

JULY/AUGUST 2010

Volume 6 Number 4

# AQUA CULTURE

A s i a • P a c i f i c

**B**iosecurity and Living with White Spot Syndrome Virus

**M**oving to Extruded Fish Feeds in India

**T**hailand's Freshwater Prawn Farming Business

**A**sian Cobia, Barramundi and Pangasius in Paris

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AQUA Culture AsiaPacific is published bimonthly by **Aqua Research Pte Ltd**

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**Online: www.aquaaasiapac.com**

Email: subscribe@aquaaasiapac.com

Annual Subscription by airmail (6 issues a year)  
Asia: SGD70

Other zones: SGD100

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# From the editor

## Market led production

### *How the consumer market can determine the production model in aquaculture*

Demand and supply may have a short-term effect on the price of a product but it can also have a long term effect on industry growth. Industry growth can be pushed by production or pulled by demand but this growth has a significant impact on how production is done. Here is a good example in aquaculture.

In the week before the European Seafood Exhibition in Brussels in April, I attended a “cook off” on a boat in Paris where chefs were invited to work with new species brought in from Asia and Latin America (see pages 38-42). This struck me as an excellent way to introduce new species to the table and act as the catalyst for market development. The chefs shared their opinions on the flesh texture and versatility of each species and suggested ways of cooking each fish. It is clear that to make an impact, producers need to work at recipes to introduce the product to markets.

Where are we today? The Asian marine fish industry could arguably be characterised as ‘many species cooked in the same way’. The Asian predilection for live fish invariably means that the fish is steam cooked in order to enjoy its freshness. Although there are minor variations in steam cooking, consumers will soon be looking for a change and which means adding new and different species to be put on the table. This is the major reason why we are seeing the culture of a varied species of freshwater and marine fish. It is akin to nomadic farming of slash and burn, moving to new species when the novelty runs out on the old.

Compare this with another marine fish industry –salmon which is characterised as ‘one species cooked in many ways’. When the salmon industry developed in Europe, it was mainly pan-fried, baked and smoked but interestingly enough, the significant jump in consumption came when salmon became a staple in Japanese cuisine.

The significance of this observation is the profound effect it has on the production methodology. The ‘many species cooked in the same way’ has given rise to a dominant backyard industry with no economies of scale. This may be beneficial to the consumer but not producers, who are subjected to a learning curve for each new species. The majority of the farms are family owned and cost of production varies tremendously with farm made feeds and trash fish as the main feed source.

It becomes a ‘Catch 22’ situation when the industry finds it difficult to move forward with using compound feeds because of high feed costs which, in turn, is based on small volume production. The short time frame makes it difficult to develop feeds specific to the requirements of the species. In our news article, it was noted that it has taken almost 10 years to develop a suitable feed for the tuna. In the same way, industry will never be able to manage diseases, generally species specific, due to limited resources for the research and development of protocols. This low volume high value model limits the use of vaccination in disease management when available. The model itself limits its own growth and expansion, let alone the question of sustainability, traceability and environmental protection.

The salmon industry, on the other hand, is dominated by corporations with economies of scale. This helps with lowering the cost of production and standardising methodology. It is also supported by research and development, genetic improvement and formulated feed to maximise growth potential.

The Asian aquaculture industry already has three species which follow the salmon industry’s production for the mass market. These are the vannamei shrimp, pangasius and tilapia. However, in marine fish, the closest is the barramundi (*Lates calcarifer*) which still has a long way to go. The best measure is perhaps price elasticity – when there is a small overproduction, the price tumbles. The current market demand is unable to absorb the upturn in supply. Another good gauge is per capita consumption which exists for shrimp and salmon in many countries but none exists today for barramundi. To develop this species, perhaps the way forward is to invest in ‘cook-offs’ to make the species more attractive to a larger consumer market. We need at least one marine fish species to become ‘one species cooked in many ways’ in order see a paradigm shift in the industry.

Zuridah Merican

## WRITE TO THE EDITOR

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# Catfish vs Catfish

The eight-year standoff has continued with a video on production in Vietnam and calling for USDA to incorporate Vietnam's catfish under its agriculture inspection program. A hurt industry in Vietnam responds.

Many years ago, during Vietfish 2003, the excitement of catfish producers was marred by the uncertainty of the pending antidumping duties (AD) of tra catfish by the US Department of Commerce, due on the final day of the show. Eight years later, catfish fillets to the US are still subjected to AD tariffs, although these have been reduced to zero for some exporters. The countrywide rate remains at 64%. Even before the announcement of the AD tariffs, exporters were ready to divert their products to other countries and by 2008, pangasius catfish, as it is known in many countries, was marketed in 96 countries. In the first quarter 2010, only 9,007 tonnes were exported to the US as compared to 52,122 tonnes to the EU (Vietfish International, May/June 2010).

Nonetheless, the industry continues to face the backlash from the US catfish industry, mainly on food safety issues and on the method of production in Vietnam. In 2002, a new law prevented the pangasius from being labelled as catfish. This can only apply to the *Ictaluridae* family. In the US, the pangasius is marketed as swai and striped pangasius. More recently, the campaign is to relabel pangasius as catfish and bring inspection under the purview of the USDA with stricter food safety checks.

The latest rant in May is because of a YouTube video produced by the Catfish Farmers of America showing production of catfish in polluted ponds. At Vietfish 2010 (June 12-14), Vietnam's major producers expressed dismay on this new attack. Although the video was designed to increase pressure on US Department of Agriculture (USDA) inspectors to include catfish, it has also caused injury to Vietnamese producers by implying that the imported fish is unsafe to eat. Producers say that the food safety of pangasius is not a problem because there are strict checks, on both microbiology and chemical from the production process to shipment.

Prior to the show, on June 8, the Vietnam Association of Seafood Exporters and Producers (VASEP) issued a strong protest on the 'false information on Vietnam catfish'. It also opposed the redefinition of "catfish" to include Vietnamese pangasius and the attempt to impose more restrictions for the entry of pangasius into the US. The saigon-gpdaily.com.vn quoted that 'In fact, Vietnamese farmers no longer farm pangasius in floating cages in the Mekong River, but in earthen farming ponds which meet SQF1000 standards and other international standards for stringent hygiene and safety assurance.' A large proportion is from integrated production chains to ensure food safety 'from-farm-to-table'. Integrators have hatchery, feed production, farming and processing. Those without feed production usually contract this to one or two feed mills. More pangasius farming areas in Vietnam have been granted GlobalGap certifications, ensuring the cleanest and safest farming conditions.

Vinh Hoan, the number one exporter of catfish to the US is particularly affected by this latest campaign. As an example, Ta Thi Bich Ngoc, Vinh Hoan Corporation, said that Vinh Hoan has been implementing measures to meet GlobalGap good aquaculture practices for pangasius. The company has 5 out of its 8 farms ready for certification. In one farm, 5ha out of the 17ha farm are allocated for treatment ponds. In general 10% of the total pond area is now reserved for water treatment. Vinh Hoan has been officially approved on the compliance of its pangasius



Ta Thi Bich Ngoc (left) is Vinh Hoan - Green Farm Project Manager with Vo Phu Duc, General Director of Vinh Hoan Feed

farms with GlobalGap standards for two areas, Tan Thuan Tay and Tan Hoa (located in Dong Thap province) by Bureau Veritas.

Before water from the treatment ponds can be discharged into the Mekong River, the quality of the water must meet national standards. Usually it takes 3 days to complete treatment. In turn, incoming water is filtered prior to use. There is also a system of treating waste water from processing plant and this is in accordance to ISO14001.

"We want to emphasise to our consumers that over the years, there has been radical changes in the industry. Catfish is no longer cultured in cages in the Mekong Delta. All of the large farms use floating extruded feeds. In ponds, we are able to control feeding and pond water quality. We calculate feed conversion ratios to avoid feed wastage. In our feed mill, since early 2009, we have been using phytase to increase the bioavailability of phosphorus and reduce its release into the environment. Many other feed mills are also doing the same. We feel that these measures are comparable to practices in Europe for freshwater fish farming," said Vo Phu Duc, General Director of Vinh Hoan Feed, the feed production business of the company.

"The environment is important for us as well as for our customers. It is our livelihood and business and we know that if we continue to pollute the river, in 5 years, our business will be gone," said Ta.



## Tilapia 2010 shaping into another milestone event

**Tilapia 2010 promises to be another milestone event just like the two other tilapia meetings preceding, in 2001 and 2007. The conference programme is shaping up well as a host of internationally renowned speakers confirm their participation in the event.**

The conference will have not one but two inaugural addresses in Session I; a keynote address by Kevin Fitzsimmons, Professor, College of Agriculture and Life Sciences, University of Arizona, USA and a special address by Sena de Silva, Director General, Network of Aquaculture Centres in Asia-Pacific (NACA). In addition, Rohana Subasinghe, Senior Fisheries Officer, Food and Agriculture Organization (FAO) will speak on the global tilapia aquaculture scenario while Fisheries Industry Officer Helga Josupeit, also of FAO, will discuss the global supply and demand scenario for tilapia.

The industry situation and outlook in different parts of the world will be featured in Session II. A key speaker from China will present the tilapia situation for the world's largest producer. Rafael Guerrero, a consultant from the Philippines, will provide the scenario for the rest of Asia. The status of the industry in the Middle East will be given by Izzat Feidi, an international fisheries consultant, while Erik Hempel of Hempel Consult, Norway and Blessing Mapfumo of INFOSA will update participants on the situation in Africa. The tilapia scenario in the Americas will be presented by Kevin Fitzsimmons.

In Session III (Products, Markets and Marketing), Sherry Frey of the Perishables Group, USA will review the latest trends, issues and growth factors in the US tilapia market while Fatima Ferdouse of INFOFISH will cover trends and prospects for tilapia in Asian markets. Craig Appleyard, Vice President Operations and Business Development of Tropical Aquaculture Products Inc, USA will speak on the market demand for sustainable tilapia in the US and Canada. Other speakers expected to join the programme will speak on tilapia in the European market, the Middle East market and Asian markets. Other potential topics are market prospects for organic tilapia and tilapia in the catering trade.

Key industry players will discuss their experiences in Session IV. Among them are Norbert Sporns, CEO of HQ Enterprises based in Hainan, China; Morten Hoyum of Trapia Malaysia Sdn Bhd; and Jose Antonio Lince, General Manager of Produmar, Ecuador. Others expected to join are representatives of Lake Harvest, Regal Springs Tilapia, and Rain Forest. Mohamed Razali Mohamed, CEO of Aquagrow Corporation, Malaysia, will discuss aspects of tilapia marketing and value addition. A representative from the Vietnam Association of Seafood Exporters and Producers (VASEP) will explain how Vietnam will translate the lessons from its pangasius experience to its plans to develop tilapia. A speaker from Taiwan will present the island's technological and marketing initiatives for tilapia.

In Session V (Technological Developments and Issues), Eric Roderick, Director, Fishgen Ltd, UK will discuss YY technology in tilapia farming while Neil Wendover, Asia Technical Manager, Intervet/Schering Plough, Singapore, will review health management of tilapia. Hans Magnus Gjoen, professor, University of Life Sciences, Norway, will discuss recent developments and prospects of genetics in tilapia. Bill More of the Aquaculture Certification Council, USA will cover BAP certification for tilapia. Other subjects planned are developments in culture systems, genetics in tilapia, standards for farmed tilapia, economics of eco-labelling, value addition, by products from tilapia, processing technology and equipment, and nutrition and feeding.

A trade exhibition will be held. The exhibition is open to industry players as well as suppliers of inputs and services.

More information: Infofish-Tilapia 2010 Kuala Lumpur, P.O. Box 10899, 50728 Kuala Lumpur, Malaysia. Tel: +603 2078 3466, Fax: +603 2078 6804, email: [info@infofish.org](mailto:info@infofish.org) Web: [www.tilapia2010.com](http://www.tilapia2010.com)

## GFSI Food Safety Benchmark for BAP

**The Global Aquaculture Alliance Best Aquaculture Practices (BAP) certification program has been successfully benchmarked against Global Food Safety Initiative (GFSI) food safety requirements.**

Seafood-processing plants can now achieve both BAP certification and GFSI compliance through a single audit process. GAA Executive Director Wally Stevens said, "Achieving this prestigious GFSI benchmarking is an important milestone for the BAP program that will assure global markets that seafood from BAP-certified facilities meets the highest standards for food safety. It also will make it easier for plants to meet the demands of seafood retailers, distributors and marketers that require GFSI."

GFSI documents provide an internationally recognized benchmark against which any food or farm assurance standard can be

measured. Representing a collaboration of leading experts from retail, manufacturing and foodservice companies, GFSI pursues continuous improvement in food safety management and cost efficiency in the supply chain.

The food safety elements of the BAP program comply with the guidelines established by GFSI based on industry best practices and sound science. The Best Aquaculture Practices certification program also goes beyond food safety to address traceability, animal welfare, environmental sustainability and social responsibility in additional certification standards. More information: [www.gaalliance.org/bap/](http://www.gaalliance.org/bap/)

# News in Brief

## Higher economic potential for groupers

The grouper, included in the early list of the newly signed trade pact with China, will be given zero tariffs. The increased trade with China, particularly during the Shanghai World Exposition, has already led to planned expansion by grouper farms. Produced mainly in Kaohsiung and Pingtung counties in southern Taiwan, the annual production is expected to increase to TWD 7.6 billion (USD 237 million). In [focustaiwan.tw](http://focustaiwan.tw), farmer Dai Kun-Tsai in Pingtung said that the demand from China has been the highest in 20 years. Huang Tsai-tuan, head of Pingtung County's Aquaculture Development Association expect this to help farmers recover from losses sustained from typhoon Morakot in August 2009. Grouper prices are also better with increases of 56% from 2009, to TWD416/kg (USD 12.94/kg) whilst that of the giant grouper increased by 27% to TWD466/kg (USD 14.5/kg).

## Boost for growth with new BT shrimp

The new breed of the black tiger (BT) shrimp developed by CSIRO scientists after a 10-year selective breeding program has higher growth and survival. It is projected that Australian marine shrimp production will increase to 12,500 tonnes by 2020 from the current 5,000 tonnes, assuming no expansion of production area. The additional value will be AUD120 million. The significance of the research project is in improving the production efficiency and profitability of locally produced seafood. After 8 generations, the new shrimp increased productivity to 17.5 tonnes/ha in comparison to an industry average of 5 tonnes/ha. One pond produced 24.2 tonnes/ha, a world record for BT shrimp. It also means that Australian BT shrimp producers can out-compete international producers, despite lower labour costs in most of the competing countries.

## Feed concept for tuna

Since 1997, Skretting Australia has carried out R&D on feed for the blue fin tuna. Over the past year, Australian fish farmers have been using the feed. It is also tested in Japan with positive results. The path to this stage has not been easy, as blue fin tuna has a discerning palate. Karl Sveinsvoll, a researcher in Skretting ARC, said, "The main challenge was to develop a feed with a texture and size that the bluefin tuna wanted to eat, at the same time as containing sufficient and the correct nutrients. This problem was solved by using the feed block concept, Aurora Gel, which was patented in 2003." ARC and Skretting are currently testing a new generation of feed blocks, which they have called AquaSoft Tuna. "The alternative to formulated feed is trash fish, such as herring and mackerel, with a feed conversion ratio up to 20. Formulated feed contributes toward greater sustainability, traceability, less risk of transmitting disease and better control of the nutritional profile of the fish."

## Jamaica suspends Asian tilapia

The Ministry of Agriculture and Fisheries (MOAF) has implemented a ban on tilapia imports from South East Asia in April based on concerns that imports have not been meeting sanitary and phyto-sanitary standards. The ministry is also moving aggressively to reinstate the once vibrant tilapia sector which was wiped by cheaper imports. Jamaica was the largest tilapia producer in the Caribbean but due to a liberal trade policy, productive capacity was destroyed, said Dr Marc Panton, MOAF. However, producers want an assurance that their investments will not be lost by any new import policy.

## Containerised feed mill for mariculture zones

The Bureau of Fisheries and Aquatic Resources (BFAR) will build a 3 tonnes per hour feed mill in Tacloban to support mariculture in the Eastern Visayas, Philippines. Regional Director Juan D. Albaladejo said that the new feed production technology will be from Denmark. Construction of the facility will start in early 2011. The facility will meet the growing demand for aqua feeds in existing mariculture zones with sea cages rearing the milkfish, siganids, groupers and red snappers. There are nearly 6,000 ha of mariculture parks with about 500 fish cages in the region. The feed mill can use local raw materials in the area such as excess fish catches and root crops. A highlight of the project is the use of containers for future expansion and changes.

## Acquisition of fish and shrimp feed mill in Vietnam

In early July, Nutreco acquired 100% of the shares in Tomboy Aquafeed JSC in Vietnam. With a number four market position, Tomboy Aquafeed is a leading player in Vietnam for shrimp. Recently it invested in a new plant and started producing feed for marine and high value fresh water species such as tilapia, barramundi, snapper and grouper. Tomboy has two plants near Ho Chi Min City and in Long An Province. It employs approximately 300 staff. Annual revenues totaled EUR 18 million in 2009.

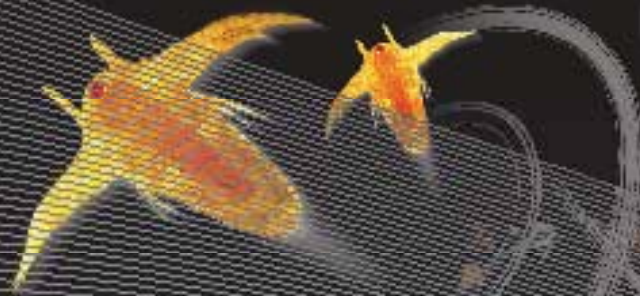
The acquisition of Tomboy Aquafeed is in line with Nutreco's strategy to expand its global market positions in feed specialties and fish feed in growth markets. Knut Nesse, Nutreco Executive Vice-President Aquaculture said, "Skretting has a global leading position for the production of high-quality fish feed in a sustainable manner. We want to capitalize on this position and our know-how by approaching new markets with regards to geography and species. This acquisition perfectly fits in our growth strategy to further develop positions in strategic markets with feed for new species such as shrimp. It offers Skretting an entrance in Vietnam and an interesting platform for future growth."

## IMNV in Indonesia

According to reports in Kompas.com, the spread of the infectious myonecrosis virus in Lampung Province in Indonesia has brought down regional production of vannamei shrimp by 70%. The average harvest has been reduced to 1.5 tonnes/ha from 6 tonnes/ha. Since March 2010, PT Prima Nusa in Lampung has stopped stocking in 95% of the ponds to break the cycle. This is the worst disease epidemic faced by industry in 10 years. Farmers also said that they have tried to overcome the infection from using specialized feeds to probiotics. The virus attacks the shrimp at 50 to 60 days and shrimp continue to consume feed but at a lower rate. When harvested, prices of harvest are lower at IDR 28,000 in comparison to the average of IDR 34,000/kg. In 2009, production in Lampung was 75,223 tonnes as compared to 144,264 tonnes in 2008, according to data from the regional office of the Department of Marine Affairs and Fisheries.

# A NEW GENERATION OF ARTEMIA CYSTS

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- Increased biomass output

# The proactive way to live with WSSV

By Roselyn Usero and Leobert D. de la Peña

**An extremely rigid biosecurity system at Aqua-Cards Victorias is helping to deal with diseases but there is still no zero exposure to WSSV.**

Biosecurity in the context of shrimp farming has taken on several forms. As the occurrence of disease especially white spot syndrome virus (WSSV) is a combination of several factors: health of the shrimp, state of the environment and presence of the pathogen, biosecurity at the farm level requires various measures.

Several years ago, it was discovered that crustaceans are the carriers of the causative pathogen of WSSV. Subsequently, most farms in several parts of Asia have installed single or double layers of nets to fend off crabs and other crustaceans and even other animals from entering the ponds. Above ponds, there are several rows of plastic lines to prevent birds from entering the pond. The spread of diseases by pond workers or external sources (such as vehicles entering farms) is reduced with disinfection baths located at the various entrances to the farm or sections of a farm. Equipment such as nets, are dedicated to a particular pond or tank and are disinfected. WSSV carriers in incoming water are filtered out by several levels of filtration. These are simple biosecurity systems which are prerequisites in any shrimp farm today, especially those culturing *Penaeus monodon*.

However, a total biosecurity concept is more than this. The total system pays attention also to post larvae, reservoir ponds, water filtration and treatment for incoming and outgoing water and assumes responsibility for the environment and to other neighbouring producers. It involves a proactive approach to identify the stressors in the ponds, which when not identified early and corrected, will trigger re-infections. Proactive management and good record keeping are essential.

## A long term investment in the Philippines

This is how the management team at the Aqua-Cards Victorias regards its comprehensive biosecurity system installed at the farm which is one of the premier intensive farms in the Philippines for the culture of *P. monodon*. The farm is located 36 kilometres north of Bacolod City, Negros Occidental and the owners are Roy Villaflores Yanson and Susan Flores Yanson. The farm underwent major renovations in 2005 after being affected with diseases: luminous bacteria and WSSV in the mid 1990s and early 2000, respectively.

"The first stage in our biosecurity system is the one entrance and one exit policy. All company vehicles are subjected to a bath with disinfectants at the main biosecurity house and then at another tyre bath area. We have a zero visitor policy during the production cycle. Sometimes, even I have difficulty entering some parts of the farm," said Roy who inherited the management of this 20-year old farm from his parents.

Some 40% of the 114 ponds in the 162 ha complex is occupied by the three-stage reservoir and water treatment system. There are 15 settling ponds, 17 treatment ponds and 42 shrimp grow-out ponds. Other ponds are used to culture milkfish. The farm practices a closed water system with minimal water exchange. The 15 ponds are used as settling ponds for incoming water from a river which has been filtered using extra fine netting material. Water is settled for 4 days in these ponds. Before entering the treatment ponds, water is filtered with an



Roy Villaflores Yanson



Aquacards team at the 7th Philippines Shrimp Congress

80 mesh filter. Seawater and freshwater is mixed to reach 22‰ in the reservoir ponds, some of which also hold tilapia.

Previously, in the treatment ponds, the farm used electrolysis to produce chlorine gas from the saline water as disinfectant. However, with problems of lower salinity during certain times of the year and high electricity costs, this is now replaced by chemical disinfectants. Before entering the grow-out ponds, water is filtered through an 80 mesh screen.

"The inlet channel pumps in water from one river and we drain out water into another river. Our staff only enter the pond areas assigned to them. They must wear white plastic boots and go through the footbath and shower. There are plastic lines above the ponds, installed 15 inches apart to deter bird carriers from entering the ponds and crab nets," said Delmer Bacroya, Production Manager at the farm, since 2008. "Ponds are divided into modules and these are fenced in. Only staff working in their designated module have access. We have 3 staff per pond module and in total 30 staff for all grow out ponds."



Delmer Bacroya

Blacktiger shrimp production began in 2006 at the farm. Successful harvests followed in 2007 and 2008. In early 2008, production was good at 9-10 tonnes/ha of black tiger shrimp with good survival but later the farm was hit by WSSV. Most of the harvest is sold to a major Japanese seafood export company.

## Disease management

"During the culture period, proactive monitoring specifically on WSSV is carried out on every shrimp pond to determine the disease status. This is done at a regular interval of every 15 days starting with 15 to 100 days of culture (DOC). Regular water and shrimp analyses, usually twice a week, include both chemical and bacterial checks," said Delmer.

Routine monitoring can help identify disease problems before they become unmanageable. The farm has an in-house laboratory where physico-chemical, bacteriological and PCR tests can be done. PCR can detect early stage of infection and immediately will enable the farm to adapt a suitable disease management strategy. Diagnosis relying on the appearance of white spots does not help as by then the shrimp

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Photo of the biosecure area for the culture of *P. monodon* taken through the wire fencing



New system for the restocking of post larvae in ponds developed at the farm. This fiberglass tank is built to float and to acclimatise PL slowly. Live PL are released to the pond by opening the hatch doors (centre).

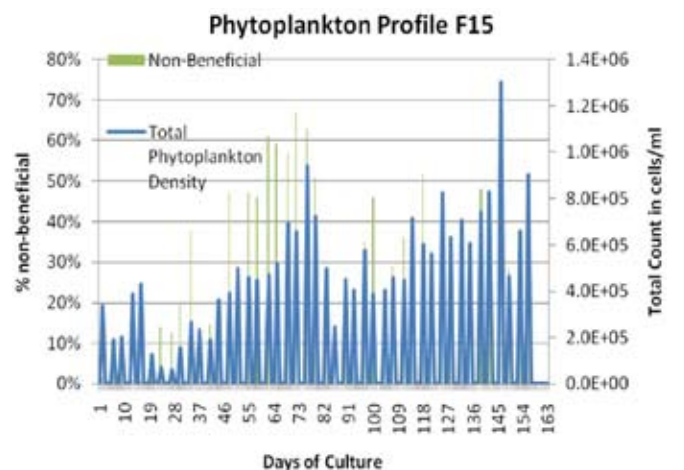
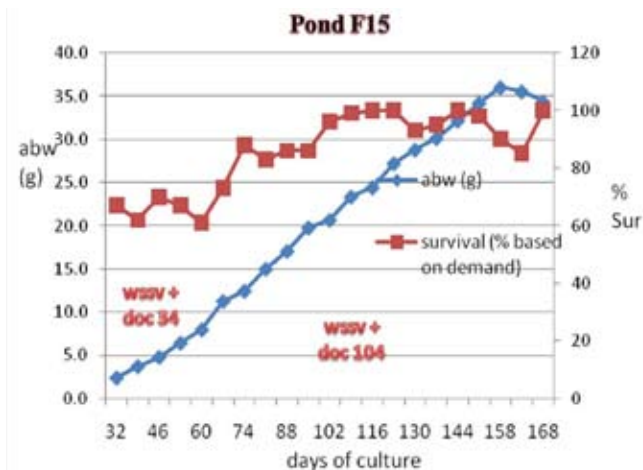


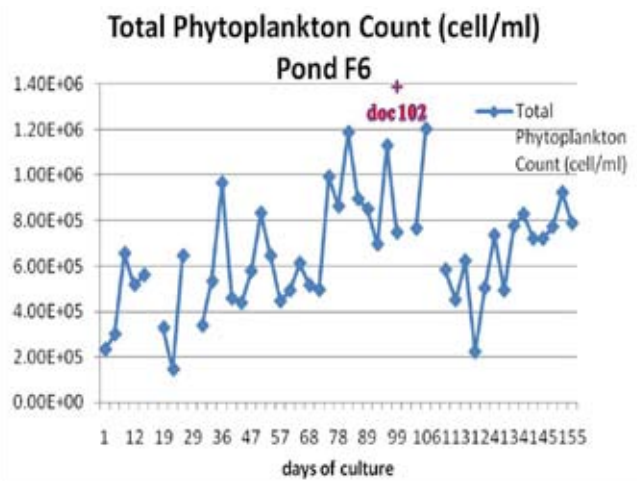
will die within a few days resulting in severe losses. To prevent losses, samples are screened every 15 days. Measures taken are based on the severity of infection, mortality rate and other important factors. If white spot infection is confirmed (one step positive-high viral load in the shrimp) by PCR, culture is aborted. The culture can be continued if only low viral load is detected (nested PCR positive), but a more frequent (5-7 days) PCR screening is done to determine if the health problem is worsening or improving.

In 2009, disease monitoring with nested PCR showed infections in two ponds. In one pond (Pond F15), infection occurred at average body weight (ABW) of 2.38 g and 20.67 g, at DOC 34 and 102, respectively. Our investigations identified the disease stressors. At 5 days prior to the first infection, there were 2 days of continuous rain, low temperature readings (26°C), low alkalinity (70 mg/l), poor plankton profiles (50% were classified non-beneficial species) and density. In the subsequent infection, there was an exposure to more than 0.5 pH units above the optimal pH range, toxic ammonia and nitrite, dominance of green *Vibrio* colonies, plankton die-offs and dominance of *Chroococcus*.

In another pond, positive results for WSSV were obtained by nested PCR at DOC 102 when the ABW was 21.17 g. Similar investigations again showed that the stressors were high pH (7.6-9.0), 10 days prior to the infection, toxic concentrations of un-ionized ammonia-nitrogen and nitrite. The majority of the plankton from DOC 92 to 104 were blue green algae.

In both cases, the management strategy was isolation of the infected area and pond. Corrective measures varied but included the addition of probiotics and vitamin C in feeds and the addition of immune enhancers above the regular application dosage. When water dilution was required, water was pumped in from the reservoir at the same salinity as in the pond.





In both cases, harvesting was carried out at DOC 168 for one pond with a yield of 5.28 tonnes/ha and harvest size of 34.39 g. Survival was 100% with stocking density at 23 PL/m<sup>2</sup>. In the other pond, production was 5.37 tonnes/ha of 35 g shrimp after DOC 159. Survival was also 100%. The stocking density was 27 PL/m<sup>2</sup>.

**Bottomline**

The tangible costs of any biosecurity program including the one described above may be difficult to justify. This is especially so when a farm has had minimal disease outbreaks and there will be a reluctance to adopt such a program. However, we need to realise that WSSV infection is almost always lurking, just waiting for the right conditions to manifest. The absence of a well established internal control or biosecurity system merely exposes us to greater risks. Lastly, the presence of an in-house laboratory and good record keeping as shown in this farm will help hasten the identification of the stressors and the implementation of the appropriate preventive and corrective measures.

*This article was also presented as 'Living with the threat of WSSV- the Aquacards Victorias experience at the 7th Philippines shrimp congress held from March 17-19, 2010, Bacolod City, Philippines.*



**Roselyn Usero** is the Technical Supervisor of the Negros Prawn Producers Marketing Cooperative, Inc., Bacolod City, Negros Occidental, Philippines. Her recent work focussed on the identification of the various risks factors involved in shrimp farming through continued monitoring, documentation and evaluation. This also includes the implementation and monitoring of appropriate risks management measures.



**Dr Leobert D. de la Peña** is a scientist in the Fish Health Section, Seafdec Aquaculture Department, Tigbauan, Iloilo, Philippines. He specialises in aquatic animal health and his interests are in disease diagnosis, prevention and control. He is also responsible for the establishment

and audit of the biosecurity program in every phase of the production as well as the establishment and maintenance of the in-house diagnostic laboratory.



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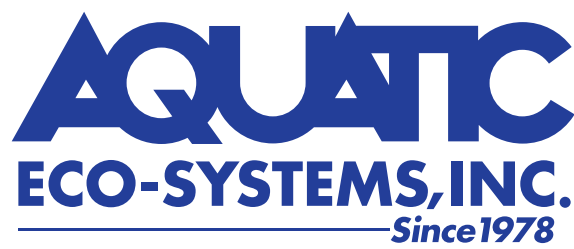
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# Responsible use of drugs in Vietnamese pangasius farming

By Cedric Komar and Dang Thi Hoang Oanh

**A general reduction in the use of antibiotics for disease treatment is apparent, but industry needs a holistic approach in disease management to be sustainable from the animal and human health perspective.**

Over the last 10 years, the rapid growth of the pangasius industry in Vietnam has impressed many industry stakeholders. Exports from Vietnam increased 65 times in 10 years according to the Vietnam Association of Seafood Exporters and Producers. Production was 1.1 million tonnes in 2009. The plan of the Vietnamese Government is to continue investing in this industry to reach 2 million tonnes of production in 2020. It took almost 30 years for Atlantic salmon production in Norway to reach the production figures achieved by the pangasius industry in Vietnam in 10 years.

This success in focusing efforts on one single species has paid off in terms of outcome and is also encouraging other Asian countries to follow a similar path. Aquaculture in Asia has long suffered from a lack of focus in terms of number of species being farmed and this has resulted in a dilution of research resources available for each species from the aqua feed industry, pharmaceutical industry and universities. Most agree today that being a master at farming one species is better than the mediocre farming of many species.

In Vietnam, the maturation of the pangasius industry is in progress. Smaller farmers are going out of business, pushed out by increasing competition as well as lower margins and tough market conditions. Consolidation of the industry from many small players to a few very large vertically integrated companies and few multinational feed millers is a logical industry phenomenon which was also observed in the salmon, swine and poultry industries. This trend is likely to continue over the next few years at a similar pace. With this is a greater responsibility for the fewer industry leaders who need to ensure implementation of traceability measures, standards of practice, and rational aquatic health management.

Due to its astonishing and excessive growth, the industry is now facing a variety of significant problems related to fish disease and health management. This article will mainly focus on the origins of the problems and the paths to be taken to ensure sustainability of the industry from both the animal and human health perspective.

## Antibiotic resistance problems

With intensification in catfish production, the pressure from disease has greatly increased. Some of the bacterial diseases such as *Edwardsiella ictaluri* responsible for Enteric Septicemia of Catfish



Internal lesions due to *E. ictaluri*

(ESC) have had an increasing impact over the years. The growth of the pangasius industry occurred so fast that it took universities and epidemiological research bodies such as FAO and OIE by surprise. As a consequence, today there is a lack of available epidemiological data to fully understand the range of primary infectious agents involved in pangasius mortality and their triggering factors in the farm.

In the past, most farmers have dealt empirically with the diseases and mortalities observed, using chemicals and antibiotics without laboratory diagnostic support and veterinary supervision. Consequently, antibiotic resistance has increased and the related problem of unregulated antibiotic residues and human food safety has also risen.

In order to assure that unauthorised substances are not readily available in the market, the Vietnamese government and national authorities have issued a list of banned and limited use antibiotics and chemicals in aquaculture. This list is updated regularly to comply with food safety standards required by importing markets. Only a few kinds of antibiotics are permitted to be used in catfish farming. Any drug or chemical product that is permitted for use in aquaculture has to be registered with the national authorities. The regulatory approvals also include a review of manufacturing processes and quality standards.

Today, it is in the best interest of the pangasius industry, grow-out farmers and feed millers, Vietnamese Fisheries Authorities and producers to professionally tackle this problem of responsible use of antibiotics by:

- Using only pharmaceutical products from reputable manufacturers who are GMP compliant
- Monitoring antibiotic residues in fish tissue
- Monitoring antibiotic concentrations in feed to assure correct feed mixing
- Establishing programs to assure compliance with EMEA maximum residue limits
- Becoming aware of the possible directions to take to ensure sustainability from a health management perspective
- Implementing the necessary actions to obtain internationally recognised monitoring systems and responsible use of veterinary medicines which have been reviewed and authorised by the appropriate regulatory authorities.

## In depth analysis of reasons for appearance of multiple antibiotic resistant bacteria

As pangasius is the fastest growing fish commodity in the world, the focus has been on the quantitative output through extension of farming areas and intensification of production. Meanwhile, the interest given to disease prevention and fish health management may have been limited. In this early development phase, farmers have applied an empirical approach to deal with bacterial diseases, without following fundamental principles of veterinary medicine.

- **Diagnosis of the etiological agent should precede any treatment.** In most cases, whenever mortality increases, farmers would use antibiotics based on increased mortality or on clinical signs. In some cases, the treatment given was appropriate and mortality reduced but in many other cases, treatment was not specific for the etiological agent.



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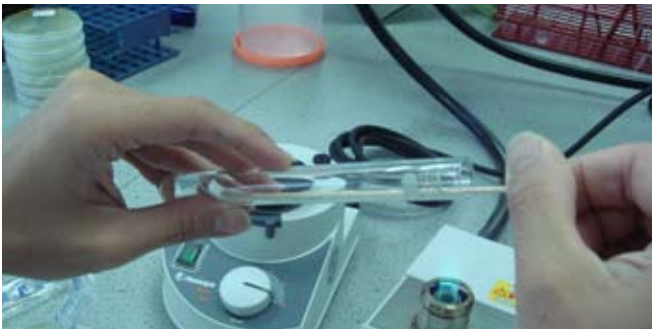
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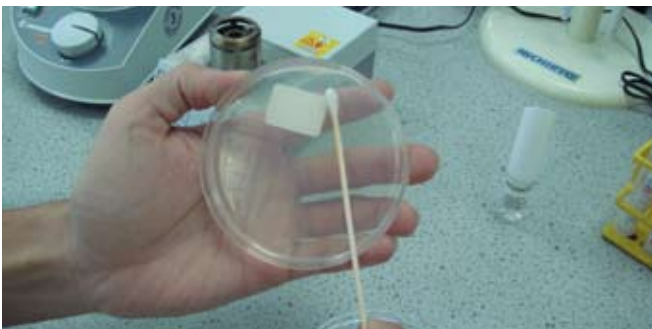
Illustration of antibiotic sensitivity analysis.



1. Collection of pure colonies



2. Inoculation in saline



3. Inoculation of agar plate with swab



4. Placement of sensitivity disc on agar plate



5. Reading of inhibition disc

- **Evaluation of antibiotic sensitivity of the etiological agent should precede the choice of any antibiotic.** Antibiotic sensitivity testing has rarely been performed especially in the earlier years of pangasius farming, and when it was done, it was not necessarily done using internationally recognised standards and guidelines. This often led to an inappropriate use of antibiotics, not based on scientific and veterinary basis. In practice, sensitivity tests are often done after treatment is initiated so antibiotic treatment is not delayed to the detriment of the fish. This is where farm history and antibiotic sensitivity are important.
- **For an antibiotic treatment to be effective, the proper dose of antibiotic must be applied for the proper duration.** In both livestock as well as human medicine, following the prescribed dosage as well as the prescribed duration of treatment is a way to limit the incidence of resistance. Indeed, factors such as treating below the recommended dose and duration create a favourable environment for pathogenic bacteria to develop resistance to antibiotics.
- **Mixing antibiotics together is not recommended as it can lead to multi-resistance.** Moreover, some antibiotics have antagonistic effects when used together.

The industry has switched from a base consisting of many small farmers to a limited number of very large operations. These large exporting companies have a reputation to uphold/protect and cannot risk inappropriate use of approved drugs or use of unapproved antibiotics. Consequently a paradigm shift is underway where stakeholders are

The following table is the compilation of several surveys and these produced by Can Tho University. It illustrates resistance situation for various antibiotics in the pangasius industry.

Antibiotic	Number of resistant isolates	Number of tested isolates	% resistant isolates	References
Oxytetracycline	65	85	76	Phuong et al., 2005; Dung et al., 2008
Oxolinic acid	22	85	26	
Sulphonamide	21	85	25	
Amoxicillin	3	21	14	Oanh et al. (unpublished data)
Flofenicol	27	55	49	
Enrofloxacin	4	105	04	
Ampicillin	29	105	28	
Nitrofurantoin	12	105	11	
Norfloxacin	14	105	13	
Tetracycline	39	105	37	
Trimethoprim/sulfamethoxazole	85	105	81	
Chloramphenicol, ampicillin, tetracycline	29	41	71	
Streptomycin, Oxytetracylin, trimethoprim/sulfamethoxazole	53	105	50	
Chloramphenicol, ampicillin, tetracycline, trimethoprim/sulfamethoxazole	14	41	34	
Chloramphenicol, ampicillin, tetracycline, trimethoprim/sulfamethoxazole, nitrofurantoin	10	41	24	

Antibiotic susceptibility was determined by the single disk diffusion method. Bacteria were cultured overnight at 28°C in Iso Sensitest Agar (Oxoid), harvested by sterilized cotton swab, resuspended in saline solution (0.85% NaCl) to a turbidity visually corresponding to 1.0 McFarland standard. Then 100ul of the standardised suspension was spread onto the surface of the agar plate. Antibiotic-impregnated discs (Oxoid or Biorad) were placed on the solid medium and the plates were incubated 24hrs at 28°C. Inhibition zones formed around the discs were measured, and antibiotic sensitivity was assayed from the length of the diameter of the zones (in mm). The zone radius was scaled from the centre of the antibiotic disc to the end of the clear zone where bacteria could be seen growing. Zone diameters were interpreted as sensitive, intermediate and resistant according to the manufacturer's instructions. Type of antibiotics were chosen for susceptibility test based on the most common antimicrobials used at farms where bacterial strains were isolated.

becoming aware of the importance of proper use of medicine, long term health management strategies and disease prevention. It is an evolution where the stakeholder has to take the right decisions.

### Which direction to sustainability?

Several of the large players have already started to address professional aquatic health management. Nevertheless, it is often discussed among industry stakeholders that information and details available to the industry on how to use antibiotics responsibly and properly are insufficient to systematically implement a health management program. Below are some ideas on what could be implemented:

#### Set up of a professional health management team

A licensed veterinarian assisted by fish pathologists and/or biologists specifically trained in fish disease and aquatic health management should be responsible for implementing a proper health management program for each farming operation. The role of the farm health management team is critical for the sustainability of the operation and has several missions.

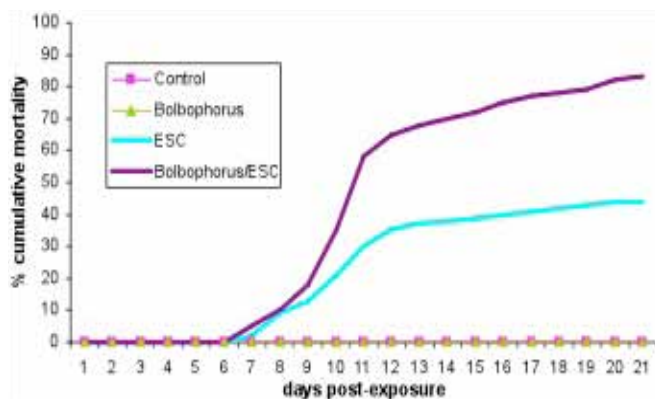
The first one is to perform daily sampling of sick fish taken from ponds in order to monitor, at any given time, what are the causes of mortality (parasites, bacterial agents and others). By doing so, diseases outbreaks can be diagnosed at the laboratory and documented. Indeed, the health management team should work in close collaboration with a laboratory able to diagnose bacterial diseases as well as viral and parasitic diseases. As a consequence, an awareness of the disease situation over major areas of the operation is created and a proper course of action can be proposed by the licensed veterinarian.

Another advantage of establishing a health monitoring system is the development of an **Accurate Alert Response System**. At present, the idea of an alert response system is used by farmers, i.e. when mortality

goes over a certain level, they start treating. However, the advantage of a more accurate system is to be able to target more specifically the etiological agent involved at this specific time.

Over the long term, it is a rich source of epidemiological information for the farm where patterns of specific diseases along specific seasons can be recognised and courses of action optimised. Some outbreaks result from the concomitant influence of more than one pathological agent.

An example taken from the U.S. channel catfish industry can illustrate this point: The digenetic trematode *Bolbophorus damnificus* was implicated as a cause of mortalities and reduced production in farmed channel catfish *Ictalurus punctatus* in northwestern Mississippi. Field observations indicated that *Bolbophorus* infection can exacerbate losses from common bacterial diseases, such as enteric septicemia of catfish (ESC). Laboratory studies (Labrie et al, 2004) conducted at the National Warmwater Aquaculture Center in Mississippi, USA have shown that sublethal *Bolbophorus* infection increases mortalities from *E. ictaluri* when exposure occurs simultaneously. This is illustrated by the following graph.



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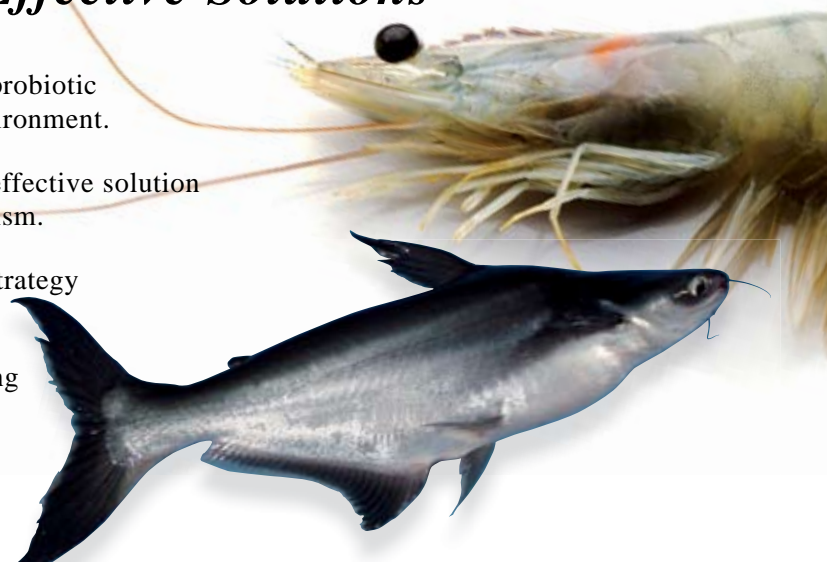
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**Ensure a traceability system of all treatments during the production cycle that is often required by large EU importers**

One of the key roles of the professional health management team is to pre-define a list of approved therapeutics and accompanying treatment protocols for specific disease indications. This is typically done by many integrated swine, poultry or salmon operations. This procedure has the advantage of selecting drugs or antibiotics which are approved for use in fish by the importing country.

Basically this can give an insurance that all treatments applied to the operation are fully supervised by a licensed and approved veterinarian and that no other treatments are given. Only officially legal and authorised medicines are used in the operation. Moreover, treatments given will be optimally designed based upon a rational and scientific basis. In the longer term, this will address the problem of multi-resistance by only applying medicines which are sensitive to a specific disease pathogen.

**Optimise and validate treatment**

At present, medicated feeds are banned for use in aquaculture in Vietnam unless the feed containing the premix is approved by the Fisheries Authorities. One way to help standardise and optimise the treatment given is to use medicated feed prepared in a feed mill under a standardised process. In this way, the concentration of the drug given to the fish and distributed to target organs is consistently kept above the minimum inhibitory concentration (MIC) throughout treatment. This is a necessary condition for successful treatment.

For approved drugs against which bacteria are proven to be sensitive, an optimal feeding regime should be developed in order to ensure that an adequate dose is given every day in the feed. This is to ensure that the bio-availability is appropriate and effective doses in target organs are provided.

**Conclusions**

There is an overall trend towards preventive strategies and a reduction of treatment and antibiotic usage. This general trend in aquaculture is also demanded by the end user. In order to reach this goal, a total health management strategy is advisable.

First, there needs to be a balance in terms of nutrition, husbandry, stress and possibly the use of immune stimulants to keep the fish population in a state of health more resistant to diseases. Secondly and more importantly, there is a need to develop preventive disease strategies including the development and introduction of specialised vaccines against the most important diseases of the pangasius. This is presently the focus of several research groups to help the pangasius industry reach a more sustainable level. Finally, when disease outbreaks occur despite preventive measures and best management practices, pharmaceuticals should be responsibly used. If antibiotics are used, key principles should be applied to ensure a responsible use of these essential medicines for treatment of bacterial diseases.



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# Energy partitioning for white shrimp *Litopenaeus vannamei* fed rendered animal proteins

By Jorge A Suárez, Gabriela Gaxiola, Sergio Nates and Gerald Cuzon

**A poultry by-product meal replacing fish meal did not affect the digestive process of shrimp. Shrimp showed a lower energy expenditure with marine meals but the difference is acceptable for incorporation of rendered proteins in feeds.**

There is an advantage to rely on a digestive process under physiological conditions for an ingredient evaluation. Ingredient digestibility could be measured far more readily than nutrient availability and has been the estimate most widely reported in the literature and used in feed formulation (Lee and Lawrence, 1997). Although this topic has been covered in recent years (Fox et al., 2004), its importance resurfaced with the growing pressure on fishmeal demand.

In this study, diets were evaluated for digestibility by a strain of *L. vannamei* shrimp. The results were then used to establish an energy budget and trace the energy derived from both protein and energy fractions in each diet. All parameters derived from oxygen consumption were measured to determine an energy budget calculated on a 24h basis.

## Experimental design

At a local research facility, all shrimp were from CENIACUA. Shrimp were derived from a selection process to the F7 generation. The average rate of inbreeding per generation was 0.24%.

## Diets and ingredients

The feed ingredients used in this study were obtained from commercial suppliers through the AGRINAL® pilot feed mill plant. Poultry by-product meal (PBM) was supplied by Carolina by Product, USA. The nutrient composition of PBM is presented in Table 1.

**Table 1. Analytical composition of poultry by-product meal (PBM) on % as fed basis.**

	PBM
Protein (Nx6.25)	56.8
Lysine	3.29
Arginine	3.65
Histidine	1.38
Leucine	3.71
Isoleucine	1.87
Valine	2.54
Threonine	2.02
Methionine	0.9
Phenylalanine	2.2
Tryptophan	0.48
Crude Fat	13.52
Moisture	3.89
Ash	22.39

The diets were formulated on an as-fed basis and are presented in Table 2. Diets were prepared by mixing dry ingredients for 10 minutes. Liquid ingredients were added and the mixing continued for an additional 10 minutes. For pelleting, a Torrey meat grinder with 1.6



*Diet treatments were randomly assigned in outdoor 1,200 litre fiberglass tanks (2m<sup>2</sup> bottom) with 40 shrimp per tank.*

**Table 2. Diet composition (% as fed) of reference and tests diets.**

	Reference Diet	PBM
Fish meal	33	23.1
Squid meal	3.0	2.1
Soybean meal	17	11.9
Corn gluten	12	8.4
Wheat flour	25.3	17.0
Fish oil	4	2.8
Soybean lecithin	2	1.4
Cholesterol	0.5	0.35
Vit. & Min. Premix <sup>a</sup>	0.99	0.99
Celite <sup>b</sup>	2	2
Poultry meal <sup>c</sup>		30

<sup>a</sup> Vitamin and mineral premix includes (IU/kg or g/kg or mg/kg of premix): Vit. A, 10000 IU/g; B<sub>1</sub>, 30 mg/kg; B<sub>2</sub>, 15 mg/kg; DL Ca pantothenate, 50 mg/kg; B<sub>6</sub>, 35 mg/kg; B<sub>12</sub>, 40 mcg/kg; Ascorbic, 150 mg/kg; K<sub>1</sub>, 3 mg/kg; D<sup>3</sup>, 3500 IU/g; E, 150 IU/g; niacin, 100 mg/kg; folic acid, 4 mg/kg; biotin, 1000 mcg/kg; Mn, 40 mg/kg; Zn, 40 mg/kg; Cu, 25 mg/kg; Fe, 100 mg/kg; Se, 0.3 mg/kg; I, 0.35 mg/kg.

<sup>b</sup> Celite. Acid-washed standard super-cel ©NF. Celite corporation, Lompoc, CA, USA.

<sup>c</sup> Poultry by-product meal (Carolina by-products meal Winchester, VA 22604).

mm diameter die was used. Celite®NF at 2% (acid-washed standard Super-Cel® NF, Celite Corporation, Lompoc, CA, USA) was included in the experimental diets as an inert indicator.

Between several markers, celite was chosen for the present study based on the performance criteria required for such a compound. In fish, an endogenous marker such as acid-insoluble ash produced large variation in results (Morales et al., 1999). However, coefficients of variation obtained from *L. vannamei* were below 4%, an acceptable range for shrimp.

**Table 3. Analytical composition of experimental diets (% as fed).**

	REF <sup>c</sup>	PBM
Protein (Nx6.25)	40	46
crude fat	8	11.6
carbohydrate <sup>a</sup>	29.5	20.9
GE (kJ/g DM)	19.3	19.5
crude fiber	2.5	2.3
moisture	10.2	8.8
Ash	9.8	10.4
% DM loss <sup>b</sup>	12.7 <sup>a</sup>	11.1 <sup>b</sup>

<sup>a</sup> carbohydrate (by difference).  
<sup>b</sup> stability of the diets in dry matter after 1 h-immersion in seawater (Aquacop 1978). Values were means of four replicates. Means within columns with the same letter were not significantly different at p<0.05.  
<sup>c</sup> Reference diet abbreviated as REF

The chemical contents of the experimental diets were obtained and are given in Table 3. Protein content was around 40% and loss in dry matter remained at an acceptable level, at less than 15% after an hour.

**In vivo digestibility**

For *in vivo* digestibility studies, shrimp with an average weight 15±0.9g, were transferred from the grow-out ponds in CENIACUA. Diet treatments were randomly assigned in 8 outdoor 1,200 litre fiber tanks (2m<sup>2</sup> bottom) with 40 shrimp per tank. Shrimp were fed twice daily at 08:00h and 12:00h. Thirty minutes after feeding, the tanks were brushed out to remove uneaten feed. One hour later faecal matter were siphoned from each tank twice a day (09:30h and 13:30h), and were gently rinsed with



*A metabolic chamber with continuous flow rate (Rosas et al. 1998) allowed us to measure oxygen consumption individually for 12 shrimp (4.9±0.6g average weight) on each diet*

distilled water to eliminate excess salts. Daily fecal samples from each treatment were pooled together. Acid-insoluble ash (AIA) content in diets and faecal matter was determined as described by Atkinson et al. (1984).

**Respirometry trial and energy budget**

Shrimp with average weight of 0.125g were acclimatised to the dietary treatment for 58 days prior to commencement of the experiment. The

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technique described earlier (Gauquelin et al. 2007) was applied to *L. vannamei*. Twelve shrimp per treatment were randomly taken (4.9±0.6 g average weight) for respirometry trials and energy budget calculations.

The information from the feeding trial was used to build an energy budget following the established nomenclature (NRC 1981) and was based on energy partitioning, taking into account the following steps: intake (IE), digestible energy (DE), metabolizable energy (ME), urinary and branchial excretion (UE+ZE) and basal metabolism (HeE).

Two chambers without animals were used as controls for each ten chambers stocked with shrimp. A metabolic chamber with continuous flow rate (Rosas et al. 1998) allowed us to measure oxygen consumption individually for 12 shrimp (4.9±0.6 g average weight) on each diet. Oxygen consumption transformed with the oxycaloric coefficient 13.6 kJ/g O<sub>2</sub> (Cho & Bureau 1998) yielded a value for heat production (kJ). Urinary and branchial excretion (UE+ZE) was calculated from the following equation: UE+ZE=0.08\*(RE+HeE+HiE+HxE) from Bureau et al. (2000), without taking into account the last item (HxE) due to the short duration of the study.

## Results

### Apparent digestibility

The reference diet was readily digested by juvenile shrimp. Some 30% of the fishmeal content was replaced by poultry meal protein sources in the test diets without a significant effect on digestibility. The apparent digestibility coefficients (ADC) for dry matter, protein and energy of the diets are presented in Table 4.

There were no significant differences between REF and PBM in ADC of dry matter, protein and energy (p>0.05). Values for the poultry by-product meal (PBM) in *L. vannamei* were high and greater than 85%. All parameters derived from oxygen consumption were measured to determine an energy budget calculated on a 24h basis.

**Table 4. Shrimp diet ADC (±S.D.) for dry matter, protein and energy.**

ADC	REF.	PBM
Dry matter	83.9±0.43 <sup>a</sup>	84.9±3.69 <sup>a</sup>
Protein	90.8±0.21 <sup>a</sup>	92.1±2.06 <sup>a</sup>
Energy	88.2±0.76 <sup>a</sup>	88.0±3.5 <sup>a</sup>

Values are means of four replicates±S.D. Means within columns with the same letter are not significantly different at P>0.05.

The protein, dry matter and energy digestibility of the ingredients, poultry by-products meal (PBM), soybean meal (SBM), feed pea meal

(FPM), and canola meal (CNA), are presented in Table 5. PBM digestibility values are in accordance to those reported by Suárez et al. (2010: in review) for ADC of dry matter, protein and energy obtained for soybean meal and feed pea meal in *L. vannamei*. Amongst these ingredients, the canola meal showed the lowest ADC for dry matter at 64%, ADC of protein at 89% and ADC of energy at 75% (Suárez et al., 2010: in review).

Values of digestibility for diet were in a good range and obviously it led to similar values for ingredients as far as the additivity of digestibilities remains valid.

**Table 5. Ingredient ADC (±S.D.) for dry matter, protein and energy.**

Ingredients	PBM	*SBM <sup>a</sup>	*FPM <sup>b</sup>	*CAN <sup>c</sup>
ADC dry matter	87.4±5.4	80.0±3.8	87.0±5.0	64.0±8.2
ADC protein	95.1±6.87	96.7±2.7	97.9±3.7	89.4±4.8
ADC energy	87.7±6.07	88.9±3.4	93.9±2.6	75.5±6.4

Values are means of four replicates ±S.D. \* digestibility reported by Suárez et al. (2010): in review.  
<sup>a</sup>soybean meal (SBM), <sup>b</sup>feed pea meal (FPM), <sup>c</sup>canola meal (CNA).

### Energy budget

Animals (4.9±0.13g) fed experimental diets on a weekly basis were used to obtain the energy budget, the results of which are given in Table 6. The reference diet provided higher DE values (1.26 kJ/shrimp/day) than PBM (1.17 kJ/shrimp/day). The estimated value in kJ/shrimp/day from UE+ZE for REF and PBM was very similar. Energy used for maintenance metabolism (HeE) change at the dietary protein levels used for this experiment (REF: 40% crude protein, PBM: 46% crude protein). PBM provided higher HeE values (0.37 kJ/shrimp/day) than REF (0.31 kJ/shrimp/day). Heat increment of feeding with PBM provided higher HiE values (0.18 kJ/shrimp/day) than REF (0.16 kJ/shrimp/day). The difference in recovered energy (RE) in kJ/shrimp/day between REF and PBM was 24% in favour of REF.

**Table 6. Impact of feed composition on energy budget (kJ/shrimp/day) for individual animals placed in a metabolic chamber for 24 h.**

	DE <sup>1</sup>	UE+ZE <sup>2</sup>	HiE <sup>3</sup>	HeE <sup>4</sup>	RE <sup>5</sup>
REF	1.26	0.04	0.16	0.31	0.74
PBM	1.17	0.05	0.18	0.37	0.56

<sup>1</sup>DE: digestible energy values from ADC experiment  
<sup>2</sup>UE+ZE: urinary and gill excretion (Bureau et al., 2000)  
<sup>3</sup>HiE: heat increment of feeding on the basis of one meal per day  
<sup>4</sup>HeE: maintenance based on value measured at t0  
<sup>5</sup>RE: recovered energy.

## Discussion

Two possible ways for measuring digestibility; *in vivo* or *in vitro* could be applied considering previous research in this field. The *in vivo* method was adopted despite it being time consuming because of the long-term collecting periods.

ADC of dry matter measured total quantity digested for an ingredient (Brunson et al., 1997). ADC of dry matter for *L. vannamei* fed PBM in this trial was 87.4%. Protein digestibility in the experimental diet was found to be high and greater than 90%. High ADC protein values in the present study were in accordance with values reported previously by Cruz-Suárez et al. (2007) for PBM-PFG (poultry by-product meal-pet food grade).

However, further experiments would be necessary to investigate protein level influence on ADC (Cousin et al., 1996) and associative effects on protein sources related to heat increment variation (Koshio et al., 1993). Our results are also in the line of those reported by Suárez et al. (2010; in review) for ADC of dry matter, protein and energy obtained for soybean meal (SBM) and feed pea meal (FPM) in *L. vannamei*.



The research team at CENIACUA.

There were no differences related to DE between the reference and PBM diet. Interestingly, the energy budget showed a difference in HeE and HiE. It is evident that marine protein sources produce lower energy expenditure in HeE and HiE than poultry by product meal in a first approximation. The difference in recovered energy (RE) in kJ/shrimp/day between REF and PBM was 24% in favour of REF. However, such differences remained acceptable for PBM and indicative of a possible incorporation of rendered protein in a compounded feed for shrimp.

The formulation in the present study did not produce negative effects on ingestion, and the experimental diets formulated with poultry by products meal ingredients showed no decrease in digestibility as compared to the reference diet, indicating that PBM components replacing fish meal in this study did not affect the digestive process of shrimp.

### Acknowledgments

The authors would like to thank the following for their contributions: Dr. Pablo Aguirre. SOLLA, Colombia, Dra. Marcela Salazar, Oramis Zambrano, Adriana Cortina and Diana Buendia CENIACUA, Colombia.

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# Yeast in aquaculture from nutrition to well-being

By Philippe Tacon and Eric Auclair

**Yeasts are fungi with the common characteristic of a predominant or permanent unicellular state. They are eukaryotic microorganisms and their properties are different from the prokaryotic bacteria. Yeasts are resistant, for example, to antibiotics sulfamide and other anti-bacterial agents. This resistance is natural and genetic and is neither susceptible to modification nor transmitted to other microorganisms.**

The particle size of yeast (5 x 10 µm) is also significantly higher than bacteria (0.5 x 5 µm). Among the yeast, *Saccharomyces cerevisiae* is industrially important due to its ability to convert sugars (i.e. glucose, maltose) into ethanol and carbon dioxide, the latter for the baking, brewing, distillery and liquid fuel industries. *S. cerevisiae* has the GRAS status (Generally Recognised As Safe) from the US Food and Drug Administration.

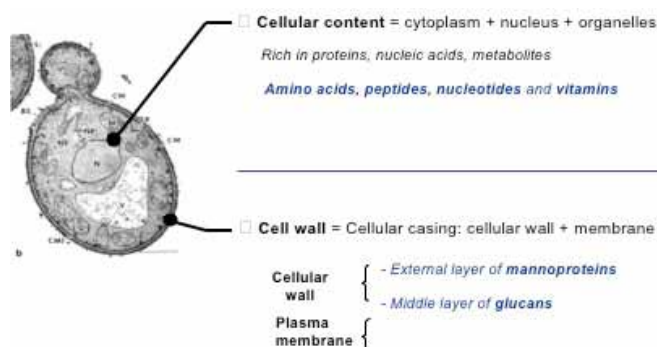
Yeasts from bakery, brewery, ethanol production or other origins such as torula have been used for a long time in aquaculture and has followed the evolution of the industry. Due to their high protein content, yeast, a Single Cell Protein (SCP), dead, inactivated or autolysed, has been primarily used as a protein source to complement other protein sources or a replacement to some such as fish meal. In the example of the rainbow trout, there is the possibility to replace 40% of the fish meal.

*S. cerevisiae* from the bakery industry is a major ingredient for enrichment in rotifer production and is a substitute for live algae. However the low unsaturated fatty acids levels in yeast need to be supplemented. *S. cerevisiae* is particularly useful due to its resistance to sea water, but its thick cell wall needs to be broken down as it can prevent the efficient utilisation of protein (Coutteau et al., 1990).

Another well known role of yeasts is the production of astaxanthin by the *Phaffia rhodozyma* yeast. The higher costs and lower incorporation rates than its synthetic counterpart has led to a lower use of *Phaffia* astaxanthin in salmonid aquaculture. However, it has found its niche as a feed additive in organic salmon farming where the use of synthetic astaxanthin is prohibited. More recently, there is a renewed interest in yeast in aquaculture with new applications in health and immune stimulation. This is nutritional supplementation with live yeasts or yeast derivatives, such as yeast cell walls or yeast extracts.

## Live yeast

Live yeast can act as probiotics in fish gut and has been showed to have an effect on the microflora, immune modulation and fish metabolism (see review by Gatesoupe, 2007). In *Litopenaeus vannamei* post larvae, for example, *P. rhodozyma* and *S. cerevisiae* have been shown to increase survival and help against disease such as vibriosis when fed



at 0.1%. The higher survival with *P. rhodozyma* is likely to have been triggered by an antioxidant effect of the carotenoids it contains (Shotlitz et al., 1999). A similar defence against oxidative stress has also been shown in sea bass larvae. A supplementation of 4.3% of *Debaryomyces hansenii*, a yeast isolated from the gut of rainbow trout, could maintain the activity of the superoxide dismutase and glutathione peroxidase (Daniel et al., 2010). In carp, *S. cerevisiae* incorporated at a rate of 1g/kg of feed improved growth and feed conversion ratio (Mazurkiewicz et al., 2005). The authors did not explain the possible effect of the yeast, but another study on tilapia fry suggested that used at the same dosage, *S. cerevisiae* could act as a growth stimulating agent and a stress reliever (Lara-Flores et al., 2003).

However, in all these studies live yeasts were incorporated in pelleted feed or top dressed. Extrusion, which is becoming common in fish feeds and the high temperatures and long conditioning times used to produce shrimp feed would kill the yeast cell and prevent a wider use of live yeast in aquafeed. Live cells would have to be sprayed onto feeds after production. Another solution would be the development of products that would resist these high conditions but at the same time can be easily assimilated by the animal.

## Yeast cell walls

The yeast cell wall (YCW) is a thick and complex component of the cell. It includes the cellular wall and the plasma membrane. Typically, commercial YCW are composed of polysaccharides (15-30% of β-1,3/1,6-glucan and 15-30% of mannan sugar polymers), proteins (15-30%), lipids (5-20%) and chitin (< 5%) (Eurasyp, 2007). It is a fine, uniform and beige creamy powder with a yeast smell and is easily soluble. YCW produced by Lesaffre Feed Additives (LFA) comes from a single cell production and is not a by-product of the fermentation industry. Beta-glucans, with a dedicated purification process, can also be further enriched in YCW.

The action of yeast cell wall material on the complement system has been known for a long time (Pillemer et al., 1954). Generally these properties are related to the presence, in the inner part of yeast cell wall, of glucans, which comprise main chains of beta (1-3)-linked D-Glucose molecules to which are attached linear side chains of beta-(1-6) linked residues. These macromolecules have the ability to stimulate certain aspects of the immune system, especially inflammatory response and reticuloendothelial system (RES), liver and spleen of mammals. The inflammatory response involves a glucan receptor, present on peripheral blood leukocytes and extravascular macrophages (Czop, 1986). Mannan-oligosaccharides (MOS) can trap mycotoxins in aquafeeds and bind to pathogenic bacteria via mannose specific sites. (see Sakai (1999) and Raa (2000) for reviews of YCW as immunostimulants in aquatic animals).

Between 2006 and 2008, some trials were undertaken by LFA to evaluate the different roles of YCW and yeast extracts in aquatic animals.

## Tilapia trials

An aquarium trial was undertaken in Thailand by Prof. Jirasak Tangtrongpiros at the Veterinary Medical Aquatic Animal Research Centre, Faculty of Veterinary Science, Chulalongkorn University. The trial used 1g tilapia fry which were raised for 3 months in 50 litre aquaria at the ratio of 30 fish per aquarium. Fish were fed 5 different diets containing 0, 100, 500, 1000, and 2000 ppm of LFA Yeast cell wall. Four replicates were used per treatment.

In order to evaluate the ability of fish to resist stress, the ammonia concentration was adjusted at 0.5 mg/l. Yeast cell wall at concentrations above 100 ppm showed a positive effect on growth (Table 1), which could be the result of a better fight against stress.

**Table 1. Comparison of individual weight of fish (n=40) fed diets with YCW\* in each lot during the 3-month experiment.**

	Initial weight (g)	Month 1 (g)	Month 2 (g)	Month 3 (g)
Control	1.1	13.5	18.7	23.5 <sup>a</sup>
YCW 100	1.1	11.9	16.6	22.1 <sup>a</sup>
YCW 500	1.1	13.0	18.5	28.2 <sup>b</sup>
YCW 1000	1.1	11.5	16.9	26.7 <sup>c</sup>
YCW 2000	1.1	13.0	16.1	26.9 <sup>d</sup>

Values in the same column with different superscript letters are significantly different (P<0.05). Data were analysed by the SPSS program (one-way Analysis of Variance by Parametric Method) and Chi Square test. P<0.05  
\*YCW Lesaffre Feed Additives (LFA), France

During the course of this trial, five fish were challenged every month with LD50 *Streptococcus agalactiae* at dosages in the range of 10<sup>5</sup> cfu per fish by intraperitoneal injection. The mortality rate was

recorded for seven days. The results are shown in table 2 and we can see a better survival rate with fish treated with yeast cell walls.

**Table 2. Mortality rate (%) of fish after challenge; seven days after injection (aquarium) and 4 days after injection (cages).**

	Control	YCW 100	YCW 500	YCW 1000	YCW 2000
1st month	40	10*	30	25	30
2nd month	75	60	40*	35*	40
3rd month	70	50	35*	40	45
Average	61.70	40*	35**	33.33**	38.3*
Cages trial	55±5.8		40±8.2*	27.5±9.6*	

\*p < 0.05, \*\* p < 0.01

In order to confirm these results, a similar trial was conducted in cages for 3 months in a commercial setting in Nakon Nayok under the supervision of the same research team. Only concentrations of 500 and 1000 ppm were used and no extra stress was applied to the fish. Three replicates of cages were used per treatment. Although fish fed diets with YCW were larger at the end of the trial, no significant differences could be found in growth and feed conversion ratio.

A *S. agalactiae* challenge performed at the end of the trial with 20 fish per cage showed the same results as in the aquaria trial with a 50% improvement in survival (Table 2). *Streptococcus* concentration was measured in the gut of the challenged fish and fish treated exhibited a lower count of bacteria suggesting that YCW had a direct stimulating effect on the immune system or that bacteria were bound with MOS thus decreasing their numbers in the gut (Figure 1). This was also confirmed in a trial in Mexico where 400g tilapia fed with YCW at



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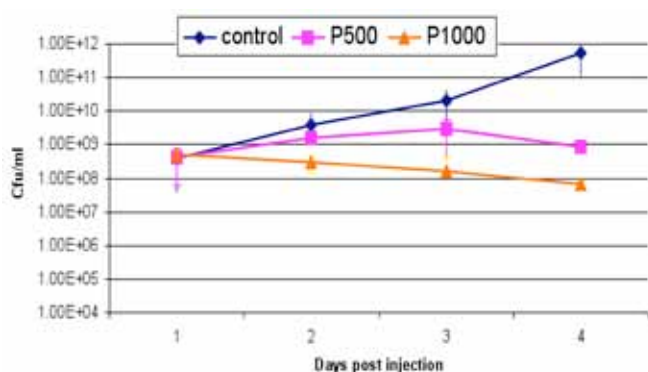
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**Figure 1. Number of *S. algalactiae* (cfu/ml) in intestines of challenged tilapia during the 4 days of the challenge (cage trial) P500 = YCW 500 ppm; P1000 = YCW 1000 ppm.**



the dose of 1g/kg for 21 days, showed higher IgM levels in blood when sampled at 42 days of trial.

### Shrimp trials

The YCW was also tested in shrimp feed in a joint trial with the Prince of Songkhla University and Coastal Aquatic Animal Health Research Institute in Thailand. *L. vannamei* of 1g were fed with YCW at doses of 100, 500, and 2000 ppm incorporated in feed, over 42 days (15 pieces/50 litre aquarium; 4 replicates). No significant differences were seen in growth. Haemolymph was sampled at the end of the trial and 2 hours after a stress was applied to the shrimp (salinity decreased quickly from 25 to 8 ppt) and some immune parameters tested. The dose of 2000 ppm gave significant differences in total haemocyte count before stress and the dose of 500 ppm on spontaneous superoxide production (respiratory burst) after stress, indicating a positive effect of YCW in pathogen defence ability. This was confirmed in a subsequent trial performed in 600 litre cement ponds with 2g shrimp fed for 4 weeks (50 pieces per pond in triplicate) with feed supplemented with 2000 ppm of yeast yell wall (Table 3).

**Table 3. Blood components and immune responses of experimental shrimp after 26 days of feeding in cement ponds.**

Parameters	Control	YCW 2000 ppm	YES 2000 ppm
THC (1x10 <sup>7</sup> cell/ml)	2.47±0.96 <sup>a</sup>	2.26±0.79 <sup>a</sup>	2.70±0.86 <sup>a</sup>
Spontaneous O2-	0.027±0.010 <sup>a</sup>	0.040±0.013 <sup>b</sup>	0.038±0.012 <sup>b</sup>
Stimulated O2-	0.192±0.089 <sup>a</sup>	0.327±0.075 <sup>b</sup>	0.369±0.106 <sup>b</sup>

\*Values in the same raw with different superscript letters are significantly different (P<0.05) among treatments (n=30).  
YCW = LFA Yeast Cell Wall ; YES = LFA Yeast Extract Standard.

The YCW showed a positive effect on the immune system in aquatic animals. Nevertheless, it is very important that the appropriate dosage is applied. YCW are sometimes used in a pulse manner in aquaculture to avoid an immune depression, possibly triggered by an overstimulation of the immune system by beta-glucans. However, more work is necessary to identify the correct dosages, correct applications of YCW within aquafeed and appropriate culture stages to ensure an optimal result.

### Yeast extracts

Yeast extracts represent the cellular content of the yeast cell. They include cytoplasm, nucleus and organelles and are naturally rich in amino-acids, peptides, vitamins (Vit B, glutathione), carbohydrates and salt. They come from the separation of yeast fractions after it has been autolysed. They are mainly used in the food industry to create

natural savoury flavours and in pharmaceutical industry as nutrients for bacteria culture media. They can come in different forms such as liquid or powder. The powder has more than 94% dry matter and can be fine or microgranulated. Yeast extracts have typically 50-75% proteins, 4-13% carbohydrates and no lipids. They can also be further enriched in nucleotides under specific production processes and can be available with various contents of two natural nucleotides: 5'GMP and 5'IMP (inosine monophosphate).

Yeast extracts are sources of highly digestible peptides. Free amino acids and nucleotides especially IMP can also act as attractants in fish. Supplementation of aquafeed with yeast extracts can improve their nutritional efficacy. Furthermore it has been shown in fish that an external supply of nucleotides can complement efficiently the *de novo* synthesis particularly when the animals face stress (Burells et al., 2001). Yeast extracts have also been shown to be able to replace partially or completely fish meal in some diets.

In the same shrimp trial performed as above, three concentrations of LFA standard yeast extract were also tested at 100, 500 and 2000 ppm. Yeast extract at the concentration of 2000 ppm (2 kg/tonne) gave a significant effect on growth in the aquarium trial but did not show any effect on immune parameters (Table 4). Standard yeast extract has the ability to improve shrimp growth rate either by supplying more digestible proteins or attracting the shrimp to feed.

**Table 4. Final weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), and total haemocyte counts (THC) of white shrimp fed experimental diets for 42 days.**

	WG (%/shrimp)	SGR	FCR	THC 10 <sup>7</sup> /ml
Control	366 ± 20 <sup>a</sup>	3.66 ± 0.10 <sup>a</sup>	1.77 ± 0.23 <sup>a</sup>	1.64 ± 0.87 <sup>a</sup>
YE 2000 ppm	435 ± 39 <sup>b</sup>	3.99 ± 0.10 <sup>b</sup>	1.66 ± 0.16 <sup>a</sup>	2.39 ± 0.89 <sup>abc</sup>

\*Values in the same column with different superscript letters are significantly different (P<0.05) among treatments. Values are mean ± SD (n=4 replication tanks)

### Bottomline

Yeast, with its probiotic abilities, the components of its cell wall or its cellular content, has a good potential in bringing solutions towards the problems that the aquaculture industry is facing, should they be nutritional such as fish meal replacement or sanitary issues such as bacterial diseases or parasites infestation. However more work between the actors of the aquaculture sector and the yeast manufacturer will be needed to bring the best of this very interesting microorganism.



Philippe Tacon

Philippe Tacon has recently joined Lesaffre Feed Additives as market Manager for Aquaculture. After completing his PhD at the INRA institute, France, he served in several positions in aquaculture in Asia. Email: ptn@lesaffre.fr



Eric Auclair

Eric Auclair conducted his PhD in the field of amino acid digestibility in pigs and poultry. After eight years as a nutritionist specialising in milk replacers with the UFAC group in France, he joined Lesaffre in 1996. He is now R&D Director of Lesaffre Feed Additives, a business unit especially dedicated to the feed additives business.

# Indian freshwater fish farming: moving to soy-based extruded fish feeds

By P. E. Vijay Anand, Michael Cremer and G. Ramesh

In a win-win situation, the American Soybean Association-International Marketing has created an entirely new business sector using soy-based extruded floating fish feeds in India. It has also shown the technical and economic merits of these feeds to farmers. The road map for the sector will be a creation of demand all along the supply chain.



An 18 tph capacity Wenger machine at the Indian Broiler Group

The American Soybean Association-International Marketing (ASA-IM) program focuses on the promotion of sustainable, feed-based production technologies and high quality soy-based (plant protein based) feeds for aquaculture in a program that addresses the global aquaculture industry. As a result of work carried out by ASA-IM, the freshwater fish farming industry is undergoing modernisation through the use of nutritionally balanced extruded floating fish feeds. Acceptance of technologies promoted by the Soy-in-Aquaculture Program ([www.soyaqua.org](http://www.soyaqua.org)) of the ASA-IM is now building a whole new business opportunity around this development.

The organisation, funded by U.S. soybean farmers, identified this opportunity and invested funds to develop the same in India in 2003. By 2005, the fish farming industry accepted that modern soy-based fish feeds are well utilised by fish and yield good economic returns. The organisation continued to carry out work to demonstrate the technology,

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32/6 ASA-IM formulated soy-based extruded fish feed



A new plant with a 10 tph Extru-Tech extruder for Rudra Techno Feeds.

and the repeatability and refinement of this technology are visible in the form of commercial extrusion feed mills that now produce and market soy-based feeds. ASA-IM continues to work on more strategies for the aquaculture industry in India so that it will be developed in a sustainable and profitable manner.

### Building demand in India

India, despite second to China, in terms of freshwater fish production, has a low utilisation rate of commercially produced feeds. Farmers

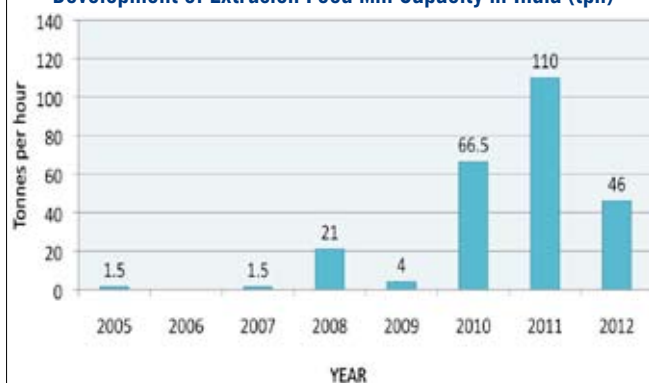
use the traditional method of feeding fish with nutritionally poor agricultural by-products, coupled with generating natural foods with organic manure added into ponds. The low utilisation of scientifically formulated feeds in commercial fish farming provides an excellent opportunity to promote artificial feeds with the incorporation of soy meal.

In 2003, the ASA-IM program evaluated the potential of introducing high quality soy-based feeds and initiated several aquaculture activities in India to test this feasibility. Typically, as in any other technology introduction, the industry initially showed resistance on the use of these new generation feeds. Farmers cited reasons such as carps will not eat floating fish feeds while some said that the modern feed technology is not commercially feasible when compared to the low cost feed input system (rice-bran, oil cakes and animal manure for natural food production).

The team explained that the use of extruded floating fish feeds is common all over Asia and is not a new technology. However, the best way to influence and change perception was through commercial feeding demonstrations at the farmer's facilities and through a participatory management approach. Following successful results on feed response (feed acceptance) from studies conducted at the Fisheries Research Station of the University of Agricultural Sciences, Bangalore, ASA-IM then carried out a series of commercial feeding demonstrations in the states of Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. The species covered under these demonstrations were the Indian carps, *Labeo rohita* (rohu) and *Catla catla* (catla), *Ctenopharyngodon idella* (Grass carp) and *Pangasius sp* (catfish). The aim was to build demand and prove to both farmers and aqua feed producers that extruded soy-based fish feeds will work in India too.

Table 1 shows trends in investments for fish extrusion plants after ASA-IM started demonstrating the feasibility of using soy-based formulated fish feeds in India (Note: Figures market 'X' are those feed mills which have given up small extruders and have expanded; figures provided up to 2010 are on an actual basis; figures for 2011 and 2012 are forecasts and may change with varying plans of the investors, new investors, as well as market developments).

Development of Extrusion Feed Mill Capacity in India (tph)



Company	2005	2006	2007	2008	2009	2010	2011	2012	Total tph
Indian Broiler				8		18+12		16	54.0
Uno				3 (X)		5+5+1.5			21.5
Kwality	1.5(X)		1.5(X)		4	4+1	10		19.0
Ananda				5			10		15.0
CP				5			20		25.0
Growel						10	10		20.0
Rudra						10		10	20.0
Nexus							15		15.0
Mulpuri							15		15.0
Cateroh							10	10	20.0
Indepesca							10		10.0
Sneha							10		10.0
Year total	1.5	-	1.5	21	4	66.5	110	46	244.5

Feed mill installed capacity forecast by 2012 is likely to be 1.1 million tonnes and will need about 0.4 million tonnes of soy meal for inclusion. (Feed volumes/year was calculated at 248tph x 75% mill efficiency; 20 hour shift/day, 25 days/month)

### Feed demonstrations

The commercial feeding demonstrations were meant to compare traditional feeding methods with soy-based extruded floating feeds and at times it was a direct demonstration to evaluate economic returns to the farmer by using modern feeds. Farmers were provided with protocols and assistance on site including pond selection, pond preparation, seed selection and stocking procedures. They also learnt how to wean fish onto feed prior to stocking, feeding to satiation, periodical sampling, water quality monitoring and accurate production/ cost data and feed recording.

Finally all scientific inputs were analysed and the Return on Investments (ROI) calculated. This was the most effective tool that helped entrepreneurs to accept the new technologies. The gestation period was about three years before the fish farmers started to adopt the technology.

### Going further

The next step was extension work and dissemination of these results. These were shared by all industry stakeholders in India (fish farmers,



Ananda feeds with a 5 tph Muyang extruder.

universities, government officials, potential feed millers, other investors and hatchery operators). Information was disseminated in various extension/marketing modules specifically created for different groups of stakeholders. For example, when the demonstration ponds were harvested, all aquaculture stakeholders gathered at the site to physically observe the harvest, examine the condition of the fish, assess fish performance and examine data recording procedures. Such an exposure instilled confidence.

Field days were also conducted to discuss the results and invite comments and suggestions from stakeholders for continuous

improvement in the new technology. Seminars and workshops were regularly conducted to bring the information to a wider cross section of the industry. In addition, all results and feed formulations were published and posted on the internet for the general public.

### Industry response

Undoubtedly, these formulated feeds were far superior to mash feeds for freshwater fish farming in the country. The positive responses from initial users were very encouraging. Some observations also helped to catalyse major changes in the industry.

Most importantly, floating feeds allow for efficient nutrient delivery and ingestion is almost complete. With floating feeds, the situation is closer to farming terrestrial animals where the farmers could see the feed usage and manage this more efficiently. Extruded formulated feeds are consistent in physical form and quality and can be easily stored, contrary to traditional mash feeds which fluctuate greatly in overall quality, physical form and nutritional composition. The feeds could be easily handled in the farm thus reducing labour. Due to scientific formulations resulting in need-based balanced diets, fish grew faster on these feeds. Faster growth reduced grow-out durations and the waiting time to derive economic returns from the operations. Cooking by extrusion also increases the digestibility and availability of several raw materials in the feed. Users noticed that water quality was better when these feeds were used. As a result, the incidence of diseases is gradually reducing.

### Trying times

Extrusion was and is still a new tool for the Indian feed milling industry. The process demands a greater level of precision and technical expertise compared to operating pellet feed plants. The

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Dr. Vijay Anand, Lukas Manomaitis (ASA-IM Aquaculture) and G. Ramesh sampling fish during feeding demonstrations in India.

initial demonstration used the lone extrusion machine in the country, owned by an ornamental fish feed manufacturer in Chennai for the manufacture of soy-based fish feeds (termed by its protein and fat content – 36/7 or 32/6 feed). In 2005/2006, when the fish farming industry finally started accepting these feeds, there were no feed mills to produce the required quantity and quality of feed. The next stage was in capacity building for extruded fish feeds.

As expected, the industry was initially sensitive to the cost of investments for extrusion equipment. Some looked at importing extrusion equipment but were deterred by the high customs duty in India. They then bought cheaper domestic extrusion equipment which failed to produce the desired quality of feeds. This was a typical learning curve for all feed mill investors.

Both feed millers and end-users (fish farmers) gradually realised the importance of quality feeds which was directly linked to quality equipment. In turn, this led to better feed performance and fish production. Finally the first imported extruder (an 8 tph machine) was installed in 2007. This became the landmark for extruded soy-based fish feed in India and paved the way for more extruders in India.

### Extrusion support

With the entire industry new to the operations of extruders, ASA-IM had the responsibility of providing appropriate exposure, training, support, guidance and knowledge on extrusion as a tool for manufacturing fish feeds. Potential entrepreneurs were exposed to extrusion technology in other Asian countries (China and Vietnam) and were provided training on extrusion technology in Kansas and Texas, USA. Trade linkages with extrusion equipment manufacturers in India were facilitated. These efforts collectively gave the industry more confidence to decide on investing into this new business venture.

### Learning from others

One of the modalities used to convince Indian entrepreneurs was exposing them to fish feed usage in other Asian countries. Most often there is talent and investment power in entrepreneurs, but what they lack is the ability to quickly change and adopt technologies. Once the potential and the constraints were identified, it took only mere observation and attention to detail to promote learning and adoption of techniques from those who were already successful. ASA-IM's soy-based fish feeding models in China have been a flagship reference for other countries and so was it with ASA-IM's India- aquaculture program which is efficiently adopting many useful techniques.

## 9<sup>th</sup> Asian Fisheries and Aquaculture Forum (9AFAF) 21<sup>st</sup> – 25<sup>th</sup> April 2011, Shanghai, China



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Growel Feeds Ltd, with a 10 tph Muyang extruder.

### Formulation support

Once extrusion hardware was in place, the next issue to be addressed was feed formulations. Consequently, a typical trend of using low cost feeds crept in. Through continuous education and awareness work of the Soy-in-Aquaculture Program, ASA-IM, the industry is now gradually moving towards the use of quality feeds. Competition amongst feed mills is also certain to drive the industry towards manufacturing quality feeds. As specialisations gradually come in, there will be increasing dependence/need for formulation support for these new feed mills in the country.

### Expansion in India

As a result of these efforts, we now have a current fish feed milling capacity in India at 91 tph with an annual production of 408,000 tpy (Table 1). As the industry will most probably depend on soy meal as a protein source, the requirement for milling the above quantities of feed will be 142,000 tonnes at an average inclusion rate of 35%.

Rapid expansion in feed milling capacity is expected by the end of 2011 and 2012 when some major feed mills start operations. It is estimated that this will boost fish feed manufacturing in India to about one million tonnes. This level of feed production will require an estimated 350,000 to 450,000 tonnes of soy meal and the industry will have to address a consistent supply and availability to support these feed mills.

### A road map for India's fish feed sector

At present, fish farming in India is based on a small range of fish species, many of them currently dependent on natural foods or farm made feeds. There is an urgent need to shift to feed based fish farming and include more species of fish, especially the high value ones. With the current situation, the expansion of aqua feed production has to be carried out with caution.

Key areas to increasing the feed user base include: species diversification, establishment of feed use for juvenile fish, developing commercially viable/proven hatchery technologies for new species, conversion of existing fish farmers from using traditional feeds to formulated feeds and culture systems (cage farming-freshwater and coastal) diversification.

To develop feed based fish farming, ASA-IM first began with 'demand building work' where technical and economic benefits of using soy-based fish feeds were demonstrated to the industry. This was then followed by work on capacity building, which convinced the industry to establish feed mills to meet demand. In order to develop the industry further, we expect the cycle to switch between demand and capacity building work. To be able to do this, all stakeholders involved in the aquaculture industry have to continuously investigate and create new opportunities for the industry.



P. Emmanuel Vijay Anand



Michael C. Cremer



G. Ramesh

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**G. Ramesh** is ASA-IM's Technical Manager for Aquaculture since 2006. He works with the feed mills and fish farmers in India to further expand, establish and popularise the use of soy-based extruded fish feeds. He has a Master's degree in aquaculture and has 15 years of work experience.

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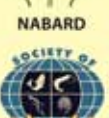
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# Making a difference in Thailand

By Soraphat Panakorn and Zuridah Merican

**Small margins in freshwater prawn farming require caution in production and the ability to innovate.**

Some 16 years ago, Mr Prakob Subyod Keaw started a grow-out farm for the giant freshwater prawn *Macrobrachium rosenbergii* in Amphoe Bangpae, Ratchaburee Province. The area is 120 km away from the coast. He was encouraged to start prawn farming by his elder sister after spending some time at her farm. Now, he has 32 ponds, ranging from 0.7 to 1.6ha. Faced with some problems in obtaining a supply of good post larvae, he decided to start his own hatchery in 2002.

“At that time, I decided that aquaculture will be my future career although I finished my vocational training in mechanics. I knew that I can learn as I go along and pick up knowledge from successful farmers. Whenever I meet one, I will tap his or her knowledge and then try to apply these at my farm,” said Prakob.

“I chose to culture the freshwater prawn here is because the area is most suitable for its culture. Furthermore, this is an attractive cash business. As nobody buys the prawn with credit, the risk is very low and is only during the culture cycle. It is an easy to control business if you have enough knowledge and learn to manage the culture well. As I have been solving problems by myself, I am confident that I have all the knowledge available nowadays to make a success of this business”.

Over the years, Prakob himself has been developing several innovative ideas to improve his business and he heartily shares some of these with other farmers. By doing this, he is well respected by the aquaculture community. He is also president of the Ratchaburee Shrimp Club. In 2008, he received the ‘Best farmer in freshwater aquaculture’ award from the Department of Fisheries.

In Ratchaburee Province there are about 1,077 farms culturing the freshwater prawn. Since 2005, the number of ponds nationwide has remained relatively stable at 6,500-6,700 ponds, averaging 78,200 rai (12,512ha). Production was 28,540 tonnes in 2008 (Pongmaneerat, J., 2010). It has also remained a small scale industry in comparison to the production of the white shrimp. Currently demand exceeds supply as production has been less than expected because of problems in seed supply and adverse climatic conditions. However, for the farmers, this status quo in production is preferable as any increase in supply may mean reduced ex-farm prices for their products. Some 95% of the production goes to local restaurants (either directly or through brokers) and to the Mahachai market and 5% is exported to China.



## Control on post larvae

In the production of post larvae and juveniles, Prakob uses broodstock collected from the wild, in lakes and rivers. He also collects some best performing prawns from the ponds. He selects them for best growth, less aggressive behaviour and small claws. Brood stocks are tested for diseases using polymerase chain reaction-PCR. The maximum capacity at the hatchery is 30 million post larvae/year but Prakob produces less than this capacity to ensure quality. He sells post larvae (PL) at 220 PL/USD in comparison to the market price of 400-450 PL/USD. The main problems at the hatchery are infections with *Macrobrachium rosenbergii* nodavirus (MrNV) and extra small virus (XSV) which usually result in mortality of post larvae.

“Prior to constructing this hatchery, I had so many problems with post larvae from other hatcheries and with the quality of the juveniles. With my own hatchery, I have solved these and producing my own seed



Prakob Subyod Keaw and wife



The hatchery is GAP certified by the Department of Fisheries. Inside of the hatchery, in between production cycles.



*Ponds ready for harvest.*



*A pond after the harvest.*

stock gives me the peace of mind that my production target can be achieved.”

### A differentiation

In general, during the grow-out of the freshwater prawn, the control on water quality is not as demanding as in the farming of the white shrimp, said Prakob. “We usually check pond water colour and will add fertiliser when required. We look at the prawns and monitor their activity. If the prawns do not look healthy, we seek the causes and find a cure. We only use 2 long arm aerators with 3 hp during the night and on cloudy and rainy days.”

Another common problem in freshwater prawn grow-out is high mortality because of the aggressive behaviour. “When I started this farming, I was aware that prawns will attack those that are undergoing molting because the former want more space to move around. This is usually the case when the stocking density is high. That is the reason why we stock at only 3 PL/m<sup>2</sup> and so far we have avoided mortality from this aggressive behaviour.”

In explaining the different steps carried out at his farm, Prakob said that he does not do any grading or culling of the prawns during the grow-out period. At such a low stocking density, the results are similar to stocking at higher density and culling the smaller prawns. Neither does he separate the females from the males. The netting of the prawns will stress the prawns, disturb pond bottom and stunt growth for several days. In some cases, when there is a large build up of organic sediment, stirring the pond bottom will expel hydrogen

sulphide. Then it is common to see almost half of the prawns dead.

“Contrary to perception, disease is not my major threat. It is skilled labour. To overcome diseases, I undertake proper pond and water preparations, use disease free seed stock and am alert during the culture period. I ensure that prawns are always in a healthy environment.”

The culture period is 6 months and harvest sizes are 10-12 prawns/kg. The farm uses three brands of feeds (usually with 30-35% crude protein) to maintain friendly relationship with feed companies. Feeding is by hand, 3 times a day, until the 60th day of culture, after which feeding is done twice a day. Survival rates have been good at 90-100% in the nursery and 90% during grow-out. Over 70% of the harvest is usually booked by restaurants and brokers. The balance is sent to the Mahachai market. Current ex farm prices depend on quality, live, dead and big or small claw. Average prices range from THB 450/kg for 4-5 pcs/kg; THB 350/kg for 5-6 pcs/kg; THB 250/kg for 8-10pcs/kg; THB 200/kg for 13-14pcs/kg; THB150/kg for 15-16 pcs/kg to THB 120/kg for 25-40 pcs/kg. Prices are 3-5% higher when live prawns are sent directly to restaurants. (Exchange rate on 18 June 2010: THB 32.4 to one USD).

### Innovate to survive

“With today prices, the margins are only 15%. Thus all of us have to be very careful during the production process. We cannot afford to make any mistakes. Each crop must be successful. On the other hand, small margins are forcing farmers to find innovations to survive. Since I started prawn farming, I have learnt that the low stocking density of 3 post larvae/m<sup>2</sup> is giving me the same results as grading.”

Prakob also added that he would like to see better growth in his prawns and be able to have consistent production. He is aware that males grow faster than females. “I understand that technology to produce all male seed stock is a possibility soon. If I can be successful with this and am able to produce only male seed stock, this will be the greatest achievement in my life.”



*A recent harvest of freshwater prawns*



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# Thailand's vannamei aquaculture in 2009 and in Q1 2010



Dhanapong Sangsue

In 2009, a potential seafood exporter said that production of Thai shrimp has already reached its maturity which could be identified by the consumer pattern. If this observation was true, it seemed that almost all of the life cycles in Thai shrimp production should be known, says Dhanapong Sangsue.

## Production of vannamei shrimp

Since there was a report on the outbreak of infectious myonecrosis virus (IMNV), in a few vannamei producing countries (namely Brazil, Indonesia, and south China), the Thai Department of Fisheries then instructed all parties to stay alert for this disease. Screening and quarantine programs were tightened to reduce risks of an IMNV outbreak in the country.

In the first quarter of 2010, there was evidence that growth of shrimp was slower than in the same period of 2009. It was an unusual summer and the Thai Meteorological Department said that in 2010, average maximum temperatures would be higher than in 2009. Besides this, the country's rainfall would be slightly lower than last year. Therefore, farmers have to be prepared for possibly long drawn out droughts.

## Higher feed prices

In the feed sector, price increases of the main raw materials used in marine shrimp feed resulted in an overall wholesale price increase. Since March 2010, the average increase was 2.5%. In reverse, the average market price of 60 pc/kg size shrimp at the Shrimp Sellers Association Samutsakon was only THB 117/kg in the first quarter of 2010, much lower than the THB 127 /kg in the same period of 2009. However, THB117/kg was slightly higher than the price in the same period of 2007 and 2008. Average market prices for size 60 pieces/kg were THB 107/kg, 112/kg, and 112/kg in 2007, 2008 and 2009 respectively.

According to the Thai Department of Fisheries, the number of GAP and CoC certified shrimp farms decreased from 18,365 and 172 farms in 2008 to 14,396 and 157 farms in 2009. Concurrently, the Thai Feed Mill Association estimated a reduction of shrimp feed use down from 720,000 tonnes in 2008 to 672,000 tonnes in 2009. The competition within the shrimp feed industry is pushing for more reliability in feed quality. It is also moving towards fish meal replacement and the continuous development of low protein diets with amino acids supplementation to meet minimum dietary requirements. This is deemed as crucial for a sustainable development of the industry.

## Export market

According to statistics of the Thai Frozen Food Association, in January 2006, 2007, 2008, and 2009 respectively, Thai shrimp exports were around 20,000 tonnes/quarter. However, export figures for January 2010 were elevated to around 31,000 tonnes in which value added products outperformed fresh shrimp.

**Table 1. Import of Thai shrimp and shrimp products into the US market in 2008/2009.**

Category	2008 (tonnes)	2008 (USD)	2009 (tonnes)	2009 (USD)
Shrimp breaded frozen	11,050	64,009,159	10,861	70,584,512
Shrimp canned	263	1,918,177	337	2,489,307
Shrimp frozen in ATC	1,001	6,917,781	1,090	7,395,460
Shrimp frozen other preparation	58,851	444,945,814	65,303	492,069,427
Shrimp other preparation	233	1,753,498	229	1,235,972
Shrimp peeled fresh/dried/salted/brine	172	2,720,025	175	2,747,466
Shrimp peeled frozen	51,953	394,003,580	61,668	452,573,548
Shrimp product prepared dinners in ATC	112	637,656	309	1,811,648
Shrimp product prepared dinners not in ATC	923	6,026,914	1,982	12,379,976
Shrimp shell-on fresh/dried/salted/brine	16	252,700	15	256,756
Shrimp shell-on frozen all sizes	58,827	364,259,555	50,792	310,664,959

Source: U.S. National Marine Fisheries Service, Fisheries Statistics and Economics Division

Dhanapong Sangsue is Technical Sales Manager – Aqua at Evonik Degussa (SEA) Pte. Ltd, Singapore.

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## Pond mesocosm hatchery for blue swimmer crabs

*Harvesting of crablets from the green house mesocosm pond for stocking into nursery ponds*

**With optimal culture conditions in this system, the first production of crablets is now in the grow-out stage for a harvest in 6 months.**

Blue swimmer crabs *Portunus pelagicus* are popular in restaurants in Malaysia. Within the metropolitan area of Kuala Lumpur, restaurants display live crabs in aquarium tanks and these are sold at MYR 50-60/kg (USD 15-18) for 6-7 pcs/kg. Ex farm prices are MYR 22-24/kg (USD 6.6-7.2/kg). The average demand is 1-2 tonnes/day. At present, the main supply is from capture fisheries with a small volume from aquaculture, usually using wild caught juveniles as seed stock. Breeding technology for blue swimmer crab has been developed but existing hatcheries only commence crablet production once a booking is made by grow-out farms.

The production of crablets is not too different from that of the marine shrimp. A recent development involves marine shrimp hatchery operators shifting to produce crablets of this species as well as mud crab or mangrove crab, *Scylla spp.* Sandwiched between the 30m of mangrove reserve and some villages in Tanjong Karang, Selangor, Malaysian technopreneur and aquaculture pioneer Khoo Eng Wah has set up a farm, complete with a green house pond mesocosm hatchery. With this, he joins two other hatcheries in Selangor to produce blue swimmer crablets.

"In general, it is easier to farm crabs as compared to the marine shrimp. Prices are more stable too. We have been trying to farm marine crabs since 2003 in our prawn farm. We stopped because of inconsistent production of crablets using the traditional indoor tank system. Now we have returned to crab farming as we have this innovative green house mesocosm system," said Khoo.

"In fact, in Selangor, there is a large investment in a rack system for soft-shell crab production. We estimate that this project would



*Khoo Eng Wah (left) and son JiaZin*

require large numbers of both blue swimmer and mud crablets to meet its production needs."

The farm has 8 ha with 8 ponds. Currently only 3 ponds of 600m<sup>2</sup> and 2 ponds of 1.1 ha are used. This is a joint venture project between Khoo and a Malaysian investor. Operations started in February 2010 and at the end of March, the first batch of crablets were transferred from the greenhouse hatchery to the HDPE (High Density Polyethylene) lined outdoor ponds. The stocking density is 20/m<sup>2</sup> in the nursery ponds



The stocking size of the crablets in the nursery pond is about 0.2 g (5,000 crablets/kg).



Berried female blue swimmer crab with black coloured eggs and the hatching will occur in 1-2 days.

and after a month, crabs of 25g are transferred to grow out ponds at a density of 3/m<sup>2</sup>, for another 3 months before harvest. In the ponds, crablets are fed starter and grower vannamei shrimp feed as well as bivalve mussel meat.

### Engineered for optimal conditions

In Malaysia, the annual rainfall ranges from 1,500 mm to 2,500mm. The monthly average is about 125-200 mm. From their previous experience, the team of Khoo and son JiaZin knew that rapid changes in salinity, alkalinity and water temperature during the rainy season causes low

survival rate and slow growth. JiaZin, a mechanical engineer by training and a participant of the certificate course in Integrated Fish Farming at the Freshwater Fisheries Research Centre of Wuxi China designed a greenhouse covered with 600m<sup>2</sup> LDPE (Low Density Polyethylene) film of 0.22mm thickness and enclosing a mesocosm hatchery pond. A locally made LDPE film was chosen to reduce installation costs.

“It is essential to ensure that the pond water salinity in the hatchery mesocosm pond is consistent at 28‰ and alkalinity of the pond water at 120 mg/l. The main purpose of the greenhouse is firstly to prevent dilution of the seawater in the ponds with rainwater and

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Greenhouse and outdoor tanks



Pond assistant Wong Kian Joo. All ponds and dykes are lined with 0.75mm HDPE liners.

secondly maintain temperature at 29°C to 33°C. Biosecurity is assured in the enclosed greenhouse. With this set up, we can have a steady production at any time of the year,” said Khoo.

In the grow-out area, the open ponds and dykes are thoroughly lined with the more durable 0.75mm HDPE liners. In the ponds, netting is used as separators to increase the surface area for the crablets during the grow-out.

“Crabs are benthic organisms and when we have soil bottoms, crabs will be churning the soil. We try to avoid anaerobic conditions. The other advantage we have discovered is an abundance of chironomids larvae and this is natural live food for the crablets. Aeration with diffusers is used as well as micro-air tubes as we need to keep the dissolved oxygen levels at more than 4 mg/l. Two air blowers are used, each for a duration of 12 hours.”

### Crablet production

The farm gets its brood stock from fishermen. Berried females, carrying eggs cost MYR 20 each. Khoo explained that the colouration of the eggs, carried on the abdomen indicates the incubation period. Reddish orange indicates an incubation period of 1-2 days, yellow 4-5 days, grey 6-8 days and black 10-12 days and is ready for spawning. Thus, the selection of mature females is from the colour of the eggs.

Berried females with the same egg colour are selected to synchronise hatching and have a uniform larvae size to minimise cannibalism. The berried females are kept in a plastic cage in the pond. The cage is lifted regularly to check on the colour of eggs. After hatching, the brood stock is removed. There are five zoea stages lasting 12-14 days and a megalopa larval stage of 2-3 days. This is followed by the crablet stage. The target survival rate from egg to crablet is 10%. Zoea are fed with rotifers, copepods, artemia as well as artificial feeds. Shrimp post larval feeds are used to feed megalopa larvae. Green water culture of *Nannochloropsis* for rotifers and copepods culture is carried out in outdoor tanks with transparent covers. *Skeletonema*, *Chaetoceros* and other diatoms are added as supplementary feed as well.

Pond operations are similar to marine shrimp farming. Incoming water is filtered with a 25 micron filter bag to prevent entry of predators and fish eggs. Effective microorganisms and PSB (Photosynthetic bacteria) are added to maintain water quality in ponds. Minimal water exchange is practised. The main disease threat is *zoothamnium*. The artemia cysts are disinfected and decapsulated using 100 ppm chlorine water to prevent *Vibrio* and *zoothamnium* infestations. Green water culture is filtered with a 10 micron PE filter bag against jellyfish and other parasites.

# NEXT ISSUE

**September /October 2010** issue will feature

- Cage Culture
- Industry Review On Tilapia
- Processing Technology
- Feed Additives

#### Bonus distribution

Aquaculture Europe 2010, Porto, Portugal, October 5-8  
Aquaculture China & 15th China Seafood and Fisheries Expo 2010, Dalian, China, November 2-4

**Deadlines:** Technical articles – August 2, 2010

Advert bookings – August 6, 2010

Contact information: Email: [zuridah@aquasiapac.com](mailto:zuridah@aquasiapac.com) ; [enquiries@aquasiapac.com](mailto:enquiries@aquasiapac.com)



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# Unleashing the potential of six tropical species for the French market

By Zuridah Merican

The debut of some unique species into the French market using the innovative skills of its chefs.

This was a unique collaboration between the French feed specialist Ocialis and magazine PDM- Produits de la mer on April 23, prior to the European Seafood Exposition. It brought together six producers with their fish to Paris for Euro-toques® chefs (Association of European grand chefs) to prepare and give their opinion on the fish, testing of the products prepared by Chef Benoit Charvet and followed by one to one buyer-producer meetings. The setting for this first Labo PDM was on a cruise boat along the river Seine allowing participants to enjoy the sights of Paris at the same time. France is the second largest consumer of seafood after Spain. In 2006-2008, the average per capita consumption was 34 kg (France AgriMer, 2010).

“As Ocialis has a strong presence in warm water aquaculture markets (Vietnam, Indonesia, Brazil and Mexico), our customers asked us for ideas on how to introduce their products to markets in France and Europe. We know that a major bottle neck in marketing any new species is the lack of awareness, both on the part of consumers and buyers. Together with PDM, we decided on this; to get the top chefs to provide presentation ideas, test the fish and give their independent opinions on the suitability of the fish for the French palate and perhaps inclusion of some of these fish in their restaurants. This will be our first Labo-PDM approach,” said Stéphane Ralite, Head of Aquaculture, Ocialis.

“At this meeting, we introduced several unique tropical fishes; three interesting freshwater fish from Brazil, the pirarucu, pintado and tambaqui or pacu all farmed by Mar & Terra and the pangasius farmed by Caseamex in Cantho City, Vietnam. We also had three marine fish species: cobia farmed by Marine Farms Vietnam and Camanor in Brazil, barramundi farmed by Fega Marikultura, Indonesia and yellowtail kingfish, from Clean Seas Tuna, Australia. All these have their own unique flavours and we left it to the chefs to unleash the potential, show their innovative skills with these species and benchmark for the French market.”

The list of 28 buyers and retailers present at the event read like a who's who in the French seafood industry. Present were CEOs, top management and buyers from major French companies such as Comptoir Oceaniques & Cap Cavally, Carrefour, Nautilus Food SA, Sovintex, Gelazur and Davigel, Future Seafood, Auchan, Casino and Flunch.



Stéphane Ralite (centre) with Vuong Quang Khanh, Marketing Manager, Caseamex (left) and Carlos Massad, Managing Director, Marine Farms Vietnam



Azusa Asai and Katsuhisa Hanayama, Seven & I Holdings Co Ltd (left) with Fega Marikultura's Sofjan Alisjahbana, President (second right) and Svida Alisjahbana, Director (right).

## Freshwater fish need markets

How much does the market know about the production of tropical fish? In a presentation on the potential of some freshwater species and its farming, Jerome Lazard, CIRAD said that there are several species likely to have strong market potential. As the global demand will escalate to 270.9 million tonnes by 2050, aquaculture will need to contribute to a majority of the supply for both high priced and cheap fish. The global average fish consumption is 16.7 kg/capita. There are already 15 main families of fish contributing to almost 85% of production.

“Gradually, we will need to keep farming of new species which will take 10-15 years to develop and market globally”, said Jerome. “In the case of the pirarucu *Arapaima gigas*, it is currently farmed in ponds and grows fast at a rate of 15kg/year to a maximum of 200kg. The fish reaches maturity at 50kg and a shortcoming is hatchery production of fry. The production in Brazil is currently a few thousand tonnes and prices in urban markets in Peru are USD 4.50/kg as compared to tilapia and pangasius priced at USD 6/kg and USD 5/kg, respectively. In contrast, the omnivorous pacu *Colossoma macropomun* is well established with hatchery production. Market size is only 0.5kg and fish costs USD 3.50/kg. There are organoleptic differences between the two fish species.”

“Besides the well known pangasius farmed in Vietnam, there are 14 potential catfish species in the Mekong River. The tilapia is also not well known in Europe and I am convinced that there is a market for this species here,” said Jerome.

## Focus on value

The production of marine species comprise less than 5% of the total world production, said Jacques Trichereau, Idee Aquaculture. However, it is in terms of value that the marine fish stands out. In terms of volumes, salmon is ranked 7 but second in terms of value. The lessons in marketing the salmon since 1980 should be applied to other species.

“The production of tropical species which started much earlier than that for the salmonids in the 1950s is now at 1.7 million tonnes, comprising 10 main species. Unfortunately, the sector is still inadequately structured for the several species under culture. Two



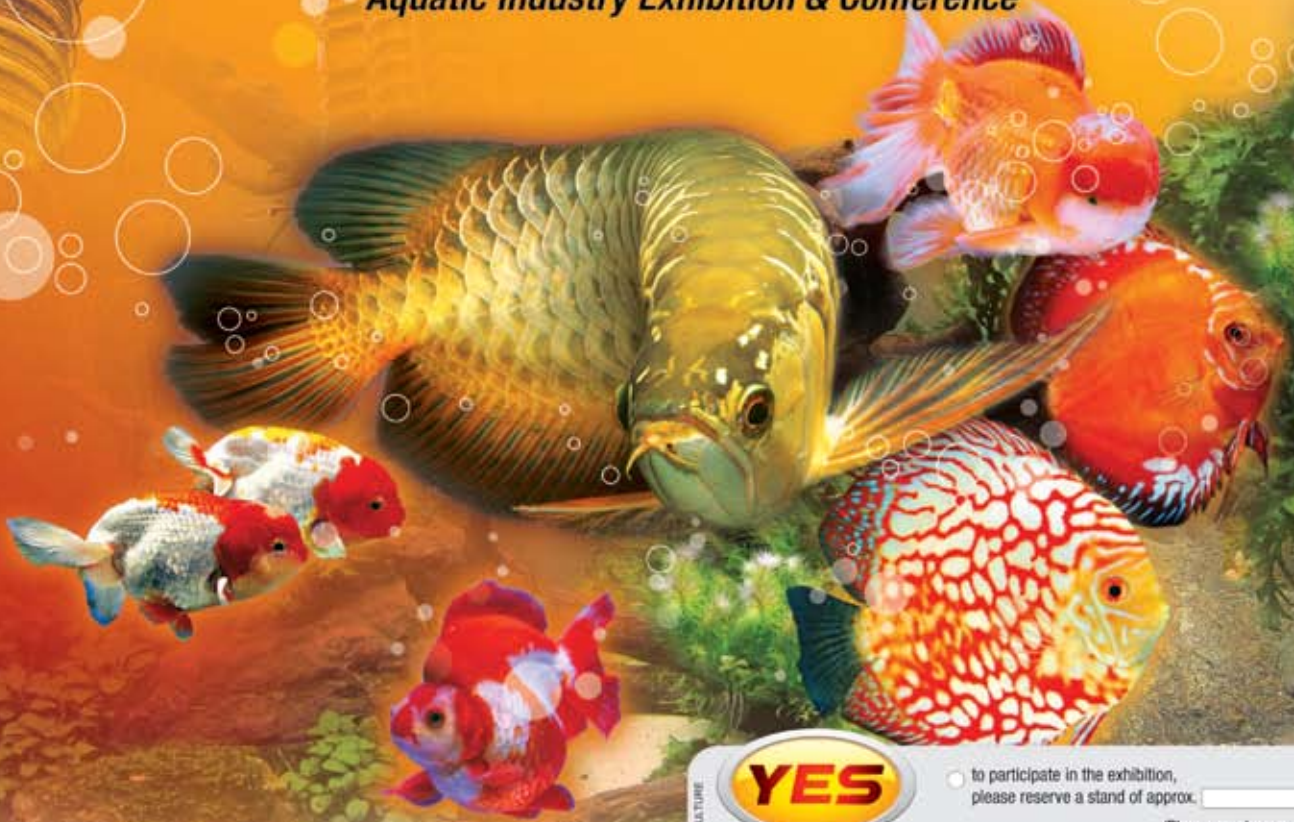
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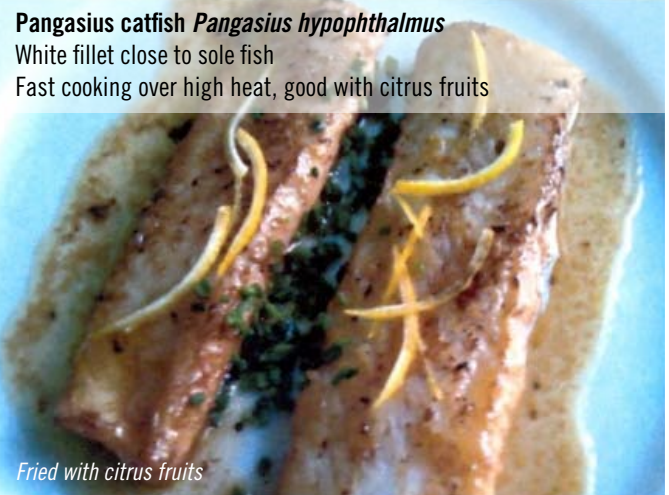
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# What the chefs say



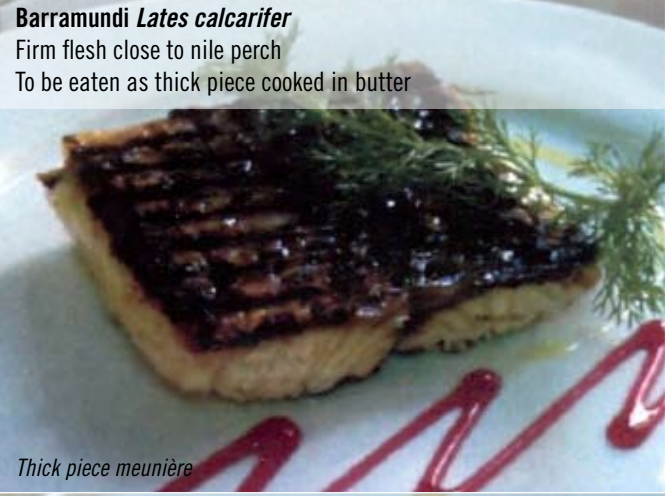
**Pangasius catfish *Pangasius hypophthalmus***  
White fillet close to sole fish  
Fast cooking over high heat, good with citrus fruits

*Fried with citrus fruits*



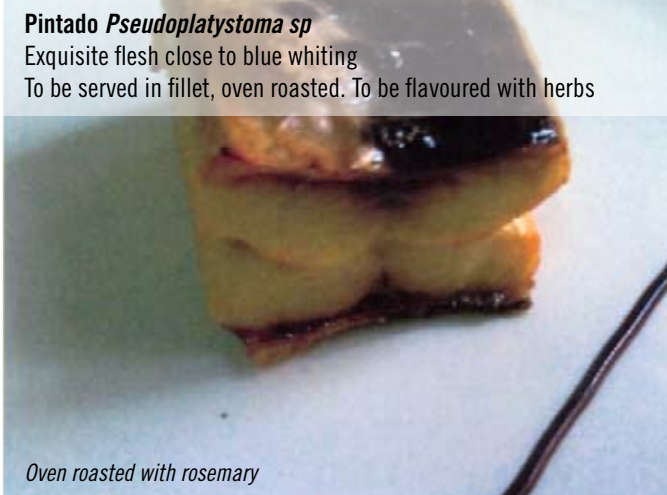
**Pirarucu *Arapaima gigas***  
White flesh comparable to seabass. To be prepared as thick piece and steamed to keep its softness

*Thick piece poached with thyme*



**Barramundi *Lates calcarifer***  
Firm flesh close to Nile perch  
To be eaten as thick piece cooked in butter

*Thick piece meunière*



**Pintado *Pseudoplatystoma sp***  
Exquisite flesh close to blue whiting  
To be served in fillet, oven roasted. To be flavoured with herbs

*Oven roasted with rosemary*



**Gobia *Rachycentron canadum***  
Firm flesh close to sword fish.  
Can be eaten raw or grilled slightly



**Tambaqui or pacu *Colossoma macropomum***  
Quite tasteless flesh.  
Eaten caramelised with bones



**Yellowtail kingfish *Seriola lalandi***  
Flesh similar to tuna but white.  
Served raw, grilled or fried slightly

*Thick piece fried*

remaining challenges are the lack of control on production technology and high costs of feed. Fish are usually sold locally to regional markets as live and chilled fish. In open systems, control is restricted since culture is subjected to environmental, climatic and adverse weather conditions,” said Jacques.

“In Asia, traditional systems dominate, although there are already several industrialised operations. The latter are usually fully integrated with marketing in global markets and producers know market demands. These are mainly producers of the cobia, amberjack, groupers and barramundi.”

In his summary on new marine finfish species, Jacques said that among the amberjacks, the market for the yellowtail, mainly cultured in Japan, is well established. However, market opportunities are being sought for the yellowtail kingfish *Seriola lalandi* mainly produced in Australia, which has good growth and good quality meat. The Asian seabass or barramundi is a high quality and tasty fish. Production is only 45,000 tonnes annually. The firm white meat of the cobia *Rachycentron canadum* is suitable for high quality sashimi and is akin to its nickname ‘tropical salmon’. The red drum, cultured in many parts from China to Israel has white meat but many bloody veins. The grouper, in particular the tiger grouper *Epinephelus fuscoguttatus*, pompano *Trachinotus blochii* and rabbit fish or Siganids are other species that will appear in the future.

## Sustainability of aquaculture

According to Stéphane, Ocialis is not just helping in the expansion of markets for tropical fish, but also in ensuring the sustainability of the industry. As a global feed producer of Euro 1.4 billion, it is helping to provide answers on sustainability of production. The amount of fish meal required to produce one kg of product has gone down with Ocialis feed to 0.8 kg for the marine shrimp, 0 to 0.4kg for the pangasius, 2-2.5kg for the cobia and 3kg for the seabass.

“We can further improve the resilience of fish farming when we seek some alternatives such as algae in feeds. We can reduce the impact of aquaculture on the environment when we use less protein in feeds. Through our ‘fish house’ located in the farming areas in Vietnam and monitoring fish health we are working on a development of vaccines with a partner company and at the same time, advise against the use of antibiotics for disease treatment. In the B to B on traceability, we work with buyers and producers,” said Stéphane.

## Success with the pangasius

The pangasius is well known in Europe, followed by that of the tilapia but what are the factors contributing to consumer acceptance for these two species. Marion Fischer, France AgriMer said that in 2009, imports of the pangasius increased by 13% to 5,700 tonnes. There was also a slight price increase of 3%. Fresh pangasius was sold at Euro 7.6/kg whereas frozen products was sold at Euro 5.4/kg. In contrast, prices for the tilapia were Euro 11.3/kg and Euro 7.1/kg for fresh and frozen, respectively.

In comparing fish prices, where the average price was Euro 12/kg for fresh products and Euro 6/kg for frozen, both carry low fresh fish prices. Pangasius prices are just above those for sardines and mackerel and fresh tilapia is at the same level as the perch.

“There is a seasonal trend with higher sales at the beginning of the year and this could be associated with the low fishing season. Some 95% of sales are in supermarkets and the pangasius is bought by families with children.”

The role of the pangasius is as a substitute for traditional white fish in France, particularly for the service industry. Recent developments in the production in integrated operations (almost 80%), emphasising on quality and the short time between harvests to processing have improved quality of fish. Nevertheless, during the meeting, buyers expressed concern on the effect of density on quality of fish.



Cruising past Tour Eiffel, participants at the Labo PDM.

## The producers

**Mar & Terra**, a Brazilian company located in Midwest Brazil produces the freshwater and carnivorous pintado or Brazilian tiger fish, pacu or tambaqui, an omnivorous Amazonian fish and pirarucu. These fishes are already marketed frozen and chilled to Switzerland, UK, Germany and Japan. It has an integrated farm with hatchery, two grow out farms and processing and cold storage facilities.

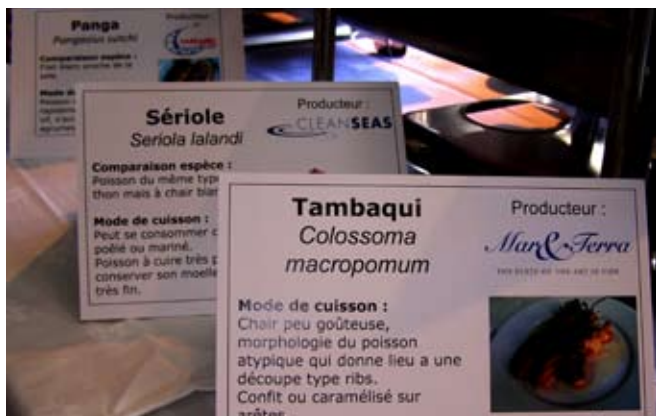
**Camamor** is a Brazilian integrator well known in Europe for its vannamei shrimp production. It is also reproducing cobia for several years in the North East region of the country. It produces cobia in ponds and wants to develop its market in Europe and America.

**Caseamex Vietnam** is an integrated farm comprising hatchery, farm and processing plant in Cantho Province. It produces premium pangasius following the code of practice developed and defined by Davigel and feed management by Ocialis. Fish are stocked at lower density and production is monitored closely by veterinarians as controls on traceability and sustainability.

**Fega Marikultura** is Indonesia's top producer of ‘java barramundi’. The farm located off Seribu Archipelago, Java Island has 25-30 circular cages in operation. The company recently embarked on an expansion program to be a leading producer of quality barramundi production in the region. Production capacity will rise from the current production capacity of 2500 tonnes to 5,000 to 6,000 tonnes annually. Current markets are in Australia and USA where it exports fresh chilled and frozen fish, respectively.

**Cleans Seas Tuna** is a major supplier of yellowtail kingfish and mullet to Australia and export markets. Production facilities are in Arno Bay, South Australia. The core business of the company based in Port Lincoln, South Australia is the propagation of southern blue fin tuna.

**Marine Farms Vietnam** part of Marine Farms AS group produces cobia in Van Phong Bay, off the Nha Trang coast of Vietnam. The ten farming sites practice Norwegian farm management techniques to produce market size cobia within a year. Products are marketed frozen. Fish are available year round to sushi and sashimi markets as well as to the food service and retail markets.



### View from chefs

Euro-toques® chefs are clear on the code of ethics with respect to the environment in the selection of fish, notwithstanding their role in finding the best way to prepare a particular fish. To remedy the shortage in some well known fish species, Henri Charvet, Président, Euro-toques said, "In general, chefs are willing to test new species but they also have the responsibility to customers to ensure that the production method meets food safety standards. So far, chefs have checked fish farms in Norway and yellowtail kingfish farms in Australia. Most likely in a few years, with fishing quotas, we will have less wild fish to work with and will need to use more farmed species."

"However, it will be quite difficult for chefs to be constantly aware of the new species available to them. It is up to the producer to do the marketing and create awareness on these species. It is not normally the practice of the top chefs to work with unknown species and they have to develop a recipe for the product. Nevertheless, chefs would also welcome a list of vendors of these new species in the Rungis market in Paris," said Henri.

Among top chefs, working with fresh product is a norm. Fish can be airflown across the globe such as in the case of the yellowtail kingfish from Australia. However, with the development of better freezing technology and vacuum packaging, the traditional method of using only fresh fish might change in the future. Depending on the time between harvesting and freezing, defrosted products may show better attributes than a similar product marketed fresh and airflown over a long period. However, what is clear is that supermarkets and small retailers have to notify consumers when frozen products are defrosted and sold as fresh chilled. However, it may not be a usual practice for restaurants to do so.

### Views of the French consumer

At this meeting, Daniel Moute, Technical Consultant, Seafood, Casino Group gave some views of the French consumer on tropical fish species. He said that, firstly the consumer will ask whether the fish is wild or farmed as wild fish remains a preference. However, once a product is imported, the consumer gives less thought on the exact origin of the fish.

"In the case of any exotic fish, the first hurdle is on how to prepare the fish. It is normal for the consumer to assume that an exotic fish has to be cooked in the same way as in the country of origin. For this, they try to draw upon some touristic experiences during a visit to the country of origin of a particular fish," said Daniel.

"In the case of the pangasius, its neutral taste lends itself well to many preparations. However on the other hand, there are French consumers who enjoy eating well and need the flavour to be in the flesh itself. This is lacking in the pangasius fish. In contrast, others consume fish only for nourishment." Daniel also wondered whether the pangasius is being harvested too early, that is well before the fish can develop its own unique taste.

"The media has also played a major role in informing the consumer on the production methods and they see some production methods for economic gains and not to develop a tasteful product."

<http://www.sifse.com/en/>

## The 5<sup>th</sup> Shanghai International Fishery & Seafood Expo 2010

### Dec 10-13, 2010

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European Seafood Exposition, Belgium

# Certification and sustainable aquaculture



Whole and fillet of barramundi from Fega Marikultura.

**Annually, seafood buyers and sellers descend on Brussels which aside from the usual networking also allow those present the opportunity to see, taste and touch the products.**

This year, despite the threat of the volcanic ash cloud from Iceland disrupting air travel, some 24,266 buyers and sellers attended the 18th annual European Seafood Exposition, held from 27 to 29 April. Organisers said that the show drew visitors from more than 140 countries and featured 1,635 exhibiting companies from 76 countries around the globe. The exhibits covered 33,500 square meters of combined exhibit space.

The majority of participation was under the umbrella of country pavilions of which there were 70. Several companies from China were with Cappma- China Aquatic Products Processing and Marketing Association and the majority of Thailand's participation was under the Department of Export Promotion. The delegation led by the Vietnam Association of Seafood Exporters and Producers comprised 130 members from 54 companies, mostly marketing the pangasius catfish and shrimp.

This year's show was also the first for several Asian producers. There were first time displays of barramundi from Indonesia's Fega Marikultura and pompano from PT Lucky Samudra Pratama. Fega's



Misai and Djuniati Tsai, PT Lucky Samudra Pratama marketing whole or fillet and vacuum packed or frozen pompano.



Visiting the show, seafood and aquaculture producers from Sarawak, Malaysia



Grobest from Thailand



Frozen shrimp from Indonesia.

display of its java barramundi was together with those of several other aquaculture and wild caught fish marketed by partner Lee Fish Asia. The booth also displayed yellowtail kingfish from Australia's Clean

Seas Tuna. PT Lucky Samudra Pratama participated in the show as part of Sippo-Swiss Import Promotion Program.

### Certification and sustainable aquaculture

Efforts in this were demonstrated at several locations during the exposition. The newly formed ASC was introduced and certifying body GlobalGap held a press conference to announce developments (see following pages). Unima Group with black tiger shrimp farming operations in Madagascar presented the results of a case study and documented sustainability impacts. Qualasa is leading to transform Soc Tang Province in Vietnam into a leader in traceability and sustainability. This will be in collaboration with the My Thanh Farmer Association. It has established with IMO a multistep certification program with the aim that the farmers will be AquaGap certified and gradually move on to other certification standards such as ASC and GlobalGap. As VASEP's Standing Vice Chairman said during ESE, "Wherever we go, the demand is now sustainability and certification."

The 2011 event is scheduled from 3-5 May, 2011 at the Parc des Expositions in Brussels, Belgium.



On 28th April 2010 during the European Seafood show in Brussels, Laurent Galloux, presented the Official Bureau Veritas Recognition for responsible aquaculture of pangasius to Christophe Romefort, Key Account Manager, Davigel, Vo Dong Duc, Caseamex and Marc Campet, Ocialis, Vietnam.

### BV recognition for a specific pangasius network

For over two years, three companies, Davigel, Caseamex and Ocialis worked together to develop the farming protocols for a premium pangasius suitable for European consumers demanding more traceability and a guarantee on safety measures. For Davigel, part of the Nestle group and a major player in the food catering business in Europe, this will help in white fish sourcing. Ocialis took care of feed management and monitoring of farming practices and fish health. Caseamex is the production enterprise.

The certification of compliance from Bureau Veritas covered from feed production to finished product. This is a new way to produce sustainable pangasius, thanks to this partnership.

"Companies want to differentiate their products on the market, and they want to use tools like certification to do this," said Laurent Galloux, Seafood Department Manager with certification group Bureau Veritas.

# ASC - The fruition of Aquaculture Dialogue standards

The standard holding body gears up certification to be the most credible in industry.

After five years, the mission of the multi stakeholder Aquaculture Dialogues to develop standards in order to transform aquaculture towards environmental and social responsibility, is nearing completion. Standards emanating from the 8 multi stakeholder dialogues for 12 species (salmon, shrimp, tilapia, pangasius, freshwater trout, oysters, mussels, clams, abalone, amberjack (*Seriola* spp) and cobia) will be finalised by end 2010. These will be passed to the non profit foundation and more importantly, an independent entity with transparency, responsibility and credibility, the Aquaculture Stewardship Council (ASC). The goal of the ASC is to be the world's leading certification and labelling program for responsibly farmed seafood.

World Wildlife Fund (WWF) and the Dutch Sustainable Trade Initiative (IDH) co-founded the ASC in 2009 which is located in Utrecht, Netherlands. Nine months ago, **Philip Smith** joined as Development Director of the newly formed ASC. Philip has 37 years experience in the aquaculture industry, in particular in the farming and feed sectors of salmon, trout, sea bass, sea bream, barramundi and yellowtail. His illustrious career included positions with Nutreco as managing director of the global feed business, CEO of Ewos's global feed business and Managing Director of Marine Harvest Europe.

It is this business background which is an asset for the ASC as the processes which need to be set up are similar to any business entity. During the European Seafood Exhibition 2010, Philip, now Chief Executive Officer talked on the future tasks ahead for him and the ASC.

## The process

The initial steps are to get the foundation registered as a non profit association with its deed of governance structure and Supervisory Board. The multi stake holder approach is carried over into the ASC Supervisory Board and future advisory/steering groups. It has to be compliant with the Code of Good Practice of ISEAL, the International Social and Environmental Accreditation and Labeling Alliance, for the creation of solid and credible standards.

"Beyond that I am looking at appointing independent third party accreditation organisations and certifications bodies. With this we can offer producers to be certified against ASC standards.

"The decision is with the board on how best to do this but it should not be a long process. As we have a multi stakeholder board, we will need time to address everybody's concerns. In mid 2010, we should have the accreditation body set up to start accrediting of certification bodies for the AD standards. We will build capacity and will be able to offer fish, shrimp and mollusc producers the option to be certified."

"We are also in dialogue with retailers and food service companies to build interest at the retail and consumer levels. By mid 2011, we will have a consuming facing label (like the MSC) ready for those producers and intermediary processors that want to use the label in



Philip Smith

their marketing approach. By this time, we will likely see products certified by the ASC standards."

## Firewalls to assure independence

At the ASC Supervisory Board, members are from WWF US, IDH, WWF NL, Pew Environment Group and Birds Eye/Iglo. As part of its mandate, how does the ASC set itself apart from the several standards and certification organisations in the market and assure industry of its independence from the standards setting group?

"Although on the board we have WWF etc., these board members have been nominated as individuals and they do not represent their organisations. For example, although we have Jose Villalon (WWF US) on the board, his responsibility is to the ASC. Currently we have five board members and we will increase this to between 7-9 members but the selection will be on the basis of their skills aside from geography and sectors. The multi stakeholder board will also appoint an accreditation body."

"It is very important to note that the standards have been set up through a multi stakeholder process and the governance of the ASC is an independent, multi stakeholder structure. It is totally independent from the accreditation body, whoever that may be. The accreditation body will be independent of the ASC. There are firewalls at every stage."

"We already have a lot of support and interest from industry and retailers. They say that they agree with the direction we have set. Some of them have also participated in the standards setting process and are waiting for the next stage. I think there is a lot of demand in the market place."

*(See related articles in issue May/June 2010 on the shrimp aquaculture dialogues and ASC, pp 29-34).*

## TAD standards - first to cross the finish line

The tilapia dialogue standards (TAD) are ready for auditing. However, the ASC is not ready with accredited certifiers in place.

"In the meantime, WWF has an agreement with GlobalGap to have TAD standards added on. With this, we can offer producers to be certified with GlobalGap standards and be assessed against the TAD standards 'in one go'. There will be no label at this stage, but they will get a certificate of compliance from GlobalGap if they are compliant with TAD standards. However, after a year, when the tilapia producers certified by GlobalGap return for their annual auditing against TAD standards, the tilapia standards will have transitioned to the ASC which will then organise certification and labeling."

"When the producers opt for this, it is a good combination as GlobalGap standards for tilapia focus on food safety whilst the TAD standards emphasise key social and environmental issues."

More information: [www.ascworldwide.org](http://www.ascworldwide.org)

# First certification in tilapia and pangasius

The GlobalGap good aquaculture practice standards for the tilapia and pangasius were launched in April 2009 and one year later at ESE 2010, some first experiences in the certification of these two species were announced.

In 2010, GlobalGap celebrates 12 years as a private sector body setting standards for certification of agriculture products. In aquaculture, it has a shorter history of five years but nevertheless has made inroads into setting voluntary standards for the certification of four major aquaculture species (salmon, shrimp, pangasius and tilapia). It is the leading program for salmon farming available since 2004 followed by shrimp in 2008.

The criteria for GlobalGap's aquaculture certification comprise HACCP based food safety, environmental impact, social responsibility and animal welfare. There is also a requirement for a chain of custody certification with which there is full segregation and traceability of certified products. The standard not only covers good aquaculture practices at the farm-level, but also enables the farmer to demonstrate that feed and fingerlings entering the farming process are also GlobalGap certified. The recently launched Compound Feed Manufacturing Standards for farms provide a reliable tool when it comes to feed safety of compound feed used.

## Firsts for tilapia and pangasius

At the press conference on April 28, the global standard owner announced several tributes. HQ Sustainable Maritime Industries Inc, the largest integrated tilapia producer in Hainan, China attained the first GlobalGap certification for Asia and Aquamar S.A., one of Tropical

Aquaculture's largest farms in Ecuador is the first in the Western Hemisphere. The first GlobalGap pangasius certification was awarded to Binca Seafoods GmbH, a year after the launch of the standard for the pangasius.

On this day, the certification awards were given to Trapia Malaysia Sdn Bhd, the largest tilapia cage culture farm in Malaysia and part of Genomar AS. It produces sustainable and traceable tilapia. A certification was also announced for Lake Harvest Africa, the largest in Africa and farms tilapia in cages. Assessments for certification are ongoing for Regal Springs farms in Indonesia and Honduras.

Recently, two pangasius farms in Vietnam have been certified. In April, Control Union of Vietnam awarded a certificate to NTACO Corporation which has 30 ha of pangasius farming area. Aquatex Ben Tree (ABT) received the GlobalGap Certification from the Vietnam Association of Seafood Exporters and Producers (VASEP) in May. ABT owns the largest pangasius farm with 43.5ha and produces 15,000 tonnes of fish.

## Capacity building in pangasius farming

"GlobalGap certified pangasius will continue to respond to market demands," said Jos Exters, Manager from ANOVA Seafood BV and Chairman of the GlobalGap Pangasius Working Group. The company together with the Dutch Sustainable Trade Initiative-IDH and WWF,



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<p><b>Andrea Artoni</b> Quality &amp; Development Manager, CONAD soc.coop, Italy</p>	<p><b>Nigel Garbutt</b> Chairman GLOBALG.A.P., UK</p>	<p><b>Shi Xiaowei</b> General Director, CNCA, China</p>	
<p><b>Joan Mir Piqueras</b> Deputy Managing Director Management &amp; Company Strategy, Anecoop, Spain</p>	<p><b>Hugo Byrnes</b> Director Product Integrity, Royal Ahold, Netherlands</p>	<p><b>Jorge A. Hernandez</b> Senior Vice President for Food Safety and Quality Assurance for US Foodservice, USA</p>	
<p><b>Bert Urlings</b> Vion, Netherlands</p>	<p><b>Johann Zueblin</b> Head of Standards &amp; Social Compliance, Migros-Genossenschafts-Bund, Switzerland</p>	<p><b>José Villalón</b> Managing Director Aquaculture, World Wildlife Fund, US</p>	
<p><b>Craig Watson</b> Vice President Agricultural Sustainability, Sysco Corporation, UK</p>			

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The Global Partnership for Good Agricultural Practice



The GlobalGap certificate for *Trapia Malaysia* was given to Morten Hoyum, President & CEO, GenoMar AS (centre right) and Dr Mazuki Hashim (centre, left), Department of Fisheries, Malaysia by Eerik Schipper Deputy Director, Control Union Certifications, The Netherlands (left). On the right is Kristian Moeller, GlobalGap.

with funding from the German Agency for Technical Cooperation-GTZ is working on supply chain monitoring in Vietnam for the next two years. The aim is to ensure that standards are applied well.

Dr. Marc Nolting, Senior Planning Officer (Fisheries, Aquaculture, Coastal zones), GTZ, said, "In Vietnam the pangasius industry stands at a crossroads where environmental and social sustainability of the whole pangasius supply chain can only be reached by cooperation between farming and buying partners. Particularly, smallholders need to be assured of an incentive to produce a product which complies with internationally accepted standards for environmental and social sustainability as well as with customer-driven specification."

"By applying an accredited certification scheme such as GlobalGap Pangasius standard tool, pangasius farming will be sustained as an important economy and livelihood for many small-scale farmers and households in the Mekong River delta region. Moreover, it will increase the contribution of aquaculture to the alleviation of poverty and rural development in that region."

### Partnership with WWF

As the Tilapia Aquaculture Dialogue standards are available, GlobalGap is working with WWF to train auditors how to assess farms that adopt the final Tilapia Aquaculture Dialogue standards and teaching farmers what they need to do to adopt the standards. This effort will be followed by certification against the Aquaculture Stewardship Council (ASC) sustainability standards operational next year (see page 45).

### What's next?

GlobalGap Aquaculture is subject to periodical reviews in order to continue improvements, to incorporate feedback at farm level and to cover consumer requirements. The Draft Version 4 is ready for public consultation and field trials. From April 28, the new standard aims at certification of any aquaculture species. However, the body will exclude farms that use wild seed stock given the potential sustainability implications this might have. The publicly available draft will also be tested on-farm to collect feedback on the application through a hands-on learning-by-doing approach.

Aldin Hilbrands, Senior Manager Product Integrity for Royal Ahold and Chairman of the GlobalGap Aquaculture Sector Committee said, "We have made great progress last year. Firstly, we are in the process of building a new aquaculture standard that aims at certification of any aquaculture species farmed. This interim standard will be published for public consultation and on-farm testing soon."

"Secondly, we are developing an assessment protocol with WWF for the Aquaculture Dialogue standards as a meaningful add-on to the GlobalGap standards. Lastly, I am very proud to mention that we have achieved GFSI recognition for the GlobalGap Aquaculture standards which is the global benchmark for credible food safety certification that the major food retailers, food service and manufacturing businesses are demanding to assure safety of their seafood supplies."

More information: [www.globalgap.org](http://www.globalgap.org)

# MDU technology

**A cost effective on-farm production of one tph of water stable shrimp feeds using marumerisation technology.**

The marumerisation or extrusion-spherisation process was initially developed for the pharmaceutical industry and is now commonly used in the production of larval feeds. Since 2007, Netherlands based specialist in feed process technology, Van Aarsen International B.V. has invested in this concept and carried out R&D to develop an upscale version for the production of sinking shrimp feed using the Marumerised Diet Unit (MDU) technology. The company has a 60 year history providing innovative technologies and processes for several industries. In aqua feed production, besides pellet mills, post conditioners and extruders, it provides fully dedicated equipment for fine grinding, micro-dosing and blending.

The MDU technology meets the industry's requirements for the production of small volumes of on-farm bespoke shrimp feeds of up to 5,000 tonnes of feeds/year. There are several unique features in using this technology, said Guus Heijnen, Director of Sales, Van Aarsen. "We can start with a mash mixture containing 35-40% moisture which is not possible with either pelleting where only 14-15% moisture or 18-20% moisture in hot extrusion is allowable to prevent slipping of the roller and die blockage respectively. With the MDU, we can add liquid products such as hydrolysates. With such high prices for fish meal, this has turned out to be an asset".



Guus Heijnen

"Commercial shrimp feeds usually contain 10% moisture because of storage requirements. In on-site production and for immediate use, it is not essential to maintain such low moisture levels and wet pellets which contain perhaps 30% moisture can be produced. We know that farmers add water to salmon feeds before use. Surface drying of the pellets will remove 4-5% of the water in feed".

In terms of raw material usage, there are also savings, according to Guus. "In this cold extrusion method, we will have a much lower dough temperature than in either pelleting (90°C) or hot extrusion (120°C or higher). At such high temperatures, it is a common practice to over fortify heat sensitive nutrients such as vitamins to account for losses. In our case, we do not need to do this and can save on raw material costs".

## MDU versus classical pelleting for shrimp feeds

The production process with the MDU starts with mixing and grinding. In pelleting of shrimp feeds, extremely fine grinding to 250 microns particle size using pulverisers is common to produce compact and water stable feeds. Here grinding with hammer mills to obtain 90% of particles at 250 microns is sufficient. The next stage is pre conditioning and a single step is proposed in contrast with current 2-3 steps preconditioning in commercial shrimp feed production.

The subsequent steps are extrusion and spherisation within the Central Process Unit. After extrusion, spherisation produces round shape balls of feed corresponding to the diameter of the die. As the extrusion process is not sensitive to most components in raw materials, there is flexibility in feed formulation and in production time, said Guus. "In general, the production of quality diets is possible even with high levels of soybean and by-product meals. Natural binders can be used and even semi moist feeds are possible. Overall, the operational cost savings, subject to local cost



The module of the MDU at Van Aarsen's plant in Panheel, Netherlands.

of raw material have been calculated as 13% in comparison to pelleting technology and 32% in comparison to extrusion."

Another advantage is that post conditioning is also not required. The final stages are post pellet coating of dry pellets, if required, bagging and sealing. Van Aarsen has also simplified the controls to make it easy for one operator to handle the equipment. Cleaning is also made easy. The MDU also has a small footprint covering only 120m<sup>2</sup> as well as low installed consumption of energy at less than 100kW/tonne.

The disadvantages are mostly with on-farm feed production itself rather than with the MDU. Although the producer will have more control on feed and cost savings, the challenges faced will be on lack of experience in formulation of diets, quality and prices of raw material and in process management. In commercial feed production, hygiene and sanitation are in place and any on-farm production will need to have similar controls. Adherence to good manufacturing practices in feed production will be necessary.

A future development by the company will be production of wet feeds for other species. The production of maturation diets with 35% moisture has been successful. Lastly, it was clarified that the MDU will not replace pelleting technology as such equipment will be required for the production of higher volumes of shrimp feeds.

More information: Email: [guus.heijnen@aarsen.com](mailto:guus.heijnen@aarsen.com) (Guus Heijnen); Web: [www.aarsen.com](http://www.aarsen.com)



SEM of 2mm feed

# New website for the Gold Coin Group

The Gold Coin Group has recently re-launched their web site [www.goldcoin-group.com](http://www.goldcoin-group.com)

J.C. Filippi, Group Chief Executive Officer, explained “Gold Coin has transformed many aspects of its operations during the last five years hence our updated website provides us with another avenue to communicate and share information on our growth plans and our ongoing efforts to deliver increasing value for our customers and partners.”

“Our updated website also provides us with a vehicle to reach out to prospective employees via our career section whilst recognizing the contributions of our existing employees who continue to drive our ambitious transformation process throughout the region”.



## MSC Certification for Omega3 Rich Krill Oil

In May, it was confirmed that Aker BioMarine’s krill fishery will be certified by the Marine Stewardship Council (MSC), an independent, global, non-profit organisation that works to promote the best choices in sustainable seafood. MSC’s fishery certification program contributes to the health of the world’s oceans by recognising and rewarding sustainable fishing practices, influencing the choices people make when buying seafood and working with partners to transform the seafood market to a sustainable basis. The MSC certification is a firm recognition of Aker BioMarine’s long term commitment to the environment.

“Since its inception, Aker BioMarine has proactively adopted the highest standards in environmentally sustainable management of krill resources to ensure that we maintain the health of our ecosystem and krill populations,” said CEO Hallvard Muri. “This certification from MSC is a hallmark for our customers who can purchase our products with confidence, knowing that our Omega 3 rich krill oil was sustainably harvested and that their choices help protect the environment.”

Aker BioMarine is the first and currently only participant in the krill fishery to receive the MSC certification because of its commitment to environmental harvesting, managed catch levels, and responsible approach to fishing. It actively collaborates with environmental organisations such as the World Wildlife Fund Norway to adopt and promote new standards for operations where the health of the environment is foremost, including the innovative Eco Harvesting.

More information: [www.akerbiomarine.com](http://www.akerbiomarine.com); [www.superbakrill.com](http://www.superbakrill.com)



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## Future-Focused Aquaculture Session

Industry leaders explored boosting profits and working towards the sustainability of the environment in which aquaculture operates.

This year, Alltech's 26th International Animal Health and Nutrition Symposium took place from May 16 - 19, 2010, at the Lexington Convention Center in Kentucky, USA. As part of this major industry event entitled 'Bounce Back 2010: A Time for People, Profits and Planet,' an aquaculture session hosted expert speakers from around the world. This was one of several species sessions held at the symposium; the other sessions focused on dairy, beef, pig, poultry, feed quality and regulation, equine and pet.

The aquaculture session presentation topics explored the potential role of aquatic proteins becoming a major source to feed a growing population. Other topics covered by the speakers included mineral source contamination, such as with heavy metals; aquaculture's answer of tilapia to chicken; new ingredients for fish such as amino acids, flavourings and enzymes; nutritional strategies for unique species such as rock lobster; nutritional breakthroughs with organic chromium; and recirculation technology. Twelve speakers presented over two days, each day concluded with a discussion-style question and answer session among the speakers and attendees.

### Yes, the future is bright for aquaculture but ....

As part of the Alltech Symposium experience, discussion dinners also took place. Fifty guests were in attendance at the aquaculture discussion



Prof. Dr. K. Fitzsimmons, from The University of Arizona, USA was addressing "Aquaculture's answer to chicken – Tilapia, food of the future?"

dinner entitled 'Aquaculture: Is the future so bright?. For two hours, the attendees shared their thoughts on the industry's future. The group agreed that the future is, indeed, bright with aquaculture reaching the 50:50 mark in relation to capture fisheries in 2010. Aquaculture business is also growing 9.8% a year and aqua feed currently accounts for 7-8% of total animal feed business. Furthermore, it was noted that significant investments in the aquaculture industry will occur in the foreseeable future. Despite the abundance of positive points in favour of a bright future, however, this discussion group also pointed out challenges present in the aqua industry that must be overcome in order to achieve this ultimate goal.

Some of these challenges raised were sustainability and traceability related, while others related to marketing. A number of the issues voiced came paired with helpful solutions. Beginning with the former type of challenge, one of the first issues raised was the magnification of toxins and concentration in the feed chain. Furthermore on the issue of sustainability and traceability, it is important to find the means to feed the hungry, even if with a less expensive product. In some areas of the world, a bright future will be difficult to reach due to current situations of disease and environmental problems. The answer lies in the cooperation between the private and governmental sectors. Regarding the major problems encountered with the destruction of mangroves and in aqua nutrition, multi-trophic systems will be on the rise since they increase the number of seaweeds and bivalves.

Several challenges in the marketing arena also surfaced during the discussion. The industry needs to increase generic marketing as there is an under-demand problem. More investment in marketing and more promotions to 'eat fish' is required. Presently, the US imports 75% of the seafood that Americans consume, and an increase in aquaculture in the country will only happen with niche products and markets. How do we increase demand? If Americans are encouraged to eat more seafood, it could change the situation for the best. In the UK, lipids are implicit in cognitive skill. Facts such as this should be used in marketing to play on the medical benefits and other positive points of seafood.

Furthermore, the UK has experienced a resurgence of urban aquaculture, which is the case with tilapia and cod. Marketing can open the doors to such resurgence if the opportunity is seized. Aquaculture is a supply driven market; with so many aqua products. Therefore, aqua marketing is different than with other species. Quality assurance and traceability should be a part of marketing, and while consistency, volume and quality are useful points for aqua marketing, they are also challenges to ensure this to consumers.

Alltech's 27th International Animal Health and Nutrition Symposium will be held from May 22-25, 2011. For more information on the 2010 symposium; [www.alltech.com/blogs/symposium2010](http://www.alltech.com/blogs/symposium2010).



## Trade at Philippines Shrimp Congress 2010

# Fast separation of freshly hatched nauplii

The INVE Aquaculture team, led by Wim Martens, introduced the SEP-Art Technology developed for the efficient separation of freshly hatched nauplii from unhatched cysts and empty shells, producing undamaged, clean and lively Artemia nauplii from cysts. The technique, which was developed by Inve Technologies in Belgium, requires the use of the SEP-Art separator, which was shown at the booth of Spectrum Biosolutions, INVE Aquaculture's partner in the Philippines, and SEP-Art Artemia cysts which are coated with a non-toxic ferro-magnetic material. In the hatchery, no structural modifications, additional equipment or changes to the incubation protocols are required. During the harvesting of the nauplii, the hatching medium is simply passed through the SEP-Art separator. The nauplii will move through the separator and can be collected at the outlet. All unhatched cysts and empty shells will be attracted by magnets and remain in the separator. According to Wim, although there will be extra costs as the system will only work with SEP-Art Artemia, the savings from a 100% recovery of nauplii, the ease of use and the quality of the biomass more than compensate these. Marketing of the SEP-Art Artemia and the separator began in November 2009 for the Asian market.



Wim Martens (right) and team at the Spectrum Biosolutions booth.

## GAA completes BAP Certification Standards for feed mills

The Global Aquaculture Alliance, has added another link to its Best Aquaculture Practices certification program by completing BAP standards for feed mill certification. This expands BAP certification to cover the full aquaculture production chain, from hatchery to processing plant.

"In developing these new standards, GAA has not only addressed best practices for food safety within manufacturing plants, but also the sustainability of fishmeal supplies," GAA President George Chamberlain said.

The BAP program requires feed mills to develop plans to avoid unsustainable sources of raw materials and transition to fishmeal and fish oil from responsibly managed fisheries. By 2015, at least 50% of the fishmeal and fish oil derived from reduction fisheries and fishery by-products must come from approved certified sources. BAP-certified feed mills must indicate a feed fish inclusion factor (FFIF) on product labels, packaging or other documentation that quantifies marine ingredient content for all aquaculture feeds. This allows farms to easily calculate fish in:fish out ratios simply by multiplying the inclusion factors by their feed-conversion ratios.

The feed mill standards are the result of work by a technical committee chaired by Dr. Sergio Nates, President of the Fats and Proteins Research Foundation. Begun in 2007, the standards development process benefited from a public review in which

comments were received from both conservationists and aquaculture professionals. The standards were also revised following review and unanimous approval by the BAP Standards Oversight Committee.

"Development of the feed mill standards was a lengthy process that involved input from major ingredient suppliers, feed manufacturers, NGOs and other stakeholders," Nates said. "Once completed, however, we resolved some difficult issues, such as the transition to certified sustainable fishmeal sources and a transparent and audited system that allows farmers to determine fish in:fish out ratios."

The BAP standards and guidelines for feed mills, which share many points with the BAP standards for aquaculture farms and processing plants, address food safety as well as environmental and social responsibility. Mills must apply management practices that protect workers and their rights, and process controls that properly handle ingredients and finished products to avoid potential environmental, health and food safety issues. Feed manufacturers can now achieve BAP certification by contacting Best Aquaculture Practices Certification Management, formerly the Aquaculture Certification Council.

For more information: Daniel Lee, [dangelle@aol.com](mailto:dangelle@aol.com). Web: [www.aquaculturecertification.org](http://www.aquaculturecertification.org)

# Aquaculture at Ildex Vietnam 2010

Aquaculture became a significant part of Ildex 2010 Vietnam which was held in Ho Chi Minh City in March with this conference on 'New dimensions for Vietnam's Aquaculture Industry'.

**Dr Flavio Corsin**, Senior Aquaculture Adviser, WWF started the conference by assessing the developments in shrimp and pangasius catfish farming in Vietnam. The speed of development in Vietnam and the projections are of concern. Data from the Ministry of Agriculture and Rural Development (MARD) indicated that there will be expansion of pangasius farming to 1.8 million tonnes in 2015 and to 2 million tonnes by 2020. Although efficiency in terms of yield has been increasing for both commodities, prices have been on the decline. The current challenges are in aquatic animal health, environmental and social issues. In traceability of production, top producers may find it easy to implement some traceability concepts but the industry has about 0.5 million small scale producers with limited access to markets and a complex supply chain (at least 2-3 brokers in shrimp marketing) complicates traceability. It will take time to organise all these. The development of more auditable standards is required and Flavio outlined the ongoing process in setting standards under the pangasius and shrimp aquaculture dialogues.

## Sustainability revisited

**Yiannis Christodoulou**, Novus International discussed the several definitions of sustainability. He said, it is "having enough, for everyone, forever". Sustainability will remain a driver in the market as there are consumer based demands and pressure from supermarket chains. The pressure is also because of concerns on the availability of natural resources and demand for more animal protein. In aquaculture, he looked at the main compartments in farming; markets, aqua feed and diseases and discussed how these can be managed. In nutrition, we are still hampered by the lack of sufficient knowledge such as digestible energy values of ingredients, said Yiannis. The challenge is to reduce fish meal in feeds for the pangasius and shrimp. In India, pangasius feeds have 3 to 0% fishmeal with supplementation of amino acids. The lack of sustainable practices and its effects on the Mekong Delta was also discussed.

The final remarks are that "industrialised farming makes good nutrition possible around the world but it needs to be sustainable."

As consumers, local governments and NGOs will step up the pressure on producers to address nutrient wastage and pond effluents, there may be more pressure to use phytase in extruded feeds said **Dr Dirk Lorenz-Meyer**, Behn Meyer Vietnam Co., Ltd. Phytase reduces the phosphorus loads of the water environment and improves feed efficiency of fish and thus has a firm place in sustainable aquaculture. In his presentation on looking into the future of phytase in extruded feeds, Dirk added that with phytase addition, feed producers can 'go

green', improve feed quality and at the same time save feed costs. Phytase allows for us to use existing phosphorus in the feed, said Dirk. The presentation also covered the economics, formulation and applications of using phytase in feeds. A thorough explanation on the criteria for selection of phytase and answers to some frequently asked questions on phytase were also included.

## Cost benefits of certification

**Xavier Bocquillet** said that certification is voluntary and farmers must see that this is an investment during the life cycle of the enterprise before they will embark on the process of certification. There are two kinds of costs, direct and indirect. Direct costs are for the certification itself and may also include technical support, consultancy and training and laboratory costs. In the indirect costs, it will be deployment or employment of dedicated staff, equipment or changes in production systems. Although the perceived benefits might be premium prices, this is not always the case, said Xavier. Thus, it is more important to emphasise that the benefits will be better market access. Other benefits can include better management and image for the farm, reduction in costs of production and less impact on the environment. How this can be done in Vietnam is through an organised Internal Control system (ICS) where groups of 25 farmers cooperate. This has been applied in organic shrimp farming in Camau for 800 farmers.

## Monitoring culture and health of the pangasius and shrimp

**Marc Campet**, Ocialis Vietnam said that more is now known on what is happening in the field, a result of data collection through the company's fish house concept. He discussed the current status of pangasius farming and questioned the zootechnical information available for the progress of its farming. Farmers are happy with a feed conversion ratio of 1.5, but feed costs have been increasing with higher raw material costs. However, there are other measures to improve culture efficiency.

**Cedric Komar**, Intervet-Schering Plough Animal Health looked at the recent challenges in pangasius farming and discussed aquatic health management in the catfish covering the major diseases in pangasius farming (see his article on pages 12-16). In biosecurity in controlling shrimp diseases, **Dr Supornchai Sri-Nhonghang**, DuPont Animal Health Solutions said that although biosecurity is a series of steps to control the entry of potential diseases into the farm or stop spreading to other ponds, it does not give an answer to all the problems. It is a continuous

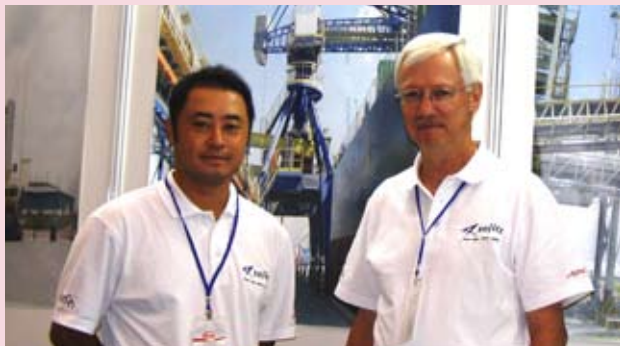


Dirk Lorenz-Meyer (right, back row) with customers and their families on a boat cruise organised by Behn Meyer Vietnam Co., Ltd.



Alltech's team, from left. Quang Le, Binh Nguyen, Hanh Vu and Le Thien.

## Trade at Ildex Vietnam 2010



Takanobu Hama (left) and Jim Echle, Sojitz Vietnam Company Ltd

**Sojitz Vietnam Company Ltd.**, a Branch of the Japanese trading company, has joined with Salim Group and CBH, the Western Australian Farmers Cooperative to take over operations of the agriport in Ba-Ria Vung Tau Province. With the port, Sojitz which has 20% share in the JV, sees an efficient system of transportation of agricultural products by sea, especially in Vietnam where logistics is a constraint.

At the booth, the company displayed a model of the port facilities located in Cai Mep at the SGC Industrial Zone, Tan Thanh district in Ba-Ria Vung Tau Province which comprise silo storage of 60,000 tonnes for grain, flat storage of 100,000 tonnes which will be completed in August, 6 truck loading bays and 3 unloaders, 2 fully covered high speed conveyors and a 200m jetty. The port will be used only for agriculture products such as wheat, soybean meal, corn, etc.

Jim Echle, Senior Project Manager and Takanobu Hama, Deputy General Manager said that when the company Interflour was the operator, it was the only wheat factory with port facilities. The 14m draft will enable Panamax vessels, fully loaded with 75,000 DWT to enter the Thi Vai River. The advantage is that raw materials for agriculture can be easily transported to South Vietnam, where the bulk of agriculture activity occurs.

Sojitz deals from food and consumer lifestyle products to machinery and was formed by the combination of Nissho Iwai and Nichimen Corporations six years ago. Sojitz Vietnam was established in 1986. It was the first foreign company to obtain a Representative Licence and has 19 joint ventures in Vietnam. In the seafood industry, it has 5% market share of shrimp exports from Vietnam. It buys shrimp from shrimp packers and exports the majority of these to Japan, followed by Australia. Most of these are black tiger shrimp. The company is also an importer of tuna, the majority is exported to Japan. It has a processing plant in Dalian for further export to Japan and to European markets. It has also started tuna culture with the Fisheries Farmers Cooperative in Kyushu, Japan.

At the booth of **GSE Lining Technology**, the world's largest producer of geomembranes, most of the interest on geomembranes lining systems is for animal waste and biogas containment. However, Hermann Ng Hoe Boon, Technical Manager of GSE Lining Technology Co. Ltd, who manages the Asia Pacific operations from the office in Bangkok, said that the utilisation of lining technology in fish and shrimp facilities is increasing. The company has a manufacturing facility in Rayong Province, Thailand. It produces high density polyethylene (HDPE) and linear low density polyethylene (LLDPE) geomembranes with thickness range from 0.3 to 3mm in black, white and green surface at seamless widths of 7m. The geomembranes offer significant operational and cost benefits over aquaculture in earthen and concrete ponds.



Hermann Ng Hoe Boon (left) and Kenny Tran Ngoc Hung, GSE's chief representative in Vietnam.

In Vietnam, there is an overall desire to use pond liners to improve production and avoid many of the problems with soil and water quality. In turn, these allow for higher stocking density, yields and better control of dissolved oxygen in the pond. Effective erosion control of pond sides and dykes is another advantage of using liners. However, farmers continue to seek lower cost liner materials. The main interest is for 0.5mm or the thinner 0.3mm HDPE liners which are actually only suitable for firm ground. In contrast, most of the ponds in CP's Lampung farms have been lined with 0.75mm HDPE liners for the past 13 years.

GSE HDPE geomembranes contain no additives or chemicals which can leach out and impact water quality or affect fish and shrimp quality. It is suitable for portable water containment application. The membranes can be repeatedly cleaned and disinfected without any decrease in liner performance.

Hermann also explained that the costs are in material and installation which is carried out by GSE approved installers using state of the art welding technology. The joining of two adjacent geomembranes is either by fusion wedge or extrusion thermal welding. In both cases there is a permanent bond.



Syed Afaque (left) and Bhumika Kesari, Perfect Biotech, India

India's **Perfect Biotech** is a three year old company marketing non-genetically modified soybean products such as value added lecithin soya products, certified non GMO by Cert -id.com. Due to the large difference in cost in comparison to conventional soy lecithin, Europe is a large customer for the company, said Syed Afaque, Manager, International Business. In the aqua feed industry, the soya lecithin is usually used for specialty feeds. Soy lecithin is a source of phospholipids, an essential requirement in aqua feeds, particularly shrimp feeds. After making inroads into the European markets and attending shows such as VIV Europe, the company is focusing on the Asian market for the cheaper liquid form.



From left: Dr Zhang Song, Dr Li Peng, Nguyen Minh Phuong and Yu Van Dung, Aquaculture Department, Vietnam, Dr Yang Yong, Trinh Tú Le, General Manager of Nam Hoa Manufacturing Co., Ltd, Vietnam and Wang Xingcan

**Guangzhou Hinter Biotechnology Co** develops aqua feed premixes, additives and feed techniques. R&D support is from the Guangdong Haid Husbandry and Aquaculture Research Centre which has 13 researchers with PhDs in nutrition, physiology, microbiology and aquaculture. It is part of the Guangzhou Haid Group, based in Panyu, Guangdong Province, China which produced 2 million

tonnes of animal feeds, including 1 million tonnes of aqua feeds in 2009.

In a half day seminar, the R&D and marketing team shared their experiences in China with Vietnamese farmers and local feed companies in the culture of the marine shrimp, catfish and snakehead fish. Zhang Taizhou, Deputy Technical Director reported the success in feeding snakeheads with extruded feeds. In 2008, extruded feeds costing VND 18,000/kg were introduced by a local company under the guidance of Hinter. Farmers reported FCRs of 1.2 to 1.4, in the last two years. The fish is very popular in Vietnam where selling prices for 400g fish range from VND 29,000 to 32,000/kg.

In vannamei shrimp farming, the average FCR is 1. Wang Xingcan, Senior aqua expert gave tips on dealing with water quality, covering ponds during the colder months and mixed culture with crabs and shellfish. Dr Yang Yong, General Manager said that the preferred colouration in catfish is possible with 3 kinds of peptides developed by Hinter. Other presentations included experiences in building a QC system by Dr Zhang Song, Vice-General Manager and new areas in QC of lipids by Dr Li Peng, Asia Regional Director of the National Renderers Association (NRA).



Pedro Encarnacao (second from right) with the Biomin team.

process and is a culture that people in the farm, organisation or the industry share together. He also detailed some actions to prevent disease hazards.

## Nutritional approaches on fish/shrimp health

**Dr Jorge Arias**, Alltech said that industry really needs to address viral infections because of poor immune functions, poor growth of fish and shrimp, increases in mortality and initiate a gradual phasing out of antibiotic growth promoters. The solutions from Alltech are to make a change in the evaluation of nutritional status and responses. The new technology is nutrigenomics which is a molecular understanding of how common dietary chemicals affect health and performance. He demonstrated the benefits of several solutions with enzymes, nucleotides, mannan oligosaccharides and selenium on growth performance and health of fish and shrimp.

With probiotics in aquaculture, **Dr Pedro Encarnacao**, Biomin said that in feed, they improve the intestinal microbial balance. In water applications, it is to change the microbial community in the rearing environment. In health, probiotics prevent infections from fish pathogens through competitive exclusion (depending on strains), neutralizing toxins and as bactericide. Furthermore, Pedro explained why there are doubts on probiotics. The reason is that farmers cannot identify the benefits of application and benefits do not compensate for the costs. Probiotic strains are also regional in nature and the concentration (CFU) must

be must be high (>10<sup>8</sup>) for probiotics to work. Other reasons are the improper management of probiotics because of poor storage and activation. However, there is enough evidence to show that probiotics are effective tools for aquaculture application and the success of probiotic application depends on the strains, concentration and management.

The list affecting the immune systems in fish and shrimp ranges from seasonal variations, farming conditions to water quality, said **Dr Jaques Gabaudan**, DSM Aquaculture Center Asia Pacific. To counterbalance the effects are functional feeds with 'specialised formulation to give benefits beyond their nutritional value'. In turn this will require adjusting the levels of selected nutrients and micronutrients as well as supplementing with non-nutrient immune enhancers. Feeding strategies will need to be adjusted too. These compounds are immune nutrients, immune stimulants and others including probiotics, prebiotics and essential oils. Jacques discussed the benefits of several compounds such as Vitamin E which has an effect on leucocyte apoptosis. Nucleotides are useful tools in disease management. In the tilapia, increasing dietary nucleotides increases the respiratory burst and reduces mortality when challenged. There is also the prophylactic concept whereby from a blend of different compounds there will be benefits from different activities. In general a combination of immune stimulants is more effective and nutrition-based strategies supporting growth and the immune system should be developed.



Vo Hoang Nguyen and wife at our booth. Vo publishes online, news for the livestock and aquaculture industry in Vietnam.

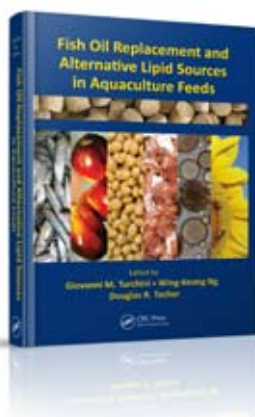
# Fish Oil Replacement and Alternative Lipid Sources in Aquaculture Feeds

Editors: Giovanni M. Turchini, Wing-Keong Ng, and Douglas Redford Tocher, University of Stirling, Stirlingshire, UK. Publisher: CRC Press ISBN: 9781439808627; 544p

The increasing intensification of aquaculture systems worldwide have been fueled by the use of industrially manufactured aquafeeds. The aquafeed manufacturing industry is experiencing exponential growth in many countries (especially in Asia) with estimates of annual growth of up to 30%. In modern intensive aquaculture, feed costs can account for 50 to 80% of the total production costs with a major impact on farm profitability.

It is estimated that aquafeeds currently consume about 90% of the global supply of fish oil. Many have predicted that the demand for fish oil from the aquaculture industry will imminently outstrip supply. In order to further expand, the global aquaculture industry cannot continue to rely on marine fish oils where the annual production has not increased beyond 1.5 million tonnes for the past quarter of a century. The high demand/low supply situation and fluctuating prices makes dietary fish oil a bottleneck in the farming of aquatic animals. There is an urgent need within the global aquafeed industry to find suitable alternatives to marine fish oils.

This book "Fish Oil Replacement and Alternative Lipid Sources in Aquaculture Feeds" is therefore timely and pertinent. In the first three chapters, a global perspective on the production, rationale and use of



fish oils, vegetable oils and animal fats in relation to the aquaculture and aquafeeds industry is presented.

A total of seven chapters are then individually dedicated to a detailed discussion on a specific group of alternative lipid sources, grouped accordingly to main chemical characteristics. Each of these chapters presents readers with an overview of the specific oil or fat industry, the latest research information on the use of these lipid sources as fish oil substitutes as well as their unique potential advantages and challenges for use in aquafeeds. Another five chapters detail the important physiological effects of various lipid sources and their components on growth, lipid

metabolism, health and post-harvest qualities of the farmed fish. Each chapter is written by world-renowned scientists and leading industry experts. Within the 15 chapters of this book, readers will find the most complete, up-to-date and scientifically sound information on the use of fish oil and alternative lipid sources in aquafeeds.

It is our wish that the book is a valuable reference for researchers, nutritionists, oil chemists, graduate students, seafood processors and suppliers, policy makers and personnel related to the agriculture, edible oil refinery, animal rendering, fisheries, aquaculture and aquafeed industries.

More information: [www.crcpress.com](http://www.crcpress.com)

## What can you expect from Aqua Culture Asia Pacific in 2011

To date in 2010, we have brought to you an extensive coverage on issues affecting the Asian-Pacific industry. Some of our lead articles meant to catalyse a paradigm shift for Asia's industry were on vaccination of tilapia against the *Streptococcus*; optimisation of feed ingredients; diseases of the barramundi; pangasius seed quality; feed sustainability with marine meals and selective breeding of the marine shrimp. As we aim to move the aquaculture industry to the next phase of growth, we see that there will always be new opportunities to use the magazine for your marketing needs. During this 7th year of our publication, we invite you to join us to look at current issues, trends, latest developments and technology and be updated.

Volume 7 2011						
Number	1 - January/February	2 - March/April	3 - May/June	4 - July/August	5 - September/October	6 - November/December
<b>Issue focus</b> Recent developments and challenges for the next step	Aqua Feed Production	Cage Culture	Sustainable & Responsible Aquaculture	Health Management	Hatchery	Food Safety & Traceability
<b>Industry Review</b> Trends and outlook	Marine Shrimp	Groupers	Catfish	Tilapia	Freshwater Fish/Prawn	Marine fish (Cobia/Sea bass)
<b>Feeds &amp; Processing Technology</b> Technical contributions influencing the final value of aqua feeds	Additives/ Protein meals Processing Technology	Micro-nutrients /Vitamins & Minerals Extrusion	Feed Enzymes/Lipids Post Pellet Additions	Nutritional Health Feed Management	Feed Probiotics Drying Technology	Novel Feed Ingredients/ Nutrition
<b>Production Technology</b> Technical information and ideas	Biofloc Technology	Breeding and Genetic Improvement	BMP, Standards and Certification	Recirculation Aquaculture Systems	Hygiene & Food Safety	Health Management & Biosecurity
<b>Aqua business</b> Feature articles	Experiences from industry, including role models, benchmarking and opinion articles in shrimp/fish culture					
<b>Markets</b>	Market trends, product development and promotions at ESE 2011, Vietfish 2011 and regional trade shows					
<b>Show Issue</b> Distribution at these events *Show preview in prior issues	VIV Asia 2011/Aquatic Asia 2011, Bangkok, Thailand 9-11 March*	9th Asian Fisheries and Aquaculture Forum & ISTA 2011, Shanghai, China, 21-25 April*	Vietfish 2011, Ho Chi Minh City, Vietnam 12-14 June  World Aquaculture 2011, Natal, Brazil June 6-10*		Aquaculture Europe 2011, Rhodes, Greece 18-21 October  16th China Seafood & Fisheries Exposition 2011 & Aquaculture China 2011, November*	Shanghai International Fisheries & Seafood Exposition, Shanghai, China, December



## International Conferences on Indonesian Aquaculture and Shrimp Aquaculture 2010

These are two back to back conferences hosted by the Indonesian Aquaculture Society (IAS) or MAI (Masyarakat Akuakultur Indonesia), an affiliate of the World Aquaculture Society. The venue is Hang Tuah University, Surabaya, Indonesia.

The International Conference of Aquaculture Indonesia 2010 (ICAI 2010) will be from 25-28 October 2010. The theme of ICAI 2010 is 'Sustainable Aquaculture for Healthy Food and Environment'. All programs have plenary sessions and commodity-based parallel sessions during the two days of the conference. These cover aquaculture for marine finfish, freshwater fish, ornamentals, seaweeds and algae and shellfish.

The International Conference on Shrimp Aquaculture (ICOSA) 2010 will be from 27 to 30 October 2010. It will review advances in the shrimp aquaculture industry, analyse the global supply, demand and

prices of the shrimp commodity. This event is a replacement for the International Conference & Exhibition on Shrimp Aquaculture (ICE-SA) 2010 which was scheduled for May 5-7, 2010 in Jakarta. Some 600 participants is expected for this first and biggest international shrimp aquaculture conference in Indonesia.

ICOSA 2010, with the theme 'Sustainability and Global Market Share of Shrimp Aquaculture Industry' will consist of 2 programs; a conference and exhibition and is open to all stakeholders involved in shrimp aquaculture. The conference will feature four concurrent sessions covering production systems & nutrition, breeding and genetics, disease and health and a business forum for cultured shrimp including crabs, lobster, freshwater prawn. Organisers are calling for paper submissions for both conferences and for participation in the 60 booth exhibition. More information: [www.aquaculture-mai.org](http://www.aquaculture-mai.org)

### August 2-5

**2010 ASAIM Southeast Asia Aquaculture Conference**

Manila, Philippines

Email: [organizer@soyevents.com](mailto:organizer@soyevents.com)

Web: [www.soyevents.com](http://www.soyevents.com)

### August 20-22

**8th International Conference on Recirculating Aquaculture**

Roanoke, VA, USA

Email: [Terry.Rakestraw@aquaconf@gmail.com](mailto:Terry.Rakestraw@aquaconf@gmail.com)

Web: [www.recircaqua.com](http://www.recircaqua.com)

### September 22-25

**Global Conference on Aquaculture 2010**

Phuket, Thailand

Email: [aqua-conference2010@fao.org](mailto:aqua-conference2010@fao.org)

Web: [www.aqua-conference2010.org](http://www.aqua-conference2010.org)

### September 26-October 1

**17th Annual Practical Short Course on Aquaculture Feed Extrusion, Nutrition, & Feed Management**

Texas, USA

Email: [mriaz@tamu.edu](mailto:mriaz@tamu.edu) (Mian Riaz)

Web: [www.tamu.edu/extrusion](http://www.tamu.edu/extrusion)

### October 5-8

**Aquaculture Europe 2010**

Porto, Portugal

Web: [www.easonline.org](http://www.easonline.org)

Web for exhibition: [www.marevent.com](http://www.marevent.com)

### October 3-6

**GlobalGap Workshop for Version 4- Aquaculture**

### October 7-8

**Summit 2010, 10th GlobalGap Conference**

London, UK

Email: [conference@globalgap.org](mailto:conference@globalgap.org)

Web: [www.globalgap.org](http://www.globalgap.org)

### October 25-28

**International Conference of Aquaculture Indonesia 2010**

### October 27-30

**International Conference on Shrimp Aquaculture 2010**

Surabaya, Indonesia

Email: [aquacultureindonesia@gmail.com](mailto:aquacultureindonesia@gmail.com)

Web: [www.aquaculture-mai.org](http://www.aquaculture-mai.org)

### October 27-29

**Tilapia 2010**

Kuala Lumpur, Malaysia

Email: [infish@po.jaring.my](mailto:infish@po.jaring.my)/ [infish@tm.net.my](mailto:infish@tm.net.my)

Web: [www.tilapia2010.com](http://www.tilapia2010.com)

### November 2-4

**Aquaculture China 2010**

**15th China Seafood and Fisheries Expo 2010**

Dalian, China PRC

Web: [www.Seafare.com](http://www.Seafare.com)

### November 8-10

**X International Symposium on Aquaculture Nutrition**

Monterrey, Nuevo Leon, México

Email: [sina2010@uanl.mx](mailto:sina2010@uanl.mx) (Dr. L. Elizabeth Cruz Suarez)

Web: [www.fcb.uanl.mx/xsina/index.html](http://www.fcb.uanl.mx/xsina/index.html)

### November 25-28

**Aquafair Malaysia 2010**

Kuala Lumpur

Email: [enquiry@aquafairmalaysia.com.my](mailto:enquiry@aquafairmalaysia.com.my)

Web: [www.aquafairmalaysia.com.my](http://www.aquafairmalaysia.com.my)

### December 10-13

**5th Shanghai International Fisheries & Seafood Exposition**

Shanghai, China

Email: [sifse@yahoo.cn](mailto:sifse@yahoo.cn) (Wei zi qiang)

Web: [www.sifse.com](http://www.sifse.com)

### January 17-20

**Asian-Pacific Aquaculture 2011 and Giant Prawn 2011**

Kochi, India

Email: [worldaqua@aol.com](mailto:worldaqua@aol.com)

Web: [www.was.org](http://www.was.org)

### April 21-25

**9th Asian Fisheries and Aquaculture Forum & 9ISTA-International Symposium of Tilapia Aquaculture**

Shanghai, China

Web: [www.9afaf.org](http://www.9afaf.org)

Web: <http://ag.arizona.edu/azaqua/ista/ISTA9/ISTA9.htm>



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