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WRITE TO THE EDITOR

We want to hear from you. Write your comments on the industry to the editor.

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Letters may be edited prior to publication

From the editor

Moving from mass to quality

Apart from rising costs, the aquaculture industry in Asia seems to have hit another bump on its road to growth in the past 6 months. The impending recession and the US Federal Reserve's actions in alleviating the subprime crisis have its consequences in our industry as well. The fall of the USD against the currencies of many of Asia's aquaculture exporting countries has created a new scenario we have not seen before. The Hindu Times reported that seafood exports in India have fallen due to the depreciation of the USD to the INR by 15% and the anti dumping duties levied by the US government. Processors have resorted to asking for export subsidies while farmers are looking toward farming lower cost vanammei (which is currently banned). This scenario is not limited to shrimp alone. The US market which has been a major trading partner for these countries for many species will stagnate soon as household spending tightens. How will this affect the Asian aquaculture industry?

Most Asian exporting countries started from a business model of low cost production which caters to the mass market. Perhaps it is time to relook the strategy of moving up the quality ladder and differentiating from the volume model. This gels well with the current efforts in the food safety program and traceability (which is covered in this issue of Aquaculture Asia Pacific).

The major importing markets of the US, EU and Japan all require certain criteria which are prerequisites. Moving upstream along the value chain, the retail processor requires the same from aquaculture producers. These are surety of supply, consistency of quality specifications and evidence of compliance to best practices. Ultimately, there must be no surprises. We understand that volume and quality are not mutually exclusive but we would urge the industry to focus on quality first, making it a non-negotiable criteria. This raises the bar such that the industry can then ask for higher prices to meet these specifications. Once this bar becomes the industry norm (and this may take 3-5 years), we can then push for volumes again. This is expansion/consolidation is part of any product- market evolution cycle.

The EU market cannot be ignored today due to the current strength of the Euro. However, the EU zone has food safety regulations and certifications which require the retail processor to 'jump through hoops' to attain. The adage 'the customer is always right' holds true here as well. The whole supply chain of Asian aquaculture has to work together to comply to these regulations. Any failure in any part of the chain will be detrimental to the whole supply chain. This is part and parcel of the traceability program.

Another growing market is domestic and that in China serves as the best example. The past decade has brought up a significant middle class in China who are willing to spend on seafood at local restaurants. One only has to visit any major city in the southern province of Guangdong to experience this. It was once thought that the live and chilled seafood market was so niche that volumes would never be interesting. We believe this is changing and hopefully the local markets of India and Vietnam will follow suit. This is a reverse model which started with quality and is now moving toward larger volumes. To see how this can be a successful and sustainable market, we only have to look at the oyster industry in France. French oysters are branded by their place of origin and by default (fresh and live), they do not tend to travel out of their region. Imports also play a role but account for a relatively small share of total volumes. The French population of 70 million supports a Euro 340 (Fish Stat Plus, 2005) million industry with annual volumes of 125,000 tonnes in 2007. Faced with difficult market conditions, the French oyster industry has responded in recent years with a series of marketing and quality initiatives aimed at differentiating its products, achieving stronger margins and expanding its customer base. (Globefish, 2007). Asia can look forward to this for many of its species and also with private and public sponsored promotional campaigns to develop species-specific domestic markets.

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Vietnam

Prices and demand up for tra

After a prolonged slide, prices for the tra catfish are recovering in the Cuu Long River Delta, said the An Giang Fisheries Association (AFA). Ex- farm prices have increase by VN 300/kg to VND 14,300/kg (USD 0.89/kg) since early April.

In Tien Gang province, Vietnam Net reported that new supply contracts have been fixed at VND 15,000/kg (USD 0.94/kg). In An Giang province, the largest areas for tra catfish culture, the production is expected to increase to 24,000 tonnes in the second quarter. However, seafood companies expect that supply will be short in May to August 2008.

World markets for the tra catfish are also increasing. A feed processing plant said that although tra output has been on the rise by at least 25%, this is still insufficient to fulfill contracts that it had signed with partners. The demand for tra has increased by 30% in Europe and by four times in Central America and by twice in the Middle East. The fish remains the largest import item in the European market. The quantity of Vietnam's exports increased 168% in 2007 and exports to Russia increased by 15,000 tonnes and by 199% in value. (see related article on the catfish industry in Vietnam on pages 15-17).

Thailand

Organic boost for shrimp

Thailand has opened an Organic Agriculture and Farm Products Certification Centre which will be the national body to accredit organic farm products for export.

This will operate under the umbrella of the International Federation of Organic Agriculture Movements (IFOAM). At present, the production of organic shrimp is very small and it is mainly from the Sureerath Farm in Chanthaburi which will export 60 tonnes in 2008 and increasing to 100 tonnes in 2009. The farm exports to Germany and Switzerland at premium prices of 30% higher than conventional farmed shrimp. It is also the only Naturland certified farm for organic products.

The success of this farm has also prompted several farms to form an alliance to apply organic farming methods. They expect a combined production of 1,073 tonnes annually. The participants are Eastern Organic Alliance in Chantaburi, Kungkrabaen Bay Royal Development Study Centre, also in Chantaburi, Laemfapha Shrimp Aquaculture Community Enterprise Group in Samut Prakan, Black Tiger Group Farm in Trang and Dumrong Farm in Songkhla. The first two groups have received certification from the Department of Fisheries.

Prayoon Hongrah, President of Sureerath Farm and chief of the Eastern Alliance group, said that higher premiums could draw more farms to produce organic shrimp. The culture cycle is usually longer at 6-7 months in comparison to 3 to 4 months for commercial culture. The principles of organic farming which emphasizes on health, ecology and good management precludes the use of chemicals and genetically modified organisms. Organic shrimp feed is essential and the entire production cycle must be traceable.

Tilapia

Supplies down and rising prices

In 2007, tilapia exports from China were 120,000 tonnes, 19% more than in the same period of 2006.

In early 2008, volumes of raw material into the market were much lower than the demand as the harsh winter weather in the southern part of China has wiped out large populations of tilapia. Observers in China said that production will decline by as much as 80% and tilapia traders estimated that there will be a scarcity in supply in 2008 which could last for at least 8-12 months. As a result tilapia prices have started moving up in recent weeks and by as much as 20%.

The tilapia market report for April 2008 by Globefish also said that in 2007, the US consumed 173,000 tonnes of fillet, which equaled 400,000 tonnes of whole fish. This was an increase of 33% over volumes in 2006. Tilapia imports from China continued to increase into the US as tilapia from China was excluded from FDA checks on seafood. The largest proportion of product was frozen fillet which China dominated with 90% of supply, followed by Indonesia and Taiwan. The niche market for fresh fillet is dominated by Latin American producers.

The low supply from China will benefit Latin American producers, the second largest group exporting tilapia and in particular fresh tilapia at better prices. Another group which could benefit from this situation will be suppliers of marine whitefish. In US and EU markets, marine whitefish have been substituted by the tilapia.

Some trends were indicated. In the US, fresh seafood in wholesale markets will cost 10% more because of increases in cost of transport and production and the depreciating US dollar. The market of frozen fillet increased in the US market by 30%, while that for whole frozen tilapia is losing ground. Prices for the frozen tilapia fillets have bottomed out. The larger sized frozen fillets reached USD 2.35/lb in March 2008, up from a low USD 1.95/lb in mid 2007. Prices for fresh tilapia fillet which is almost double that of frozen fillets have increased in 2007 and 2008. However, despite better export prices, some exporters of this product, such as Brazil have found a better market in their own country and have stopped exporting to the US (Source: www.globefish.org)

India

New initiative on aqua feeds and nutrition

The National Workshop on Aquaculture Nutrition and Feeds was organized by the Rajiv Gandhi Centre for Aquaculture (RGCA) at Chennai, India, on 14-15 March, 2008.

RGCA is the R&D organization of the Marine Products Export Development Authority (MPEDA) which is affiliated with the Ministry of Commerce and Industry of the Government of India. RGCA is entrusted with carrying out research and development of aquaculture in India and was recently given the mandate to launch a new initiative on "Aquaculture Feeds and Nutrition".

This is timely considering the pivotal role of aquafeeds and feeding management in ensuring the success of any modern aquaculture enterprise. A national workshop was therefore convened to review the present status of aqua feed technology available in India and to recommend areas for further R&D efforts. A group of 34 experts from both academia and industry in India was specially invited to take part in this inaugural workshop.

Dr. E.G. Silas (Chairman, Scientific Advisory Committee, RGCA) addressed the workshop on the importance of adaptive research in aquaculture nutrition and the role of feed additives in enhancing aquaculture output. Dr. Wing-Keong Ng (Fish Nutrition Laboratory, School of Biological Sciences, University Sains Malaysia, Penang, Malaysia) was invited as the coordinator of the workshop and delivered the keynote address which highlighted the increasing important role of aqua feeds in the global aquaculture industry and the urgent need to evaluate renewable resources for use in this rapidly expanding industry.

Following the opening ceremony, three technical sessions were held in which 13 oral presentations were made. The technical sessions were divided into an overview of research conducted by various institutions in India, species based presentations which included presentations on spirulina culture, microalgal live feed, polychaetes, artemia cysts production, mud crabs and ornamental fish and feed production issues which included presentation on alternative raw materials, issues related to the shrimp feed sector, extruded feed for seabass and fish feed additives

Some of the participants at the National Aquaculture Nutrition and Feeds Workshop. Seated in the front row (L to R): Mr. Thampi Sam Raj, Mr. Vishnu Bhat, Dr. Ng, Dr. Silas, Mr. Mohan Kumar and Dr. Muthuraman.

were presented. Dr Ng summarized the proceedings and formed seven task groups with specific group leaders for further discussion.

The seven areas identified by RGCA for further R&D initiatives were shrimp, scampi, marine finfish, crabs, live feeds, ornamental fish and feed production through sustainable resources. Gaps in R&D in each of these seven areas were identified during the second day of the workshop and recommendations for further research were listed for further action to be undertaken RGCA. The proceedings of the workshop detailing the scientific output are currently being planned.

Mr. Y. C. Thampi Sam Raj, Project Director, RGCA summed up the group discussions and informed the participants that RGCA will act as an effective platform to disseminate all R&D information and to develop adequate infrastructure for aquaculture nutrition research with focus on eco-friendly feed production. RGCA will also support adaptive research through collaborative programs and hope to prepare a basic database on the nutritional quality of locally available feed ingredients.

GAA challenges Shrimp Labor Study Group

The Global Aquaculture Alliance (GAA) has challenged authors of a newly released 40 page report on working conditions in shrimp-processing plants in Thailand and Bangladesh. It asked for specific details or deliver an apology to the countries and companies involved in shrimp production. This was said by GAA Executive Director Wally Stevens, in an interview on CNN.

"Over the past 10 years, our organization has led the way in the development of global aquaculture standards," Stevens said. He added that GAA's Best Aquaculture Practices standards encompass social justice issues such as worker safety and child labor regulations, and address food safety, traceability and the environment, as well. Producers seeking BAP certification must undergo a rigorous, independent audit by a recognized certification body. Companies that do not measure up on all of the key areas are not certified. Failure to maintain compliance with a standard will also cause a company to lose its certification, Stevens said.

The report by the Solidarity Centre, a labour rights organization, "The Degradation of Work: The True Cost of Shrimp," contained information from interviews with workers in Thailand and Bangladesh. It stated that workers at a factory owned by a major Thai shrimp processing company alleged hazardous working conditions as well as an intimidating and discriminatory work environment. They also claimed regular exposure to harsh chemicals. It also tracked shrimp from factories it criticized directly to some of America's best-known retailers and restaurants, though it did not allege wrongdoing on the part of the US companies.

GAA has questioned why the report's authors chose to release their report without contacting it as the leading global aquaculture standards-setting organization. "Our approach is to work with many organizations to find common ground and solutions to the challenges that face a young industry such as aquaculture," Stevens said. "We prefer a solution-oriented approach rather than one that creates headlines and creates a climate of fear, uncertainty and doubt."

News in brief

BPG for cage farmers

Philminaq, an action plan to mitigate the impact from aquaculture in the Philippines has completed Better Practice Guidelines (BPGs) for small-scale fish cage and fish pen operators. These will give farmers practical guidelines to follow in the planning, management and operation of their farms. A certification scheme will assist the Department of Agriculture to ensure safe and quality aquaculture products. BAP farmers will be part of the nationally recognized list of fish farmers that is setting the benchmark for the production of safe and quality fishery products in the country and will enable consumers to exercise the option of buying quality products from traceable and certified sources. It will then increase the market access of safe and quality products both in the local and foreign markets. Philminaq partners are Akvaplan-niva, Scottish Association of Marine Science and BFAR-Bureau of Fisheries and Aquatic Resources (www. philminaq.eu).

ACC certifies tilapia plants in China and Indonesia

Aquaculture Certification Council (ACC) reported that it has certified three plants in China that are processing and exporting tilapia to world markets, during the first three months of 2008. The three plants are Guangzhou Luxe Seafood Enterprise Ltd., Shenzhen Allied Aquatic Produce Development Ltd. and Asian Seafoods (Zhanjiang) Co. Ltd. Other seafood processing plants certified in the first quarter of 2008 included: Savvy Seafoods Inc. (Zhanjiang, China), PT. Central Pertiwi Bahari (Lampung, Indonesia) and PT. Kelola Mina Laut (Surabaya, Indonesia). Currently there are 66 processing plants located in 13 different countries that are BAP certified. These plants export more than 300,000 tonnes of BAP certified shrimp and 18,000 tonnes of BAP certified tilapia. ACC also said that it will participate with Sustainable Fisheries Partnership (SFP), GlobalGAP, Global Aquaculture Alliance (GAA) and Tilapia Aquaculture Dialogue (World Wildlife Fund) in a benchmarking project to develop and test criteria used for auditing tilapia farm. This is expected to be completed by November 2008. (source: www.aquaculturecertification.org).

Traceable tilapia in Malaysia

A project in Temengor Lake in Perak, Malaysia will start production of tilapia with a unique tracking system. In the Star, Albert Altena, Trapia Malaysia Sdn Bhd said that the system, developed by Norwegian firm, GenoMar AS, would allow Trapia to check on the fish's genetic patterns taken from tissue samples. He added that the traceable fish has been bred for many years through research and development. The batch in Perak is the 17th generation. The company has set up tilapia farms in Temengor and Kenering Lakes and at Sungai Dala. In September 2007, the company began trial breeding runs with the Fisheries Department at its test site in Temengor.

EU may lift embargo threat

The food safety level of Indonesia's fishery exports to the EU has improved. In 2007, there were 17 RAS cases monitored, down from 34 and 49 cases in 2006 and 2005, respectively. Bisnes Indonesia reported that at a meeting in Brussels with the EU Commission, Director General of Fisheries Marketing and Processing, Department of Marine Affairs and Fisheries, Martani Huseini said that the EU will be ready to lift its embargo threat if there are no significant cases in the next two months. It has considered Indonesia a lead example of exporting countries that can improve its quality management system in a relatively short time. He added that records from the Department of Marine Affairs and Fisheries showed that the EU has twice rejected Indonesia's fishery exports in the past four months in 2008.

Norwegian-Indian research project on the development of new fish vaccines

A consortium of the Norwegian College of Fishery Science, Nofima, the Norwegian School of Veterinary Science, Bodo Regional College, Pharmac AS and the Institute of Marine Research has been awarded NOK 44 million for a major Norwegian –Indian research project to develop vaccines for fish and shrimp. The funding for the 4 year project comes from the Research Council of Norway. The project aims to develop vaccines for diseases of fish in Norway and India, with particular focus on IPN and VNN, which is caused by a Nodavirus in fish and white spot syndrome virus in shrimp. The consortium will collaborate with seven Indian research institutes to draw on their competency for developing vaccines for human medicine (source: Nofima).

More farmed catfish in the US

During March 2008, 49 million lbs (22 million kg) of US farmed catfish were processed. This was an 8% increase from the volume in March 2007, according to US import and export data. Average ex farm prices was 74.5 cents/lb. Sales of fresh fish remained unchanged at 8.82 million lbs (4 million kg) and that of processed fish was 24.1 million lbs, up 3% from the volume in March 2007. Imports of *Ictalurus* spp. from China, Trinidad and Tobago totaled 2.58 million lbs. Average prices were lower, ranging from USD 2.33/lb for fresh fish to USD 2.96/lb for fresh fillets. Imports of all species of catfish (*Ictalurus* and *Pangasius* etc) for February 2008 totaled 9.6 million lbs, up 27% from that imported in February 2007. These were from Cambodia, Chile, China, Indonesia, Malaysia, Spain, Thailand, Trinidad and Tobago, and Vietnam.

Immunomodulation by carrageenans

Drs Su-Tuen Yeh and Jiann-Chu Chen, Department of Aquaculture, National Taiwan Ocean University have reported in the journal Aquaculture that white shrimp *Litopenaeus vannamei* receiving any type of carrageenan via injection at 6μg g-1 showed increased resistance against *V. alginolyticus* after a 24 h challenge. *L. vannamei* that received type IV carrageenan (λ-carrageenan) showed significantly higher resistance than that of shrimp that received any other type of carrageenan after 120 h of challenge. The authors also discussed the mechanisms of the immune-stimulating action of carrageenan and improvement of the shrimp's immunity. Glucan consists of β-1, 3-linked glucosyl residues with 95% of glucose whereas carrageenan consists of D-galactose molecules joined together by alternating α-1, 3 and β-1, 4-glycosidic linkages. In teleosts, β-glucan enhances the innate immunity through direct activation of macrophages. The phagocytic activity and respiratory burst in *L. vannamei* following treatment with carrageenan supports the review that carrageenan receptors exist in macrophages and haemocytes. The higher phenoloxidase activity of white shrimp *L. vannamei* following λ-carrageenan treatment is considered to be related to its structure and higher solubility compared to other types of carrageenan. Further research is needed to identify the PRP and its receptor for carrageenan and how they trigger the innate response in shrimp.

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Committed to black tiger shrimp

Farming black tiger shrimp is a long term business for the company and the strategy is to ensure consistent supply to buyers while managing costs, said Ting Kwong Chung of JW Aquaculture in Malaysia. A shift to vannamei farming is not a choice as a large production may create a glut in the local market, bringing down prices in an already high cost producing country. By Zuridah Merican

The pull factor in vannamei shrimp culture in Asia is availability of domesticated and specific pathogen free brood stock and post larvae, high yields from high stocking density (80 to 300 post larvae/m^2) and a lower cost of production (MYR 7.50-8/kg versus MYR 14/kg for black tiger shrimp). Many farms in Indonesia and Malaysia and the majority in Thailand and have followed this route after repeated failures in farming black tiger shrimp due to White Spot Syndrome Virus (WSSV) since the late 1990's. In Malaysia, the estimated production of vannamei shrimp was 56,000 tonnes out of the total 70,000 tonnes in 2007.

JW Aquaculture in Kuala Selangor, Malaysia is the largest producer of only black tiger shrimp. In the years, 2004-2005, there were frequent disease outbreaks with WSSV causing considerable financial losses. In these circumstances one would expect the farm to shift to vannamei shrimp culture when Malaysia authorities removed the ban on the farming of this shrimp in 2006. Ting, Director gave his reasons for this business decision to continue with black tiger shrimp.

Glut and competing internationally

"The cost of shrimp production in Malaysia has always been higher than its neighbours, Thailand and Indonesia and in comparison to China. Current vannamei production in the country is mainly for local consumption and profit margins are small at MYR3-3.50/kg (USD 1.1/kg) during good times. There is a window when prices of vannamei shrimp are good. It is highest at the end of the year, when there is a shortage of production from Thailand entering Malaysia. Last year, farmers also benefited when the US stopped imports from China and opened the market to Malaysian producers when supply was not available from Thailand. This may not happen again".

He added, "However imagine the impact on the local market when a large farm like JW produces only vannamei shrimp. There will be a glut in the local market. If we start with vannamei shrimp at 80 post larvae/m^2, production can increase to 20,000 tonnes which translates to 54 tonnes of shrimp per day in the local market. Imagine the impact on prices. The question is how sustainable can this business model be if we farm vannamei shrimp".

Managing production

Staying with black tiger shrimp requires various changes to maintain consistent production. Stocking density which used to be 40-50 post larvae/m^2 has been reduced to 20-30 post larvae/m^2. A close system is now practiced instead the frequent changes of water. Fortunately average survival rate is still good at 60-70% although there have been cases of low survival in several ponds. Pond management practices such as stocking ponds only at night and following acclimation procedures during stocking have become more critical. The harvest size is now reduced to 45 pcs/kg (22g) although efforts are ongoing to increase sizes to 35-40 pcs/kg (25-28g). In comparison, average shrimp harvested was around 40g in 2003 when the open system was used.

It has managed to keep cost of production low with several initiatives and cost cutting measures. This starts with post larvae produced at its own hatchery 15 km away. The farm produces between 10 to 35 million post larvae/cycle, depending on the survival rate from nauplii to PL15. PL are used for its ponds and a small portion (5%) are sold to the open market. The hatchery has developed a good reputation as a producer of quality PL such that prices are above industry average at MYR 18,000/million PL. The whole batch is discarded when there is any positive result for disease in wild caught or with post larvae in culture tanks. This is not a major cost in comparison with massive losses in a breeding cycle which may cost a few MYR hundred thousand or in the ponds which can run to MYR millions.

Ting said, "We do not compromise on the quality of our post larvae and have continued to use the best feed (Artemia and encapsulated diets). Our current survival rate is 50-60% from nauplii to PL 15 but we are targeting higher survival rates. Our experience has been that with our own PL, 90% of ponds perform well. When hatchery production is insufficient, we prefer to leave the ponds empty rather than outsource post larvae".

During grow out, 24/7 surveillance is carried out by the lab team. Instant disease analysis is with a PCR in the laboratory. This rapid diagnosis in turn has allowed for fast remedial action in the ponds.

" We have already established ourselves as consistent producers of black tiger shrimp. We cannot risk the confidence and consistency which buyers seek if we change to vannamei shrimp. Furthermore, we will be facing competition from Asian and South American producers when we export. We will enter a new segment and will have to work hard and seek new markets".

"Feed costs have been increasing regularly but this is understandable when we see the high cost of raw materials. Costs of feeds have increased 18%", said Ting

The use of calcium carbonate has been reduced. Higher costs in petrol have prompted several changes to the pond design. All new ponds will be around 0.4ha with 110-120m lengths. Gradually, older ponds are being renovated to this design. The narrower ponds will allow for broadcasting feed by hand. Previously, with wider ponds, hand held petrol driven blowers were used. The number of paddlewheels, all electrical driven, have been maintained. However, most repair and fabrication works are carried by farm staff with the exception of wiring works. Previously, the farm outsourced all repairs at considerable costs and higher down time.

Marketing

A processing plant with a capacity of 7-10 tonnes/day was set up in 2004. It has been time consuming for a new entrant to secure all the necessary certifications required for seafood processing and to market seafood to major markets. Alas, today, the company is very confident that it has several advantages over many other operations in Malaysia.

"Our main market is now Europe. Although the documentation required can be voluminous, the offer prices are higher than those from US buyers. Presently, offer prices from Japanese buyers are too low. As a small producer, the farm will be unable to meet the large orders from US buyers," said Ting.

"Our advantage is a processing plant within the farm itself which means that we control the quality and supply of shrimp. We control the production chain with our own post larvae. Quality aspects in production are monitored by our in-house laboratory. One supermarket audit compared our laboratory facilities, complete with ELISA, PCR and HPLC as better than most farms in the country and equivalent to those in South America. We are very proud of this", said Ting.

Domestication is a national contribution

This requires commitments in terms of investments, manpower and knowledge but as a major stakeholder in industry, JW has to play its part to contribute to the future of shrimp culture in Malaysia. It is also a necessary measure on the part of the company. At present, 14 ponds, each stocked with 500-600 shrimp are used for rearing to maturity its first generation broodstock. These currently weigh 80-100g after 175 days of culture. Ting is convinced that the local stocks grow well and have better flesh quality in comparison to stocks from Madagascar which may have better colour.

The future

Similar to any business, expanding operations will be next and it will be along the same model-integrated operations with hatchery and processing plant. However, Ting said, "For a new farm, I will need to be hands-on to make it a success. As the current farm is yet to be at the stage of being 'self sustaining', any expansion will have to wait".

Choosing quality black tiger shrimp postlarvae

Some critical aspects on post larval quality and criteria for selection

By Shravan Kumar Mishra and Joachim W Hertrampf

In selecting the right quality of postlarvae, the most important criteria is the stage of development. Identification of anatomical parts of the post larvae will require a microscope but a farmer could do well by carrying a small eye piece/eye glass to the hatchery for observation of post larvae before purchase. The selection process of seed involves four stages which need to be strictly followed.

Step 1. Gross inspection

It is the first step of quality assessment where the initial observation is made on a large population. It can be done with post larvae in a small basin or it can also be done directly in the hatchery tanks.

What to look for?

- Larger animals are generally more aggressive in searching for food and have a better chance of survival over smaller ones. It is preferable to stock uniform size post larvae. (see picture).
- Healthy post larvae are usually active and slight disturbance can cause them to jump toward a solid surface. The healthy post larvae can be easily observed if water in the basin containing them is swirled. The healthy ones will moves to the side against the current whereas the weaker ones will remain in the center.

Step 2: Microscopic inspection

The microscopic observation can be carried out with the help of qualified technician. These observations include:

- **Total length of post larvae & rostral spine count** indicates the age of the post larva. Black tiger shrimp post larvae 15 should be 12 mm in length and a rostral spine count of 3-4
- **Gut mussel ratio:**The ideal gut mussel ratio should be 1:4 .
- **Condition and coloration of the hepatopancreas** gives a clear idea on the feeding habit and quality of feed used in the larval rearing
- **Fouling and deformities** are clear indications of the rearing environment and health condition of post larvae. Seed should be free from any kind of fouling and there should not be any deformities.
- **Monodon Baculovirus** (**MBV** is not a major problem in shrimp grow-out but its presence relates to the hygienic practices followed in the hatchery. Preferably, post larvae should be MBV negative.

Step 3: PCR screening of postlarvae

This is now mandatory. As shrimp is an active carrier of the white spot virus syndrome, testing the post larvae using PCR is most important. Screening through PCR is also an important tool to minimize the risk of farming operations. It is essential that one should take adequate care during sample collection and carry tests in reputable laboratories.

Step 4: Stress test

It is one of the most important tests. A good quality seed should have a high degree of tolerance to environmental variation.The stress test plays an important role in the purchasing decision as it directly reflects on the health of seed. The survival of the shrimp larvae is checked by exposing them into following stress tests:

- Salinity stress test (water salinity dropped by 15 ppt by adding freshwater)
- Formalin stress test (animals exposed to 200 ppm formalin solution)
- Temperature stress test (temperature is dropped by 10 0C by adding ice cubes)

Post larvae with sufficient strength will show high survival (>80%) after an exposure time of two hours. These are considered fit for stocking. Feeding behaviour is observed once they are brought back to normal temperature and salinity after a stipulated time period.

How to transport shrimp larvae

Most hatcheries are located away from ponds and seed has to be transported over long distances. In order to ensure a good survival in the pond after stocking, it is necessary to communicate to the hatchery, the pond parameters to enable it to modify the water parameters at the nursery stage itself. Current industry practice is to pack 2,000 to 2,500 post larvae in a plastic bag which are oxygenated, sealed and packed in cardboard cartons lined with thermocole (= expanded polystyrene). When an insulated vehicle is used, bags are stored directly in stackable plastic crates. If transportation time is more than six (6) hours, it is recommended that the temperature is lowered to 20 to 26°C

by adding small bags of ice above and around the plastic bags. Temperature reduction is done to reduce the metabolic rate and oxygen consumption.

Tips for stocking and acclimatization in ponds

- The best stocking time is early in the morning or after 6 pm. The collection and transport from hatchery can be coordinated to match the stocking time.
- It is advisable to postpone the delivery of seed from the hatchery if the algal bloom in the pond is not correct.
- For acclimatization, make a barricade with the help of a rope or bamboo poles in one corner of the pond.
- Place all the unopened bags within the barricade for 15 to 20 minutes.
- Open bags one by one and make a collar by folding the upper part of the bag. Open bags will be floating with PL inside.
- Add a small quantity of pond water into the bag and mix slowly.
- Check the water temperature in the bag and pond water temperature.
- Keep adding slowly pond water into bag water till the temperature equalises.
- Start releasing post larvae slowly into the pond. The post larvae will swim out into pond water.
- When post larvae do not swim out quickly enough, it indicates that further acclimatization is required.
- While stocking, care is taken that no sediment is stirred up and the person who is releasing seed should not move rapidly.

Essence

The right procedure for screening of post larvae is very important. A proper interpretation of seed quality report is most important than just an observation and that PCR screening should not be the only criteria for seed selection. As farmers demand the quality and accept to pay the premium, they should pay sufficient attention to pond preparation and ensure that PL are well acclimatized before stocking.

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Food safety in Indonesia – What stakeholders say

Production has been on the rise but the issue at stake is quality of farmed shrimp, mainly from small to medium sized farms. The higher requirements for quality shrimp are now putting a strain on these farms in Indonesia. A traceability program is being promoted by the government and shrimp farming associations. Below, Iffa Suraiya poses some FAQs to stakeholders.

The marine shrimp contributes more than 62% in value of fisheries exports and is the fourth largest trading commodity for Indonesia. The major markets are Japan, the US and European Union (EU). Total exports in 2006 to these markets totalled 147,048 tonnes, valued at USD1.03 billion. Currently, the government wants to increase not only production but quality of shrimp exports.

Indonesia has faced restrictions on her shrimp exports because of antibiotics. Japan limited the residue level to 1 ppb since September 2006 (Gain, 2007). In 2007, there were risks of an embargo on exports to the EU (Trobos, 2007). In 2008, inspections by teams from the European Commission (EC) and the US FDA surmised that shrimp from Indonesia meet the food safety standards of the respective markets. Dr Made L Nurdjana, Director of Aquaculture, Ministry of Marine Affairs and Fisheries said that in contrast to previous inspections, where they looked at the processing facilities, the EC team inspected the complete production process. They also emphasised the importance of the commitment of the authorities in ensuring production of quality shrimp (Trobos, 2008).

The certification of shrimp farms began in 2004 and 15 shrimp and fish hatcheries and 23 farms have been certified to date. The government has established a series of regulations to get traceability in order. The authority in charge is the Department of Marine Affairs and Fisheries. At the implementation stage, the government is collaborating with members of Shrimp Club of Indonesia to spread the message on traceability in shrimp farming.

Mr. Aris Utama, PT Bumi Menara Internusa, a seafood processor based in Surabaya.

What is expected from farmers?

The traceability program would require the farmers to keep an accurate record (or database) of most (if not all) of their farming activities, including source of post larvae in each pond, feed used, other chemical or additives used, testing results, the harvesting and transporting party of each pond, etc. Ideally, this record would be forwarded to the party/factory which receives and further processes the product. Ultimately, the exporter would forward the information to the importer.

Basically, it is a chain of documentation as the strength of a chain is only as strong as its weakest point; it is crucial to understand that the importers are only as good as the exporters/processors, and the processors are only as good as the farmers; etc. Therefore, the farmers play a very important role in this program.

The certification program would require the farmer to ensure that their farming techniques are in line with BAP/GAP (Best Aquaculture Practices/Good Aquaculture Practice) standards set by the certifying organisation.

Who will pay for this and will farmers be paid more for certified shrimp?

At the beginning, some parties would be willing to provide a slight incentive to get this started and/or to fulfil the emerging demand of certified shrimp. Eventually, people would expect that, when they buy shrimp at the market price, the shrimp comes from a certified farm and that it is traceable to the farm which produces the shrimp.

I think that the shrimp price will outweigh the cost for the program, especially for those farmers who manage larger operations. For those smaller farmers, I believe that the clustering practice is under serious discussion to help alleviate the costs. The important thing is that this requirement will eventually become the norm of the industry.

What are they doing to help industry?

The certification would have some criteria which ensure that the farming activity is sustainable, environmentally friendly, socially responsible, etc. Therefore, the benefit to the industry from these positive 'campaign' would be very much self-explanatory. One of the greatest benefits of the traceability program is that it would help isolate a problem or an outbreak, should this happen. It would help pin-point the factor(s) contributing to the problem. Thus, it will help to direct a more effective remedy to the underlying cases.

Dr. Achmad Poernomo, Director of Processing, Ministry of Marine Affairs and Fisheries, Indonesia

What are the target dates?

Basically the government does not require the seafood industries to have ISO 9001:2000 certification. The government sees that to be ISO 9001:2000 certified is market driven and it is left to the industries whether they want to be certified for this or not. However, we encourage the industries to do so as this will add to the competitiveness of their products. Ideally all export oriented seafood industries should be certified by the year of 2013 as this is the year when the ASEAN Free Trade Agreement with six country partners (China, Japan, South Korea, India, Australia and New Zealand) is expected to be completed and will take effect.

The competent authority (CA) for seafood quality and safety assurance, which is my organisation, is now in the process of ISO 9001:2000 certification. By doing this, we ensure that other countries are confident with our system of seafood quality and safety assurance, which in turn will give an advantage for our seafood industries.

All aquaculture establishments will need to be certified for GAP-Good Aquaculture Practices, while seafood processing establishments are required to have the certification for basic pre-requirement certification plus HACCP certification even if their products are not intended for export. All products for export are also required to be accompanied by a Health Certificate issued by assigned government laboratories.

How much does all this cost?

The cost for certifications done by the government (pre-requirement, HACCP and GAP) is practically free. However, cost of certification by other certification bodies such as GAP, ISO etc, varies depending upon the size of the establishments etc.

What is the role of the Shrimp Club? What has been achieved to date?

The role of shrimp club and other similar organisations is very important, as they can act as a bridge between the government and farmers. The dissemination of information on regulations and standards will be much easier if it is done together with such organisation. The organisation will be in a better shape to convince its members on the importance of such certification and in some cases, would be able to assist or support its members which do not have the resources for certification. At the same time, they can represent the farmers in negotiations with other parties.

Will non integrated farmers suffer if they do not have any ISO certification?

Yes, in the future non integrated farmers can suffer if they do not have ISO certification, especially if they are targeting the export market. However, currently we are encouraging and assisting them to be GAP certified. This will be the first step for them to get ISO certification.

What about alternative markets?

Alternative markets for such farmers will be the domestic market or other countries which do not require such stringent standards for shrimp products. However, in such markets their products will not command high prices. Thus, sooner or later they will have to be certified.

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Developing certification standards for pangasius aquaculture

By Flavio Corsin

Pangasius certification is evolving almost as rapidly as the pangasius aquaculture sector. Ongoing efforts reflect the raising concerns about pangasius sustainability.

The rapid development of pangasius aquaculture in VietNam and the growing interest in pangasius farming in several other countries raises concerns about the sustainability of pangasius aquaculture. Issues of concern include the shortening of production cycles, increasing stocking densities, water exchange, discharge of nutrients, shortage of carrying capacity-based plans and food safety.

One solution to address these issues is developing standards for certifying farmed pangasius. Certification can be an effective strategy for improving the environmental performance of an industry because it can provide a credible and concrete alternative for identifying the best of the industry and a mechanism to move the industry forward responsibly.

There are several sets of standards applicable to pangasius farming. The U.S. based Safe Quality Food (SQF) Institute, now part of the Food Marketing Institute has applied its **SQF** 1000 and SQF 2000 standards for seafood quality and safety to pangasius farms and processing plants, respectively. Organic schemes, such as **Naturland** and **Bio Suisse**, have also been adopted by some pangasius farmers. Like other organic schemes, these address primarily food safety and quality by controlling both inputs and farming practices. Recently, a set of **AquaGAP** standards was issued by Qualiservice, although its use by producers is not yet documented. AquaGAP standards cover farming practices broadly attempting to improve management and address food safety, traceability and environmental protection.

Several other schemes are under development. EurepGAP (now **GlobalGAP**), an organization holding standards for agriculture, livestock and a range of aquaculture species, recently released draft standards for public comment. The standards are based on the work of the Pangasius Working Group, a group of producers, buyers, government representatives and experts in different aspects of pangasius aquaculture. The standards are expected to be finalized this year.

The Global Aquaculture Alliance (**GAA**), an industry organization that has developed standards for shrimp production and processing has announced it will be developing standards for pangasius farming. In 2007, the World Wildlife Fund (**WWF**) initiated the Pangasius Aquaculture Dialogue (PAD) as part of a global effort to develop standards for the production of several key aquaculture commodities Draft PAD standards are expected to be submitted to a multi-stakeholder platform by the end of this year.

Vietnamese stakeholders from both the public and private sector are also engaged in standard development. The Ministry of Agriculture and Rural Development (**MARD**), for example, has expanded its efforts towards a voluntary certification scheme for aquaculture production to pangasius through the development of VietGAP standards. Similarly, the VietNam Association of Seafood Exporters and Producers (**VASEP**) is developing **VietGAP** standards for responsible pangasius production.

A review of the costs and benefits for each scheme, which vary, was recently published by the Asia-Pacific Fisheries Commission (APFIC) and is available at http://www.apfic.org/modules/wfdownloads/visit.php?cid=14&lid=212. The report highlights that SQF tends to focus primarily on food safety issues, although it is developing voluntary modules for environmental and social responsibility. Organic schemes often are the most effective schemes for addressing food safety, and environment and social issues more indirectly, but they are schemes that impact niche markets, not larger markets. Nevertheless, the above existing schemes have received varying degrees of market acceptance and organic schemes also are capable of offering premium prices.

Schemes under development also can be assessed by looking at comparable standards that are in use. For example, GlobalGAP is likely to have large market recognition, but mainly in Europe. Although partially covering some environmental and social criteria, GlobalGAP is not an eco-label and focuses primarily on food safety issues. Also, GAA standards for shrimp have been accepted by many retailers and restaurants, especially in the U.S. VietGAP standards are likely to be focused on developing practices to increase the quality and efficiency of production.

WWF, which has developed standards for several non-aquaculture commodities, believes standards are credible if they are performance-based, measurable, developed with good science, created by a diverse and balanced group of stakeholders, focused only on key impacts and are produced through an ISEAL-compliant process.

The large number of schemes available or under development has also raised concerns associated with the cost for farmers and other players in the supply chain and for the potential confusion that a high number of standards can create among consumers. Efforts towards the harmonization of some of the schemes are currently ongoing, with SQF potentially using the WWF-initiated dialogue standards as environmental and social modules, GlobalGAP in dialogue with both GAA and WWF and organisations involved with the development of the VietGAP standards involved with a number of other efforts and claiming willingness to benchmark their standards against some other schemes.

Pangasius certification is indeed evolving almost as rapidly as the pangasius aquaculture sector. Plenty of efforts ongoing to reflect the raising concerns about pangasius sustainability.

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Sustainability issues in Vietnam's catfish industry

By Võ Hoàng Nguyên

The rapid development has brought many risk factors viz at the hatchery, grow out and processing plant. Issues of environment protection, food safety, nutrition and health management are now critical for its long term development strategy.

The fluctuation of the US dollar and the high inflation rate of the Vietnamese Dong recently caused considerable difficulties for all stakeholders in Vietnam's catfish industry. Farmers with bank loans had to pay higher interest rates while processing plants could not sell US dollar to get Vietnamese Dong in order to purchase raw materials. This situation in early 2008 was an alert for the industry. However, the demand from the export market which reached USD 750 million in 2006 (Dzung, 2007) is still the key driving force. New export markets such as Mexico and the core markets in Europe are seen as a guarantee that catfish production will continue its growth as previewed.

Production trends

There are nine species of catfish in Vietnam but only two, tra catfish *Pangasius hypophthalmus* and basa catfish *P. bocourti* are cultured. Catfish culture started since the 1960s but it was only in 1998, after hatchery seed production developed, that production started increasing. By 2006, the annual production was 800,000 and this escalated to 1.0 to 1.2 million tonnes in 2007 (Hung & Kim, 2007). There was rapid growth in cage culture of the basa catfish up to 1974 which recovered in 1985 and then collapsed in 2004. Tra catfish was cultured in ponds, cages and pens. Since 2004, culture is mainly in ponds. Catfish production comprised up to 80% of freshwater aquaculture production in 2006 (Tuan et al, 2007).

At present, the tra catfish is the major commercial species. It is marketed as panga, tra, patin, dory fillet, striped catfish and sutchi catfish. The provinces of An Giang, Can Tho and Dong Thap are leading culture regions for the catfish in the Mekong delta and they account for 80% of the national catfish production. In recent years, farms are integrated with hatchery, grow out and processing. They are also bigger with 20 - 40 ha and yields from 5,000 to 15,000 tonnes (Dzung, 2007).

Hatchery development

In the initial years, the catfish farmer used to catch fingerlings of basa catfish or larvae of tra catfish in the Mekong river. During 1960-1970, some 500-800 million of wild fish were caught annually to produce 70-120 million fingerlings. From 1990, the number of wild fish was only 150-200 million/ year. Induced spawning was essential and urgent in order to maintain production as well as to protect natural stocks (Khanh, 2004).

Year 1978 saw the first time that broodstock of *P. hypophthalamus* were raised in ponds and were successfully used for induced spawning in 1979. This was followed by the development of a production system for broodstock and fingerlings in 1980s by Vietnamese scientists. This was standardised in the years following 1991 to 1996 (Khanh, 2004).

Currently, there is a shortage of fingerlings which costs VND 1,000/piece (USD 0.063). Farmers buy fingerlings from any available source. Consequently, this raises the issue of quality of fingerlings. Only farms integrated with hatchery facilities were assured of the quality of fingerlings and was independent of price fluctuations. Some big farms buy directly from nurseries and they check nursery facilities two days before buying. However, for large scale farming, they can never get enough fingerlings to stock from one unique fingerling supplier.

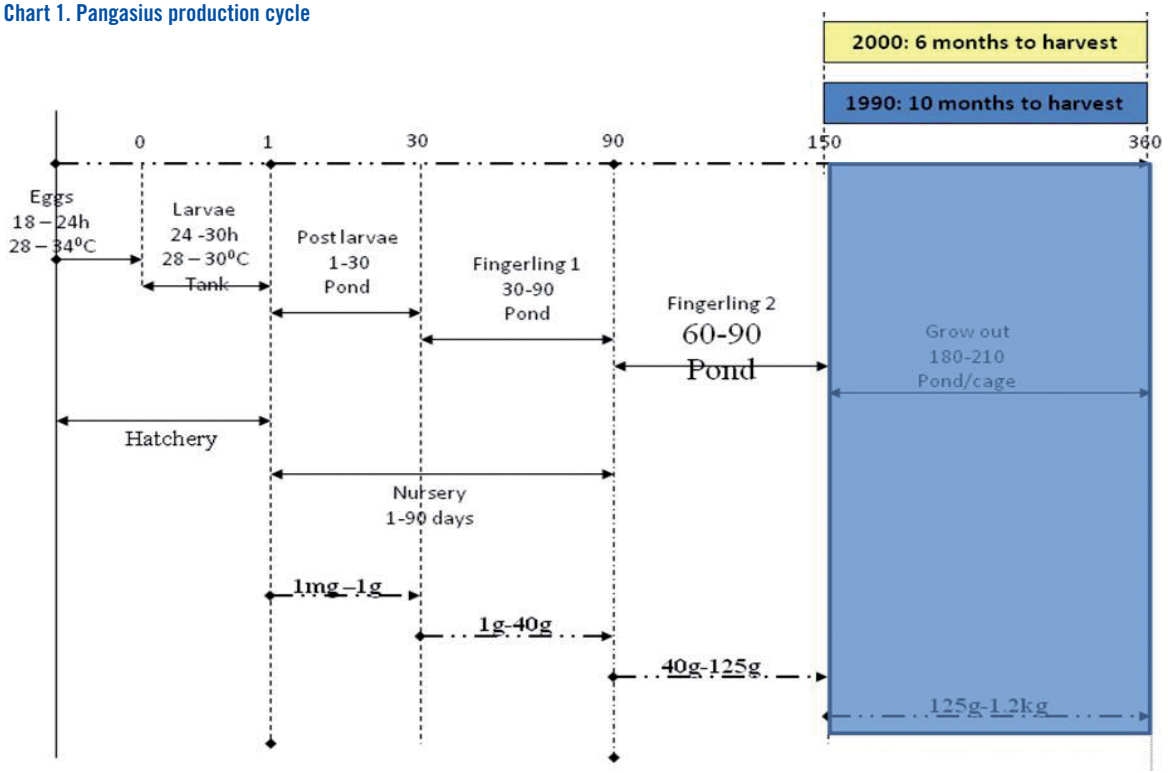
Selective breeding

In an effort to get better fillet ratio for the tra catfish, the Research Institute of Aquaculture No 2 (RIA2), carried out a breeding selection project in 2001. The outcome of this study was promising with 0.9% improvement on fillet ratio and a 13% growth improvement for each generation (Hao, 2007). To date, this has been applied in four breeding farms in Dong Thap and An Giang provinces. However, fingerling production remains focused on quantity instead of the quality of larvae and fingerlings.

Production cycle

This is demonstrated in Chart 1. Typically, farmers obtain feed conversion ratio (FCR) of 1.5:1 in pond culture and 2:1 in cage culture, using starter feeds containing 30% crude protein and grower feeds with 18-20% crude protein. Commercial feeds have to meet the feed quality standard that is assigned by the Ministry of Fisheries (28 TCN 188:2004). The specifications are that crude proteins in formulated feed should be at least 18% for grow out (500g) and up to 40% for fingerling stage (1g). Gross energy should be in the range of 1,500 kcal/g for fish size of 500g and up to 3,300 kcal/g for fingerling (1-5g). Other nutrients

Chart 1. Pangasius production cycle



of the feed including lipids, fiber, ash, calcium, phosphorus, lysine and methionine are officially standardized (Hung 2005).

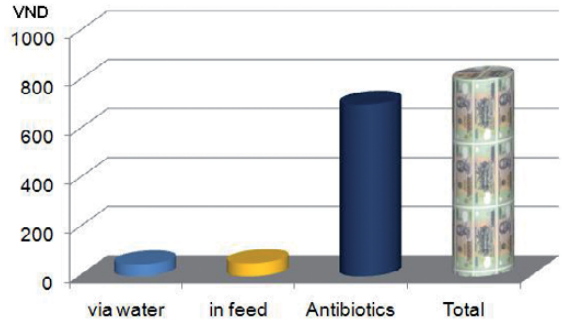
It has been almost 20 years since the catfish feed industry was established and there has been no change in feed formulation for tra catfish. However, the rearing period has been remarkably reduced from 10 months in 1990 to only 6 months in 2000. Yields have increased from 50 tonnes /ha in 2002 to 250-300 tonnes/ha in 2007. This shows that the current intensive culture system is putting a lot of stress on the catfish and subsequently fish have become more susceptible to diseases and parasites.

Issues of fish health

Gill fluke infection is commonly seen in all farms with infection rates varying from 60% to 100% of fish, and an average 92.4% (Nguyen 2006). The highest mortality due to gill fluke is manifested during the first week after stocking. There is no study on infection rate during hatchery period, but it is assumed to be equally high. Farmers pay a lot of attention to the direct economical loss from ESC (Enteric Septicemia in catfish) which is caused by *Edwardsiella ictaluri*, rather than that from gill fluke infection. In fact, gill fluke might contribute significantly to the loss due to ESC as secondary bacterial infections follow the initial infections with the parasite. A proper treatment strategy should be developed and more technical training for farmers is now a necessity for the continued success of pangasius farming in Vietnam.

Fish infected with gil fluke

Chart2: Cost components in disease treatment



There are few practical alternatives to antibiotic treatment of infectious diseases, especially for ESC. The cost of antibiotic is a major part in infectious diseases treatment. Farmers spend VND11,000/1000 fish (USD 0.67) for the treatment of gill fluke and nearly VND700,000/1000 fish (USD 43) of antibiotics for the treatment of infectious diseases. (Nguyen 2007) as indicated in chart 2.

Food safety

Some of the current issues are antibiotic and chemicals residues, overuse of polyphosphates and over glazing. These are key issues in ensuring a stable export market. In actual fact, the contamination with banned chemicals and antibiotics might occur at any stage throughout the production chain. Frequent outbreaks in bacterial diseases have put considerable pressure on farms to use a variety of antibiotics and

Large processing plants invest in water purification systems such as above.

chemicals at hatchery to grow out farms. Processing plants set up a strict monitoring program to check for chemical residues in fish organs.

The government has spent a lot of effort to promote GAP (Good Aquaculture Practices) to fish farms. VietnamGAP will be voluntarily implemented for responsible and sustainable pangasius farming. VietnamGAP is benchmarked with EurepGAP & BAP-ACC standards. VASEP (Vietnam Association of Seafood Exporters and Producers) promotes Trace Tracker Project to establish traceability.

Recently, there was a nationwide campaign to improve food safety in aquatic products with activities aimed at ensuring quarantine warranty, environmental purity and food safety for aquaculture. In another project targeted to 2020, more than VND 850 billion (USD 53 million) will be invested to develop and apply biotechnology in the fisheries sector. The objectives are: to preserve and develop gene sources; to support research on feed, disease prevention/ treatment, and to manage the aquaculture environment.

Environmental issues

There are mandatory national standards for farms to treat waste water before discharging into water-bodies. A water purification system is a requirement for Good Aquaculture Practices (GAP). According to Quali Service, a local company that offers consultancy services to implement GAP and organic standards to catfish farms in Vietnam, the main difficulty for farmers is the reservation of a large area as water treatment ponds and this has led to a hesitation to participate in a GAP program. Alternatively, farmers will use probiotics or other enzymatic solutions to biologically degrade all sludge, ammonia and phosphorus in waste water from culture pond. Some large processing plants have to invest large sums of money for water purification systems for discharge water. It is also questionable whether the Mekong river will be able to self recover from the high pollution from aquaculture activities.

References available upon request.

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Aquafeed Horizons updates industry on processing technology and novel ingredients

This is the third aquafeed conference held in the series and the second in Asia. The aim, according to the organiser, Suzi Fraser-Dominy, aquafeed.com was to explore the market, learn the latest processing technology and ingredients for aqua feeds. This conference, in conjunction with Victam Asia & FIAAP 2008 trade show in Bangkok attracted some 160 participants from all corners of Asia.

Dr. Juadee Pongmaneerat, Thai Department of Fisheries, opened the conference with a review on recent developments in the aquaculture and aqua feed industry in Thailand. Thailand is a major producer of shrimp and shrimp feeds in Asia. In 2007, production was more than 794,000 tonnes of shrimp feed and 514,000 tonnes of fish feed.

New approaches

Some recent developments in aquaculture production showed that freshwater fish accounted for 12.8% of production at 523,709 tonnes in 2004 and comprising mainly tilapia, silver barb and walking catfish. This is followed by freshwater prawn, striped catfish, gourami, tilapia and walking catfish. These are mainly for local consumption, either fresh or frozen. Fish consumption in the country increased to 41.95 kg/capita. Shrimp is a major product with 530,000 tonnes in 2007 but 90% is exported. Local consumption was only 800g/year per capita.

The main changes in the feed industry in Thailand followed the major shift from the culture of the black tiger to white shrimp *Penaeus vannamei* since 2002. The 15% of total production of this shrimp in 2002 reached almost 98% of production in 2007. In shrimp farming, there has been significant progress in the certification of farms for GAP and CoC. Out of the 33,400 shrimp farms registered, 20,859 have been certified for GAP and 148 for CoC.

The aqua feed industry in Thailand is regulated under the Animal Feed Quality Control Act 1982 and is overseen by the Department of Fisheries. Commercial feed manufacturing and feed formulations must be registered. There are eight categories for aqua feeds. There is a monitoring system for feed quality control and these are performed at both manufacturing and farm sites under GAP and COC standards. In general, aqua feeds must meet the general policy that feed and feed stuffs should meet the nutritional quality requirements for target species and are reasonably priced to benefit farmers.

New approaches are in meeting both GMP and HACCP. Currently, there are 64 aquafeed mills comprising 22 shrimp feed plants, 13 fish feed plants and 29 producing both fish and shrimp feeds. Some 6 plants have HACCP certification and 8 GMP. Juadee added that the goal in Thailand is to work at quality standards along the production chain and this means GAP, CoC, GMP and HACCP. Part of this is the national residue control program for drugs and chemicals, including monitoring of antibiotics and malachite green residues.

Bottleneck situation with ingredients

Dr Peter Coutteau, Inve Aquaculture, Belgium reviewed a number of innovative concepts in aquafeed formulation to optimize performance and health in aquaculture as industry continuously face increasing prices for fish meal and fish oil and lately prices for plant meals, feed phosphate, amino acids, minerals and vitamins. A dilemma for the industry is the nutritional imbalances in terms of essential amino acids, fatty acids and lipo soluble vitamins and palatability of the feed

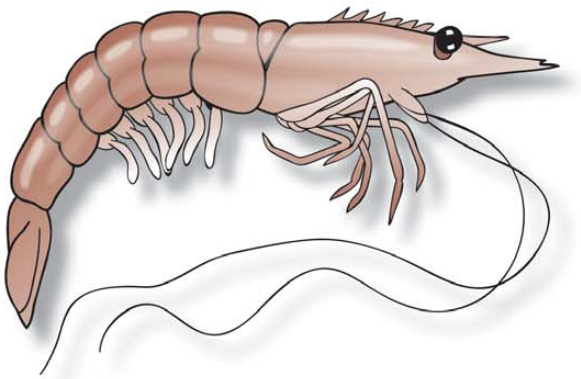
Lilyanti Soewanto, President Director and Ir Candra Yanuartin (right), PT Sinta Prima Feedmill, Indonesia

when fish meal/fish oil is omitted in feeds for carnivorous fish species. There is also the consumer acceptability of lower levels of n-3 HUFA in fish fed low levels of marine ingredients.

In a collaborative study with American Soybean Association (ASA), replacing fish meal/fish oil with vegetable proteins and fats, predominantly of soybean origin, from traditional inclusion levels of 45/15% down to 24/10% can be compensated with additions of amino acids, feed phosphates and a palatability enhancer. In January 2007, the formula cost of the replacement feed was 15% lower than the traditional feed. However this difference was only 4% a year later due to the price increases of the alternative ingredients. Peter discussed how to get more from increasingly-expensive ingredients by the use of various routes of improving the digestibility and utilization efficiency, such as the phytase to improve availability of phytate phosphate from plant meals. He added that the enzyme route is still complicated at the feed processing stage in extruded feeds. On page 26, details on current research for feed supplements designed to optimize feed digestibility and nutrient utilization efficiency for different aquaculture species are described.

Feed palatability

Among the methods available in assessing palatability of feed or ingredients for the shrimp, **Dr. Vincent Fournier**, Aquativ, France said the two pal test could appear to be an efficient one. The method is to offer shrimp two feeds at the same time and in the same tank. The apparent feed consumption for each feed is measured. He presented and discussed results of some trials conducted in the marine shrimp *Litopenaeus vannamei* in the University of Songkla (Thailand) and in Labomar (Brazil).



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Produced by Aker BioMarine

Thitipong Ekanee, Gold Coin Specialities, Thailand (left) and Chuchai Kanjanamayaon, Virgos International Co.,Ltd, Thailand

In the first trial, feeds with different levels in fish meal (9% and 4%) and squid meal (3% and 0%) were compared. The results indicated that palatability was higher with feeds containing 9% fishmeal and 3% squid meal as compared to diets with only 4% fish meal and no squid meal. In a second trial, Vincent said that they used a fish meal-free formulation as a basal diet. Squid liver meal (SLM) was included at 1% in the basal diet as a positive control. Four prototypes, two powders (1%) and two liquids (3%) were challenged to the SLM using the two pal-test. Results showed that three of the four prototypes performed significantly better than SLM but the high deviation among tanks implied that many replicates are required.

The last trial was conducted to investigate the influence of feed texture on apparent feed intake. A three month trial was conducted with feeds having the same formulation but showing significant differences in water absorption and dry matter leaching. Results showed a high correlation between water absorption and feed consumption values. It was concluded that although a two pal-test can be a good method to discriminate raw materials or ingredients in terms of palatability, attention is required on experimental design (feeding method and rhythm, number of replicate etc) and feed texture to effectively conclude on palatability performance of feeds or ingredients.

Feed stimulants, krill and insect protein

The Centre for the Environment, Fisheries and Aquaculture Science (Cefas), UK and Kiotech International plc has developed chemo-sensory feeding stimulants. **Dr Andrew Moore**, Cefas presented the results of some field trials conducted in Thailand with hybrid and with shrimp *L. vannamei* and in China at the Pearl River Research Institute and in Zhouhai with tilapia. **Dimitri Scalabos**, Tharos, Chile gave an overview of the South Antarctic krill Industry. He said that krill meals and oils have high nutritional values, but price competitiveness, processing and logistics complexities may mean that aqua feed producers should count on it being a feed component rather than an entire substitution option. **Ernest D. Papadoyianis**, Neptune Industries, Inc. USA said that R&D on the development of high quality protein meal derived from insects is in final stages. This Ento-protein has nutritional properties close to that of fish meal.

Extrusion and raw materials

Galen J Rokey, Process Technology Manager Wenger, USA looked at the impact of extrusion on raw materials for aquafeeds. The challenge for every processor is the ability to alter processing conditions and raw material formulations to keep formulation costs at a minimum, while maintaining high quality standards and minimum operating costs. Galen said that ingredient must be looked from the standpoint of the processor and how these fit into the realm of aquatic feeds. In raw material preparation, it is particle size. This will affect texture and uniformity of the final product. The guideline is that particle size must not exceed a third of the die opening. Farmers' perception on the product appearance is important.

Galen discussed functional aspects of formulation components with extrusion. The benefits of plant protein meals are more evident in floating diets, more binding properties for increased durability and lower incidence of mineral deposits in screw die. The flow index test for fish meal determines its processibility. Fish meals have relatively high flow numbers and thus have poor extrusion characteristics. The steps to overcome the poor flow properties were provided. In aquatic feeds, starch is a functional agent to improve pellet durability, fat absorption and buoyancy. Increasing starch will decrease bulk density. Floating diets have a minimum 20% starch and sinking 10% starch. As starch is gelatinized, digestibility improves.

Not all starches behave in the same manner, said Galen. Rice is sticky when gelatinised and short grain varieties should be avoided. Bran by products in rice and wheat can lower bulk density and affect equipment performance. In the case of fat, its nutritional value can be affected through oxidation, isomerisation or hydrogenation. Fat analysis via acid hydrolysis will give the true value of its composition. However, lipid binding occurring during extrusion does not impair digestion of the fat when consumed. Only values above 7% can impair the mechanical process during extrusion. Above this level, fats also weaken dough strength and textural development. Producing semi moist diets using humectants, may impact the entire plant layout, said Galen. On pathogen destruction, he said that extrusion at 75°C can destroy all pathogens in feed. While contaminated raw materials are not encouraged, extrusion does allow for complete destruction of pathogens such as *E.coli*, Salmonella and Listeria.

The Wenger group from the US and Asia at the Victam Asia 2008 trade show. From left, Cliff Zhou, Manager, Service Dept., China, Joe and Gayle Kearns, Doug Baldwin, Marketing Director, Wenger USA, Paul Chen, Sales Engineer, Christina Chen, James Chen, Country Manager, China and Jacquelin Chuang.

Value in extruding shrimp feeds

Joe Kearns, Process Manager, Wenger Manufacturing covered the technical advancements in extruded shrimp feeds. For many years, industry has looked at pelleting as the method of producing shrimp feeds. Today, the trend is to have sustainable practices. These include control over buoyancy, use of renewable resources, hygienic feeds and improvements in pellet durability to avoid pollution. It is also producing competitive feeds at profitable margins. The advantages of pelleting are the high production rate and low complexity of the equipment. However, pelleting is not adequate enough to destroy anti-nutritional factors and pathogenic organism and viruses. It is also not possible to produce micro-aquatic feeds directly with a pelletiser.

Extrusion can give the flexibility in uniform sizes, correct pellet density, good pellet durability, rapid hydration and good water stability. Most importantly, extrusion lends well to least cost formulation and to using plant meal in comparison to pelleting. With extruded shrimp feeds, density control to produce sinking pellets has been a challenge. However, with the recent advances consistent product density by varying moisture level is achievable.

A product density unit (PDU) attached to a single screw extruder can produce sinking pellets at high production rates. The Extrusion Density Management System (EDMS) for the production of shrimp feeds was also discussed. Current research is to replace the complex EDMS system with more user friendly technology.

Joe said, "I believe that cleaner feed are produced in extrusion as bacteria is eliminated during the process. However, as far as feed performance is concerned, farmers using extruded feed in South America have indicated 15-25% increases in growth but we have to conduct our own tests to be assured of this. In Asia, we now have vannamei shrimp as the main culture species and as this shrimp can accept more plant proteins as compared to the black tiger shrimp, this is where extruded shrimp feeds can be cost efficient".

Louis Mourey (left) and Louis Tricot at the Stolz Asia booth.

The future work will include evaluation of a variety of production methods for shrimp with a standard diet comparing extrusion of different styles with the pelleting process. Tests will include growth rate of shrimp, leaching of nutrients, digestibility of the feeds as well as water durability and standard feed lab tests.

Other presentations included starter feed technology by Will Henry, Extru-Tech, USA and beyond pre-conditioning; reducing carbon footprint and increasing quality by Colin Mair, Cormal Technology, U.K.

The potential of prebiotics, organic acids and plant-based immunostimulants as feed additives to enhance culture of aquatic animals

By Matthew R. P. Briggs and Antonio Martinez Sanchez

Increasing emphasis is being placed on the production of traceable, environmentally-friendly and residue-free seafood. Lack of acceptance of antibiotics and other banned drugs and chemicals is forcing the industry to look for alternative means of reducing disease incidence, whilst supporting/ enhancing production.

Recently, efforts have been made at combining synergistic mixtures of prebiotics, organic acids and salts and/or plant-based immune stimulants, which can be incorporated into aquatic animal diets. Such substances have proven capable of improving nutrient digestibility, favouring beneficial intestinal flora, eliminating intra and extra-cellular pathogenic bacteria, and promoting the immune system, resulting in higher resistance to stress and disease and improved growth, survival, FCR, production and cost-efficiency, even in the face of viral epidemics.

Prebiotics

Prebiotics such as fructo-oligosaccharides (FOS) are non-digestible carbohydrates which beneficially affect the host by selectively stimulating growth of beneficial bacterial species such as Lactobacilli or Bifidobacteria. FOS are the most selective prebiotic as they do not promote growth of non-probiotic bacteria (Rycroft et al., 2001). Prebiotics are a substrate for these beneficial micro-organisms, which ferment and metabolize them readily and thus enhance digestion and competitive exclusion of harmful pathogenic bacteria, as well as enhance the mucous, thicken the intestinal epithelium and prevent adhesion of pathogenic bacteria (Panigrahi et al., 2005).

Another benefit of prebiotics is that there is limited utilization by harmful bacteria including Vibrio, *E. Coli*, Listeria, Clostridium, Edwardsiella, Pasteurella, Aeromonas and Salmonella (Steiner, 2006). This pushes the essential equilibrium between helpful and harmful intestinal bacteria towards health. Products of prebiotic fermentation include volatile organic acids causing a lowering of pH, resulting in unfavourable conditions for pathogenic bacteria and increased mineral absorption. As immunomodulators, prebiotics can stimulate phagocytosis and the beneficial microflora they promote help imprint an immune response on developing larvae.

Prebiotics have been used extensively in terrestrial animal diets, but until recently have been little studied or used in aquaculture (Burr et al., 2005). Some data with *Litopenaeus vannamei* has shown that FOS enhanced the haemocyte respiratory burst (Li et al., 2007), whilst various fish species fed prebiotic supplemented diets have shown enhanced resistance to pathogens, increased growth and digestibility and stimulation of intestinal Bacillus at the expenses of Vibrio (Li and Gatlin, 2006).

The main advantage of prebiotics over probiotics is that there is less regulatory control over their use as they are natural feed ingredients, and that they can be incorporated directly into the feed without loss during manufacture. There is potential for combining pre and pro-biotics (synbiotics) as synergistic effects have been noted in various species (Gibson and Roberfroid 1995, Ziggers, 2001).

Organic acids or acidifiers

Organic acids are 1-7 carbon chain acids such as formic, acetic, proprionic, lactic, butyric, sorbic, fumaric and citric. They are widely distributed in nature as normal components of plant and animal tissues and commonly formed through microbial fermentation of carbohydrates in the proximal intestinal tract of animals. Blending these acids together has synergistic effects which improve the growth and cost-efficiency of livestock (Liu, 2001).

Organic acids and their salts have potential to replace antibiotic growth promoters in livestock diets. They act within the animal intestine to inhibit pathogenic bacterial species such as Vibrios, *E. coli* and Salmonella, hence reducing the proliferation and/or colonization of these pathogens and toxin production. Useful gram-positive bacterial species (i.e. Lactobacilli) have high intracellular K concentration, stabilizing pH and allowing them to resist low pHs (Russell and Diez-Gonzales, 1998).

Organic acids have an antimicrobial effect through penetrating intra and extra-cellular bacterial cells and then dissociating, releasing a hydrogen ion which disrupts the acid-base balance and hence the bacterias' biochemical activities, resulting in bacterial death. Organic acids have activity over a broad range of pathogenic (and antibiotic resistant) bacterial species (Liu, 2001). The commonly believed paradigm that probiotics function through the bacteriocidal activity of bacteriocins was shown to be false by Vazquez et al. (2005), with the lactic and acetic acids produced by fermentation of the lactic acid bacterial probiotics used, being responsible for the effects.

The nutritional benefits of organic acids include lowering gastric pH, resulting in increased activity of proteolytic enzymes and retention time and improved protein and mineral digestibility, absorption and retention. They may also affect intestinal morphology and serve as intermediary metabolic substrates.

Although substantial evidence exists of the positive effects of organic acids in livestock diets (in terms of growth, feed conversion and bacteria and diarrhorea control and feed sanitization), very little work has been done with aquatic species. A recent review done by Luckstadt (2007) suggested that work done on salmon trout, char, tilapia, Clarias catfish and shrimp showed that dietary inclusions of organic acid salts or blends can result in improved growth and survival rates, improved digestibility and feed conversion ratios (FCR), lower gastric emptying rate, augmenting the antibacterial effect of the acids. Trials with red sea bream showed improved growth and phosphorus utilization in fish fed 1% of organic acids, especially citric (Hossain et al., 2007). Trials with tilapia revealed that survival after Vibrio challenge tests was improved in fish fed as little as 2 mg/tonne of potassium diformate (Ramli et al., 2005). In shrimp, addition of 5 kg/tonne of Na citrate and inactivated Lactobacilli have been shown to improve growth of *P. japonicus* (Tung et al., 2006), whilst 2.5 kg/tonne of Ca-formate can enhance survival rates in shrimp growout (Luckstadt, 2007).

Plant extracts or phytobiotics

Plants and fruits have evolved with effective antimicrobial, antifungal and antioxidant defence systems. Combining their strengths with an

effective promoter of beneficial gut bacteria (prebiotics and organic acids) provides a multi-functional weapon in the fight against production losses.

Such phytochemicals are low molecular weight secondary metabolites which come from a wide range of plant species. Mixtures of herbal extracts can have strong antimicrobial, antioxidant and appetizing effects and can help stimulate the production of digestive juices and enzymes, which in turn improve feeding efficiency, digestibility and the immune system (Mellor, 2001).

Plant extracts are natural immunostimulants which have been shown to improve resistance to viral, bacterial, fungal and parasite infections in both land and aquatic animals. This is achieved through their stimulatory effects of the immune system which responds to them as if it were being challenged by a pathogen and thus protect the animal against subsequent infection. A wide variety of plant extracts have been tested (mostly in the lab) against various pathogens of aquatic animals with encouraging results. Several phytochemicals have been found effective against viruses (i.e. white spot and yellowhead viruses in shrimp) and bacteria in both fish and shrimp (Direkbusarakom, 2004, Immanuel et al., 2004, Sivaram et al., 2004, Citarasu et al., 2006, Balasubramanian et al., 2007). However, commercial trials to confirm under field conditions are still largely lacking.

Liptocitro neutraceutical

The proprietary feed ingredient Liptocitro (Liptosa, Spain) is the result of a combination of over 50 natural active substances, including prebiotics, organic acids and plant extracts which improve health, with prebiosis, immunostimulation and flora modulation all acting synergistically.

Trials have been conducted both in laboratory and field with a range of fish and shrimp species, at all phases of the life cycle, where improvements in nutrient digestibility, growth and survival, the balance of intestinal flora and stress resistance to various pathogens have been observed. The better immune and health status of the treated populations have generated more heterogeneous batches, with higher added value for the packing plants. It can be incorporated in the feed mill during diet manufacture, or it can be top-dressed on the feed.

Liptocitro trial data

Unpublished trials conducted in the VISAVET laboratory of the Complutense University, Madrid, Spain showed that Liptocitro possessed strong antibacterial activity against a range of pathogenic bacterial species commonly encountered in aquacultural production systems (Table 1).

Unpublished 6 month trials conducted in 4 replicate tanks in the laboratories of IMIDA, Spain with European seabass (*Dicentrarchus labrax*) under ideal conditions, without a disease challenge showed that fish fed 3g/kg of Liptocitro showed 3% improvement in growth and survival rates and 8% improvement in FCR over the fish in the control tanks. Improvements in the haemocrit and haemoglobin levels of fish blood following a stress test were also observed.

Table 1. MIC of Liptocitro against bacterial strains tested in VISAVET laboratory, Spain.

Microorganism	Minimum Inhibitory Concentration (ppm)
Aeromonas hydrophila	3
Aeromonas salmonicida	1
Vibrio parahaemolyticus	6
Vibrio alginolyticus	6
Vibrio ordali	6
Vibrio vulnificus	1
Listonella anguillarum	3
Pseudomonas anguilliseptica	0.1
Pseudomonas flourescens	3
Photobacterium damselae	3
Yersinia ruckeri	3
Lactococcus garvieae	6
Strepococcus parauberis	6
Mycobacterium marinum	0.1

Figure1. Production data stocking juvenile shrimp in the Honduran trial during WSSV outbreak

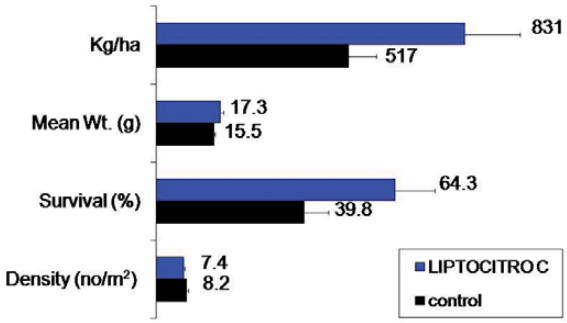
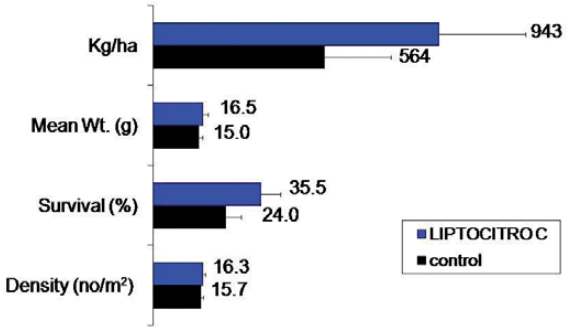


Figure2. Production data stocking PL shrimp in the Honduran trail during WSSV outbreak



There is evidence that Liptocitro can help mediate mortality caused by the white spot virus in shrimp. To test its effects against the WSSV virus, trials were conducted in the laboratory of a shrimp farm in Panama feeding 12g/kg of Liptocitro in diets fed to 9 gram *P. vannamei* for 22 days, before an oral challenge with the white spot virus. Results showed almost a doubling in survival from an average 12 % in the control tanks (10 reps) to 21% in the treated tanks (10 reps).

Follow up work conducted in commercial shrimp farms in Honduras were conducted during the rainy season when outbreaks of the WSSV occur each year, during the summer of 2007. Results from these trials stocking at least 2-3 replicates of both juvenile (Figure 1) and postlarval (Figure 2) *P. vananmei* at low (7-16/m^2) density showed significant and consistent improvements in growth, survival and production of the shrimp treated with 3-6g/kg of Liptocitro throughout the culture cycle, despite outbreaks of WSSV during the cycle. These gains resulted in almost a doubling in gross profit in the treated ponds.

Acknowledgements

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Enhancing value of expensive ingredients and nutrients: innovative feed concentrates to maximize feed utilization

By Peter Coutteau PhD, Sam Ceulemans, Wouter Meeuws, Alexander Van Halteren, Rocio Robles and Abidin Nur

The continued inflation in prices for several ingredients is creating new opportunities for innovative feed additives that can optimize the feed utilization efficiency. This article illustrates the current research for feed supplements designed to optimize feed digestibility and nutrient utilization efficiency for different aquaculture species.

The fast growing aquaculture sector now accounts for almost 50 % of the world's food fish. It is perceived as having the greatest potential to meet the growing demand for aquatic food. This 'blue revolution' presents opportunities for the feedmilling industry to increase production by several million tonnes of aquafeed in the coming years. Global feed production for farming fish and crustaceans is expected to reach 32 million tonnes by 2012 (extrapolated from 21 million tonnes in 2005; FAO, 2006). Rising prices of feed ingredients is a continuous challenge for the aquafeed industry, particularly in regions where the farmers face difficulties in accepting higher feed prices because of the stagnation or decline in ex-farm prices for commodities species such as shrimp, tilapia and catfish.

Apart from fishmeal/fish oil of which prices have escalated since 2006, in 2007, all major ingredients, including vegetable proteins, wheat flour, feed phosphates, additives, vitamins and minerals, have shown significant price increases. For example the price of wheat doubled in price in two months. The background to these increases is competition for common resources among bio-diesel,bio-ethanol and feed industries, the global demand for limited resources, increasing environmental awareness and associated costs for the additive-producing industry in China. Although predictions are difficult under the current global economic panorama, it is unlikely that ingredient prices will return to previous levels.

Therefore, we can expect increasing benefits from innovative concepts that can optimize the utilization efficiency of nutrients from traditional ingredients. This was recently illustrated by the increasing use of phytase enzymes in poultry and pig feeds to improve the use of plant-bound phytate phosphorous as a response to increasing feed phosphate prices. Various types of feed supplements can enhance the absorption and/or utilization efficiency of nutrients. These include exogenous enzymes, compounds which aid the digestive process by improving absorption, mobilization and transport of nutrients, stimulators of enzyme secretion, feeding stimulants reducing feed/nutrient waste, pre and probiotics enhancing gut function and botanical extracts modulating the gut microflora. However, the screening of these active compounds for aquaculture has just started.

Getting the most from shrimp feed ingredients

Similar to poultry and livestock production, the drive for improved competitiveness is pushing for innovations in shrimp nutrition and a better understanding of the cost benefit of feed formulations under the wide variety of shrimp culture conditions. The challenge for shrimp feed producers is to continuously tailor their formulations to meet the best cost-efficiency for each farm situation. Shrimp, similar to other animals, require a set of digestible nutrients in the right proportions to grow in the most effective way.

Shrimp test center at BADC, Jepara, Indonesia

However, the application of least cost formulation in shrimp feeds is still limited due to the inadequate knowledge of nutrient requirements and their availability in various ingredients, the inputs of natural food supplementation in the pond and interactions between different nutrients. Furthermore, interactions between ingredients and feed stability and the difficulty to cost characteristics such as attractability, often result in formulations with low degrees of freedom for the formulator. Increasing research efforts in the field of shrimp nutrition has resulted in a range of specialty ingredients to fortify the typical raw materials used in the shrimp feed mill.

In shrimp feed formulations, significant value is given to marine ingredients, including fishmeal, squid, shrimp by-products and fish oil. Reducing the levels of these valuable ingredients is often limited by the restrictions on digestible protein/energy values, palatability and essential lipids such as phospholipids, n-3 fatty acids and cholesterol. The combined application of a novel feed supplement to enhance digestion and absorption of dietary lipids in shrimp (Aquasterol, Coutteau et al., 2002) and a formulated palatability enhancer developed specifically for shrimp (Aquaflavour; Ceulemans et al., 2003) to reduce the requirements for traditional ingredients was evaluated in practical feed formulations with *Litopenaeus vannamei* in a tank trial at the Brackishwater Aquaculture Development Center, Jepara, Indonesia (Table 1).

Two feeds were formulated at the same cost using either exclusively commercial feed ingredients ("traditional feed") or a combination of standard ingredients with the feed supplements Aquasterol and Aquaflavour ('novel feed'). To balance the cost of the novel feed, significant reductions were made in the formulation for traditional feed ingredients, which resulted in lower analytical levels for various nutrients compared to the 'traditional' formula. These are in available phosphorous (water soluble phosphorous), cholesterol, phospholipids and n-3 HUFA which were different by minus 7% to minus 44% (Table 1). Due to some

Soybean meal bulk storage at a feedmill

variations in practical ingredients, the 'novel' feed also showed lower specifications in crude protein and fat compared to the 'traditional' feed.

Results showed that shrimp fed the 'novel' feed had significantly better growth (1.17 g/week versus 1.07 g/week) and showed no differences in terms of survival, food conversion and protein efficiency ratio compared to animals fed the traditional feed (Table 1). This seemed contrary to the lower nutritional specifications of the novel feed. Verification trials under pond conditions in Indonesia using similar formulations confirmed the above findings. These results clearly showed the potential for making shrimp formulations less dependent on traditional feed ingredients by enhancing the digestibility and availability of nutrients using novel feed supplements.

Table 1: Evaluation of novel feed supplements to reduce the requirements for traditional ingredients in commercial feeds for *Litopenaeus vannamei*. Data from a 70-day feeding trial with *L. vannamei* using triplicate tanks of 1 m³ stocked with 20 shrimp/tank. Two feeds were formulated at the same cost using either exclusively commercial feed ingredients ('traditional') or a combination of standard ingredients with the feed supplements Aquasterol and Aquaflavour to enhance feed utilization and palatability ('novel').

Shrimp feed formula	Traditional	Novel	% difference (novel vs traditional)
Diet analysis			
Crude Protein (%)	35.8	34.8	-3%
Crude Fat (%)	8.7	8.2	-6%
Crude Ash (%)	9.1	9.4	4%
Moisture (%)	9.59	9.64	1%
Watersoluble Phosphorous (%)	0.48	0.32	-34%
Cholesterol (GLC, %)	0.18	0.10	-44%
Phospholipids (Iatro scan, %)	0.93	0.85	-9%
EPA (mg/g DM)	4.8	5.0	4%
DHA (mg/g DM)	5.7	4.8	-16%
n-3 HUFA sum (mg/g DM)	11.9	11.1	-7%
Results growth trial 70 days *L. vannamei*			
Survival (%)	91.7	93.3	ns
Initial weight (g)	1.02	1.02	ns
Final weight (g)	11.31	12.74	+13% *
Gram/week	1.03	1.17	+14% *
Feed Intake (%/ABW/day)	5.45	5.61	ns
FCR	2.29	2.31	ns
PER (weight gain/protein intake)	1.23	1.25	ns

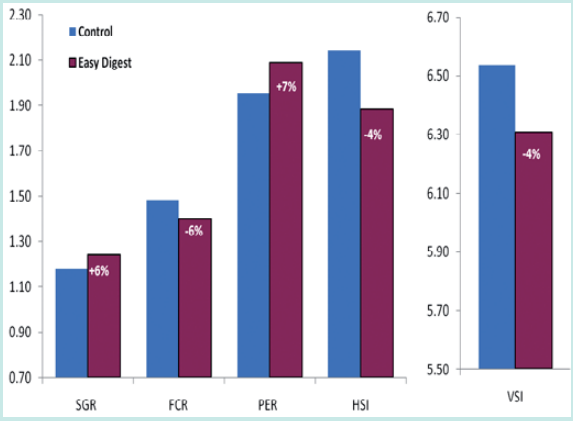
*ns= not significantly different; *= significantly different P<0.05*

Getting more from fish feed ingredients

In the livestock industry, a wide variety of feed additives are currently being investigated to get more value out of valuable raw materials. This is especially because supplementing sub-therapeutic levels of antibiotics as growth promoters is banned in the European Union. Organic acids, enzymes, probiotics, prebiotics, highly available minerals, essential oils and natural plant extracts are some alternatives to antibiotics without causing bacterial resistance that would have at least similar effects on growth and food conversion. This active search for natural growth promoters is starting to extend into fish farming as consumer pressure is likely to ban antibiotics from production in most countries.

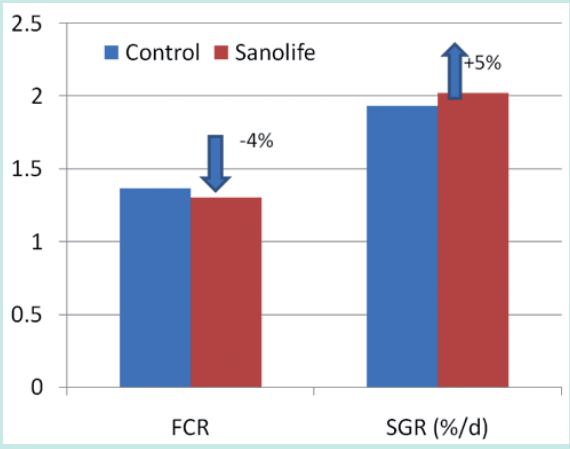
Recent screening work under controlled lab conditions at Caditec Testing (Spain) has revealed the potential of several natural products for improving the feed utilization in fish. The addition of a concentrate of natural digestibility enhancers to practical feed formulations for Nile Tilapia (*Oreochromis niloticus*) significantly improved growth, food conversion and protein efficiency (Fig. 1). The improved availability of dietary nutrients and energy for muscle growth was illustrated by the reduction of visceral wastes consisting of digestive system and fat deposits in the belly and liver of the fish, resulting in reduced hepatosomatic and viscerosomatic indexes. Reducing processing wastes and maximizing filleting yield has important consequences for the profitability of the production of fillet fish such as Tilapia and Pangasius catfish.

Figure 1. Effects of a concentrate of natural digestibility enhancers (Easy Digest) on growth, food conversion, protein efficiency ratio,and liver/viscera weight in Nile Tilapia. Data from a 70 day lab trial with Nile Tilapia using triplicate tanks of 100l per diet. Fish were grown at 26°C in a freshwater recirculation unit from 40g to ± 90g while fed on a practical tilapia grow out diet with CP/CF of 33/7.6.



An innovative feed concentrate based on a synergistic combination of natural plant extracts, selected after an intensive screening for extracts with bacteriostatic and/or bactericidal properties, had significant effects on growth and feed conversion in Gilthead seabream (Decamp et al., 2007). These effects have been confirmed for Nile tilapia (Fig. 2). Phytobiotics are currently successfully used as natural growth promoters replacing antibiotics in weaning and ongrowing pigs and are a promising area of additive research for improving growth and feed conversion in aquaculture feeds. Furthermore, since the gut is the main entry port for bacterial and viral infections, the capability of specific plant extracts to modulate the composition of the gut microflora offers interesting perspectives for better protection against bacterial and viral infections in aquaculture organisms.

Figure 2. Effects of a concentrate of synergistic phytobiotics (Sanolife GUT) on growth and food conversion in Nile Tilapia. Data from an 10 week laboratory trial with *Oreochromis niloticus* using triplicate tanks of 100l per diet. Fish were grown at 25°C in a freshwater recirculation system from 16g till 70g while fed on a practical tilapia grow out diet with CP/CF of 33/7.5



Bottomline

Due to rising ingredient prices, feed additives that improve the nutrient digestibility and feed utilization of fish and shrimp offer good opportunities to improve the cost-efficiency of aquafeed formulations. More research in aquaculture species is required to screen for more active compounds and to understand the mechanisms of action for different species and compounds.

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Ulcerative disease in cultured grouper in Khanh Hoa Province, Vietnam

By Nguyen Thi Thanh Thuy and Nguyen Huu Dung

A survey on the ulcerative disease of several groupers showed that the infection rate was 30%, mainly with monogeneans. Bacterial infection was mainly with Vibrio sp.

The high value groupers (*Serranidae*) are commonly cultured in China, Indonesia, Malaysia, Thailand, the Philippines and Hong Kong. In Viet Nam, traditional grouper culture, mainly in sea cages started in the early 90's in Quang Ninh, Hai Phong, Phu Yen and Khanh Hoa provinces.

However, as culture expanded, disease has become one of the major limiting factors for its continued growth. One major challenge is the ulcerative disease which often occurs in the summer months from March to July. Some 78% of 12 farms culturing groupers in ponds and 83% of 38 cage farms in Khanh Hoa Province were affected in 2005. The infected rate was 30% of the cultured grouper population (Nguyen T,T.T, 2005). The resultant economic loses to grouper farming has been severe. Investigations on the agent, or agents, causing the disease are part of an ongoing fish health problem in aquaculture. Solutions to prevent these are necessary for a sustainable development of grouper culture in Viet Nam.

In 2005, the Research Institute for Aquaculture No. 3 (RIA3) and University of Nha trang conducted a series of investigations on the disease. Affected fish with extensive haemorrhagic septicemia and ulceration of the skin, fins and tail were collected from the main culture area in Khanh Hoa Province. Live fish were transported to laboratory in aerated seawater.

Examination for ectoparasites and isolation of bacteria and fungi

The external surface and gills of the fish were examined for ectoparasites. Fungal isolation was performed using muscle lesions plated on Sabouraud Chloramphenicol Agar (SA) supplemented with 2% NaCl

The liver, kidney and muscle lesions of the affected fish were sampled aseptically and plated directly onto Thiosulphate citrate bile salt sucrose agar (TCBS), Trypticase Soy Agar (TSA) and Cetrimide agar (CA) supplemented with 2% NaCl. They were then incubated at 33-35°C and colonies were observed after 24 hours of incubation. The predominant colony was sub-cultured to pure growth and held on TSA slopes for subsequent identification using primary tests (Gram stain, shape, motility, oxidase, catalase and salinity tolerance) and secondary tests (API 20E Kit, bioMe'rieux) (Frerichs, 1993; Holt *et al.*, 1994).). Predominant strains were tested for their susceptibility to seven antibiotics by the agar diffusion method as described by Larsen and Farid, (1980).

Bacterial challenge

Epinephelus bleekeri (13.6 ± 1.6 cm in length and 33.5 ± 9.2 g in body weight) were collected from the wild and held in a 4m^3 composite tank in aerated seawater, with daily exchange of seawater. The fish were fed daily with steamed trash fish for 10 days before the challenge test.

Three high prevalence bacteria strains (*V.parahaemolyticus*, *V.alginolyticus*, and *V.carhariae*) were selected for the challenge tests to determine their pathogenicity to grouper with duplicate groups. Each trial was conducted in four 500 litre composite tanks for the 3 treatments plus a control group. The challenges were given at 10^4, 10^6 and 10^8 cfu/ml. All tanks were covered with dark plastic covers during the experiment.

The challenged fish were injected intramuscularly with 0.2 ml suspension bacteria/fish. Sterile physiological saline (0.85% NaCl) was used for control groups. The fish were then monitored daily for clinical signs and for mortality for 10 days. Dead fish were removed daily and kidney, liver and muscle lesions were sampled for bacteria isolation. The mean percent cumulative mortality of challenged fish was determined for each trial over the 10 day period.

Gross clinical symptoms

The main species of groupers cultured in Khanh Hoa were *Epinephelus bleekeri*, *E. coioides*, *Plectropomus leopardus* and *Cromileptes altivelis*. With the exception of *C.altivelis*, the other three species were often infected. Among these species, *E.coioides* and *E bleekeri* were often cultured in

Figure 1. Grouper species infected with ulcerative disease collected in Khanh Hoa Province. Clockwise from left: *P. leopardus, E. bleekeri, internal E. coioides* and *E. coioides*

ponds and others were cultured in cages in Khanh Hoa. The order of frequency of infection was *P.leopardus* > *E. coioides, E. bleekeri* > *C.altivelis.*

The first symptons of the disease were loss of appetite accompanied by darkening of fish colour. Affected fish were often lethargic and were found swimming at the water surface. This may be accompanied by a loss of equilibrium and exhibition of abnormal swimming behaviour. These abnormal signs were followed by hemorrhaging on the mouth, fin and anus and subsequently the development of body ulcers and fin rot (Figure 1). Heavily infected fish may exhibit bloody discharges in the abdominal cavity. This was due to internal hemorrhaging, as well, as darkening of the liver.

Composition of ectoparasites

In the 16 fish examined for ectoparasites, 7 species, belonging to 7 genera in 5 phyla were found. The monogeneans, *Pseudorhabdosynochus epinepheli* and *Benedenia* sp., were dominant amongst the parasites having a prevalence of 37.5%. Other parasites found were the ciliates, *Trichodina* sp., *Apiosoma* sp., *Ambiphrya* sp., the crustacean, *Caligus* sp. and the annelid, *Zylanicobdella* sp.

All of these parasites may cause disease conditions in grouper by their direct action upon the hosts. They may also be responsible for breaking the host surface epithelial barrier and aiding other diseases, primarily bacteria and/or virus to enter the hosts (Bui, 1998; Cruz-Lacierda and Gregoria, 2004; Leong, 1994).

Fungal infections

After 48 hours incubation on SA at 33-35°C only one fungus was found. It was characterized by white tubular hyphae, with large conidiophores with one row of sterigmata, spores were small and dark grey. These were identified as belonging to the genus Aspergillus. This fungus was found only in 2 of 16 fish and was not considered the cause of the ulcerative disease.

Bacterial infections

Nine bacteria species were isolated (Table 1). Amongst them, Vibrio occurred most often at 55.6%, followed by *V. parahaemolyticus* (56%), *V. alginolyticus* (50%) and *V. carchariae* (25%).

Table 1. Bacterial composition of affected grouper (n=16)

No.	Species	Frequency (n = 16)	Percent (%)
1	*Vibrio alginolyticus*	8	50.0
2	*V. parahaemolyticus*	9	56.0
3	*V. carchariae*	4	25.0
4	*V. anguillarum*	3	18.8
5	*V. harveyi*	1	6.0
6	*Edwardsiella tarda*	2	12.5
7	*E. ictaluri*	2	12.5
8	*Pseudomonas sp*	1	6.0
9	*Pasteurella piscicida*	1	6.0

Vibrio species occur widely in aquatic environments and are part of the normal flora of coastal seawater. They also exist as normal flora in fish and shellfish but have also been recognized as opportunistic pathogens in many marine animals (Austin and Austin, 1999).

The present study showed that at least 5 species of Vibrio are associated with ulcerative disease in grouper. Studies on cage culture grouper in other countries have showed the presence of the same species as in Table 1. Lee (1995), Ong (1988) and Li et al. (1999) also reported seven Vibrio species associated with vibriosis in silver sea bream (*Sparus sarba*) with a dominance of *V.alginolyticus* and *V.parahaemolyticus*. Studies in Viet Nam's Quang Ninh, Hai Phong and Nghe An areas also showed similar results with Vibrio being present in 15-44% of the total grouper tested (Bui,1998; Phan, 2005).

Antibiotic sensitivity test

The results of the antibiotic sensitivity tests are shown in Table 2. All strains were resistant to Kanamycin, Cefalecin and Ampicilin but sensitive to Ciprofloxacin, Erythromycin and Tetracylin.

Table 2. Antibiotics sensitivity of studied strains

Antibiotic	Diameter of Resistant circle (mm)		
	V.alginolyticus	*V.parahaemolyticus*	*V.carchariae*
Tetracylin (30g/l)	20.0 S	18.0 I	22.0 S
Kanamycin (30g/l)	12.7 R	12.0R	13.0 R
Streptomycin (10g/l)	12.0 I	13.0 I	15.0 S
Cefalecin (30g/l)	12.0 R	13.0 R	12.0 R
Ciprofloxacin (5g/l)	25.7 S	32.0 S	27.0 S
Erythromycin (15g/l)	19.0 S	22.0 S	24.0 S
Ampicilin (10g/l)	11.0 R	10.0 R	11.0 R

Notes: S: sensitive; I: Intermediate; R: resistant.

Challenge tests

After 10 days of experimental infection, the fish injected with *V. parahaemolyticus* and *V. alginolyticus* displayed ulcers with similar clinical signs previously observed in cultured fish in Khanh Hoa province. Cumulative mortality of the fish is shown in figures 2 and 3.

Figure 2. Cumulative mortality of grouper challenged with *V. parahaemolyticus* (NTC1207BI7k55)

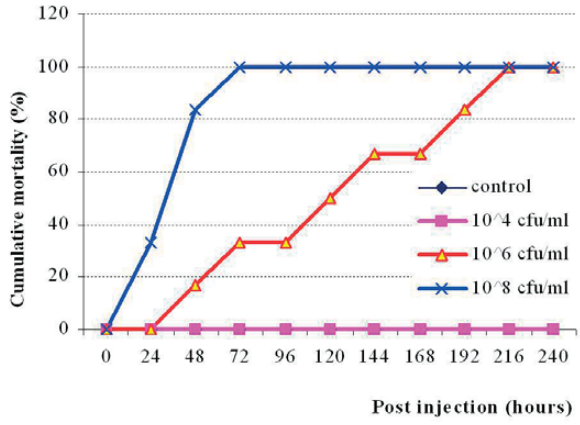
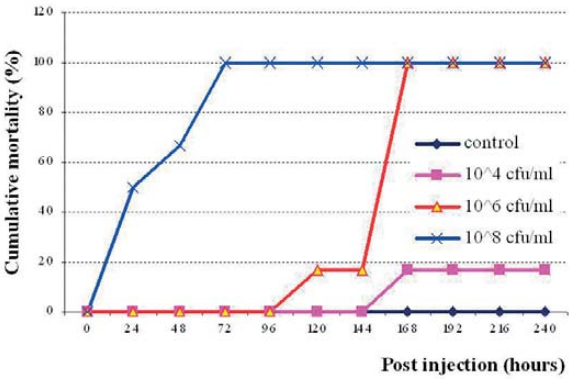


Figure 3. Cumulative mortality of grouper challenged with *V. alginolyticus* (NTC0606BI4k50)



Conclusion

These results suggested that *V. alginolyticus* and *V. parahaemolyticus* were the causative agents of ulcerative disease of grouper in Khanh Hoa Province, rather than parasites and fungus. However, the latter may also cause disease condition in grouper by their direct action on the host surface epithelial barrier for bacteria to enter the host and cause disease.

Authors' note: The same problem with groupers is still happening in Nha Trang, fortunately with lower level seriousness/prevalence thanks to the reduction of stocking density, and better pond water quality management as a prevention strategy in pond culture. However, the infection is still serious in grouper cage culture. Thus Thuy is continuing with the fish immune response and vaccine development as her Ph.D thesis work.

Acknowledgements

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References are available on request from the editor

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Impact of a commercial mixture of nucleotides on growth and health in vannamei shrimp and tilapia

An illustration on the efficiency of a well balanced mixture of nucleotides used as immunostimulants.

By Hervé Lucien-Brun and Frédéric Vidal

Immunity is the capacity of the organisms to resist infections. In fish and shrimp, immunity against bacterial and/or virus diseases in the aquatic environment is of high-priority. Fish have two immune systems, the non specific and specific. Shrimp seems to be protected only by the non-specific immune system. The use of immunostimulants on the non-specific immune system is a method that has proved its effectiveness. Most of the time, this is through feeds.

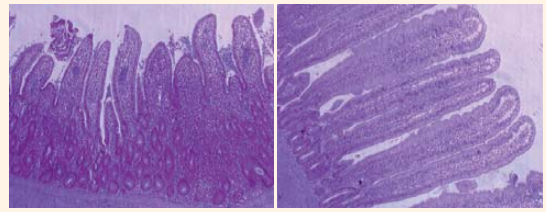
Nucleotides revisited

A nucleotide is a chemical compound consisting of a heterocyclic base of a sugar and one or more phosphate groups. In the most common nucleotides the base is a derivative of purine or pyrimidine, and the sugar is the pentose (five-carbon sugar) deoxyribose or ribose. Nucleotides are the structural units of RNA, DNA, and several cofactors. In the cell they play important roles in energy production, metabolism, and signalling. Nucleotides are essential to support all body functions. Nucleotides provide the natural building blocks for cellular growth, multiplication and for the biosynthesis of proteins and enzymes.

A nucleotide deficiency is a serious limiting factor for many of the key functions of the organism such as the fast multiplication of cells of the immune system, the liver or the hepatopancreas and/or the intestine.

The growth of the number of the internal cells of the small intestine or enterocytes which facilitates the selective transit of the nutrients to the blood, depend on the availability of nucleotides in the food ration. This is because its capacity in synthesizing nucleotides is very limited. The development or re-establishment of the intestinal mucous integrity is only possible if the organism receive a well balanced mixture of nucleotides (Figure 1).

Figure 1. (left) a- Fish fed control diet (day 14) and right b. Fish fed Nucleo 20 supplemented diet (day 14). Photo courtesy of Lallemand.



Many of the requirements for nucleotides cannot be supplied sufficiently through *de novo* synthesis. The addition of free nucleotides in the food ration is beneficial, especially to surpass stress situations. Diets are deficient especially during periods of peak demand. The *de novo* synthesis is energy consuming and so it is important to provide dietary nucleotides. It is also important to note that the nucleotides not in its free form or the nucleic acid forms tend to be very stable and therefore are very difficult to digest by the organisms.

Several components have been used as immunostimulants without a real demonstration of their efficiency. The most promising substances are the glucans and the nucleotides. Below, we illustrate the efficiency of a well balanced mixture of nucleotides used as immunostimulants.

A commercial mixture of nucleotides

In a series of trials, Nucleo 20 which is a specific combination of purified nucleotides, specifically formulated for aquaculture applications was tested.This product contains naturally occurring RNA, nucleotides, precursor of nucleotides extracted from the yeast *Saccharomyces cerevisiae*.

Growth, survival and FCR of vannamei shrimp

The trial was conducted with juvenile shrimp (initial body weight, 0.2g) for 8 weeks. Stressful conditions were induced with low salinity (3 ppt). The shrimp were fed with a commercial feed (Zeigler Bros. USA -45% crude protein, 15% crude fat). The trial was done with two groups in triplicate. The control group was fed a standard feed and the treatment group was fed diet containing Nucleo 20 supplemented in the feed at 2kg per tonne of feed. Experiments were conducted in 60 litre tanks. The results show a similar mortality level in both groups but the treatment group showed significantly higher ($p<0.05$) weekly average weight (Figure 2).

Figure 2. Effect of mixture of nucleotides on the growth of juveniles shrimp.

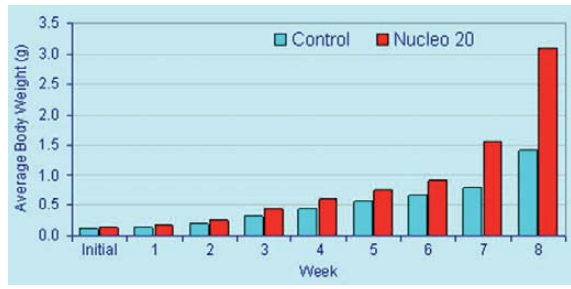


Figure 3. Effect on the growth of *L.vannamei* after WSSV contamination.

Figure 4. Effect on the survival of *L.vannamei* after WSSV contamination.

A similar trial was carried out with 5.5g shrimp reared at a density of 115 animals per litre in 60 litres tanks under similar protocol. The experimental period was 31 days. The results showed a similar significant improvement in growth. The final body weight was 13.6% higher and the survival was 4.05% higher. In another trial in earthern ponds in Ecuador, shrimp at an initial density of 170,000 pcs/ ha, did not show any growth after 31 days. However, there was an improvement in terms of food conversion ration and survival which were -10.8% and + 4.05% respectively.

Similar results were obtained in some field trials in Thailand. The trial period was 110 days. These results show that supplementation with the nucleotides mixture in the feed for *L. vannamei* induced a direct a direct improvement on growth rate, survival and FCR (Table 1).

Table 1. Result of the trials with *L. vannamei* in Thailand

Parameters	Unit	Control group	Treatment group	Change % (1)
Trial 1- Trial Period 110 days				
Final Weight	gram	20	25	+25
FCR	1:	1.65	1.2	+27.3
Survival	%	70	80	+14.3
Trial2- Trial Period 87 days				
Final Weight	gram	12.5	15.4	+23.2
Survival	%	65	90	+38.5

(1) *Control= 100*

Effects on resistance against disease

A 24 day trial was conducted in 60 litres tanks with *L. vannamei* juveniles of initial body weight, 0.97g at a salinity of 31 ppt reared for. Triplicate groups of shrimp were fed three times per day with a commercial diet and a diet supplemented with the nucleotide mixture (2kg/tonne). After 5 days, each tank was contaminated with White Spot Virus (WSSV) WSSV infected animals.

These trials conducted in Thailand, showed that the treatment diet improved significantly the resistance of shrimp during this experimental infection with WSSV in terms of growth and survival .

Tilapia

Similar trials were also conducted on tilapia *Oreochromis* hybrids. Each batch comprised 50 juvenile tilapia and the experimental period was 16 weeks. Triplicate treatment groups were fed feed supplemented with 2kg of Nucleo 20/tonne. The survival and the growth parameters were measured weekly. The results show a direct significant impact on the growth of the fish, in terms of length, body weight and growth rate. Results in Table 2, showed that total length was 6.6% higher and average body weight was 33.8%.

A similar positive effect was observed on the survival and on the FCR.

Table 2. Result of the trials with Tilapia hybrid in Thailand conducted over 16 weeks

Parameters	Unit	Control group	Treatment group	Change % (1)
Trial				
Total length	cm	7.8	8.3	+6.6%
Average body weight	gram	12.	16	+33.8%
Weight gain	gram	4.7	6.4	+35.8%
Final Weight	gram	12,5	15,4	+23,2
Feed conversion rate	1:	2.14	2.09	-2.3%
Survival/16 weeks	%	90	95	+5.6%

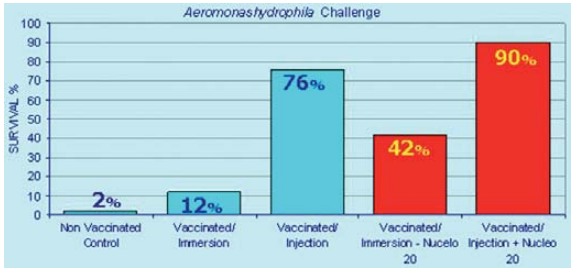
(1) *Control= 100*

Immunoreactions

These trials were conducted to compare the reaction of tilapia in the control group and those fed diets supplemented with the nucleotides. The experimental period was 84 days. Experimental details and diet composition was similar to the previous experiments.

In these trials, fish were vaccinated by immersion or intramuscular injection. The animals were infected with a virulent stock of *Aeromonas hydrophila* which is a heterotrophic gram-negative bacterium, mainly found in of warm climate areas. When infected with *Aeromonas hydrophila*, fish are usually affected by diseases such as, ulcers, tail rot, fin rot and haemorrhagic septicaemia, which in tune may induce heavy mortalities. The survival was measured daily. The results of this trial show that the nucleotides mixture in the diet improved the immune response of tilapia after vaccination and significantly reduced mortality due to *Aeromonas hydrophila*.

Figure 5. The effect of nucleotide on the efficiency of vaccination in tilapia.



Conclusion

The results of these trials showed that the supplementation of the feed with a well balanced mixture of nucleotides, promoted better growth and survival throughout the production cycle. It improved diseases resistance, growth and the vaccination effectiveness of aquaculture species. It also helped to to reduce the negative effect of stress.

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Note: The presented trials was conducted with the collaboration of Lallemand

Role of Bacillus probiotics in fish larvae production

By Olivier Decamp

The benefits of selected strains of Bacillus as alternatives to prophylactic use of chemicals in the hatchery are described.

The intensive rearing of marine fish larvae implies important interactions between the larval fish and bacteria, which may be detrimental when they are not kept under control. Hatcheries have been plagued by an increased incidence of microbial diseases, often claimed to be caused by opportunistic Vibrio spp. For this reason, hatcheries apply different types of water treatment methods to reduce bacterial loads in the culture water. This includes the indiscriminate use of disinfectants and drugs into the rearing water. These approaches disturb the balance of microbial communities and favour uncontrolled growth of opportunistic bacteria. Another consequence receiving attention in the press is the development of resistant strains.

Microbial products are seen as, among other things, alternatives to the prophylactic use of chemicals. As discussed in numerous scientific reviews, selected microbial strains can perform a range of functions, from the control of pathogens, both in digestive system and environment, by direct inhibition and competition for nutrients, to the stimulation of the immune system, an enhanced feed utilization and the improvement of water quality.

Bacillus strains

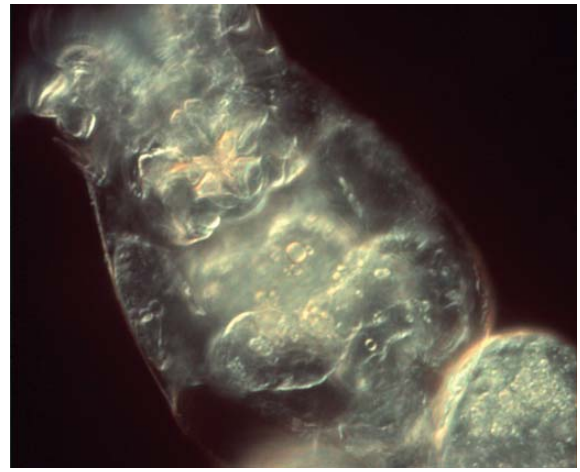
In a previous report, the selection procedure required to design mixtures of Bacillus strains for shrimp and fish rearing, both larviculture and ongrowing was discussed. The Bacillus strains that make up the Sanolife fish products were selected for their ability to inhibit fish pathogens directly, to grow in a wide range of environmental conditions prevailing in aquaculture environments (dissolved oxygen concentration, salinity and temperature) and to degrade organic wastes. Their safety to humans and target organisms had also been investigated (see our previous communications on the subject in AQUA Culture AsiaPacific, Sept/Oct 2005; Feed Technology Update, September 2006; Feed Mix Issue 1, 2007)

Here we report on the benefits of applying a mixture of selected Bacillus strains in fish larviculture. These include the reduction in Vibrio load in live food, reduced fish stress and improved fish growth. The latter is being investigated using recently described biomarkers. In a series of trials carried out in Asia and Europe, the mixtures of selected Bacillus strains was applied at a final concentration ranging between 1 and 5 x 104 cfu/ml in rearing tanks, and/or 1 x 107 cfu/ml in the rotifer enrichment medium.

Effect on live food

Among the solutions is the control of bacteria in live food production. Both types of generally used live food, rotifers and Artemia, have high loads of bacteria. As the nutritional composition of both live feeds is inadequate for marine fish larvae, their DHA (docosahexanenoic acid) and EPA (eicosapentaenoic acid) content is boosted through enrichment. However, this procedure leads to an even higher bacterial load. Makridis et al. first demonstrated that the microbial communities associated with rotifers can be influenced with the aim to obtain a beneficial microflora in the larval gut of turbot and then emphasized the need to colonise the rotifers and Artemia with the favourable strains via bioencapsulation as shown in the picture. This approach was used in order to deliver Sanolife Bacilus strains to fish larvae. Laboratory and field experiments showed that the addition of selected Bacillus strains could reduce the Vibrio load in both rotifer and algal cultures (see International Aquafeed September 2006).

The combination of relatively high water temperature, high density of larvae, high loads of organic matter, and low water exchange rates can quickly result in poor hygienic conditions in the larval rearing tanks. The addition of safe bacteria can improve water quality conditions by degrading the waste products. Bacillus strains were selected for their ability to release a wide range of exo enzymes.



Bioencapsulation

Effect on fish growth

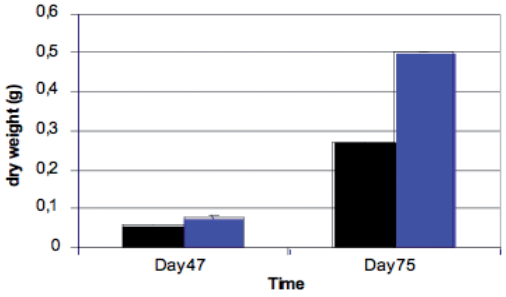
Several molecular biomarkers are widely used to define fish appetite, metabolism and growth. In all vertebrates, the regulation of appetite, digestion and, consequently, body weight is a complex phenomenon involving interactions between the brain and peripheral signals. Early studies indicated that in fish as in mammals the hypothalamus is involved in the control of food intake by the action of complex pathways. This pathways includes Growth Hormone (GH) release enhancing the secretion of IGF-I from the liver (stimulating muscle growth) but also myostatin (MSTN), a member of the Transforming Growth Factor-β (TGF-β) family that has a negative effect on myoblast proliferation and growth.

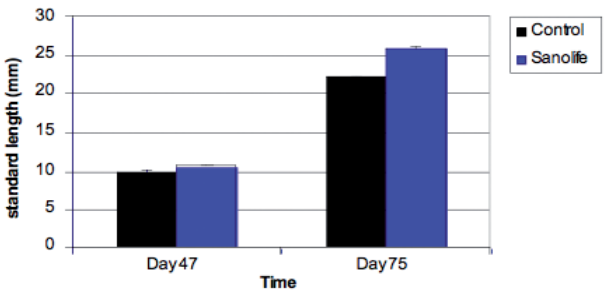
A collaborative project with Prof Carnevali from Delle Marche University (Italy) and Pavlos Makridis (HCMR, Greece) showed that larvae and juveniles fed on live prey treated with Sanolife probiotic had statistically significant ($p<0.05$) increase in growth rate in both standard length and body dry weight compared to the control group (Figure 1), but also a higher expression of Insulin-like Growth Factor-1 (IGF-1) and lower expression of myostatin.

Effect on fish stress

At the physiological level, stress activates the nervous system and triggers a cascade of humoral reactions along the hypothalamo–pituitary –interrenal axis that ultimately results in the rapid release of corticosteroid stress hormones. The physiological effects of corticosteroids are regulated by the cellular glucocorticoid receptor (GR), a ligand-inducible transcription factor that can activate or repress target genes. Stress leads to an increase of the level of HSP 70, a chaperonin that plays important roles in a variety of physiological processes, including

Figure 1.





cellular stress. Stress conditions can negatively influence a variety of physiological functions related to metabolism, immunity, behaviour and osmoregulation.

The same collaborative project showed lower levels of HSP70 (Figure 2) and GR gene expression in fish fed on live prey treated with Sanolife probiotic during all the treatment indicating a better tolerance to far conditions of this group.

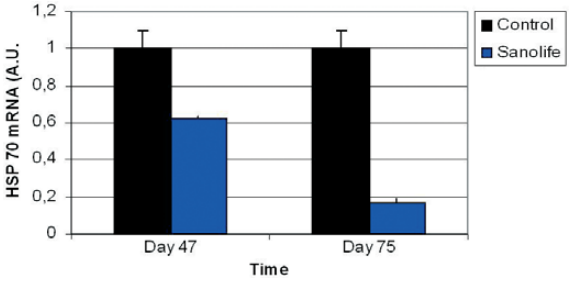
Finally, after 80 days of culture, the larval mortality was markedly reduced in the tanks that had received Sanolife probiotics delivered via water and live food.

Conclusion

These results show that the addition of selected strains of Bacillus has the potential to improve fish production, either by controlling Vibrio load, improving water quality, reducing stress (and thus reducing mortality), or by increasing the expression of genes involved in growth or improving the uptake of nutrients in the gastrointestinal tracts (and thus increasing growth rate).

References available on request

Figure 2.



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A new concept in algal production

The father and son team Jan Vanhoutte and Dr. Koenraad Vanhoutte (right)

By bridging the classic gap between laboratory model and industrial production, SBAE Industries in Belgium sees the potential for its pure algal products to meet the specific needs of aquaculture.

It all started back in 2005, with the brilliant idea of Dr. Koenraad Vanhoutte, biologist and algae expert, when he wanted to use algae to produce biomass for several applications.

Koenraad Vanhoutte said, "It was very difficult to convince potential stakeholders of the academic breakthroughs of the last 10 to 15 years. I knew that, in combination with solid industrial experience, they would result in professional B-to-B products".

However, it was not until mid 2006 that the company SBAE was started together with Jan Vanhoutte, his partner and father. The combination of indepth scientific know how from Koenraad and the vast industrial experience from Jan allowed to bridge the classic gap between science and a working factory.

Today, there are 16 people working in the company, four of them with PhDs in biology. Among them is Dr. Victor Chepurnov, one of the world's leading experts on experimental culturing of micro-algae and author of more than 60 international peer-reviewed scientific papers on the subject. He started the culture collection of micro algae at the University of Ghent (B). It was here that he met Koenraad and accepted to be the Head of R&D of SBAE Industries.

Koenraad added, " We now produce algae based on a proprietary indoor technology resulting in pure algae species for high value application: *Nannochloropsis spp., Phaeodactylum spp., Tetrasemis spp. Chaetoceres spp., Isochrysis spp., Thalassiosira spp. Cyclotella spp., Skeletonema spp.* and many more in our own culture collections. We also use the SBAE Diaforce outdoor technology to produce large volumes of biomass with extremely high nutritional value".

Aquaculture as the core business

Koenraad explained that while algae can be used in many fields, the focus will be on the global aquaculture industry. As a second step, the bio energy industry will be looked at.

"The reason for this choice is simply that aquaculture has a tremendous opportunity to grow and prosper. However, the unavailability of large volumes of high quality algae has been a substantial draw back until now. SBAE has solved that problem with the sustainable technologies it has designed."

On the significance of algae to aquaculture, he said, "Algae forms an essential part of the natural diet of many aquaculture species, be they fish, molluscs or shrimp. We target those specific times in the life cycle where algae has the highest positive impact on growth and survival. We can supply that missing part of the natural diet of a particular species. One of the very critical issues in hatcheries is the uncertainty of delivery of algae of the right quality and at the right time. Through our long standing experience of our production manager in aquaculture feed formulation, we know exactly what the problems are with conventional micro-algae products. We have a continuity of supply in large volumes of different types of algae, each with its own specific advantage, and last but not least with stable optimum quality".

The company also differentiates itself from other producers of algae. "We have our own culture collection and we have the skills to isolate new cell strains, new species and carry out our own breeding programs from which optimum algae are then selected (e.g. omega-3 concentration, antioxidant, pigment, etc). We can even select local species on demand. Being independent of publicly available collections, we are fully in control of the quality of our algae. We have a continuous production process that provides algae in their optimum condition. Through our tailor made harvesting process, cell integrity is guaranteed. As a result there is no leaching of cell content which strongly reduces nutrient pollution and bacterial activity in the tanks. Cell integrity is also crucial to increase the shelf life of the products. Finally our products have 100% traceability from raw material to the shelf of the customer/blender".

The target is for SBAE is to become the world centre of knowledge when it comes to algae application in the aquaculture sector. Based upon this continuously evolving knowhow, it will continue to formulate and customize the best solutions to meet specific needs of this industry. This will help to reduce mortality, improve health of shrimp and fish, reduce the cost of production and therefore increase and stabilize income of fish/shrimp farmers.

On the route to marketing, Koenraad said, "We want to work together with local professionals in the different fields (research, sales and technical support) and target the best possible service to our customers.

Industrial production of micro-algae for aquaculture applications

SBAE Industries produces micro-algae and derivatives for a variety of applications such as nutritional supplements for fish farms and other aquaculture activities. We developed a profound and ground-breaking technology with expertise that enables us to develop a stable industrial manufacturing process for micro-algae.

Aquaculture

SBAE Industries can offer 100% pure algae solutions for aquaculture. Some advantages of the grades produced by SBAE Industries are:

- Guaranteed no toxic residues.
- Proven lower mortality rate in hatchery.
- Additional nutritional benefits of the algae.
- Continuous (high volume) production process guaranteed.
- Clean surface water in the hatchery.
- No hassle with unstable, on-site algae production.

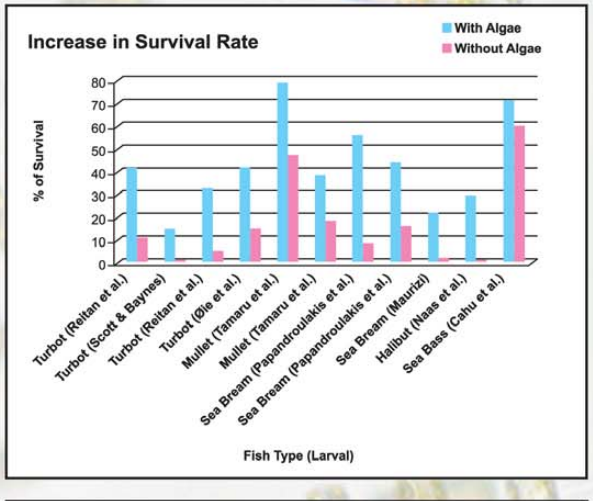
Company Facts and figures

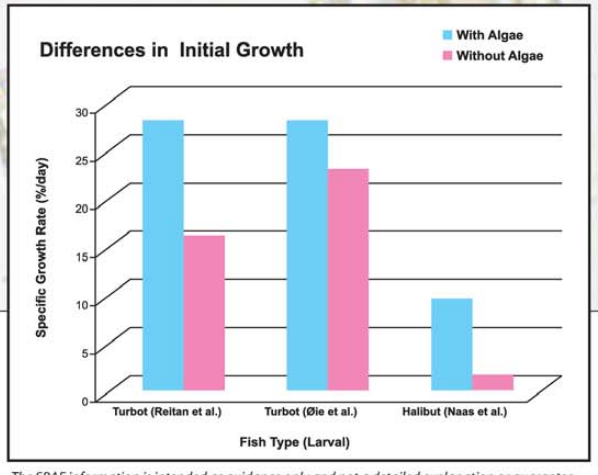
- Founded in 2006 by Koenraad Vanhoutte, PhD in biology (University of Ghent) and expert in algae, and Jan Vanhoutte, CEO.

A few of our available products are:

- Nannochloropsis
- Tetraselmis
- Thalassiosira
- Skeletonema
- Isochrysis
- Phaeodactylum
- Chaetoceros

....and more.





The SBAE information is intended as guidance only and not a detailed explanation or guarantee for future performance (of any example, real or hypothetical mentioned). SBAE can make no representation of any kind.

Source: Live feeds in marine aquaculture.

sbaeindustries nv/sa

sustainable bio-engineering for the aquatic environment

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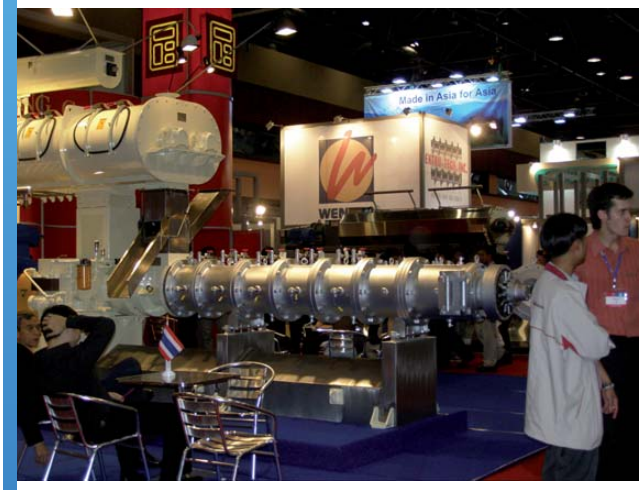
Victam Asia & FIAAP 2008

A one stop for additives to ingredients, aqua feeds and processing technology

The show, a combination of Victam Asia 2008 and Feed Ingredients & Additives Asia Pacific 2008 was the largest in Asia for the feed industry. At the Queen Sirikit National Convention Centre in Bangkok there were 6,000 visitors from 69 countries from 5 to 7 March 2008. This was an increase of 55% as compared to Victam 2006, which was also held in Bangkok. The number of non-Thai visitors increased to 40% as against 29% for the previous event.



Dr Günter Romer and Christian Lückstädt at the Addcon booth

The Victam show displayed a wide range of equipment for the processing, moving and storage of animal feeds, aqua feeds, pet food, rice and grains, as well as biomass. Exhibitors within FIAAP 2008 introduced a comprehensive display of ingredients and additives to the specialist animal feed markets of South and South East Asia.

Aquaculture as an important market for feed equipment and products was clearly evident. Out of the 150 exhibitors, some 54 exhibitors had products for the aquafeed industry. Aside from the Aquafeed Horizons and FIAAP technical conferences, technical seminars also covered process technology for aqua feeds.

Norway to Asia with special feeds

New to the show and to the aquaculture industry in Asia is **Blue Limit** AS and Siamalgamate Co. Ltd. Blue Limit is a Norwegian aquaculture larvae/fry feed product and technology company with its headquarters in Bergen, Norway. It was established in August 2006 by researchers from Fiskeriforskning (now Nofima) and business developers from Sarsia Innovation AS. Nofima is a new industry-oriented research group that conducts research and development for aquaculture, fisheries and food industries. Siamalgamate is a technology-market developer that assists new and existing companies with new technologies and products into the South-East Asian and Scandinavian markets. In the South-East Asian aquaculture industry, it represents Blue Limit AS.

The pending technology from Blue Limit combines the in-depth understanding of the attraction, ingestion and digestion of feeds with extensive knowledge on available marine ingredient sources and innovative processing to provide unique hatchery feeds meeting optimal physico-chemical and nutritional properties. The target of Blue Limit is to produce and sell a range of formulated aquaculture larvae/fry feed products for crustaceans and fish. At the show, the new product was Brilliant Blue, a unique early stage formulated shrimp hatchery feed (see product news for details). The company is targeting to produce and sell a range of formulated aquaculture larvae/fry feed products. Subsequently, it will have Brilliant Glory to substitute Artemia (live feed) for part or all of the hatchery development of shrimp larvae.

Sustainability

Sustainability, the key word in aquaculture industry, is the focus for Dalian, China based **Addcon Asia** which promotes environmental products. This is Aquaform, a safe and sustainable additive containing EU approved ingredients. This is a non antibiotic growth promoter which Christian Luckstadt introduced at their booth. It is effective for significant increase in growth, feed conversion and has strong antimicrobial effects to help mitigate the impact of bacterial infections. Trials conducted in China showed that a 2kg/tonne application led to higher growth (18.6%) of tilapia.

Olivier Derome, Sopropêche

Lyndon Flower (left), A&J Mixing International

The French company, **Sopropêche** was created in 1968 and then became a world leader in fish meal and specific proteins for the feed industry. It has some innovative products, mainly for the aquaculture and pet food industry. The company is well known for its soluble fish protein hydrolysates, the results of enzyme hydrolysis to ensure a high content of bio active peptides with high digestibility. This is well known in Asia as an attractant in shrimp feeds as well for the nutritional value of the ingredient. There are two products CPSP 90 with 82-84% protein and 9-11% fish oil and CPSP G which has 72-74% CP, 20-23% fat and are used in the early development stages of young animals which do not havea developed enzymatic system such as in young fish, shrimp, calves, piglets and petfood. The hydrolysates are flash pasteurized and spray dried.

At its booth, Olivier Derome, President said that it is important to note that CPSP is a result of enzymes hydrolysis on fresh fish as opposed to fish soluble with lower nutritional value which are products from fish meal production. CPSP are not only excellent attractants, having high protein composition and excellent digestibility, they inhibit the enzyme which converts angiotensin and act on stress mitigation. Sopropêche is a major producer and importer of fish meals and marine proteins. The extensive range of products are not only French, Scandinavian and South American fish meals, salmon meals, fish bone meals, krill meals, squid meals, salmon, tuna, cod, crustaceans and all kind of marine meals, but also animal and vegetable proteins and yeast products. At the show, the company which is already present for about 20 years in Asia sees huge potential markets in the aqua and petfood industries.

Vet Superior Consultant Co, Thailand Group is a leading manufacturer of quality biotechnology fermented and hydrolysed soy protein for replacement of fishmeal, soybean meal, skimmed milk, milk replacer and soy protein concentrate in animal feed and organic mineral supplement for swine, poultry, diary, beef, equine, fish and shrimp. The patented fermentation and hydrolysed technology yields the most bioavailable value soy protein products in the market today. At its booth, it introduced a new innovative product from soybeans. Inno- Pro is fermented and hydrolysed with *Lactabacillus* and proteolytic enzymes. It has a minimum of 50% protein and 3% fat.

Also marketing products for aquafeeds was **Beijing Sunpu Biochemical and Technology Co., Ltd. China**. Founded in 1992, the company focuses on research and development on environment friendly biochemical products. It is one of the key collaborators for the Chinese National Standard of L-Ascobic acid-2-phosphate product. It is the largest supplier of L-Ascobic acid-2-phosphate for feed industry in China, and has more than 60% market share in home market. In order to provide risk-free and uniform quality products, Sunpu has passed ISO9001:2000 and GMP certification.

Some of the other companies at the show with feed additives for aquaculture were Novus Aqua, DSM Nutritional Products, Ye Cherng Biotechnology, Aquativ and Chemoforma.

Optimisation in extrusion

There were huge displays of feed equipment, principally extruders. **Wenger** and **Extru-Tech** took the centre stage with two large single screw extruders. Extru-Tech offers a complete family of single screw cooking extruders ranging in capacity from 90 to 15,000 tph depending on product type, formulation, size, shape and density specifications. At the show was a unit of a 8-10 tph single screw E925 cooker/extruder which the company said is the most efficient single screw extrusion cooking system available on the market. This particular extruder will be used to produce catfish feeds in Vietnam. Equally impressive was Wenger's single screw extruder with a chimney to vent out excess steam. Wenger is also one of the world's largest suppliers of dryers and dryer/coolers for commercial applications. Drying is a costly process and the advantage of their dryers is the +/- 0.5% variance in drying, according to Joe Kearns. He added that their dryers are usually purchased together with extruders.

Higher capacity and flexibility

At the booth of **Clextral, France**, Patrice Breillot, Asia Pacific Market Manager said that a focus for the company at the show was in the production of microfeeds, both floating and sinking and for fish and shrimp. The prerequisites for this are a fine particle grinder, a Clextral twin screw extruder fitted with the specific die and cutting device. Most importantly, dust is not created during the production process. Another focus is for higher capacity extruders to meet the increasing production requirements. The company has recently supplied two extruders to Vietnam with capacity of 10-12 tph each. One of the benefits of the unit is the flexibility to use a wide range of raw materials as well as cheaper raw materials to optimize the cost of recipe and lower cost of operations. As for quality feed, he noted that the demand is for feeds with less wastage when in water and a focus on environment. This requires appropriate extruder technology that can cook a product well so that feed is well utilized with good feed conversion ratios.

Mixing and vacuum coating

New to this show in Asia was **A&J Mixing International**, Canada. It has a 20 year history in manufacturing cost effective high performance mixers and machines customized for mixing, coating and vacuum infusion. Over 400 machines have being built in that time. The company supplies complete systems - mixer coater, hoppers, and automated controls. At the booth, the mixing performance of a mixer, PHLAUER (pronounced Flower) was demonstrated.

Lyndon Flower, Regional Sales Manager said, "The vacuum coaters are designed to apply the full range of coatings; enzymes, minerals and medical blends. For extruded fish pellets, we would also go to 12%

Patrice Breillot (left) and colleague at the Clextral booth

atmospherically. However on fish feed pellets from a pellet mill, the highest we would go is 8% and you may even need vacuum for that, depending on density. We have a demonstration vacuum infusion mixer that we would test to showcase our abilities with the customers product and to alleviate any concerns.

He added, "We like to take responsibility from the exit of the dryer or screener after the dryer to the inlet of the cooler, including local liquid tanks, powder additions, vacuum system, valves and flexible connections. We are The Good People to Mix With! for a reason".

Also at the show were feed equipment manufacturers from Asia with large booths and display of extruders. Triumph Engineering, Thailand, China's top equipment manufacturers, Muyang Group and Zhengchang and Taiwan's Idah Machinery displayed pellet mills, conditioners and mixers for shrimp and fish feed production.

DuPont Qualicon

New approach to disease testing and food safety

A test to specifically target *Vibrio* spp. and compliment automated systems for diagnosis of pathogens and food contaminants.

Aquaculture in Asian countries contributes a major share to total global marine food production. However, bacteria such *Vibrio* spp., usually associated with fish diseases in marine and brackish water systems, are frequently encountered. These usually result in considerable losses to the industry as well as to human health. Vibriosis is a disease caused by infection with bacteria of the Vibrio genus, most commonly *Vibrio parahemolyticus* or *V. vulnificus*. Vibrio bacteria cause diarrhea, skin infections, and/or blood infections. The diarrhea-causing *V. parahemolyticus* is a relatively harmless infection, but *V. vulnificus* infection, though rare, can lead to blood poisoning and death in many cases.

Aquaculture is plagued with disease problems stemming from the intensification of culture systems, similar to other farming systems. Disease is a result of the complex interaction between the host, the pathogen and the environment. However, once a pathogen or disease agent is introduced and is established in the natural environment, there is little or no possibility for either treatment or eradication. In an intensive culture system, opportunistic Vibrio-related disease can progress rapidly, especially under poor quality water and nutrition environments, thus prevention is essential.

Diagnostics in aquaculture is an important tool for pathogen detection and control, particularly as disease can spread rapidly through tanks, ponds and cages. In addition to various conventional microbiological and serological methods, nucleic acid-based methods are widely adopted for pathogen detection. The most common feedback from the industry relates to the technical gaps and general need for faster, more accurate, user-friendly techniques for the diagnosis of the different pathogens.

DuPont Qualicon is developing a new single-tube polymerase chain reaction (PCR) test for use with the BAX system, an automated method for screening and detecting pathogens and other microbial contaminants in food. The test will specifically target Vibrio cholera, *parahaemolyticus* and *vulnificus*. This application aims to deliver a dramatic increase in speed over previous technologies and lead the aquaculture industry into a new era of fast, easy-to-use testing with more accurate results.

The use of a genetic–based diagnostic system can be applied for brood stock, hatchery/nursery, and grow out stages as well as for aqua-feeds and other inputs used in the production process to help ensure consistent Vibrio-free products. Potential areas where the Bax system can also be implemented are raw and cooked fish and shellfish, processing and distribution chain, where safety and quality can change as the product moves along and in the production process, where traceability from farm to table has become increasingly important.

Tableted PCR reagents make the BAX® detection system easy, quick and cost-effective.

The BAX® System Q7 incorporates innovative PCR technology to offer advanced DNA-based detection for food safety and quality testing.

Food processing companies around the world can rely on this system to detect pathogens or other organisms in raw ingredients, finished products and environmental samples. Its uses leading-edge technology, including PCR assays, reagent tablets and optimized media, to also detect *Salmonella*, *Listeria*, *E. coli* O157:H7, *Enterobacter sakazakii*, *Campylobacter* and *Staphylococcus aureus*. With certifications from AOAC and AFNOR, adoption by the USDA Food Safety & Inspection Service and validations by government laboratories in the Americas, Asia and Europe, the BAX system is recognized globally as the most advanced pathogen testing system available to food companies.

Another DuPont Qualicon product, the RiboPrinter® Microbial Characterization System is an automated, bacterial genetic fingerprinting system with the capabilities to do source tracking at the strain level. By linking genetic fingerprints of bacterial isolates to historical or geographical data associated with each isolate, food processors can obtain detailed microbial information to track bacterial contamination in production facilities. When used in concert with the BAX system, both tools are useful in ensuring traceability and safe products from farm or sea to table.

More information about DuPont Qualicon and its products is available at www.qualicon.com

ASA-IM and IB

Soy-based fish feed extrusion

The large, well-known Indian Broiler (IB) Group has invested USD 3 million in extrusion machinery for a 200 tpd feed plant, after being convinced on the viability of new fish feed technology demonstrated by American Soybean Association-International Marketing (ASA-IM).

The production of high quality soy-based floating fish feeds is a new venture for this major company that historically has focused primarily on the poultry and dairy industries. The new facility was inaugurated in March 2008 by United Soybean Board's Director, Jim Call and US Soybean Export Council's Project Manager, Colby Sutter, who cut the ribbon and started the plant for the first time.

This event included a technical seminar where Call made a presentation on "The Future of Soy-based Aquaculture Feeds" and Dr. Victor Suresh, Director of Integrated Aquaculture International, made a presentation on "Why Extruded Fish Feeds for India?" Dr. Vijay Anand, Technical Director for Poultry, Livestock and Aquaculture, ASA-IM, India referred the event as the "First Extrusion Landmark" and informed the audience about how ASA-IM chronologically made progress to establish this new modern feed technology avenue.

Bahadur Ali, Managing Director of the IB Group shared his experience and understanding on the fish feeds, and the parameters he considered prior to making this decision, the large dormant market and his vision to tap this segment. A stakeholders meeting after the seminar was organized by the IB group and ASA-IM where important trading and marketing-related decisions were adopted by IB's management team in order to effectively launch the sales process in major fish feed markets in India.

The newly imported extrusion equipment of Indian Broiler Group.

Colby Sutter (Project Manager-US Soybean Export Council) launching the new extrusion feed mill through the electronic control panel. On extreme right is Dr P. E. Vijay Anand.

The Indian Broiler Group is a diverse company with an annual turnover of USD112 million. Its main activity, involving vertical integration of commercial broilers, has a combined (breeders, layers, broilers and cockerel) rearing capacity of 4 million birds using environment controlled housing and automatic feeding systems. Broilers are efficiently marketed to corporate consumers and through its own 125-odd chicken outlets in Central India. IB's state-of-the-art feed mill of 400 tpd capacity for poultry and dairy feeds is equipped with bulk silos and bulk feed tankers. On the backward integration model, the group has established its own 500 tpd solvent extraction plant and 250 tpd oil refinery for soy producing soy oil. The group also has a large dairy farm with over 2,000 high yielding animals, and IB markets its own packaged milk. The company also has a 100 tpd organic pellet fertilizer plant through which it recycles poultry and dairy manure produced in their farms.

G. Ramesh, Technical Manager-Aquaculture, ASA-IM said that IB's pioneering entry into fish feed production is a major development step for the Indian fish feed sector. The company's expansion into fish feeds is a strong indication towards adoption of technology and ability to foresee a potential market and its requirements. Two grades of extruded floating feeds with 28% crude protein, 3% fat and 32% crude protein and 6% fat will be launched initially under the brand name 'Abis Fish Feed' and these will meet nutritional requirements of most omnivorous freshwater fish farmed in India.

(The article was contributed by P.E.Vijay Anand, More information: Email: vanand@asaimasc.org / Tel: +91- 9312274564

Key nutrients in Antarctic krill product lower cost in shrimp production

Aker BioMarine, in a series of scientific studies, has demonstrated improvements in yields for key industrial aquaculture species such as the salmon and shrimp for its Qrill™ products. A recent study at the Brazilian research centre LABOMAR confirms these findings with the shrimp *Litopenaeus vannamei*.

The company is an integrated company supplying biomarine ingredients a controlled value chain from raw materials to customer.

Krill

Antarctic krill *Euphausia superba* are small, shrimp-like crustaceans that constitute one of the world's most abundant sources of marine nutritients. Krill derived products, such as oil and meal, have a high content of bioactive ingredients such as omega-3 bound phospholipids and astaxanthin. These have positive effects in both humans and animals.

Omega-3 fatty acids are known to contribute to cell membrane functioning through elasticity and permeability and thus as the transport mechanism of key components of cells. Phospholipids play a key role in the absorption and metabolism of nutrients. Phospholipids are also important building blocks for all cells in the body. As the omega 3 fatty acid, DHA is of particular importance in the first few months after hatching, and DHA bound to phospholipids seems to increase survival rates and decrease malformation in fish and shrimp larvae.

Protein and lipid source

Qrill™ meal has been reported to act as a feeding effector and growth promoter in shrimp diets. However, as a relatively new ingredient, little is known about its potential to replace key protein and lipid sources in shrimp diets. Thus an extensive study was performed at the centre to evaluate the growth and the economical performance of juveniles of *L. vannamei* when fishmeal, fish oil, soy lecithin and cholesterol were partially or fully replaced by the product.

The study was conducted in 25 indoor and 25 outdoor tanks. Five replicates were designated for each control and treatment diet. Feeds consisted of a basal diet designed to fully meet the nutritional requirements of the shrimp. From the basal diet, three other formulae were designed to progressively replace fishmeal, fish oil, soy lecitin and cholesterol by Qrill™ meal. Diets N1, N2 and N3 contained the meal at 11%, 5% and 1%, respectively, with reduced levels of fishmeal (0%, 6.25%, 12.50%, respectively), fishoil (0.80%, 2%, 1.58%), soylecitin (0%, 0% and 1.55%) and cholesterol (0%, 0.08%, 0.15%). As these ingredients were replaced by the meal, formula costs in N1, N2 and N3 reduced by 18.0%, 15.9% and 7.5%, respectively, compared to the basal diet (Figure 1).

After 72 days of rearing, shrimp in both systems showed no differences in performance among treatment feeds ($P > 0.05$). An economic analysis indicated that gross profit margin was mainly driven by formula costs. Increased gross profits were obtained with greater savings in formula costs. Thus, all formulas containing Qrill™ were more cost competitive and advantageous than the basal diet.

Conclusion

Results showed that Qrill™ meal was able to fully replace fishmeal and soy lecithin with no significant impact on shrimp performance. The use of the meal at all inclusion levels (1%, 5% and 11%) led to a higher economical return when compared to a diet containing 18.5% fishmeal, 2.0% fish oil, 1.5% soy lecithin and 0.15% cholesterol.

Figure 1. Relative formulation cost of *L. vannamei* diets (USD/tonne).

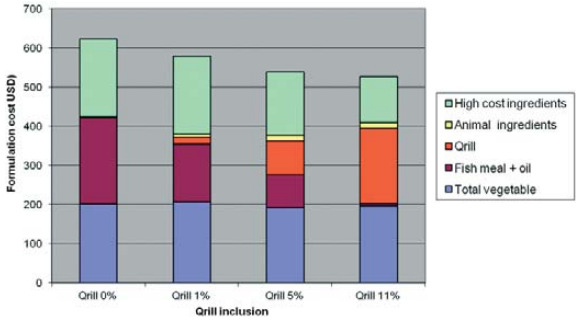
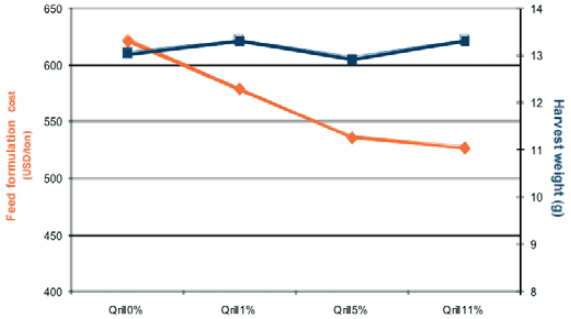


Figure 2. Relative formulation cost of *L. vannamei* diets.



One step diagnosis kit fish for nodavirus

Lab-Ind Resource Sdn Bhd (LIR Biotech), a dynamic biotechnology company providing products to scientists, laboratories, universities and biotechnology oriented solutions to industries has announced its new website (www.mylabind.com).

This features the latest news on aquatic health as well as company updates. Robin Liew, Business Development Manager said, "Our strength is the professional and experienced team, market tested reputation, technical know-how and commitment to customers. We are active in forging alliances with biotechnology R&D set-ups in Malaysia and abroad to develop and commercialise market driven products".

LIR Biotech aims to be a significant solutions and technology provider in aquatic/livestock health and food safety emphasizing on residue detection and microbiology. It has offered technical know-how through various turnkey projects integrating hardware with suitable technology platforms (detection kits) and hands-on techniques to many clients across the region in aquaculture disease detection. It operates a PCR laboratory set-up as part of the service to the industry.

The company will be launching a new test kit, a rapid and convenient detection tool to check nodavirus infection in commercial fish fry. They cause Viral Nervous Necrosis (VNN) or Viral Encephalopathy and Retinopathy (VER). The kit is an antigen capture immuno-chromatography lateral flow device. The antibody used is tested against four major nodavirus genotypes RGNNV, TPNNV, BFNNV and SJNNV. The ready to use kit comes with test device, lysis solution, grinder and dropper.

The detection sensitivity is 104 TCID50/ml and the results are available within 30 minutes. In challenge tests with grouper fry exposed to nodavirus, the detection of NVV in post challenged fish with no clinical signs, 3 out 4 fish was positive with this kit but all were positive with RT-PCR. In fish showing signs of disease such as loss of appetite and swimming abnormally, 100% detection was observed with both detection

methods. Some 75% of surviving fish were detected as positive for NVV with the kit whereas all were detected positive with RT-PCR.

The result shows the rapid one step nodavirus (NNV) kit can be a useful tool in the early presumptive diagnosis or screening of NNV infection in fish population. The kit is fast, easy to use on site, does not require trained operators or capital investment such as for a PCR. Hatchery operators, fish farmers, importers and aquatic health officers will find this kit useful.

Fish species known to be susceptible to nodavirus include grouper *Epinephelus spp.*, asian seabass *Lates calcarifer*, sea bass *Dicentrarchus labrax*, striped jack *Pseudocaranx dentex*, red drum *Sciaenops ocella* and golden grey mullet *Liza auratus*.

More information: email: info@mylabind.com

Spotlight on food safety

Today the consumers want to know what they are buying and what ends up on their plate. The question is 'Where does the salmon fillet in the freezer come from?' The requirements to be complied with by feed and food manufacturers are correspondingly high in terms of safety, quality, traceability and environmentally benign manufacture of individual products and ingredients.

The BASF Nutrition Ingredients business unit has now developed a method that makes all these aspects transparent. "Our S.E.T. initiative allows feed and food manufacturers to trace exactly which ingredients were used and which conditions applied in the manufacture of a prod-uct," says Dr. Christoph Günther, the man in charge of the initiative in the Nutrition Ingredients unit.

S.E.T. stands for Sustainability, Eco-Efficiency and Traceability and is based on the TÜV-certified (TÜV stands for Technical Standards Or-ganization, a body that conducts technical safety checks, especially those specified by national laws (or regulations). Eco-efficiency analysis analyses the life cycle of a product or manufacturing process "from cradle to grave." The process hence includes aspects such as environmental pollution and carbon dioxide (CO_2) emissions by the products themselves and their precursor products. This method is also used by the Eco Institute in Freiburg, Germany.

"In S.E.T., we apply this principle to our food ingredients and feed additives, making sustainability tangible," says Günther. "The data generated in eco-efficiency analysis of our products are available to our customers from the feed and food industry as required." That way, customers can see any time whether and to what extent the starting materials they use to manufacture their products are sustainable. Data is accessible to all customers anywhere in the world via GTNet® (Global Traceability Net-work), a global platform used in the food industry for targeted sharing of product information material. "In this manner, we help our customers to meet consumers' growing expectations in terms of the sustainability and traceability of food products," Günther continued.

BASF's Nutrition Ingredients business unit is a leading supplier of food ingredients and feed additives. The product portfolio for human nutrition includes vitamins, carotenoids, omega-3s and others. More information: www.basf.com

Traceability standard with Q+TM Quality control measures

With the issue of traceability currently dominating discussions in the agricultural sector, global animal nutrition company, Alltech has launched a rigorous quality control programme for its Bioplex® range of organic trace minerals.

The Q+™ (Quality Plus) program will supplement the company's existing quality system, AQS (Alltech Quality System), which incorporates standards set by all major regulatory bodies. Alltech is one of the first companies to implement such stringent and all encompassing controls throughout its production chain of organic trace minerals. The program adopts a multifaceted approach, combining several different quality control measures, including the Bioplex quality measures developed over the last 18 years which guarantee total chelation and mineral content. Furthermore, Q+ is a positive release program, whereby all batches of inorganic trace mineral sources and final Bioplex batches are tested for Dioxin, PCBs and heavy metals.

Speaking of the initiative Dr. Pearse Lyons, president and founder of Alltech, said, "Q+ meets and exceeds regulatory standards by combining several different quality control measures. In addition, all trace mineral batches are tested both prior to use and before sale. Some may consider this level of testing excessive, however, we believe that it is Alltech's duty to provide products which ensure highest final product quality, safety and performance to the end user. Alltech's stringent quality system permeates every step of Alltech product research, development and delivery."

The Alltech Quality System (AQS) is currently in operation in 14 production facilities and 68 blending and warehouse sites across the globe. The system, which is strictly enforced at all stages of production, as well as, upon receipt of the raw material and when shipping, aims to instil confidence in relation to quality, safety, traceability and consistency of all Alltech products.

For more information, visit www.alltech.com

Appointment

Aquaculture Process Technology Manager

Wenger Manufacturing, Inc, a leading supplier of extrusion and drying systems for food and feed products, has appointed Mr. Joe Kearns as Aquaculture Process Technology Manager. He will be responsible for strategy and support of all the company's aquaculture projects worldwide. Joe has been with Wenger for 34 years, working in extrusion processing system layout & design, and in sales and engineering support throughout Latin America, the Pacific Rim, and other geographic areas with significant aquaculture activity. Recently he served as Corporate Sales Manager for South America, Australia, and New Zealand.

LaVon Wenger, President of Wenger, says: "Joe's experience within the aquatic feed sector is a real benefit to us and to our clients. He brings valuable insight to the total extrusion process – and more specifically as it applies to the aquatic industry."

To date, Joe has published nearly 70 technical articles and has over 50 industry speaking engagements to his credit. Joe will be based in Sabetha, Kansas, USA.

Shrimp seed multiplication centre in India

A shrimp seed multiplication centre will be established in India in the Srikakulam district of Andhra Pradesh. An agreement for the above project was signed between the National Fisheries Development Board and M/s Moana Technologies, Hong Kong.

This will bring genetically improved shrimp (SPF shrimp) and produce about three billion post larvae at full capacity in about three years. It is expected to bring in a new approach for quality seed management, enhanced productivity and profitability in Indian aquaculture.

Shri Pawar, Union Minister for Agriculture, lauded the pioneering effort and said that this would greatly help the shrimp farmers in the years to come. Dr. Pradeep Kumar, Secretary, Department of Animal Husbandry, Dairying & Fisheries, gave details of the project on the multiplication centre. Indian shrimp farming is mainly based mainly on black tiger shrimp, *Penaeus monodon*. While the present annual production through culture is around 120,000 tonnes, the main problem has been the availability of quality post larvae. White spot syndrome virus has been a major problem too.

FM replacement meals

At two recent shows, Aquaculture Europe 2008 in Istanbul and Victam Asia 2008 in Bangkok, GePro Geflügel Protein Vertriebsgesellschaft, Germany, introduced the new product Goldmehl® developed specially for aquafeeds.

These are processed feather meal or poultry meat produced using a low temperature production technology with fluid bed drying and which are close to LT fish meal. As a non aquaculture source, it lends itself well for aqua feeds with extremely low content of contaminants such as heavy metals and dioxin. The product from feather meal has 85% crude protein (85% is digestible), and 6% crude fat whereas the product from fresh poultry meat contains 67% crude protein (90% is digestible) and 12 % crude fat, respectively.

In Istanbul, Franz-Peter Rebafka said, "Warm air (at around 80°C) is used as the drying medium in a pre- and post drying step. This is in contrast to using classical ring dryers which will destroy a considerable portion of the digestible protein fraction in the ingredient. The product is derived from poultry certified fit for human consumption".

The company also introduced C-meal®, a special fish meal analogue which is also derived from edible poultry by products. It contains 65% crude protein and has been designed to emulate the nutrient profile of fish meal. It contains 1.8% methionine + cystine and 4.7% lysine, among others. Both Goldmehl® and C-meal® can be considered as a replacement ingredient for fish meal which is recommended on a weight basis or on a nutrient replacement basis.

More information: www.ge-pro.de, email: info@ge-pro.de

A comparison of Goldmehl® FM with feather meal.

Shrimp hatchery feed

Newly introduced into the market in Asia, is Brilliant Blue, a unique patent pending formulated micro-compounded shrimp larvae feed for zoea-to-post larvae (PL15-20) stage feeding in shrimp hatcheries. This was introduced at Victam Asia & FIAAP 2008, held from March 5-7, Bangkok, Thailand by Blue Limit AS.

The feed is based on more than 30 years of experience of Dr. Anders Aksnes who researched and developed a range of aquaculture feed projects for fish, shell fish and crustaceans. This is bottom-up-not top-down concept using available ingredients and processes. It takes a holistic view of detection, ingestion and digestion to optimal nutritional value to the organism.

Brilliant Blue has been approved for import into Thailand and Blue Limit AS is currently obtaining approval for sales in countries in Asia and South-East Asia. The feed has been tested in Sri Lanka for black tiger shrimp (*Penaeus monodon*) and China for (*Litopenaeus vannamei*) and is being tested in Thailand and Vietnam. The results show that when fed together with Artemia, survival rate was higher and weight gain increased for PL 12 *L. vannamei* and higher survival rate for PL20 *P. monodon*. This was relative to post larvae in the control group fed with competitor products.

The company attributed this performance to the innovative combination of ingredients and processing steps developed and patented for Brilliant Blue. It provided the unique properties, mainly good dispersal and low leaching of key nutrients, excellent palatability, correctly sized for all stages and is easily digested.

More information: www.siamagm.com; www.bluelimit.no Email: spv@siamagm.com

Herbal alternatives

At Aquaculture Europe 2007, Judith Kolkovski, general manager of Australian based Nutra-Kol Pty Ltd, introduced alternative herbal-based remedies to antibiotics and other chemicals for aquatic animals. The company, is the result of collaboration between Judith, human nutritionist, naturopath and herbalist and Dr Sagiv Kolkovski who is an expert in marine fish larvae physiology and nutrition. This unique combination of joint expertise resulted in innovative new natural health and nutrition products

NutraGreen is an innovative natural therapy line of products that based solely on herbal extracts approved and listed for human consumption in Australia. These are designed to ease problems encountered in aquaculture; disease outbreaks, low survival at larval and grow out stages and microbial and pathogen infections. The unique mix of the herbal extracts combines the natural antibacterial, anti fungal and anti parasitic properties of the herbs together with the immune and digestive systems. It increases the ability of the larvae and juvenile to fight pathogens and stress.

Starting from broodstock, NutraBrood Enhance is specifically designed to reduce stress and regulate the hormonal cycle. The formulation includes adaptogenic, hepatoprotective, antioxidants and immunomodulator designed to stimulate spermatogenesis in male fish and aid gonadal maturation and high egg viability in female fish. In freshly-hatched Artemia and rotifers, NutraLive will reduce, viral, and fungal pathogens. The herbal mix is transferred to the larvae through the live feed resulting in higher larvae survival rate, effective feed utilization through improved conversion and increased resistance to specific and non-specific infections. The metamorphosis stage in fish larvae demands high physiological and nutritional resources from the larvae. Nutra-MetaEnhanch, reduces stress, improves immune response (immunomodulator) and helps in adapting to adverse environmental conditions.

Nuta-Kol is also developing and manufacturing 'tailor-made' nutritional solutions for aquaculture concentrating at the hatchery and early development. These 'tailor-made' products are currently been used by commercial companies, hatcheries, R&D centers and universities around the world.

Judith Kolkovski at Eurasia Aquaculture 2007

The company is also concentrating in the development of semi-moist diet for lobster puerulus and juveniles. Due to the recent development in lobster culture in South East Asia, there is a demand for a semi-moist diet that can replace the current use of 'trash fish'. The diet with a 24 hour water stability is easily digested by the lobster puerulus without the usual water pollution problems with wet diets. Nutra-Kol semi-most diets are also used in as shrimp broodstock diets for wild-caught shrimp in Australia. More information: www.nutrakol.com; email: info@nutrakol.com

What to expect in AQUACulture Asia Pacific Magazine in 2008

Issue	January/ February	March/ April	May/ June	July/ August	September/ October	November/ December
Focus on current trends & challenges	Aqua Feed Production	Disease & Health Management	Food Safety	Sustainable Aquaculture	Organic Aquaculture	Cage Culture
Industry review	Marine shrimp	Marine fish	Catfish	Tilapia	Freshwater prawn	Hatchery
Features on success stories, best practices, new technology and developments						
Feed technology NEW	Enzymes & feed additives	Feed processing	Immuno-stimulants & Feed ingredients	Novel protein meals & amino acids	Nutrition & Formulation	Extrusion & Larval feeding
Technical	Culture technology	Recirculation technology	Product quality & markets	Biotechnology & diseases management	Pre & Pro-biotics	Health management/ Larval feeding
Shows	Victam & FIAAP Asia 2008	World Aquaculture 2008	Vietfish 2008	Australasian Aquaculture 2008	Aquaculture China	

Aeration with disc diffusers

Malaysian based Airspec Marketing Sdn Bhd has developed cost effective solutions in aeration for aquaculture. At two trade shows accompanying Tilapia 2007 and Giant Malaysian Prawn 2008 in Kuala Lumpur, the company demonstrated its Airspec Disc diffuser as well as Airspec Roots/Ring air blowers.

Rogini and Jimmy Cheong with a demonstration model of the diffusers in a tank with ring blower.

The disc diffusers are located in different aquatic environments such as ponds, fibre or concrete tanks. The upward facing convex dishes are made of ABS and elastic membrane. Airspec is also using the latest technology on their blower system such as double stage regenerative ring blower and roots blower with Tri-Lobe rotor and both end oil lubricated for maximum durability and highest performance.

Ms Rogini, sales coordinator explained that the diffusers have about 10,000 micro pores on one piece of 12 inches diameter membrane. These membrane diffusers bring considerable savings with low operating and maintenance costs. It increases the transfer rate of oxygen and help to minimize the horse power of blower use. She added that other features are the self purification ability to the membrane which prevents clogging. It is also highly resistant to fouling. A simple installation system allows the diffuser to be fixed onto existing air header systems without special tools.

The company has installed several units of the diffuser in fish and shrimp ponds and hatcheries in Malaysia. In addition, their blowers are already in use in many countries such as India, Indonesia, Sri Lanka and Thailand for aquatic purpose.

More information: www. airspec.com.my Email: marketing@airspec.com.my

Phytochemicals as anti foulants

These are compounds isolated from botanical sources which Magellan, USA has developed and patented as antifoulants for aquaculture. The environmental friendly phytochemical based coatings for aquaculture systems control unwanted marine organisms. Aquaculture loses approximately USD 2 billion per year in production due to the effects of fouling (the buildup of marine organisms, such as barnacles, algae, tubeworms, bryozoans, etc.), which decreases the flow of water and nutrients and festers certain harmful bacteria. The result affects the quality and production level of marine fish. The aquaculture industry also spends an additional USD 1 billion/year in the manual cleaning of the aquaculture systems due to fouling.

"Phytochemicals leach out of the coating in low concentrations and disperse extremely well throughout the water. Furthermore, their biodegradability will ensure they do not accumulate to unacceptable levels in the environment", said Guy Seabrook, President/CEO of Magellan Companies, during a presentation at Aquaculture Europe 2007. He added that marine organisms controlled by Magellan's formula include parazoans, coelenterates such as polychaete and oligochaete worms; molluscs such as zebra mussels; crustaceans such as acorn and gooseneck barnacles. This safe, economical technology combines several phytochemicals found in the human diet and can easily be applied on site. The formula falls under the "Generally Regarded as Safe" standard of the United States Food and Drug Administration.

Currently, the leading competitor for the company's anti fouling coating is cuprous oxide which has been shown to be detrimental to the environment. Many countries are seeking safer and green alternatives. "Cuprous oxide has a performance life of three months for this application. However, Magellan's latest aquaculture test samples lasted 6 months before showing signs of minor fouling. This is a break through for us. We are moving to the next stage of development by having the formula microencapsulated and expect the microencapsulated formula to play a key role in making the product safe for handling by the end-user as well as to further extend the performance to 9-12 months," said Guy.

Ongoing tests of coated polyethylene rope containing the latest phytochemical formula are in 7 strategic global locations. In June 2007, the first of these trials in the San Diego Bay demonstrated 8 months of excellent anti-fouling performance.

More information: Email: GuySeabrook@aol.com

Preparations for the third Australasian Aquaculture Conference and Trade Show are now in full swing with the event just over three months away. From August 3-6, 2008, the aquaculture and associated industries will convene at the Brisbane Convention and Exhibition Centre to hear from the industry's innovators, see the latest developments and network with leaders in the field.

"Innovation in a Global Market" is the very appropriate theme for 2008 as innovation in global marketing; innovation in sustainability and innovation in production have come to the forefront this year. The global and local perspectives will enable domestic and international audiences to explore this theme from both a practical and theoretical viewpoint.

Skretting Australasian Aquaculture 2008 is hosted by the National Aquaculture Council of Australia (NAC) and supported by the Australian Prawn Farmers Association, the Australian Barramundi Farmers Association and the World Aquaculture Society's Asia-Pacific Chapter (WAS-APC). It is proudly sponsored by Skretting and the FRDC.

The three plenary sessions across the conference will see a line-up of some of the world's finest trailblazers in both aquaculture and other industries. The confirmed speakers are Viggo Halseth (Skretting,Norway), Jason Clay, World Wildlife Fund and Hein van der Steen (Stonebridge Breeding Ltd, UK). Some of Australia's industry leaders, including Peter Bender from Huon Aquaculture will also make presentations.

This year's program has a fresh approach with sessions and workshops integrated into the event. The wide range of topics that will be covered are: crustaceans, shellfish and molluscs, finfish, education, training and extension, climate change, aquaculture technology, the aquaculture business environment and husbandry. Within this broad scope, current topics of interest such as organics, carbon footprints, marketing and access to the EU market will also be addressed.

Trade show booths are selling out quickly with a diverse range of companies and products being represented. A full list of exhibitors confirmed to date is given below.

COMPANY NAME	PRODUCTS & SERVICES	BOOTH NUMBER
Aeration Industries International Inc	Aeration, filtration & pond equipment	101
AGK Technology/Fresh By Design	Fish farming & processing equipment	75,76
Airpak Packaging	Packaging	85
Aquaculture Asia Pacific	Publication	122
Aquatic Diagnostic Services Int.P/L	Aquatic health management	10
Aquatic Eco-Systems Inc	Aeration &pond equipment	95
Aquasonic	Recirculation systems, filtration & water testing	44,45,50,51
Australian Seafood CRC	Marketing	41,42,43
Australian Rope and Twine	Ropes and equipment	61
BST Oyster Supplies	Long line farming systems	87
Clean Water Scientific	Equipment	113
Department of Agriculture, Fisheries and Forestry	Policy and industry development	60
Donaghys Pty Ltd	Systems for mussel culture	30
Fisheries Research and Development Corporation (FRDC)	Fisheries R&D	47,48,58,59
Grobest Australia	Feeds	86
Kinoshita Fishing Net MFG Co Ltd	Cage systems	74
Malaguna P/L	Fish Health Services	69
Marine Innovation South Australia	Industry development	110,111,117,118
National Aquaculture Council	Association	49
NSW Department of Primary Industries	Governmental	72,83
Panorama Acuicola Magazine	Publication	100
Phoslock Water Solutions Ltd	Water technologies	40
Praktisk Teknologi AS	Culture systems	112
Primo/INVE	Specialty hatchery feeds	98,99,104,105
Proaqua	Aquaculture equipment, feeds & aeration	46
Protective Structures Australia Pty Ltd	Protective structures	55
QIS Energy Conservation Systems P/L	Pool heating specialists	62
Queensland Government Department of Tourism, Regional Development and Industry	Policy and industry development	65,66,67,77,78,79, 88,89,90
Ridley Aqua Feed	Feeds	
Scanz Technologies	Equipment for hatcheries, grow out & processing	19,29
Seapa Pty Ltd	Equipment for oyster farming	54
Skretting Australia	Feeds	52,53,63,64
Sunderland Pacific Management Ltd		32
Tasmanian Department of Economic Development	Policy and industry development	15,16,17,18,25,26,27,28
TenCate Australia Pty Ltd	Containment netting	124,125
Turtle Pres, Austasia Aquaculture	Publication	2
Wenger Manufacturing	Feed processing equipment	56
Wiley-Blackwell	Publications	109

More information:
Web: www.australian-aquaculturereportal.com
Register online at http://australian-aquaculturereportal.com/aa08/
Contact: Conference Coordinator: Sarah-Jane Day, Tel: +61 437 152 234, Email: sarah-jane.day@aquaculture.org.au
Registrations may be completed online. Register by May 26th for a discounted rate.

May 28-30
6th Philippine Shrimp Congress
Bacolod City
Email: philshrimp@aquaphil.org
Web: www.aquaphil.org

June 1-5
XIII International Symposium on Fish Nutrition and Feeding (ISFNF)
Florianópolis, Brazil
Web: www.isfnf2008.com.br

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

June 22-26
DAA VII-7th Symposium on Diseases in Asian Aquaculture
Taipei, Taiwan
Email: daaseven@gmail.com
Web:
http://homepage.ntu.edu.tw/~daaseven/index1.htm

June 28-30
Shanghai Fisheries and Seafood Exposition 2008
Shanghai, China
Email: sifse@sifse.com
Web: www.sifse.com

July 22-25
IIFET 2008 Vietnam
Nha Trang, Vietnam
Email: iifet2008@yahoo.com;
haolevan@yahoo.com
Web: www.ntu.edu.vn/iifet2008/

July 25-27
The Seventh International Conference on Recirculating Aquaculture
Roanoke, VA, USA
Email: aqua@vt.edu
Web: www.cpe.vt.edu/aquaculture/r-aqua/

August 3-6
Australasian Aquaculture 2008
Brisbane, Australia
Email: sarahjane.day@aquaculture.org.au
Web: www.australian-aquacultureportal.com

September 14-18
12th International Lupin Conference
Fremantle, Western Australia
Email: lupinconference@lupins.org
Web: www.lupins.org

September 28-October 3
15th Annual Practical Short Course on Aquaculture Feed Extrusion, Nutrition and Feed Management
Texas A& M, USA
Email: mnriaz@tamu.edu
Web: www.tamu.edu/extrusion

October 12-14
8th International Symposium on Tilapia in Aquaculture
Cairo,Egypt
Web:
http://ag.arizona.edu/azaqua/ista/ ISTA8/ISTA8.htm

November 4-6
13 Annual China Fisheries & Seafood Expo
Qingdao, China
Email: seafoodchina@seafare.com
Web: www.seafare.com

November 24-26
IX International Symposium on Aquatic Nutrition
Ensenada, B.C. Mexico
Email: sinaix@cicese.mx

2008

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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FOR MORE INFORMATION:

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