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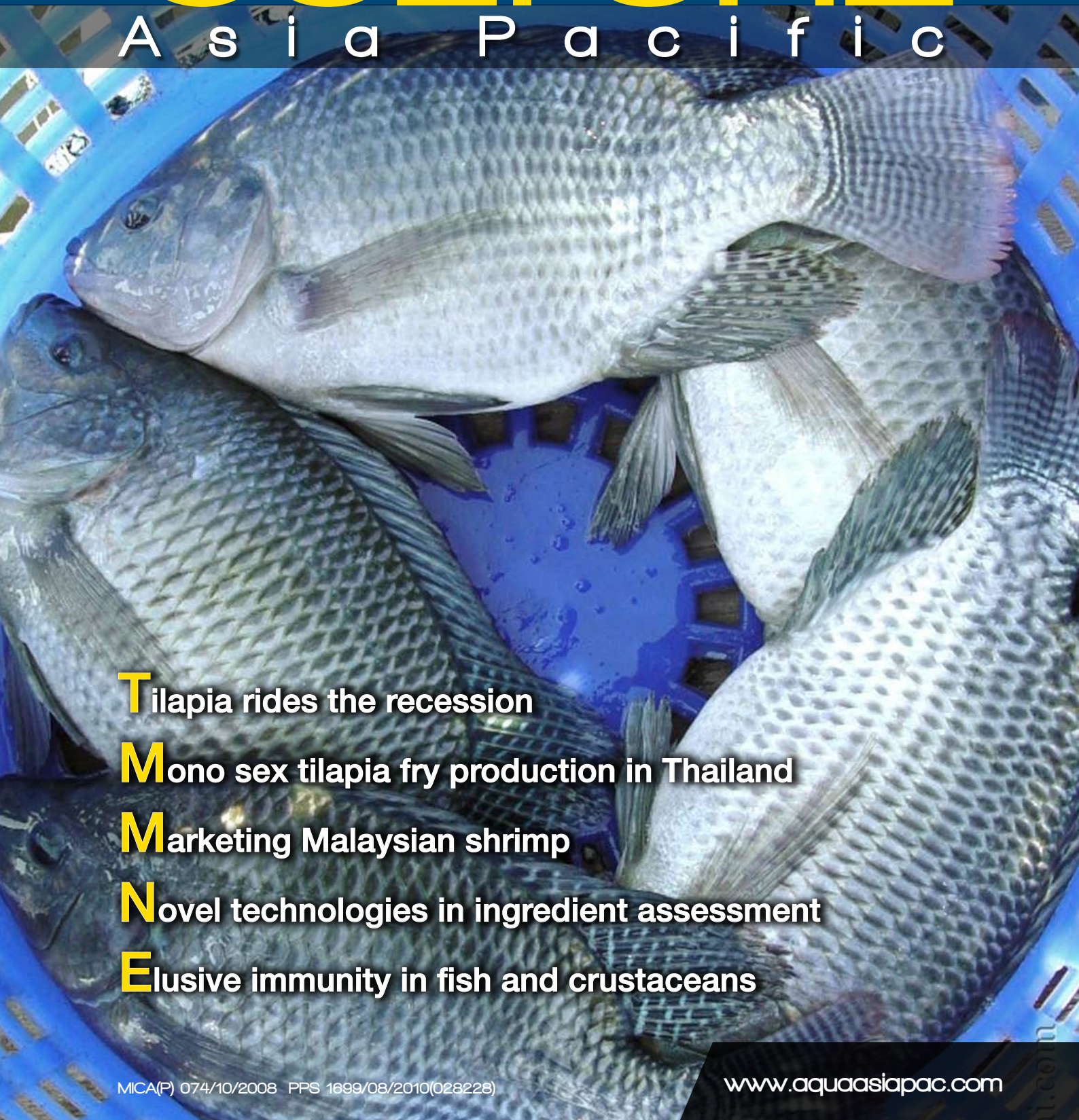

Tilapia rides the recession

Mono sex tilapia fry production in Thailand

Marketing Malaysian shrimp

Novel technologies in ingredient assessment

Elusive immunity in fish and crustaceans

MICA(P) 074/10/2008 PPS 1699/08/2010(028228)

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Contents

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Nile tilapia in basket courtesy of Nam Sai Farms

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From the editor

Research – where art thou?

The driving force of any industry is research and aquaculture is no exception. Aquaculture is much younger compared to the poultry industry and that is the reason why we always look at research in that industry as a role model. At this juncture, after 30 years from the start of commercial marine shrimp farming and when we first coined the name 'aquatic chicken' for the tilapia, the two top commodities in Asian aquaculture, we need to ask where we are going in the next phase. This is where research should be leading us but where are we in terms of research for these two billion dollar commodities?

Research has pushed the growth of the poultry industry in stepped increases to its current level with breakthroughs in feed, genetic selection for fast growth and now with high breast yield and in vaccinations for disease control. Similarly, when we analyse the value chain in aquaculture, domestication and genetic selection, feed, disease control and culture technology are the critical areas which require development. If we benchmark against the chicken in terms of genetic improvement, among the Asian commodities, the tilapia leads, although still far behind the salmon.

This R&D in tilapia was contributed by a regional effort of public and private effort working together. In the 1980s, the marine shrimp industry in the Americas realised that to commercialise the Pacific white shrimp, a domestication program was essential and this resulted in the availability of specific pathogen free brood stock. This is now driving the shrimp industry in Asia whilst crowding out the black tiger shrimp. In Asia, we can compliment researchers in Indonesia for the development of Induk Vaname Nusantara-1 (IVN-1) brood stock. However, with the black tiger shrimp, R&D on domestication and genetic selection is urgently required for industry to be ready for the next spurt in the growth of shrimp culture. Similar to the 20 year public funding for SPF vannamei shrimp, this will be a long term and dedicated effort.

The initial work in R&D in feed for the tilapia can be credited to several research groups in the Philippines, Scotland and US and that for the black tiger shrimp to those in Japan and Taiwan and vannamei shrimp to those in the US. However, the challenges in feed are no longer at the level of major nutrients but at the level of amino and fatty acids and other micro nutrients. It is not only for growth performance but also for the general well being of the animal and for food safety. The lack of precision also means that current feeds are overformulated and inefficient in order to compensate for performance. The market challenge for tilapia and shrimp is production of quality products but at low prices. The new paradigm in feed research is to take up this challenge.

As long as the environment cannot be controlled, disease is an unknown entity and a grave area of concern for farmers. They see the daily impact of disease and often are helpless. Unfortunately, research on diseases requires considerable investment both in terms of time and funds. Pharmaceutical and animal health companies will only embark on such an expensive R&D if there are substantial returns. We face a typical Catch 22 situation – which comes first? The product or market potential?

These research activities are essential to prepare industry for the next spurt of growth. For the major part of this research, we can conclude that we cannot rely on the private sector hence research must be led by the public sector and we would recommend a sharing of information among research groups. It is also suggested that a regional centre for aquaculture research coordinate activities and prevent duplication of research to ensure the efficient use of resources available. It is clear that research is certainly lagging the industry. For an industry to move forward, research must be ahead of the industry.

Zuridah Merican

WRITE TO THE EDITOR

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

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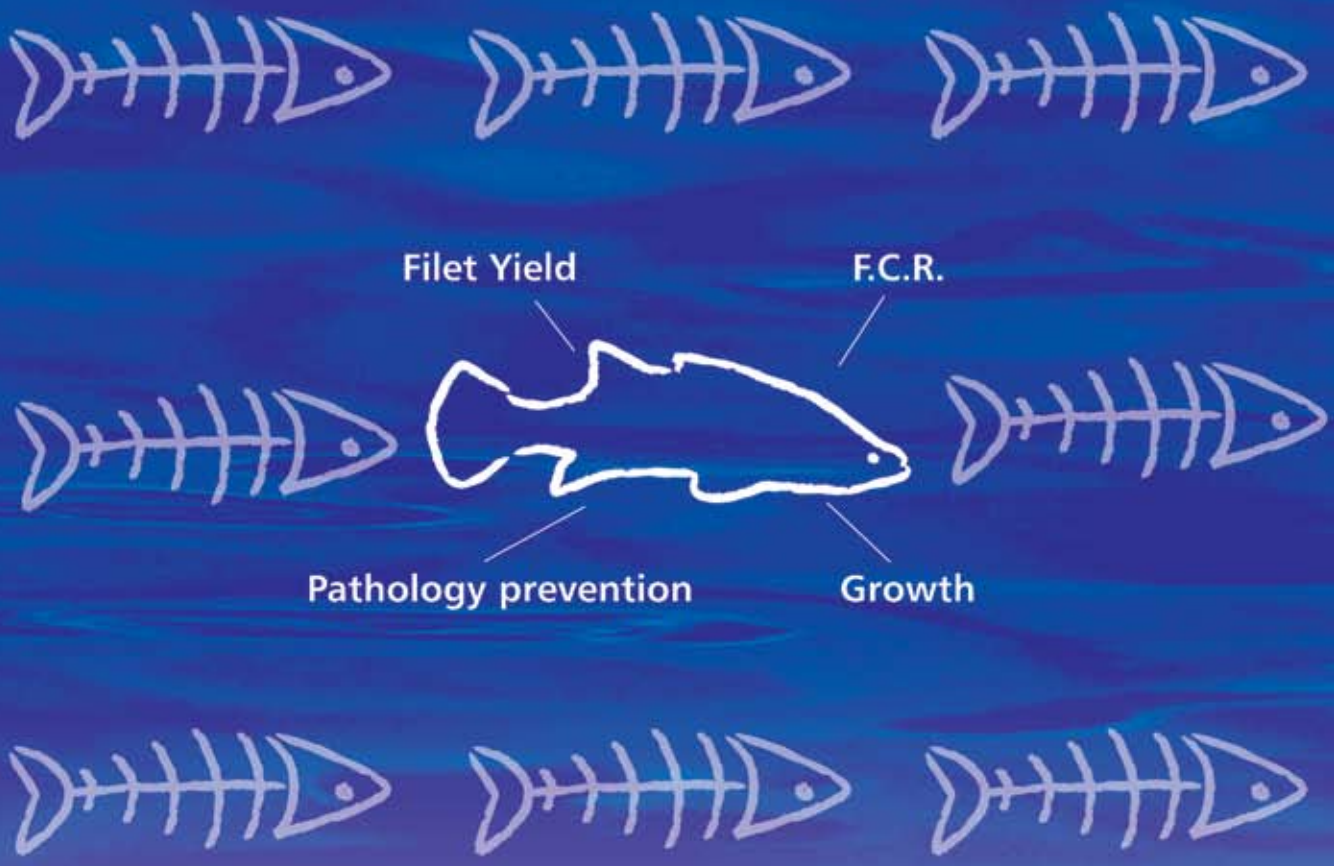
Letters may be edited prior to publication



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Thai contract farming strategy

A business arrangement producing 10,000 tonnes of shrimp and giving a price guarantee for shrimp raw materials.

At the contract signing, from left: Bunluesak Sorajjakit, Managing Director of Thai Union Feed Mill, Rittirong Boonmechote, Chairman of Thai Union Feed Mill and Managing Director of the shrimp business unit at Thai Union Frozen Products PLC (TUF) and others are representatives of the farming group. Decha Bunluedej Chairman of President Cooperative Samroiyod, Pranburi Province, Udron Songsream Chairman of (COC) Rayong Province and Khun Nongluk Thaisin, shrimp farmer from Suratthani Province.

Thailand's major producer and exporter of canned and frozen seafood products, Thai Union Frozen Products PLC (TUF), together with a business ally, Marine Gold Products, have joined forces with 185 shrimp farmers in Thailand in a contract farming arrangement. This includes price guarantees for 10,000 tonnes of shrimp. The company believes that the so-called '3 Win + 1' strategy will propel its shrimp business growth to 15%.

Rittirong Boonmechote, the managing director of the shrimp business unit listed the details of the company's '3 Win + 1' contract farming strategy. This will benefit three groups, namely shrimp farmers, seafood processors and overseas seafood buyers. The '+ 1' win refers to the Thai government and Thailand as a whole. This shrimp contract farming arrangement which will give a price guarantee for shrimp raw materials on a specified amount of shrimp, has attracted 185 shrimp farmers from various regions of Thailand. The overall size of the contract at 10,000 tonnes, is unprecedented for the country.

This contract farming will assure shrimp farmers that there will be a buyer for their products at a specified price. With a target of how much shrimp to farm and to what size and at what ex farm price, the farmers will be better equipped to plan their production effectively. This arrangement eliminates any market risk for them. Rittirong said, "Traceability and food safety are two issues that our foreign customers are concerned about. We would like our contract farming program to serve as a model for other seafood processors with the potential to undertake a similar arrangement."

The second 'win' goes to the processors, such as TUF, which will benefit from better cost management and steady supply of raw materials. Quality control, freshness and food safety issues are managed more effectively with contract farming, allowing the processors to meet the expectations of the customer. The third 'win' refers to seafood buyers in the international markets. Contract farming will assure timely delivery of finished products, better quality and traceability, giving the consumers more confidence in the safety of their shrimp.

Contract farming is important in reducing the government's burden in issuing a price guarantee during periods of oversupply. The scheme will enhance price stability and eliminate the need for government intervention in the market. The company believes that contract farming will reduce risks for all parties involved, especially for farmers who will not have to worry about how to sell their shrimp during periods of surplus. The company also believes that by forming strong and transparent and mutually beneficial alliances, this arrangement will help the farmers, processors and buyers, grow their businesses together in the long run.

The most appropriate time for the company to pursue this strategy is from May to December 2009, usually when shrimp are in abundant supply and raw material prices are low. "Despite this, we are determined to roll out the program now to help Thai shrimp farmers, who have played a key role in our success. We are determined to set up contract prices acceptable to farmers while keeping our costs at a competitive level. We fully believe that shrimp farmers and processors can achieve a mutually beneficial relationship. Our philosophy is that we cannot succeed without first making our farmers succeed," said Rittirong.

Currently, Thai shrimp farmers are facing a shrimp price crisis. The global economic downturn has also driven down demand for shrimp consumption in restaurants. However, the shift towards dining at home has resulted in higher demand for retail shrimp products sold in supermarkets. Rittirong concluded that, "all players in the shrimp industry, shrimp farmers, seafood processors, as well as the government, must work together to withstand the current crisis and to be able to increase Thai shrimp exports on a sustainable basis."

More investment in post larvae production

Since the middle of 2008, Uni President Vietnam has been supplying *Penaeus vannamei* post larvae from its hatchery in Ninh Thuan Province to farmers throughout the country. June 26, saw the official opening ceremony of Uni-President Aquatic Breeding (UPAB), a 100% investment of Uni-President, Vietnam, a leading food and feed company in Vietnam.

The ceremony was attended by Lo Chih-Hsien, President of Uni-President Group, Hsieh Chih-Peng, Vice President of Uni-President Enterprises Corp, Franky Lee, General Manager of Uni-President Vietnam, Cheng Wen-Chin, Director of Uni-President Enterprises Corp and Chuang Jie-Cheng, Jeff, General Manager of Uni-President China as well as more than 300 participants including provincial officials, Tran Thi Kim Van, Vice Chairwoman of Binh Duong Province, Hoang Thi Ut Lan, former Chairman of Ninh Thuan Province, Do Huu Nghi, Vice Chairman of Ninh Thuan Province and Dr. Nguyen Viet Thang, President of VINAFIS, governors, suppliers, distributors, farmers and media. Uni-President Vietnam had invested USD 4 million to focus on the supply of high quality specific pathogen free (SPF) white shrimp post larvae to farmers in Vietnam. The current capacity is more than 120 million post larvae/month. A future target is 150 million post larvae/month, when it expands from the current 2ha to 5ha.

The biosecure hatchery management system was developed by several international experts from the Americas and Taiwan. The management of the disease and PCR–polymerase chain reaction laboratory was developed by Dr. Grace Lo, the chair of the OIE recognized laboratory in the National Taiwan University. The aim of UPAB is to offer UniLarva, a commercial brand of SPF post larval shrimp produced through a system of ozone and UV for water treatment, filters, eco-friendly biological system and algae incubation systems. Food hygiene is certified by USDA.

"If UPAB's clients have more opportunities to select high quality shrimp post larvae, their culture risks will be reduced significantly. It follows that their production cost will be lower than current levels", said Lo Chih-Hsien. "UPAB will continue to devote to the development of a sustainable shrimp industry of Vietnam. This new hatchery is just the first step as UPAB is also planning to expand to 2-3 hatcheries in other provinces to reduce transportation costs and to be able to supply post larvae in a more efficient way. In addition, there is concern on the management of the environment in Vietnam. At UPAB, we have waste water treatment that meets government regulations and the location of hatchery is in the specialized hatchery zone in central of Vietnam".

More than 30% of production losses in typhoon-hit Taiwan

Typhoon Morakot, the deadliest weather disaster in half a century brought more than 2.6 m (102 inches) of rain over the southern part of Taiwan, the island's main fish farming region, on August 8, 2009.

Strong winds and heavy rains caused the worst flooding in decades in Taiwan and floodwaters were as high as 1.7 m (7 feet) in some areas. According to the statistics released by the Council of Agriculture (COA) of Taiwan, the total estimated financial losses from agricultural, fisheries, poultry and livestock sectors exceeded NTD 14.6 billion (USD 442 million) as of August 24. The losses in the fisheries sector, mainly aquaculture, amounted to NTD 4.2 billion (USD 126 million). More than 6,900 ha of inland fish ponds and 2,200 ha of coastal fish farms were severely damaged by the storm and floodwater. Eel (*Anguilla japonica*), grouper (*Epinephelus malabaricus*), and tilapia (*Oreochromis hybrids Tialpia* spp.) farms have suffered the most. Eel, grouper, and tilapia are the main exporting fisheries products in Taiwan. In a preliminary survey, over 30% of eel, grouper, and tilapia production were lost. Grouper farmers suffered the worst damage, with 90% of grouper ponds ravaged by flooding. It is expected that it might take 1-3 years to recover and resume production. (Contributed by Dr Fu-Sung Frank Chiang, National Taiwan Ocean University)

News in Brief

Lampung shrimp ponds stagger with four viruses

The production losses from shrimp ponds in Lampung, which produces 40% of Indonesia's shrimp production, could be due to four viruses, said Muhammad Mudjani from the Marine Aquaculture Extension Centre in Lampung. PCR analyses of samples showed that the slow death of shrimp could be due to Infectious myonecrosis virus (IMNV), White spot syndrome (WSSV), Taura syndrome virus (TSV) and Infectious hypodermal and haematopoietic necrosis virus (IHHNV). He advised farmers to stop culture to break the cycle. An attributing factor is also the high organic loads in the water around Lampung, according to Kontan online. In May, Lampung Post reported the slow death of shrimp at 60-80 days and mortality started with 7-15 shrimp when stocking density was 130-170 post larvae/m^2. Harvests were reduced to 5.5 to 6.5 tonnes/ha. The affected farms are mostly intensive farms of CP Prima, PT Suri Tani Pemuka (STP) and those belonging to members of the Shrimp Club Indonesia. Similar occurrences have been reported in East Jawa. In August, after drying ponds, CP Prima reported an export of 70 containers versus only 50 containers in January 2009.

Up to June 2009, exports from Lampung declined to 29,712 tonnes from 31,187 tonnes for the same period in 2008. In 2008, CP Prima produced 86,174 tonnes of shrimp and the total production from Indonesia was 358,925 tonnes with 110,281 tonnes exported and 248,644 tonnes consumed locally.

A still difficult shrimp market

The June 2009 shrimp market report from NFMS showed that the US only marginally increased imports of shrimp. It imported 42,750 tonnes of shrimp in June 2009 as compared to 40,728 tonnes in June 2008. Up to June 2009, the total volume was 233, 912 tonnes as compared to 236,023 for the same period in 2008. Thailand was the leading supplier at 72,003 tonnes, followed by Indonesia at 40,130 tonnes and Ecuador at 33,248 tonnes. Other top suppliers from Asia were Vietnam, China, Malaysia and India. India increased exports significantly by 64% for the Jan-June 2009 period. In Europe, volumes of shrimp from India increased 24%, despite the difficult situation on the European market. With 15,200 tonnes of shrimp exported to Europe during January to March 2009, India is presently the largest shrimp supplier to the EU, said Globefish. Overall, total imports of shrimp into the EU were 3% lower at 154,500 tonnes for the Jan-March 2009 period as compared with the same period in 2008.

New feedmill in Hainan

HQ Sustainable Maritime Industries, Inc. has announced the operations of its new 100,000 tpy feed mill in Hainan, China. This supplies superior extruded feeds to the cooperative farmers in Hainan and the specialty aquaculture feeds market. Norbert Sporns, President and Chief Executive Officer said that it will also improve efficiency and reduce costs for their clients and that the company will be able to better control quality of the final product. The factory will produce floating feed with omega-3 added through all-natural algae meal to significantly increase omega 3 levels in fresh water farmed tilapia. The feed mill has state-of-the-art extrusion technology from Buhler.

HQ is an integrated aquaculture and aquatic product processing company, with production facilities in Hainan, China. The tilapia processing has Aquaculture Certification Council, Inc. (ACC) certification and the Chinese government gave organic certification to the company's tilapia production, processing, labelling, marketing and management system. The new mill followed months of quality and efficiency testing in order to optimize production and to ensure that the mill met or exceeded the highest global HACCP and ISO standards as well as the European Regulation on Feed Hygiene FAMI-QS. The HQ management believes that this is an important step to control the quality of fish products, vertical integration and traceability.

Stranded with vannamei shrimp

In India, some 60,000 tonnes of vannamei shrimp may be not sold as the authorities said that the post larvae shrimp were brought into the country illegally and thus cultivated without permission of the Coastal Aquaculture Authority (CAA) and MPEDA. Farmers cannot sell these shrimp locally or overseas. Farms implicated are in East Godavari, West Godavari, Guntur, Krishna and Nellore. The concern raised was on the quality of the brood stock, smuggled into the country without proper testing and quarantine examination and which implied that infected shrimp post larvae may have been farmed. The Ministry of Agriculture granted permission to culture the vannamei species in India in October 2008.

Quarantine centre opens in India

The Aquatic Quarantine Centre at Neelankarai, Chennai has begun its operations with the first stock of brood stock from Shrimp Improvement Systems, Florida, and USA. This will pave the way for the commercial hatchery production of *Penaeus vannamei* post larvae and followed by grow-out in the country. Fishing Chimes reported that the Centre was set up by the Rajiv Gandhi Centre for Aquaculture with funding support from the National Fisheries Development Board. With this facility, hatchery owners with permission from the Coastal Aquaculture Authority of India (CAA) can order their brood stocks from suppliers approved by the CAA. The biosecure centre will test for the seven OIE listed pathogens. Brood stock will be kept in climate controlled rooms with independent recirculation water systems.

First set of abalone juveniles

Mega Fishing Corp in the Philippines which operates the government-owned Tawi-Tawi high-value multi-species hatchery complex has successfully sold its first batch of abalone juveniles to local farmers. The company sold an initial 1,800 pieces of abalone spats at a cost of PHP10 per piece to the Belatan Halo Association. Arlyn J. Carroz, manager of the Mega Fishing's land and sea hatchery, said abalone is just one of the many high-value species that the hatchery is breeding. In the next few months, it will also sell grouper fingerlings.

Probing the eating habits of the marine shrimp

Australian researchers at CSIRO have teamed up with Tasmanian aquaculture company AQ1 Systems to probe the feeding habits of the marine shrimp. The team will use acoustics or hydrophones to analyse the sounds in the ponds and use the sounds to regulate feeding. AQ1 Systems has spent years working with scientists to develop an underwater recorder in order to listen to the shrimp eating. On radioaustralia.net.au, Ross Dodd, AQ1 Systems, said that the value of the information could be close to USD 20 million a year to the domestic marine shrimp farming industry. It will help regulate feeding and if less feed can be used, it will reduce the environmental impact. Local production in Australia is 4,000 tonnes/year, which is a third of national consumption.

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Market options for surplus shrimp

By Zuridah Merican

High production of the vannamei shrimp is depressing prices and industry wants to channel volume away from local wet markets.

In 2005, the Malaysian marine shrimp farming industry took a new life when the Department of Fisheries (DOF) approved the culture of vannamei shrimp *Penaeus vannamei* alongside that of the black tiger shrimp *P. monodon*. Production figures published by DOF showed an increase to 33,324 tonnes of the marine shrimp, comprising 65% monodon shrimp in 2006. In 2007, production was 35,172 tonnes, with 67% vannamei shrimp, valued at MYR 703 million (USD 187 million). In 2004, monodon shrimp production was only 25,720 tonnes.

The shift to farming the vannamei shrimp using post larvae produced from imported specific pathogen free brood stock has helped to sustain the business of 1,200 farmers involving 7,315 ha of ponds and 85 seafood processors (Mazuki, 2008). In 2004, the DOF decided on the strategy of increasing yields to 3-4 tonnes/ha of monodon shrimp and expanding culture areas to achieve its target of 150,000 tonnes of marine shrimp by 2010. With this changeover to vannamei shrimp, where production averages 8-10 tonnes/ha of mainly 60-100 pcs/kg, achieving the target seems closer. According to industry estimates, production will rise to 85,000 tonnes by the end of 2009.

The farms under Asia Aquaculture produce around 6,000 tonnes annually only of vannamei shrimp. Blue Archipelago, the third largest shrimp farming company now produces 1,800 tonnes, 80% of which is vannamei shrimp. In its first year of operations in 2008, the production was 500 tonnes of monodon shrimp. JW Aquaculture remains an exclusive monodon shrimp producer and has an annual target of 3,500 to 4,000 tonnes. Another large farming group, Agrobest produced 2,600 tonnes of monodon shrimp in 2006 and after its recent acquisition by Maruha Nichiro Holdings Inc, planned to farm 7,500 tonnes of shrimp in 2009, with more than half to be vannamei shrimp.

Business challenges

Currently, stocking densities for the vannamei shrimp vary between 80 and 150 pc/m^2, and many farms practice multiple harvesting starting with shrimp comprising 70 pcs/kg, achieved usually after 75 days culture. A main complaint is the uncertainty with viral infection. The infection rate, according to Mazuki (2008) was 74% for white spot syndrome (WSSV) and 26% for Taura Syndrome Virus (TSV). Recently, there are reports of slow death of shrimp, and infectious hypodermal and hematopoietic necrosis virus (IHHNV) in the post larvae shrimp.

In Peninsular Malaysia, old culture ponds, some more than 30 years old, are being used but farmers maintain that this is not the reason for viral infection. Opinions also vary on the level of biosecurity implemented by farms, notwithstanding whether farms

have implemented them, shrimp still succumb to viral infections, mainly WSSV. Syed Omar Syed Jaafar, Chairman of the Malaysian Shrimp Industry Association, is of the opinion that "biosecurity measures have been adequately implemented in most farms. This followed the recommendations of the EU inspection team as one of the conditions for export to the EU. Disease could be due to illegal imports of post larvae or that the rampant spread of diseases in certain localities is a consequence of affected farms not notifying neighbouring farms".

When there is white spot infection, farmers cut losses quickly by emergency harvests. The lost in value, estimated from 15% to 30% due to the drop in quality and mortality further drives down the price and the impact is just as serious for big farms as oppose to smaller farms, said Christopher Lim, COO, Blue Archipelago Sdn Bhd.

"It has been especially difficult recently as current ex farm prices are at their lowest. As farmers search for higher productivity levels to sustain, often they push themselves beyond the risk threshold. When conditions become adverse or diseases occur, the damage is further aggravated. The overall level of investments to improve culture conditions is low. In our case, we are now looking at investing into pond liners which may improve productivity by 50% and the payback period will be 1.5 years".

Initially it was estimated that vannamei shrimp would comprise 60% of national production. However, since most small farms have totally deserted the culture of the monodon shrimp, the ratio of vannamei: monodon shrimp will be 90:10. In general, very few of them are reverting to culturing monodon shrimp. In a survey by DOF in 2008, Mazuki reported that some 42% said that they will not return to monodon shrimp farming. This means that large volumes of the vannamei shrimp in the market can be expected in the near future.

However, there are still some nostalgic sentiments among some farmers with regards to monodon shrimp, a species they know well and started the business with. Some have a desire to revert back to farming this species, if only they have access to domesticated stocks and post larvae from specific pathogen free or resistant brood stock. They also feel that there is a niche demand for large shrimp and for special markets such as for sportfishing in ponds where offer prices are MYR 29/kg.

In August 2009, the large price difference between vannamei shrimp (70pcs/kg) and monodon shrimp (40pcs/kg) in Malaysia may be seen as a good incentive to culture monodon shimp. It was 52% higher, with the vannamei shrimp fetching MYR 9.50/kg (USD2.67) and monodon shrimp MYR 20/kg (USD5.63).The profit margin was only MYR 0.50/kg for vannamei shrimp with cost of production of MYR 9.00/kg (USD 2.53) in comparison to MYR 7/kg for monodon shrimp with a cost of production of MYR 13kg (USD 3.66). However, the business model has to look at long term trends and the uncertainty with monodon post larvae quality, the longer minimum culture period before harvest (150 days versus 75 days) and fluctuations in prices. In February 2009, the monodon price was only USD 3.5/kg in comparison to USD 3.00/kg for vannamei shrimp (Guerin, 2008).

The before and after in monodon shrimp marketing

JW Aquaculture is a major producer and exporter of monodon shrimp and over the years has been exporting nearly its entire production to the European markets, mainly France, UK, Germany, Italy and Belgium.

Ting Kwong Chung, Director, said, "We have built up our export market well and in France, we used to supply to the three major hypermarket chains. Offer prices have been very good because of the confidence in the quality of our shrimp. When Malaysia decided to delist from exporting to Europe, buyers went to Indonesia and India for the supplies. Apparently, with lack of supply of quality shrimp, some even stopped offering this shrimp in their stores".

Ting Kwong Chung

"We have always depended on these export markets but with the delisting in 2008, we had no choice but to channel shrimp to the local and Singapore wholesale and restaurant markets. We also increased the number of buyers in Japan. Now even as the opportunity to reopen our EU export is here, we will still continue with these channels".

"Now that we are back into the EU markets, offer prices are now lower than before. Some buyers have stood by us and are resuming imports. Unfortunately, some have not been happy with the interruption in supplies and are asking for some guarantee that Malaysia will not delist itself again!"

Farm specially designed for the vannamei shrimp culture in Sanglang, Pontian, Johor

Exporting the shrimp

Live shrimp (30-50g/pcs) is exported to China, Korea, Taiwan, Japan and Singapore (Ismail, 2008) and frozen shrimp to USA, EU and Japan. Since 2005, shrimp imports into the US have been on the upward trend from 17,200 tonnes in 2005, 20,300 tonnes in 2006, 22,800 tonnes in 2007 and 30,100 tonnes in 2008 (Globefish, 2009). Up to June 2009, imports totalled only 7,398 tonnes, a 28% decline from the January-June 2008 volume of 10,381 tonnes.

In June 2008, Malaysia de-listed voluntarily from the EU market in order to upgrade their farms and processing plants to be compliant with EU standards. Malaysian shrimp imports to the EU were mainly to France, Italy and UK and have been declining from 6,400 tonnes in 2005 to 6,000 tonnes in 2006, 5,500 tonnes in 2007 and 2,600 tonnes in 2008 (Globefish 2009). Exports have been increasing to China, Japan and Korea. China is now the largest importer of Malaysian shrimp. Prices are much lower than for EU markets but producers say that this is compensated by the lower cost of transport.

Since March 2009, 6 processors and 6 farms have been approved to export to the EU. (See box)

Surplus brings low prices

In good times, farmers make good profits, such as in October 2007 when a profit margin of USD 0.90/kg was achieved. However, as more shrimp in the 70-90 pcs/kg size range are being produced and with a limited export market, the profit margin is extremely low. In January 2009, the price for 70 pcs/kg was more than USD 3.5/kg. According to an industry source, the current production in Peninsular Malaysia is around 300 tonnes/day and only 150 tonnes are processed for the export market as headless and head on forms. The rest are sold to the local and Singapore market.

There are two proposals by the Malaysian marine shrimp industry. It wants the government to encourage farms to move up the value chain, by legislating that farms with larger than 1,000 tonnes capacity to have their own processing facilities.

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Way forward

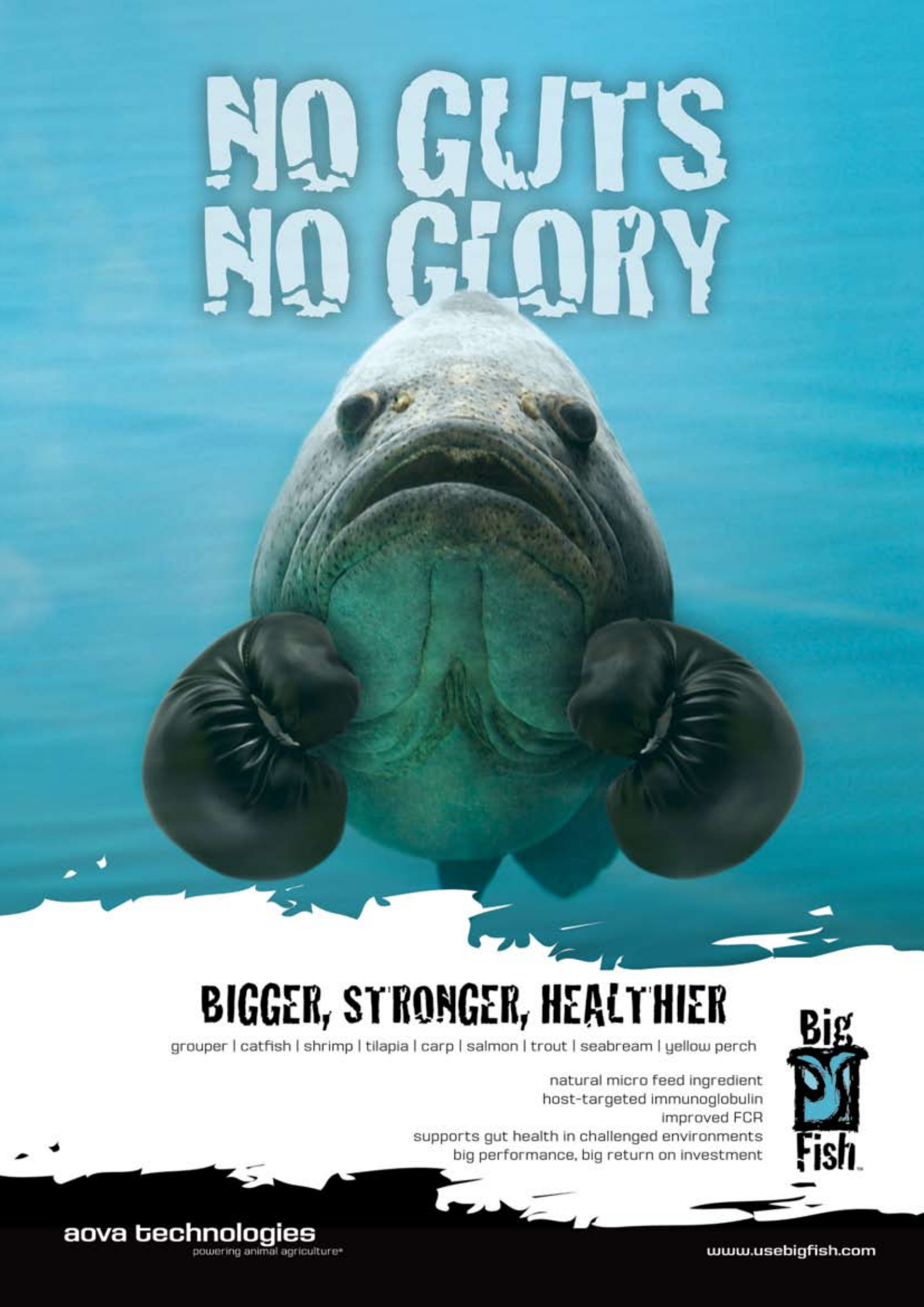
"Today the main challenge for the industry is ex-farm prices. We have now achieved a production of 80,000 tonnes per year but our problem is in marketing the shrimp. Some farmers are keeping the shrimp in the ponds for more than 5 months waiting for higher prices. Others are waiting to have more cycles in the year. We already have 2 cycles per year with the vannamei shrimp and have to be prepared for higher production. The culture period for the new fast growing variety of post larvae is 100 days for the 45 pcs/kg grade. Mortality is also lower. This 'wait and see' attitude is affecting our hatchery industry which now has a surplus of high-quality post larvae, ready for farms to empty stocks and restart culture".

Syed Omar Syed Jaafar, Chairman, Malaysian Shrimp Industry Association

"The first choice for farmers is to sell to the wet market as they will be paid usually within 1-2 weeks. There are a few players that buy shrimp at a higher MYR10/kg (USD 2.8) in the southern and central regions of Peninsular Malaysia but they offer this only to selected farmers. The alternative choice is selling to processors but payments can stretch over several months."

"The capacity of the local wet market (chilled shrimp) is less than 100 tonnes per day. We used to depend heavily on the live shrimp market in Singapore but shrimp from several other countries are also descending on Singapore. Prices have been low too at USD 2.8/kg. We have estimated that less than 35 tonnes/day goes to this market".

"The way forward is to have a more proactive marketing strategy. We are now seeking the government's help to provide processing facilities for small farms to sell their produce at regulated prices and in exporting the shrimp. We are also seeking help with a minimum price. Processors said that they have been approached to supply to the EU but are hindered from doing so because most farms with available raw material are yet to be certified by SPLAM or SAAB, the two local aquaculture certification schemes".



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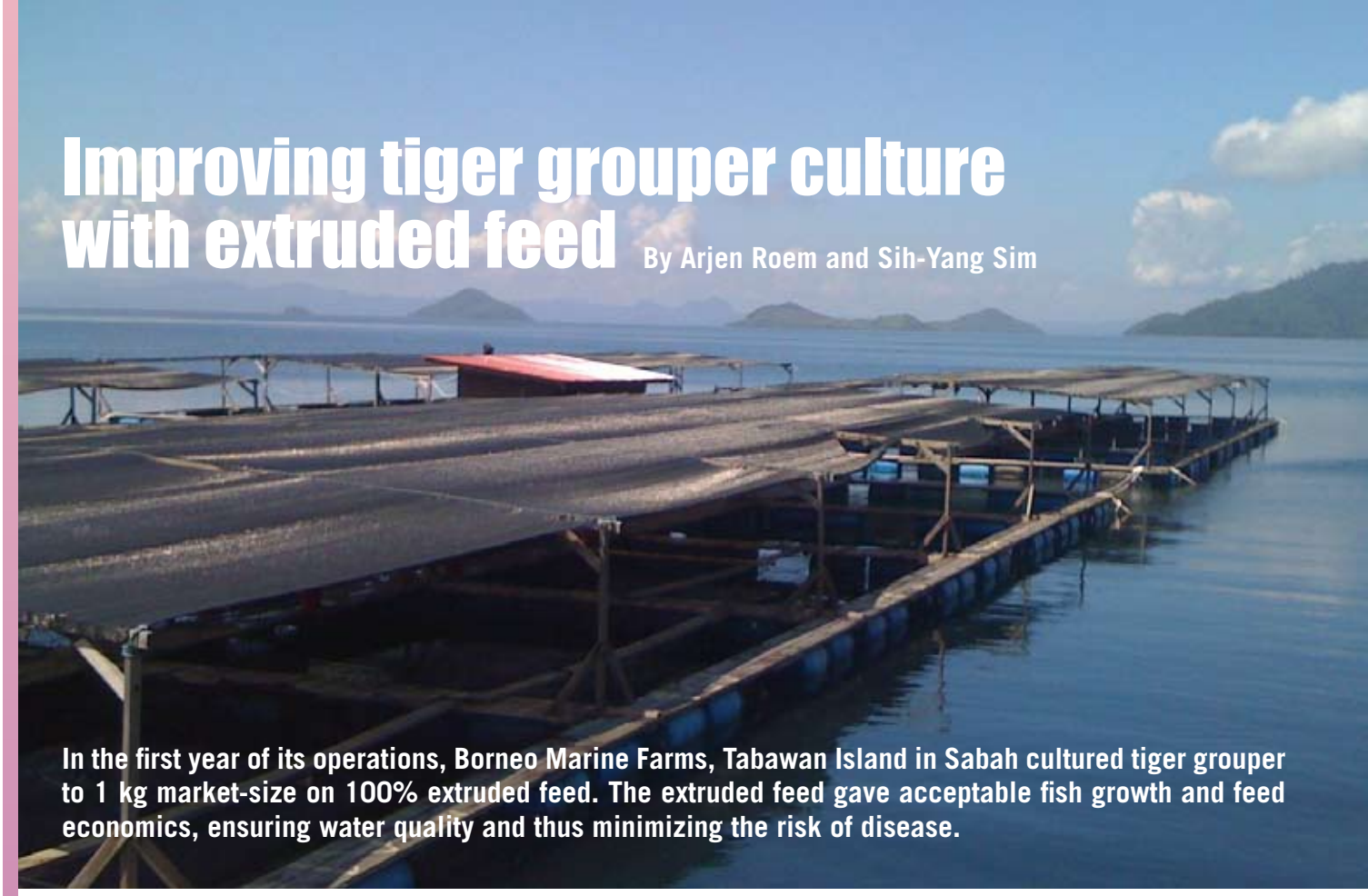
Improving tiger grouper culture with extruded feed

By Arjen Roem and Sih-Yang Sim



In the first year of its operations, Borneo Marine Farms, Tabawan Island in Sabah cultured tiger grouper to 1 kg market-size on 100% extruded feed. The extruded feed gave acceptable fish growth and feed economics, ensuring water quality and thus minimizing the risk of disease.

Sabah in Malaysia has seen a huge interest in grouper farming. Many small hatcheries and nurseries have been trying to meet demand for high quality grouper fry. Most farmers are targeting the Hong Kong market for live groupers. In 2008, grouper production was estimated at more than 200 tonnes. It is a common belief that most groupers cannot be grown to market-size on dry feed. Beyond the juvenile stages, moist feed is required for normal feed intake and palatability. Trash or fresh fish is cheap, locally available and gives good growth and farm economics in grouper farming. However, in Sabah, Hiro Matsumoto is going his own way.

After working for more than 7 years in the fish feed business, Hiro decided to become a fish farmer himself. He established a tiger grouper farm at Tabawan Island, 30 minutes by boat from Kunak, a small town near Tawau, Sabah. The cage farm is located in a large bay, the water is 28-30°C and crystal-clear most of the time with many natural tropical fishes and beautiful colored corals can be seen everywhere. "The scenery seems fitting for a blue lagoon resort", said Hiro.

Learning curve

Hiro relies on his experiences in fish farming practices in Asia and Europe.

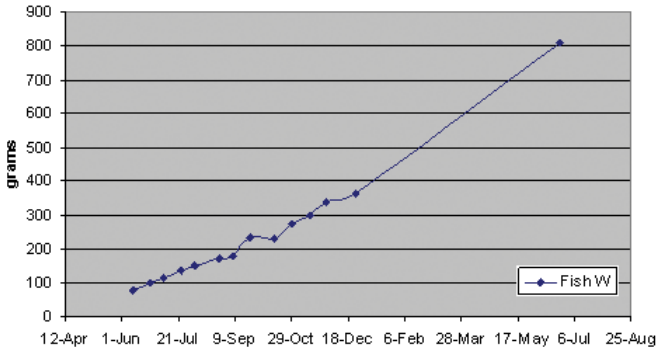
He designed and supervised the construction of the farm himself. He wanted to build a demonstration cage farm while maintaining an Asian 'architecture' and focusing on costs reduction by using locally available construction materials.

The farm has 40 cages, each measuring 6 m x 6 m, and depths are dependent on nets and range from 3 to 10 m. The farm is well equipped with an office, living quarters and bedrooms for the farm employees, central kitchen, laundry, shower and toilet facilities. Electrical power is supplied by a low fuel consumption generator. All waste and waste water is collected and treated on land.

He stocked 3,000 tiger grouper juveniles averaging 75-100g in June 2008. This was a small number to start with as he intends to build up stocks gradually while gaining experience at the site. During the first 3 months, he was sampling the fish every other week for weight estimates. Twelve months later, he was able to harvest 1,500 tiger groupers at 0.8 – 1.1 kg weight.

The groupers showed linear growth (Figure 1) and the feed conversion ratio was 2.0. Survival was 50% for the year which included one disease outbreak in December in which more than 20% of the fish

Figure 1. Growth of Tiger Grouper



were lost. Although profit targets were met, Hiro expects that he can still make significant improvements on growth and survival rate.

Extruded feed

Hiro uses only extruded feeds in his farm.

"For the grow-out, I have selected Nova GR (Skretting), a grouper diet line enriched with plant extracts to promote gut health and reduce stress. My forecasts show that I can 'afford' extruded feed in this business model. Although extruded feed may be more expensive on a per kg basis, I was uncertain about the growth potential at first but the expected lower FCR would pay off", said Hiro.

The compelling reason was the poor water quality and disease problems which were found with farms using fresh fish feeding. "Fresh fish is just not sustainable when grouper farming will be scaled up and industrialised in the years to come." said Hiro.

After working for more than 7 years in the fish feed business, **Hiro Matsumoto** decided to become a fish farmer himself. A Japanese married to a Malaysian, he established the 40 cage tiger grouper farm at Tabawan Island, Sabah.

Arjen Roem

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Fighting fluke ectoparasites in Asian marine fish

By Serge Corneillie, T. Masumoto and Hiroshi Nakayama

In the tropical regions of Asia, where sea water temperatures are above 25°C for the whole year, monogenean ectoparasites (flukes) are threatening the survival of the aquaculture industry. Skin and gill flukes have been observed to infect fish even on new farm sites within a couple of months of start up and they are proving very hard to combat.

In Japan, the ectoparasite *Seriolae benedeniae* (skin fluke) is causing enormous losses in the yellowtail (*Seriola quinqueradiata*) and amberjack (*Seriola dumerili*) farming and recently, in red seabream (*Pagrus major*) farming (Whittington et al., 2001). Amberjack are particularly sensitive to this fluke and in some areas of Japan, freshwater bath treatments have to be carried out on a weekly basis. A significant proportion of the losses can be attributed to the labour intensive and expensive bath and therapeutic treatments required to control the fluke. In addition, economic loss also occurs, as fish with a large prevalence of ectoparasites are significantly stressed which results in reduced growth and in significantly higher economical feed conversion ratios (Ernst *et al.* 2002)

Persistent damage from ectoparasites

Ectoparasites are also responsible for secondary infections. Sea lice cause skin damage which acts as a direct entrance gate for devastating diseases such as Nocardia. Nocardia can cause up to 30% mortality in the on-growing phases of yellowtail production. This has been estimated to cost the industry in Japan alone, through direct and indirect costs, over USD 150 million per year.

In Japan, yellowtail with skin damage caused by ectoparasites have been shown to become quickly infected with Nocardia bacteria when present in the water, although researchers have failed to demonstrate infection of yellowtail with Nocardia through water entering via the mouth. In order to effectively combat fluke ectoparasites, farmers need to have a multi disciplinary approach in which the right husbandry and nutrition are key elements.

What can be done?

A multidisciplinary approach, using all the tools and available knowledge, involving different management strategies and novel nutritional solutions have been shown to be effective in controlling these very persistent ectoparasites and these include:-

- Understand the life-cycle of the parasites in your particular area and instigate a monitoring program to assess the fluke numbers on the fish.
- Treat the fish as required to keep them 'parasite free'. This will involve ensuring all treatments are optimized and therapeutics are applied as recommended with the correct dose rate. This will ensure efficient therapeutic drug uptake and reduce the risk of development of resistance.

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Yellowtail farmer in Shikoku, Japan with open sea-water cages of 20 x 20 m

- Ensuring that clean nets are used in fish stocking and that these are kept clean with regular net changes.
- Boost the nutritional and immune status of the fish.
- Increase the protective mucus layer of the fish.
- Coordinate a parasite combat plan with all the farmers in your particular area or bay.

By stocking fish in a site that has been free of fish for at least 3 months (fallowing) the life-cycle of the parasite will have been partially broken, at least all the parasite eggs will have hatched and the larvae completely dispersed in the sea. In addition new fish stocked into the site should be treated with therapeutics to remove any ectoparasites. Currently the preferred treatment method is hydroperoxide baths or a combination of fresh water baths and praziquantel (Bayer). Fresh water baths alone will not kill 100 % of all flukes but the combination with praziquantel is very effective in removing 100 % of all flukes.

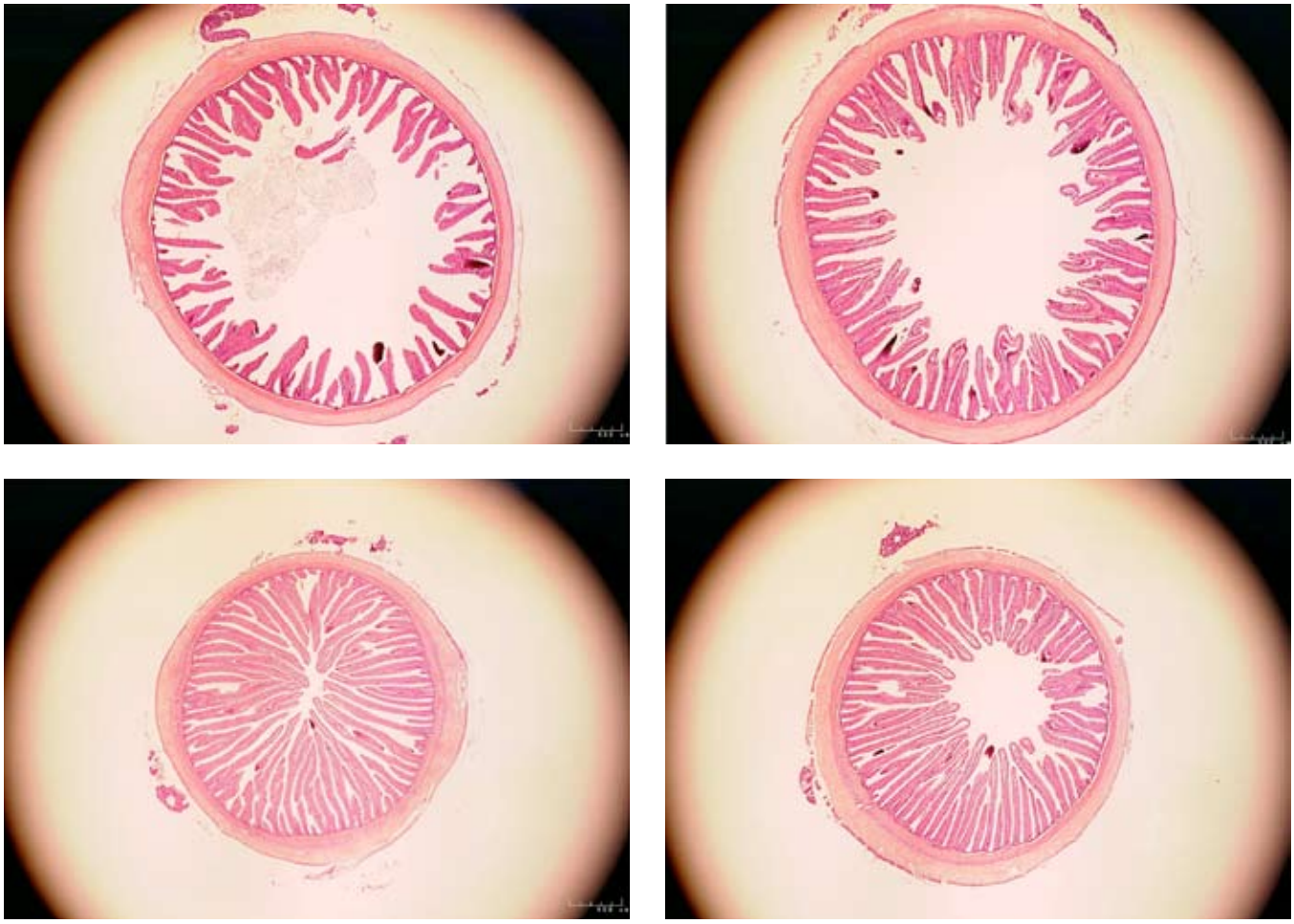
Control with clean nets

The importance of husbandry methods cannot be overstated. Starting with clean nets that are kept clean is a vital point. Dr. Ingo Ernst together with Skretting Japan have studied intensively the life cycle of the Benedeniae fluke. Important findings have showed that the eggs have a long tail which attaches to the fouling present on the nets. More importantly the authors observed that the tail of the eggs was too short to attach to the nets themselves and only attached to the algae on the nets. This means that an effective way to stop the re-infection is to keep clean nets as this will wash the eggs out of the cages. However Chambers and Ernst (2005) found eggs 8 km away from the cages.

Window for infection

Understanding the role of temperature on the life cycle of the monogenean ectoparasites means that in non tropical areas, temperature variations can be used to optimize treatment. Temperature has a major influence on the duration of the life cycle (Ernst *et al.*, 2005). In winter when the temperature is 12-14°C, the development time for the eggs is 22 days and the time between hatching and maturation takes 48 days.

Figure 1. Development of microvilli in yellowtail in control group (2 upper pictures) and group fed Amos (2 lower pictures).



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However when temperatures reach 21°C, the fluke produces 37 eggs/day which hatch after 9 days and the larvae become mature after 22 days. Therefore, in winter one cycle will takes 70 days, but only 31 days in the summer. In order to clean an area from flukes, ideally you should do it before the water temperatures rises, however in the more tropical parts of Asia, this window does not exist.

Feeding management

Nutrition plays a vital role in the fight against ectoparasites as this will maintain strong populations of fish with fully working immune systems. All the fish should be properly fed and receive the right diet with the necessary vitamins and minerals (preferably organic) and include selenium. Neighboring farms in Sukumo Bay, Japan found that the parasite level in a farm which fed the fish ad libitum was much lower than the neighboring farm which was feeding to a feed table. Although, a significant relation between fish condition factor and parasite numbers was not found in the second farm, it is clear that an improperly fed fish population will create weaker fish. These weak fish will be the first to be attacked by parasites and or any other bacterial or viral disease. On top of this, many factors can significantly reduce the immune status of animals such as low selenium or the presence of mycotoxins in the fish feed.

Our recent work showed improved growth in small yellowtail fed a diet containing 0.8% AMOS. AMOS is a combination of organic acid and Bio-Mos®, a mannin oligosaccaride produced by Alltech Inc. USA. Two groups of fish of approximately 187g were fed a control diet and the same diet containing 0.8 % AMOS. After 2 months the AMOS fed group was 10 % larger than the control group (342g versus 308g). The protein digestion coefficient was also much higher for the AMOS fed group than the control (81 % versus 62 %). In addition when the gut morphology of the fish was examined the microvilli structure in the intestine was much better developed in the AMOS group than in the control. (Figure 1). When improved microvilli structures are observed nutrient uptake is also improved.

These results are in agreement with studies in other fish species such as salmon, trout, sea breams and sole. (Sweetman *et al.*, 2009).

Wallace *et al.*, (2009) reported higher flesh levels of emamectin in salmon fed SPMP, of which Bio-Mos is a key component, supporting improved nutrient uptake with improved microvilli structures. This offers opportunities to improve therapeutic treatments and reduce environmental effects.

Wallace *et al.*, (2009) also found that SPMP (Bio-Mos) doubled the mucus production of the salmon and this much thicker layer of mucus made it more difficult for the parasite larvae to attach to the fish. (Figure 2).

Figure 2. Typical mucus development on Salmon fed SPMP compared to control diet Loch Sunart Site C 2008.

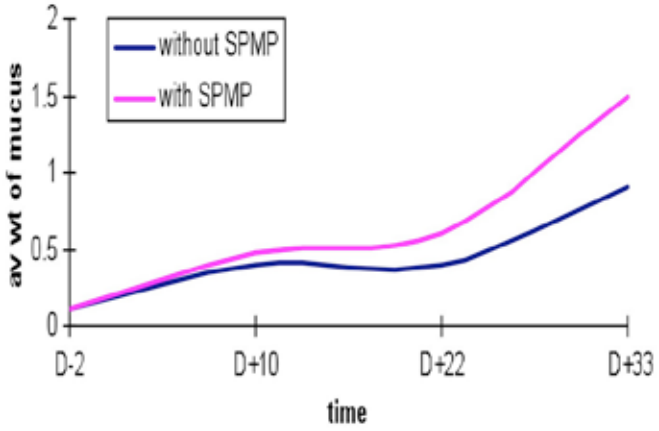

Figure 2 illustrates mucus production related to SPMP (Bio-Mos) and control diets over time at site C. It indicates a distinct and typical increase in epidermal mucus in the SPMP fed population (Wallace et al. 2009).

Endnote

A multidisciplinary approach using both management strategies and novel nutritional solutions can help in the fight against flukes. Coordination with neighboring farms within an area is vital in helping to make these treatments more effective. In 2008, Marine Harvest Scotland demonstrated that such a total approach worked in their farms and that this could reduce significantly the occurrence of sea lice and therapeutic cost. (Wallace et al. 2009).

Work is continuing to further advance this approach to ectoparasites and farmers who really want to reduce this problem in their farms will need to adopt these strategies and go the full length to become more effective.

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A feed is only as good as its ingredients – Optimising ingredient evaluation technology for aquaculture diets – Part III

By Brett Glencross

This final part in the ingredient evaluation series looks at complementary accessory and novel technologies in the assessment of the ingredients.

The future sustainability of feed production for aquaculture species will be dependent on our ability to use a wide range of alternative ingredients, which can satisfy formulation constraints for the specific nutrient, energy and processing requirements of each intended diet. Prior to the use of any particular ingredient it is critical for that ingredient to undergo evaluation to enable us to consider its potential limitations. This nutritional evaluation process has several key facets that need to be considered to be able to provide a clear indication of the potential that any ingredient may have for use in an aquaculture feed. This ingredient evaluation process has been reviewed in detail by: *Glencross, B.D., Booth, M. and Allan, G.L. 2007. A feed is only as good as its ingredients – A review of ingredient evaluation for aquaculture feeds. Aquaculture Nutrition 13, 17–34.*

This is the final article, in the three-part series which are largely abridged versions of that review. For further details and references readers should refer to that article. In this third and final part of the series the use of accessory and frontier technologies in the assessment of the ingredients will be considered.

Gene and protein expression

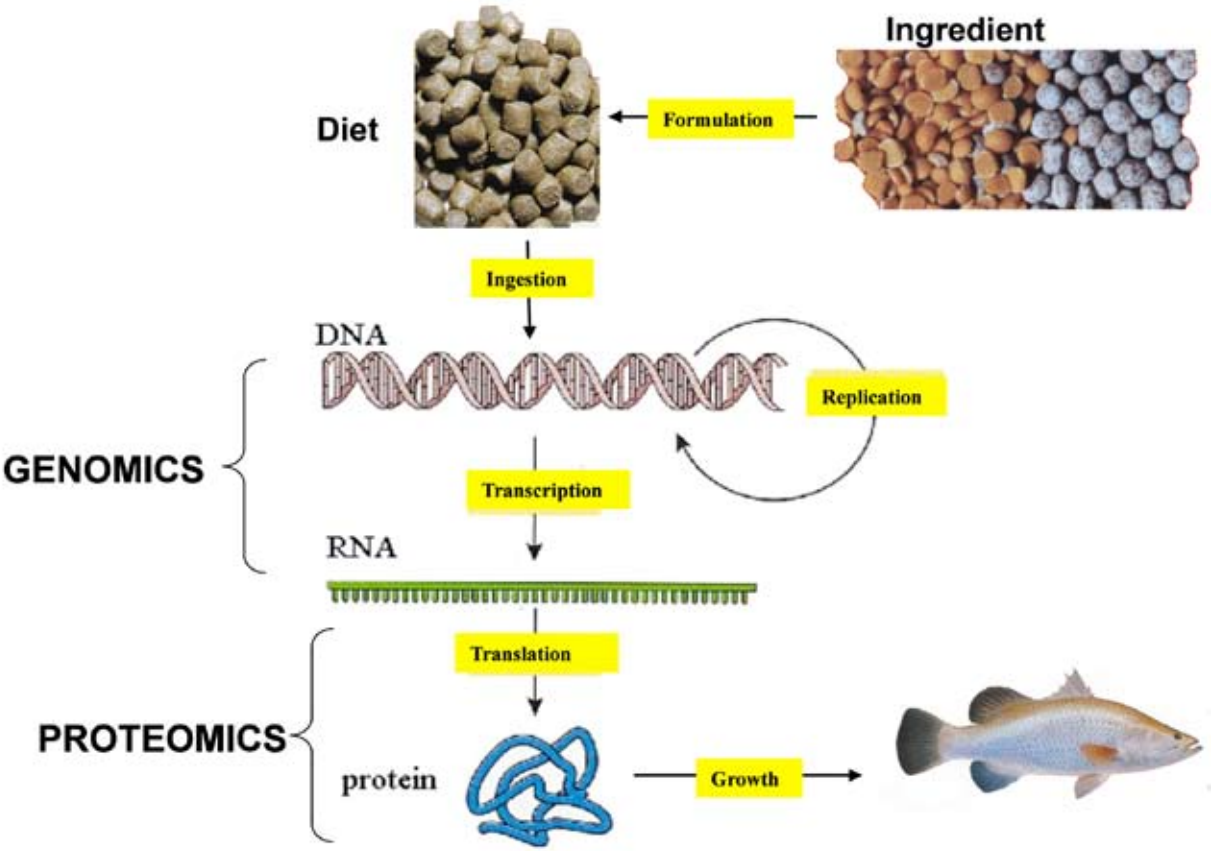
Ultimately, nutritional regulation of growth has to occur by influencing the genetic potential of the animal. This influence can be measured as a range of molecular responses, most notably the expression of genes and their translation to proteins (Figure 1). The evaluation of such nutritional effects on fish performance has been termed nutrigenomics (Panserat et al., 2007). This aspect of nutritional evaluation allows an examination of changes occurring at the molecular level.

The two main streams of molecular science applied to ingredient assessment in fish diets have been genomics and proteomics, where gene and protein expression respectively are examined (Figure 1). Proteomics has arguably more direct relevance to animal function because it examines the actual changes occurring in protein expression within the cell. In contrast, genomics explores the expression of genes through transcriptional processes, but still has to rely on translational processes to allow its effects to be mediated upon the animal (Kolditz et al., 2007). This branch of science also offers some exciting potential to the examination of the influence of microbial populations in the gut of fish as a function of ingredient choice (Lilleeng et al., 2007)

Biochemical, histological and sensory factors in ingredient evaluation

One of the primary biochemical evaluations undertaken in ingredient evaluation studies is the systematic comparison of the effects of dietary treatments on whole body or organ specific composition. Indeed, analysis of whole body composition is required for the examination of nutrient/energy utilisation efficiency and/or apparent biological value. In addition to this more standard biochemical assessment, other biochemical parameters such as changes in blood metabolites, hormones or enzyme activities have also been used to provide an indication of potential disruption to metabolic function and nutrient

Figure 1. The key loci of where nutrigenomic and nutriproteomic technologies apply. Nutrigenomic technologies focus on effects seen at the transcription point, while nutriproteomics focuses on effects at the translation point.



utilisation by fish. There are assays that can be examined, including those for hormones such as somatatropin and insulin-like growth factor 1, which have been used as a correlates of synthetic activity in fish (Dyer et al., 2004).

An evaluation of immune responses and parameters associated with an immune challenge has been effectively used to examine nutritional treatments (Bakke-McKellup et al., 2007). An assessment of tissue histology has also provided useful insights into examining some of the more long-term and chronic effects of ingredient inclusion in fish diets. For example, some specific parameters such as gastrointestinal enteritis problems, are associated with the use of soybean meals in Atlantic salmon diets (Uran et al., 2007).

Organoleptic or sensory properties, while not a common assessment parameter in nutritional research on ingredients, have been used to evaluate the potential impact of alternative ingredients, such as meat meals, on some taste and odour quality aspects on final products.

Ingredient functionality and feed technical qualities

The functionality of feed ingredients relates to their effects on the physical properties of the processed feed (Thomas and van der Poel, 2001).

"Irrespective of how good the nutritional value of an ingredient may be, if it cannot be usefully incorporated into a feed, or reduces the physical qualities of the feed, then its value as an ingredient is diminished".

The key physical attributes sought are those that result in a product with properties that provide advantages for feeding aquatic species. Improved sinking rates (or even floating), pellet durability, degree of starch gelatinisation and oil absorption capacity are some of such parameters.

Experimental extrusion processing or steam-pelleting is the most obvious way to evaluate ingredient functionality, as the results have direct implications for a final product. In these studies, a formulation including a test ingredient is run through the machinery and the properties of the pellets produced are compared against either a reference formulation or a series of target specifications.

Novel technologies and future directions

Already there is substantial scope for the use of many plant and animal meals and oils as alternative protein and lipid sources for aquaculture feeds (Gatlin et al., 2007). The increasing use of alternatives will also introduce a greater array of challenges, the foremost being the reliable, accurate and rapid assessment of the nutritional value of each alternative nutrient source prior to its inclusion in a formulation.

The use of rapid analysis techniques for ingredient composition, such as near infrared spectroscopy (NIRS), offer potential to improve the basis for diet formulation from variable batches of raw ingredients. Although NIRS is almost routinely used in many feed companies for the evaluation of crude protein, moisture and fat composition of ingredients and products, it has also begun to be used for the assessment of digestible nutrients and energy from ingredients and diets (Aufrere et al., 1996).

Some good attempts at in vitro digestibility assessment of ingredient quality have been made, routine assays using such technology are yet to be adopted (Carter et al., 1999). While such in vitro digestibility techniques do not offer the same potential turnaround as NIRS, they are still significantly quicker and cheaper than in vivo studies. In addition to in vitro assessments on digestibility values, the development of rapid assessment methods for the influence of ingredients on animal health is another aspect to ingredient evaluation and the use of molecular and biochemical techniques have much to offer in this regard (Lilleeng et al., 2007).

The use of nutritional modelling techniques to understand interactions among different dietary compounds is another frontier. While recent studies have shown that specific interactions among compositional features of some plant ingredients affect their digestible value, this is by no means the only source of variation in nutritional quality (Glencross et al., 2008). It is clear that the causes of variability in nutritional quality vary between different ingredients and that in most cases there are also more than two just single factors that affect the nutritional qualities. Therefore using multivariate analytical and modelling methods, will

not only identify these interactions, but also describing them will be a significant advance forward in understanding ingredient limitations.

Endnote

The science behind aquaculture diets and ingredient evaluation has come a long way since the days when feeding trash-fish was the only feed option. As our knowledge of dietary requirements has improved so too has our ability to discriminate and adapt different types of ingredients to supply nutrients and energy to fish. As aquaculture diets continue to use a broader range of ingredients into the future, not only will this improve the industry's overall sustainability, but it will also significantly increase the complexity of the nutritional inputs. This increasing complexity will demand an even greater understanding of how ingredients interact to become feeds and how animals respond to those combinations.

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Stimulating immunity in fish and crustaceans: some light but more shadows

By Klaus Hoffmann

Unlike in the animal production industry where the effects are well defined, the several options to impart immunity in aquatic species remain elusive.

For several years functional aqua feeds have been the new paradigm to overcome almost all problems in aquaculture. Claims on functional feeds go beyond satisfying basic nutritional requirements of the cultured organism to improve growth, feed utilisation to general health and stress resistance.

Under intensive production systems, fish and crustaceans are exposed to various stressful conditions leading to growth reduction, immuno-suppression and susceptibility to infectious diseases resulting in major economic loss for farmers. The potential for reducing stress and enhancing immunity and disease resistance by nutritional factors/feed additives (such as probiotics/prebiotics, immunostimulants and bacterins) has been demonstrated in warm-blooded animals.

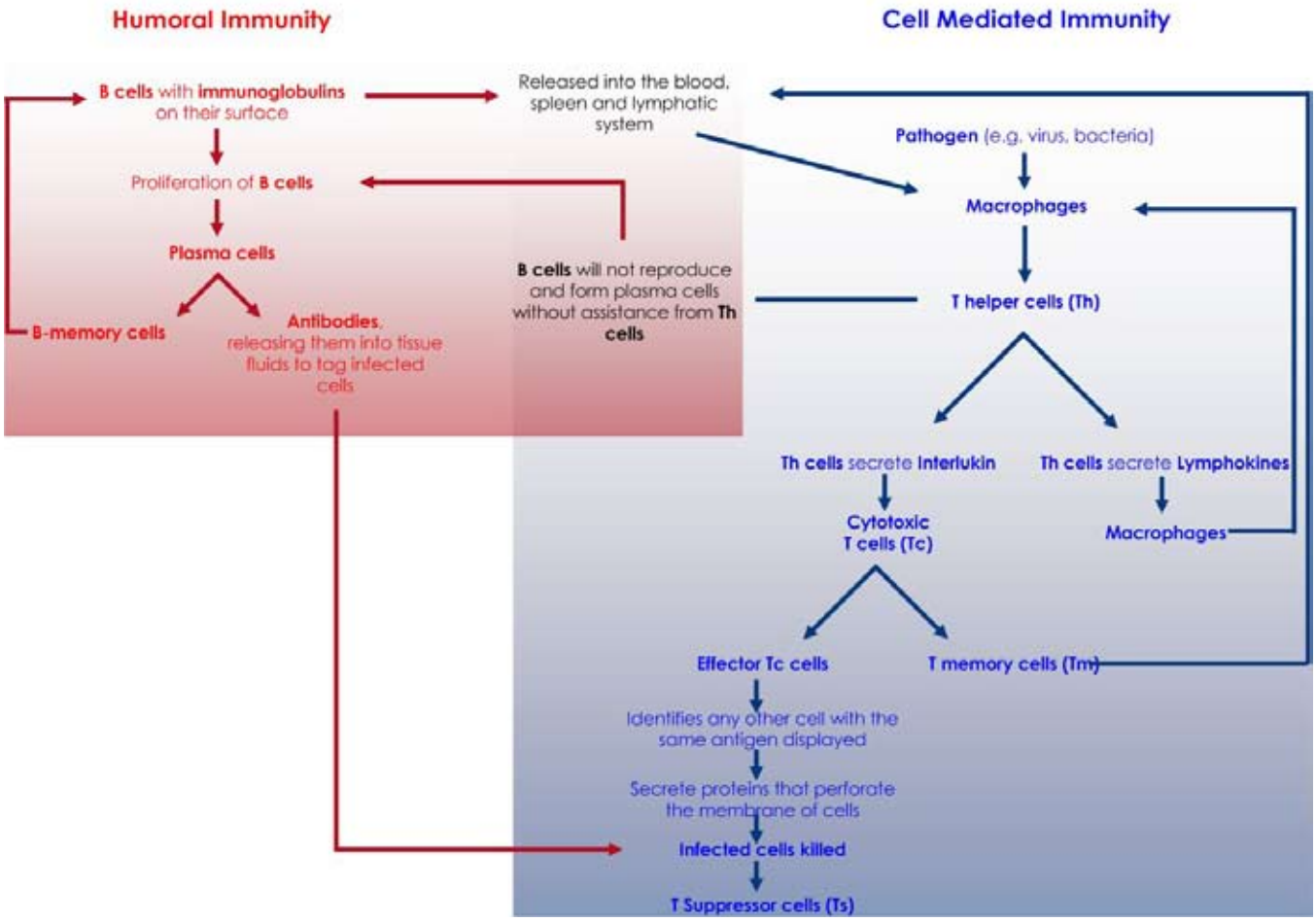
However, very little work in this area has been conducted in aquaculture. Thus, the effects of dietary nutrients and their interactions, anti-nutritional factors, additives, feed and feeding strategy need to be assessed to develop economically viable feeds and feeding practices to optimize growth, improve stress resistance, immune response and disease resistance, and improve product quality of aquaculture species. But is this really possible?

Immunity

An immune system is the collection of biological processes within an organism that protects against disease by identifying and killing pathogens. It detects a wide variety of agents, from viruses to parasitic worms. Multiple mechanisms are involved in immunity that recognize and neutralize pathogens. The immune system protects organisms from infection with layered defenses of increasing specificity. In simple terms, physical barriers prevent pathogens such as bacteria and viruses from entering the organism. If a pathogen breaches these barriers, the cellular immune system provides an immediate, but non-specific response.

Cellular immune systems are found in all plants and animals. However, if pathogens successfully evade the cellular response, vertebrates possess a third layer of protection, the adaptive immune system, which is activated by the cellular immunity. Here the immune system adapts its response during an infection to improve its recognition of the pathogen. This improved response is then retained after the pathogen has been eliminated, in the form of an immunological

Figure 1. Pathways to cell mediated and humoral immunity in vertebrates.



memory, and allows the adaptive immune system to mount faster and stronger attacks each time this pathogen is encountered.

Both cellular and adaptive immunity depend on the ability of the immune system to distinguish between self and non-self molecules. In immunology, *self* molecules are those components of an organism's body that can be distinguished from foreign substances by the immune system.

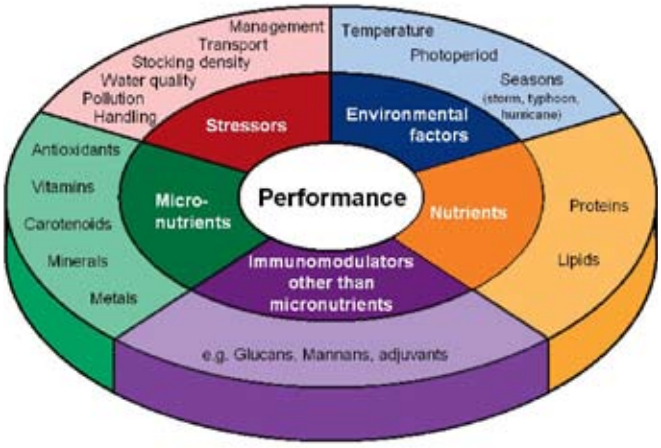
Conversely, *non-self* molecules are those recognized as foreign molecules. One class of *non-self* molecules is called antigens (short for antibody generators) and is defined as substances that bind to specific immune receptors and elicit an immune response. These mechanisms at least partially apply to fish too. *However, in crustaceans a more primitive immune response involving cellular immunity only is utilized.*

The immune system is a complex catenation of cells and regulatory mechanisms (see Figure 1 for details). Although working quite reliable and efficient, it can be influenced by diverse internal and external factors as illustrated in Figure 2.

The gastrointestinal tract is a prominent part of the immune system. Relative to the size of the organism, it has a large surface area. As such, the immune system must work hard to prevent pathogens from entering into blood and lymph. The low pH (ranging from 1 to 4) of the stomach is fatal for many microorganisms that enter it. Similarly, mucus (containing IgA antibodies) neutralizes many of these microorganisms. Other factors in the GI tract help with immune function as well, including enzymes in the saliva and bile.

Health-enhancing intestinal bacteria serve to prevent the over production of potentially harmful bacteria in the gut. These two types of bacteria compete for space and 'food' as these are limited resources within the intestinal tract. A ratio of 80-85% beneficial to 15-20% potentially harmful bacteria is generally considered normal in the intestines. Microorganisms are also kept at bay by an extensive immune

Figure 2. Essential factors for proper functionality of the immune system.



system comprising the gut-associated lymphoid tissue (GALT). It has been documented in a number of terrestrial animals as well as humans that the microbiota of the gastrointestinal tract plays an important role in affecting nutrition and health of the host. This similarly should apply, at least to some extent to aquaculture.

In the following paragraphs some possibilities to increase gut health of aquatic organisms are discussed.

Probiotics

These are dietary supplements containing potentially beneficial live bacteria, yeast or algae. The health benefit is established by directly affecting the intestinal microbial balance of the host organism. Examples of probiotices include gram-positive bacteria such as *Bacillus*

sp, *Carnobacterium inhibens* K1 and *Lactobacillus sp* as well as gram-negative bacteria such as *Aeromonas hydrophila, Pseudomonas fluerescens* and *Vibrio fluvialis*. Other probiotics are bacteriophages and yeast (*Saccharomyces cerevisiae, Phaffia Rhodozoma, Debaryomyces hansenii*) as well as microalgae (*Tetraselmis suecica*). Probiotics are usually selected to control specific pathogens through competitive exclusion or direct mild stimulation of fish immune system.

In early work on probiotics, the microbial preparations were either applied directly to the water or added to the feed. It is necessary to identify and characterize the normal gut microbiota in order to provide the adequate cocktail of probiotics for a given organism or species. Questions on the ability of the probiotics to adhere to the mucosal surface of the gut were raised by some scientists. What is the survival time and activity of the microorganisms in the intestinal tract? What about the environmental impact? These questions as well as issues on optimal dosage or survival of the probiotics in or on pelleted feeds were addressed. There has been some success in the application of probiotics.

In addition, there are some potential constraints to dietary application of probiotics including the susceptibility of these live organisms to inactivation by heat during extrusion or pelletisation as well as the different pH values present in different parts of the intestinal tract. Last but not least the costs of probiotics may prohibit the area-wide use in feeds.

"It is necessary to identify and characterize the normal gut microbiota in order to provide the adequate cocktail of probiotics for a given organism or species."

Prebiotics

The various potential constraints to probiotic application have resulted in the evaluation of the so-called prebiotics in aquatic animals. These are non-digestible feed ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the intestinal tract. Thus it improves host health. The main advantage of prebiotics over probiotics is that they are natural feed ingredients and thus regulatory control over dietary supplementation should be limited.

The classic definition of prebiotics today only fits fructooligosaccharide (FOS), galactooligosaccharides (GOS) and transgalactoologosaccharides (TOS). Other feed supplements often referred as prebiotics, such as mannanoligosaccharides (MOS) have effects on the composition of the intestinal microflora but their mode of action is different as they are not directly utilized or metabolized by the bacteria.

The inclusion of prebiotics in the diet has been reported to increase the uptake of glucose and the bioavailability of trace elements most likely by decreasing the pH of the intestinal tract. Moreover effects on volatile fatty acids (VFAs) have been observed.

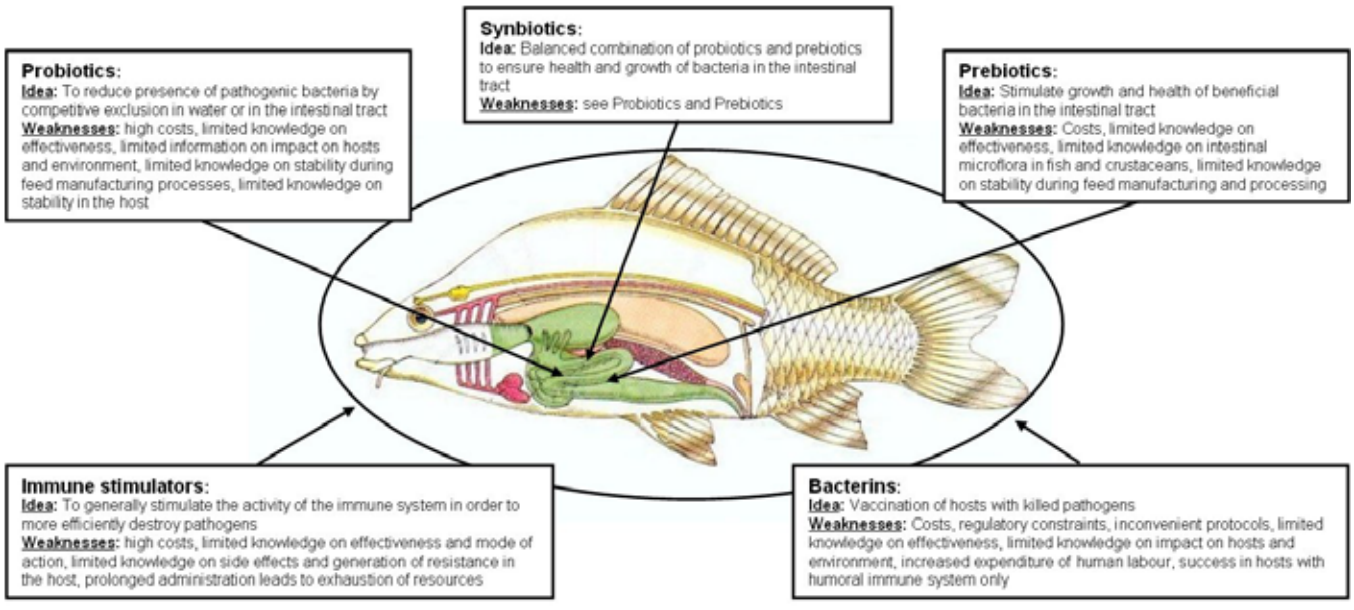
Although prebiotics are widely regarded as being safe, their use in aquaculture is still in its infancy and it will take several years to establish cheap, profitable and feasible protocols for their usage.

Synbiotics

Synbiotics refer to nutritional supplements combining probiotics and prebiotics to form a symbiotic relationship. This new concept for aquaculture needs further evaluation and research to more fully characterize the effects in aquatic organisms.

Improving general health and performance in aquaculture by stimulating the growth of specific microbes in the intestinal tract or directly stimulating the immune system basically is a good and rational strategy. The prospective of simultaneously improving performance and the general health of the animals by addition of specific feed supplements is appealing, not only to farmers but also feed producers in times of increasing market competition. The success of probiotics and prebiotics in the livestock industry has spilled over to aquaculture.

Nevertheless, the basic requirements of a diet to supply adequate quantities of essential and conditionally essential nutrients for the various organisms must not be neglected. The stimulation of growth of intestinal bacteria by pro- or prebiotics involves the supply of sufficient amounts of other nutrients to enable the multiplication of these microbes. If the supply of basic nutrients cannot be guaranteed by the diet or the animal itself, the beneficial effects of pro- and/or prebiotics will be reduced or even unverifiable.



It is still questionable whether there there are other possibilities to increase performance and at the same time the immunity of fish or crustaceans without the risk of extensive biological and environmental consequences.

Classic stimulators of the immune system

It is well established that some microbial products such as lipopolysaccharides, βglucans and some herbal extracts can stimulate the cell-mediated immune system. Some of these products can be delivered orally without complete degradation and thus may be used as potential immunostimulants for aquaculture. The mode of action of these stimulators is not yet fully elaborated. Farmers and feed producers need to be careful as a general stimulation of the immune system over extended periods of time lead to adverse effects. Some resources in the organism may be exhausted leading to adverse effects on performance.

Bacterins

Bacterins are vaccines produced from killed bacteria. Some of them have been successfully tested in fish. Disease prevention and treatment strategies such as vaccination are currently limited in large-scale aquaculture due to regulatory constraints or inconvenient administration protocols. Moreover the cost for the treatment and the additional handling of the animals restricts their usage. Perhaps, this fairly new strategy is a link to future applications in aquaculture.

Bottom line

All the options to improve natural health and immunity in aquaculture are dependent on the proper functionality of the immune system. This includes the sufficient supply of nutrients. The immune systems of vertebrates consist of many types of proteins, cells, organs, and tissues, which interact in an elaborate and dynamic network. As part of this more complex immune response, the immune system adapts over time to recognise specific pathogens more efficiently. This adaptation process is referred to as 'adaptive immunity' or 'acquired immunity' and creates immunological memory. In order to function, unmitigated new cells with various functions need to be produced. The production of these cells needs sufficient supply of raw materials. If this supply cannot be guaranteed, the time for proper immune response is retarded.

Currently, there are already scientifically approved feed supplements, regarded as nutraceuticals which achieve the dual advantage of improving performance and general health of fish and crustaceans at the same time. These need to be taken into considerations whenever general health or immunity in aquatic animals need to supported or improved.

References are available on request

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Krill meal and oil in shrimp feeds improve economics and growth performance

Krill meal and krill oil both showed promising potential as ingredients in shrimp feed in a series of trials conducted in Brazil on behalf of Akvaforsk. Krill meal fully replaced anchovy fishmeal and soya lecithin with no reduction in growth performance and with a higher economic margin compared with the standard diet. Krill oil at 2.5% replaced all cholesterol and partially replaced fish oil and soya lecithin in a diet with 18.75% anchovy fishmeal and delivered the highest economic performance of all diets tested. In subsequent trials, krill oil demonstrated an ability to support shrimp performance in hypersaline conditions.

Alberto Nunes

The trials were conducted by Alberto Nunes of the Laboratory of Shrimp Nutrition at the Instituto de Ciências do Mar (Labomar), in the Federal University of Ceará, Brazil. The objective was to evaluate the growth performance of juvenile shrimp, *Litopenaeus vannamei*, fed diets with krill meal and krill oil in replacement of fishmeal, fish oil, soya lecithin and cholesterol. Trials were conducted in 25 indoors and 25 outdoors rearing tanks over a period of 72 days.

Experimental shrimp were all part of the same batch and came originally from the Sealife® hatchery in Brazil. They were collected from a commercial growout facility 18 km from the trial site. Stocking rate in the indoor tanks was 100/m^2 (tank bottom area 0.57 m^2) and in the outdoor tanks it was 60/m^2 (tank bottom area 1.02 m^2). Water in the indoor tanks was clear, with overnight filtering and a 12-hour light/dark regime. Tank water outdoors was green, providing natural food in addition to the diet and the tanks were exposed to the weather so that water conditions changed. Each week 25% of the water was replaced. The shrimp were reared for the first ten days on a commercial extruded diet, to acclimatise them evenly to the new conditions.

Experimental diets

Four experimental diets with QRILL™ Antarctic krill meal or QRILL™ oil, both from Aker BioMarine, were compared with a conventional diet. Three diets had krill meal at 1%, 5% and 11% and the fourth had krill oil at 2.5%. Diets were formulated to provide a significant cost reduction in comparison with the standard diet. All diets were produced at the laboratory.

Diets were presented in feeding trays with a mesh base and solid rim to avoid loss of feed into the water and consequent effects on water quality. The trays were replenished at 07.30 and 16.00 each day and the amount of feed supplied was adjusted in line with consumption: 25% less if more than 25% remained and 25% more if no feed remained. Water quality (pH, temperature and salinity) was monitored daily and remained within the ideal range for the culture of *L. vannamei* throughout the trial period. However, the pH of water in the outdoor tanks did increase, probably because of the presence of algae.

Each week, a sample of the shrimp was taken from each tank and the wet weight recorded before returning to the tank. Shrimp in all tanks grew continuously throughout the culture period.

There was no statistically significant difference in the shrimp wet body weight with any of the diets provided in the indoor tanks. These results indicate that replacing anchovy meal, fish oil, soya lecithin and cholesterol with krill meal and krill oil had no detrimental effect on the growth of *L. vannamei*, even at 11% krill meal.

Litopenaeus vannamei at Labomar

Alberto Nunes said, "The data indicate that krill meal and krill oil can fully replace fishmeal, soya lecithin or cholesterol and meet *L. vannamei* nutritional requirements." He added that there are significant formulation cost savings in comparison with the base diet.

In the outdoor tanks, shrimp fed the krill oil diet and those on the conventional diet performed best in terms of growth. However, the krill oil diet delivered a greater economic benefit. Due to the lower costs involved with the krill meal diets, two out of three also delivered overall economic benefits in comparison with the conventional diet.

Sigve Nordrum, Aker BioMarine Vice President explained, "For commercial purposes, the addition of QRILL™ Antarctic krill meal alone will provide krill oil as well as the nutrient input from krill meal. QRILL™ Antarctic krill meal contains 25% krill oil, thus a feed with 10% krill meal will have 2.5% oil. Due to the refinement process, pure krill

Sigve Nordrum

Saga Sea is used to harvest the krill

oil costs more and is best reserved for larval diets where the benefits justify the investment."

Growth under hypersalinity conditions

Under more challenging culture conditions, nutrients to overcome stress can be more important than those used for growth. A further set of trials investigated the influence of supplementation with QRILL™ oil, on the growth of *L. vannamei* when cultured under hypersaline water conditions.

High salinity can occur in grow-out ponds, where salinity fluctuates between the rainy and dry seasons. Other factors such as pond depth and water exchange rates also influence salinity. In a high salinity environment, shrimp are forced to use the osmoregulatory mechanisms to restore physiological balance. In turn, these mechanisms can lead to stress that affects, for example, digestive and antioxidant enzyme activity. Krill products are noted for their high levels of polyunsaturated fatty acids, cholesterol, phospholipids and astaxanthin (provitamin E); these ingredients are thought to be of benefit for shrimp growth in high salinity culture conditions

Trials were conducted over 48 days and used diets in which the lipid sources were krill oil, fish oil or soya oil in various marine/vegetable combinations and one with soya oil alone. The shrimp were in tanks in ideal and high salinity conditions (21–26 ppt and 40–47 ppt).

Accordingly, Alberto Nunes said, "The results indicated that the higher the salinity the more the presence of n-3 highly unsaturated fatty acids, specifically DHA and EPA. Both of these are from marine sources and are important in the ability of the shrimp to counterbalance osmoregulatory stress".

"Within the marine oil feeds, QRILL™ outperformed fish oil in the high salinity conditions, and under normal salinity. When we investigated rates of inclusion, it appeared that daily exposure to krill oil in the diet was more important than an increased inclusion level. Optimum growth was achieved when DHA reached 10.8% of the total lipid content. Taking the DHA content of the feed above that did not increase growth."

Mono sex tilapia fry production

Strains with better disease resistance for all culture situations

Breeder red

In tilapia farming, the culture of mono-sex tilapia is the preferred model as male fish grow faster and larger than females. The problem of uncontrolled breeding of fish and subsequent inability to control density is also alleviated. Hybridisation or hormonal methods are the common methods to obtain a population skewed towards males.

In 1994, after a 3 year stint at the Asian Institute of Technology (AIT) in Bangkok, Warren Turner chose a 10ha site in Ban Sang, Prachinburi Province, to start a moderately-sized mono-sex tilapia hatchery based on the use of hormonal techniques. The aim was to initially produce 2 million 1-inch (2.5cm) fry per month for sale to farmers predominantly in Central Thailand and to expand to 5 million fry per month within 1 to 2 years.

At that time, Thailand produced only 60,000 tonnes per year of black tilapia, *Oreochromis mossambicus* and Nile tilapia, *O. niloticus*, as compared to the current production of more than 200,000 tonnes of tilapia (FAO). These figures are underestimates as shown in a 2006 survey by Ben Belton in his PhD dissertation. He reported that five large wholesale markets in and around Bangkok were selling 110,000 tonnes of tilapia per year.

Grading of fry

Nile tilapia is the common food fish in North-eastern Thailand, even in restaurants. However, the acceptance of tilapia as a mid price fish in restaurants in Central Thailand came about only recently with the introduction of the red tilapia strain called Tabtim. "When I was in AIT, 3 pcs/kg of Nile tilapia produced in green water ponds and fed on cheap supplementary feeds used to fetch THB 18/kg. Prices have not changed and are around THB25/kg for 500g fish and THB 18/kg for smaller 300g fish. This has been made possible by the high quality monosex tilapia available today and improvements in selectively bred fish which grow much faster", said Turner.

Red tilapia varieties, introduced as a food-fish to Thailand in 2000, are raised in cages in rivers and lakes throughout the country. They are now common in restaurants and supermarkets and farm-gate prices for cage-reared 700g red tilapia are generally around THB40/kg. The price rose to as high as THB90/kg in 2007 due limited supply after an outbreak of disease. Prices have been reducing in 2009 to the current THB53/kg.

Farmers typically stock 4-inch (10cm/25g) fingerlings in floating cages and raise them to 700g in 4 months using commercial floating feed. Nursery farmers who buy 1-inch fish and raise them to 4-inches have sprung up in response to this demand for fingerling-sized fish. Pond farmers, in contrast, mainly stock 1-inch fish and raise Nile tilapia more extensively. They use manure, cheap feeds and a variety of agricultural and industrial wastes on a large scale in ponds ranging from 3-15 ha. Culture period is typically 9 months and the majority of farmers practise polyculture with carps and catfish at a low density with 90% of the fish comprising tilapia. Quite recently farmers have turned to culturing white shrimp *Penaeus vannamei* in polyculture with tilapia. The white shrimps are raised for 3 months before harvesting and are then restocked with post larvae. After three crops the fish are harvested and the pond drained. Feeding is supplementary and not

In the pond, the egg collecting team coax the mouth brooder to release eggs

significantly different from raising tilapia without shrimp. In this way, costs are not significantly increased, but income is more regular and substantially higher.

Mono-sex seed production

The raison d'être of Nam Sai Farms is to be able to supply a 100% male progeny, first to industry in Thailand and then to the rest of the world. The monthly targets are 10 to 20 million 1-inch monosex fry per month and approximately 10 million swim-up fry, the majority of which are stocked at Nam Sai's franchise branch west of Bangkok in Nakhon Pathom province. Approximately 98% of the market is in Thailand, as transporting live fish by air is expensive, but exports are growing and in the first 6 months of 2009, the company exported live fish to 15 different countries worldwide.

The demand is for mono-sex fingerlings of 1-inch (0.2g) and Nam Sai packs them at 1,000 to 2,000 per foam box of 60 x 45 x 30 cm (13.5 kg equivalent). An alternative being promoted for several years is for customers to buy swim-up fry (8 day old fry), as 10,000-15,000 can be placed in one box for journeys up to 40 hours and significantly reducing transport costs. Transporting swim-up fry is low risk, as fry use very little oxygen and can survive on yolk sac reserves for very long journeys. However, they have yet to undergo sex reversal and as part of a do-it-yourself arrangement, Nam Sai offers equipment such as hapas, feed and the protocols, but only to more experienced farmers.

Nam Sai Farms Co Ltd is now a group of 5 farms located within a radius of 5 km, covering 64 hectares and employing 200 staff. Two farms have broodstock, three farms have hatcheries and three farms carry out sex reversal work. The company produces fry of four strains

Swim up fry in an incubator tray

Hatchlings with yolk in an incubator tray

of Nile tilapia *Oreochromis niloticus* and three strains of the hybrid red tilapia *O. niloticus* X *O.mossambicus*. In 2004, an experimental franchise branch was started at Nakhon Pathom to supply farms west of Bangkok. The biggest risk was getting lower quality than the main farm, but this was avoided by using the same fish and feed, thus avoiding the need to do broodstock and hatchery at this site. The experiment was very successful and the branch now supplies up to 5 million monosex fry per month. Further branches are now planned in Thailand based on this concept.

Another development that has taken shape over the years is the supply of equipment for export. This came about when many visitors to the farm wanted a one stop shop for farm equipment and accessories. Nam Sai Farm Equipment was set up to supply these needs and this has recently been taken over by Angus MacNiven who has expanded the services provided to also include training, study tours, consultancy and turnkey aquaculture projects such as a small hatchery set up in Malawi in 2009 for USAID.

Hapas in seed production

The process of mono-sex tilapia production can be broken down into brood stock rearing and spawning, egg incubation, sac-fry rearing, sex reversal and nursery. Areas and rearing systems for each stage of the process are separate and distinct, and are largely carried out in hapas suspended in earthen ponds, with incubation carried out in incubation jars and trays placed in tanks. Nam Sai has more than 100,000 broodstock for the current volume of production and these take up 60% of the total pond area.

According to Turner, the protocol for mono-sex seed production is very well defined. The breeding process begins with the selection of spawners. These are kept in net hapas in fertilised ponds at a stocking density of 0.8-1.0 kg/m^2. Only 15% of the female brood fish are expected to spawn every 5 days, although it can be as high as 30% or as low as zero when the weather is hot. In the hapas, a specialised collection team removes eggs from the mouths of brooders and disinfects eggs to remove pathogens. Batches of eggs are staged, separated and transferred to hatching incubators for 3 days. These will hatch differentially depending on the stage. Hatchlings are scooped up, transferred and kept in rearing trays until the yolk sac is absorbed, usually for 5 days, at a temperature of 28-30 °C.

Fry are then transferred to any one of the four sex reversal farms where they are fed diets containing 60ppm methyl testosterone 5 times/day continuously for 21 days. As the fry develop according to

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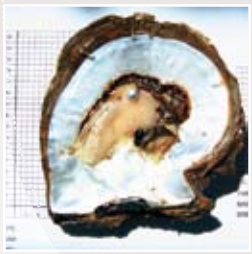

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The market for Nile tilapia is much bigger than that for red tilapia

their genetically predetermined sex, feeding with the hormone ensures that all fish in the population develop into males. After this 21-day period, no further treatment with hormone is needed. The fish are then graded and transferred to a nursery where they are kept in larger hapas and fed powdered feed without methyl testosterone and are ready for sale to farmers.

It is not possible to identify sex by eye in tilapia at such an early age and this makes quality control problematic. Two samples of 300 fish are kept from each sex reversal farm per month and raised in hapas for 6 weeks for gonad squash analysis. This allows the farm to monitor quality and ensure that there is a very low incidence of female fish (about 1 fish in 300) using the above technology.

"It is imperative that Nam Sai supply 100% all male fry. When there are 99% males or less we lose our markets", said Turner. "Although hormonal manipulation of the sex ratio is an efficient method, it faces concerns on the unnecessary use of hormones in food products. An early study at AIT demonstrated that adult sex reversed fish had lower levels of testosterone as compared to natural male fish from a mixed sex population".

"The Nam Sai procedure shows that the hormone does not accumulate in the fish and is naturally broken down. The issue of hormones getting into the environment will depend on the methods used in breeding farms. Nam Say farms use earthen ponds and recirculating systems based on 'green-water' aquaculture techniques using minimal chemicals. We also do not discharge waste water into the environment. Any feed escaping from the hapas is quickly mopped up by the fish, shrimp and zooplankton living outside the hapas and we have been unable to detect methyl testosterone in the bottom sediment", added Turner.

Not a simple business

"There may be the impression that this is a trouble-free business but it is far from the reality", said Turner.

"The business itself requires hi-tech tools in water quality control and being meticulous in feeding, keeping hapas clean, stocking correctly, monitoring and treatment of ectoparasites and good husbandry practices on a very large scale. A recirculating water system in which effluent passes through reservoirs before being re-used has been adopted at all Nam Sai farms. Ground water is not available and water from the river has heavy loads of sediment, unsuitable for a flow-through system. Utilising rain water for most of the year, however, reduces the risk of pathogen transmission via the water supply".

"We contract egg collection to encourage quick and efficient work. It is a laborious job that must be conducted every 5 days and involves robbing eggs from the mouths of female broodstock one by one. Since there are a total of over 300 spawning hapas of 120 m^2 to harvest every 5 days, it is a huge task requiring a large workforce. Good labelling and attention to detail is essential, as we need to ensure that there is no mixing of tilapia strains and that eggs arrive in the hatchery in good condition. Mobile hatcheries with multilple numbers of incubators aid us in this task."

For the tank-based hatchery system, pre-gravel and slow sand filters are used for removing egg shells and bacteria that originates from dead eggs. Tray systems employ simple gravel filters, as bacteria infection is not a problem during sac-fry incubation. Ozone treatment was tried as a back-up, but it too was difficult to control. The farm continues to rely on the use of slow sand filters. Salt added to the water provides a further protection against certain ectoparasites.

Once the yolk sac is absorbed, the swim-up fry are stocked at a rate of 120,000 per 20 m^2 hapa. Sex reversal feed is fed 5 times a day at a rate of 30% body weight per day, reducing to 20% on day 11 when the hapas are changed.

According to Turner, the feed should be very palatable and float, as the young fry feed at the water surface. It is essential that the fish consume this feed regularly to ensure that they get a steady supply of hormone. "The amount of feed given is increased every 5 days and so good management is needed to ensure that fish in the hapas are fed at the correct rate. A survival rate of 55% for red tilapia and 75% for Nile tilapia is considered good during sex reversal and another 20% losses can be expected during nursing and sales".

"The heart of the operation is a database system that monitors output of eggs from the spawners, hatchery survival, egg quality, survival of fry and all aspects of the process. This also enables easy comparison of data concerned with commercial-scale research such as comparing strains, feeds and management techniques".

"Our highest cost component in the hatchery is labour at 40% followed by feed at about 15% of running costs. Aerators help with better growth and we reduce costs by using them at night when oxygen levels are low and when electricity charges are a third of day time rates", added Turner.

Another aspect is matching production to demand. This is largely seasonal, but is affected by weather, availability of water, disease, prices of other protein sources and levels of exports. There are two periods of high demand in Central Thailand, during the early rainy season from May to July and during the onset of the dry season from December to February. Demand is lower from August to October, as farmers do not drain ponds due to the heavy monsoon rains. Unfortunately fry production is also seasonal and opposite to demand. During the early rainy season, when demand is high, it is very hot and egg production is low. The end of the rainy season marks the peak for fry production and this coincides with low demand. During the cold season egg production is fine, but growth of fry is slow and parasites cause high mortality. The only option is to hold excess fry in stock during periods of high production and sell them 2-3 months later when demand is high. Close control of numbers of breeding fish is also another useful strategy.

R&D in brood stock development

"At any farm, a certain level of R&D is required to be able to at least compare performances of the brood stock and to prepare for the following year in the short term and for the future", said Turner.

Despite tilapia being well known for its intrinsic high resistance to pathogens, disease is nevertheless becoming of major concern. Streptococcus is a hot season problem that causes mortality in 2-month old tilapia and for which a solution must be found. The farm is participating in research to isolate Streptococcus in tilapia and testing of trial vaccines using natural Streptococcus or challenge testing by

Nursery cages

injection of laboratory-prepared Streptococcus culture. Use of different tilapia strains and selection of Streptococcus-resistant fish is the long term key to combating this pathogen. Tests have shown the GIFT strain to be the most resistant strain of tilapia and having a wide choice of strains ensures that a farmer has the right fish for any situation.

"Brood stock selection is never going to be a complete solution for treating serious disease. Other measures such as biosecurity and use of chemical theraputants are important. Vaccine, for example, will no doubt be a useful tool in combating Streptococcus, although presently there is no commercial vaccine available for *Streptococcus agalactiae* biotype 1, the strain found in Thailand, Malaysia and Singapore, despite the disease being a problem now for over 10 years. The main problem will be protecting the young tilapia until they are large and old enough to be vaccinated. Such a technique will no doubt be practical and economic for treating Streptotoccus in red tilapia, as farmers stock a 15-40g fish which has a high value and financial losses due to disease outbreak in intensively-farmed tilapia in cages are much higher than those suffered by more extensive pond farmers who traditionally stock a 1 inch fry", said Turner.

Warren Turner (centre in white) explaining to the VIV 2009 media in December 2008.

In general, the tilapia industry has arrived at the stage whereby it has options to use the various strains with their unique characteristics and which are generally disease resistant. Through a rigorous but systematic process, Nam Sai now markets fry and fingerlings of the Chitralada, GIFT, Nam Sai, Big Nin, Thai Red and Taiwanese red strains, plus a number of F1 hybrids selected for their compatibility. The latest hybrid, Nam Sai 2, for example, is a hybrid of the weak, but fast growing Big Nin strain and the slower growing, but very strong GIFT strain.

According to Turner, each of these strains has specific attributes. In trials, less than 4- inch (10 cm) young red tilapia showed a lower survival rate than Nile tilapia. The Taiwanese red strain has better colour and the Thai Red has better body shape. Crossing these two will produce a fish not only with a nice colour and shape, but also good Streptococcus resistance. This is better than many pure Nile strains. The Big Nin is an advanced GIFT tilapia strain with exceptional growth, but suffers higher mortality. The GIFT tilapia is a strong fish and is the most widely cultured strain in Thailand, but growth is slower than the Big Nin and Chitralada, a strain that exhibits very quick growth up to 250g. In general, the market for Nile tilapia is much bigger than that for red tilapia and the most popular strain of all is still the GIFT, but things change quickly and the farm must quickly respond to match production with this ever changing demand.

Future in supplies for cage culture

However, this is not the end of the development road for tilapia, as Turner said, "It is just a moment in time on a never-ending treadmill. Research, selection, improvement in farm design, use of new feedstuffs and techniques, is a continual process requiring dedication. Tilapia culture in Thailand could increase significantly especially if it starts exporting significant volumes of tilapia to supply the ever-increasing global demand for tilapia meat. The hope is that it will follow the successful road of shrimp, but with a lot more sustainability added for good measure".

Tilapia-riding the recession

By Eric Roderick

With a farm gate turnover of USD 5 billion predicted for 2010, the worldwide global recession seems to be having little effect on the tilapia industry's continuing growth and the diversity of products especially value added products are booming.

Tilapia products from Ecuador

Consumption in the USA and particularly the EU continues to increase steadily. In the USA, tilapia has been climbing the fish consumption ladder over the past 10 years and is now at fourth place in terms of value, but represents the second highest volume of sales after salmon, increasing in 2008 to 453,264 tonnes of live weight. This massive US importation of tilapia is a major driving force encouraging further expansion.

Stable prices

Many new farms have begun production, and the increased capacity has meant that prices have been relatively stable again this year. As with all maturing industries, price increases are not expected, even though input costs have increased significantly especially feed and energy costs. This will mean that only the very efficient and well run farms will do well in the current economic climate. There is now a financial incentive to waste nothing in the production chain.

The major factor influencing the industry in 2008 was the massive mortality of tilapia in China and to a lesser extent in Israel, due to the lower than usual winter temperatures. As China is by far the largest producer and exporter of tilapia, this caused some shortages in the market and this did give rise to some localised price increases. Production has now returned to normal, but other markets that tried to capitalise on the Chinese shortages are now finding it difficult to compete.

The most widespread and popular cultured species is the Nile Tilapia (*Oreochromis niloticus*) accounting for 85% of the total production of over 2.6 million tonnes in 2007 valued at over USD 3 billion. This total is expected to rise to over 3 million tonnes by 2010 making tilapia or the aquatic chicken, a truly global product, equally suited to backyard culture and large multinational, agro-industrial production, growing quickly and efficiently on either natural grazing or high protein formulated feeds and is acceptable to both rich and poor consumers.

Ideal 'green' product

With all the publicity regarding fishmeal prices and long term sustainability, tilapia, as a mainly herbivorous fish can grow well on plant based proteins which makes it the ideal 'green' product. It is also the ideal replacement for other freshwater fish species and seafood that can no longer be supplied from overfished and polluted waters. It faces stiff competition from Pangasius catfish from Asia (mainly Vietnam), which is making significant inroads into the fillet markets in Europe, but less so in the more important US markets, where tilapia is a firm favourite.

Diversification is also important and many new projects are incorporating aquaponics in their tilapia farms, enabling the farmers to gain a valuable cash crop of vegetables with minimum inputs. Intensive recirculation systems are also more common, as water use and the ecological footprint of farms become more important. In water-scarce regions of the world, crop irrigation using fish farm water seems to work extremely well. Polyculture with shrimp and other fish species is also making a come back in an effort to maximise yields.

Global production

China is by far the largest producer of the tilapia at 1.07 million tonnes for 2006, with much of it being consumed locally. Chinese tilapia exports for 2006 were 181,831 tonnes. The USA is the main importer of tilapia from China at 104,668 tonnes in 2006, up from 80,853 tonnes in 2005. China is trying to diversify away from a high dependence on the US market and now Russia has also become a significant importer of tilapia from China with 5,500 tonnes in 2006, compared to just 22 tonnes in 2005. Mexico also imports significant quantities of Chinese frozen tilapia fillet. China's exports to Europe are still small, but with significant growth in consumption and awareness of tilapia throughout Europe especially Eastern Europe and more recently Africa, Chinese imports will certainly increase.

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Your key to success

Farm in Cuba

In **Africa**, **Egypt** is the largest producer with production of around 300,000 tonnes for 2007 and accounting for 90% of Africa's total production. There is almost no export, with domestic sales buoyant and prices high. Egypt must upgrade its farming practices and processing capabilities to international standards in order to take advantage of their proximity to European and Middle East markets. The rest of Africa has a lot of wild tilapia, but all of the stocks are declining and aquaculture is still small. The potential is huge, domestic prices are high, demand is there, but investors are wary.

Lake Harvest is currently the only large producer and exporter, but being based in **Zimbabwe**, it has experienced considerable difficulties recently and has also set up in **Uganda**, mainly due to the decline of the wild fishery in Lake Victoria and there are many smaller projects looking to expand throughout East Africa especially **Zambia**, whose economy is recovering due to a recovery in copper prices. There is a lot of expertise in **South Africa**, but government opposition to importing improved varieties of the Nile tilapia is hampering the industry's expansion. Almost all the African countries are looking to expand their aquaculture industries, with a range of projects ongoing throughout the region. The potential production is huge, with all the benefits of food security, as well as increased GDP through some exporting.

In Asia, the **Philippines** and **Thailand** produce over 150,000 tonnes each, mostly consumed locally. However, there is a growing export market for sashimi grade fillets to Japan at premium prices. All the major producers are now looking at the export markets and are improving quality and food safety. Tilapia farming is very diverse in Asia, with huge numbers of small backyard ponds, massive extensive operations, semi intensive farms, and some very intensive high tech systems. **Indonesia** is the third largest producer at around 200,000 tonnes mostly cage-based in the large freshwater lakes of Central Java and Sumatra. Regal Springs is the largest producer.

Malaysia, with major government backing aims to increase tilapia production from 25,000 tonnes in 1999 to 500,000 tonnes by 2010. In February 2009, a new USD 10 million integrated farm with production potential of 20,000 tonnes began production at Lake Temenggor in Perak State. This is partly government and partly private venture, under the supervision of Genomar the Norwegian aquaculture company. The first fish are due to be processed in mid August and exported to the USA. There are many other tilapia projects underway in Malaysia.

Vietnam, **India**, **Sri Lanka** and **Bangladesh** are fast expanding their tilapia industries. Farms should make a significant contribution to global production shortly with very low production costs and a wealth of aquaculture expertise on carp. **Vietnam** has focussed its attention on Pangasius, which competes directly in the marketplace with tilapia, but there are several big tilapia projects underway now. Grobest Group, is expanding its tilapia operations dramatically along the Mekong, and is aiming for 45,000 tonnes per annum. It owns hatcheries, feed mills, farms and processing plants. **Bangladesh** has seen a huge increase in production to 67,000 tonnes in 2007 from the estimated 446 medium to large farms, with carps and catfish being replaced by tilapia. Bangladesh is using the GIFT strain along with Fishgen's YY technology through a partnership with Bangla-Fishgen which recently scored an award at the National Fish Fair 2009. **India** has some restrictions on

Tilapia produced in Ecuador

Farm in Costa Rica

Tanks in Veracruz, Mexico

importing new species, so the current production is mostly using inferior stocks, many illegally imported. The government is now looking again at relaxing the importation restrictions. MPEDA are carrying out small scale trials using the GIFT strains and Fishgen's YY male technology.

In the **Americas** one of the largest farms exporting fresh fillets to the USA is **Costa Rica's** Aquacorporation International (ACI), through its market-leading brand Rainforest Tilapia. With the recent buy out of ACI by **AquaChile**, total group production of tilapia was 22,000 tonnes for 2008, highlighting the importance being placed on tilapia even by such staunch salmon conglomerates as AquaChile. Costa Rica experienced major mortalities of tilapia in 2006 with exports cut by almost 50%, but everything seems to be back on track now and expanding as demand for fresh fillets in the USA grows.

Most South and Central American countries are mainly exporting to the US, which has led to an overall decline in prices and encouraging most countries to expand their domestic markets. **Honduras** has increased production, with a combined production of 60,000 tonnes produced by the Regal Springs group from its farms in Honduras, Indonesia and Mexico. Aquacorporacion Honduras, the second largest farm in Honduras produces around 4,000 tonnes. **Peru**, a newcomer to tilapia farming, is selling its harvest from Aquaperu, its first large-scale farm, based at Poechos on Peru's border with Ecuador. The fillets are sold in the USA under the Mountain Stream brand.

In **Ecuador**, with the decimation of the marine shrimp industry by the white spot virus some years ago, many of the larger corporations turned to tilapia to stock their redundant shrimp ponds. They found that polyculture of shrimp and tilapia greatly enhanced shrimp production, reducing the effects of white spot. Tropical Aquaculture Products Inc, is selling tilapia produced in Ecuador throughout the USA, but has recently started exporting to Europe and is diversifying into value- added products, which will include marinated, shaped /formed pieces, breaded fillets, and precooked portions. This is definitely yielding a better profit margin.

Most South and Central American countries are expanding tilapia production, with **Brazil** and **Mexico** producing in excess of 100,000 tonnes, but mostly for their domestic markets. There is a similar picture in **Columbia**, and **Cuba** where tilapia is a very popular local food. **Guyana** has recently embarked on a major government backed expansion of tilapia, through the National Aquaculture Association which has formed a cooperative of farmers, processors, and distributors all working together under the Ministry of Agriculture's guidance.

In 2009, The UK government lent its support to a government backed tilapia project to alleviate poverty and provide food security to some of Guyana's poorest regions, using Fishgen's YY male technology. Initial results are very promising. Nearly all the **Caribbean Islands** are looking at tilapia farming now, not only as a means to earn foreign exchange, but to service the hotel industry, as tourism expands dramatically in the region. Trinidad has several very ambitious projects planned. Jamaica has been exporting to the EU for many years, but is finding it a lot more competitive recently.

European tilapia production is relatively low, due mainly to the warm water requirements for rearing tilapia (optimum temperature 28°C), so all the production has to be temperature controlled, indoors, or utilise a waste hot water industrial source. **Belgium's** VitaFish, the largest recirculation farm in Europe can produce 4,000 tonnes a year. It also has a processing plant and was a total investment of USD 20 million.

In July, Fish Farming International published interviews with the three largest global tilapia production companies: Regal Springs (60,000 tonnes in 2008, 71,000 predicted in 2009), AquaChile (22,000 tonnes in 2008 with farms in Chile, Costa Rica, USA and Panama) and Tropical Aquaculture Products Inc (10,200 tonnes for 2008 with farms in Ecuador Costa Rica, Columbia and Brazil) and they were all increasingly targeting European markets where prices are higher.

There is also production in **Holland**, **Switzerland**, **Spain**, **Germany**, **France** and the **UK**. Tilapia is available in many European restaurants and also in all UK supermarkets, mostly imported from Jamaica, Indonesia, Zimbabwe and Ecuador. Several producers are now introducing value added tilapia products such as crunchy breaded and beer-battered fillets. This will increase tilapia's appeal amongst the consumers in Europe seeking easier menus.

The **Middle East** is also expanding its industry and with strong domestic demand and high prices there is great potential here. There are a few farms in **Jordan**, **Saudi Arabia**, **Kuwait** and **Lebanon**. Some of these farms are using saline ground water, which require salt tolerant strains and species of tilapia, particularly *Oreochromis spiluris*, and due to the lack of water, many of the freshwater farms are reusing the water in aquaponics or some form of crop irrigation. With the Middle East and Dubai in particular experiencing a tourist boom, fresh fish for all the new hotels must be sourced somewhere, so the market is there waiting for increased production.

The Tilapia industry is therefore better placed than most related industries to ride out the current global recession and the overall outlook is promising.

Eric Roderick is CEO of Fishgen Ltd, and is a Global consultant with 25 years experience in the tilapia industry, having been involved in projects in over 30 countries. Email: eeroderick@aol.com

Cost effective pangasius culture in Lampung

By Fauzan Bahri, Mohammad Nadjib, Mika Prasetia and Olivier Decamp

Field information documents the cost-benefits of effective health measures during larviculture and grow-out of Pangasius, a species often described as a low price fish.

The situation in the farming of the pangasius in Indonesia is very different from that in Vietnam, the world's largest producer of pangasius catfish. Three species of pangasius are reared in Indonesia, *Pangasius hypophthalmus*, *P. sutchi*, and *P. jambal*. Up to 3,000 small hatcheries and 12,000 small farms, which are located in West and East Java, Lampung, Jambi, Riau, Palembang and south Kalimantan, produce fish for local consumption. In 2008, 4 billion 2-inch (5 cm) fry were produced, valued at USD 33.5 million. Production is expected to reach 6 billion fry in 2009. Pangasius, harvested at 500g sells for 1 USD. This represented USD 215 million in 2008, and is expected to reach USD 300 million in 2009.

Fish are consumed locally and this gives a 'local aspect' to the pangasius industry in Indonesia. However, the many problems faced by the farmers are similar to those faced by farmers targeting the export market: feed cost, disease and damage to the environment. In this article, we review some of these problems and look at some cost-effective solutions adopted by hatcheries and farmers from Lampung.

Outdoor ponds with natural food.

Larviculture

The first week of larval rearing represents the most critical period. Typically the hatchery cycle include 2 phases, first in tanks and then in ponds. The presence of natural food in fertilized outdoor ponds gives better results.

Unfortunately, rearing larvae in outdoor ponds makes temperature control and biosecurity measures quite impossible. Most farms use a flow-through system with incoming water pumped in directly from canals. This results in mortality due to temperature inducing stress or promoting the growth of protozoan parasites. There is also the presence of agriculture chemicals leaching from farm fields into incoming canals, presence of pathogens such as *Edwardsiella ictaluri*, responsible for white spot disease or Bacillus Necrosis Pangasius and *Aeromonas hydrophila*, *A. sobria* and *A. caviae* responsible for Motile Aeromonas Septicaemia.

A first solution adopted by hatcheries such as Mixa Fish Farm, was to switch from a two phase to a three phase production cycle. The first phase relies on small indoor tanks, for the first week, followed by a second phase in small outdoor tanks. These outdoor tanks allow better biosecurity measures with disinfection and limited water exchange and better water quality management than big outdoor tanks. The third phase (in the classic system 'the second phase') relies on large outdoor tanks with flow through water.

The applications of Sanocare PUR 0.3 ppm and Sanolife PRO-W 0.5ppm prevented any disease outbreak whilst the application of Sanoguard TOP range product improved the health status of the larvae. This seems a valid alternative to the prophylactic application of antibiotic such as oxytetracycline (5 to 20 mg/l) that was reported to give good results in the first week post hatching. The larval cycle is closed after 30-40 days, when 2-inch long fry can be sold for ongrowing.

Grow-out

Pangasius are omnivorous and ingest detritus and sediments to obtain nutrition from particulate organic matter, microbial biomass and benthic invertebrates Food conversions generally range within 1.5–2.0.The rapid growth of the pangasius aquaculture industry has raised a number of environmental concerns:

- Pangasius aquaculture can have a negative effect on water quality, particularly when the farming leads to excess effluents and nutrients in pond sediments;

Dead fry as a result of stress due to temperature, presence of chemicals or pathogens

The pangasius can utilize a modified swim bladder to absorb oxygen directly from the atmosphere. This greatly reduces or eliminates the need for pond aeration

Pangasius can be produced efficiently using either homemade feed or compound diet with reduced protein (28-32%) and lipid sources

- Pangasius farms are prone to health problems that can impact farmed and wild stocks.

Therefore, managing the health of farmed pangasius stocks depends on the overall management of the farm, including the reasonable and responsible use of veterinary medicines and chemicals. The current disease control strategies are a combination of improved husbandry skills and application of a wide range of antibiotics. Reports of a very rapid development of antibiotic resistance by both bacterial species to a wide range of antibiotics indicate the urgent need to improve the current disease control strategies adopted within the industry.

The solution is provided by this example from Lampung area, where farmers used two products in the pond preparation phase:

- Sanolife Nutrilake at 30kg/ha, to improve the oxidation of waste product and stimulate the growth of favourable algae
- Sanocare PUR at 0.5ppm (to treat water prior to stocking.

The ponds (700 m^2 with 1.5 m depth) were stocked at 15 animals (2 inch size) per m^2. During the production cycle, Sanolife PRO-W (a mixture of Bacillus strains selected for their ability to degrade waste products) were applied at the recommended dose of 200g/ha on a weekly basis. A mixture of immunostimulants and nutraceuticals (Sanogard TOP range of product) was applied at 1-2g/kg feed during critical stages. After 5 months of culture, 500g size fish were harvested. With a survival of 70%, each pond produced 5,500 kg. This gives an income of USD 5,450 USD per pond per crop. There would be 2 crops per year.




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From left to right, Fauzan Bahri, Mohammad Nadjib, Mika Prasetia and Olivier Decamp

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Vietfish 2009

Resilience to pessimism in the global economy

The attraction of the annual Vietfish International Exhibitions, organised by the Vietnam Association of Seafood Exporters and Producers (VASEP), is the expectation that there will be something new at the show and the marketing strategies of its seafood producers. At Vietfish 2009, alongside displays of pangasius catfish and marine shrimp, it had more value added products, sea bass fillets and products from locally cultured sturgeon.

This year, there was also a larger participation from aquaculture suppliers, visibly to provide an outlet for the aquaculture industry. Supporting the show were seminars by the Norwegian group, comprising Akva, Pharmaq and Ewos on culture technologies, health management in the catfish industry and feed management. Bayer Vietnam discussed shrimp health management. As processing companies embark into farming to control raw material supply, such information was sought-after. Yearly, VASEP pulls together the industry and this year saw 85 seafood exhibitors, representing 60% of the Vietnam's seafood production. The exhibition was held at the new and larger Saigon Exhibition & Convention Centre (SECC) in Ho Chi Minh City from 12-14 June.

VASEP has 160 members representing 80% of the total value of exports. Most members have processing and production facilities whilst others are only involved in the trading of seafood. As a marketing organisation, VASEP has made considerable headway into opening markets for producers in Vietnam. Marketing within the country with limited cold storage and infrastructure versus for exports remains a challenge. However, with supermarket chains emerging and higher disposable incomes, domestic producers are looking at value adding for the local market. Vietnam itself, is now seen as a market or centre for seafood processing evidenced by the presence of country pavilions from within Asia (such as from Bangladesh, Malaysia and Korea).

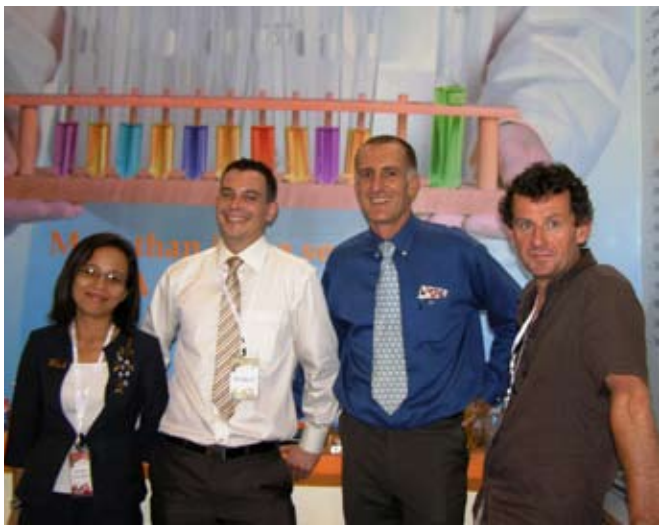
Regardless of the gloom in the economy and perceived declines in demand, there has been some good news for Vietnamese pangasius fillet and frozen shrimp exporters during the early part of 2009. Exports to the US are still subjected to antidumping duties (AD), imposed in 2003 and 2005 respectively. However, the recent reduction to a zero tax rate for pangasius fillet exports is welcomed by some such as Binh An Seafood Joint Stock Company (Bianfishco) even though the US market comprises only 7% of the total volume of exports. A concern now is how the USDA catfish regulations which may subject tra and basa to the same inspection programs as for local catfish, will affect Vietnam's exports.

At Vietfish 2009, Nguyen Thi Minh Huong from Behn Meyer Vietnam (centre) with colleagues and Nguyen Quang Hien, General Director, Viet Thang (second from right).

In 2008, the EU imported 25.4% of seafood valued at USD 1.1 billion in 2008. The markets in 21 EU countries will continue to be a focus for pangasius exports especially since 30 more plants have applied for the for the EU code (approved in August) bringing the total to 330 plants allowed to export to the EU.

Glory days for the pangasius

In 2008, catfish production reached 1,200,000 tonnes and exports totalled USD 1.4 billion. The processors were clamouring for more production to meet demand from new markets such as Russia and Ukraine. The ban on exports to Russia initiated in December 2008 was lifted in April 2009. The Russian market imported 10,000 tonnes up to June 2009 at USD 3.1/kg for tra and basa fillet and year end projection is 70,000 tonnes. The good news is that this market consumed oversized fish which farmers keep in ponds in anticipation of higher prices. For the first five months in 2009, exports totalled USD 477 million which is only 35% of the value expected for 2009. A brighter outlook for exports was also announced by VASEP which said that demand from Romania, Bulgaria, Estonia and Lithuania increased four times and Chile, Peru,



One of the several aquaculture companies at the show, Lareal Vietnam, a member of the French laboratory group provides feed, food and drug analysis at its new Binh Duong Laboratory. Pictured here are from left Tran Ngoc Hoa, Operation Manager and Mathieu Guillaume, Commercial Manager, Lareal Vietnam with Marc Campet, Ocialis Vietnam and Dominique Guillot, Journalist.

Argentina and Mexico are also increasing imports. The order volumes from some African countries have increased ten times. A temporary stoppage of exports to Egypt, a new market, was caused by adverse internet reports on hygiene during parts of the farming and processing of the fish. These were quickly resolved and exports resumed.

The leading exporters for the January to April 2009 period were Vinh Hoan Corp followed by Hung Vuong Corp. Quality was the by-word at the show as and on quality in catfish production continued into 2009. Bianfishco, fourth largest exporter, qualifies its slogan " Yes We Can- We do Quality' by using GAP at its 40ha farm area and only contracts with selected family farming operations. Together with Camimex, it will apply a traceability system using RFID for three months under a project by the Ministry of Science and Technology and IBM. When successful, this will hasten the adoption of RFID solutions for the country's seafood industry.

Quality does comes at the price but farmers do not see this as they face low ex-farm prices and declining profit margins. Due to low prices, unpaid debts and limited credit, farmers stopped farming and the shortage led to the cyclic but marginal increase in prices. In June, production was 233,000 tonnes from 1,009ha. (Vietfish News, June 2009). More consolidation is evident as processing plants expand farming areas to supply raw material, reducing their dependence on small farmers and are able to guarantee the 'free from antibiotic' aspect of products.

Marine shrimp

In 2008, the marine shrimp was overshadowed by that of the pangasius catfish. Shrimp exports have been on the decline since 2008 and for January to April 2009, volumes were 38,852 tonnes valued at USD 329

Is sustainability in production an issue?

Xavier Bocquillet

"Yes, there are some buyers from Europe who specify food safety and sustainability when purchasing in Vietnam and are willing to pay higher prices for quality. Of course, on the opposite side, there are those that ask for cheap products but also insist on certification and traceability and emphasise less on the production impact on the environment", said Xavier Bocquillet, Manager at the QualiService booth.

"In the case of the former, the terms of what constitutes 'a sustainable production' may be vague for some buyers but the crux of the matter is that these buyers need to meet the demands of consumers. We must remember that buyers purchase on behalf of retailers who in turn have to be very careful. If they do not adhere to sustainability norms, it may mean that the retailers are delisted by environmentalist groups such as Greenpeace etc. However, on the producer side, there will be added costs. Whether the producer is a large enterprise or a small family business, they are already facing low profit margins and will think twice before incurring extra costs for this requirement".

"Buyers have their own criteria and sometimes do not bother whether the products are certified following local or international certification bodies. Quality is of utmost importance. Their criteria are usually not far off from existing standards. These are still different as they have been adapted to the demands of the clients. Some of these include demands on some aspects such as environment and social issues", added Bocquillet. "In my opinion, products without certification but with good quality and low impact on environment will represent an important niche market ."

Qualiservice, which was set up in 2002, provides consultancy and pre-certification services for sustainable development of the food industry on South East Asia. It sees itself as the link between the buyer and supplier. Bocquillet said that buyers approach the company when seeking suppliers of quality products. He will then work with the supplier on changes required to comply with the criteria set by the buyer. "Sometimes, this becomes a chicken and egg situation as buyers do not wish to pay more for quality and for the supplier, the benefits may not be tangible immediately. It is difficult to show that in the future, compliance with quality requirements will allow access to certain markets."

"Usually the small producers are interested in learning on how to improve production following standards but they are often unable to pay for such services. Quality fish should come with premium prices between 5 and 30%, depending on quality", said Bocquillet.

"There is now a lot of attention on traceability in aquaculture production. However, very often the attention is limited to the processing steps. The origin of brood stocks and history of the grow-out production are often very weakly documented. However, traceability in the field cannot be neglected. Qualiservice can work with groups of buyers or associations in this area. Under the Asia Invest program, on changing quality attitude in the food industry, we conducted seminars for 100 farmers on such topics."

In the catfish grow-out industry where integrated companies are more and more important, individual farmers are slowly sidelined. Bocquillet said that ideally the company would like to introduce internal control systems (ICS) to groups of farmers to facilitate certification and compete with larger company. Such system allows the group of producers to control themselves if the group respect all criteria of a specific standard. A certification body will audit controllers of the group and assess if they are able to detect non-conforming groups.

This group effort will reduce the costs of certification, reduce risks by the individual farmers and there is self regulation within the group. Moreover the project can easily be extended to numerous producers. In Africa, coffee producers are grouped into an ICS of more than 10,000 smallholders. In Vietnam six ICS have already been implemented by Qualiservice.

million, down 4.8% as compared to the same period in 2008. The highest growth was to markets in China at 84.4%. (Vietfish News, June 2009)

The largest marine shrimp producer and processor, Minh Phu Seafood Corp displayed both black tiger and vannamei shrimp at its booth. In the first four months of 2009, the company exported 2,967 tonnes of shrimp valued at USD31.77 million (Vietfish News, June 2009). Production is integrated with a hatchery at Ninh Thuan and two farms in Kien Giang and Camau using intensive and extensive culture methods and three processing plants (www.minhphu.com). A new processing plant for 20,000 tonnes and operational in 2011 is being constructed in the Mekong Delta. Camimex has second place with USD 16 million of exports and Quoc Viet, a company established in 1996 has the largest area for black tiger shrimp farming.

Russian sturgeon in Vietnam

The Vietnam Sturgeon Company is the pioneer in the culture of the Siberian sturgeon *Acipenser baeri* as well as *Acipenser gueldenstaedtii* in Vietnam for meat and caviar production. The project was started in 2007. The company uses specialists from Russia to manage roe production and breeding technology as well as in the roe selection process. These are currently produced in three farms in Vietnam located at Lam Dong, Yen Bai and Binh Thuan Provinces. The variety of products include fresh whole, fillet and sliced meat which has only 11% fat. It also markets cold and hot smoked sturgeon in several forms. The sturgeon roe or black caviar production was started in 2007. The sturgeon is included under the Convention on the International Trade of Endangered Species (CITIES) which forbids the import of wild sturgeon roe. This has pushed for the farming of the sturgeon in several countries (US, Canada, Russia and Iran). This company is the only one which has successfully bred fish from the roe. (www.catam.vn)

The initial work on the breeding and farming of the fish started in 2005 with a pilot project in Hai Duong and Lao Cai provinces. In 2006, other companies started projects in Lam Dong. In 2007, Ha Quang Company successfully hatched eggs and farmed the fish in Tuyen Lake in Dalat. In March 2009, another project was launched by the Institute of Aquaculture Research 1 (RIA 1) to breed salmon and sturgeon in Dai Tu district. It is also collaborating with Ha Quang and Vinashin Vung Tau JS Company to farm the Siberian, Chinese and Sterlet sturgeon in Na Hang, Tuyen Quang province and in Sapa in Lai Cai province. In Vietnam, the fish reaches 2.7 kg in 18 months as compared to 4 years in Europe. In 2008, prices for the meat were USD 12.50/kg and eggs were USD 1,500 to 5,000/kg.

Successful seminar on FDA regulations

US FDA Regulations

Pending the new regulations for food imports likely to occur under the Obama Administration, David Lennarz, Vice President of Registrar Corp, USA presented information on the impact of these at a seminar for Vietnamese processors and exporters. He also discussed some of the more important US Food and Drug Administration regulations currently in force, including the Bioterrorism Act registration, Prior Notice, and food labelling.

In his overview of the US agencies involved in the inspection, importation and sale of seafood in the US, he said that the FDA is the Federal Agency that regulates food and beverages on a national level. FDA is responsible for enforcing food safety regulations, and is the principal government body responsible for inspecting food being offered for import into the U.S. All seafood produced for export to the U.S. must be done so under HACCP plans. More information on HACCP is available at www.cfsan.fda.gov/~comm/haccpsea.html.

Changes

In the future, he said that importers should expect some changes on how food and drugs are regulated in the US. The FDA is concerned that food imported is safe and the US public may have the perception that the FDA is not doing its job with the several cases of unhygienic and contaminated food entering the country. As such, the recent moves have been on straightening current FDA regulations by increasing FDA's funding. Most of the proposed legislation currently being debated in the US Congress will require FDA to be more proactive, rather than reactive.

Under a recently established food protection plan, branch offices of FDA have been set up in China and India for rapid intervention and better communication. Since November 2008, there are branches in three regions in China, to work together with the government and regulate legislation. The modernisation of the FDA act will most likely come into force in late 2009 or early 2010 and may require an annual registration of the factory and HACCP for all factories. The FDA user fee to be imposed may range from USD500 to USD1,000 annually.

Detentions and Labelling

The FDA has long detained products due to incorrect labelling. Lennarz said that the country of origin labelling such as "Product of Vietnam" and "Made in Vietnam" is increasingly important among consumers. Since January 1, 2006, trans-fat composition must be written and since January 1, 2004 consumer allergens in the 8 major groups must be written.

For assistance with FDA compliance, including registrations, prior notice filings, FCE/SID registrations, and labelling, manufacturers and exporters may contact Registrar Corp in the U.S., or one of their many international offices. Web: www.registrarcorp.com.

Vietfish 2009

Marketing Malaysian aquatic products

The aim of the business group at the Malaysian Pavilion during Vietfish 2009 was to seek markets in Vietnam and to gain a foothold in the international seafood scene. The Department of Fisheries and Fisheries Development Authority gathered 10 companies under their seafood entrepreneurial scheme.

The Malaysian team at Vietfish 2009

Hasamudin Ami

Among them was One New Tech which produces smoked catfish using a smoke house technology from Germany. Temanse Aquaculture Sdn Bhd farms the Pangasius catfish and markets these as sustainable cultured chemical free fish (see box). BioHaruan Tech Resources was marketing fish soup made from the snakehead fish. Les Moules Sdn Bhd is a pioneer in the production of depurated mussels. Value added products include half shell mussel with various dressing, mussel nuggets, fillet and snacks. Keropok House and Association of Fishermen, Tanjong Dawai markets fish crackers. Taharah Global (M) Sdn Bhd farms the seaweed *Euchema cottoni* and Izans Trading Sdn Bhd produces seaweed based products for the health and cosmetics industries.

Hasamudin Ami, Ambang Wibawa Sdn Bhd said that the processing company located in Perak in central West Malaysia farms and processes red and black tilapia as the main product range. Other products are IQF bulk packing of Asian sea bass, milkfish, pangasius catfish and marine shrimp. The tilapia is mostly gutted with skin on or skinless for the Middle East markets. Sizes are 300-500gm to 500-700gm fish. The company started by purchasing wild tilapia from lake fishermen for raw material. A year ago, it ventured into farming the tilapia and currently has a total of 600 acres of farms in several locations. One farm is a joint venture with the Perak State government. The aim is to market products to the EU after August when it gets the approval to do so.

'High end' catfish from Malaysia

In Terengganu, Temanse Aquaculture is farming the catfish *Pangasius sutchi* in floating cages in the pristine Como River which is part of Kenyir Lake, the largest man-made lake in South East Asia, covering 28,000 hectares and more than 300 islands. The water that feeds Lake Kenyir comes from the National Forest Reserve and surrounding forest catchment areas.

The project was started in 2007. Fish are fed 100% on pellet feed, specially produced for the company containing plant meals and fish meal; there are no animal by-product meals. This strategy was based on the special requirement from buyers in Europe that no animal meals should be used. The guarantee by the company is that fish is chemical free and it only processes fish farmed by the company.

"As such, we decided on the name 'basa' as a high-end pangasius catfish farmed in Malaysia but fits the demands of markets and palates of Europe', said Nurul Aini Mohd Tajuddin, COO and Director.

"Our catfish is currently processed into different products at a processing facility in Seberang Takir, Terengganu, leased from the Department of Fisheries Malaysia. We use only raw material farmed in Como River, to produce value added products under the Como Asli range. These are basa steaks marinated with various sauces, basa chunks in local as well as western sauces, dry-salted basa and salted basa preserved in oil. We also market live basa. Our markets are local hypermarkets at present but when we complete the HACCP certification, we can begin to export to Singapore and Brunei." With an EU code from the Ministry of Health Malaysia, expected by end of 2010, Temanse will be able to export to European markets.

Temanse Aquaculture cages in Como

The company is awaiting approval from the state government on its application for a 15ha site to enable the company to build its own purpose built processing facility. The site is situated about 15 minutes drive from Como River, thus ensuring the freshness of harvested fish being used for processing either for fillets or value added products.

Fish are cultured in cages for 7-8 months for harvest sizes of 1kg in weight. There are more than 200 cages of 4.8 m^2 cages and 1.2 to 4m deep, with production capacity of 3 to 4 tonnes of fish per day. Fingerlings are brought from hatcheries in Perak and Pahang but soon Temanse will set up its own hatchery to control the quality of seed stock. The company's on growing capacity will then be substantially increased once the hatchery facility becomes fully operational in the third quarter of 2010.

The company is very bullish about the project as consumers around the world, including Malaysia are becoming more aware of health and environmental issues in food production. Its challenge is to reduce the production cost and produce more affordable products free from chemicals and antibiotics.

Sustainable Aquaculture and Quality Seafood for All

Welcome to Malaysia for the Asian Pacific Aquaculture 2009

In November, global aquaculturists in the Asia Pacific region as well as from other parts of the world will meet in Kuala Lumpur, Malaysia for this event. The conference will start on 4 November for three days. The opening ceremony will be held on Tuesday 3 November followed by three days of trade show. A selection of farm tours has been planned for Saturday 7 November.

For more information on how to participate in this conference and trade show, contact:

Asian-Pacific Aquaculture 2009, Conference Manager,
P.O. Box 2302, Valley Center, CA 92082 USA
Tel: +1-760-751-5005; Fax: +1-760-751-5003

Stay in touch with the program developments for ASIAN-PACIFIC AQUACULTURE 2009 through Web Page at http://www.was.org

The plenary speakers

Dato' Junaidi Bin Che Ayub

Dato' Junaidi Bin Che Ayub, Director General, Department of Fisheries Malaysia will talk on "Trends and prospects in Malaysian aquaculture". The development of fish and shrimp aquaculture in Malaysia is for food security and export. Both private and public enterprises, including small farmers, are actively engaged in projects aimed at increasing production. In this presentation, Dato' Junaidi will emphasize on the recent focus of the government on high impact projects in aquaculture industrial zones. In line with competitive global trends, the approach in Malaysia is on sustainability, food safety and protection of the environment through a comprehensive and well-planned programme supported by research and development as well as the use of appropriate biotechnology.

Sena S. De Silva

Sena S. De Silva is the Director General of the Network of Aquaculture Centres in Asia-Pacific (NACA) based in Bangkok, Thailand. In his presentation on the "Aquaculture in Asia: Successes, Challenges and Way Forward", Dr De Silva will look at the success in aquaculture in Asia, measured in terms of production, provision of livelihood opportunities, contribution to food security, poverty alleviation and social harmony. Some examples include the explosive growth of the striped catfish farming sector in the Mekong Delta in Vietnam. The common denominator in respect of all these developments is sustainability and prudent use of primary resources and maintenance of environmental integrity, as best as any farming could possibly achieve.

John Sackton, Publisher of Seafood.com News will discuss 'Raising the positive profile of aquaculture in major market'. While aquaculture continues its impressive growth in Asia, a major campaign to persuade consumers to have a negative view of aquaculture products has been underway in the West. As a result, many seafood consumers express preferences for wild caught seafood, and negative opinions of Aquaculture. To continue to maximize the value of aquaculture products, Asian producers need to understand the anti-aquaculture campaigns and the positive steps they can take to promote a more favourable understanding of aquaculture among Western consumers.

John Sackton

AT THE TRADE SHOW

With two more months to go, as at press time 83% of the 66 booth trade show has been confirmed. Below some companies detailed their participation at the show.

Trade Show Schedule

November 2009

Monday	Tuesday	Wednesday	Thursday	Friday
2	**3**	**4**	**5**	**6**
Move-in 14:00-21:00	Move-in 8:00-15:00 Trade Show will open at 16:00-17:00	Exhibits Open 10:30-19:00 Refreshments 17:40-19.00 Conference Dinner 20:00-23:00	Exhibits Open 10:30-17:30	Exhibits Open 10:00-15:00 Move-Out 15:00-20:00 Asian Pacific Chapter Closing Reception 17:40-19:30

Nov 3 16:00 – Ribbon Cutting and Trade Show Opening by Minister
16:00-17:00 – The Trade Show will be open for visit by Minister

Move-Out Friday, November 6, 15:00-20:00

Shrimp viral detection

Malaysian based Lab-Ind Resource Sdn Bhd (LIR Biotech) provides technical expertise, training and turn-key consultancies in disease and food safety (chemical, residue and microbiology) detection platforms to the aquaculture industry. It actively works with government agencies and private stake-holders to address disease and food safety issues. The regional clients are in Malaysia, Indonesia, Brunei, Thailand and Bangladesh.

The company operates a PCR viral disease screening laboratory that actively serves Malaysian aquaculture clients. Tests provided include WSSV, TSV, YHV/GAV, IHHNV, MBV, HPV, IMNV, PvNv and MrNv. The laboratory is in the process of ISO 17025 accreditation. In the area of food safety, LIR Biotech works with clients to validate screening platforms based on EC/657/2002 Directives especially the use of ELISA for residue detection as a complementary tool to analytical confirmatory method. It is also currently working in a long term project with the Bangladesh authorities and private stake-holders.

At the trade show, The company will show case an innovative, cost effective, specific and sensitive iso-thermal amplification detection platform for shrimp viral detection. The system can be applied at site and does not require complicated or expensive equipment like thermal cycler. The platform can be expanded to accommodate detection of a wide range of pathogens.

Booth 48
Lab-Ind Resource Sdn Bhd (LIR Biotech), 7A Jalan Kemboja1B/2, Bukit Beruntung 48300,Selangor Darul Ehsan, Malaysia
Web: www.mylabind.com
Contact person: Dennis Teoh, Business Development Manager;
Email: info@mylabind.com

Education and research

The goal of AKUATROP, University Malaysia Terengganu, is to improve the development of the aquaculture industry in Malaysia through R&D. It also has a role to assist the government and the aquaculture industry to boost their production and play an important role in human resource development and R&D-C (Research, Development and Commercialization) in aquaculture.

At the trade show, members of the institute will discuss with visitors their training and research plans such as the visiting fellows and post doctoral program in several fields of research. There are also opportunities for students interested in post graduate degrees in aquaculture. The institute also organises courses and workshop to provide hands-on training to entrepreneurs, farmers, officers and interested individuals. It also provides consultancy and diagnostic services to farmers particularly diagnostic of diseases, determination of feed quality, water and soil quality services.

Booths: 24-26
Institute of Tropical Aquaculture AKUATROP,
Universiti Malaysia Terengganu, Mengabang Telipot,
21030 Kuala Terengganu, Terengganu, Malaysia
Website : www.umt.edu.my/akuatrop email: akuatrop@umt.edu.my
Contact person: Dr Faizah Shahrom, Email: faizah@umt.edu.my

An organic approach to aquaculture

Behn Meyer Aquaculture is promoting an organic approach to aquaculture. Most products are OMRI certified and are allowed for use in organic aquaculture. The portfolio stretches from organic minerals, probiotics and prebiotics to liquid enzymes and a new line of phytobiotics. Behn Meyer Aquaculture is active across Southeast Asia and is currently building a new R&D complex for fresh water fish in Vietnam. "We have done a lot of research with the tilapia and shrimp in Thailand, Indonesia and Vietnam, so the conference will be an ideal occasion to introduce our solutions in Malaysia. At the same time we want to learn about marine fish farming here." says Dirk Lorenz-Meyer, Regional Technical Advisor of Behn Meyer Aquaculture.

Malaysia has a clear vision to step up its aquaculture production and we believe that our organic additives can help the industry to focus on high value products. Consumer safety and environmental protection are key requirements for today's aquaculture output, and organic solutions are playing a growing role in sustainable farming.

Key products during the show will be Hemicell WL® and Digestarom®. Hemicell WL is a novel liquid enzyme for fish feeds that contains fiber degrading activities, as well as specific activities to hydrolyze feed-born antigens. Digestarom is a liquid phytobiotic that consists of essential oils and plant extracts. Both have been shown to stimulate feed intake, increase weight gain and most importantly improve FCR. Behn Meyer Aquaculture will also present new findings with combinations of its prebiotic brands Azomite, Penergetic and Fermacto. Trials in Europe show much better feed conversion and improved immunity in Pangasius. "We are now looking for partners in Malaysia to extend these experiments to tilapia in order to validate the synergies between the different prebiotic concepts involved."

Booth 64
Behn Meyer Aquaculture
No. 5, Jalan TP2, Taman Perindustrian Sime UEP, 47600 Subang Jaya, Selangor, Malaysia
Web : www.behnmeyer.com
Contact person: Dr. Dirk Lorenz-Meyer, Email: dirk@behnmeyer-vietnam.com; Tel: +60 13 395 5003

RAS, cage systems and accessories

Malaysian based Recirculating Aquaculture System Sdn Bhd together with Rotomas Technology will be at booth No 28 to exhibit the following new products:

- The newly launched "AquaFish" floats (patent pending) for floating cages, walkways, pontoons, floating workshop, houses etc. These are for minimum cage sizes of 3.5m x 3.5m.
- Windmill for pumping ground water. This is an effective source of energy when there is constant wind. Vanes are from 2.4m to 9m and from 4.5m to 60m depth. The pumping capacity is 4 tonnes to 149 tonnes of water.
- Solar panel as an alternative energy source for air blower, pumps and lighting.

Booth 28
Rotomas Marketing, Lot 5295, 5296 Batu 19, Jalan Semenyih, Semenyih 43500, Selangor, Malaysia
Web: www.recirculatingaquaculturesystem.com
Contact person: Bluey Chew; Email: blueychew@gmail.com

Shrimp and fish feeds

Uni-President (Vietnam) is a Taiwanese-based aqua feed company and a leading shrimp feed producer in Vietnam. It produces mainly feeds for the marine shrimp and catfish as well as feeds for the fresh water prawn, tilapia, grouper and sea bass. In 2006, a new feed mill was set up in the Mekong Delta to focus on tilapia and catfish feed production. In keeping with global market trends, the company has an integrated business model with an aqua feed, hatchery and laboratory facilities. The biosecure hatchery, set up in 2007 is equipped for brood stock culture, larval and nursery rearing of post larvae of both the black tiger shrimp and vannamei shrimp. It is also equipped with laboratory facilities, complete with PCR- polymerase chain reaction and other equipment for the monitoring of diseases.

"Our plan is to play a larger role in the industry in Vietnam. The estimated country wide demand is 35 billion post larvae, valued at USD 100 million. Our goal is supplying quality post larvae. Our Specific Pathogen Resistant-SPR vannamei post larvae business has reached 150 million post larvae/month in July 2009. Next is to produce Specific Pathogen Free-SPF black tiger post larvae from domesticated brood stock. Now, we are also planning for a third aqua feed mill in the Central and Northern area of Vietnam to meet the feed demand of vannamei shrimp farmers", said Ming-Hsun Wu, Director of Uni-President Vietnam Co., Ltd.

Booth 39-41
Uni-President (Vietnam) Co Ltd
16-18 DT 743, Song Than II, Industrial Zone, Binh Duong, Vietnam
Web: www.uni-president.com.tw; www.aquafeed.com.tw; aquafeed@upvn.com.vn
Contact person: Wu Ming-Hsun Email: mhwu@upvn.com.vn

Nutritional solutions

Zymonutrients Private Limited is part of the 30 year old progressive Indian company Zeus Biotech Limited. It is GMP, ISO & HACCP certified for the manufacture of nutritional and healthcare supplements for aquaculture. One of the reasons for the participation of Zymo nutrients at the trade show is to seek suitable business associates in the Asia Pacific Region. At Booth No 45, the company will discuss with visitors their product range which includes SSF enzymes, multiculture probiotics, herbo-mineral-complexes and various other nutritional healthcare supplements for aquaculture.

Booth 45
Zymonutrients Private Limited, A-114, Industrial Estate, Hebbal,Mysore - 570 016, Karnataka, India.
Web: www.zymonutrients.net Email: info@zymonutrients.net
Contact persons: Abhilash Nair (Managing Director) and Brajesh Kumar (Business Development Manager).

Aquaculture supplies

In 1994, Syndel Asia was established in Malaysia to cater for the rapid expansion of the aquaculture industry in the Asean region. Since then, Syndel Asia has come a long way from being a local company trading in proprietary products to one with a skilled team of sales and technical support providing solutions to industry. "We not only provide strong technical support for the products we sell but we are also eager to share and disseminate whatever knowledge we have gathered in our endeavour to help improve farming practices. Currently, the main area of focus is providing biosecurity solutions for the shrimp industry", said Sugania Vijayan Sales & Marketing Manager.

Niche products cover solutions for fish breeding, disease prevention and handling of aquatic animals. This participation at the trade show is an opportunity for Syndel Asia, distributor in Malaysia for Bayer Thai, to launch and introduce new products for the shrimp and fish industry. These include Pond Plus, Pond Protect and Pond Dtox, microbial products manufactured by Novozymes. It will also display Remedor Aquatic, a wide spectrum, bioorganic disinfectant, Aquasept 3.0 a low residue chlorine tablets for quick disinfection and Neguvon which is used to eradicate external parasites, crustaceans and virus carriers.

Booth 57
Syndel Asia Sdn. Bhd. Unit 5-1-9, 1st Floor, Jalan 3/109F, Danau Business Center, Taman Danau Desa, 58100 Kuala Lumpur. Malaysia
Web: www.syndelasia.com. Email: syndel@streamyx.com.
Contact person: Sugania Vijayan (Sales & Marketing Manager) Tel: +6012 327 6737. Email: sugania@syndelasia.com and Erin tan Chung Wei (Technical Services Manager) Tel : +6017 338 8816 Email: erin@syndelasia.com

Taiwan's Team Aqua Corporation will be exhibiting a selection from its aquaculture products. There will be the high speed paddlewheel aerator with a new water-breaking impeller and with a higher and wider water splash and faster rpm for super high aeration. The Turbinal Aerator is an evolution in aeration technology with deeper, powerful and effective cost saving aeration. Other products include the HDPE sea cage and inland cage, high quality fish/shrimp feeds and high efficient water pumps.

The new launch will be that for the Water-breaking Impeller Series which has lower power consumption whilst the high rpm provides for very high aeration.

Booth 51
Team Aqua Corporation
14 Floor-1, No. 115, Jungshan Rd., Shinying City, Tainan, Taiwan, 730, R.O.C.
Web: www.aquaculture-product.com.tw/ Email: teamaqua@ms13.hinet.net
Contact person: C.T. Chu and Charles Liu

List of exhibitors as of 26 August 2009

Exhibitor	Booth Nos
Malaysia	
Akuatrop, UMT	24-26
Aquatic Enterprise	32
Aquaculture Asia-Pacific	47
Behn Meyer Aquaculture	64
DOF -Department of Fisheries Malaysia	49-50/59
Infofish	13
Kembang Subur Sdn Bhd	7
Lab-Ind Resource Sdn Bhd (LIR Biotech)	48
Recirculating Aquaculture Systems Sdn Bhd	28
QL Foods	36-37
Syndel Asia	57
World Fish Centre	6
Belgium	
Inve Aquaculture	58
India	
Zymonutrients	45
Australia	
Wiley-Blackwell	29
Mexico	
Panorama Acuicola	66
Thailand	
AKVA group	1-2
Novus	42-43
GSE Lining Technologies	55
Taiwan	
Fish Breeding Association Taiwan (FBA)	14-20/52-53
Team Aqua	51
Uni-President	39-41
UK	
Intervet Schering Plough	4-5
USA	
Cargill Corn Milling	27
Cargill Animal Nutrition	61-62
Moana	21-23
Tekni-plex	65
Ten Cate	46
Turkey	
Erisler Gida San ve Tic.	60

Malaysian Olefins

Environmental friendly cage frames

Malaysian Olefins Sdn Bhd has announced the success of its multi-purpose floating frame made of High Density Polyethylene (HDPE) under the trade mark ETER. Recently it has expanded to Indonesia, opening up a new factory with PT. Batam Usaha Marikultur, an integrated marine culture company based in Batam Island with 25 years expertise in the fishery industry. Several cage farms and government research institutes in Indonesia have installed these frames in several locations: Batam Island, Riau Province, Lombok, Borneo, Lampung, Bangka, Jambi, Ambon, Makassar and Papua.

According to YW Hooi, General Manager, the investment costs of such a system are high but it can be depreciated over 15 years. To date, the durability of the frames has been proven for 8 years, since the frames were first introduced. Other features are easy to maintain with minimum cost, excellent buoyancy and material refinement, UV resistant, non toxic and HACCP preferred. These are 'green' products with little impact on the environment and are recyclable. The company has also installed in Brunei Darussalam 140 cages with the ETER Type C frames. Others countries are Australia, Vietnam, Malaysia, Papua New Guinea, India, Nigeria and Singapore. These are available in several lengths, ranging from 2 to 15m long. There is also the ET-01R range suitable and cheaper for freshwater cages in dams and lakes. Cage sizes are 2 to 9 m squares cages. More information:Email: enquiry@malaysianolefins.com; Website: www.malaysianolefins.com

Zeigler

Economic benefits with new synthetic Artemia

This is a highly nutritional feed developed by Zeigler, USA. It has demonstrated the complete replacement of Artemia as a major feed source in shrimp hatcheries. The preliminary economic modeling suggests that hatcheries will be able to reduce their direct feeding costs by USD50-USD100 and total production costs by USD100-USD200 per million post larvae produced. Furthermore, production managers will now have access to a more predictable and bio-secure supply of diet.

Tim Zeigler, Vice President of Sales, indicated that "this product comes along at a critical time when economic conditions are forcing the industry to seek out more cost-effective solutions."

Neil Gervais, Hatchery Product Manager for Zeigler, was the driving force in the development of the new product. Gervais, who has managed numerous large-scale hatchery production facilities in the Western Hemisphere, has always recognized the need for more bio-secure and predictable methods of hatchery production.

"The results have been outstanding. Feedback from our testing labs has indicated that overall survivals have increased up to 30%. In addition, the time to PL 10 has been shortened by 2-3 days. Testing with clients replacing 100% artemia from cysts has consistently outperformed control tanks fed natural artemia in survival, growth and staging."

Artemia has been considered a staple of the industry for more than 30 years as its nutritional composition is effective in larval rearing up through PL stages. However, there have been limitations in terms of price, available supply, and quality has been highly variable. This limits predictability of production costs. Artemia also involves extra costs related to shipping, storage, hatching and disinfection by trained personnel. In addition, artemia can be a major source of bio-security breach from the introduction and culture of undesired pathogens. More information: Email: info@zeiglerfeed.com; web: www.zeiglerfeed.com.

Kiotech

New Head of Aquaculture

Maarten Jay van Schoonhoven

Kiotech, the supplier of high performance natural feed additives to the aquaculture, commercial fishing and sports fishing markets, has appointed Maarten Jay van Schoonhoven as Head of Aquaculture. Maarten joins Kiotech from INVE and Salt Creek where he was sales manager across South East Asia and in the Latin and North America region. Maarten has also worked with aquaculture supplier Catvis and has a two MSc's from Wageningen and Cork Universities in both biology and aquaculture.

As head of aquaculture, Maarten will be appointing distributors and working with feed mills and farmers to promote Aquatice's species specific products to key customers. He will also be overseeing and monitoring customer trials and conducting the product launch process in each country. His initial focus will be in South East Asia and supporting the Chinese business to get first commercial sales.

DuPont Qualicon

Assays for *Listeria* certified by AOAC

Two BAX® System assays from DuPont Qualicon have received certification from the AOAC Research Institute as next-day methods for detecting *Listeria* in food and environmental samples. The BAX® System 24E Assays for detecting *Listeria* species, an indicator organism, and *Listeria monocytogenes*, a pathogen, were developed in collaboration with Oxoid, Ltd. Validation studies on hot dogs, spinach, cooked shrimp, queso fresco cheese and stainless steel showed that the BAX® System performed as well or better than traditional culture methods and with much quicker time to result. The automated system uses leading-edge technology, including polymerase chain reaction (PCR) assays, tableted reagents and optimized media to detect *Salmonella*, *Listeria species*, *Listeria monocytogenes*, *E. coli* O157:H7, *Enterobacter sakazakii*, *Campylobacter*, *Staphylococcus aureus*, *Vibrio*, yeast and mold.

Primerless tablets and lysis reagents simplify PCR process

Molecular biologists in government labs, academia and industry who practice the polymerase chain reaction (PCR) with customized primers for detecting DNA can now use DuPont™ PCR Reagent Kits to simplify the process. The PCR tablets in each kit deliver high-quality, standardized PCR reagents in a convenient, tableted format that provides standardization, long shelf life and stability. Users simply hydrate the tablets with their own primers and template DNA from biological samples such as bacteria, viruses and more. The kits provide research and industry with maximum convenience and flexibility, said Amy Smith, regulatory specialist, DuPont Qualicon. Customers can use the DuPont™ PCR Reagent Kits with any open PCR system and their detection method of choice for consistently reliable, reproducible reactions. More information: Web: www.qualicon.com

Skretting Norway

Silo-silo delivery raises efficiency, reduces CO_2 footprint

Skretting Norway began phasing in the option of silo-silo feed deliveries in June. The feed is transported in a purpose-built vessel, the Eidsvaag Polaris, loading from a feed silo at the Averøy feed plant into silos on the boat and then directly into storage silos at the customer, with no bags involved. Silo-silo delivery increases operational efficiency at the feed mill while reducing the need for plastics made from petrochemicals and the time taken to unload at customer farms.

When operating at full capacity the new boat will save the production and use of 275,000 plastic bags a year while delivering 130,000 to 150,000 tonnes of feed. The new silo battery and related equipment was part of the recent upgrade at the Averøy plant. "Skipping the bag filling and emptying process saves time and energy. It also dispenses with the need for forklift trucks to move feed bags into and out of storage and onto the boat," said Viggo Halseth, Managing Director of Skretting Northern Europe, Australia and Japan, adding that the new boat can carry more feed for the same amount of fuel. "Together, these changes add up to greater efficiency and a smaller CO_2 footprint per tonne of delivered feed. Silo-silo feed delivery is a further step forward in the efficiency of fish farming and once again Norway is the pioneer.

"Delivery directly into the customer's silo improves efficiency for the fish farmer as well. The unloading speed is far faster than with bags, which means the vessel spends less time, and causes less distraction at the farm sites. If everything is in order at the farm, delivery time is halved compared with bag systems, freeing time for other more productive work. However, we will continue to deliver feed in bags as an option for as long as we have fish farmers that want it," added Halseth.

Loading only requires one person thanks to on-board sensors and a new software application, which generates excellent traceability records. To unload, one person works on the vessel and one on the farm site, both are equipped with remote control systems. In a further benefit, silo-silo delivery eliminates potential hazards associated with bag handling. Skretting is the world leader in the production and supply of feed for farmed fish. Total annual production of high quality feeds is more than 1.3 million tonnes. More information: Email: viggo.halseth@skretting.com

Biomin

Biggest mycotoxin event of the year

This is the 1st International Society of Mycotoxicology Conference, gathering scientists, opinion leaders, decision-makers and industry in the specific research area of mycotoxin reduction in the food and feed chains. It will be held in from 9-11 September in Tulln, Austria. This ISM 2009 conference will gather 400 scientists, opinion leaders, decision-makers and industry representatives from around the world. "We will cover pre-harvest and post-harvest strategies and discuss bioavailability of mycotoxins as well as mycotoxin analysis" says Prof. Dr. Rudolf Krska, the host of the event in an interview (http://www.youtube.com/watch?v=MG45Iqoj7hs) published on the MycotoxinChannel on YouTube. Biomin, a global leader in the area of mycotoxins risk management, as a sponsor of the ISM 2009, will participate in the conference and exhibition to present its effective solutions for mycotoxins risk management.

STAC
SEPANG TODAY AQUACULTURE CENTRE

Short courses in Malaysia

From September to December 2009, Sepang Today Aquaculture Centre in Malaysia will have the following short training courses. These have been designed for new entrants into aquafarming.

- 3-day Marble goby breeding and farming course with RAS
- 3-day Marine fish hatchery operations
- 3-day Live feed production (rotifer, copepod, daphnia/moina,red worm)
- 3-day Marine crab hatchery operation
- 3-day Fresh water prawn grow-out farming
- 3-day Bullfrog breeding and farming

More information on course content and enrollment details, Email: info@stac.com.my Web: www.stac.com.my.
Postal address: STAC R&D Center, No.1, Jalan Tasik Ara 2, Pantai Sepang Putra, Sg. Pelek, 43950, Sepang, Sepangor, Malaysia.
Fax:+603-31413948 Tel:+603-31412761

What to expect in AQUA CULTURE Asia Pacific Magazine in 2010

As we continue to move the aquaculture industry to the next phase of growth, new opportunities and challenges arise. The only constant we see is change. During this 6th year of our publication, we will continue to look at current issues, trends and the latest developments and technology to keep readers updated.

Editorial calendar 2010

Volume 6 2010						
Number	1	2	3	4	5	6
	January/February	March/April	May/June	July/August	September/October	November/December
Issue focus *Current trends and challenges*	Aqua feed Production	Hatchery	Sustainable & Responsible Aquaculture	Health & Biosecurity	Cage Culture	Food Safety & Traceability
Industry review *with profiles and outlook*	Marine Shrimp	Marine Fish	Catfish	Freshwater Fish	Tilapia	Marine Fish
Feed Technology	Processing Technology Animal & plant meals	Larval feeds & processing Feed additives	Feed standards Feed enzymes	Pre and Probiotics Immunostimulants	Processing Technology Feed additives	Nutrition Novel meals & oils
Production Technology	Aeration & Disinfection Technology	Brood stock & genetic Improvement	BMP, Standards and Certification	Recirculation aquaculture technology	Feed management	Health management
Shrimp/Fish culture developments	Coverage on experiences from industry, including role models, benchmarking and opinion articles.					
Markets	Contributed reports on market trends, product development, issues and challenges.					
Show Preview/Issue	Victam 2010, Bangkok, Thailand 3- 5 March World Aquaculture 2010, San Diego, USA March 1-5	Australasian Aquaculture 2010 Hobart, Tasmania 23-26 May	Vietfish 2010, Ho Chi Minh City, Vietnam 12-14 June		Aquaculture Europe 2010, Porto, Portugal 6-8 October 9th Asian Fisheries and Aquaculture Forum & ISTA 2010, Shanghai, China, 15-19 October	

Urban Aquaponics Conference

February 24-26 2010, Brisbane, Australia

The Aquaponics Network Australia (ANA) is organising this three day urban aquaponics development training at the Brisbane Technology Park conference centre, in Eight Mile Plains, south of Brisbane (about 20 km from Brisbane airport). There will be 3 full day components costing AUD200 per day. Some 250 participants are expected.

- **Day 1 – Aquaponics teaching in high schools** is designed to significantly improve the standard of science teaching, plus the number of young people able to know and manage hobby hydroponics at home. This is expected to better equip homes for greenery and low-cost food responses to climate change – in which urban organic agriculture without waste, clean organic matter recycling, water harvesting and recycling, and energy conservation, will be key objectives.
- **Day 2-3 – Aquaponics equipment advances** suited to Australia and other hot-dry climate countries with temperate, sub-tropical and tropical climates. **Integrations of aquaponics systems** with green walls, green roofs, solar and other sustainable energy sources, rain-water harvesting, storage and use, recycling of "grey water", and recycling of clean organic matter for fish feed via vemiculture/insect culture. Advances in "food from the roof" will be strongly featured.
- **Aquaponics in LED-lit (Light Emitting Diodes) operations deep inside buildings.** The technology operates up to 24 hours a day, uses solar or other sustainable energy, and extends the aquaponics technology to the kind of "protected agriculture" likely to be required if and when climate change weather turns violent.

More information: ***Anyone interested in attending the Aquaponics Conference or receiveing a CD (non attendees) should register with Geoff Wilson. Email: wilson.geoff@optusnet.com.au.***

2009

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

September 20–25
16th 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

September 25 –27
2009 Forum on Fishery Science and Technology
Guangzhou, China
Email: 09forum@cafs.ac.cn, 2009fishforum@gmail.com

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

October 3-7
IAFI World Seafood Congress (WSC)
Agadir, Morocco
Email: Ms Jayne Gallagher (jayne.gallagher@seafoodcrc.com) or Roy Palmer (palmerroy@hotmail.com)

October 11-31
Training on grouper hatchery production
Lampung, Indonesia
Email:yuan@enaca.org (Yuan Derun)
Web: www.enaca.org

October 13-15
Integrated Technologies for Advanced Shrimp Production
Hawaii, USA
Email: shrimp2009@oceanicinstitute.org
Web: www.oceanicinstitute.org

November 3-6
Asian-Pacific Aquaculture 2009
Kuala Lumpur, Malaysia
Email: worldaqua@aol.com
Web: www.was.org (page 40/46)

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

November 8-11
International Symposium on Aquaculture, Biology and Management of Commercially Important Crabs – 2009 (ISABMC-2009)
Shanghai, China
Email: shanghai09crabconference@gmail.com
Web: www.crablab.org

November 27 - 30
1st International Symposium on Aquaculture and Fisheries Education (ISAFE)
Pathumthani, Thailand
Email: aarm@ait.ac.th

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

2010

February 19-21
17th India International Seafood Show
Chennai, India
Email: premchandran@mpeda.cm
Web: www.mpeda.com

February 24-26
Urban Aquaponics Conference
Brisbane, Australia
Email: wilson.geoff@optusnet.com.au

March 3
Aquafeed Horizons Asia 2010
Bangkok Thailand
Web: www.feedconferences.com (page 35)

March 3 – 5
Victam Asia 2010
Bangkok, Thailand
E-mail: expo@victam.com
Web: www.victam.com (page 35)

May 5-7
International Conference and Exhibition On Shrimp Aquaculture 2010
Jakarta, Indonesia
Email: donedwin@bimatama-inka.co.id

May 23-26
Australasian Aquaculture 2010
Hobart, Australia
Email: sarah-jane.day@aquaculture.org.au
Web: www.australian-aquacultureportal.com/ (page 31)

After we've fitted the final piece, we find a new puzzle

How can we find new alternatives to fishmeal and fish oil, and how can we increase the omega-3 content in fish raised on such feeds? How can we boost fish health and performance through functional ingredients? The researchers at Skretting Aquaculture Research Centre are committed to finding answers in a world that changes rapidly. Their priorities are consumer safety, fish health and productivity, improved feed management and sustainability both in feed production and in fish farming. Their discoveries benefit fish farmers directly, by ensuring that consumers can eat healthy, sustainable and delicious fish. **www.skretting.com**

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