silver bullet but it is an integral part of the health management plan. With uncontrolled environment, vaccine might still be effective but other diseases will emerge. Government, academia and the private sector must collaborate and share information."

Bacterial communications

In his presentation on *Hitting below the MIC belt: tackling bacterial virulence using Quorum Sensing'*, microbiologist, **Dr Tim Goossens**, Nutriad Belgium introduced the quorum sensing or QS as an alternative strategy to reduce the impact of bacterial diseases in aquaculture.

"If we take a group of botanical ingredients, empirically, it has been shown that some of them can give better performance in aquaculture *in vivo*. Some of their functions have been described such as antimicrobial but overall, there is still a big gap in information on how botanical ingredients work; the mode of action, stability and efficacy etc. This needs to be bridged through research. This new line of research is QS."

Goossens suggested that QS can be described in the same way that birds gathered and attacked in Alfred Hitchcock's movie 'The Birds'. "QS is a form of bacterial communication. Bacteria send and receive signals. They secrete molecules and have receptors but this form of communication is dependent on density. When a quorum is reached, they are activated. The activation of certain intercellular pathways results in communication which is often linked to pathogenicity."

In his work, Goossens has analysed QS signaling in different compounds, single and mixed, at concentrations well-below the minimum inhibitory concentration (MIC), at which bacterial growth is inhibited.

"As proof of efficacy, we used sterile *Artemia* and challenged them with *Vibrio harveyi*. It is well known that infection will decrease the survival of *Artemia*. Pathogenicity is QS-dependent. We treated the *Artemia* with different dilutions of the selected extract and measured after 2 days. *Artemia* survival and *Vibrio* counts in the culture water and homogenised *Artemia* larvae. This gave us the result that the components that we developed protected completely the *Artemia* from *Vibrio* induced mortality, even at low concentrations.

The next step is looking at other pathogens. Apart from determining MIC levels of components, it will be worthwhile to look at QS inhibition as well. The list of several aquaculture pathogens for which QS has been documented in literature was provided.

His take home message was, "Selecting for QS inhibitors might be an interesting approach to develop feed additives with high biological activity and further research will provide insights into the full potential of QS-modulating feed additives."

Challenges to sustainability
Fish meal and fish oil in feeds

Fish meal and fish oil have been crucial to aquaculture production, but is there enough fish meal and fish oil to support the continued growth of aquaculture? Based on his academic and industry experiences with finfish farming in the Mediterranean, **Dr Ioannis Nengas**, aquaculture nutrition expert with Alltech Europe outlined the crisis faced with fish meal and fish oil in the last few years and some solutions in his presentation on '*The sustainability challenges of fish meal and fish oil crisis in the finfish aquaculture in Europe*'.

"The limited access to marine fish meals and fish oils is not only a European but global issue and the intensity of the issue will depend on the fish each region cultures and specific legislation and concerns of consumers. The demand for aquafeed is increasing and is there enough fish meal and fish oil to sustain this demand? The answer is "no" and the reality is that marine ingredients will no longer be 'commodities' but used only for sensitive culture stages and brood stock diets. We will need to replace them with alternatives.

"Research on the replacement of fish meal and fish oils has been done for several years but with conflicting results. We have information which shows that this is viable but the methodology used to evaluate is different among research groups, as well as the processing and batches

Raymond Kwok, Singapore said investor funding is available but industry needs to show credibility and financial management.

Keita Kajiwara, Japan. "In Japan, the key words are reliable and traceable."

David Serene, Thailand said that industry and governments should work closer.

Ioannis Nengas

Han Han (right) with Evelyne Mazaleyrat, Bureau Veritas, China

of ingredients. When industry applied the information commercially, the results have not been good. The information has to be adapted to the genetics of the fish, different environments and changes in the fish during its lifecycle."

In the salmonids, there has been a continuous increase in replacing with plant meals from 46 to 62% in diets containing as low as 10% fish meal. Laboratory scale results show that salmon can cope with diets containing 5% fish meal with some depression of growth. In seabass fed diets with less than 12.5% of fish meal using a mixture of plant ingredients and the addition of amino acids and phosphorus, the fish did not show any decrease in performance. In seabream, growth was similar, FCR was better but the immune system was affected and so was the omega-3 composition in the fillet at levels of 17% fish meal inclusion. Rainbow trout seems to tolerate zero fish meal and in a recent study in 2012, fish meal was replaced with vegetable proteins and concentrates. The fish showed similar growth and better FCR.

"However when we passed these technologies to the industry, we saw some negative effects such as onset of enteritis in culture fish. We have had outbreaks of diseases in the last few years which I am convinced is due to malnutrition. Historically, we always have a decrease of FCR but now with replacement with plant meals, FCR seems to be either stable or slightly increased. The effect on flesh quality was with the taste."

Inevitable to reduce fish meals and fish oils usage

"With replacements of fish oil, the picture is the same. Fish can tolerate this up to a certain level, depending on species. Atlantic salmon can take more vegetable fatty acids as it can actually desaturate short chain fatty acids to longer chain fatty acids and satisfy the requirements for growth and physiology. However, when we reduce the levels, we have dramatic effects on fillet composition; EPA went down from 9% to 0.5% and DHA from 15% to 6%. Seabass and seabream do not have this ability to convert. The reduction of fish oil affected diet utilisation and liver fat with a decrease in long chain fatty acids and reduced ratio of w3:w6. We know that it is inevitable that we need to reduce usage anyway."

With this new reality, Nengas said that even supermarkets had to lower their standards. The EPA: DHA ratio was reduced down to 6% from 15% and total omega 3 down to 10% from 18%. However, "this means that we are destroying the reason why seafood is in demand and the claims that seafood is good for human nutrition."

The solution is replacing fish meal and fish oil with products from advances in biotechnology such as yeast hydrolysates, functional carbohydrates, enzyme technologies, organic minerals and algae. Yeast hydrolysates in diets at 15% for the salmon and only 5% for the seabream and seabass showed among other benefits, enhanced immunity and growth. With enzymes, it is possible to incorporate high levels of plant ingredients. A diet of up to 60% soybean meal gave improved growth performance and added to this, better immunity when innovative enzyme technologies were incorporated.

Functional carbohydrates at 4 kg/tonne in diets stimulated feeding, promoted growth by 10% and also enhanced phagocytic activity. In salmon, it stimulates mucous production and prevents the resettlement of sea lice post treatment, prevents skin damage, scale loss and decreased secondary opportunistic infections. Similar to farming in Asia, there has been parasitic infections leading to 20-30% mortality with seabass and seabream in the Mediterranean. As fish did not die because of the parasites but due to anaemia, feeding diets with organic iron helped to overcome this problem. Organic selenium shows significant benefits on immune system and stress related mortalities. An organic mineral mix prevented gaping in muscle. Algae, now commercially available, have high levels of DHA at 14% and fat at 60% and are particularly useful to reverse the decrease in long chain polyunsaturated fatty acids in fillet of fish fed vegetable oils.

Finally Nengas said, "We need to farm fish using sustainable ingredients and respect the fish-in: fish-out ratios. We need to change and if not nature will force this upon us. We should use products from biotechnology to solve the issues arising from the absence of marine ingredients and ensure seafood continues to be the 'good' food for human nutrition."

From left, Evie Erlina Santi, PT Behn Meyer and Wira Wisnu Wardani, PT Trouw Nutrition from Indonesia and Suchanun Soongsawang, Mars, Thailand

Mike Rimmer, ACIAR, (right) with Marc Wasistha, (left) and Agus Somamiharja PT Suri Tani Pemuka, Indonesia

Production sustainability

In her presentation on *Mitigating environmental risks: lessons learnt and zonal management for sustainability*, **Han Han**, Sustainable Fisheries Partnership (SFP), China said that the Chinese tilapia industry is a global business but suffers from low prices and image issues. Tilapia farming comprises largely of small and medium size farms and achieving sustainability and certification for them require a uniform voice as they learn how to collaborate, self-regulate, communicate and present themselves in zonal management. Han discussed the zonal management approach for sustainability in an Aquaculture Improvement Project (AIP).

SFP is well known in capture fisheries where its fisheries improvement projects (FIP) have been adopted by major seafood companies to improve procurement policies and encourage suppliers to make changes. This approach is now applied in aquaculture through AIPs. Han said that in China, in theory, a farm can be successful in controlling all aspects within the farm and gain certification. "But in reality, we have uncertified farms sitting next to certified farms, sharing effluent discharge canal, water resources and tools for transporting fish. Overall, a lack of spatial planning and coordination among a mass of small farms place the entire industry under high risks at which accumulative impacts exceed the environmental carrying capacity and disease outbreaks wipe out a zone of production.

"Improvement has to go beyond individual farms to work at a zonal level. The objective of AIP is to enhance the local supply chain and technical capacity to achieve sustainable development. It is also to facilitate a formation of industry alliance towards sustainable tilapia aquaculture with minimum negative environmental impacts at the zonal level. This must be industry led.

"A deep understanding and respect of local socio-economic context as well as political and cultural background will increase the chance of success in AIP," concluded Han Han.

From left, Ronald Cheong, Cargill Feed, Malaysia, Tan Yit Wee, Agri-Food Veterinary Authority, Singapore and Prof Ng Wing Keong, Universiti Sains Malaysia.

Moving forward

The key challenges and strategies identified by participants in the break-out groups on aspects of production, health, environment, marketing and sustainability are summarised below.

Improving health and production efficiency

Industry itself needs to be better organised and work together on non-competitive issues such as health and environment. In health, understanding and knowledge on emerging diseases are difficult for producers. Often, there is lag time of 1-2 years before a disease is realised. Usually farms do not inform neighbours of an outbreak.

Self-regulation is important for industry to deal with its own problems. The epidemiological focus to diseases is lacking and more effort should be on route of entry and infection. Better access to trained veterinarians at public and private laboratories is required. Government support is proposed in traceability systems for live animal transfers and to have early warning systems for disease outbreaks.

Vaccination is identified as an important production strategy when available. A pre-vaccination approach as prerequisite against endemic diseases, was suggested. However, for vaccines to be more widely used, governments should fast track legislation, development and certification of vaccines.

Faced with low prices and high costs, producers need to have better production efficiency. It needs to explore mechanisms to get higher prices and better bargaining positions. Groups asked for better government support, such as in generic marketing. In Norway, companies pay a levy which is used for generic marketing of the salmon. A suggestion that large companies with government support embark on selective breeding programs which require huge resources, was mooted.

Communication

This is generally poor among the academia, farmers, industry and government. To improve the knowledge base of farmers, direct interactions with scientists and industry is required but science has to be explained in simple terms to small farmers. Industry is not in competition with government in providing extension services but is complimentary. More integration and collaboration are essential to avoid problems.

Environment

Environmental issues revolve around control of expansion, intensification and environmental impact of farming and feeds usage. Unfortunately, control of expansion usually happens after a problem has occurred such as in Lake Cirata (Indonesia) and Lake Taal (Philippines). Better enforcement of appropriate regulations, licensing, zoning to manage growth and use of certification and codes of conduct to maintain standards were suggested. Recirculation aquaculture technology (RAS) is a way to manage fish health and reduce adverse environmental impacts. In open waters, improvements are suggested in feed quality, feeding efficiency, use of floating feeds and better feed delivery systems.

Investing into the sector

The general opinion is that banks regard aquaculture as a roller coaster business. But if it is to be a candidate for equity funding, then industry needs to share information and work together and be transparent. Farms need to show a model that will convince financial analysts. Asia could learn from the Norwegian example, where fish and licence are collateral for farm mortgages of 50% to run farms. Capital expenditure is reduced with leasing of nets, platforms etc. Banks also require farms to be protected by insurance coverage against losses.

Marketing and sustainability

The key challenge is to be better and profitable but alongside this is building a good image and improving efficiency of production. Environmental and social responsibility should be part of the long term commitment to the sector. Support was also suggested for global marketing of farmed fish from Asia. But the question is should marketing be for the industry as a whole or for just a product. Among consumers, there is the perception that farmed fish is not as good as white fish from capture fisheries, although in many cases, farmed fish can be equal or better. Support is also required to push local consumption of fish. Government must support industry by structuring the market with fundamental legislation and regulation.

There is a need for more communication among stakeholders; government, NGOs, consumers, farmers, fishermen, processors and distributors to increase industry awareness. Although fish farmers and fisherman sell into the same market, there is usually little interaction. This should be encouraged for both to understand their markets and problems facing both stakeholders. Similarly, there should be more communication between processors and fish farmers, so that each group can understand the problems and constraints and build long term partnerships.

At the moment, sustainability is not a demand in local markets in Asia. It is affordability and taste. However, in China, Indonesia and Vietnam, consumers already are becoming aware of food safety issues and in a few years, specifications on food safety in local markets may be a requirement. Currently there are some private brands for high end markets but in general, branding is not essential until supply exceeds demand.

On global and local governance, the group noted that in most countries, there are usually two groups –one for the export and the other local markets. The former will go through a process of traceability, certification and standards. However, the price differentiation between the two markets is narrowing. It is expected that the export group will start selling locally but still using the same specifications as for the export market.

In 2014, TARS will focus on shrimp aquaculture: Recovery • Revival • Renaissance. It will be held from 20-21 August in Phuket, Thailand.

Breakout roundtable for production, health and environment

Marketing farmed white fish

An insight into the whitefish markets and positioning of farmed whitefish and image building

Break out session on marketing

In the global whitefish markets, farmed fish comprise 50% with the top three fish being the tilapia, pangasius catfish and Atlantic salmon. In her presentation on *White fish markets: Towards a new balance? Trends and requirements*, **Christelle Vigot**, food business developer at Bayong Ltd, Hong Kong said that it is important to realise that consumer preference is still with sea caught wild fish which account for almost 50% of the trade in whitefish.

"Farmed fish producers must realise this and learn to integrate this part of production when developing a strategy for aquaculture. If we think that we are really different we will not have consumer agreement. Aquaculture may be growing fast, and is an exciting industry but is still viewed as a new industry by seafood marketers."

Currently, the whitefish market is dominated by the Alaskan pollock (APO) at 3.12 million tonnes, followed by Atlantic cod, 1.04 million tonnes and hake at 435,000 tonnes. Vigot added, "Due to conservation and management measures, the capture fishery is recovering fast and catches have improved since 2010. Quotas are also increasing. These are important considerations for farmed fish producers.

"In making decisions on the species to farm, they should observe the status of the wild source of the same species. For example, the reason why farmed cod failed is because of the recovery of wild stock such as Canada's cod fishery resulting in higher landings in recent years which brought down prices. The salmon is different because farmed and wild species are not the same and is seasonal."

According to Vigot, the potential species for whitefish markets are the barramundi, milkfish and cobia from South and SE Asia, *Clarias* from Africa and the sturgeon, where farming is developing for its eggs and flesh, in France, Vietnam and China. The salmon will remain important as Norway has mastered its production and added to this, technical knowledge should facilitate its production in other countries such as China and Russia.

Christelle Vigot

A new balance

The purchasing criteria of western markets have been price followed by affordability and regularity. The balance has changed with the economic crisis in Europe. Consumers seek cheap products at any quality. But since tropical fish can have a bad image in Europe and despite the criteria on price, European purchasers still prefer local fish which they know well. The US is still one of the biggest market for seafood, and its consumers are less discerning," said Vigot.

"More attention is required on food safety. Sustainability is becoming a minimum requirement but at no additional cost.

"We should pay attention to farmed salmon which has a well-structured industry and can be the role model. It is present in all markets from fresh whole fish to head and gutted (H&G) and smoked and even in the surimi market. Asian producers should propose more finished products to reach diversified markets," said Vigot.

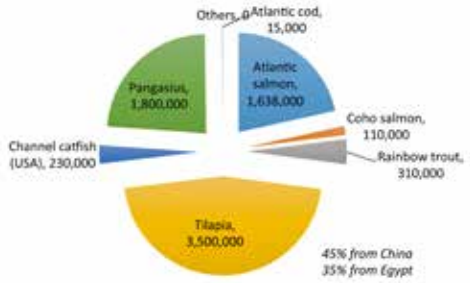
New opportunities

These are in emerging markets such as China, Mongolia and Myanmar. These are mass and easy markets seeking basic products. The only disadvantages are the financial uncertainty and possible short term nature of these markets.

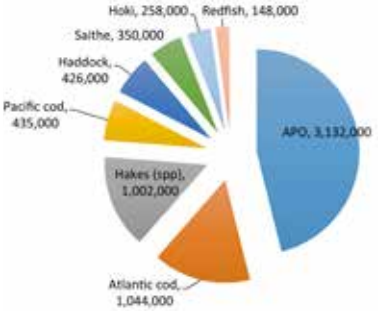
"China is interesting as consumption in 2012 was almost 300,000 tonnes. There is a preference for whole fish and the government is encouraging consumption with the removal of duties on four species. There has been a rapid growth of supermarket chains with 86% of market share. Chinese buyers are very knowledgeable on seafood. In contrast, seafood consumption is relatively new in Mongolia and Myanmar. Investments are required for promotions and training to enter these markets.

Vigot's message was, "The global market is progressively switching to farmed whitefish, affordable and available all year around and producers have to diversify their offer to go into market of groundfish. There is a new balance between consuming markets. Markets in Europe and US seek volume and quality products with low prices but have more requirements."

Main sea caught white fish in tonnes



Main farmed whitefish in tonnes



Building positive image

In general aquaculture producers use very little public relations in their business. Fish fillet can have good prices because of good perception from consumers. **Anton Rizki**, Kiroyan Partners, said that the end point is the product reputation. In his presentation on building an image, he used the Vietnamese catfish case. "The issue is complex as it involves not only a concern over environment and consumer protection, but a mixed of political economy and protectionist sentiments both in the US and Europe. Although pangasius producers have responded well with improvements in culture practices and accreditation to certifications, this may not be sufficient in rebuilding the image and reputation of the pangasius catfish."

Rizki proposed to approach these challenges from a strategic communications standpoint. This is how producers reach their objectives; build a good reputation for their products. "Reputation is a result of, on one hand an organisation's performance and behaviour and on the other hand, engagement with stakeholders. The stakeholder mindset is important as it enables companies to better grasp the perspectives of others, including how the brand can reach the consumer. Good environmental performance is reflected in certification and labelling. But certification is now considered a prerequisite. As a result it offers little differentiation and becomes a poor marketing tool which helps in pricing and sales. Thus, we need to go beyond this."

Reputation is an outcome of performance and behaviour by an organisation. So, to build reputation, the first step is to improve performance and make this known. Stakeholders, such as NGOs who now have access to information will know when the company is spinning stories, i.e. saying good stuff but without any performance improvements. On the other hand, companies may be doing their best with certifications and environmental performance but without good communication, the public may continue to believe adverse news from the media.

Anton Rizki

"Communication is about building relationships and responding to stakeholder expectations. Each stakeholder has their sets of interests and the industry needs to understand the complexity of these interests. In the case of pangasius, stakeholders involved are competitors, European members of Parliament, retailers and consumers. With the environmental NGOs, retailers and governments, it is about the environment and sustainability; but for the consumers, it is more about food safety. Labelling is a solution that answers activist concerns but does not do much to improve the brand among consumers," Rizki added.

His message, "The industry has to look beyond labels and focus on the product and the brand using marketing and public relations strategies."

Go green at a new premix plant

Another milestone for BIOMIN with the official opening of the state-of-the-art premix plant in Binh Duong province, Vietnam. Operating on solar energy, the plant also presents a green factor for the company

Guests and the Biomin team pulling the bar to launch the new plant.

"During the Biomin World Nutrition Forum 2012 held in Singapore, our pledge was that the carbon used at this biennial gathering, for participants' travel, use of electricity and local transport will be offset by a photovoltaic plant here in Vietnam. Today, we have fulfilled this," said Erich Erber, chairman of Biomin at the opening ceremony for the premix plant on October 2. This was held in the presence of 250 guests comprising, Le Thanh Cung, president, Binh Duong People's Committee, Nguyen Dang Vang, chairman of Vietnam Livestock Association, government representatives, customers from Vietnam and the region. Guests also had a tour of the premix plant. This year also marks the 30th anniversary of Biomin, since Erber founded the company in 1983.

Biomin, a leading global animal health and nutrition company, is part of the Erber Group. The business is based on three principles: innovation, internationalisation and integration. The group has three leading businesses: innovative production technologies and feed additives (Biomin); food safety and laboratory services (Romer Labs); and animal health and vaccines (Sanphar). At a press conference, Erber together with Andreas Kern, CEO, Jan Vanbrabant, CEO, Asia Pacific and Phuong Nguyen Quang, COO, Biomin Vietnam Co. Ltd. discussed the innovative features of this new plant as well as other company news.

Presence in Vietnam

The new premix plant located in the Vietnam Singapore Industrial Park and 45 km away from Ho Chi Minh City is the second plant in Vietnam. According to Erber, this also makes Biomin the first company with two feed additives plants in Vietnam. The first premix plant is in Hanoi when it became the first Austrian company to enter the Vietnamese market in 1996. The new facility, built at a cost of USD10 million, has a capacity of 60 tonnes/day.

Phuong was instrumental in setting up this plant. He said, "Our plant in Hanoi has a much smaller capacity at 20 tonnes/day and was running at full capacity. With strong demand for premixes, both for aquaculture and livestock feeds, we needed a second plant. Construction on the Binh Duong plant commenced officially on 12 May 2012.

"However, the plant in Hanoi will continue to serve the northern provinces whilst this one will allow us to deliver to customers in the south within the day. It will also export to customers in Cambodia and Myanmar. Today, we have 30 customers from Myanmar attending the ceremony. We have a very strong position in Vietnam with our mycotoxin risk management program with an 'A to Z' approach."

"Today, customers also saw the services that we can provide. We have invested extensively in the laboratory services at Binh Duong. We have a LC-MS/MS system which is the most sophisticated in Vietnam and also for Biomin in Asia. It is capable of analysing 300 samples but we have established methods for 100 samples. This will enable us to provide the highest possible level of nutritional and mycotoxin analytical services for customers and assure customers on feed and food safety. On top of that, the LC-MS/MS will also support our annual mycotoxin survey program, strengthening our position as the market leader in this field," said Vanbrabant.

Phuong is confident that the new Binh Duong facility will meet the highest standards of the industry. "Vietnam is an important market for us, and with the addition of the new facility, we will achieve a five-fold increase in total capacity. Using only 15 staff, the fully-automated production system commissioned by Buhler has the participation of international partners such as BASF and Adisseo."

Sustainable production

There is the green factor with this new plant, said Erber. "The photovoltaic plant can provide 100 kW of energy for the plant. This is an advantage as Vietnam often has brownouts. Any extra solar energy power is given back to national grid; this is our service to the community

After the press conference, from left, Erich Erber, with Jan Vanbrabant, Phuong Nguyen Quang and Andreas Kern.

in Binh Duong. Initially, solar energy will be more expensive than using supply from the national grid, but in 10 years, it will be cheaper on a kW/hr basis. It is also renewable energy and more sustainable."

Kern added, "The cost of setting up the system has been high, which also included thicker walls and a green roof to provide insulation to conserve energy used for air conditioning. The use of renewable energy began in our headquarters in Austria where we used ground water and heat exchangers.

"The sustainability approach also extends to the production. Our business of agriculture has been blamed for global warming and so we need to give back to the environment. Each product uses a certain amount of carbon dioxide but there are also carbon credits when industry uses products such as Digestarom®. We are ISO14040 certified and recognised for our environmental sustainability measures. The life cycle assessment (LCA) requires us to ensure our suppliers determine CO_2 equivalent emissions. Today we are affiliated with BASF and Adisseo for some raw materials but this does not mean exclusivity. To safeguard our customers, we need to get value and guaranteed quality from suppliers. We have to be aware of, and ensure that, suppliers have the right level of quality control too."

Building momentum in aquaculture

The company's aquaculture business has been growing steadily. At the same time, Erber and the team acknowledge that aquaculture also presents new challenges and opportunities and Biomin will support the growth of aquaculture with innovations and practical solutions. The R&D in aquaculture is carried out in Thailand at the Aquaculture Centre for Applied Nutrition (ACAN) and Austria.

"The Biomin aquaculture product line is well-known in Ecuador and in Asia we are also getting there fast," said Vanbrabant. "For us the potential will be to further develop a future range of products based on phytogenics, which are species-specific for fish and shrimp farming. We have built-up plant-based phytogenic products for health management which has already provided benefits, with the EU commission's restrictions on the use of antibiotic growth promoters (AGPs). These became the life line in Korea with the ban on AGPs. Gradually, we see that these products will provide the health support required by the aquaculture industry."

Expanding globally

A new facility is also being developed in Wuxi, China, as part of the regional expansion plans of the company. "This is a USD 15 million investment for the company which will be for the production of all acidifier products as well as for a new line of products specifically for the Chinese market. The target completion is expected in spring 2015," said Vanbrabant.

Also in the pipeline is an additive plant in Panama to serve the central American market. "As a leading company in the global animal health and nutrition industry, Biomin is committed to the continuous development of its business. We will work on our strengths to develop organic growth," said Kern.

On where the company is today, Erber said that each country has its own entry hurdles. "In Vietnam we have reached the position of one of the top three feed additive suppliers, but globally we may be the second largest player in the premix business, and first in the feed additive business. The aim is for Biomin to be the global leader in both businesses."

Appointments

Lesaffre Nutrition & Health division announced the appointment of **Dr Frédérique Clusel**, DVM & MBA, as managing director of LFA (Lesaffre Feed Additives). She is based at the headquarters in Marcq-en-Baroeul (Lille area), France. Clusel graduated as a Doctor of Veterinary Medicine in 1993 and holds a MBA from HEC Executive Education. Over her 20 years' experience in animal health business, she gained expertise in management functions worldwide, particularly in Asia Pacific and EMEA (Europe, Middle East and Africa). Prior to joining LFA, Clusel was managing the Swine Business Unit EMEA at Zoetis as group director.

With more than 30 years' experience on the field of animal productions and feed industry, Lesaffre Feed Additives is one of the leading companies in probiotics and yeast-based product application for animal feed. Widely recognised as a key player in the animal feed market, LFA designs, develops and markets a range of products all derived from fermentation processes. These natural yeast-based additives contribute to the animal's health, getting the most from feed and promoting optimal performance. More information: www.yeast-science.com

Health diet to improve immune defences of farmed fish

Most aquaculture systems are exposed to the natural environment, where cultured organisms are constantly in contact with parasites, bacteria and viruses. By using functional diets that strengthen the immune systems of fish, farmers can help their stocks cope with disease and environmental shocks. These diets are becoming an integral part of managing fish health in culture systems.

In 2007, Skretting launched the proactive health diet, Protec which contains active ingredients that boost the immune systems of fish by enhancing their ability to cope with stressful situations caused by disease, handling, transport and vaccination.

Protec delivers benefits in four ways. First, it supports the immune system, including the stimulation of macrophage activity, helping the fish to resist bacterial infections more effectively as well as enabling them to respond faster to vaccination. Secondly, the feeds contain Skretting's unique blend of organic acids and plant extracts, which act to stimulate gut health. The third benefit is that it provides optimisation of gut microbiota. Finally, these feeds provide a huge supply of anti-oxidants, which work on an intra-cellular level mopping-up the free radicals generated by the immune system fighting a reaction.

The company's Aquaculture Research Centre (ARC) in Stavanger, Norway, first started introducing active ingredients in its Response anti-stress feed in 1992. Response was later developed into the group's Protec and React feeds. Today Protec diets are widely used for salmonids and other species worldwide. Also in 2007, the diet was introduced to the UK Atlantic salmon and freshwater trout farming sectors. A year later it was introduced into the French market as a supplement in trout and marine fish grower diets.

"In France, Protec is used to counteract some diseases such as vibriosis in marine fish and sleeping disease in trout. It is used prior to vaccination," says Skretting veterinarian Frederic Esnault. "It can also be used in anticipation of difficult environmental conditions such as hot or cold water temperatures or deficient oxygen level."

Tackling viral threats

In a controlled viral infection study with pancreas disease (PD) in Atlantic salmon, conducted by ARC in 2010, it was confirmed that the diet reduced mortality levels in salmon by 70%. Furthermore, combined with a PD vaccination, mortality was reduced by 85%. According to ARC fish health researchers, studies confirmed that Protec supports the salmon's natural defence mechanisms sufficiently to significantly reduce the degree of heart damage.

Further evidence of the benefits of its use in combating PD risks appeared in the 2012 Fish Health Report in Norway, which found that customers using the diet reported lower mortality and less impaired growth. It has also been documented that the number of fish infected with virus is 30% less in fish fed Protec. When infected, fish have lower virus levels. This has a positive impact on mortality and recovery. The health diet has also been used to help prevent the closely-related Cardiomyopathy Syndrome (CMS) after researchers found that feeding the diet reduces the degree of inflammation in the heart and skeletal muscle. In general, the diet stimulates the fish defence mechanisms regardless of the viral disease the fish is exposed to.

Australasian successes

The diet was first introduced in Australia more than five years ago. Today it is used in both Australia and New Zealand, where it is fed to Atlantic salmon, Chinook salmon, ocean trout, barramundi and other species for a wide range of conditions.

In the salmonids, it is effective in preparing the fish for stressful situations. It has contributed to a reduction in mortality due to extreme environmental conditions. It has also been used to improve the healing of skin and to reduce the impact of amoebic gill disease (AGD) in barramundi and other marine species, leading to an improved winter performance. It is also widely used during fish transfers.

"On the back of well documented results with its use in Europe, including in offsetting the negative effects of 'winter syndrome' in marine fish in the Mediterranean and in improving growth and disease resistance in juvenile marine fish during transfer, we want to use the positive experiences from the northern hemisphere in the Australasian market," said Skretting Australia's product manager Dr Nicole Ruff.

"Skretting Australia felt that there are common challenges to fish farmers where Protec could play a pivotal role in improving fish health and performance," says Ruff. Over the past two years, some thorough local R&D and documentation have further strengthened its use in the market.

Between April and July 2012, a laboratory trial was conducted at the University of Tasmania's aquaculture facility. The study investigated the use of some experimental diets (variations of Protec-based feeds) to mitigate mortality caused by *Neoparamoeba perurans*, the causative agent of AGD.

Fish fed the control and two experimental feeds for four weeks were challenged with *N.perurans* in a standard challenge model. At the conclusion of the challenge trial, salmon fed the experimental diets achieved a significantly improved survival rate compared to those fed the control diet. The relative survival was 27% higher using the experimental diets. This was the first study in the world to demonstrate diet manipulation can actively play a role in reducing mortality caused by AGD.

Numerous commercial trials have demonstrated the beneficial effects of the diet. As an example, post-stress (exhaustive exercise) levels of secondary stress response parameters (blood lactate and glucose) were reduced by more than 10% in triploid Atlantic salmon parr and by 30% in large barramundi fed Protec. "From a practical point of view, leading up to periods of stress caused by handling, grading and vaccination, Protec can be used to help reduce mortality," says Ruff.

Reducing mortalities

In Chile, several controlled trials were performed to measure the efficacy of the diet on pathogens that adversely affected local aquaculture. The trials were run by independent laboratory ADL Diagnostic against the infectious salmon anaemia (ISA) virus, the fungus *Saprolegnia spp.* and against four bacteria - *Vibrio ordalii, Aeromonas salmonicida, Flavobacterium psychrophilum* and *Piscirickettsia salmonis*.

"The results proved the efficacy of the diet on the fish, reducing the number of pathogens," says Dr Ronald Barlow, technical manager, Skretting Chile. "Protection of the primary fish barriers (skin and mucus) was another positive effect related to defence mechanisms and immune and non-immune specific responses."

From the beginning, Skretting Chile recommended farmers to use the diet as part of a broader sanitary strategy.

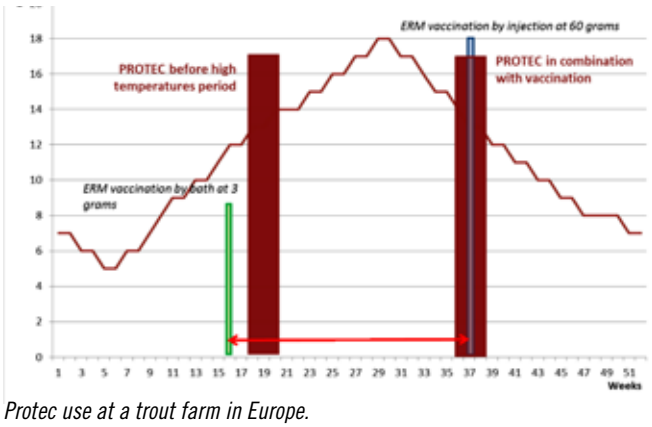
Ronald Barlow

"The farmers started to progressively use the diet at the end of the last decade, adopting the preventive concept as an alternative way to culture fish. The functional diet is recommended to be given continuously for four to six weeks to fish facing critical periods of stress, such as vaccinations, grading, transport and extreme environmental conditions," added Barlow.

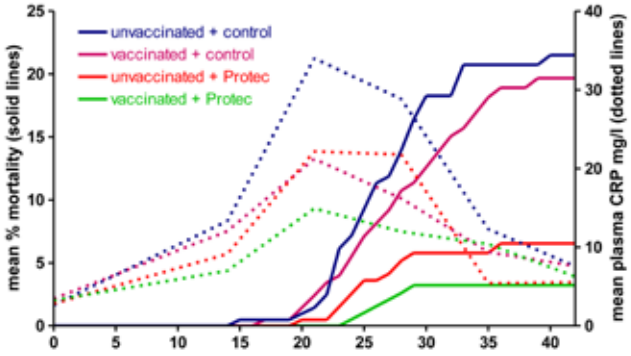
The Skretting Data Feed tool is utilised for every site. This is a software that estimates the outbreak probability according to site and proximity of Salmon Rickettsial Syndrome (SRS) and Infectious Pancreatic Necrosis (IPN) illnesses. According to Barlow, there is a strong correlation between the use of the health diet and reduced mortality rates.

Using public data supplied in an official report of 'Caligidosis (sea lice) situation in high surveillance sites', another clear association was found between the use of Protec and a reduction in the number of parasites detected among adults and juveniles in stocks of both Atlantic salmon and trout.

This progress in the field of nutrition was further extended in October this year when the next generation of Protec went on sale in Norway. The new product was launched at the Aqua Nor aquaculture technology exhibition held in Trondheim, Norway, in August.



Protec use at a trout farm in Europe.



A pancreas disease (PD) trial in Norway.

What to look forward to in AQUA Culture Asia Pacific in 2014

As we celebrate our tenth anniversary in 2014, we will continue to bring you issues relevant to the industry, predict trends and update you with technologies to help the aquaculture industry in Asia Pacific move to the next level.

Volume 10 2014						
Number	1 – **January/February**	2 – **March/April**	3 – **May/June**	4 – **July/August**	5 – **September/October**	6 – **November/ December**
Issue focus *Recent developments and challenges for the next step*	Aqua Feed Production	Health Management	Hatchery & Breeding technology	Industrialisation	Sustainable & Responsible Aquaculture	Culture technology
Industry Review *Trends and outlook, demand & supply*	Marine Shrimp	Tilapia	Marine Fish	Catfish	Marine shrimp	Freshwater Fish/Prawn
Feeds & Processing Technology *Technical contributions influencing the final value of aqua feeds*	Feed additives Processing technology	Novel feed ingredients	Phyto ingredients Feed management	Feed enzymes Product quality	Feed probiotics Good manufacturing practices	Nutrition & Formulation
Production Technology Technical information and ideas	Culture & Biosecurity	Genetic Improvements	Recirculation Aquaculture Systems	Hygiene & Food Safety	Certification and Regulations	Health Management
Aqua business Feature articles	Experiences from industry, including role models, benchmarking and opinion articles in shrimp/fish culture					
Markets	Market trends, product development and promotions at local and regional trade shows					
Deadlines for articles in 2014	**November 11 2013**	**February 3**	**April 2**	**June 2**	**August 1**	**October 1**
Show Issue & Distribution at these events as well as local and regional meetings ****Show preview***	**Aqua India 2014** 24-25 January Vijayawada, India **Aquaculture America 2014** February 9-12 Seattle, USA	***FIAAP/VICTAM Asia 2014** April 8-10 Bangkok, Thailand **Global Seafood Expo 2014** May 6-8 Brussels, Belgium	***World Aquaculture 2014** June 7-11 Adelaide, Australia	**The Aquaculture RoundTable Series (TARS 2014) - Shrimp Aquaculture** August 20-21 Phuket, Thailand **Vietfish 2014** August 6-8 Ho Chi Minh City, Vietnam	**19th China Seafood & Fisheries Exposition 2014** 5-7 November, Qingdao, China	
Deadlines Advert bookings in 2014	**December 3, 2013**	**February 7**	**April 8**	**June 9**	**August 7**	**October 8**

APA13
POSITIONING FOR PROFIT

10-13 December 2013
Ho Chi Minh City, Vietnam

The Asian Pacific Aquaculture Conference and Trade Show, scheduled from 10-13 December 2013 in the Saigon Exhibition and Conference Centre, Ho Chi Minh City, will be an exciting event for the global aquaculture fraternity. 'Positioning for Profit' is the theme of the conference and this emphasises the need for the whole industry to take a more strategic approach to expansion. The high number of abstracts for oral presentations and many industry related sessions will make this a confernce and trade show to attend.

The conference will start with a presentation from leading experts. Dr Pham Anh Tuan is deputy director general at the Directorate of Fisheries (D-FISH) of the Ministry of Agriculture and Rural Development (MARD). The second plenary speaker will be Dr David Hughes, Emeritus Professor of Food Marketing at Imperial College London and visiting professor at the University of Kent Business School and at the Royal Agricultural College.

Workshops

There are several workshop organised. Prior to APA13, the Aquaculture Engineering Society's workshop on Biofloc Technology will be held on December 9-10. (see page 59 for the program). Other workshops being organised by some APA13 exhibitors are by invitation only. VIFINET - Vietnam Fisheries and Aquaculture Institutional Network will organise a special session for all their Vietnamese members. D-Fish (Vietnamese Ministry) will have a special session on 'Restructuring Vietnam Aquaculture towards Sustainability'.

IOS5

The World Oyster Society will have the 5th International Oyster Symposium (IOS5). This two day event will feature keynote addresses as well as oral and poster presentations and promises an exciting stream of oyster expertise discussing developments such as the rise in production in northern Vietnam to over 7,000 tonnes in five years. Registrations for APA13 will include attendance to the IOS5.

Sponsors and sessions

The program grid (as at press time) is available online (www.was.org/meetings/pdf/APA2013ProgramGrid.pdf). In the press release, organisers have announced the sponsors for several sessions during APA13. Gold sponsor, Uni-President is organising a special 'disease on shrimp' session for producers (see box for program). Silver sponsor, Biomin will conduct the 'feeding for profit' session (see show preview for Biomin). Other sponsored sessions are: Utilisation of amino acids in aquaculture (Evonik), Alternative proteins of aquafeed (DaBomb Protein), Soy utilisation in aquaculture' session (US Soybean Export Council-USSEC), Aquaponics (Pentair), Health management (Pharmaq), Finfish and shrimp nutrition (Novus) and Lipids and functional ingredients (Alltech). Tyson will be the exclusive 'President reception' sponsor at APA13 which will be held on 12 December.

Tours

Tours will be set up by MARD. One tour to Cat Ba and Ha Long will include a visit to the National Marine Broodstock Centre and to the Ban Sen Oyster Farm. A second tour includes the visit of several fish cages while the tour to Ben Tre includes the visit of a clam and a shrimp farm and a shrimp hatchery and processing unit.

More information: www.was.org (worldaqua@aol.com) or www.vienthuysan2.org.vn in Vietnamese (apa2013ria2@hcm.fpt.vn). There are special reduced prices for all Vietnamese participants between October 15 and November 15th. Register online www.vienthuysan2.org.vn or email apa2013ria2@hcm.fpt.vn
For trade show information, email: mario@marevent.com (Mario Stael)

APA13 Farmer's day, December 12, Room 230

This session is organised by Uni President Vietnam. It will be chaired by Dr.Grace Chu-Fang Lo, National Cheng Kung University, Taiwan.

Program	
08:00 - 08:30	Registration farmers
08:30 - 09:10	Confirmation of the infectious nature of the agent of early mortality syndrome (EMS) affecting farmed penaeid shrimp in Mexico-Dr Donald Lightner, Arizona University, USA
09:10 - 09:50	Effects of tilapia in controlling the acute hepatopancreatic necrosis disease (AHPND)-Dr Loc Tran, School of Animals & Comparative Biomedical Sciences, Arizona University, USA
09:50 - 10:30	Preliminary result of on farm trial for controlling the outbreak of AHPND in shrimp farming in the Mekong delta, Vietnam-Dr Nguyen Van Hao, Research Institute For Aquaculture No.2 (RIA2),Vietnam
10:50-11:30	Identification and use of key host factors in a genetic program to increase shrimp resistance to WSSV- Dr Grace Chu-Fang Lo
11:30 - 12:10	From benchtop to pondside - moving basic shrimp DSCAM research into industrial practices-Dr Wang Han-Ching, National Cheng Kung University, Taiwan
12:10 - 12:50	Aquaculture environment remedies for disease prevention and control-Dr. Yew-Hu Chien, Department of Aquaculture, National Taiwan Ocean University

Trade show

Over 120 exhibitors from more than 20 countries as well from Vietnam itself will demonstrate their products and services at the APA13 exhibition. Some highlights of the trade show are given in our show preview below. At press time, there are 5 booths available as the organisers have decided to expand the trade space.

TRADE SHOW SCHEDULE			
December 10 Tuesday	December 11 Wednesday	December 12 Thursday	December 13 Friday
Move - in 12:00 - 18:00	Move-in 8am - 10 am Exhibits open 10:00 - 18:00	Exhibits open 10:00 - 17:30	Exhibits open 10:00 - 16:00
Welcome drink 19:00 - 21:30	Happy Hour 17:00 - 18:00	Reception 19:00 - 21:30	Happy Hour 17:20 - 18:30 Move-out 16:00 - 20:00

ABCA in China, is a division of AB Agri Ltd, an international agriculture and animal nutrition enterprise, part of Associated British Foods PLC (ABF). ABCA works closely with AB Mauri, a large yeast producer and Ohly, the global leader in yeast extraction technology to develop and design applications for a range of effective and innovative nutrition solutions. Products include AB MOS for gut health and improving resistance to parasites and disease with high levels of MOS and β-glucans; AB Yestex, a premium yeast extract rich with nucleotides to support larval development and increasing yield per batch; AB Tor-Sel, a new generation of high potency organic selenium yeast, produced in Australia and AB Zorba, a cost effective program for mycotoxin risk management.

Booth No: 135
Dr Kim Huang (kim.huang@abagri.com)
Rachel Liem (rachel.liem@abagri.asia)
www.abagri.asia

Alltech's mission is to develop and provide natural solutions that are beneficial to the animal, the consumer, and the environment. With a strong local presence throughout Europe, North America, Latin America, the Middle-East, Africa and Asia, Alltech improves the health and performance of people, animals and plants worldwide through nutrition and scientific innovation. The Alltech Aqua program consists of natural, nutritional solutions tailored to address challenges impacting modern aquaculture production and profitability. Among the on-farm products for aquaculture are the Aquate range, Aquate Defender, Aquate PP, SP1, Mycosorb A+, 37+ program and MIKO.

Booth No:107, 108, 121, 122
Roland Matyasi (rmatyasi@alltech.com)
Hanh Vu (Hvu@alltech.com)
www.alltech.com

AQ1 Systems Pty Ltd is a global leader in sensor based feeding control and sizing systems for aquaculture. Incorporating the latest in acoustic and optical sensing technology, AQ1 offers a range of intelligent feeding control systems for shrimp and fish farmers and fish sizing systems. The latest model of feeding technology in shrimp farming is SF200 "Sound Feeding" System which uses passive acoustics and measures feeding intensity to match feed delivery with appetite. It is also capable of environmental monitoring with all feeding and environmental data logged and available for management locally or over the internet. The system produces significant productivity gains in growth and feed conversion.

Booth No: 1
Peter Blyth (pblyth@aq1systems.com)
Ross Dodd (ross@aq1systems.com)
www.aq1systems.com

Aquativ creates and offers a unique and sustainable range of marine based functional hydrolysates to aquafeed manufacturers seeking enhanced feed performances. The strong dedication to R&D has made it the sole player demonstrating and delivering bioactive peptides to the farming industry. Adding to health and metabolism benefits, the outstanding digestibility of its functional peptides promotes growth in farmed fish and shrimp with high palatability to the feed. As part of the Diana group, Aquativ has a strong local industrial network and a fully dedicated and international technical presence. Scientific trials conducted in collaboration with Jeju University and Concepto Azul will be presented during APA 2013

Booth No: 55,56
Nguyen Anh Ngoc (nanhngoc@diana-aqua.com)
Paul Seguin (pseguin@diana-aqua.com)
Thomas Levallois (tlevallois@diana-aqua.com)
www.aquativ-diana.com

Aeration Industries International, the worldwide leader in aeration systems and expertise, offers aquaculturists the premier aeration system for all of water quality management needs. AIRE-O2® Aquaculture Aerator is aquaculture's high performance aspirator aerator. This is a high quality, minimal maintenance unit with proven, superior performance, all at an economical price.

Booth No: 112
Marcos Kroupa (marcos.kroupa@aireo2.com)
Nguyen Thi Hoai (hoai.avivaglobalent@yahoo.com)
www.aireo2.com

Biomin will organise the 'Feeding for Profit' session at the conference. Leading industry experts will present ways to improve feed and feeding strategies for more profitable farming. Expert speakers include Pedro Encarnacao, Biomin; Martin Guerin, Gold Coin; Dan Fegan, Cargill; Victor Suresh, aqua consultant and Prof. Le Thanh Hung, Nong Lam University. Biomin is also the sponsor of the 'Novel feeds, ingredients and feed additives' session, where eight global speakers will introduce their latest research work on this topic. The extensive involvement of Biomin in APA13 reinforces the strong commitment and its contributions to the aquaculture industry.

Booth No: 67,68,69,70
Pedro Encarnacao, (pedro.encarnacao@biomin.net)
www.biomin.net

Behn Meyer Animal Nutrition is an established player in SE Asia supplying a range of superior health enhancing products such as prebiotics, probiotics, mineral and enzymes, for farms and feedmills. Behn Meyer Aquaculture has developed - PhytoVit® Aqua, an all-botanical additive containing bioactive compounds rich in polyphenols, anthocyanins and flavonoids with anti-oxidant and immune enhancer properties. At the conference, the team will have 4 presentations on

- Role of feeds in growth performance and combating disease in intensive shrimp farming;
- Role of botanicals in enhancing growth and survival rates in aquaculture;
- Third phase - the potential of raceways systems in SEA as a tool to overcome EMS/AHPNS
- Impact of azomite on endogenuous enzymes and immunity of aquatic species.

Booth No: 110, 119
Nguyen Thi Minh Huong (minhhuong@behnmeyer.com.vn)
Sarapong Rattanagulvaranon (sarapong@behnmeyer.com.th)
Teddy Candinegara (teddy@behnmeyer.com.id)
Marilyn Sim (Marilyn@behnmeyer.com.my)
Dr. Wee Kok Leong (weekl@behnmeyer.com.my)
www.behnmeyer.com

Blue Aqua International is a one-stop solution provider for aquaculture. Blue Aqua has the Mixotrophic system, a patent pending system for management of super-intensive culture of shrimp and fish in outdoor environments. This system enhances the ecological system in the pond thus environmental friendly and sustainable. The system also has a proven record to prevent diseases and high returns to farmers. In this show, Blue Aqua brings new innovations that will help with water quality analysis: BA Test Kits, and multi parameter water probe that can measure up to 14 parameters and connect to a smartphone.

Booth No: 29 to 32
Yong Sun Le (angela@blueaquaint.com)
Nun Chongwitookit (nun@blueaquaint.com)
www.blueaquaint.com

DaBomb Protein Corporation, established in 2001, specialises in soluble hydrolysed soy protein products. DaBomb-P is 100% soybean meal under fermentation processing by *Lactobacillus acidophilus* inoculation in order to hydrolysis soy protein into smaller molecular weight to improve digestibility. DaBomb-P meets the EU standards. Certified by ISO 22000 (Food Hygiene and Safety Management System) and issued by SGS, DaBomb-P provide high protein solubility, and excellent palatability. DaBomb will sponsor the session on 'Alternative protein of Aquafeed' .

Booth No: 83/84/97/98
Sandy Lin (service@dabombprotein.com.tw)
www.dabombprotein.com.tw

Evonik produces and markets the essential amino acids for advanced animal nutrition: DL-Methionine for Aquaculture™, MetAMINO® (DL-methionine), Biolys® (L-lysine), AQUAVI® Lys (L-lysine for aquaculture), ThreAMINO® (L-threonine) and TrypAMINO® (L-tryptophan). In addition to extensive experience in animal nutrition in over 100 countries worldwide, Evonik provides a wide range of comprehensive AMINO services to the feed, livestock and aquaculture industry. From analysis to process optimisation, these tools foster all aspects of livestock and aquaculture nutrition management. These services contribute significantly to customers' profitability and competitiveness while enabling healthy and environmentally friendly animal nutrition. Evonik is sponsoring the session on "Utilisation of amino acid in aquaculture" on Friday December 13.

Booth No: 86/95
Dhanapong Sangsue (dhanapong.sangsue@evonik.com),
Evonik (Sea) Pte Ltd
www.feed-additives.evonik.com

GePro Gefluegel Protein GmbH & Co. KG has developed a new product range-Vital Peptide with beneficial properties to enhance stress resistance/tolerance and immunity in fish and shrimp. Environmental factors, particularly salinity, nitrite, nitrate, ammonia and diseases affect their immunity. A natural solution to combat stress conditions is the usage of hydrolysed proteins which are considered as biological active with an immune boosting effect due to the content of peptides, free amino acids and nucleotides.

Booth No: 100
Franz-Peter Rebafka(franz-peter.rebafka@ge-pro.de)
www.ge-pro.de

GeneReach Biotechnology Corp is a worldwide biotechnology company on innovations for global health management. In aquaculture, the company has POCKIT, a pond-side PCR detection platform for rapid and sensitive diagnosis of shrimp diseases. Offering high sensitivity and specificity in detecting genetic components of pathogens, polymerase chain reaction (PCR)-based assays have been included into bio-security measures and proved to improve overall shrimp production at large-scale facilities. Point-of-need detection of diseases would allow timely implementation of bio-security measures at facilities of different scales to help further minimize economic losses caused by infectious diseases. An oral presentation on this topic will be presented at the conference.

Booth No: 4 & 5
Caroline Chang (caroline@genereachbiotech.com)
www.genereach.com

InVivo NSA ASIA is a specialist in animal nutrition and health. **Ocialis** is a worldwide tropical aquaculture specialist providing customers with a full range of high quality feeds, technical assistance, expertise and R&D within the aquaculture center. **BernAqua** now integrated into the international InVivo NSA group, is a world-wide market leader in the hatchery industry. This new structure guarantees the long term development of its activities. Dynamic innovation, based on continuous field evaluation has given BernAqua a unique product portfolio, setting new trends in the hatchery feed market with VITELLUS artemia cysts.

Booth No: 104 to 106
Marc Campet (mcampet@ocialisvietnam.com)
Florian Renault (florian@ocialisvietnam.com)
www.ocialis.com/
www.bernaqua.com

INVE Aquaculture is launching a new product Sanolife PRO-TAB within its range of easy-to-use, consistent and performing microbial mixtures. These innovative tablets, with a high concentration of Sanolife *Bacillus* strains, are delivered directly to the pond, possibly together with the feed, to maintain a healthy gut microflora, leading to improved survival, growth rate and feed conversion. A range of innovative products for feed mills will also be presented, including Sanolife GUT, the result of years of in-house research on plant extracts. These products fit in the company's holistic approach to fish and shrimp farming, covering broodstock, hatchery, nursery and on-growing.

Booth No: 75, 76, 77
Tien Thuy Bui (t.bui@inveaquaculture.com)
Khanh Phuong Nguyen (k.phuongnguyen@inveaquaculture.com)
Chien Van Ho (c.hovan@inveaquaculture.com)
www.inveaquaculture.com

Jefo is a leader in the field of non-medicated performance feed additives. The company offers innovative and highly effective species-specific feed additives for dairy cows, poultry, aquaculture, swine and other species. With 30 years of experience, Jefo products have been shown to make a significant difference on farms. Visit the booth to know more about our protease specifically formulated for aquaculture.

Booth No:125
Kabir Chowdhury (kchowdbury@jefo.ca)
www.jefo.com

Lesaffre Feed Additives, the animal nutrition and health division of the Lesaffre group is now bringing its R&D experience and production consistency to the development of innovative and dedicated yeast solutions for the Asia-Pacific aquaculture market. The presence of LFA at this show is the opportunity to introduce its new range of feed attractants, yeast extracts based, EXL Aqua and gut modifiers probiotics live yeast Actisaf developed for the shrimp and fish farming markets.

Booth No: 62
Philippe Tacon, ptn@lesaffre.fr
www.yeast-science.com

Nam Sai Farms Co. Ltd, Thailand offers broodstock, red and Nile tilapia of various strains; Monosex tilapia and D.I.Y. monosex packages. It also supplies, striped catfish *(Pangasius hypophthalmus)* fry; triploid climbing perch *(Anabas testudineus)*; Barramundi *(Lates calcarifer)* fry and carries out contract research for testing aquaculture products. Equipment, training and consultancy are supplied via a joint venture company Farm Aqua (www.farm aqua.com).

Booth No: 172
Warren Andrew Turner, managing director
(warren2@tilapiathai.com)
Cherd Gaewmanee, export manager (dai_nsfarm@hotmail.com)
www.tilapiathai.com

NutraKol Pty Ltd specialises in nutritional and health solutions for aquaculture. It has 'tailor-made' diets and additives for broodstock and enrichments for larvae of new species (groupers, Seriola etc.). Nutrafeed are shrimp and other crustacean broodstock semi-moist diets and boosters for replacement of fresh/frozen food. The diet incorporates herbal extracts that boost the hormonal cycle resulting in higher broodstock and larvae performances. Nutrabrood Enhance are nutritional and herbal additives to boost gonadal development resulting in better broodstock and larvae performances. Artikol are live feed enrichments for new species made to specific requirements. Nutragreen are herbal extracts to boost the immune system and reduce/eliminate pathogen/parasites infections.

Booth No: 99
Judith and Sagiv Kolkovski (nutrakol@iinet.net.au)
www.nutrakol.com

Nutriad International is an industry leading specialist in the development, manufacture and marketing of animal and aqua feed additives. Nutriad smart feed additives combine different action mechanisms against *Vibrio* species such as direct bactericide/bacteriostatic properties as well as Quorum Sensing inhibition properties at concentrations below MIC. These are interesting candidates with a potential contribution to prevention strategies against bacterial diseases such as vibriosis or early mortality syndrome (EMS). Peter Coutteau will present a topic of Quorum Sensing Technology: A New Tool to Enhance Bio-Security Measurement against Bacterial Diseases.

Booth No: 59, 78
Allen, Ming-Hsun Wu, Regional manager, Aquaculture, Asia Pacific (a.wu@nutriad.com)
www.nutriad.com

Novus International Inc. is committed to making aquaculture production more efficient and profitable. The Novus staff, which includes nearly 80 research and development experts, dedicates itself to this mission every day. By supporting graduate scholarships at leading aquaculture research institutions worldwide, it is also investing in the future of the industry. The goal is to provide innovative total management solutions that optimise aquaculture production. Novus is dedicated to providing customised solutions that enhance the health and performance of livestock and aquatic animals.

Booth No: 41, 42, 53, 54
Ramakanta Nayak, Regional Marketing manager, SEAP (Ramakanta.Nayak@novusint.com)
www. novusint.com

Olmix's objective since 1995, is to find natural nutraceutical products and feed additives for animal nutrition and health. Today it is a main global specialists of green technology in the valorisation of algae. Aqua immune and Aqua digest sea are the two new nutraceutical products available in aquaculture. Aqua immune based on a specific blend of algae will stimulate the fish immune system to help its antiviral and anti-inflammatory activities. Aqua digest sea based on seaweed and plant will improve the digestive function and the liver performances.

Booth No: 94
Adrien Louyer (alouyer@olmix.com
Ly Luan Nguyen Thi (luan.nguyen@olmix.com)
www.olmix.com

PHARMAQ AS is the world's leading pharmaceutical company supplying the aquaculture industry. The company provides environmentally sound, safe and efficacious health products to the global aquaculture industry through targeted research and the commitment of dedicated people. The vaccines are manufactured in a state of the art production facility in Overhalla and Oslo, Norway. Pharmaq AS and Pharmaq Vietnam Ltd. have successfully developed the vaccine ALPHA JECT ® Panga 1. The vaccine protects against the pathogenic bacteria *Edwardsiella ictaluri* causing enteric septicemia of catfish (ESC). This is the first vaccine licensed fish-vaccine in Vietnam and the first vaccine for pangasius. Pharmaq will have 4 presentations to present field data and basic research results.

Booth No: 90
Kjersti Gravningen (kjersti.gravningen@pharmaq.no)
Pham-Cong Thanh (Pham-Cong.Thanh@pharmaq.no)
Vo-Thanh Tung (Vo-Thanh.Tung@pharmaq.no)
Donald Campbell (donald.campbell@pharmaq.no)
www.pharmaq.com

Pentair Aquatic Eco-Systems, Inc. is the global leader in aquatic systems and supplies. At the show, the team will discuss the SPARUS™ PUMP which offers extremely high water flow in a quiet, energy-efficient package with durable construction. This pump is ideal for commercial aquaculture applications. Available in a wide range of horsepower and voltage ratings, the innovative hydraulic design of the pump moves water more efficiently and more quietly than competitive pumps. It delivers proven reliability thanks to its saltwater-rated stainless steel internal fasteners and highly robust mechanical seal. Under typical operating conditions, it offers the highest water flow of any high-performance pump, at the lowest electricity consumption.

Booth No: 87 to 89
Huy Tran, Ricardo Arias, Darryl Jory (PAES.general@Pentair.com)
www.PentairAES.com

Range Pharma Aquatic is one of the leading and pioneer veterinary pharmaceutical companies in Malaysia, specialising in the manufacture of high quality pharmaceuticals for the prevention and treatment of diseases in livestock. Early Mortality Syndrome (EMS) has affected shrimp farms and resulting in high levels of mortality and significant losses. Range Pharma Aquatic will be presenting its new and pioneering product, Shrimp Pro to combat EMS and help shrimp recover. It assists by protecting and improving the hepatopancreas condition. Shrimp Pro has been used in several shrimp farms, producing positive and effective results.

Booth No: 138
Tan Hsian Huei (tanhsianhuei@rangepharma.com.my)
www.rangepharma.com.my/aquatic

RICH S.A. manufactures innovative products for the aquaculture industry and specifically for marine fish and shrimp hatcheries. It selects only premium quality marine ingredients of the highest nutritional value, as they are intended for to the most critical very early larva stages. At the show, the company will present the new product ESSENTIAL, a nutritionally rich, freeze dried algae powder for the green water technique.

Booth No: 66
Dr Antonios Komis, Technical director (info@rich.gr)
www.rich.gr

Santeh Feeds Corporation is a multi-species specialty feed mill in the Philippines. The Tateh Aqua Feeds brand has the strongest quality reputation in the Philippines from early fish nutrition to grow-out diets accredited by ISO: 9001:2008 for quality; ISO 14001: 2004 for the environment; OHSAS 18001: 2007 for manpower safety; and Halal certification. Santeh will display products lines such as feeds for the tilapia, mud crab, prawn and vannamei shrimp feeds, marine fish and early fish nutrition diets such as fry booster powder and micropellets.

Booth No: 170
Ma.Patricia I. Rico (patricia.rico@tateh.com)
www.tateh.com/ www.facebook.com/tatehfeeds

Service Aqua, LLC is the specialist and leading distributor for shrimp biosecure broodstock feeds in the aquaculture industry. With locations in the USA and in Europe, it can serve any location in the Americas, Europe, Africa, Middle East and Asia. Service Aqua only supplies sustainable, biosecure, pathogen free feeds such as: European frozen farmed marine polychaetes, US frozen brine shrimp (Artemia biomass) and frozen California squid.

Booth No: 101
Eric Pinon and Omara Escobar (sales@serviceaqua.com)
www.serviceaqua.com

Tyson Animal Nutrition Group is a supplier of aquaculture feed ingredients. We understand the importance of superior nutritional quality and track and traceability for your feed ingredients. We also understand the value of working with a supplier with more than 80 years experience in feeding people and their animals.

Booth No: 44, 45, 50, 51
Chuck Malone (chuck.malone@tyson.com)
Andy Dilatush (andy.dilatush@tyson.com)
www.tysonanimalnutrition.com

Uni-President Vietnam Co. Ltd has three feedmills, two hatcheries and a trading company in Vietnam. It helps farmers succeed through collaborative innovation and applying global knowledge to research and produce new ranges of feed to meet consumer demand. It is committed to using only high quality raw materials and manufactures under strict quality control. Export markets include India, Malaysia, Singapore, Bangladesh, Sri Lanka, Myanmar, Thailand and Indonesia New products include: Booster monodon feed 100 series including 5 brands LaOne 100, Hi-Aqua 100, Super UP 100, Uni Aqua 100 and LaOnest 100 to achieve good growth performance in a shorter time and reduce risks during difficult culture situations. It also has a pre-harvest shrimp feed with lower ethoxyquin to be used 5-7 days prior to harvesting. This is to reduce ethoxyquin residues and meet Japan's import regulation on shrimp.

Booth No: 46, 47, 48, 49.
Hung Cheng Yen (yen@upvn.com.vn)
Ma Chin Tien (chintien@upvn.com.vn)
www.uni-president.com.vn

Zeigler Bros Inc. is a manufacturer of quality animal feed for the aquaculture industry, specializing in finfish, shrimp hatchery and shrimp grow-out feeds. Capabilities also include custom manufacturing and Zeigler's Technology Transfer Program. Zeigler's quality program is registered to ISO 9001:2008.

Booth No: 123, 124
Chris Stock- (chris.stock@zeiglerfeed.com)
Tim Zeigler (tim.zeigler@zeiglerfeed.com)
Ramir Lee (ramir.lee@zeiglerfeed.com)
www.zeiglerfeed.com

Nutrifish 2013

Building consumer demand for farmed fish in India

Vijay Anand (fifth from left) and his USSEC/Nutrifish team

India is the second largest producer of farmed fish at 3.8 million tonnes annually but its annual per capita consumption of fish is much lower than the global average of 19 kg/capita/year (FAO, 2013). In recent years, with rising income and increased consumer spending, demand for meat has increased. This was reflected by a rising trend in the consumption of chicken. However, a modern and growing India will need more protein in different forms to cater for the diverse cultures, food habits and nutritional demand in India.

Dr P.E.Vijay Anand, who heads India's animal feed, aquaculture and soy meal programs for US Soybean Export Council (USSEC) in India strongly believes that low fish consumption in the country is due to consumer misconceptions with fish; its perishable nature, poor preservation methods and handling, inefficient distribution, fishy odour and lengthy preparation.

Nutrifish

Together with the Ananda Group, USSEC has created Nutrifish. This was a unique event to promote fish consumption and create marketing opportunities. "The target of the pilot event held in September was to popularise fish consumption in general, dismiss misconceptions, provide knowledge and spell out the benefits of fish as an ideal protein source. In addition to this, the advantages of processed and value added fish products were also demonstrated at the event," said Vijay.

The USSEC/Nutrifish team comprises Vijay, Umakanth, Gopal Pillai, Dr Pawan Kumar, Dr Yadu Nandan, J.B.Sastry, Anand Uddaraju (director of the Ananda Group), Dr Shiv Kumar (Professor, Aquatic Biology, College of Fisheries Mangalore) and Dr V. Suryaprakash Rao (executive vice-president, West Coast Frozen Foods Pvt Ltd, Gujarat). They agree that in India, lack of distribution channels, infrastructure, poor handling and preservation techniques and low demand for processed/value added fish are constraints that explain the disconnect between production and product transformations.

Vishwanadha Raju, CEO, Ananda Group, Bhimavaram said, "All these factors are bottlenecks in the value chain for the fisheries/aquaculture sectors of the country and need to be addressed quickly. At Nutrifish, the team educated the public and cleared their doubts".

According to Umakanth, who works for USSEC's aquaculture program, there is a general lack of awareness on developments or progress in the fisheries/aquaculture industry. "This is why we see that fish is less popular. Science, technology and entrepreneurship, has changed the way fish is produced and marketed. A lot of modernisation has gone into farming and feeding of fish."

Vijay added that today there are more varieties of fish to choose from. There are diverse product forms of processed fish; boneless, ready to cook, easy to cook or ready to eat products that taste great. Such facts and possibilities were demonstrated at Nutrifish.

This special event was attended by about 800 participants comprising government officials, institutions, entrepreneurs, investors, traders, distribution firms, hotels and caterers. In addition, USSEC and Ananda Group invited 70 participants from the media to bring this message to a wider audience. The Ananda Group, which operates an integrated aquaculture project with an annual turnover of USD 100 million, partnered USSEC in this effort. Experts from the Culinary Institute of India, Hyderabad and Epicurus Hospitality Group that fish can be cooked and presented in different forms to suit different occasions and tastes.

During this event, participants walked through different activity stations. In all there were six stations: a knowledge station comprising presentations, discussions and videos; a tactile station for touching and smelling fresh, well-handled, uncooked and well-preserved fish; three different fish cooking and tasting stations and marketing station to educate participants on preservation techniques, prices, cost benefit and distribution/availability of processed value added products.

USSEC and the Ananda Group hope that the event will be a model for future events for the promotion of fish consumption and market development of fish products.

Dr Shiv Kumar explaining to visitors that fresh, well-preserved fish do not smell.

Workshop on Biofloc Technology and Shrimp Diseases

December 9-10 2013,
SECC, District 7, Ho Chi Minh City, Vietnam

Disease control is critical to the existence of sustainable and profitable aquaculture. Recently, increasing laboratory and field observations have reported on the use of biofloc technology (or green water and other integrated aquaculture methods) to help manage such disease outbreaks. Yet, in most cases, these observations were not objectively supported, precluding the establishment of clear, reproducible and detailed conclusions.

Prior to Asian Pacific Aquaculture 2013 (APA13), the Aquaculture Engineering Society Biofloc Technology Working Group is organising this workshop to review new scientific studies and observations on the effect of biofloc technology on disease occurrence and on the health of shrimp and fish. It will summarise field experiences, suggest further research priorities and to propose applied strategies to minimise disease outbreaks. This will be held at the Saigon Exhibition and Convention Center (SECC) 779 Nguyen Van Linh Street, District 7, Ho Chi Minh City on December 9-10.

A round-table discussion on Dec 10 is expected to attract a great number of aquaculture producers for information exchange and the establishment of collaboration. There will be simultaneous translation for Vietnamese participants on December 10. Book of abstracts either in English or Vietnamese will be provided at the workshop while the proceedings will be sent to all participants via email.

This special workshop is gratefully supported by INVE, Tomboy Skretting, Blue Archipelago, Intron Life Sciences, Blue Aqua International, AES, International University (VNUHCM) and Novus. Organiser, Dr Yoram Avnimelech said, " Our meeting is intended to be a forum for learning, discussions and for drawing conclusions as a service to the industry, farmers, companies, policy makers and the research community. We planned the time table in a way to enable free discussion. We also left time for short relevant contributions (up to 3-5 minutes) not listed in the program. The discussions will be summarized, published and distributed."

At press time, the tentative program is as follows:

Monday, Dec 9 (09:00 - 20:00hrs)
08:30 – 09:00: Registration, introductory comments
Session 1: Immune System, Environmental Effects & Diseases (chair: Yoram Avnimelech)

- Immune mechanisms in a crustacean - Kenneth Soderhall
- Determination of the agent of (AHPND), an emerging disease in SE Asia - Donald Lightner
- Interactions between feeds, feeding and health management in biofloc systems - Craig Browdy
- Evaluation of immune enhancement in shrimp growing in biofloc systems – In Kwon Jang
- Co-infection in shrimp and its meaning in bioflocs systems - Peter Bossiers
- Early mortality syndrome: observations and doubts - Victoria Alday-Sanz
- Effects of biofloc systems on *Streptococcus* infection of tilapia – Yoram Avnimelech
- Discussion and additional short contributed papers (60 mins)

Session 2: Environmental and Management Aspects of Diseases (chair: Craig Browdy)

- Green water technology for shrimp farming: modes of action - Marc Verdegem and Eleonor A. Tendencia
- Effects of tilapia in controling the Acute Hepatopancreatic Necrosis Disease (AHPND) - Loc Tran, Kevin Fitzsimmons and Donald Lightner
- The effects of bioflocs grown on different carbon sources on shrimp immune response and disease resistance - Julie Ekasari, Muhammad Hanif Azhar, Enang Harris Surawidjaja, Peter De Schryver and Peter Bossiers
- Role of selective breeding in biofloc shrimp production and disease mitigation - Shaun Moss, Dustin R. Moss, Clete Otoshi, Steve Arce and Donald Lightner
- Bioflocs: past, present and the future - Robbins Mcintosh
- Discussion (120 mins) - chaired by Yoram Avnimelech (Take-home advice on disease control using biofloc technology, proper pond management and research priorities)
- Welcome Dinner (from 19:30)

Tuesday, December 10 (08:45 – 13:30)
8:00 – 8:45 Registration
Session 3: Practical Experience & Conclusions, with simultaneous translation into Vietnamese (chair:Tung Hoang)

- Conclusions of previous sessions - John Hargreaves
- Shrimp Farming: Biofloc as biosecurity? - Nyan Taw
- Biofloc System as an alternative treatment to WSSV - Wilson Wasielesky
- High performing biofloc systems using probiotics: view from Asia and Latin America - Olivier Decamp, Marcos Santos, Hoa Nguyen Duy, Fauzan Bahri and Jaime Munoz Medina
- Experience on *Penaeus monodon*/red tilapia co-culture using biofloc technique - Boonsirm Withyachumnarnkul
- Is it possible to control the bacterial composition in shrimp and fishponds? - Steven Newman
- A review of AHPND research in Vietnam – Dang Thi Hoang Oanh
- Practical measures to deal with EMS outbreaks in Vietnam - Tung Hoang and Marc Le Poul
- Shrimp farm management using the Mixotrophic system - Farshad Shishehchian
- Conclusions

More Information and Registration

For more information and sponsorship, contact: Tung Hoang (VNUHCM). Email: htung@hcmiu.edu.vn or Yoram Avnimelech (agyoram@technion.ac.il)/ Tung Hoang (htung@hcmiu.edu.vn).

Registration fees for both days is USD75 and USD25 for the second day only. Online registration can be made through APA13 (//www.was.org/meetings/Registration/Default.aspx?Code=APA2013). Paid participants should bring the registration receipt.

In Vietnam, participants can register with Do Ngoc Phuc Chau, International University VNUHCM (dnpchau@hcmiu.edu.vn). Information on accommodation, contact: Nguyen Thien Quang, VNUHCM (ntquang@hcmiu.edu.vn)

Triple premiere at the next Fish International

New in 2014: Gastro fair, product contest, aquaculture workshop

For nearly 30 years now, visitors from the food and fish retail sector, restaurants and catering, fish import and export, and fish processing have been meeting at two-yearly intervals at Fish International. The Bremen fair gives them a reliable overview of what the fish industry currently has to offer: fresh fish and processed products, technical solutions from filleting machines to smoking systems, or point of sale equipment. In 2012 about 8,200 visitors took advantage of the chance to look around the stands of 260 exhibitors from 23 different countries.

A new competition, an aquaculture workshop that will be the first of its kind in the EU, and a completely new gastro event: the well-established Fish International will have some new topics to offer in Halls 4, 5 and 6 of the Bremen Exhibition Centre when it opens its gates for the 14th time from 9-11 February 2014. Alongside these new features visitors to Germany's only fish trade fair will also be able to enjoy the well-tried mix of product presentations, discussion of current topics, and opportunities for nurturing existing contacts and building up new ones.

With regards to aquaculture, the 2014 will have more equipment and accessories for fish farming on display. There will also be a workshop on recirculation systems, the first of its kind in the EU, which in the USA attracts participants from all over the world. Professor Dr Michael Timmons and Dr James Ebeling normally offer this workshop at Cornell University in Ithaca, New York.

"With our Gastro Ivent we are picking up the visitor wish for even more offers for the restaurant and catering sectors", said Sabine Wedell, Fish International's project manager. "This fair will offer the industry creative ideas and solutions. It will present high-quality foods, particularly from regional production, beverages, furnishings and technology." More information: www.fishinternational.com

2013-2014

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

December 10-13
Asian Pacific Aquaculture 2013
Ho Chi Minh City, Vietnam
Web: www.was.org
Email: worldaqua@aol.com

2014

January 10-12
Indian International Seafood Show 2014 (IISS)
Chennai, India
Web: www.indianseafoodexpo.com

January 19-24
Practical Short Course on Feeds & Pet Food Extrusion
Texas A&M University, USA
Email: mnriaz@tamu.edu (Mian Riaz)
web: www.tamu.edu/extrusion

January 24 -25
Aqua India 2014
Vijayawada, Andhra Pradesh, India
Web: www.aquaprofessional.org
Email: aquaindia2014@gmail.com/ aquaprofessionals@gmail.com

February 9-11
The Fish Fair
Bremen,Germany
Web:www.fishinternational.com

February 9-12
Aquaculture America 2014
Seattle, USA
Email: worldaqua@aol.com
Web:www.was.org

March 16-18
Seafood Expo North America
Boston, USA
Email:food@divcom.com
Web:www.bostonseafood.com

April 8
Aquafeed Horizons Asia 2014
Bangkok, Thailand
Email:info@feedconferences.com
Web:www.feedconferences.com

April 8-10
FIAAP Asia 2014/Victam Asia 2014
Bangkok, Thailand
Web : www.fiaap.com/www.victam.com

May 6-8
Seafood Expo Global
Brussels, Belgium
Web: www.euroseafood.com/

May 21-23
The 13th INFOFISH World Tuna Trade Conference & Exhibition
Bangkok, Thailand
Web:www.infofish.org

May 25-30
16th International Symposium of Fish Nutrition and Feeding
Cairns, Australia
Web:www.isfnf2014.org

June 7- 11
World Aquaculture 2014
Adelaide, Australia
Web:www.was.org/ www.aquaculture.org.au

June 19-21
Malaysia International Seafood Exposition
Kuala Lumpur, Malaysia
Email:mise2014@ikim.gov.my
Web:infofish.org

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

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

FIAAP Asia 2014

Exhibition & Conferences for feed ingredients, additives and formulation

VICTAM Asia 2014

Exhibition & Conferences for feed processing technology

8 – 10 April 2014 · Bangkok International Trade & Exhibition Centre (BITEC), Bangkok, Thailand

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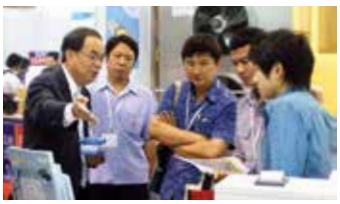
The FIAAP Conference 2014
The Thai Feed Conference 2014



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www.grapas.eu

Contact details
For visitor, exhibition stand space and conference information please visit:
www.fiaap.com or
www.victam.com

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