MARCH/APRIL2009
Volume 5 Number 2

AQUA CULTURE

Asia Pacific

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Trends in marine fish culture in Malaysia

Extruding aqua feeds with local raw materials

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MICA(P) 074/10/2008 PPS 1699/08/2009(028061)

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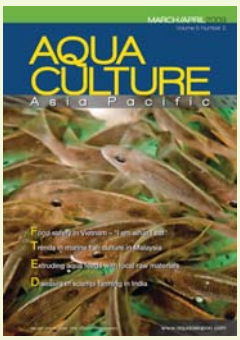
Volume 5, Number 2 March/April 2009 MICA (P) 074/10/2008 ISBN 1793-0561



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AQUA Culture AsiaPacific is published bimonthly by **Aqua Research Pte Ltd**
3 Pickering Street, #02-36 Nankin Row,
China Square Central, Singapore 048660
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Annual Subscription by airmail (6 issues a year)
Asia (excluding Japan & Korea): SGD70
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WRITE TO THE EDITOR

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Letters may be edited prior to publication

From the editor

A Flight to Quality

Asian aquaculture producers have been proudly reporting vast volumes of production for decades. The question of food safety in terms of quality and residues is hitting home, frequently asked by consumers in the EU and the US. Lately, domestic consumers have started to raise similar questions. It is beginning to hit where it hurts – the pockets of the industry. And with the global recession, this could not have come at a worse time. Are there human health threats stemming from the burgeoning aquaculture industry? Asia has been receiving the bulk of negative publicity, particularly in 2008, on the use of banned drugs and unsafe chemicals. Asia is currently perceived as a volume producer and together with its economies of scale comes low prices. However, there is also an image problem that is slowly but surely eroding credibility and the trust of its consumers. What does this mean for the future of the industry?

More than 80% of the seafood consumed in the US is imported and 40% is from aquaculture. Under the FDA's Food Protection Plan, the way to keep US food supply safe is ' to prevent harm before it can happen and intervene at key points in the production process'. The FDA conducts inspections on foreign manufacturers, importers and collection of samples. It is, therefore, the importer's responsibility to take the necessary steps to ensure that foreign suppliers meet the requirements of this regulation and to allow only products that are compliant.

The EU introduced the General Food Law to establish a principle that feed and food operators have the primary responsibility for food safety. The law takes the 'farm to fork' approach where the key driver is traceability which facilitates the withdrawal of foods and provides consumers with targeted and accurate information when the food is found to be faulty. Importers are similarly affected as they will be required to identify from whom the products were exported in the country of origin.

How does this impact the industry? In 2001, the FDA put individual firms in China on import alert when it found imports with residues of unapproved drugs. However, in June 2007 it imposed a country-wide alert when contaminated products came from different companies and in different locations. It is this fragmented nature of industry in China and other parts of Asia that makes the implementation and monitoring of food safety guidelines extremely difficult. Nevertheless, these are reactive measures. The proactive step in China has been to set up a food safety commission to strengthen the country's food monitoring system, whose inefficiency has long been blamed for repeated food scandals. The decision was written in a draft law on food safety. China's current food safety system involves at least five departments, including health, agriculture, quality supervision, industry and commerce administration, and food and drug.

Just as individuals look at retraining themselves for the future, the industry should take the opportunity of the economic slowdown to relook at the quality of their products to meet and exceed consumer requirements. Continuing as a volume producer will only add to the downward spiral as increasing production during decreasing demand will only bring down prices. Whether we want it or not, the consolidation of the industry will occur and the theory of natural selection will prevail. The big will become bigger so how will the smaller players survive? On page 26, Xavier Bocquillet explains some commendable efforts in the catfish industry in Vietnam. However, in practice, maintaining a level playing field for all is not that easy. NAFIQAVED said that the number of properly-qualified public laboratories and modern facilities is limited. Technical knowledge is limited as well as a lack of awareness among entrepreneurs on their social responsibility for food safety. Catfish from Vietnam may face another hurdle as the inspections may shift in 2010 from the FDA to US Department of Agriculture Food Safety and Inspection Service which work on more rigorous standards that are equivalent to that of meat, eggs and poultry.

The days when farmers revert to domestic markets if products do not meet international standards (remember the tagline 'export quality'?) may soon be over. There is now no escape from food safety regulations and traceability.

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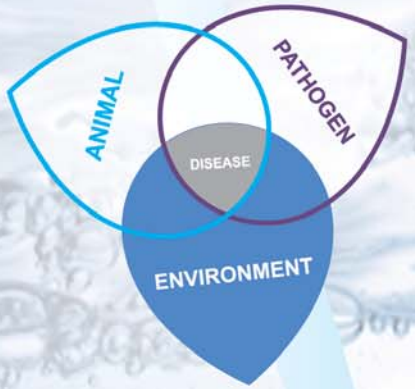

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Shrimp markets down in Europe

Eurofish's January 2009 shrimp report showed a drop in shrimp imports in Japan and Europe while imports expanded slightly in the US. Demand was very low in the three major markets. Further cutbacks in consumer purchases are expected. The best solution is for producer countries to diversify including looking at the domestic and regional markets.

The market remained quiet with demand decreasing from all major European markets. The difference in consumption is linked to whether the country has entered into a technical recession or not. Eurostat figures showed that in Q4 2008, consumption remained unchanged in the Euro zone countries and increased 0.1% in the Euro 27 zone. The French market is relatively stable with eating in restaurants continuing. A gloomier market was indicated in Spain, Italy and UK. Prices are on the downward trend following the trend in the US which has resulted in repercussions on other major markets.

Spain, the number one market for shrimp with 110,000 tonnes of imports, decreased imports by 9% for the January to September 2008 period. Shrimp consumed in Spain are from China, Ecuador and Argentina each with 18% market share. China's exports to Spain were stable in 2008. Ecuador boosted exports by 33% and Argentina suffered a 26% decline. Thailand increased her exports to Spain 7 times as a result of the difficulties in the US market. It decreased exports to the US by 6,000 tonnes and increased exports to Spain by 2,700 tonnes. UK's economic situation was reflected in consumption which declined drastically to 57,400 tonnes and this implicated more the warmwater shrimp segment rather than coldwater shrimp. Imports from India declined 24%.

In Italy, consumption also declined 9% to 47,700 tonnes but the main supplier Ecuador managed to increase market share in Q3 2008. India increased imports to Italy by 30% but at lower prices of EUR 3.32/kg which was EUR 1.15/kg cheaper than Ecuadorian shrimp. France decreased shrimp demand by only 1% in 2008 to a total of 75,300 tonnes and this applied to higher priced products such as processed shrimp, fresh shrimp and coldwater shrimp. The exception was 'luxury' shrimp from Madagascar valued at EUR 8.50/kg which increased 8% in volume. Although Germany has entered into a technical recession, imports, predominantly from Asia, expanded to 35,900 tonnes. Thailand followed by Vietnam were the leading suppliers. (www.eurofish.dk)

Year end low demand in Japan

In December, demand was down despite being a traditional peak consumption period, said an Infofish report. Overall the imports of all types of shrimp products was 188,651 tonnes in January- September 2008 as compared to 191,755 in the same period in 2007, despite the higher value of the yen against the US dollar favouring imports. Supplies of raw frozen shrimp (161,595 tonnes, 74% of imports) fell 16%. Vietnam, Indonesia, Malaysia and Bangladesh increased exports of raw frozen shrimp to Japan.

Prices also fell in domestic markets with the exception of head on black tiger. The market of the premium large size black tiger was badly affected. (www.eurofish.dk)

US shrimp imports rose 1.2%

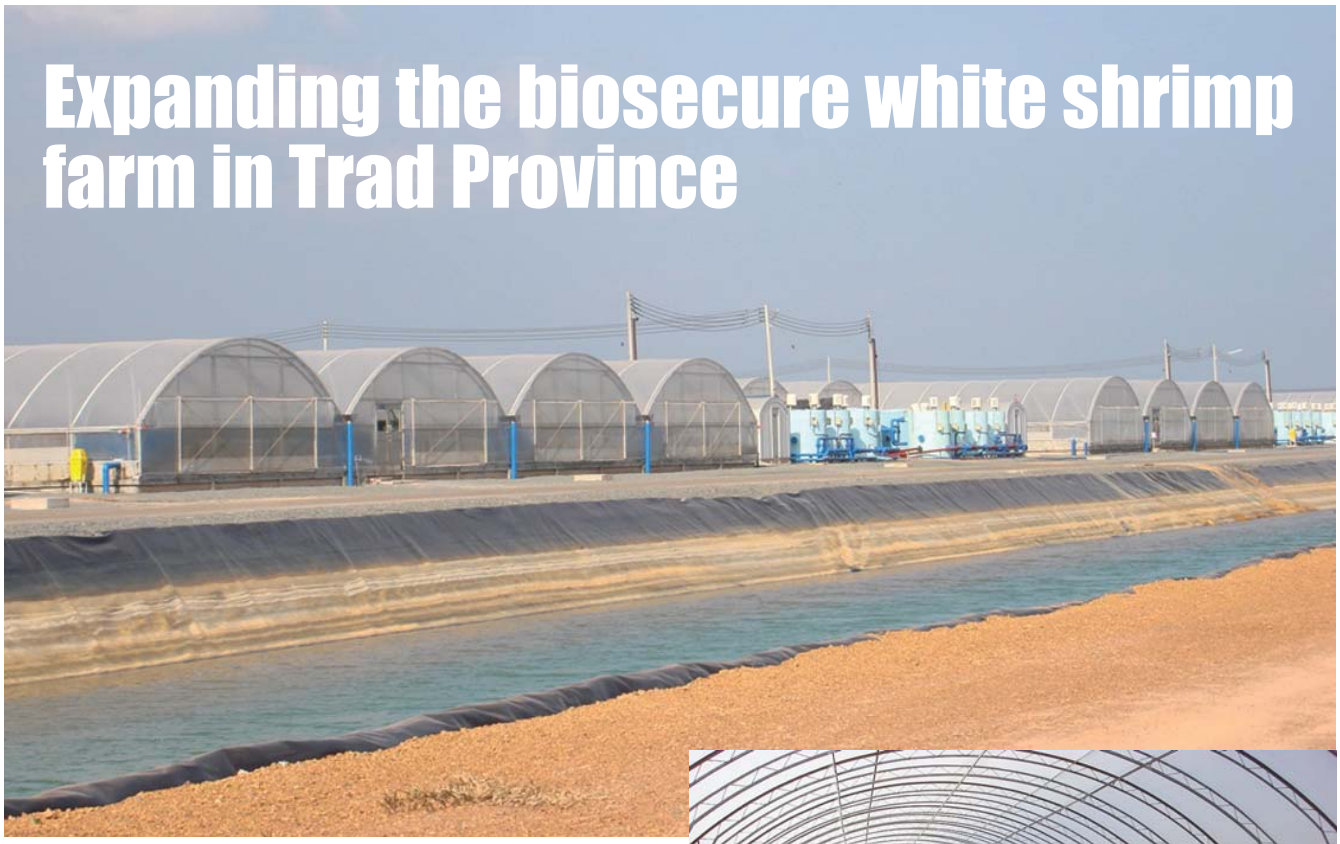
A report by the National Marine Fisheries Service said that US shrimp imports were up by 1.2% in 2008 to 562,500 tonnes . Imports from Thailand, Ecuador, China and Mexico were down, from 3.2% for Thailand to as high as 15% for Mexico. Indonesia has become the second largest supplier and increased volumes by 42.2% to 84,000 tonnes. Vietnam and Malaysia also increased volumes with increases of 22% and 32% respectively.

At INDAQUA 2009

During INDAQUA 2009, held at Bhubaneswar in January 2009, MPEDA awarded mementos to the first three organic scampi farmers of the Kuttanad Scampi Farming Group. R. Dinesh Kumar, Shri. Joseph Korah and Smt. Achamma Kurian were the first producers of cultured and certified organic scampi *Macrobrachium rosenbergii* in the world. The fresh water farms are located in Kuttanad in Aleppy District in Kerala State. The farms have been certified by Naturland, a certifying body in Germany for organic agriculture.

Shri. R.Dinesh Kumar (centre) receiving the memento from Shri. Jayram Ramesh, Minister of State for Commerce and Power (right). Also present was Shri. G. Mohankumar, IAS, Chairman, MPEDA.

Expanding the biosecure white shrimp farm in Trad Province



External view of the farm

Charoen Pokphand Foods Plc (CPF) announced that it will expand its Biosecure Roiphet Integrated Shrimp farming system in Trad province over the next two years after completing a four-year first phase at the end of 2008. This pioneering biosecure shrimp farm on a 3,000 rai (1.88ha) site, 230 km east of Bangkok, was started in 2005. The expansion is expected to start by 2010 once production under the THB one billion (USD 28 million) first phase has stabilised.

In 2008, the farm produced 600 tonnes of high-quality shrimp products, complying with the strict food-safety regulations in markets such as the European Union (EU). Production target is 4,000 tonnes in 2009. The output is sent to its processing plant in nearby Rayong, which ensures fresh products for processing and also saves on logistics costs.

This project which promotes white shrimp farming in an environmentally closed system is part of CPF's commitment to R&D in modern technology along the supply chain. Through this project it has been very successful in developing integrated shrimp farming in an environmentally close system with year round production. Part of the project is the development of disease resistant, high growth *Penaeus vannamei* stocks suitable for high density culture. In the first nursery stage, shrimp are stocked at 2,700 PL/m^2. After 25 days, these are transferred to intermediate ponds. The transfer is through a connecting pipe using gravity flow as ponds are at different levels.

In the second stage, shrimp are cultured for 50 days at a density of 900 pcs/m^2 using probiotics. These are transferred to another pond after 50 days and the stocking density reduced to 600 pcs/m^2. CPF said that it has developed a feeding program for this biosecure shrimp farming project where automatic feeders are used.

Inside view of ponds (Pictures courtesy of CPF).

The total culture period is 125 days and it was emphasized that the three level system allows for a harvest every 50 days. Within a year, 7 harvests resulting from 'interlapping' cycles are carried out whereas in traditional farming methods, there are only 2-3 cycles per year. The production is 90 tonnes/rai (1600m^2) as compared to 6 tonnes/rai in traditional open ponds. The closed system maintains a constant temperature of 31-33ºC and production can continue during winter.

The biosecure farming system guarantees the production of white shrimp that are free of disease and safe for human consumption and can give the company greater access to markets with stringent safety standards. This Trad site will provide the prototype for CPF's future expansion into other countries including China.

In 2009, CPF expects its shrimp exports to be worth about USD60 million, a drop of 15% from 2008 largely because of shrinking world consumption. However, it still expects its export volume to increase by 5-10% to about 40,000 tonnes. Shipments to the EU make up 45% of its exports, with Japan accounting for 25-30%, the United States 5-10% and South Korea and Australia making up the rest. (Source: Bangkok Post, CPF)

News in brief

Rising prices for 50 pcs/kg white shrimp

In Indonesia, due to increasing demand for 50 pcs/kg white shrimp from buyers in the US, prices reached IDR 45,000 (USD 3.74/kg) in February as compared to IDR 40,000 (USD 3.3/kg) in January. It was IDR34,000 (USD 2.8/kg) in September 2008. The 12.5% increase was also attributed to rising demand in the domestic market for larger shrimp. In Kompas.com, Iwan Sutanto, Shrimp Club Indonesia said there has been a 30% shortage in supply of 50 pcs/kg. In early January, the demand was for 70 pcs/kg shrimp and most producers were producing this size only. Farmers were not keeping shrimp in the ponds longer than necessary because of diseases and the dry weather. The price of the smaller size was IDR39,000/kg (USD 3.24/kg). Currently, 60,000 tonnes or 38% of the total shrimp exports from Indonesia are sent to the US.

Tra prices up

In the Vietnam's Mekong Delta, increasing demand raised prices for the tra catfish up to VND15,000-16,000/kg (USD 0.87-0.93/kg) for top quality fish. Processors also paid VND13,000-14,000/kg (USD 0.76-0.81/kg) for the next best quality. Both were up by VND1,500-2,500 from the end of 2008. Supply was down last year as farmers hit by low prices stopped culturing the fish. The Mekong Delta Fisheries Association in vnbusinessnews.com reported that 40-50% of catfish farms have stopped production.

AD on catfish to stay

The US Department of Commerce will maintain the antidumping duties on catfish from Vietnam. In the register of February 2008, the tariff ranged from 36.84% to 53.68% for Agifish, Vinh Hoan Ltd Company, Nam Viet Ltd Company and Cataco. Seven companies will pay the 45.55% rate including Afiex, Cafatex, Mekonimex, QVD Food Limited, Viet Hai Seafood Limited Company and Vinh Long Import-Export Company. The rest will have a rate of 63.88%. The decision was made on the basis of claims by American catfish producers that tra and basa fish imported from Vietnam were being sold below market rates. The antidumping duties on frozen catfish were imposed since August 2003.

Sustaining exports in India

India's Marine Products Export Development Authority (MPEDA) said that it has initiated the following measures to sustain the export of marine products in 2009. Among them is an increased thrust on diversification of culture practices, have a new financial assistance scheme for value addition and introduction of organic fresh water shrimp in the international markets. It will promote ornamental fish breeding for export and will set up six more screening laboratories in Andhra Pradesh to monitor quality of shrimp exports. R&D activities for new aquaculture technologies/innovative methods for increasing the production of fin/shell fish varieties will be launched.

Measures to help seafood industry

Vietnam Association of Seafood Exporters and Producers (VASEP) have asked the government to help seafood processing businesses in difficulty. In the Saigon daily, the assistance sought is to ask banks to delay recalling debts from farmers, provide low-interest rates loans and zero tax on import duty on raw seafood. It also asked for a delay in an increase in electricity and coal prices. Vietnam's Ministry of Agriculture and Rural Development (MARD) will reduce the total aquaculture acreage by 35,000 ha to 1.06 million ha. The move was prompted by lower demand in the US and Japan and the lowest price in ten years in the domestic market. MARD has requested that local authorities strictly enforce and abide by regulations governing facilities, environmental hygiene and the quality of breeding stock. They must also manage and monitor the quality of feed and the use of chemicals at breeding farms across the nation.

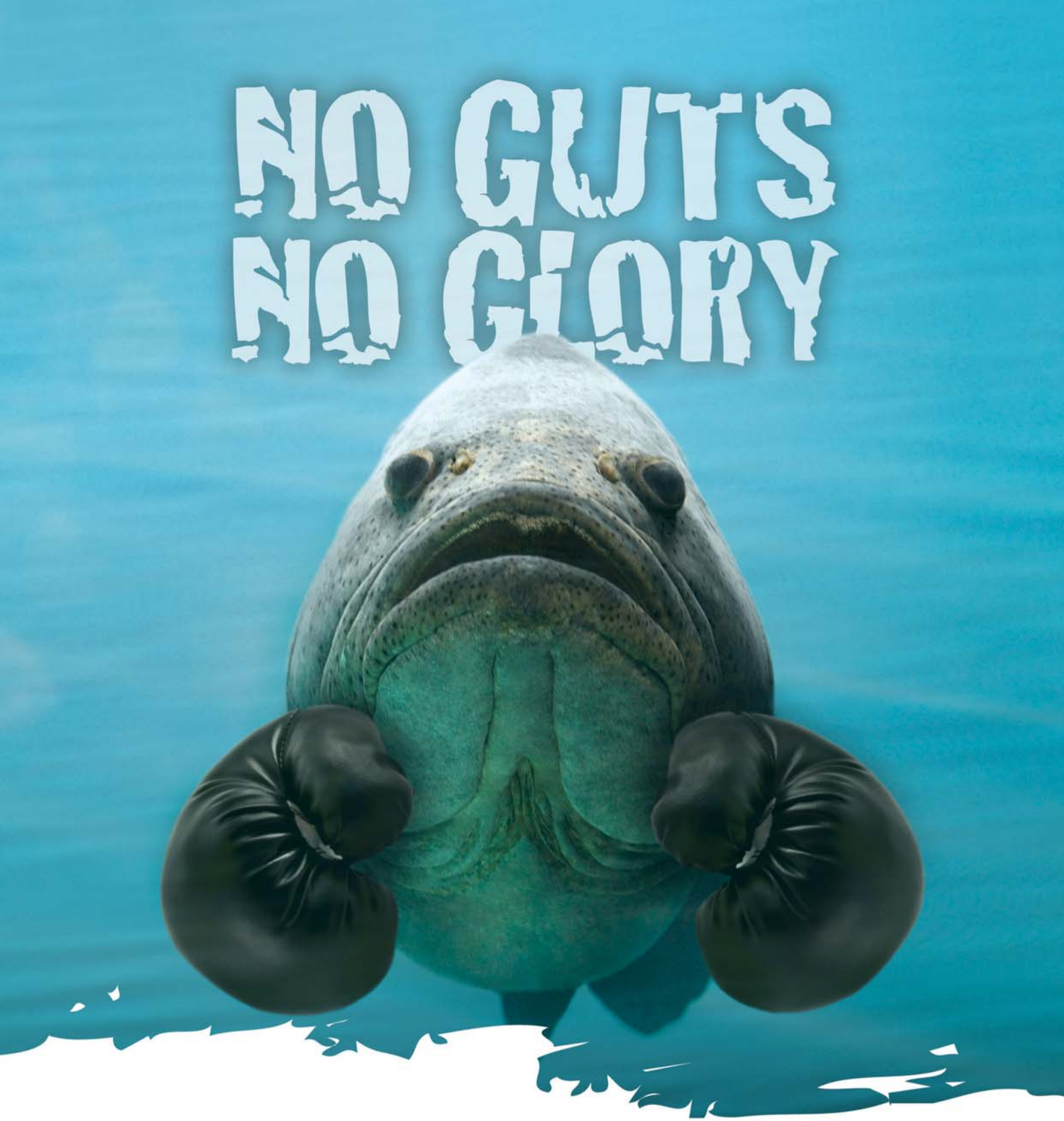
Lobster culture in Queensland

A major partnership in tropical lobster research and breeding was formed between the Department of Primary Industries and Fisheries (DPI&F) and Lobster Harvest Pty Ltd. Lobster Harvest Pty Ltd took over MG Kailis Group which first produced tropical rock lobster juveniles in June 2006. The ultimate goal of this partnership is to develop a commercial lobster hatchery on the Queensland coast to supply small lobsters to a broader grow-out sector, which might include farms in the Torres Strait. DPI&F also expects this new industry to attract considerable overseas investment and position Queensland to be a world centre of excellence in tropical rock-lobster aquaculture.

Higher prices for tilapia in 2009?

In 2008, the supply of tilapia was down 13% to 2.06 million tonnes, due to the cold spell in China in early 2008. Production in 2009 will increase as China recovers and with more farms in Asia, said Kevin Fitzsimmons at Aquaculture America 2009 in February. Globefish reported that prices of tilapia rose in 2008 as producers found better prices in the domestic market. In China, fillet prices rose 35% in the first nine months of 2008 to USD 8/kg as compared to USD6/kg in international markets. Prices also rose in Malaysia by 10%. A major producer sells live tilapia to the Carrefour supermarkets. It added that it is difficult to forecast price trends in 2009. However, other reports said that Mexico and Russia, which account for more than 30% of total Chinese tilapia exports, are purchasing more fish. EU countries are warming up to tilapia. The Metro Group is to source 4,000 tonnes of tilapia fillets from China. Spain is also starting to look for tilapia supplies. More tilapia is being consumed in China.

In 2008, US tilapia imports increased 3.3% to 175,500 tonnes. China which supplies 80% of the frozen tilapia fillets exported less at 116,200 tonnes to the US in 2008, said Seafoodsource.com. The lower supply from China was filled by Indonesia and Thailand. However, these countries need to provide high quality products as they cannot compete with China on price. China raised its export rebate rate for frozen fish fillets from 9% to 13% in November 2008. It also expects increased demand as tilapia can replace other fish such as cod and pollack.



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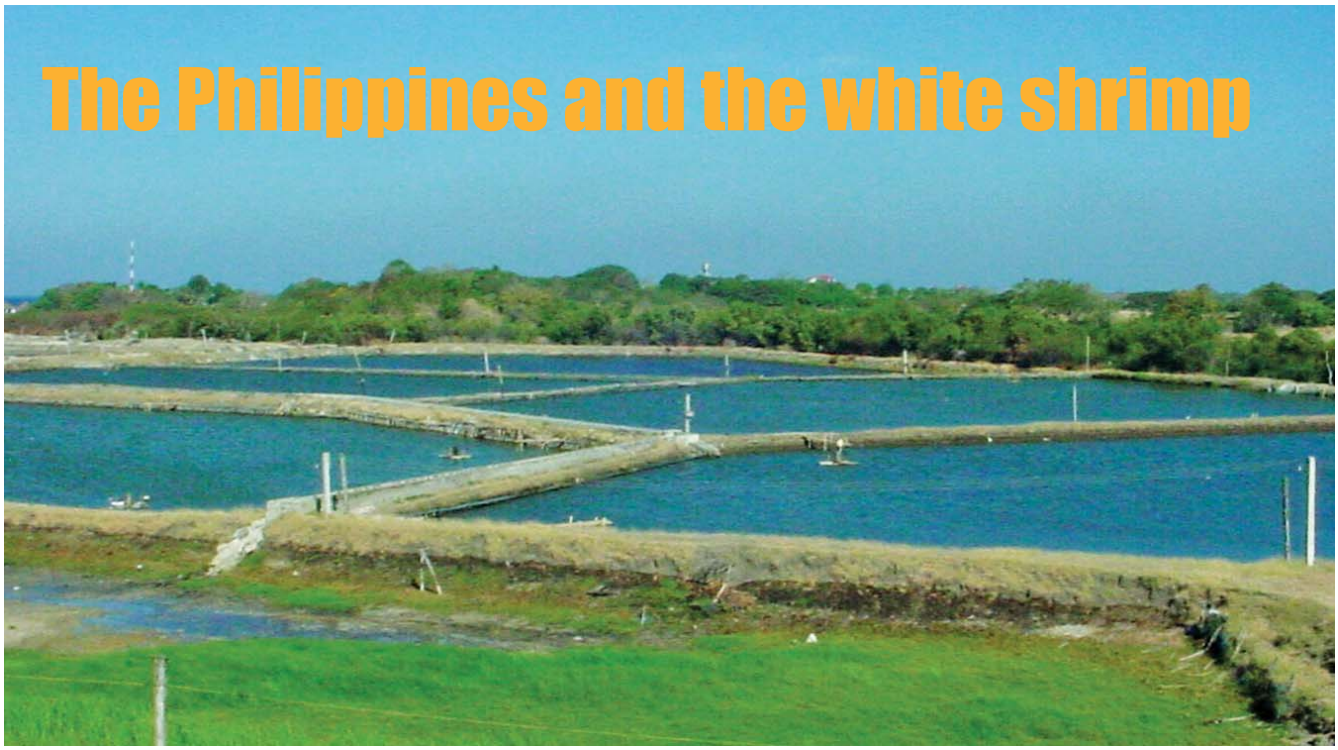
The Philippines and the white shrimp



Farm in Calatagan, Batangas

China, Thailand and Indonesia have credited the fully domesticated *Penaeus vannamei* to boosting their shrimp production. So naturally, the same was expected to happen in the Philippines when the ban on its culture was lifted in 2007. In this article, *Wilfredo G. Yap* looks at events in the introduction of the shrimp in the Philippines and says that more needs to done by public and private sectors to bring back production to the level in 1992 to 1994, when it was one of the top shrimp producers in Asia.

When the Philippines joined the *P. vannamei* bandwagon On January 8, 2007 the Department of Agriculture lifted the long standing ban on the culture of the white shrimp with the Fisheries Administrative Order 225 and thus 'allowing the importation of the broodstock of Pacific white shrimp, *P. vannamei* and the culture of the offspring thereof'. The Philippines was one of the last of Asia's shrimp producing countries to do so.

The farming of this shrimp in China, Thailand, Indonesia and Vietnam had completely changed the profile of the global shrimp industry. By 2006, the white shrimp made up 67% of the world's farmed shrimp production. At the same time, more of the species is now produced in Asia (85%) than in the Americas, the original source of this shrimp. It has replaced *P. monodon* in Thailand and Indonesia and *P. chinensis* in China.

With such precedents, it was easy to understand the optimism of the Philippine Bureau of Fisheries and Aquatic Resources (BFAR) in projecting an annual *P. vannamei* production of 20,000 tonnes over and above the annual production of 40,000 tonnes of the native (*P. monodon*) species. The projection seems reasonable as the same production facilities had produced over 90,000 tonnes annually from 1992 to 1994. Cranking up the production to increase by 20,000 tonnes every year would merely require sufficient PL of the fully domesticated and disease free species which had already demonstrated its production potential elsewhere.

BFAR also projected that exports will pick up accordingly and shrimp will become more affordable in the local market, similar as in other countries. Before its full legalization in 2007, shrimp farmers in Luzon had a two-year head start during the experimental phase from 2005 to 2006. In August 2004, a private company was licensed to import limited stocks of Specific Pathogen Free (SPF) broodstock from Hawaii, USA under an agreement with BFAR to conduct the experimental propagation in BFAR's National Integrated Fisheries Technology Development Center in Dagupan City, north of Manila.

...and two years later

With 2009 starting, almost two full years have elapsed after the removal of the ban, how has the Philippine shrimp industry fared since then? One difficulty in assessing the impact of this species is that the Bureau of Agricultural Statistics does not include the species in their statistical framework. It only reports production of the monodon shrimp , the

Made in Philippines vannamei shrimp, picture courtesy of William Kramer, Hoc Po Feeds Corporation

Semi Intensive farm in Negros Oriental

'native whites' (meaning *P. indicus, P.merguensis* etc) and the sand shrimp (*Metapenaeus ensis*).

Based on BFAR projections but allowing for the initial batch of post larvae from imported SPF *P. vannamei* brood stock by the initial four private hatcheries, it would be reasonable to expect a production of 10,000 tonnes by end 2008 out of the original projection of 30,000 tonnes of *P. vannamei*.

At present, it is estimated that the average volume of white shrimp sold in the main wholesale fish market in Metro Manila is only 10 tonnes per day. This and a few hundred tonnes sold in local markets elsewhere in the country will give a production of the shrimp of only 4,000 tonnes. Meanwhile shrimp exports are still confined to *P. monodon* and prices in the local market for white shrimp have remained high. The only visible development is regular availability of live shrimp in large supermarkets and in many Chinese restaurants.

It is also estimated that the country's total marine shrimp production which has remained at around 40,000 tonnes for the last ten years may have increased by 10%. It has not leaped by 50% as initially hoped. Why the projected production could not be realized appears to be the result of the interplay between government policy and private sector response to the culture of this shrimp.

A contraband species?

Some 7-8 years ago, in Indonesia and Thailand when the private sector started to culture the white shrimp, the government tolerated the practice in the absence of clear cut guidelines. As culture spread, governmental action was swift. In Thailand, it was legalized in 2002 with clear cut guidelines and a system of certification. Indonesia followed with its own set of guidelines by 2004. In China, as early as 1999, the government initiated R&D on the culture of this species as industry based on the Chinese fleshy prawn (*P. chinensis*) floundered. In Vietnam even with a strong production of *P. monodon* shrimp, the government welcomed the white shrimp as an alternative species to give farmers a choice depending on their circumstances following a set of guidelines.

The Philippines took a contrasting stance. When it was suspected that shrimp farmers from Taiwan were growing whites in the province of Zambalez using abandoned monodon shrimp farms, BFAR used an existing regulation to ban the import of live shrimp in all stages of its life cycle. In 2001, this was expanded to include local culture. This was

Intensive farm in Southern Mindanao

followed by sensational raids on suspected shrimp resulting in the arrest of some luckless farmers and technicians. A massive nationwide media blitz against the culture of this shrimp followed warning the public on the danger posed by the imported species on the local shrimp species, in particular on the environment and biodiversity. The presence of the Taura syndrome virus which could potentially infect and wipe out the local shrimp species was emphasized.

These measures successfully convinced local environmental groups, fisheries organizations, Philshrimp and hatchery operators that a ban on the *P. vannamei* culture was required. The irony was that the Philippines was the first to import *P. vannamei* as early as 1979 when a limited number of post larvae from a shrimp hatchery in Panama was brought to Dumangas, Iloilo by a local shrimp farm and pioneering hatchery operator. It was a one-time import for trial purposes and no attempt was made to keep even part of the stock for breeding. The perceived dangers of *P. vannamei* created an uphill battle for those in favour of the culture of the species to revive the moribund shrimp industry, in particular, the few farmers in Central Luzon who saw how the Taiwanese farmers in their midst enjoying abundant harvest of white shrimp in the very same area where they were struggling unsuccessfully in farming the monodon shrimp.

at last, a change but…

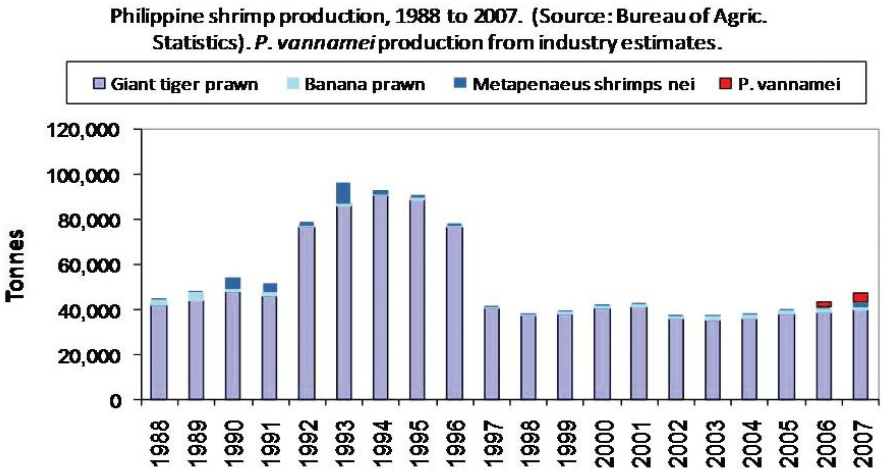
In mid-2003, the policy change came when the Speaker of the Lower House of Congress after a visit to China and Indonesia was convinced that the only way for the Philippine shrimp industry to move forward was by farming the white shrimp. In 2004, BFAR imported SPF *P. vannamei* broodstock on an 'experimental basis' with the culture of the fry produced restricted to Luzon Island. Growers on the island of Negros were against white shrimp culture.

However, by the time, culture was allowed in the entire archipelago, *P. vannamei* production in Asia has already grown to an unprecedented level. With the increased supply, prices in the export market and their respective domestic markets dropped. Just as shrimp farmers in the Philippines were adopting the species, many farmers in Thailand were already thinking of going back to the monodon shrimp because the depressed prices made it difficult to operate profitably with the whites.

Within this scenario, Philippine shrimp farmers have been careful not to expand their respective operations. With relatively low production costs (USD3.00/kg or less) compared to raising black tiger, and with domestic shrimp prices still high (USD 5.00 to USD6.00/kg depending on the size) particularly in the Metro Manila market, no one is particularly keen on expanding in order to produce enough volume for the export market.

New prospects and constraints

A way to increase production will be to allow more players to enter the market by lifting the requirement for farms to be accredited before they can legally culture the species. The country's 239,000 ha of brackishwater fishponds represent a huge potential area for extensive culture. Some fishpond operators have found it rewarding to culture the species extensively. In northern Mindanao, by stocking 30,000 PL/ha, a harvest of 400 kg is obtained in 70 days using only 100 kg



of feeds, without aeration and pumping. Although production is low, the short culture allows for two cycles per year.

A constraint is the short supply of post larvae due to the limited number of licensed hatchery (less than ten in February 2009) and the limited number of SPF brood stock each hatchery imports. As a result, in the Philippines, *P. vannamei* post larvae are the most expensive in Asia at USD5.00 to 6.00 /1000 PL as opposed to USD 2.00/1000 PL or less elsewhere.

There is also a ban on selling excess nauplii which will not allow hatcheries to optimize the use of their brood stock. Daily, an average of 10% of the breeding stock is expected to spawn. A request to lift this restriction has been made by industry though a resolution adopted during the 5th National Shrimp Congress held on May 2008. This matter is still pending. Such a move may also encourage some hatcheries to import more breeders than they require and be a nauplii supplier.

In retrospect

Clearly, the delay in the decision making process had greatly affected the potential accrual of profits by Philippine shrimp farmers. Currently, it is pointless to produce more than the demand in the domestic market as prices will fall. At the same time, while it has been shown that it is possible to culture the shrimp extensively at a competitive cost, there are insufficient post larvae for the more than 200,000 ha of mostly unproductive brackishwater fishponds. The present regulation has made it impossible for licensed hatcheries to use all of the nauplii that their imported brood stock can produce and operate economically. It also does not take full advantage of the larval rearing capacity of existing shrimp hatcheries, made idle when demand for the monodon shrimp fell.

Wilfredo G. Yap is a consultant in aquaculture. He was Head of the Research Division of SEAFDEC Aquaculture Department (AQD) in Tigbauan, Iloilo until 2006 and had worked in various capacities with AQD as Head of the Technology Verification and Commercialization Division, Researcher and Prawn Program Leader. He was Chief Technical Adviser for a UNDP-assisted Shrimp Culture Development Project in Indonesia and Iran. He was one of those who advocated for the legalization of the culture of *Penaeus vannamei* in the Philippines so that the exotic species can be fully monitored and managed.

Expanding marine fish culture in Malaysia

By Khoo Eng Wah and Zuridah Merican

Production is expanding in terms of volumes and species cultured. Sustainable culture and seed production methods are forging industry ahead.

Cages at KS Aquaculture in Pulau Ketam

It all began three decades ago by fishermen keeping some fish in cages off in Penang Island and now marine fish farming in coastal and protected waters is a leading aquaculture business. In 2007, official data from the Department of Fisheries reported 82,800 cages belonging to 2,060 farms with an area of 1,314,151 m^2 for the whole country. In comparison, the number of cages was 68,403 and with an area of 845,082 m^2 in 2000.

Production has doubled to 15,122 tonnes of marine fish as compared to that in 2000. These volumes may be small but in terms of value, the industry which says it exports 50% of production was worth MYR 400 million in 2006 (USD 108 million). Production targeted for the live fish markets of Hong Kong, China, Singapore and Korea as well as local restaurants has made this an attractive business.

The main characteristics of the industry in Malaysia is the multispecies production of some evergreen species such as the Asian sea bass, snappers and groupers alongside currently higher value species such as the tiger and giant grouper. The main production areas are in the coastal waters off Penang Island, Bukit Tambun, Sungai Udang, Pangkor Island, Kuala Seputang and Gula in the north, Pulau Ketam in Selangor in the central region and Kukup, Johor in the south. In East Malaysia, the main areas are in Sabah.

Culture systems

Cage configurations differ with location. In Pulau Ketam, most farms use 16 feet x 6 feet cages (4.8m X 1.8m) and in Penang, these are usually 14 feet square cages (4.26m) and 10 feet (3m) square cages are used in Kukup in the south. Nursery stages are usually in ponds. The production cycle is 7-8 months in cages for marketable fish ranging from 600g to 800g. Larger fish such as 800g-1kg sea bass and red snappers are cultured for the production of fillet in processing plants in Penang and Labuan. Stocking density in cages ranges from 1,000 to 2,000 pieces of 5 –inch (12.7cm) and less fingerlings. In the grow-out cages, the final stocking is usually 450-500 fish/cage of marketable size fish.

Large scale land based recirculation water systems for hatchery and grow out are being introduced. In Labuan, GP Ocean has been using an indoor hatchery system to control production parameters. The joint venture production plant, TRG Cell Sdn Bhd, in Terengganu uses recirculation aquaculture technology developed by the parent company Cell Aquaculture of Australia. Global Hi Bio-Tech in Pangkor Island will use ecological recirculation aquaculture system (ERAS) developed by Hi-Q Bio-Tech of Taiwan, for fry and grow out of grouper. Offshore cage culture farms are in the waters off Langkawi and Labuan.

Market dictates species

Generally, the choice of species to be cultured for each season will depend on current prices, demand by buyers in Hong Kong and China and seasonal availability of fingerlings. Currently, the well boats (live fish carry vessel) which frequent the region to collect live fish for markets in Hong Kong and China prefer only groupers, in particular the tiger grouper. In August, fish species at a farm in Pulau Ketam consisted of red snapper, pompano, grouper, red drum, sea bass and tiger grouper.

There is regional variation in species cultured. Of the 19 species cultured countrywide, the Asian sea bass *Lates calcarifer*, pompano *Trachinotus blochii*, red snapper *Lutjanus argentimaculatus* and *L. erythropterus*, tiger grouper or brown marble grouper *Epinephelus fuscoguttatus*, emperor snapper *L. sebae*, star snapper *L. stellatus*, green grouper or estuarine grouper *E.coioides*, giant grouper, *E.*

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lanceolatus and malabar grouper *E.malabaricus* are cultured in both East and West Malaysia.

The more demanding species such as mouse grouper *Cromileptis altivelis* and coral trout *Plectropomus leopardus*, white blotched snapper *L. rivulatus* and spotted coral trout *P. maculatus* are only cultured in East Malaysia. The cobia *Rachycentron canadum* is cultured in Pulau Ketam and Langkawi, Golden trevally *Gnathanodon specious* is cultured only in the south of the Peninsula at sizes of 3 pcs/kg for the Singapore market. Golden snapper or John's snapper, *L. johnii*, fourfinger threadfin, *Eleutheronema tetradactylum* and red drum *Sciaenops ocellatus* are only cultured in West Malaysia.

Seed production

The technology for local hatchery production of fry and fingerlings of almost all of the species cultured is available in the country. The demand is for 50-70 million fingerlings. The capacity of local hatcheries is not known but industry sources say that currently, local production can only meet 20% of the demand. Most producers still depend on imports from Taiwan, Thailand, China, Singapore and Indonesia.

Cobia fingerlings have been produced locally since January 2006. A batch of locally produced cobia by Sepang Today Aquaculture Centre (STAC) was sent to the HSL marine floating cages in Pulau Ketam and fish grew to up to 6 kg by end December 2006. Although the red drum is a fast grower at one kg in 10 months, there is little interest in its culture because the fingerling supply comes from Taiwan. White blotched snapper (hoi-dai-gai), raised to 500g-1 kg fish from 300gm wild caught juveniles fetches extremely high prices of MYR100-150/kg (USD 22-42/kg) in Sabah's restaurants. Culture of the coral trout, spotted coral trout also depend on wild caught fingerlings.

Hybrid of giant and tiger grouper

In the case of the pompano, fingerlings are obtained from Taiwan in March and later in the year, in September/October, these come from Hainan, China. Only half inch (1cm) pompano fingerlings are imported from Taiwan because of prices and freight costs whereas from Hainan, 2-inch (5cm) fingerlings at MYR 0.50 (USD 0.13) each are imported. Stocking size also depends on the culture system. The size of golden trevally fingerlings from local hatcheries and from Taiwan are 1.5 to 2-inch (3.8-5cm). The 1.5 to 2-inch fingerlings are used to stock ponds but 3- inch (7.6cm) fingerings are used in cages. It is common to stock 4-inch (10.2cm) fingerlings of sea bass, 2.5 to 3-inch (6.4 to 7.6cm) red snappers and 4 to 5-inch (10.6 to 12.7cm) golden snappers. Usually the fingerlings are given prophylactic treatment with potassium permanganate at the hatchery prior to delivery.

Harvesting giant grouper for sale at a HSL marine floating cage in Pulau Ketam, Selangor

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The high value Lutjanus rivulatus is raised in marine floating cages from wild fry and sold at RM100-150/kg in restaurants in Sabah

The government's support in seed production accelerated in 1983 with the setup of the Marine Finfish Production and Research Centre in Besut, Terengganu (see page 24). Major producers have their own hatchery which allows them to control production. Most produce only for their own farms, selling the any excess to other farms. In Peninsula Malaysia, several hatcheries are located in Johor in the south whilst farms are in the north. One of the largest hatcheries in the north is Penshrimp Hatchery which specialises in tiger grouper and red snapper fingerling production.

The leader in seed production is Borneo Aqua Harvest which has two hatcheries in Sandakan, Sabah. It was set up in 2004 and was listed on the Mesdaq market of Bursa Malaysia in 2005. Through the fully owned subsidiary Plentiful Harvest Sdn. Bhd, the company has differentiated itself from other aquaculture companies with a focus on hatchery R&D. Major achievements are in the mass production of cross-breed grouper species such as Sabah giant grouper and Sabah coral rock cod. It has also mass produced fry of the malabar red snapper, marble grouper, coral trout grouper aside from several other grouper species. The University Malaysia Sabah team of experts have also produced many batches of giant grouper x tiger grouper hybrid using sperm from the giant grouper and eggs from tiger grouper.

Mixture of moist and extruded feed

In feeding, there is a high dependence on trash fish, with an estimated 50% of production using trash fish. Fish such as the tiger grouper are weaned onto encapsulated feed at 20 days. Unfortunately the weaning effort is wasted as during nursery culture, farmers start feeding trash fish because of the unavailability of dry feeds. The use of pelleted feeds is distinguished by floating and sinking feeds in the cages in the south and sinking pellets in the central part of Peninsula Malaysia. In cages for sea bass and snappers in the north, where the current flow is faster, sinking pellets are used. This is also related to the availability of labour which is more abundant in the north where 200 cages are managed by 8 workers versus 4 workers in the south. All ponds use floating feeds.

The market leader for marine fish feeds is CP which produces feeds at its factory in Selangor. Other local producers are Cargill and Unifeed. Imported feeds from Taiwan are from Uni-President, Grobest Taiwan and Lucky Star. There is no local production of feeds for the larval stages and so these are imported from Taiwan, Japan and Australia.

SWOT on industry

These are listed in table 1. Malaysia similar to the neighbouring countries has the advantage of a climate which allows for all year round production. In East Malaysia, clean water quality is conducive for culture of species with particular water quality requirements. The country is also close to the markets.

According to industry sources, one obstacle to expansion is the lack of basic knowledge on feed management and disease. Cage farmers also need to improve on record keeping as many are unable to calculate feed conversion ratios. Sporadic occurrences of diseases are frequently reported and mortalities can reach 50%. Common to all regions are black body, scale drop, sleeping grouper disease which also affects the threadfin. Cage farmers are less savvy in disease management and treatment protocols are usually carried out on an ad hoc basis.

"In the case of feeding with trash fish, farmers need to know that using bad quality trash fish increases the risk of diseases. This may not be sustainable in the future. On the other hand, five years ago, we had an industry leader who realised the use of extruded feed as a sustainable feed source", said an industry source.

With the dependence on live fish market, fluctuating prices will be the norm but producers are optimistic. Demand for marine fish which dropped in the last quarter of 2008, will pick up this year. The price for the golden trevally went up from USD 6.2 to 6.9/kg. Pompano prices were unstable during the last 2-3 years and hovered between USD 4.1 to 5.5/kg. In 2009, it was stable at USD 5.9 to 6.2/kg. Before the Olympics Games in China, tiger grouper was sold at USD 16.7/kg but it has dropped to USD 9.7/kg today.

Harvesting and transferring fish onto well boats in Sabah

Table 1.

Strengths	Weaknesses	Opportunities	Threats
• Conducive climate • Local production of seed stock • Strong technical know how • Good infrastructure • Processing facilities	• Fluctuating prices • Highly dependent on live fish market/selected markets • Poor attention to feed management and disease control • Multispecies culture	• Federal and State Government investments for land based farms • National target of 120,000 tonnes • Close to Asian markets • Regional fry and fingerlings supplier • Segmentation of markets	• Water pollution from cages and industrial activity in coastal areas • Trash fish usage leading to poor water quality • Mortality from diseases • Conflicting use of coastal areas

Red snappers feeding in the Penshrimp hatchery.

There are opportunities to be a regional fry and fingerling supplier. Support from the government is strong for aquaculture with several programs and investment incentives. It is also building up infrastructure for aquaculture development. The most recent public investment is a 5 million fry/year hatchery in the East Coast of Peninsula Malaysia (see page 21).

Another area of development is market segmentation. For 30 years, producers are lulled by the high prices for live fish. However, limited demand may have restricted expansion as Malaysia competes with other regional producers for the same market. Although the industry is generally optimistic for the rest of the year, it could do well to look into the frozen fish and fillet market.

There is room for expansion especially if the potential of the frozen and fillet market is considered. Malaysia has sufficient processing capacity to meet the needs but producers must be geared to producing selected species for the mass market.

Top producers

Industry is led by several family run businesses, now spanning 3 generations, such as KS Aquaculture, HSL Aquaculture and Tokyo Marine Culture in Pulau Ketam. In Penang, there is the Tan family's Penshrimp Aquaculture Group (see page 22).

Three generations of the Lee family at KS Aquaculture (from right), Raymond Tea, Lee You, and Mike Lee with guests from Trouw Nutrition.

GP Ocean Food Sdn Bhd is Malaysia's first and largest fully integrated seafood producer. The fish farming activities are in Menumbok, Sabah with 600 cages in operation. Cages are 5m x 5m holding 3,500 of 5cm fingerlings. The range of marine fish include sea bass, tiger grouper and red snapper sold either as live fish or frozen raw fishes in block (whole or whole round) and fillet. It plans to increase to 3,000 cages in 2010. **KS Aquaculture,** one of the oldest farms is a family managed business group. It now has a total of 6 farms with 5,000 cages in Pulau Ketam, Selangor. The first farm was started some 25 years ago with 50 cages and its expansion is a result of consolidation of the number of cages in the predominantly cage culture community of the island, off Port Klang. The company also has a farm in Langkawi Island in Kedah and a hatchery in Johor.

Grow out of fish is in cages of 16 feet long (4.8m) by 6 feet (1.8m) wide and hold 2,000 marketable fish. There is no fixed cycle at the farm. At the farm, Raymond Tea said that the high value fish comprise the sea bass, red drum, grouper and pompano. Local markets prefer the cage reared large sea bass (more than one kg) sold at MYR 15/kg (USD 4.1/kg) as compared to MYR 11-12/kg (USD3/kg) for pond reared fish, usually between 400-500g/fish. Generally feeding is with extruded pellets but recently, the farm has also combined feeding with trash fish when feed prices increased in mid 2008. In the case of the tiger grouper, trash fish mixed with mash at a 25:75 ratio is used. Supply of fry of the tiger grouper is from its own hatchery and is supplemented by supply from hatcheries in Medan and Bali in Indonesia.

The focus of the business is live fish to markets in China and Hong Kong and to local and Singapore markets. The type of fish sold will depend on the demand and currently comprise the tiger and giant grouper. As there is now sufficient volume the company is looking at setting up a processing plant.

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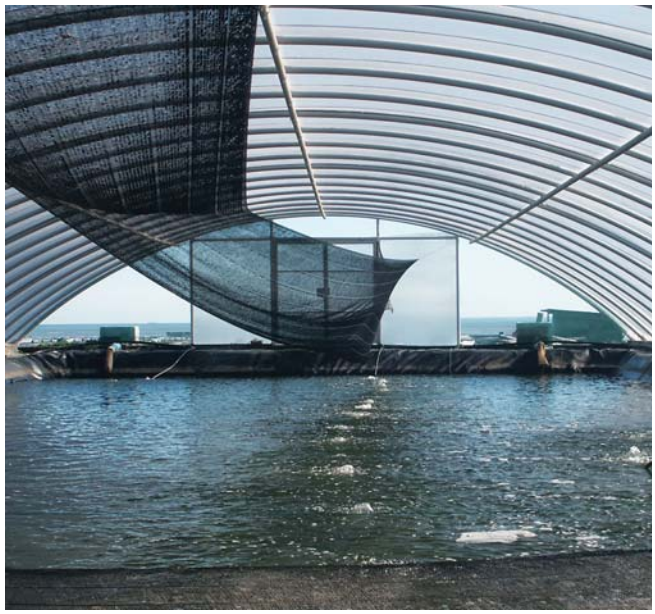
External view of the indoor mesocosm and adjacent nursery ponds



Inside view

Innovations in hatchery technology

Mesocosm system

A team of local aquaculturists led by Mr Khoo Eng Wah, STAC, has developed a 'Mesocosm System Enhancement' for the production of fingerlings of several high value marine species such as sea bass, tiger grouper, red snapper, tiger grouper and some crab species. In a traditional outdoor hatchery, the hatchery operator has to work with changing environmental conditions such as lower salinity during the rainy season, low water temperatures, low alkalinity etc. Production failures are common. This mesocosm system has the advantage of a consistent production as it removes several of these constraints. Additionally, the large volume of water used maintains a balanced ecosystem, bloom of live feeds and enhance growth. The cost of production is lower as compared to traditional systems mainly because of higher and consistent survival rates. The system has been in operation in Labuan since 2006. Although investments costs are high, it does guarantee 10 cycles per year of production.

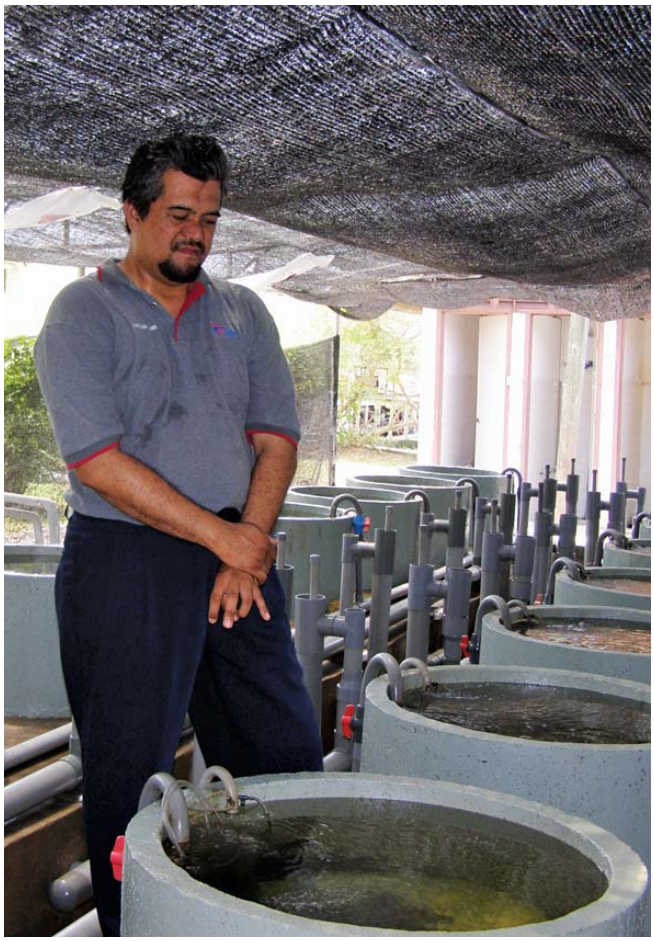
In this system, fertilized eggs are kept in the greenhouse, after 1 month the fish larvae will reach 1.5 to 2cm and are then transferred to cages in plastic lined ponds. Within 1-2 months, fry are 5-6cm long and are transferred to the cages or ponds. Productivity is higher than with traditional systems. The survival of red snapper is 15% from fertilized eggs to 2cm stage and in each cycle, 150,000 fish can be produced per green house HDPE lined pond of 600 m^2. In the case of the tiger grouper, survival is 8% and 80,000 2-cm fry can be obtained from one million eggs.

Cost efficient RAS technology for nursery

The team led by Ahmad Daud Om at the Marine Fish Production and Research Centre has developed a low cost and easy to manage recirculation aquaculture system suitable for small hatcheries. They have named this CENTS – Cheap Efficient Nursery Tank System. The system is ideal for nursing the highly carnivorous tiger grouper from 2-3cm to 7.5 - 10 cm total length in seawater of 15ppt. There are two partitioned concrete biological filters, two water pumps, one air blower and 20 concrete tanks holding 180 litres of water. Each of these can hold 2,000 2-3 cm juveniles. The investment cost is MYR 20,000.

A unique feature is a waste trap which reduces the load on the biological filters. This is merely lifted for cleaning twice a day. Water in the tanks and biological filters are topped up by 10-15% daily. Fish is graded every two weeks and stocking density is reduced by transferring fish to nursery tanks. In a one month operation, the yield is 14,000 juveniles. Fish are fed to satiation 4-6 times daily. Pre operation procedures include preparation of probiotic bacteria for tanks and biological filters. The benefits of this system include improvement in survival at 80-90% as compared to juveniles reared in open systems such as cages and ponds. The system has been commercialised and it now used by 20 farmers for nursing of various species of marine fish fry.

Juveniles of tiger groupers in a 'CENTS' tank.



Ahmad Daud and the 'CENTS'.

Khoo Eng Wah (right) with a red snapper brood-stock at a Pulau Ketam marine floating cage

Khoo Eng Wah, consultant, operates an aqua farming training center in Sepang, Selangor, Malaysia. Since 1996, the centre has trained managers in aquaculture as well as upgraded pond, farm and hatchery operators with practical skills. His experience in aquaculture spans 35 years. He has Bsc in Biology and Post-graduate Diploma in Fisheries from the University of Singapore in 1970. Previously, he worked with the Selangor State government in aquaculture, Fisheries Development Authority and with a shrimp farm in Singapore. Email: engwah.khoo@stac.com.my

AKVA group to build marine fish hatchery in Malaysia

Norway's Akva Group has been awarded a contract together with the Malaysian based construction company Erat Semarat Sdn Bhd for the building of a marine hatchery for the Malaysian Authorities. The hatchery, to be built in Romping in Pahang, Malaysia is designed for the production of 5 million marine fish fry, initially of the tiger grouper and Asian sea bass. Fry will mainly be delivered to local fish farming companies in the state. The equipment delivered will be of UNI recirculation technology and other Akva group technologies. The contract value of this delivery is of about 10 million NOK (USD1.42 million) for the company and delivery will take place over the next 12 months.

This is a first part of the Malaysian authority's initiative to increase the aquaculture production in the country. With the achievement of this contract the group is well positioned to take part in the building of this industry in Malaysia and will now formalize its presence in Malaysia.

Live tiger groupers in Penang

By Zuridah Merican

Large sized fingerlings and dedicated manpower contributes to success in this farm.

Tan at the cages off Batu Maung

Tan Kian Soo and his brothers have continued with marine cage farming, a business started by their father 30 years ago in Bukit Tambun, Penang in the northern part of Peninsula Malaysia. Currently the company Penshrimp Aquaculture has a total of 800 cages in several locations in the coastal waters off Bukit Tambun and Batu Maung, Penang. The cage farm off Batu Maung was started eight years ago. Penang is the second largest producer of marine fish from cage culture with 2,700 tonnes in 2007 (DOF, 2009).

A hatchery was started in 1997 to supply fingerlings for the group's cages. In Kuala Sungai Pinang, Balik Pulau, Penang, the Penshrimp hatchery is one of the biggest marine finfish hatchery operations. Here, ponds once used for black tiger shrimp farming were converted as nursery ponds for several marine fish species.

Sorting of L.johnii in the tanks waiting for buyers. Fingerlings are returned to the ponds after three days.

The farm off Batu Maung has a total of 400 square floating cages, each of 14x14 feet (4.2x4.2m). In February, these were stocked with only 5-inch (12.7cm) fingerlings of the tiger grouper *Epinephelus fuscoguttatus*. The local names are kerapu harimau and lo-fu-pan. The grow-out period is 10 months for 800g fish. Mortality is low in the cages because of the larger size at stocking. Fish are fed trash fish, extruded feeds or bread depending on supply. Each cage is stocked with 1,000 fingerlings and through a culling process carried out 3-4 times for each cage when fish reach 500g, 600g and 800g, the density before harvest is less than 500 fish/cage. Nets are cleaned every ten days.

Fish are produced only for the live fish market of Hong Kong. This is the reason for the culture of only the tiger grouper as the well boats from Hong Kong which frequent the area collect this fish and offer price for other species is too low for the farm to consider culturing.

"In Hong Kong, the demand is for two size ranges; 600 to 800g fish suitable for a table of 6 people and 1 to 1.5kg suitable for a table of 10 people. Prices also differ. Fish less than a kilogram are sold according to price/kg whereas prices are fixed on per piece basis for fish larger than one kilogram. We are also constrained by the shipment size which has to be a minimum of 80 tonnes. When we cannot meet this amount, we pack the fish in a small volume of chilled water and air freight the fish to Hong Kong. The minimum consignment is 8.5 kg. Usually we send 120 boxes with 14 fish per box", said Tan.

"During the last quarter of 2008, we have noticed a slowdown in demand. The frequency of the well boats has decreased. Prices have also decreased to MYR 40/kg (USD11/kg) as compared to MYR 60/kg (USD 16.6/kg) three months ago".

Nursery pond for L.johnii.

Seed production

The 100 acre (22ha) hatchery in Balik Pulau has a total of 99 ponds and cement tanks. Ponds are 0.2 to 1ha in size. Tanks are 15-tonnes to 60-tonnes in capacity. The hatchery nurtures fingerlings to 5 inches (12.7cm) only to stock the grow-out cages of the company. Species are mainly tiger grouper, red snapper *Lutjanus erythropterus* and John's snapper *L. johnii*. These comprise 50% of their total fingerling production. The balance of production is 4-inch (10cm) or smaller fingerlings for sale to farmers throughout Malaysia.

The farm has a staff of 20 to run the hatchery and he is proud that some have been with him for the last ten years. Pond preparation begins by drying the ponds. No probiotics is used during this stage. Water is brought to the ponds from an inlet one km away. In the hatchery, it takes three months from the egg stage to the 5-inch (12.7cm) fingerlings. Feeding in the ponds starts two months after stocking and the main feed is frozen *Acetes* shrimp which costs MYR 1/kg (USD 0.27/kg). Fingerlings are harvested from the ponds on demand. These are sorted in tanks and held in the tanks for 3 days. Small size and unsold fingerlings are transferred back to the ponds.

Tan attributes his success in marine fish hatchery production to an initial training by a Taiwanese consultant and hence forth knowledge learnt from years of trial and error. His objective now is to continue to update knowledge on marine fish breeding in the same manner.

"Ultimately, the success must be achieved with your own perseverance, knowledge and experience. As I have well trained and dedicated staff, I am confident that I can expand production in the future", said Tan.

Breeding the giant grouper and improving brood stock

Larval tanks coloured yellow to increase survival and growth of tiger grouper larvae

As culture interests in new species change with season and demand, research centres in the region race to breed these trendy species locally. In Malaysia's Marine Fish Production and Research Centre (MAFPREC) the focus is now on breeding the giant grouper *Epinephelus lanceolatus* and also brood stock development of core species such as the Asian sea bass *Lates calcarifer*.

It has been the trend with marine fish farmers to change species with season, prices and availability of fingerlings. Breeding and larval rearing technology had to keep up with these fast changing demands. Hussin Mat Ali, the Head of the centre located in Tanjong Demong, Besut, Terengganu on the East Coast of Peninsula Malaysia said, "When we started, our mission was production for the farmers in line with our motto 'Fish Farmers First" and so we had to keep up with the changing preferences of industry. We also had to keep up with progress in the hatcheries and research institutes in Taiwan and Indonesia, leaders in marine fish fry production. Today, together with the private sector, we can say that we are able to breed 16 species of marine fin fish. Now we need to move on to refining technologies such as improving spawning output of the giant and tiger groupers, brood stock improvements and in improving recirculation aquaculture systems for larval rearing".

The centre was initially established as a production centre for marine fish and shrimp fry production. It started with larval rearing of sea bass with eggs spawned at the Fisheries Research Institute in Penang in 1983 and went on to complete the cycle for the sea bass in 1985. In 1992, it was upgraded to a research centre. The series of success have been with the following species; green grouper *E. coioides* (1990), snapper *Lutjanus johnii* (1990), red snapper *L. argentimaculatus* (1993), tiger grouper *E. fuscoguttatus* (1995), pompano *Trachinotus blochii* (1998), red snapper *L. erythropterus* (1998), and red drum *Sciaenops ocellatus* (2000). Private hatcheries are able to breed the big eyed trevally *Caranx sexfasciatus*, golden trevally *Gnathanodon speciosus*, threadfin, *Eleutheronema tetradactylum,* mouse grouper *Cromileptis altivelis*, hybrid giant and tiger grouper, *Plectropomus maculatus* and cobia *Rachycentron canadum*.

Breeding the tiger and giant grouper

Currently, breeding technology is centred on the popular tiger grouper and MAFPREC holds the brood stock in cement tanks. Three pairs are used for spawning via hormonal stimulation each month to produce 5 to 10 million eggs per spawning. Brood stock is replaced every 3-4 years with wild stocks. Eggs are supplied free to private hatcheries such as former marine shrimp hatcheries for larval rearing and nursery to 2.5cm and 10cm fingerlings in 90-100 days. The hatcheries sell these at MYR 1 per 2.5cm.

Giant grouper broodstock.

Implantation of hormone for sex reversal of giant grouper

Collection of semen from giant grouper for hybridisation with tiger grouper

The giant grouper is the next popular species. The centre holds 95 broodstock of which only 15-20 are ready to spawn. Fish are fed juvenile tuna and water is exchanged every two days in the 150 tonne cement tanks. At more than 30 kg there are apparent signs of maturity but cannulation only indicates ready to spawn males in more than 50 kg fish. Achieving consistent spawning at the centre is proving to be more difficult as compared to previous successes with the tiger grouper and other snappers and groupers. Similar to the green grouper, usually only 10% of the mature fish are males but the challenge is how to obtain the right balance of males to females. Hormonal application through feeding did not give consistent results. The centre is looking at novel application techniques in hormonal sex reversal to have more males to work with.

Improving brood stock and technology

As breeding of most species is now commercialised, the role of the seven researchers has shifted into areas such improving brood stock performance and spawning output, refining technologies to increase larval survival of the tiger grouper, intensive live feed production, recirculation aquaculture systems for larval rearing and fish health. In the case of the tiger grouper, induced fish show irregular response after 5 years of spawning and the number of eggs collected can vary from 0.5 -15.8 million which was attributed to feed quality, quality of females and handling.

"We have started with the sea bass where our aim is to have a family line of domesticated stocks with higher survival of eggs, better growth performance and in the future develop specific pathogen free strains. The latter may be difficult as fish have a longer culture cycle in comparison with that for the marine shrimp. We already have stocks of *L. calcarifer* from local waters, Sabah and Australia," said Hussin.

The future will also see the need for more sustainable larval rearing and production methods. According to Hussin, this includes methods such using recirculation aquaculture systems with low impact on the environment. Commercially available systems are available but these needs to be tested for cannibalistic species such as the tiger grouper. For small scale hatchery operators, this has to be low cost. The work at the centre has resulted in a cheap and efficient nursery RAS, with the acronym CENTS (see page 20). The technical and cost efficacy of systems developed by local and foreign companies are also tested at the centre. In the development of production systems, tests are being carried on flow through land based tank culture in cooperation with the state government.

Role in national development

The centre fulfils two other roles in national development. The extension and training role of the centre is to nurture potential hatchery operators. The program covers two years at the centre's facilities, followed by another year in the operator's hatchery. On a regular basis, the centre conducts short term modular training courses for new and existing hatchery operators and for college students.

This industry development role is part of the overall plan to achieve a target production of 120,000 tonnes by 2010. The Department of Fisheries has selected groups of species to achieve the target. These are the sea bass which already comprise 35% of production, snappers (*L. johnii* and *L. erythropterus*), groupers (tiger and giant), and the cobia. Breeding and production technology to marketing is well up set up for most of the species, with the exception of the cobia where the challenge will be in marketing the fish.

After such an illustrious development spanning almost 3 decades, researchers at the centre are asking what will be the next species in demand by local producers. Will it be the yellow croaker, already in high demand in China or the *L. rivulatus* currently cultured using wild fingerlings with an extremely attractive farm gate price?

Reference:
H.M. Ali, N.H.N. Yussoff, A.D. Daud, C.U.C.Musa and M.F. Othman, 2008. Status and prospects of grouper aquaculture in Malaysia, in IC Liao and EM Leano (eds). The Aquaculture of Groupers. Asian Fisheries Society, Manila Philippines, p155-175.

Staff with a 25kg giant grouper broodstock

"I am what I eat"

By Xavier Bocquillet

After an initial period of producing for quantity, the catfish industry in Vietnam now has to look at how they can provide quality fish to consumers. The need for this followed by transparency has brought a feed company, a probiotics producer and a certification services provider in a pilot project to improve the value of catfish in international markets.

Vietnam's pangasius industry has been booming in the last ten years. At the end of the 1990s, production was 25,000 tonnes and 2008 just saw more than 1.2 million tonnes harvested in the farms in the Mekong Delta. Throughout this early period, the main focus was on increasing quantity of fish produced as industry went through the challenges to supply international demand. Europe represented the main buyers of pangasius in 2008 with 40% of the market share and later Eastern Europe (25%) and Middle East (10%) came into the game.

With this increase in international trade, the need for full transparency in the value chain has become critical. It is the intrinsic quality of the product which certainly is the most important factor influencing the consumer's choice. "I am what I eat" is a powerful sentence that all consumers keep in mind. This means having information on the quality of the product is very strongly linked to the history of the production process from the beginning to the end. This is the definition of traceability.

What is happening in Vietnam?

Even though it can be said that 2008 was a good year for Vietnamese pangasius farmers, some difficulties were apparent. In mid 2008, production cost rose significantly and quickly and in some cases, it was higher than selling price. As feed cost could account for 85% to 90% of the production cost, farmers faced cash flow problems. The combination of high feed prices and difficulty of getting loans forced some farmers to simply stop production.

It was in this dire situation faced by farmers that Proconco, one of the largest feed producers in Vietnam, decided to help farmers. The objective is two fold; to enable the producer to get higher incomes by improving the value of the product in international markets and reduce production cost through better farming practices. This is seen as the double benefit.

Today in Vietnam, it is evident that most processing companies can easily run reliable traceability systems within their production process. However, when one brings up the question of origin of the fish and worse, on the origin of the fry or the brood stock, one faces uncertainties. Often, traceability from hatchery to the processing gate (after taking into consideration, the total farming history) is weak. Farm performances are also very often poorly monitored. Some farmers do not know exactly the variation in performances between two cycles. So it is difficult for them to identify the key factors to improve on. The company is now providing a specific feed to partner farms that will produce better farming performances. In addition, specific training on Good Aquaculture Practices (GAP) is given to partner farms in order to be certified. The feed package will also help in improving environmental conditions which will be elaborated further.

Overall, the objective of this pilot project is to work on the establishment of a transparent pangasius value chain that can add value with certified production for export markets with lower production costs.

Partners in the pilot project

Proconco is the initiator of the project and works with a selection of 4 production companies which have agreed to use its feed package and follow strict rules regarding the monitoring and the certification of their farms. The partner in the feed package is probiotics supplier BioSolutions International. A specific protocol is also in place to ensure a maximum efficiency. Finally, a GAP training and traceability system is implemented by QualiService, an independent company specialised in the implementation

Training on the farm

of sustainable production. Together, they provide the synergy of competency for the benefit of the Vietnamese pangasius industry.

Principles of the partnership

To be a partner in this project, there are certain requirements which the farmers have to strictly follow;

- first of all, they have to use the 'GAP' feed for the whole production cycle.
- partners will have to follow the protocol for the use of the feed
- farm management must allow independent quality control staff to visit the farm regularly and to have access to all facilities and all documentation
- farm management must record regularly all information needed in the specific farm diary provided.
- farm staff must attend all training provided by QualiService during the project. Training is related to GAP implementation on farm and how to fill the farm diary.
- farm management has to agree to upgrade their farm in order to qualify for GAP certification.

What is the "GAP feed"?

This is the combination of pangasius feed produced by Proconco and a probiotics tablet produced by Biosolutions International, part of the Virbac group. This comprises five strains of bacteria with the following properties;

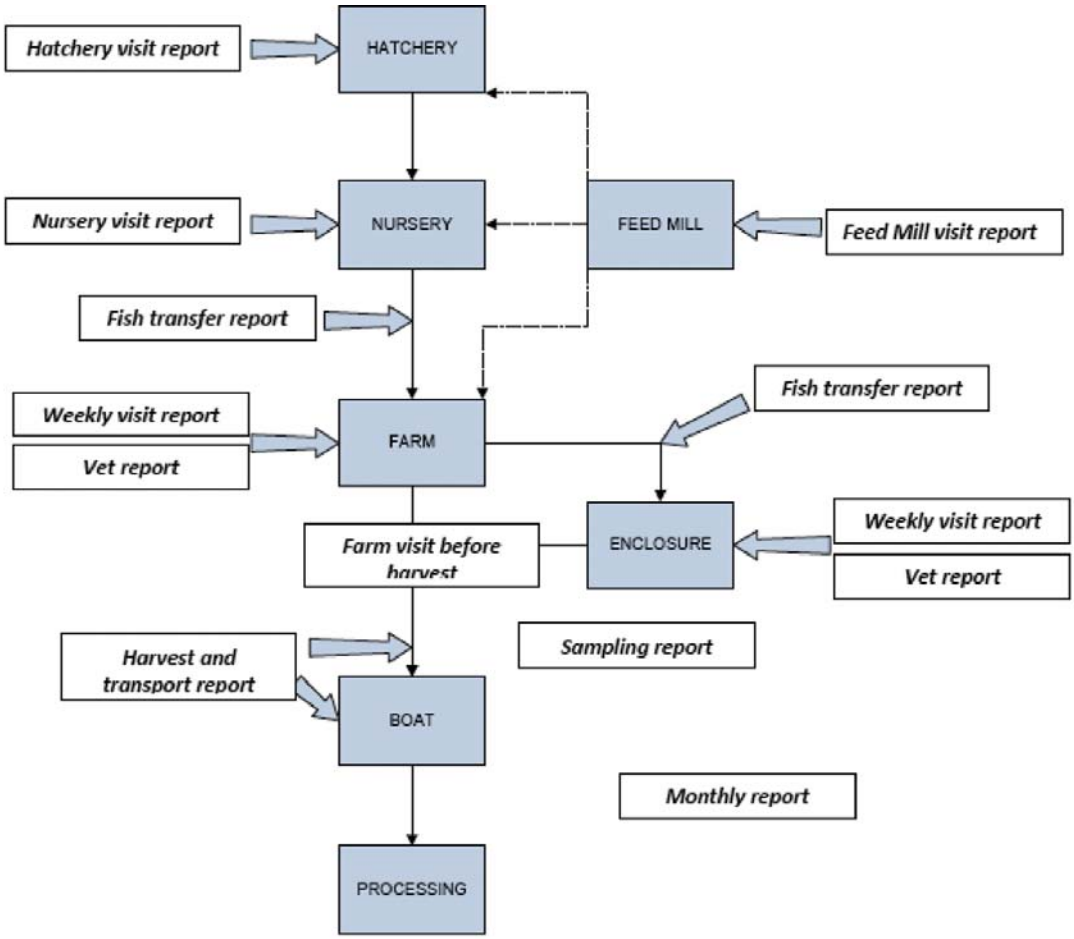
- the reduction of the level of ammonia in pond water
- the improvement in dissolved oxygen in the pond and,
- reduction of bottom sludge through the action of enzymes (amylase, protease, lipase, cellulase.).

The tablets are supplied within the feed bag and have to be used in the pond daily throughout the grow out cycle according to the given protocol. These should work to improve water quality and which in turn will improve growth performance of the stock. It has to be remembered that in a pangasius pond, fish density can be very high, between 12 and 15 kg /m^3. In such circumstances, water quality is a limiting factor and has to be monitored closely. Moreover, to be GAP certified there is a very strict requirement in existing standards on water quality and particularly on effluent quality. The use of this GAP feed will certainly allow the farmer to meet the specified standards.

What is the traceability system?

The traceability system is established through regular and unannounced visits by independent quality controllers of all parties in this 'Pangasius Value Chain'. Such monitoring will gather all information needed for a good traceability system. These are clearly described in the chart.

The goal of this system is to be able to detail the history of the fish from the broodstock to the factory gate. Specific control will be done from the hatchery stage to the boats transporting fish to the processing plant. This starts with a first visit to each participating farmer to introduce the monitoring system and to provide a first training on the GAP program. During this visit a farm diary is provided and explanations are given on how to correctly fill this diary. The farm diary in Vietnam is called 'nhat ky'. Subsequently, monitoring visits are made, during which Qualiservice staff will organize the correctness of the nhat ky and assess the knowledge of farmers on their management. During each visit the quality controller will record all data from the nhat ky and will analyse parameters (growth rate, mortality, feed use, health status, etc.). A report is given for each visit.



What is exactly the nhat ky?

This is the farm diary containing all information related to the stock of fish farmed. One nhat ky is produced for each pond. Hatchery, nursery and grow-out farm will have to fill their own nhat ky. As an example, the contents of the grow-out nhat ky is detailed below:

- general information on the farm (address, number of ponds) and the lot (age, density, etc.)
- nursery information (mortality %, feed use, etc.)
- growth curve and sampling template sheet
- stock, feed use, daily mortality, treatments used
- water parameters (pH, temperature, total ammonia-nitrogen (TAN), dissolved oxygen, etc.)
- medicine stock sheet
- harvest information (quantity, homogeneity, etc.)
- production summary (feed conversion ratio, mortality %, etc.)

All these data are collected regularly, analysed and reported. An innovation to communicate information is through a web-based database that can be accessible to international clients. The farm management (very often linked to a processing company) will decide on the specific client able to access this information which will show the quality of their production. The database will be accessible after login and the main information will be available in Excel and pdf files.

'This system will be a real decision tool for international traders who need full transparency and traceable production from hatchery to their container'.

The next step: GAP certification

In parallel with the monitoring system, we have begun to provide training to grow-out farms on how to be GAP (Good Aquaculture Practices) certified. The aim of the GAP standard is not only to improve practices on farm to ensure food safety but also to reduce the negative impact on the natural and social environment. For pangasius production, existing GAP standards are AquaGAP and ACC (Aquaculture Certification Council). However, soon WWF (World Wildlife Fund) standard and GLOBALGAP will be accessible for producers. During the San Diego Summit in early February, GAA and GLOBALGAP have signed an agreement that will allow the farmer to be inspected only once for these two standards. This may mean that one inspection should be enough to be ACC certified and GLOBALGAP certified.

Feeding of pangasius

Monitoring of Nhat ky

As mentioned earlier, the idea is to reduce production costs through GAP feed but also to increase the value of products in international markets and improve profitability of producers. GAP certification can be a good solution. The program will help farmers to be a GAP certified through a combination of training, field visits and technical advice for the various documentation needed for certification. Close cooperation is needed to reach a successful implementation of a GAP requirement in 6 to 8 months.

Conclusion

This pilot project is one of the first to combine competency from three facets of the aquaculture industry to reach targets in transparency and quality of Vietnamese pangasius. Such production will be able to be GAP certified, reach a niche market and improve income of producers in addition to reducing environmental impact. This is completed with a web based database to provide information to interested clients. This project has started with four companies but will be expanded to all those interested in improving their performance, being certified and acquiring a better value for their products in international markets.

Xavier Bocquillet is manager of QualiService in Vietnam. He has been involved in the catfish industry for almost 2 years. Xavier and his team have worked with 15 Vietnamese companies to be ready for certification in agriculture and aquaculture, five of them are involved in the pangasius industry.

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Fumonisins in fish

By Karin Griessler and Pedro Encarnação

This new group of mycotoxins suppresses growth of tilapia and catfish fingerlings and fish show liver lesions. Potential risk of contamination remains despite in-plant management of mycotoxin contamination. Biotransformation into non toxic products with new fumonisin-metabolising bacterial strains may be the answer.

Fumonisins are a group of recently discovered mycotoxins which belong to the family of Fusarium toxins. The contamination of feedstuffs with mycotoxins poses a serious threat to the health and productivity of animals and cause great economic losses. Fumonisins are mainly produced by *Fusarium verticillioides (syn. moniliforme)* as well as by *Fusarium proliferatum* and they occur predominately in maize and maize-based feeds (Ross et al. 1992).

In 1988 they were first identified and isolated and so far there are 28 fumonisin analogues known (Gelderblom et al. 1988; Rheeder et al. 2002). Fumonisins are divided into four groups: Serial A, B, C and G. With regard to their toxicity the B-type fumonisins represent the most important ones (Marasas 1996). In naturally contaminated food and feed fumonisin B1 represents about 70% - 80% of the total fumonisin content (Krska et al. 2007).

Fumonisins are very polar and water soluble compounds. Unlike other mycotoxins, they have a long chain structure. Chemically, they are polyhydroxyl alkylamines esterified with two carbon acids, i.e. tricarballylic acid (TCA). The four common members of the type B fumonisins differ by presence and position of the free hydroxyl groups respectively (ApSimon 2001). The one-sided or bilateral elimination of TCA results in partial hydrolyzed fumonisin or hydrolyzed fumonisin (HFB1). Fungal colonization and growth and/or mycotoxin production are influenced by a variety of factors. Optimum conditions for fumonisin production are temperatures between 10°C and 30°C with a water activity (amount of free available water) of 0.93 aw (Marin et al. 1999).

A recently published survey about the occurrence of mycotoxins in Asia initiated by Biomin GmbH together with Romer® laboratories in Singapore reported that 58% out of 960 feed raw material samples were contaminated with fumonisins. In this report from Asia the highest level of fumonisins detected was 21.5 mg/kg in a corn sample from China (Rodrigues and Wegleitner 2008). In Europe, levels up to 250 mg/kg were reported in maize from Italy (Bottalico et al. 1995). Table 1 gives examples on high concentrations of fumonisins found in maize samples around the world.

Table 1: Examples on high concentrations of fumonisins in maize samples

Fumonisin [mg/kg]	Country	References
250	Italy	Bottalico et al. 1995
160	Korea	Seo and Lee 1999
155	China	Chu and Li 1994
122	USA	Wilson et al. 1990
117	South Africa	Rheeder and Marasas 1998
75	Hungary	Fazekas et al. 1998
21.5	China	Rodrigues and Wegleitner, 2008
14.7	China	Tan, 2007
10.6	China	Chin and Tan, 2006

Toxicity

The toxicity of fumonisin is based on the structural similarity to the sphingoid bases; sphingosine and sphinganine (Figure 1). They are inhibitors of sphinganine (sphingosine) N-acyltransferase (ceramide synthase), a key enzyme in the lipid metabolism, resulting in a disruption of this pathway. This enzyme catalyzes the acylation of sphinganine in the biosynthesis of sphingolipids and also the deacylation of dietary sphingosine and the sphingosine that is released by the degradation of complex sphingolipids (ceramid, sphingomyelin and glycosphingolipide) (Wang et al. 1991). Sphingolipids are basically important for the membrane and lipoprotein structure and also for cell regulations and communications (second messenger for growth factors) (Berg et al. 2003).

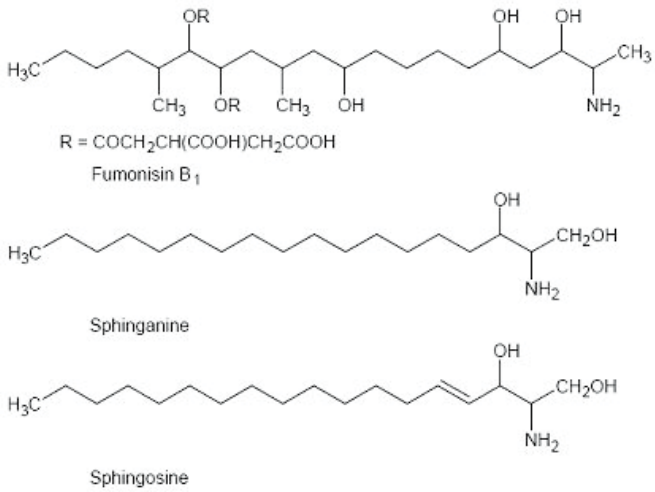

Figure 1: Structures of sphinganine, sphingosine and fumonisin B1.

As a consequence of this disruption many bioactive intermediates are elevated, others reduced. The main points are:

- Rapid increase of sphinganine (sometimes sphingosine).
- Increase of sphinganine degradation products like sphinganine 1-phosphate.
- Decrease of complex sphingolipids.

Free sphingoid bases are toxic to most cells by affecting cell proliferation and inducing apoptosis or necrotic cell death (Riley et al. 1996; Stevens et al. 1990). The accumulation of sphinganine is associated with hepato- and nephrotoxic effects (Riley et al. 1994). Complex sphingolipids are important for cell growth regulation and also cell-cell interactions. The accumulation of free sphingoid bases

Fusarium proliferatum contaminated maize (Source: Chamber of Agriculture, Styria, Austria)

in the serum and urine are a useful biomarker for the exposure of fumonisins (Riley et al. 1993).

Toxicity in fish

This is still poorly understood in fish as there have been only a few studies published. However several experiments have documented fumonisins to be toxic for fish.

Channel catfish

In an experiment, one-year and two-year channel catfish were fed diets containing *Fusarium moniliforme* from maize to contain FB1 at 20, 80, 320, and 720 mg/kg for 10 weeks and 14 weeks, respectively (Lumlertdacha et al. 1995). It was reported that dietary levels of FB1 of 20 ppm or above are toxic to one-year and two-year channel catfish fish fed with 20 mg/kg. FB1 did not show differences in mortalities but weight gain was significantly decreased by 15 % compared to the control group. Additionally, liver lesions were noted.

In another study with catfish consuming *Fusarium moniliforme* maize containing fumonisins, an increase of the free sphinganine and free sphingosine ratios (Sa:So ratio) in serum, liver, kidney and muscle were found at 10 mg FB1/kg after 12 weeks (Voss 2007). Catfish were also fed with FB1 from Fusarium cultured maize (EFSA, 2005). Eight groups of 20 catfish were fed 0, 0.7, 2.5, 5.0, 10.0, 20.0, 40.0 or 240.0 mg FB1/kg feed, respectively, for 12 weeks. At concentrations of 40 mg FB1/kg feed, weight gain and feed consumption were decreased and histological changes were detected.

Tilapia

Tuan et al. (2003) demonstrated that feeding FB1 at levels of 10, 40, 70 and 150 mg/kg feed for 8 weeks affected growth performance of Nile tilapia fingerlings. In this experiment the mortality was low and histopathological lesions were not observed. Fish fed diets containing FB1 at levels of 40 mg/kg or higher had decreased average weight gain. Haematocrit was decreased only in tilapia fed diets containing 150 mg FB1/kg. The Sa:So ratio in liver increased at a 150 mg FB1/kg in the fish feed.

Although research studies revealed that FB1 is toxic to tilapia and channel catfish by suppressing growth and/or causing histopathological lesions, this fish survived mycotoxins levels up to 150 ppm. Reduction on the percentage of survival of channel catfish was observed for diets containing 240 ppm FB1 (Li et al. 1994).

Carps

Adverse effects of fumonisin contaminated diets were reported in carps. Signs of toxicity can be observed with 10 mg FB1/kg feed (Petrinec et al. 2004) in one-year old carps. In these experiments scattered lesions in the exocrine and endocrine pancreas and inter-renal tissue, probably due to ischemia and/or increased endothelial permeability were reported. In one-year old carp, consumption of pellets contaminated with 0.5 and 5.0 mg FB1 per kg body weight resulted in a loss of body weight. Alterations of haematological and biochemical parameters, indicating) were target organs (Pepeljnjak et al. 2003).

Counteractions

Preventive measurements include several steps to counteract mycotoxins during the growth of the grain as well as during harvesting or storage. In the field, all management practices which maximize plant performance and reduce plant stress can substantially decrease mycotoxin contamination. However, all these prevention measures can only reduce but not eliminate the risk of mycotoxin contamination. Therefore successful detoxification procedures after harvest are essential. They are classified into three categories: physical, chemical and biological methods.

The efficacy of physical treatments depends on the level of contamination and the distribution of the mycotoxins in the grain. Additionally, the results obtained are often uncertain and associated with high losses. Various chemicals (bases, oxidizing agents, different gases etc) have been tested for their ability to detoxify mycotoxins but only a limited number of them are shown to be effective against them without reducing nutritive value, palatability of the feed or producing toxic by-products. In achieving adequate decontamination results, several parameters such as reaction time, temperature and moisture have to be monitored. Due to their uncertain and uneconomic results, the practical application of physical and chemical treatments is very limited.

Adsorption

Adsorbent agents are added to the feed and bind mycotoxins during digestion in the gastrointestinal tract resulting in a reduction of toxin bioavailability. Adsorption of mycotoxins requires molecule polarity and also a suitable position of the functional groups. Due to this, only a few mycotoxins can be adsorbed efficiently without affecting essential feed ingredients.

This method is especially used to counteract aflatoxins, however in the case of fumonisins there has been partially successful. In a study, different adsorbents were tested for their potential to bind FB1. An effective adsorption of FB1 was described with activated charcoal

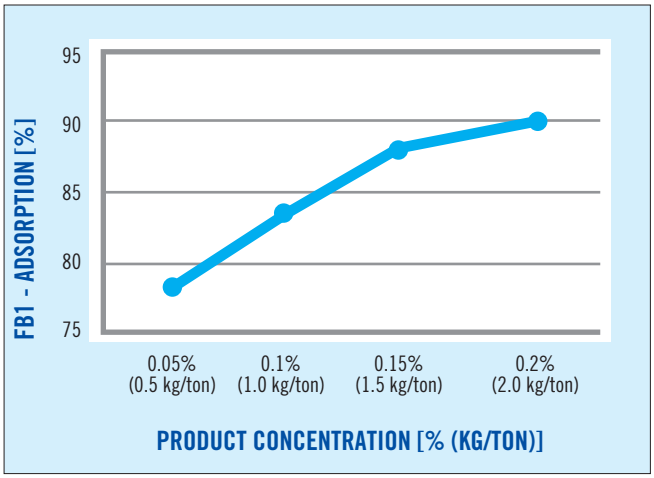

Figure 2 . Adsorption curve of fumonisins in complex media by Mycofix® Secure

and cholestyramin in vitro. However, activated charcoal is a very unspecific adsorbent and binds valuable nutrients as well; therefore these results could only be confirmed for cholestyramin in vivo (Solfrizzo 2001). Avantaggiato et al. (2005) from the Institute of Science of Food Production (ISPA) and the National Research Council (CNR), Bari, Italy, found out that among the commercially available feed additives Mycofix® Plus (Biomin GmbH) showed good results with adsorption rates of 100% and 77% of 2 μg/ml and 20 μg/ml FB1, respectively.

Recently a research project about the evaluation of various adsorbents for mycotoxin -binding-efficacy was performed by the Christian Doppler Laboratory of Mycotoxin Research Tulln in cooperation with the University of Agricultural Sciences in Vienna and BIOMIN GmbH. In the course of the research project about 60 different minerals were examined to obtain information concerning adsorption efficacy, specificity and the mechanism of the adsorption process. From this 2 year research project a new product (Mycofix® Secure) was developed which exhibits high adsorption specificity for aflatoxin B1 but is also capable to adsorb up to 90 % of FB1. (Figure 2).

Biotransformation

Fumonisins are natural toxins and therefore they are biodegradable. Compared to adsorption of mycotoxins by clay, microbial biodegradation has the advantages of being highly specific and irreversible. Several microbial strains which are capable of fumonisin biodegradation were previously isolated, and the genes encoding fumonisin detoxification enzymes were identified (Blackwell et al. 1999: Duvick et al. 1998a; Duvick et al. 1998b).

Recently, Biomin GmbH scientists isolated and characterized new fumonisin-metabolizing bacterial strains (Schatzmayr et al. 2007). Some of these isolates were found to be active in the gastrointestinal tract of animals. One of the strains with the highest technological potential belongs to the family of the Sphingomonadaceae and was called MTA144. It degrades fumonisins by first cleaving off tricarballylic acid side chains and subsequently catabolising the rest of the molecule into non-toxic products. Development of a novel feed additive for fumonisin detoxification based on this strain - whose efficacy was proven in vitro - is in progress. Nevertheless in vivo trials are necessary to prove its efficacy in the animals.

Conclusion

A number of experiments have reported that fumonisins are toxic for fish and the main target organs are the liver and kidney. Although there can be a careful selection of raw materials, maintaining good storage conditions for feeds and raw materials, there is still a potential risk of mycotoxin contamination. As a result of their different structures mycotoxins can cause various toxic effects in animals. Therefore, there is a need to reduce the negative impact of mycotoxins in aqua species. Amounting evidence shows that there cannot be only one effective strategy against mycotoxins. Through its intensive research in mycotoxin risk management Biomin has developed effective solutions to counteract the negative effects of mycotoxins combining adsorption and biotransformation strategies.

References are available on request

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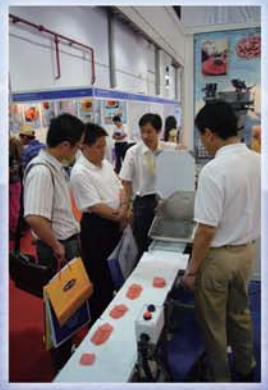
Dr Pedro Encarnação is Aquaculture Specialist for Biomin. Based in Singapore and responsible for the Asia, Pedro has an extensive background in aquaculture and nutrition and has conducted several research projects focusing on the improvement of feed formulations for aquaculture species. Email: pedro.encarnacao@biomin.net

Introduction of Shanghai International Fisheries & Seafood Expo (Sifse2009)

SIFSE2009 will take place on Dec 9–12 .2009

Shanghai Everbright Convention&Exhibtion Center,China



SIFSE Expo sustained three years continuously development under the great support and concern in fishery and Seafood industry at home and abroad.SIFSE Expo achieved qualitative progress in terms of scale,professionalism,international popularity,thus make SIFSE to be the most influential event in marine products industry in East China even whole China and best gateway to access to China's fishery and seafood market.

European Brussel and American Boston fishry expo is prone to being the exchange center of global fisheries and seafood companies,China's fishery and seafood market just like China's economy need to be gradually Incorperated into world market to facilitate the accession to China's market for the fishery and seafood giant and China's companies also are calling for a high-grade local expo to expand world market. Shanghai,lie on the midpoint of China's coastline geographically,the most highly internationalized city around Yangtze River Delta,influence the Yangtze River Delta even China with it's powerful economic strength and potentially huge fishery and seafood market,besides the advanced exhibition industry conceive and shape the SIFSE expo

Shanghai Fisheries Trade Association, associated with Shanghai Fisheries Office, China Aquatic Products Processing & Marketing Association and Taiwan Aquaculture Marketing Cooperative together with China Tongyuan Corperation are going to hold SIFSE2009 together

We will survive and grow hand in hand in presence of global economic recession under the support of China's huge market demand and purchasing power for fishery and seafood. You will catch a big “fish” in Sifse2009.book your stand now for your business opportunity from organizer

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Extrusion of floating and sinking aqua feeds with indigenous ingredients

By Joseph P Kearns

The use of indigenous ingredients reduces feeds costs and creates a greater possibility for fish farming operations to be successful. From an extrusion point of view, starch, fat, fibre and protein levels may limit their usage but changing operational variables in extrusion cooking will allow for the use of a wide range of these ingredients.

The extrusion of floating and sinking aqua feeds is a sustainable and economical process for efficient production for a wide variety of species. Worldwide uses of extrusion technology for the major floating feeds include those for the alligator, carp, catfish, eel, frog, milkfish, tilapia and trout. The slow sinking feed group normally includes flatfish, mahi-mahi, salmon, sea bass or bream, tilapia, trout and yellowtail. Sinking feed species are abalone, cod, flounder, halibut, river crab, sea bass or bream, sea urchin, shrimp and turbot. Clearly some species are in more than one category due to local traditions and physical feed requirements in different areas of the world.

It is without a doubt that farming of additional aquatic species will develop and require feeds and it is projected that extrusion will be used not only for its ability to impart exacting physical characteristics but also the wide variations of feed ingredients that can be utilised. Feeds, the highest cost of most aquaculture adventures, can be reduced if indigenous or local ingredients are utilised. This not only creates a greater possibility for aquatic operations to be successful but it also increases the need to support the growth and harvest of local crops.

Areas of concern

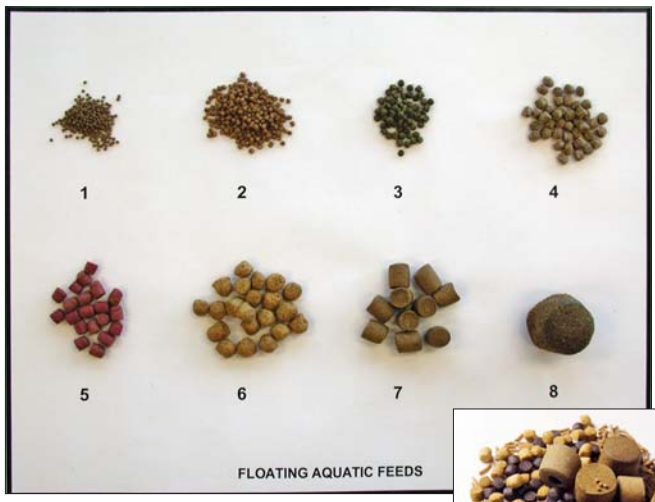
Reviewing the overall process of feed extrusion shows that there are basically four areas of concern; raw materials, the equipment used, how the equipment is operated and the final product specifications.

The aqua feed formulator specifies the available raw materials and their selection are defined by the animal's nutritional requirements for profitable business for the feedmill and the farmer. These ingredients need to be processed within a specified physical range also determined by the feed producer to also fit the needs of the animal being fed. The feedmill needs to determine if the equipment can handle the formula and produce the defined feed.

Normally extrusion process users consult with the equipment manufacturer to determine how to set the equipment up and its operation for a defined formula and set of feed specifications. Extrusion systems do have a range in which they can operate not only with regards to the formula but also the final product characteristics. Physical modifications to the extruder configuration, operational adjustments or both will change the range of final product specifications. In many cases,

Sinking characteristics of aqua feeds: final products bulk density correlation with buoyancy properties

Pellet characteristic	In seawater @ 20ºC (3% salinity)	In freshwater @ 20 ºC
Fast sinking	>640g/l	>600g/l
Slow sinking	580-600g/l	540-560g/l
Neutral Buoyancy	520-540g/l	480-500g/l
Floating	<480 g/l	<440 g/l



Group of aqua feeds

additional components added to the process can improve the ability to achieve the final product from a wider range of possible ingredients.

The possible examples of indigenous ingredients include **rice bran, palm kernel cake or meal, cassava flour or meal and copra meal or cake**, to name a few. These ingredients do have value and can be used in feeds up to a limit. The question is whose limit do you adhere to? This depends on what the equipment can handle and how much the animal will utilize from a nutritional and growth point of view or both.

We will not attempt to define what the nutritional limits are on individual ingredients for various animals as this should be defined by experienced nutritionists who know the impact of ingredients and their constituents.

Looking at these possible ingredients from an extrusion point of view, the critical points to consider are the starch levels, fat or oil levels, fiber levels and protein levels for any ingredient.

Starch

Starch is a required part of formulas and in many cases a minimum of 10% starch is needed for sinking feeds and 20% for floating feeds assuming the extruder barrel is designed for cooking low starch diets. These levels can vary depending on the balance of the formula to achieve the desired characteristics and the equipments abilities. With ingredients such as rice bran and cassava, different types of starch do affect expansion. Tuber starches generally give a high degree of expansion followed by cereal grains with corn being the cereal imparting more expansion then the other common grains such as wheat and rice. These considerations need to be accounted for by the formulator.

Oil levels

Oil levels in ingredients do affect expansion as the lubrication properties decrease the ability of the extruder to expand or cook products. Extruder barrel design with appropriate preconditioning comes into play which allow for a total oil level in feeds approaching 20% with products having the best durability when the total oil content is closer to 15% to 17% in the formula. Total percent oil would be the sum of oil in the ingredients and oil that maybe added in the process.

Fibre

Fibre levels are important as this roughage does require processing considerations. Fillers such as these require more energy per ton of product produced generally in order to get the desired effect.

Protein

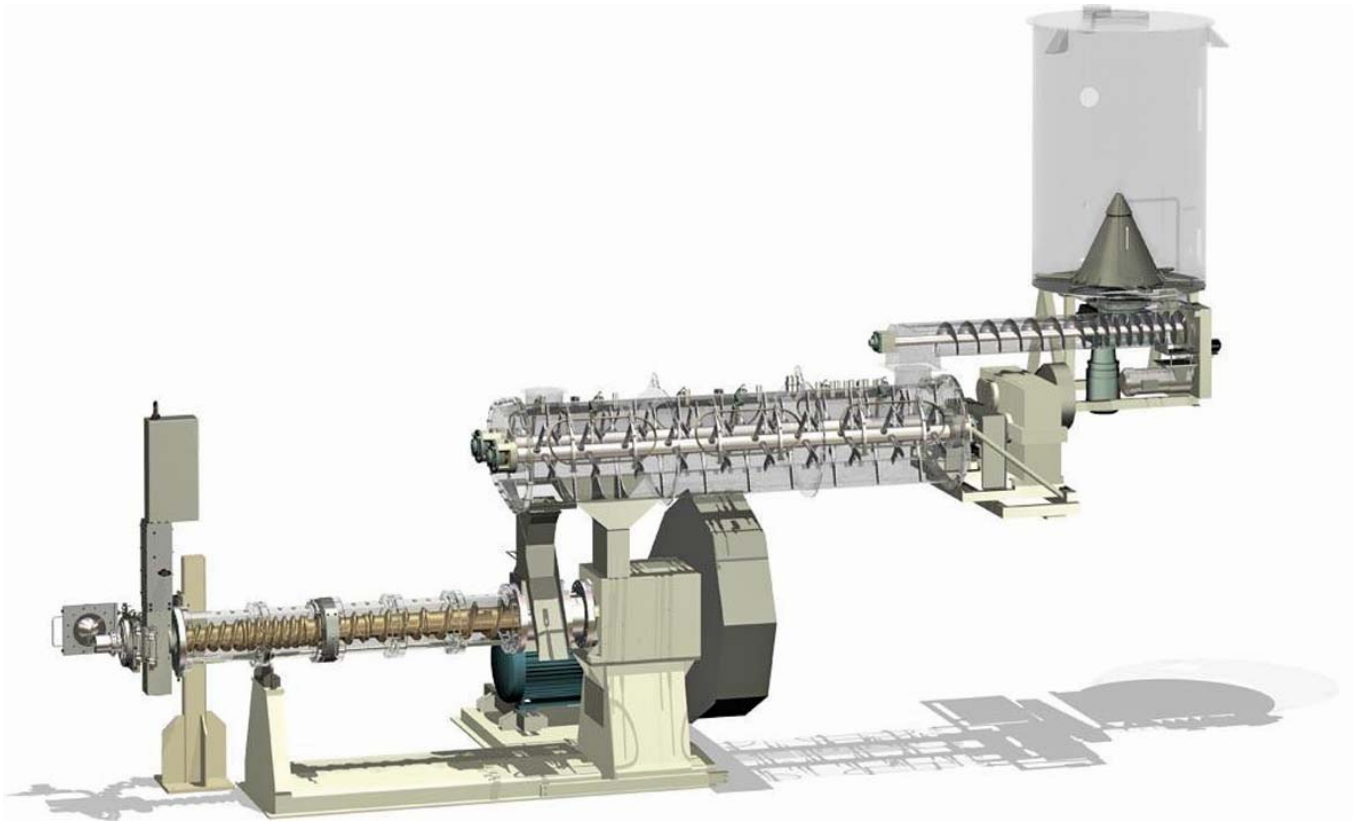
Protein obviously allows for the amino acid balance to be specified and the source of these either vegetable, marine, land animal or combinations require different process conditions. Development of laboratory equipment, Phase Transition Analyzer™, has shown that each and every ingredient as well as combinations of ingredients require processing variations. Also the condition of proteins received have an effect on their ability to be extruded. Animal and marine proteins should have a high solubility or protein dispersibility index, which means if they were heat treated in their initial processing step the proteins will be partially or fully denatured making them harder to extrude effectively and binding of the pellets will be reduced.

Marine fish feeds with 8% fat and 42% protein containing rice bran and broken rice.

Limits from extrusion point of view

In review of the selected ingredients mentioned above, rice bran is an excellent source of starch for extrusion but caution is needed as the actual starch level can vary due to milling and rice variations. Cassava flour is preferred over meal and it also is good for expansion but the usage levels are generally low as some extrusion systems find it hard to deal with this ingredient as it can become sticky. Proper preconditioning is a key to handle cassava.

Palm kernel cake and copra meal are ingredients added for the protein which is really rather low but higher then cereal grains and it should be a lower cost ingredient in the areas where available. Typical



The above photo is of a cut-a-way view of a modern high capacity single screw extruder with a back pressure valve at the end of the extruder barrel.

analysis of palm kernel cake is 19% crude protein, 18% fiber, 10% oil which makes this ingredient one to watch based on all 3 of its major aspects. Copra cake from a whole dried nut has significantly higher protein, near to 25%, and fat close to 22% versus 14% and 11 % respectively for copra cake where the oil has been pressed out. This is a big difference and one that needs to be accounted for when formulating and processing feeds.

From an extrusion manufacturer point of view we define feeds not only by the type of feed but also the ingredients. Floating feeds which are low fat and high protein typically are classified as less then 5% fat and less then 36% protein. High fat and high protein floating feeds are defined as greater then 5% fat and greater then 36% protein. Salmon and yellowtail style feeds are generally classified as 7 to 12% internal fat.

Shrimp feeds have basically 2 styles, high protein and low starch or greater then 36% protein, less then 15% starch and also less then 12% fat. Conversely, high protein and low starch shrimp feeds have less than 36% protein, greater than 15% starch and less than 12% fat. You can imagine that processing a good water stable shrimp feed does require different conditions for these two style formulas.

General sinking feeds for fish are classified as 6 to 8% internal fat, greater than 12% internal fat and between 8 to 12% internal fat. Typically these specifications allow the extruder to be set up with the right parts and specific running conditions to achieve the final product characteristics with a very wide ingredient selection promoting the use of indigenous ingredients.

Operational variables

The operational variables assuming the extruder is set up with the right configuration include water and steam inputs into the conditioning cylinder, water and steam inputs in the extruder barrel, temperature control on the extruder head jackets and variable speed drives which could increase or decrease the mechanical energy inputs. Energy inputs can also be changed by varying the dry feed rates into the extruder. In addition, mechanical devices are available to also add control to production and density of the feeds.

Historically the die was modified to achieve the right cooking effect as well as extruder screw changes. This still applies today but additional developments allow for some operational modifications based on add on controlling devices such as back pressure valves, vented heads and mid barrel valves. These devices allow for adjustments in the equipment operation while running giving a degree of density control and energy inputs which allow for variations in ingredients, formulations and other factors to be managed easily.

Properly designed extrusion cookers are very capable of handling a wide range of feedstuffs including indigenous ingredients. Assistance from extruder manufacturers with the equipment arrangement and required running conditions allow for end users to select ingredients and specify final product qualities with a great chance of a profitable success for both the feed producer and feed consumer.

These efforts will enhance the development of aquatic operations as well as use of farmed local crops in many areas of the world counting on aquaculture as a new possible growth industry.

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More than feed production

The 48 experimental cages in a pond.

In Vietnam, Ocialis wants to be known for its service oriented work. It has field stations for fish/shrimp health monitoring and has cooperated with Vasep to test products for quality criteria as well as developed methods for disease diagnostics in the marine shrimp and fish. The new experimental station set up in 2008 shows that the company is looking further in formulating economic feeds that is part of its holistic approach for a sustainable industry.

Ocialis, a major aqua feed producer has been in Vietnam since 2002. It is part of the French multinational nutrition and health specialist, Evialis. In 2008, its aqua feed production reached 100,000 tpy from its two feed plants in Hanoi and Binh Duong outside Ho Chi Minh City. A new feed factory in Dong Tap province in the Mekong Delta will start operations in 2009.

Aside from feed production, the company has created a 'presence' in the south of Vietnam with its 'maison du poisson' and 'maison de la crevette' in Long Xuyen and Quan Ngai, field stations to monitor the health status of catfish and marine shrimp, respectively. Each year the company produces an epidemiological report on catfish diseases in Vietnam.

Downstream, the company has been working in collaboration with the LAREAL laboratories of Evialis and the Vietnam Association of Seafood Exporters and Producers (VASEP) to provide supplementary laboratory facilities to test for quality aspects of products for export. This is to compliment the testing carried out by Nafiqaved. International accreditation and ISO 17025 certification will be key points for quality control of seafood for international markets. A new project in 2009 will be for the new 500m^2 laboratory specialised in quality control for feed and food.

It has been presumed that the rapid development of catfish and shrimp farming in Vietnam and the rest of Asia was due to sufficient data on nutrients requirements. This is actually not true as there are several gaps in our knowledge on nutrition. Marc Campet, Regional Technical Manager said that references on pangasius nutrition have been scarce since less than ten years ago nobody was concerned by this species.

"Contrary to what is perceived, there are still a lot that we do not know on catfish nutrition. We want to know more, say, on the nutrient digestibility in catfish. We want to find out how to optimise raw materials in our formulations. With narrow profit margins, it is more critical now than before, that industry has cost efficient feeds. At this centre, we also benchmark our products with those from competitor companies".

"We have heard a lot about immunostimulants and probiotics in aquaculture. How can we ascertain the efficacy of these feed and pond additives? We have the advantage that in France our R&D departments have been working on these additives in other species, such as chicken and pigs. Thus, we conduct research using protocols, statistical set ups and standards determined by the R&D centre in France. We also train our researchers in the best in research methodologies on nutritional research in France and in Singapore and Thailand for work in health diagnostics."

"We do not only carry out work on nutrition but also look at new

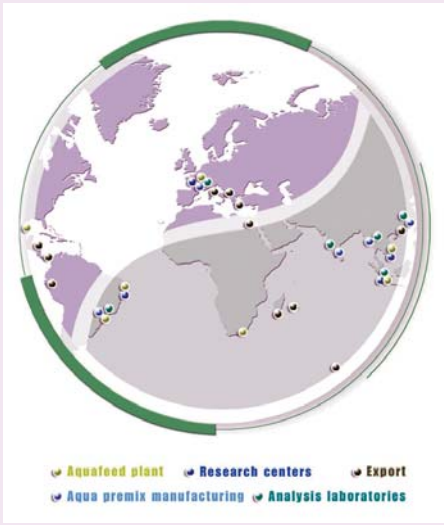
A catfish harvest at the centre. In the industry, the important goals are also to have a homogenous size of fish at harvest ranging from 1 to 1.2 kg/fish and to cut down culture period by 25% and increase margins.

OCIALIS VIETNAM www.ocialis.com/eng/

- Established in Vietnam since 2002,
- Total aqua feed volume 2008: 100,000 tpy
- Fish product:
- Specific brand (extruded feed) for the pangasius, tilapia, barramundi, cobia
- Shrimp product: *L. vannamei*, *P. monodon*
- Technical and service assets:
  - Fish house in Long Xuyen
  - Shrimp house in Quan Ngai
  - R&D centre
  - Member of Evialis group **www.evialis.com/eng/**

LAREAL www.lareal.com/eng/

- Founded in Europe in 1954,
- ISO 17025 accredited,
- More then 360 analysis type with > 2000 daily determinations,
- Launching new facility in Vietnam in 2009 for feed and food market



culture technology to farm pangasius catfish such as lowering stocking density and feeding rates to obtain the best balance for better profit margins".

Applied research

The pride of the company is the R&D centre for aquaculture in Nha Be, an hour south of Ho Chi Minh City. This is not only the largest research facility belonging to a feed company in Vietnam but also a core facility for the company to carry out comprehensive research to support shrimp and catfish culture technology and feed production. In Indonesia, it uses commercial cages to run trials. In Brazil, a similar set up focuses on tilapia culture. In Europe, Evialis conducts most of the aquaculture research in collaboration with universities and research institutes.

At this 23 ha area with 12 freshwater ponds and 12 saline water (7-20 ppt) ponds, 15 researchers conduct a wide range of experiments. The focus is to collect data on digestibility and palatability of feed and feed ingredients, attractants and on growth performance of feeds. This centre was formerly a farm with large culture ponds. Ponds have been modified to standard size experimental ponds suitable for carrying out replicate studies. Some 50% of the water area is reserved as reservoir ponds. By scheduling pumping, the centre obtains freshwater or saline water for its ponds, depending on the tidal water movements from the river.

The automatic faecal collection system developed by INRA, France and the University of Laval, Quebec, Canada. In this system, water outflow from the aquarium is filtered continuously through metal sieves. The faeces are thus extracted very rapidly from the water (between 6 and 15 seconds after emission) and preventing their disintegration. The sieves transfer the faeces to a collection tank where they are immediately chilled and freeze-dried. The rate of recovery reached 99.6%. Initially designed for the rainbow trout, this apparatus can also be used for the Atlantic salmon, bass, eel, carp, koi carp, cod, catfish and tilapia. (INRA press service).

The laboratory at the centre has a dual role; to support research at the centre as well as providing testing services to feed clients. Miss Le Thi Hong Cuc will screen shrimp post larvae with a PCR –polymerase chain reaction. She also screens fish for parasites in fingerlings, bacteria counts and identification in fish and carries out water analysis.

Digestibility and growth experiments

The distinctiveness of the centre is the presence of three experimental systems. There is a dedicated set up to conduct digestibility experiments complete with an automatic faecal collection system. The second and third systems are two separate series of freshwater and seawater tanks, cages and production ponds to carry out respectively, comprehensive nutritional trials for freshwater fish namely catfish and either the monodon or vannamei shrimp. In the fish wet laboratory, there are 48 circular one tonne tanks and there are 48 aquarium style tanks in the shrimp wet laboratory.

"In the case of any work with the catfish, we start by acclimating juveniles in adaptation outdoor tanks for two weeks. Fish are fed a 40% crude protein commercial diet. We start by carrying out experiments in the one tonne tanks and then depending on the hypothesis, we will then proceed to validate results in 48 cages held in ponds and finally in freshwater production ponds. The same applies to experiments with the marine shrimp".

"In our nutrition trials, the sizes of fish and shrimp will vary according to the experimental hypothesis. We work within set experimental protocols which in the case of the shrimp, dictates a minimum weight gain such as doubling of weight for 3-4g shrimp in 50 days. In growth trials with the catfish, we work on an acceptability level of 150% weight gain. We use the cages in the ponds to validate the results from the tank trials and if we do not succeed, we change the diets etc", added Marc.

Culture technology and flesh quality in catfish

The link between culture technology and marketability of fish is important. The preferred fillet size is 170g which translates to a fish: fillet ratio of 2.8 to 3. A goal is to increase fillet yield and reduce peripisceral fat which is related to the protein: energy ratio of feeds. Often farm made feeds can contain 50-60% rice bran which increases the level of oxidation in lipids which affect directly fillet and fish

health situation. Fillet quality of the catfish can be optimised by looking at the relationship between liver quality, flesh colour as well as feed freshness. The centre has invested in a colorimeter to analyse fillet yield and colour, similar to that used for the assessment of tuna in Japan.

Marc said, "When we look at feed regimes, we say that *ad libitum* feeding, which is a usual practice, may not be the most economic method. In the field, the farmer always reports higher FCR. A special problem is pond bottom management. This depends on feed management. Farmers report that at low temperatures, fish do not feed. In our ponds, we have installed probes to monitoring water temperature. Dissolved oxygen is also a critical parameter even if *Pangasius hypophthalmus* is a facultative air breather. We regularly collect pond turbidity data. All these are to explain to us the trend in feeding. We use these results to explain to farmers the conditions during culture. It will also help us develop a pangasius production management software".

"Another issue is the stocking density. At 20 fish/m^2, the farmer needs to change water daily once the individual weight is more than 500 gram. The environment impact will be less if the stocking density is reduced to 15 fish/m^2 and the water exchange regime is modified to keep to the best pond water quality parameters. All these are only possible only when we monitor conditions and record data well. Early in the morning without any photosynthesis, the oxygen levels reach 0mg/l. An option is to introduce aeration which may also increase growth", said Marc.

What next

The development of catfish culture in Vietnam requires the R&D work at the centre to catch up with demands from industry. One of the problems faced is in the large variation in growth. To overcome this, the centre will set up a hatchery to look into this problem.

"In future, we may open up 20% of the centre for contract research work. This will help companies in Vietnam seeking facilities to conduct research or carry out trials with their products", added Marc.

Adaptation tanks for catfish fingerlings.

Marc Campet (left) and Dr Dao Huy Phong, R&D Director

Storage control for fish, offal or by-catch

By Christian Lückstädt

The use of a blend of potassium diformate, antioxidant and corrosion inhibitor can extend the storage period of raw fish, offal or by-catch worldwide.

Almost a third of the world fish harvest is not used for direct human consumption, but is converted into fish meal or fish oil for further application in animal feed. About 25 million tonnes of fish for human consumption is processed in ways other than fresh, frozen, smoked or canned (Balios, 2003). The supply of huge volumes of high quality fish meal is necessary to supply the rapid growing aquaculture industry, which is growing at approximately 10% annually (FAO). The amount of high quality fish meal of the total amount of fish meal is expected to grow from 8% to 50% during the next 30 years (Hydro Norway, 2000).

Acid preservation

Acid preservation of fish and fish viscera to produce fish silage is a common practice and the final product has been widely used in fish feeds with reported beneficial effects (Gildbert and Raa, 1977; Åsgård and Austreng, 1981). It is a widely used method in many European countries to preserve fish-by-products as well as freshly caught "industrial fish" for further fish meal or fish oil production with formic acid or potassium diformate in order to prolong fishing time or to extend the storage duration of those fish.

A special product for this application has been developed by Addcon, the largest producer of formates in the world. Fishform® Plus, a blend of potassium diformate, antioxidant and corrosion inhibitor, was extensively tested to store raw fish, by-catch or offal world-wide. However, the existing storage procedure for fish is currently adjusted to low temperatures of about 5°C. At those temperatures the suitable storage period of fish and fish by-products can be prolonged with the aid of acid-based preservatives to roughly 3 times the normal storing period without preservatives.

There is growing interest in the preservation of fish in the booming aquaculture regions of South East Asia in order to preserve fish waste, by-catch and surplus fish as well. Trials were designed to store fish (sardines) at higher temperatures.

The present study examined the effectiveness of a blend of potassium diformate, antioxidant and corrosion inhibitor (FishForm® Plus) as a preservative of sardines at different elevated temperatures (9.8°C and 15.7°C). The blend was added in 4 different concentrations (0.25%, 0.375%, 0.50% and 0.625%) next to a negative control. Furthermore, an additional treatment level of 0.750% was stored at 15.7°C. At day zero samples of the sardines were taken for Total Volatile Nitrogen (TVN) analysis prior to distribution into the storage containers.

TVN is often used as a criterion for the freshness of fish raw material (Haaland and Njaa, 1987). This value in the fish before processing is known as the most important quality criteria for raw industrial fish. The main constituents of TVN are trimethylamine and ammonia. The amount increases with time of storage in the unfrozen

Fish for industrial purpose or human consumption

Table 1: Time in hours until the 80mg TVN limit per 100 g sardines is reached at different temperatures with or without acid-treatment

	Concentration of potassium formate blend (FishForm® Plus) in %					
Temperature	0	0.25	0.375	0.5	0.625	0.75
9.8°C	72	120	144	144	192	n.d.
15.7°C	48	48	72	72	120	120

n.d. – not determined

state. Trimethylamine originates from bacterial decomposition and the presence in fish is therefore taken as an indication for bacterial growth, while the ammonia comes from break down of amino acids – thus reducing the quality of the available protein. Levels of 40 to 80mg TVN per 100g fish mass are regarded by the industry as limits for a good quality fish meal.

A delay in TVN

At both temperatures the pH levels of the treated sardines were lower than the control. The lowest pH was shown with the highest concentration of preservative. Within treatments, once stabilised there were no significant changes in the pH-level. The overall TVN level at the start of the experiment was 36.2 mg /100g fish. Values in the control increased rapidly and exceeded 80mg after 72 hours at 9.8°C storage temperature, while they reached the same level after 48 hours at 15.7°C.

At both temperatures the fast TVN development was delayed by the addition of the potassium diformate blend. This delay was however dosage dependent. At 9.8°C it took 120 hours to exceed 80 mg TVN per 100g fish material with 0.25%, 144 hours with 0.375% and 0.5%, while it took 192 hours to reach the limit of 80mg TVN if the fish was stored with 0.625% of the potassium diformate blend. Comparable time periods at 15.7°C were 48 h, 72 h, 72 h and 120 h (Table 1).

The results clearly indicate that the addition of a potassium diformate blend result in an extension of the storage period of fish, even under high temperatures. The storage period for sardines added 0.625% potassium diformate blend or higher was 2.5 times longer than that for the control at both temperatures. This was either 8 or 5 days for storage temperatures of around 10°C and 16°C respectively.

In cases where the storage of the trash fish or by-catch is done without any cooling at high temperatures in tropical Asia, it seems necessary to increase the recommended dosage to at least 1%. This seems to be a very important finding, since many fish landing places in rural areas of South East Asia are often lacking appropriate cooling devices or possibilities.

Enriched fishmeal

Finally, several studies also showed the performance enhancing effects of Fishform® Plus treated fish meal on fish. Such a study for instance was carried out with Atlantic salmon *Salmo salar* (Christiansen and Lückstädt, 2008). Salmon with a mean weight of 270g were randomly distributed between 9 fibreglass tanks (1m^3), with 50 fish in each tank. The tanks were supplied with 20 litres/min of sea water (30-32‰) for a total experimental period of 126 days. Fish fed pelleted diets containing Fishform® Plus (potassium diformate - KDF) enriched fishmeal had a numerically increased body weight gain (17% and 19% for 0.8% and 1.4% KDF inclusion rate respectively). The SGR of fish fed 1.4% KDF tended to be higher (P=0.055) compared to the negative control. Furthermore, both groups treated with KDF had a significantly better feed conversion ratio (P<0.05). It was seen as well, that the uniformity of fish fed KDF treated fishmeal was improved.

Thus, the inclusion of Fishform® Plus to raw fish is not only to improve the quality of fishmeal, but also leads to better growth performance in fish.

Literature is available upon request from the author

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New book announcement

FAO Yearbook. Fishery and Aquaculture Statistics 2006

Rome, 2008, 80 pp. + CD-ROM, A4, Hb, Trilingual (En/Fr/Es)
ISBN 978-92-5-006067-5/ISSN 2070-6057/FAO109835

The FAO Yearbook of Fishery and Aquaculture Statistics contains all the most updated data on capture production, aquaculture production and commodities. In this new presentation, the complete yearbook package for each of these categories – all the key information and statistical tables – are contained for the first time on one CD-ROM, inserted in a booklet that includes general notes, concepts and classifications, and summary tables as well as a pull-out map of FAO major fishing areas. From the CD-ROM, you can download, consult, share and store all the data previously provided in print only. This volume presents world fishery statistics for recent years ending in 2006. The book priced at USD 150.00 can be ordered on-line from Earthprint: More information: Sales and Marketing, FAO Communication Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy. On-line catalogue: http://www.fao.org/icatalog/inter-e.htm

A new generation of natural aquafeed additives

By Hervé Lucien-Brun

How natural essential oils promote growth and health of catfish is explained

The intensification of aqua farms to meet the increasing demand of consumers has led to the use of antibiotics to improve survival and growth of fish. Secondary effects of antibiotics usage and food safety meant that these chemicals are no longer allowed in the production process. Alternatives for disease prevention are required to maintain production volumes of fish, such as the catfish in Vietnam.

A new generation of fully natural aquafeed additives based on the synergic effect of natural products association; essential oils and plant extracts have been developed by Aqua Tecna, France. These are an association of well selected ingredients which increase the appetite, stimulate the digestive functions and facilitate absorption of the nutriments. The antimicrobial and antifungal activities balances and improves the gut flora for a better intestinal environment.

Properties of essential oils

An essential oil is a concentrated, hydrophobic liquid containing volatile aroma compounds from plants. Contrary to the name, these are not necessarily oily and they must not be confused with essential fatty acids. These oils are "essential" in the sense that they carry distinctive scent, or essence, of the plant. It is a mixture of various molecules, including in particular terpenes (non-aromatic hydrocarbons) and oxygenates (alcohols, aldehydes, ketones).

In ancient Egypt, hieroglyphs papyrus has described the use of fine oils and perfumes to cure diseases. Many common essential oils have medicinal properties that have been applied in medicine since ancient times and are still widely used today for example; many essential oils have antiseptic or digestive properties. The bactericidal activity of essential oils on pathogenic strains is know and described in numerous publications (Table 1).

The essential oils effect bacteria are several ways. They interfere with the cell wall by combination with peptidoglycan. They also interfere with the lipid bilayer (LPS), block ionic transport combine with cytoplasmic proteins or inhibit the ATP production.

There are two types of bactericidal action:

- Essential oils penetrate the bacteria by membrane transport. They will act on the respiratory chain, the transport of electrons and block the phosphorylation reaction of the bacteria causing its destruction.
- The essential oils cause the loss of selective permeability of cell membranes of bacteria by changing its physical properties (breakdown of sugars, lipo-polysaccharides and phospholipids), which induces the disruption of the cell wall and the loss of bacterial content.

Properties of plant extracts

The plant extracts provide mainly Fructo-Oligo-Saccharides (FOS) with the following properties:

- Stimulate beneficial intestinal bacteria
- Reduce the infectious diseases related pathogens such as *Salmonella spp., Campylobacter spp.*
- Facilitate the intestinal absorption of calcium and iron
- Improve lipid homeostasis which is the ability to maintain balance operating despite external constraints. (Claude Bernard,a famous physiologist said that: "homeostasis is the dynamic equilibrium that keeps us alive.")

Feed additives for the pangasius catfish

In 2007, Professor Le Thanh Hung and his colleague Vo Thi Thanh Binh, from Nong Lam University, Ho Chi Minh City, Vietnam, carried out an experiment on Pangasius catfish. The aim was to determine the effects of an essential oil (Aquaviance) on growth and health of fish.

Experimental details

The trial set up had 12 outdoor composite tanks for 3 treatments with four replicate tanks each. The stocking density was 100 fish per tank for the grow-out period. The trial started in mid November 2007 and was completed in mid January 2008 for a culture period of 8 weeks.

Some 2,000 fingerlings of *Pangasius hypophthalmus* (average weight, 6-10 g) were used for the trials. Fish were acclimatised to pellet feed for at least 15 days before starting experiment, weighed and were

Experimental facilities

Table 1

MIC (ppm)	*B. subtilis*	*C. pertringens*	*C. botulinum*	*E. faecalis*	*E. coli*	Source
Origanum	625	500-800	100	2000-4000	250-1200	-Sara Burt Int. J. Food Microbio. 94 (2004)
Bud clove	800	100			400-2500	
Cinnamon	200-625		100	1400	1250	-Kalemba et al.Cur Med. Chem Vol 10, No 10 (2003)
Thyme				108-4000	108-4000	
Sage					3500-5000	-Sacchetti et al. J.Agric Food Chem. 52 (2004)
Eucalyptus					1660	
Yarrow	2500	4500			8000	
Artemisia	1000				3000	-Mehmet et al. J. Ethnopharmocology 83 (2002)
Achillea teretifolia		280				

Table 1: Growth performance and survival rates of fish after 56 days feeding with three different diets

Treatment	Initial weight (g)	Final Weight (g)	SGR (%.day-1)	Survival rates after 56 day feeding (%)
Control	13.04 a	28.24 a	1.35 a	72.50 a
0.1% *	13.05 a	33.55 ab	1.68 ab	79.00 a
0.2% *	13.00 a	37.60 b	1.88 b	80.25 a

Different letters in the same column denote significant differences ($P < 0.05$)
SGR=(W2-W1/T2-T1)x100%/day * Top dressing of 0.1% (A1: 1 kg/tonne of feed) and 0.2% (A2: 2 kg/tonne of feed) of Aquaviance

randomly distributed into the tanks. To minimize stress, MS222 was used to anaesthetize the fish.

Initially, water was changed every two days and later this was increased at week 4 to daily. Dissolved oxygen (DO) and pH were monitored twice a week. Total ammonia was also monitored weekly. Temperature was recorded twice a week at 0600h and 1400h.

In the experiment, a commercial extruded feed with 26% crude protein was used as the control (A0). The feed additive was added to the extruded feed as top dressing with two doses: 0.1% (A1: 1 kg/tonne of feed) and 0.2% (A2: 2 kg/tonne of feed). There were four replicates. Fish was fed twice daily to satiation. The feed intake in each tank was recorded every week. Excess feed was collected after 2 hours of feeding and dried to measure feed intake.

At the end of the trial, fish in each tank were weighed. Growth performances were monitored using specific growth rates (SGR). In the study, feed efficiency utilisation was monitored using the feed conversion ratio (FCR) and protein efficiency ratio (PER). All collected data (SGR, FCR) were analysed using SPSS software. The Duncan test was used to compare the significant differences in fish fed the three diets.

In order to evaluate the effect of the feed additive on fish health, fish were challenged with the bacteria *Edwardsiella ictaluri* at the end of the trial. This is a common bacterium causing severe losses in Pangasius catfish culture in the Mekong delta. After 8 weeks of feeding, 30 fish from each group were transferred to an aquarium (0.4x0.6x0.6m) in the pathogen incubation facility. A bacterial analysis was performed before the beginning of the challenge test to ensure that fish were not infected by bacteria.

Fish were injected with a solution of bacteria *Edwardsiella ictaluri* at a dosage 10^6 cells ml^{-1}. The survival in the aquarium was observed at 1, 2 and 5 days after injection. Clinical signs in the kidney, spleen and liver in fish in 12 tanks were observed and described in order to evaluate the effect of the product on fish health.

Growth performance

Results in Table 1 indicated that fish growth improved when fed with pellets supplemented with the feed additive. The final weight and specific growth rate (SGR), respectively, of 0.1% treatment was higher than the control treatment but was not significantly different. Meanwhile the growth performance of 0.2% treatment was significantly different than the control group which indicated that the supplementation of the products at 0.2% significantly improved growth of pangasius catfish. As the product is an essential oil stimulating internal enzyme excretion in digestive tract, this may account for the improvement of fish growth in Table 1.

Table 2- Feed intake and feed conversion ratio (FCR) of three diets after 56 days of feeding

Treatment	Feed intake (g/fish)	FCR
Control	34.01 a	2.46 a
0.1% *	35.73 a	1.75 ab
0.2% *	37.36 a	1.55 b

Different letters in the same column denote significant differences ($P < 0.05$).
FCR = Total feed intake/ Fish growth (W2-W1)
*See table 1

Results in table 2 also showed that feed intake increased with supplementation of the product. However, there was no significant difference among treatments.

FCR

The feed conversion ratio (FCR) of three diets (control, 0.1% and 0.2% treatment) decreased with the supplementation of the feed additive. In the experiment, the three FCRs were relatively high when compared to the FCR in the production in fish ponds which vary from 1.5 to 1.6. The reason for this was the low winter temperature during the culture period (26-27ºC) which was not conducive to fish growth. The improved FCR for fish fed the 0.2% treatment (1.55) in comparison with the control treatment (2.46) indicated that supplementation for the catfish diets had improved the feed utilisation. Feed intake in three treatments was not significantly different.

Challenge tests

The survival rates of fish are presented in Figure 1. There is high variance in survival rates among treatment even though four replicates were used in the experiment. Parameters to evaluate the fish health status such as macrophage index and lysozyme were not used in this experiment. Nevertheless it is clear that from the challenge data, that 0.2% supplementation enhanced the fish health.

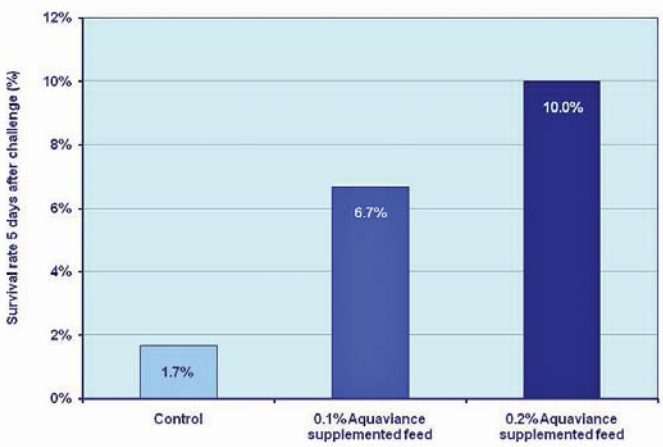

Figure 1- Survival of fish after 5-day challenge with Edwardsiella ictaluri.

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Diseases in scampi farming in India

By Partha Bandyopadhyay and Sanjeev Bhambi

The immense scope for scampi farming in India is being threatened by diseases. A lack of awareness on culture management techniques and poor quality seed is being blamed.

In India, a spurt in freshwater prawn farming activities can be seen in recent years. The giant freshwater prawn (*Macrobrachium rosenbergii* de Man, 1879), popularly called the scampi in India, is an important commercial species. It is a source of food supply as well as a valuable export commodity. This freshwater prawn is distributed mainly in the Eastern and South-eastern regions, where environmental conditions are most favourable for its growth. Increasing demand of this species in the domestic and export markets has resulted in farmers enthusiastically culturing the scampi at high stocking densities and intensive feeding. Culture has also expanded to rice fields.

India produced 54,230 tonnes of the popular freshwater prawn variety, standing at third position after China and Vietnam, which produced 128,338 and 28,000 tonnes respectively in 2004 - 05. But the production totalled 40,000 tonnes in 2005-2006 and this declined to 20,000 tonnes in 2007-2008. (Thampi Sam Raj, 2008).

Scampi culture has been extended to the coastal areas of India. As black tiger shrimp culture faced a variety of problems, the focus shifted to the scampi. Efforts are now being made by the Marine Products Export Development Authority (MPEDA) which has identified it as a thrust area for increasing production of high-end value-added products and creating employment opportunities.

Diseases outbreaks

However, during the last season (March – November 2008), production has been declining due to disease outbreaks. Industry representatives blame this on the lack of good quality post larvae. Unable to handle disease outbreaks, farmers are shifting to agriculture and some in Southeast of India have shifted to paddy or sugarcane farming. Whilst those who opted for paddy cultivation may return to scampi culture after a few months when the situation improves, those who have opted for sugarcane cultivation will have their fields unavailable for at least three years.

The main reason is that farmers are not able to source disease-free post larvae from hatcheries. Despite the obvious advantages with scampi farming, insufficient effort has been put into developing scientific culture systems or domesticating brood stock (Figure 1) for quality post larvae production. Currently, brood stock are often selected from culture ponds of farmers which are often subjected to stressful conditions and may not be the best source of healthy seed stock.

Figure 1. Different stages of quality gravid female of scampi

Figure 2. Scampi with bacterial infection in antenna

Figure 3. Sessilinasis in scampi infected with Zoothamnium sp.

It has been reported that viral pathogens cause severe losses to the scampi culture sector and mortality due to the viral pathogen, *Macrobrachium rosenbergii Nodavirus* (MrNV) can reach 100% within two or three days in the hatcheries and nursery ponds. The loss has been estimated at several millions of dollars.

Recently, a new disease with unusual clinical signs has been reported in the major scampi culture area in Nellore district, Andhra Pradesh, which has been named as appendage deformity syndrome (ADS Figure 2). ADS has affected more than 80% of culture ponds in Nellore district. It has reduced the culture area to about 20,000 acres (8,813 ha) from more than one lakh acres (100,000 acres/44,069 ha). Prawns infected by ADS have bent or deformed rostrum, antennae cut beaded or corrugated appearance of antennules and which are more prone to breakage, corrugated appearance of the carapace, poor growth and varying mortality rates. Scampi can be infected after 1-2 months

Figure 4. Sessilinasis in scampi with infected gills

Figure 5. Black spot infection in scampi

Figure 6. Blue shell disease of scampi

Figure 7. Blue shell with bacterial infection of in scampi

of stocking of juveniles in the culture ponds and infection is more pronounced during 4–5 months of culture. This type of disease or clinical signs has not been reported in any other country. The area has also recorded poor rainfall during the last three years.

In the eastern part of the country, mainly in West Bengal, White tail disease (WTD) has affected scampi. Two different sized particles, both developing in the cytoplasm of target cells, are found associated with diseased animals. WTD is responsible for mortalities in hatchery-reared scampi and causes significant economic losses. The disease was first reported in the eastern part and subsequently in southern parts of the India.

Beside this, is a very common and harmful disease, *Sessilinasis* (Figure 3) caused by a number of pathogens including *Zoothamnium spp., Vorticella spp., Carchesium spp, Epistylis spp, Gastronauta spp.* and *Intranstylum palaemoni* all of which belong to Peritrichia family. *Sessilinasis* and scampi are symbionts. Once infected, cotton wool-like growths appear and attach to the gill and body surface (Figure 4). The gills turn black and rotten which reduces its respiration and excretory capacity and making feeding difficult. This disease was more serious during the last rainy season. Losses are huge from bad quality harvests.

Other diseases encountered were 'black spot' (Figure 5) and 'blue shell disease' (Figure 6) which are caused by bacteria (Figure 7) and blue green algae that break down the outer skeleton. Usually it follows physical damage and can be avoided by careful handling. At other times, algae or insect eggs may be present on the shell. This condition is not a disease, but rather an indication of slow growth and is eliminated when the scampi moults.

Conclusion

The limitations in supply of quality seed, the intensive farming methods used and the lack of awareness of better management practices among farmers have made it difficult for the scampi farming industry to realise its full potential. What are required are proper farm and water quality management and intensive attention to the health of the animal and the development of Specific Pathogen Free (SPF) stock. Only then can the scampi become a major food commodity and source of income for India's aquaculture industry.

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World Aquaculture 2009

'Remembering the blue revolution to feed the world' in Veracruz, Mexico

World Aquaculture 2009 will take place in Veracruz, Mexico. This is a return to the Americas after the last conference and trade show in Busan Korea. It will be for participants to realize that the aquaculture industry offers a great opportunity to develop a new "Blue Revolution" to feed the world. Main sponsors for the meeting conference and trade show are Novus Aqua, Intervet for the health session and FIFA and Instituto de Pesca. World Aquaculture 2009 will take place from 25-29 May.

The Venue

The new world class World Trade Center in Veracruz

The City

Veracruz is the main port and the main tourist destination beach within Mexico. Located on the Gulf of Mexico, the State of Veracruz boosts a variety of landscapes, from jungles and mighty peaks to coasts and beaches. Veracruz is known for its friendly people, its quintessential Mexican folklore, ecotourism, amazing pre-Hispanic cities and pyramids and for its lovely beaches. For More Information: World Aquaculture 2009, Conference Manager, P.O. Box 2302 Valley Center, Ca 92082 USA. Tel: +1 760 751 5005 Fax: +1 760 751 5003
Email: **worldaqua@aol.com,** Web: **www.was.org**

Special sessions

Industry Session Program

This will comprise of presentation by worldwide consultants, successful farmers, recognized technicians, and professionals of the aquaculture industry in México, Latin America and the rest of the world. They will be presenting critical information on the main production topics in the shrimp, tilapia, trout, catfish, marine finfish, mollusk culture industries as well as many of the most important aquaculture industries around the world. It will run from Tuesday 26 to Thursday 28 May, 2009 in two conference rooms.

This program is designed for owners, investors, farmers, general managers of any type of aquaculture enterprise, consultants, advisors, technicians and specialized people from financial institutions, government agencies, insurance companies and economists. The final program of the Industry Session will be published soon on the web page of the event at www.was.org.

BFT session

A special session on bio flocs technology (BFT) will be held and will cover new research and farm experience from Belgium, India, Indonesia, Israel, Mexico, United States and the Virgin Islands.
For more information, contact: session coordinator **Yoram Avnimelech (agyoram@tx.technion.ac.il).**

Farm tours

Several options are proposed such as the combination visit to the El Colibri Farm (tilapia, crocodile, deer and pheasant) and Agroindustrias Pargo (tilapia) farms and the Cempoala Archeological site. The trout farm visit will cover the Matzinga Trout Farm and Los Manantiales Farm in the Orizaba Region. There is also a visit to a shrimp farm in Veracruz near Alvarado city. The touristic tour will be to the Veracruz aquarium which houses Latin America's largest aquarium.

Aquaculture trade in Veracruz

In February, organizers reported 233 booths at the show with 89 companies. The majority of them are companies within Latin America. The main Asian presence at the show is from Taiwan where the Fish Breeding Association has 10 booths under its umbrella. The aim is to promote aquaculture from Taiwan to Latin America. Information on the FBA and selected companies are detailed in the box.

Launches GreenStim Roti and GreenStim Marine at World Aquaculture 09

The GreenStim products are a true innovation on the classical green water technique. They provide aquaculture producers with the key to optimal results in the farms. GreenStim Marine is the green water solution for marine larvae. GreenStim Roti is an innovative rotifer diet.

GreenStim Marine is a natural mix of micro-algae creating an optimal green water environment in the marine larval tanks. Due to its higher nutritional value the GreenStim green water environment results in higher survival, better and faster growth towards weaning stages as well as a reduced use of expensive live feeds. The GreenStim Marine green water environment also results in pathogen inhibition, stress reduction and an improved development of the swim bladder.

GreenStim Roti is an innovative rotifer culture diet based on a specific blend of various microalgae. This product is a complete rotifer diet suitable for all tank systems. Depending on the requirements of the moment GreenStim Roti brings a rotifer culture from low to high densities over a short time and maintains it at high densities for longer periods. The micro-algal mix ensures a stable rotifer production with high nutritional value and Vibrio spp. inhibition in the rotifer tanks.

The launch at the exhibition in Veracruz will be highlighted during the SBAE workshop "Micro-Algae in the Aquaculture Industry" on Wednesday May 27th at 17.30h in the Olmeca 7 room. SBAE offers a free invitation to the visitors on Booth 180. More information: Email: sales@sbae-industries.com Web: www.sbae-industries.com

Meeting customers in Mexico.

Ocialis will have a booth under its Mexican brand MaltaCleyton ready to welcome its customers in Mexico. MaltaCleyton company joined Ocialis in 2008 and brought to the company its experience in vannamei shrimp and tilapia feeding. This acquisition followed the sale by Cargill of the business (under the brand Purina) in Brazil to Ocialis. The company is now the leader in Latin America for tropical fish and shrimp feeding. The Ocialis strategy is to propose to its partner the latest innovation developed at its local R&D centres. In Brazil it has a tilapia farm dedicated to research and a specific contract with one of the most well-known research stations on vannamei shrimp. In Mexico, it has its own R&D farm on shrimp. The team at the booth is looking forward to welcome visitors to the trade show and to show the latest innovations of the group.

FBA in Veracruz

The main booth #100 will feature **Fish Breeding Association Taiwan (FBA)**. Members of FBA comprise industry involved in fish breeding. The association integrates the international marketing efforts of member companies. Its role is also to strengthen the exchange of experiences among members and industry, locally and internationally. It also promotes and conducts research in aspects of fish breeding and culture and develops new breeds with good market potential. (Email: taiwan.fba@msa.hinet.net Web: www.fish.org.tw).

The companies associated with feeds include **Taiwan's Hung Kuo Industrial Co., Ltd.** (Booth 86), an established feed manufacturer and supplier since 1984. At the show, the company will promote its 'Lucky Star' encapsulated larval feed for various marine fish/shrimp species (Email: info@luckystarfeed.net Web: www.luckystarfeed.net).

Hai-Yu Enterprise Co., Ltd (Booth 101) is the first commercial manufacturer of shrimp larvae feed and grow out feed in Taiwan. Jeffrey Liu will showcase the IY MIAO PAO range of hatchery feeds for shrimp and fish and micro-encapsulated feed. It will also have artificial rotifer, artemia, flake feed, black granule feed, powder and liquid feed and Nano vitamine, grow-out feed etc (Email: haiyultd@yahoo.com.tw, service@haiyu.com.tw; Web: www.haiyu.com.tw). One of Taiwan's leading manufacturer of pellet mill, extruder, hammer mill and mixer for aqua feed mills is **Idah Machinery Co Ltd**, (Booth 87). The company has more than 300 success turnkey projects in Asia. (Email: idah.taipei@msa.hinet.net Web: www.idah.com)

Nice Garden Industrial Co.Ltd (Booth #87) has a feed premix production plant in Tainan. At the show it will be promoting products ranging from ingredients & additives, larval feeds and feed supplements, premix/basemix, probiotics to aquaculture equipment such as paddlewheels aerator, pump, fan/root blowers, etc. (Jerry Hsun, Email: jerry@nicegarden.com.tw Web: www.nicegarden.com.tw)

In shrimp diagnostics, **GeneReach Biotechnology Corporation** (Booth 99) which has been focusing on research of viruses in aquaculture since its establishment in 1997,has launched the semi-quantitative IQ2000 PCR test kits. Later it developed a completely new shrimp virus detection kit in 2006 to simplify the whole operation process for the farmer. At the WAS 2008 in Busan, Korea, it launched the shrimp virus detection kit - i-screen WSSV and TSV which drew the attention of shrimp farmers. At this show, Simon Chung will display the i-screen WSSV, TSV and IHHNV detection kits for farmers. (Email: sales@i-screen.com.tw, Web: www.i-screen.com.tw)

Aova Thai

US based Aova Technologies, Inc. has established Aova Thai, Ltd in January 2009. Aova is an agricultural biotechnology company formed in 2001 to commercialize a patented non-pathogen specific immunoglobulin product, BIG FISH. The company's marketing and business development team recently visited Bangkok to register the product with the Thai Department of Livestock Division as well as to establish the company's Thailand division. During their visit, they met with potential distributors, producers, and researchers at Chulalongkorn University regarding further trial interactions for this all-natural micro feed ingredient.

"We are excited to be moving forward with our efforts to introduce this specialized immunoglobulin for improved FCR and health in challenged environments, into the Thai marketplace. With over 1.5 million tonnes of shrimp and fish feed produced annually, Thailand was an obvious choice for Aova. We look forward to helping producers battle increasing feed costs and decreasing survival in challenged environments," said Vice President of Sales and Marketing, Kyle Montgomery.

"Product use, in simple and complex diets, has shown consistent performance and health improvements regardless of antibiotic or vaccine usage. By using Big Fish, producers and feed ingredient manufacturers gain with the use of natural products that promote better survival and health to improve their bottom line".

The company stated that they have continued to see excellent results in aquaculture. Several commercial aquaculture trials in Thailand testing a variety of species have been carried out. The trials showed very promising results. Vietnamese catfish responded to the Big Fish additive with a 15% improvement in weight gain and a feed conversion ratio improvement of 21%. In addition, survival rate was enhanced by 46%. Trials with the tiger grouper showed a survival rate of 82% and an increase in biomass of 118%. Weight gain increased by 21% and feed conversion ratio improved by 32%. Tilapia trials included a *Streptococcus agaliactiae* challenge. Tilapia fed the Big Fish diet showed an improved survival of 187% and an 85% improvement in biomass.

While 2009 may be challenging, Aova Technologies is excited about new opportunities in Asia and throughout the global market place. They plan on participating in several trade show events around the world this year. In addition to the February Aquaculture America show in Seattle, Washington, Aova Technologies will be at the VIV Asia show in Bangkok, Thailand in March and at World Aquaculture 2009 in Veracruz, Mexico.
More information: Email: kyle@aovatech.com

Dr. Serge Corneillie

Mr. Matthew Smith

Appointments

New General Managers

Global animal health and nutrition company, Alltech has appointed **Dr. Serge Corneillie** as general manager for Alltech Japan and Mr. Matthew Smith as general Manager of Alltech New Zealand. Serge, a Belgian has been working in the Japanese aquaculture industry for the past 15 years. In addition to his management role, he will also provide technical support to Alltech's Aquaculture division in Asia-Pacific. He has BSc, an MSc in Science Biology (fish endocrinology) and a PhD (1989) in the area of fish ecology and aquaculture from the Catholic University of Leuven, Belgium. Prior to joining Alltech, Serge worked with Marine Harvest where he held a number of different roles in sales, R&D, supply chain management and operations in France, South Korea and Japan. In 2007, he was appointed general manager of Marine Harvest Japan (Yellowtail Division), where he was responsible for the production of 4,000 tonnes and the sales of 5,000 tonnes of yellowtail fish.

Matthew Smith has been with Alltech for ten years and has worked extensively throughout Asia, Europe and North America. In his new role, Matthew is responsible for developing the use of Alltech's natural nutritional supplements and production solutions throughout New Zealand.
More information: www.alltech.com

A five year registration in China for FORMI

German based ADDCON offers a range of silage additives, feed additives, preservatives and also a range of aquaculture products to the industry. Formi, the first natural growth promoter which has been registered in the EU has been granted a five year registration in China. Formi as well as KOFASIL silage additives are the key focus of Addcon in China for the time being. Step by step, the full product range of Addcon shall be launched in China too. Addcon Asia was set up in 2007 and since then it has built up a team of experts in China. From its offices in Dalian and Hongkong, the company provides service to customers and distributors in China and for the rest of Asia. Recently, offices in Thailand and in the Philippines have been opened. All products of Addcon are based on its "Green Chemistry" philosophy, i.e. biodegradable and have minimal impact on the environment.
More information: info@addcon.com; www.addcon.net

Bubble Bead and PolyGeyser® Filters

Originally developed by Dr Ronald F. Malone and designed specifically to meet the water reconditioning needs in aquaculture, these filters were introduced 20 years ago. US based International Filter Solutions, Inc. (IFS) is one of two companies licensed to manufacture and sell this bead filtration technology. These now come in a wide range of sizes for every application. As these bead filters work at two levels, mechanical and biological they are effective in removing nitrogenous and solid waste. This process within one filter is called "bioclarification". Its efficiency according to IFS is because of its ability to work with low/medium head pumps (<15 psi) or airlifts, water conservative backwash, low maintenance, and media that never needs replacement. The bead filters can be upgraded to Nitrotech™ for better biological performance.

According to IFS, the Polygeyser® is the revolutionary filter for aquatic systems. The patented design is ideal for systems that cannot be maintained daily or for high volume systems with limited space for filtration. It comes complete with Nitrotech™ media which has been proven to increase load filtering capabilities by 100%. These self-washing floating bead filters recycles its own backwash waters and eliminates the need for frequent operator attention. The backwash frequency is determined by air flow rate and the operator only needs to remove the concentrated sludge periodically.

In his presentation at Australasian Aquaculture 2008 in Brisbane, Australia, Dr Ronald F. Malone, Department of Civil and Environmental Engineering, Louisiana State University, USA explained that these backwashing characteristics allow the bead bed to be operated with a high frequency backwash (8-24 times per day) allowing the media bed to remain clean and porous. Airlifting water to or from the filter provides for water circulation, aeration, and gas stripping in certain models.

"Sizing of all system components is based upon the intended use (brood stock, fingerling, grow-out). Filter sizing is generically conducted using conservative guidelines ranging from 6-24 kg feed/ m^3-day for feed (organic) loading. The water recirculation rate to provide adequate oxygen delivery to the submerged bead bed has been determined to be between 56-83 lpm/kg feed -day. Airlift diameters are sized to provide a water velocity in the lift tube of 0.3 m/sec while the amount of air required are set by a gas/liquid ratio of 2:1", added Dr. Malone.
More information: email: info@ifsolutions.us

Shoreline Polychaete Farms has acquired Seabait

In July 2008, Shoreline Polychaete Farms LLP, a privately-owned UK company has acquired the business and assets of Seabait Ltd. It will continue to supply marine polychaetes of the highest quality for use in aquaculture worldwide. The new owners have extensive interests in aquaculture in the UK and an established reputation for their commitment to quality and sustainability. Under this new management, Dr Stephen Craig, Director of Research and Development and Mr Jonathan Land, Director of Production, Shoreline is investing in the expansion of production and the continued development of patented advances in this field.

The company listed the unique features of their marine polychaete worms in aquaculture as patented techniques to produce fat-rich king ragworm (*Nereis virens*) (about 17% dry weight fat and twice that of other known European cultured worms), suitable for a broad range of penaeids and fish; risk free with Specific Pathogen-free polychaetes and biosecurity ensured as worms are independently tested for WSSV, TSV, YHV, IHHNV, BP and MBV. The products are ideal in maturation diets for shrimp and finfish broodstock. Research and commercial fish hatcheries now use Shoreline ragworms routinely in their broodstock feeds. It added that the use of non-GM, terrestrial crop-based feeds containing very low levels of fish meal and fish oil (<2%) and predominantly consisting of wheat, maize and soya bean gives both quality and sustainability.
More information: Email: www.shorelinepolychaetes.com

The World Nutrition Forum 2010 in Salzburg

Biomin has announced that the bi-annual congress, World Nutrition Forum will be held from October 13 to 16 in Salzburg, Austria. More than 600 of the top industry decision-makers, consultants, executives and veterinary nutritionists from all over the world will attend this invitation-only congress to discuss the future of animal nutrition.

The main aim of this bi-annual forum is to present and discuss the scientific progress in healthy animal nutrition and performance. Participants of academic centres and corporations will deal with various aspects of the feed additive business in presentations and panel discussions. This World Nutrition Forum 2010 will be completed by an appealing social program on October 16th in the scenic city Salzburg, known to be W.A. Mozart's birthplace and the film location of the popular musical "The Sound of Music".
More information: www.worldnutritionforum.info.

Original aspirator aerator

Aeration Industries International, USA, the global leader in aeration technology introduced to the world shrimp culture industry, the famous Aire-O_2® aspirator aerator some 30 years ago. This has been a leader in aeration technology in terms of dispersion and mixing of water and water stratification when compared with copies of the aspirator aerator and paddle wheel systems, said Michael Ramirez, Regional Sales Manager at its booth during Australasian Aquaculture in Brisbane. "The transfer of oxygen increases with salinity. This aspirator is ideal for zero exchange systems and produces bubbles less than 2.2mm in diameter to ensure optimum oxygen transfer"'.

The Aire-O_2® series II operates by creating a partial vacuum under the water, drawing air through the shaft and dispersing it into the water in a horizontal direction. As the propeller rotates, it induces a flow of atmospheric air through the air intake ports on the shaft, located above the water surface. This air is then drawn through the shaft, past the propeller and exits in a high velocity stream of fine bubbles as it is diffused into the water. This gives a large amount of oxygen while providing a strong horizontal mixing pattern for oxygen dispersal. The capacity range is from 1, 2, 3, 5 and 7.5 hp. The angle of the aerator can be adjusted for the various species, ie 25 º for the shrimp and 35º for the catfish and tilapia.

The comparison of this to the paddle wheel aerators was done in a vannamei shrimp farm, Aquicola Boca Co in Mexico. The usual farming protocol was carried out in ponds with three configurations: ponds with only paddle wheels, ponds with only Aire-O_2 and ponds with both types. There was no significant difference with respect to growth and survival. The production was 4,000 lbs (1,818kg) of 23-30g shrimp in the 14.4 and 19.2 acres (5.82-7.77ha) ponds with 25-30 shrimp/m^2. Each pond had 3-5 hp aeration/acre (1.2-2hp/ha). Average growth was 1.12 to 1.28g/week and FCR was 1.7 to 1.9. Survival was 80-90% and no chronic diseases were identified.

"Although results were not significantly different, technicians at the farm noted advantages such as the strength of the machine and that the Aire-O_2 required less maintenance. In contrast, paddle wheel aerators came apart during strong winds and require twice the time for routine maintenance", added Michael.
More information: Email: cheric@aireo2.com Web: www.aireo2.com

Bringing sensitivity of PCR to the pond

DuPont Animal Health Solutions (DAHS) announced DuPont™ Virkon Aquatic Biosecurity Monitoring System which will bring shrimp-pathogen detection straight to the farm. This is an integrated, easy-to-use solution for pond-site shrimp pathogen diagnostic testing that detects viruses impacting shrimp health and farm productivity. Early stage detection with high sensitivity combined with an easy-to-use format in the hands of the farmer allows for rapid feedback and for pond-site decision making. This is a next generation diagnostic tool for on-site disease diagnostic, biosecurity monitoring and productivity improvements for farmers and producers.

According to Paolo Barbieri, global business director, Clean & Disinfect, this will give shrimp farmers a faster and improved solution for early White Spot Syndrome Virus (WSSV) detection in their ponds. It can help shrimp farmers monitor and improve biosecurity measures. This affordable and cost-effective product ensures shrimp farmers control of the grow-out operation. It also delivers the fastest test results among PCR methods and its test sensitivity is superior to other field methods such as immunoassays. The test performance is also superior to typical lab methods such as one-step Polymerase Chain Reaction (PCR) currently used in the industry. The test detects viruses at an early development stage which allows for meaningful intervention, offering farmers a faster response to improve and proactively guide grow-out management. Depending on sample size, test results are obtained within two hours versus days using traditional methods.

"Thailand is the first country to launch this test kit. It was developed by DuPont in close contact with its customers to meet the needs of the shrimp industry globally," said Somchai Laohverapanich, managing director of DuPont Thailand. "Since Thailand is one of the world's leading producers and exporters of shrimp products, we see that this new product line will benefit the economic health and overall sustainability of the shrimp manufacturing value chain".

Rapid vibrio detection

The new BAX® system assay from DuPont Qualicon can be used by seafood processors and government laboratories to detect Vibrio in less than 24 hours. The Bax® system Real-Time PCR Assay for Vibrio detects even low levels of three distinct species- *V. cholerae, V. parahaemolyticus*, and *V. vulnificus* from the same sample. Tested on shrimp, tuna, oysters, scallops and crab, the BAX® system delivers reliable, differentiated results in less than one day and its performance is equivalent to or better than the reference culture method, which typically takes three to five days.

"DuPont Qualicon is constantly finding ways to make food testing faster, more accurate and more convenient," said Michael Chong, Asia Pacific business manager. "A 20-hour test for Vibrio will certainly improve operational efficiencies for seafood companies. In addition it will allow them to make product release decisions quickly and with confidence."

The automated system uses leading-edge technology, including polymerase chain reaction (PCR) assays, tablet reagents and optimized media to also detect Salmonella, *Listeria monocytogenes*, E. coli O157:H7, *Enterobacter sakazakii, Campylobacter, Staphylococcus aureus*, and yeast and mold. With certifications and regulatory approvals in the Americas, Asia and Europe, the system is recognized globally as the most advanced pathogen testing system available to food companies.
More information: www.qualicon.com.

First tilapia, catfish farms certified to BAP standards

With a growing list of over 200 aquaculture facilities certified to the Best Aquaculture Practices (BAP) standards around the world, GAA announced in January that two facilities culturing and processing tilapia and channel catfish have been certified. Elite Seafood's operation in Beihai, Guangxi Province, China, became the first tilapia farm to complete BAP certification. A leader in tilapia farming, Elite Seafood raises its fish in cages. The tilapia are processed in the company's state-of-the-art Beihai Beilian Frozen Foods Industry plant, which is also BAP-certified. The tilapia can be traced back to the farm operations using the Trace Register traceability component of the BAP certification. The farm and plant operations of Harvest Select Catfish in the southern United States were certified January 9. Their certifications also pushed the total for BAP-certified facilities over the 200 mark.
www.gaalliance.org

Stepping up the PACE for a sustainable future

This is the challenge to industry at Alltech's 25th Annual Symposium in Lexington, Kentucky, USA, 17-20 May 2009. It will focus on finding answers to some of the major issues facing the animal feed industry such as rising feed costs, managing in a time of crisis, sustaining and growing business in the current environment. The Sustainability Principle – securing long term profitability in a period of crisis' is the theme. Some 1000 attendees are expected.

The company's Medal of Excellence will be awarded to Dr. David Byrne, former EU Commissioner for Health and Consumer Protection. Dr. Byrne will also take part in the Plenary Session where he will discuss Crisis Management in today's environment and will challenge our industry to meet, what he calls, the 'PACE Principle', i.e. to achieve long-term profitability while continuing to be conscious of animal welfare, responsive to consumer needs and environmentally friendly.

''The 2009 programme is the most dynamic to date'' said, Alltech's Founder and President, Dr. Pearse Lyons. "To mark the 25th annual meeting, we will host the 'Great Debate' on Sustainability. Here, representatives from the consumer food market and from the animal production industry will discuss the 'PACE Principle' with the aim of exploring the viability of sustainability initiatives in the animal production industry", he said. To mark the focus on effective branding of businesses, the company will have 'the living icon' Muhammad Ali attend the opening session.

In addition to the species nutrition sessions, there will be section on feed quality and regulation. This is in response to increasing demand for information on how products are regulated in global environments and how the registration process works in different markets. Topics within each species session will include discussions on: the importance of nucleotides in early diets; the use of multi-enzyme complexes to release maximum energy from both traditional diets and non-traditional diets containing ingredients such as higher fibre; and immune modulatory compounds. The meeting will also explore opportunities in the area of novel mycotoxin binders. The sessions will include information on the interactions between inorganic and organic minerals and their overall interaction with compounds in a premix. More information: www.alltech.com/symposium

What to expect in AQUA CULTURE Asia Pacific Magazine in 2009

Vol 5 2009	May/June	July/August	September/October	November/December
Issue focus *current trends & challenges*	**Responsible and Sustainable Aquaculture**	**Health Management**	**Cage culture**	**Hatchery Management**
Industry review *with profiles & outlook*	Catfish	Freshwater prawn	Tilapia	Offshore cage culture
Shrimp/fish culture and developments	Features best practices and experiences from industry. Coverage on role models, benchmarking and breakthroughs in industry throughout the region			
Feed technology	Feed regulations/ Organic feeds	Fish meal & oil replacements Novel meals	Feed processing/ Immunostimulants	Nutrition & formulation Larval feeds
Technical contributions	Hatchery management/ Pre and Probiotics	Biosecurity/ Aeration technology	Fish diseases/ Biotechnology	Pond culture technology
Markets	Reports on opportunities, market trends, regulations and certifications, branding and product development			
Show preview/ issue	Vietfish 2009 Ho Chi Minh City 12-14 June		Asia Pacific Aquaculture 2009 & Malaysian International Seafood Exposition 2009 Kuala Lumpur, Malaysia 3-6 November	Shanghai International Fisheries and Seafood Expo (Sifse 2009) Shanghai, China 9-12 December

World Fishing Exhibition VIGO'09 hosts the first aqua farming international.

September 16-19, 2009, Vigo, Spain

Under the umbrella of the World Fishing Exhibition, this First Aqua Farming International, is a professional aquaculture exhibition where companies and professionals of the aquaculture sector will meet in a venue of 3,000 m^2 venue. This first edition is supported by the World Fishing Exhibition, which provides it with a special attraction. At its coming-out in society, Aqua Farming International will benefit from the synergies created at each edition of the World fishing Exhibition in Vigo, its high impact in the media coverage and the presence of the top authorities in fisheries attending the fifth International Fisheries Ministers Conference.

All these reasons are a big incentive to exhibitors of equipment destined to the aquaculture sector and to the producers who will be able to exhibit their products and set new markets and trade relations. This is one of the great aims of the Aqua Farming International organization, to establish a benchmark regarding equipment and supplies for aquaculture, apart from the final product.

Mr. Andrew Webster, President of World Trade Exhibitions, organisers of the event, recognizes that thanks to Aqua Farming International "the aquaculture will receive the recognition it deserves". In fact, the WFE is held in a crucial moment for the fishing and aquaculture industries, which have to meet the global growing demand for fish. Health researches backing the properties of fish as a source of proteins and good health widen the range of benefits of eating fish.

Mr. Alfonso Paz-Andrade, President of the Executive Committee of the WFE-Vigo'09 highlights that "hunger in depressed areas of the world cannot be eradicated without the contribution of fisheries and aquaculture". The world offer of fishing is kept steady at around 86 million tonnes and aquaculture contributes with 46 million per year. However, this amount does not cover the growing demand and FAO has notified that aquaculture needs a new boost, as it seems that its growth rhythm has slowed down in the last years. Likewise, the European Commission will launch its proposal of Communication for Aquaculture in the European Union next April.

A little less than a year away from the celebration of the World Fishing Exhibition- Vigo'09, more than 70% of the space available has already been booked. The WFE will also have an international approach; Italy, France, Faroe Islands, United Kingdom, Cuba, Iceland, Norway, Denmark and Sweden have already confirmed their participation with national pavilions. Under these prospects, we expect to beat the figures of 2003, when 800 companies from 80 countries participated and the turnover registered amounted to around 400 million Euros. The big emerging countries in the fishing field, especially from Southeast Asia, are among the targets of Vigo'09.

According to Mr. Alfonso Paz-Andrade, WFE`09 "will be a great opportunity to get in touch with the main international producers, who will present their latest technologic advances and innovations in energy saving for vessels and industry; as well as to take part in the different meetings and events held in parallel".

More information: www.worldfishingexhibition.com

March 25
Seminar on Fish Reproduction
Kuala Lumpur, Malaysia
Email: myfisoc@gmail.com
Web: www.vet.upm.edu.my/~mfs/

May 12-14
International Ocean Science, Technology and Policy Symposium and exhibition 2009
(WOC 09)
Manado, Indonesia
Email: info@woc2009.org
Web: www.woc2009.org

May 25-29
World Aquaculture 2009
Veracruz, Mexico
Email: worldaqua@aol.com
Web: www.was.org

May 28-31
Aquarama 11th International Ornamental Fish Exhibition
Singapore
Email: linda_tan@cmpasia.com.sg
Web: www.aquarama.com.sg

June 12-14
Vietfish 2009- Vietnam Fisheries International Exhibition
Ho Chi Minh City
Email: quocthanh@vasep.com.vn
Web: www.vietfish.com.vn

July 5 to 7
Genomics in Aquaculture
Bodø, Norway
Web: www.gia2009.com

August 14-17
Aquaculture Europe 2009
Trondheim, Norway.
Web :www.easonline.org

September 7 - 10
Larvi 2009-5th Fish & Shellfish Larviculture Symposium
Belgium
Email: larvi@ugent.be
Web: www.aquaculture.ugent.be

September 16 - 19
World Fishing Exhibition
Vigo, Spain
Email: iroberts@mercatormedia.com
Web: www.worldfishingexhibition.com

November 3-5
14th annual China Fisheries & Seafood Expo'2009
Qingdao, China
Email: seafoodchina@seafare.com
Web: www.chinaseafoodexpo.com

November 3-6
Asian-Pacific Aquaculture & Malaysian International Seafood Expo 2009
Kuala Lumpur, Malaysia
Email: worldaqua@aol.com
Web: www.was.org

December 9-12
4th Shanghai International Fisheries & Seafood Exposition
Shanghai, China PRC
Email: daniel@sifse.com
Web: www.sifse.com

List your events in AQUA Culture AsiaPacific Magazine for FREE. Fax details to: +603 2096 2276 or email to the Editor at zuridah@aquaasiapac.com

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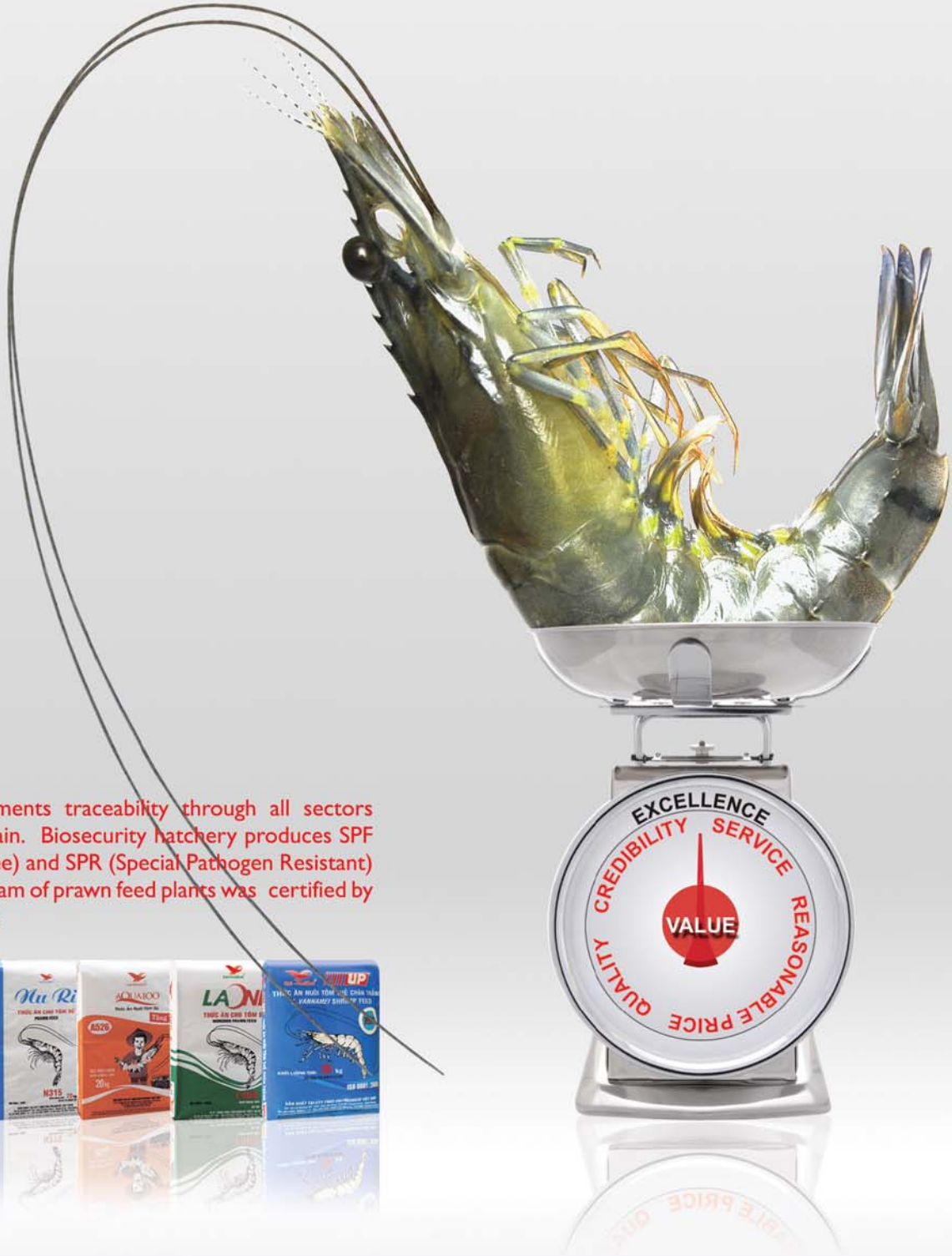

Uni-President implements traceability through all sectors along with supply chain. Biosecurity hatchery produces SPF (Special Pathogen Free) and SPR (Special Pathogen Resistant) larvae. Quality program of prawn feed plants was certified by ISO 22000 & HACCP.

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