

AQUA Culture

Asia Pacific

Focus on Disease Management in Shrimp Culture

IMNV in Indonesia

Review on Marine Shrimp
Production

Marketing Shrimp

Breakthrough in Pompret
Breeding in Kuwait

Preparing Microdiets
for Fish

Probiotics for the Flounder

Aquaculture at VIV Asia,
Bangkok



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From the editor

The year ahead

Some unsettled business

It is that time of the year to reflect on past achievements and issues ahead. Year 2006 was stirring, yet gloomy for some sectors and countries. Year 2007 brings with it, two main challenges: reducing feed and production costs, and improving survival rates and food safety.

There are two issues pertaining to the use of fish meal in feeds, shrimp in particular. There is the image of feeding fish to grow a species lower in the food chain and thus, the issue of sustainability (see below) and economics. With increasing demand and limited supply, experts are predicting that fish meal prices will not come down dramatically. This is also compounded by increases in fuel costs.

When feed formulation for the monodon shrimp were developed, fish meal prices were in the region of USD 700/tonne. Now it is USD 1,200/tonne. Yet levels in feed have remained high at 30% to perhaps as low as 20% in feeds for vannamei. The demand is expected to escalate as the large-scale culture of marine fish such the cobia and tuna takes off in the region. Feed millers have mitigated this by using local sources of fish meal but this is merely an interim solution. The concern is *where are we* in terms of research into replacing fish meals with sustainable sources of protein. Again, it is reiterated that the root cause of this is the lack of knowledge on fish and shrimp nutrition and how to formulate, based on amino acids requirements.

As the years go by, we can see increases in investment and technical information to combat diseases in shrimp farming. However, small-scale farmers still continue to use banned chemicals (see page 6). The culture of the black tiger shrimp has been practically decimated in many countries (perhaps to only 5% in Thailand in 2006). It is common knowledge that its revival requires domesticated stocks and selective breeding as we see with the vannamei shrimp. There have been developments in some countries (see issue November/December 2006) but we are still far behind vis-a-vis the level of domestication in the livestock industry. Even with specific pathogen free (SPF) vannamei, lessons are to be learnt from Indonesia where IMNV has been detected (see page 17). New diseases will likely occur and thus, only preventive measures can avoid a 'monodon like' collapse of the industry.

It has been emphasized often that it is the market economy that rules and consumers dictate. It is natural when prices are low that small farmers try to improve on yields quickly by using prophylactics which are usually banned antibiotics. There are no short cuts to food safety. According to FAO, some 90% production comes from small farmers and regulating them is a massive task. The industry must learn to self regulate by encompassing all producers, big and small. One cannot work alone.

..and remember sustainability

The future of aquaculture remains in its sustainability. This is the image that aquaculture needs to build. As fisheries resources deplete, it is aquaculture's role to supply aquatic products. The notion of feeding fish to grow fish has to be mitigated. The press may have dramatized this but it is up to the industry to contest this negative image of aquaculture, through market promotions and education. We can leave market promotions to the large companies but the education aspect needs to be dealt by a non-aligned party. Another aspect is the need for a standard accreditation of products (see page 6).

A gentle reminder -the Asia Pacific Aquaculture 2007 takes place in August in Hanoi, Vietnam. This is organized by the Asian Chapter of the World Aquaculture Society together with the Ministry of Fisheries, Vietnam. I hope to see you there to support the event.

In February 2007 we will enter the year of the Fire Boar in the Chinese lunar calendar. We wish one and all a Happy and Prosperous New Year!

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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Pacific white shrimp

The final step for its culture in the Philippines

The year 2007 hails the official lifting of the ban on the import of broodstock and the culture of Pacific white shrimp *Penaeus vannamei* in the Philippines. This came after the landmark signing of the Fisheries Administrative Order (FAO) by DA Secretary Arthur C. Yap on January 8. The industry in the Philippines has been waiting for this since June 2006.



Phillip Cruz

The planning to allow the culture of the shrimp in the country began two years ago in Cebu City. At the Business Meeting of the Shrimp Congress in 2004, members agreed to explore the potential of *P. vannamei* culture in the Philippines. This came after passionate debates on the pros and cons of the import of the species into the country. The government, represented by Director Malcolm I. Sarmiento, Jr. of the Bureau of Fisheries and Aquatic Resources (BFAR) and the shrimp industry stakeholders agreed on an experimental introduction (as stated in FAO 207) to establish the level of risks. This was also to put into place any necessary remedial measures.

In August 2004, a Memorandum of Agreement (MOA) between BFAR and a private sector proponent, the Agri-Fisheries World, Inc. marked the experimental introduction of *P. vannamei* using BFAR's National Integrated Fisheries Technology Development Center (NIFTDC) hatchery facility in Dagupan City. Guidelines for the monitoring and establishment of biosecurity measures for the experimental trials were drafted by BFAR with the help from shrimp industry stakeholders. This was called the Protocol for the Experimental Introduction of Pacific White Shrimp (*Penaeus vannamei*). This was then ratified by the Risk Assessment Committee (RAC) created through the Department of Agriculture Special Order 255, Series of 2005 on July 4, 2005. Based on this document, the DA Special Permit to Import No. 07-2005 was issued. This allowed the import of a new batch of 550 pairs of *P. vannamei* broodstock from a verified specific pathogen free (SPF) facility in Hawaii. These arrived in the Philippines on August 19, 2005. They were then placed in the biosecure hatchery facility in NIFTDC, Dagupan City.

On September 30, 2005, the second meeting of the Risk Assessment Committee ratified the guidelines on shrimp grow-out farm accreditation for the field trials of the *vannamei* shrimp in different culture systems. These were used for the identification of recipient farms to check the suitability and production yield of *P. vannamei* under ponds conditions in the Philippines.

Encouraging results from the recipient farms confirmed the good performance of the postlarvae from the NIFTDC Nucleus Hatchery. The experts and stakeholders confirmed the completion of the experimental trials for the safe introduction of the *P. vannamei*. This was positive with no expected negative impacts to disease introduction and biodiversity issues. At the 5th Philippines Congress in June 2006, stakeholders voted to agree that *P. vannamei* shrimp will be allowed into the country.

During this time, industry in the Philippines had been anticipating the culture of the species which by now is known as "the *vannamei*". The trend in Asian shrimp aquaculture is a shift to *P. vannamei* from the traditionally black tiger prawn or "sugpo" culture. The report added that as examples, the two major shrimp producers in Asia have since shifted progressively to *P. vannamei* culture. The industry is proclaiming *P. vannamei* to have the pedigree and next "sea chicken" after tilapia.

Once the commercial introduction of the *P. vannamei* is official, renowned Philippine aquaculture expert, Mr. Phillip Cruz, sees an immediate and remarkable increase in production of cultured *P. vannamei* shrimp. In the first year, he estimated an increase to 15,000 tonnes from the current production estimate of 5,000 tonnes in 2006. This is a 300% increase. Then the estimates are annual increases of approximately 20,000 tonnes and in 5 years (2011), the Philippines will be producing 100,000 tonnes of the shrimp. This projection only covers the existing total hectares of brackishwater and marine fishponds, either utilising intensive, semi-intensive and extensive culture systems. A fraction of the production will also come from freshwater ponds.

However, over this production of white shrimp, the black tiger prawn will steadily contribute its share. If realised, this would be reminiscent of the heyday of "sugpo" production in the 1990's where it reach its peak to 94,000 tonnes in 1994.

CP Prima

Acquires Shrimp Improvement Systems

Indonesia's PT Central Proteinaprima (CP Prima) has acquired Shrimp Improvement Systems, LLC (SIS), a large marine shrimp breeding company based in Florida, USA, for an undisclosed sum.



CP Prima at the Jakarta Seafood Expo in August, 2006

CP Prima's Director of Operations, Erwin Sutanto said, "The acquisition will strengthen the vertical integration of CP Prima. It will also expand on the research in shrimp genetics of SIS. The company will market SIS's Great White shrimp broodstock into the industry in Indonesia".

CP Prima is part of the Charoen Pokphand Aquaculture Business unit in Indonesia. It is the largest vertically integrated shrimp producer in the world. Shrimp farming operations are carried out in Lampung and Medan in North Sumatra and in Paiton, East Java. Shrimp hatchery facilities are also in Lampung and Medan as well as in Rembang and Situbondo in Java and in Bali. The company was relisted in the Jakarta Stock Exchange in November, 2006. In 2006, the company expected sales of 50,000 tonnes of frozen shrimp valued at USD 200 million.

SIS, founded in 1998 is a leader in applying genetic breeding techniques to the global marine shrimp farming industry. The company produces broodstock and seedstock shrimp that are certifiable free of all serious pathogens ("SPF") affecting shrimp and markets this in 20 countries. It maintains

a 64,000 m² biosecure breeding and multiplication centre in Plantation Key, Florida. This allows it to hold and rear up to 320 new families each year. Asian operations are in Thailand and Singapore. (Source: www.cpp.co.id; www.shrimpimprovement.com).



Gold Coin Group Relocates to Hong Kong

The Gold Coin Group, a leading animal and aqua feed manufacturer in the Asia Pacific region, has moved its group headquarters to Hong Kong and has established 3 Regional Operating Centers (ROC) in China, Malaysia and Indonesia.



JC Filippi

For the past 50 years, the company has had its headquarters in Singapore. Mr. JC Filippi, the Group Chief Executive, explained: "The current relocation of the headquarters is in line with operational needs of multiple locations and the Group's increasing focus in the growing Chinese market in order to increase its presence and market share there. Notwithstanding the relocation, the Group remains firmly committed to the Southeast Asian markets, where our roots are. Overall, the new structure enables the Group to put together its human resources in a thoroughly multinational way while being able to be close and responsive to its various markets".

The Gold Coin Group is a pioneer in animal feed production in this part of the world since 1954 with its first operations in Singapore. Since then, the company has built on its successes and it now has operations in China, East & West Malaysia, India, Indonesia, Sri Lanka, Thailand and Vietnam. The whole Group produces a combine volume

of some 1.5 million tonnes of feeds a year for various animals including poultry, pigs, fish, shrimp, and other exotic animals.

The press release also said that the Gold Coin Group has become the first feed milling group in this region to achieve the ISO 22000 certification, the latest international food safety standard. Accreditations have been achieved for the Malaysian mills with the Chinese and Indonesian mills to follow towards end of this year. The adoption of ISO 22000 standards is part of the Group's overall effort in striving towards excellence, premium quality products, food-chain safety, and public responsibility.

The new address and contact details are as follows: The Gold Coin Group Limited, #1204-07, 12F, Shui On Centre, 6-8 Harbour Road, Wanchai, Hong Kong SAR. Tel: +852 2585 1200 Fax: +852 2598 7111 Email: general@goldcoin.com.hk; Web: www.goldcoin.com.hk; Contact persons: Ms Peggy Leung or Ms Fidelia Wong

CPF expands

Beginning with shrimp hatchery business in China and feeds in Malaysia

Thailand based agribusiness giant, Charoen Pokphand Foods Plc (CPF), is expanding its aquaculture business into China and Malaysia. In the Bangkok Post, Mr Adirek Sripratak, president and CEO said that CPF planned to establish a new 100% owned company, CP Aquaculture (Dongfang) Co Ltd, to operate a shrimp hatchery business in China. This will have an initial registered capital of CNY 10 million (USD 1.25 million). Operations will start in the first quarter of 2007. The capital of this new company will increase by another CNY 22 million, (USD 2.75 million) in the second quarter of 2007.

After entering the aquaculture market in Malaysia in 2005, CPF has expanded its investments through Star Feedmills (M) Sdn Bhd. CPF indirectly holds a 100% stake in this subsidiary. It has also purchased fixed assets in the Malaysian fish feed market from Charoen Pokphand Jaya Farm (M) Sdn Bhd, connected to CPF, for MYR 1.29 million (USD 0.36 million). The transaction would fulfill CPF's objective to expand its aquaculture business in Malaysia, where it sees great potential.

The expansion of offshore investments is in line with CPF's new strategy. Adirek recently announced that CPF would lower domestic investment over the next three years to shift focus to offshore expansion, aiming to counteract local currency volatility and growing trade barriers against the Thai meat trade. Among the recent offshore investment are injections of one billion THB (USD 26 million) in livestock, THB 300 million (USD 7.8 million) in aquaculture projects in Malaysia and India and USD 3 million to set up an aquaculture project in China. The company is also involved in operations, under the CP Group umbrella, in Indonesia, Cambodia and Burma.



Support for the aquaculture industry in Malaysia. The booth of Star Feedmills at the Aquafair Malaysia in November, 2006

Brief news

FAO harmonises responsible shrimp farming

Shrimp exports from the developing world add up to USD 8.7 billion annually. To meet specifications of different overseas markets, producers in developing countries struggle to adapt to new and changing rules on food safety and environmental impacts. The current proliferation of standards causes confusion, particularly for small-scale producers.

In September, FAO announced a series of international principles for responsible shrimp farming. These cover issues such as siting of farms, their design and the use of resources such as water and feed as well as the social impacts of aquaculture on local communities. These new principles represent the first-ever attempt to have an international framework for improving the sustainability of the shrimp farming industry. This was the result of a five-year consultative process with the Network for Aquaculture Centres for the Asia Pacific (NACA), WWF, World Bank and UN Environmental Program.

Dr Rohana Subasinghe, a senior aquaculture expert at FAO, said, "We hope that these new principles will help pave the way for a more common vision of how we should define responsible shrimp farming, globally. They can also serve as a point of reference for governments, non-governmental organizations and private industry who are developing systems to certify farm-raised shrimp as eco-friendly or sustainable, or who are looking to harmonize systems that are already in place".

Watch on US and Australian standards

Thailand's Department of Fisheries (DOF) said that it is closely monitoring the introduction of new health and safety standards in the US and Australia which may hamper Thai shrimp exports.

In MCOT news, Director General, Dr Jaranthada Karnasuta said that Walmart, the US retail giant and a major buyer of Thai shrimp recently ordered its suppliers to get aquaculture certification from an independent body. The Aquaculture Certification Council (ACC) will certify whether imported supplies meet the social, environmental and food safety standards along the supply chain.

He added that such measures could potentially affect export prices, making Thai produce less competitive. A Thai official also said that such unilateral actions made it difficult for suppliers to comply with varied and changing standards. DOF was negotiating for lower certification fees and would ask the FAO to look into the standardization of food safety guidelines. Australia, citing concerns for possible contamination and spreading of aquatic diseases, may introduce a total ban on shrimp imports in 2008. (also see page 16)

New vaccination process for catfish

Scientists at Agricultural Research Service (ARS) of the USDA, have invented two vaccines for catfish against enteric septicemia and columnaris which cost the US catfish industry an estimated USD 50-70 million/year. These were patented and licensed to international vaccine manufacturer Intervet for distribution.

Currently, fish are vaccinated when they are 10 days old. In a recent study, ARS scientists showed that catfish can be successfully vaccinated during the 'eyed-egg stage', when they are still in the hatchery, before exposure to pond pathogens. Both vaccines can be given to channel catfish eggs at 24-48 hours before hatching. Catfish are still protected against the disease 140 days after immunization. They also proved that the two vaccines administered simultaneously could be beneficial as both pathogens frequently appear in the same ponds. With vaccination, fish grows faster in comparison with non vaccinated fish and fish farmers can increase their profits by about USD 3,000/ha (Southeast Farm Press).

Turbot is back on the menu in Beijing

A month long ban on sales of turbot was imposed in early December, when the Centre for Food Safety (CFS) found the carcinogenic malachite green in samples of turbot. China produces 55,000 tonnes of turbot annually, of which 70% is produced in Shandong Province. The ban devastated producers more so as it was the peak season for sales. It was estimated that 25,000 tonnes remained unsold.

Authorities in China said that they have asked farmers to follow proper culture management and to record the procedures used during culture, such as the purchase of turbot fingerlings and feeding. With complete records, they could trace the sources of contamination. However, Prof Lei Jilin, the man who introduced the flatfish to China and a researcher with the Yellow Sea Fishery Research Institute said that there was no quality control before fish enter the market. The recent scare regarding turbot sales in Beijing and other cities reflects loopholes in food safety monitoring (Source: Xinhua, CCTV.com).

Japan lifts tariffs on Indonesian shrimp

Shrimp imports into Japan from Indonesia will enjoy zero duty next year under a Free Trade Agreement (FTA). Shrimp accounts for 90% of Indonesia's fishery exports to Japan. Imports are now liable to duty from 4.8% to 7.3%. In 2005, Indonesia was the second largest shrimp supplier to Japan with exports reaching 45,574 tonnes or 19.9% of Japan's total shrimp imports, according to Xinhua News.

New catfish processing complex

Agifish, the An Giang Fisheries Import and Export Joint Stock Company is to set up a complex to process tra and basa catfish in 2007, according to the Vietnam Association of Seafood Exporters and Producers (VASEP) in VNeconomy news. This will cost 100 billion VND (USD 6.25 million) which will be funded by members and through shares and bonds. The complex will include plants specialised in processing bone, skin and fat of the catfish into products serving industry, pharmaceuticals and food processing.

Organic feed mill in Hainan

HQ Sustainable Maritime Industries, Inc (HQSM) will set up the first organic feed mill and processing plant by the fourth quarter of 2007, according to their press release. This will produce 100,000 tonnes per year of extruded floating feed using organic corn and soybean meal from China and abroad. Feed will be for the large cooperative farm operations of the company in Wenchang and Qionghai, Hainan with a total farming area of 3,294 ha. Each farm will be required to use feed from this organic feed mill to meet the company's strict organic standards. Production from the feed mill is also for other shrimp and fish farms in Hainan.

Fish farms from desert aquifers

Israeli scientists at the Jacob Blaustein Institute for Desert Research are using brackish water drilled from deep sea aquifers to culture warm water fish. The unpolluted geothermal water at 37°C has a salinity of less than a tenth of that of seawater. The report in the Herald Tribune indicated that similar uses of water are carried out in the Sonoran Desert in Arizona, USA. The next step is to show farmers that they can later use the water in which fish is grown to irrigate crops. The scientists are working to fine tune the technology and share it with Tanzania, India, Australia and China.



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The Intervet logo features the word "intervet" in a lowercase, sans-serif font. The letter "i" is stylized with a green dot above it. A green swoosh underline is positioned beneath the letters "n", "t", "e", and "t".

Uni-President Vietnam

Ends a good year in Singapore with dealers

How does a feed company reward the contribution of its dealers to its success during the year? Vietnam's aqua feed producer Uni-President Vietnam (UPV) did this by bringing some 250 fish and shrimp feed dealers, including spouses to Singapore. A meeting to assess performance for the year, present awards to top performers and to set out targets for the following year was also included.

In his welcome address, the Director General of Uni President Vietnam, Mr Cheng Wen Chin said that since 1999, the company has been performing well, all due to the participation of its dealers. During 2006 if the main grouse of many was the short supply of shrimp feed, it was fortunate that they could meet demand by the third quarter of 2006 with the commissioning of the new factory in My Tho, Tien Giang Province. With this, the company could hold on to its leading position in Vietnam's shrimp feed market.

However, as a feed producer, it could not escape the challenges of high prices of fish meal and that of other raw materials. To keep up with feed quality, it could choose to implement frequent price adjustments to commensurate with changes in production costs but this would just burden dealers. Consequently the best option to maximize profit margins will be to have economies of scale. It is looking forward to increasing sales volumes that will benefit dealers too.

To help the industry progress, in 2006 UPV started the construction of a hatchery for the production of quality postlarvae, both of the black tiger and white (vannamei) shrimp. This will also improve the export potential of shrimp from Vietnam as traceability will be extended to seedstock. To complete its integration approach, there will be a processing plant in the near future, added Cheng.

During the year, sales volumes of the several brands of shrimp feed have been encouraging. UPV sales and technical managers reported on shrimp and fish farming activities and how these affected the feed market. The overall shrimp feed sales indicated that they have continued to have a major market share in the southern region and a substantial market share in other regions. In 2006, feed demand also declined by approximately 10% in some areas as farmers stopped operations due to diseases.

In the southern region, feed usage for the black tiger shrimp has remained relatively stable. Marginal increases in feed volumes can be



General Director of Uni President Vietnam, Mr Cheng Wen Chin with the UPV team (fourth from left)

expected in 2007, only if there are new areas used for farming and when farms change from semi intensive or extensive to intensive culture. In the other regions, feed demand will most likely be from new farms as currently only 43% of the potential areas for shrimp culture have been used. In the northern region, demand is low because extensive farms use farm made feeds. The conversion to commercial feeds can generate about 7% increase in sales.

Table 1. Available land area and marine shrimp production in 2006.

	Total potential area (ha)	Total area under shrimp culture (ha)	Shrimp production in 2006 (tonnes)
South	44,290	39,340	26,630
West	497,754	248,877	174,606
Central	10,000	5,560	10,700
North	22,699	14,240	14,650
Total	574,743	308,017	226,646

Sleepless nights are over with new feedmill

Jie Cheng Chuang, the Vice president of UPV said that since 2002, he had been having sleepless nights fearing they could not produce enough shrimp feed to meet demand from dealers. The anxiety only ended in September when operations began at the new feed mill in My Tho. Now the company has two warehouses to facilitate fast distribution of the feed.

Next is a hatchery in a 2.5ha complex complete with a laboratory equipped with a real time PCR (polymerase chain reaction) machine. This is a service for customers to detect diseases. The hatchery will have the capacity to produce 300 million each of black tiger and white shrimp postlarvae. They will be importing black tiger and Specific Pathogen Free (SPF) vannamei broodstock from Madagascar and Hawaii, respectively. Chuang went on to explain to dealers the procedures that they will use in the production of the postlarvae.

"Our role is to make the culture of black tiger shrimp sustainable. Even with vannamei shrimp, our production costs are much higher than in China or Thailand. But as they do not produce large shrimp, this is where we can have the advantage. Thailand and China does not produce more than 25 g shrimp whereas this was 30% of production in Vietnam. We have a large market in Japan but with the recent problem, I do not know whether we can continue to keep this market. It is good that we are also looking at markets in Russia and Middle East".

He added, "Vietnam will need to be more competitive as soon, it will enter the World Trade Organisation (WTO). Production of vannamei shrimp will continue to increase from China, Thailand, Indonesia and Latin America. These Asian countries are already producing up to 95% of production of vannamei shrimp. Indonesia itself moved from 35% in 2004 to 70% in 2005".

He estimated that the volumes of vannamei shrimp will continue to increase towards 2010, whereas that of black tiger shrimp will remain at current levels of 250,000 tonnes.



Jie Cheng Chuang



Top performing dealers

In 2007, the company will focus on feeds for the vannamei shrimp. It will be expanding the SX vannamei feed range. Farms in the northern and central regions are already increasing production of this species. In 2007, 50% of the country-wide production is estimated to be vannamei shrimp. In Quang Ngai, 100% of production is already from vannamei shrimp and in Khanh Hoa it is already 70-80% but only 20-30% in Ninh Thuan. In the south, in Dong Nai, some 90% of production is vannamei shrimp.

Another market which the company wants to exploit is the large and expanding catfish feed market. This is now possible with the new feed mill. Feed demand is estimated at 450,000 tonnes and UPV has a small share of this market. In 2006, an expansion of 12% in pond culture was recorded for the An Giang and Can Tho provinces. In addition, a new feed range for the frog has been developed.

At the meeting, dealers also heard on what is ahead for the shrimp markets. Mr Vo Van Phuc of Phuung Nam Co., Ltd said that although



Mr Pho Van Lieu receiving an award from Mr Cheng. Mr Lieu's catfish farm was featured in Vol 2 (3).

Vietnam has been performing well with increases of shrimp exports of more 25% in 2006, the recent discovery of antibiotic residues in shrimp imports to Japan may force the Japanese Government to impose 100% testing on all consignments. This is a real damper for the industry as 30% of imports into Japan are from Vietnam. Vietnam is also the leading producer of black tiger shrimp and prices are increasing with decreasing supply. However, markets want larger shrimp of 40-45/kg size range.

The aquatic feed business in Vietnam of Taiwan based Uni President started in 1999. At present, it has two factories producing pelleted feeds for the black tiger and vannamei shrimp and for the scampi or freshwater prawn. Extruded feeds are for catfish, tilapia, grouper and frog. Currently, the largest feed segment for the company is feed for the black tiger shrimp.

Relevant article: Changing industry patterns to gain a lead. AquaCulture Asia Pacific, Vol 2 (4), 2006. pp10-12.

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Marine shrimp in Asia

By Zuridah Merican and Iffa Suraiya

Production rising in 2007 with more vannamei shrimp.

In 2006, estimates of production showed that volumes reached 1.485 million tonnes. The global total was 1.835 million tonnes.

This overall increase of 6.2% over production estimates in 2005 was achieved despite adverse weather conditions. China, Vietnam and the Philippines were affected by typhoons. Cyclones in India and floods in Thailand delayed the start up of culture, according to Dr Chen Ming Dang, Charoen Pokphand Foods Ltd, Thailand. Furthermore, Asian shrimp production will rise to 1.591 million tonnes in 2007, according to estimates by the Thai Shrimp Association (Table 1).

Some 74% of production was from the top four producers. China's production is discussed below (see box). The year 2006 was good for farmed shrimp in Thailand. Estimated production rose to more than 400,000 tonnes. Some industry experts said that it could possibly reach 500,000 tonnes.

On the contrary, the estimate of Indonesian production in 2006 of 260,000 tonnes (Table 1) was below the national target of 350,000 tonnes. The Shrimp Club of Indonesia said that production was much lower in 2006 at 110,000 tonnes from its members. The rest was production from



Black tigers from the Philippines. Picture courtesy of William Kramer

Table 1. Estimates of recent production of shrimp ('000 tonnes)

Country	2005	2006	2007 (forecast)
China	380	371	402
Thailand	380	410	420
Indonesia	230	260	290
Viet Nam	115	133	155
India	100	103	112
Malaysia	32	42	44
Philippines	35	36	38
Others	125	130	130
Asia Total	1,397	1,485	1,591
Latin and South America	304	350	376
Global Total	1,701	1,835	1,967

large corporate farms and traditional farms. The challenges facing industry in Indonesia will be discussed in a future article.

According to FAO statistics, production in Vietnam was already 225,000 tonnes in 2004. Industry in Vietnam gave estimates of 230,000 in 2005 and increasing to 260,000 tonnes in 2006.

Vannamei versus black tiger shrimp

Similar to recent years, the increase in production was due to the culture of *Penaeus vannamei*, albeit legal or illegally. The spread of vannamei in Asia has been rather quick. In published figures (FAO, 2006, Table 2) the ratio of vannamei: black tiger shrimp in Asia was 60:40 in 2004.

Shrimp in China

It is evident that views on production emanating from China diverge depending on sources. Nevertheless, China remains the largest producer of farmed shrimp. Statistics from the Ministry of Agriculture reported that marine shrimp production in 2005 reached 624,000 tonnes. The species are *P. monodon*, *Ferropenaeus chinensis*, *P. vannamei* and *P. japonicus*. In addition, 440,000 tonnes of the white shrimp *P. vannamei* were produced in freshwater ponds. Vannamei shrimp comprised 65% of cultured shrimp in seawater ponds. Including vannamei shrimp cultured in freshwater, 80% of total production of farmed shrimp was vannamei shrimp (Cue He, China Fisheries Magazine, 2006). However, Prof Chen Jiabin, of the Yellowsea Fisheries Research indicated that out of an estimated production of 600,000 to 700,000 tonnes in 2006, some 65-68% comprised of vannamei shrimp and that 8-10% comprised of the Chinese shrimp.

A major issue in the industry in China is the high production rates which have brought down ex farm prices in the country. High production in 2004 (534,000 tonnes) exceeded demand and caused prices to decline as low as RMB 10/kg (USD 1.3/kg). In 2003, prices were 25% higher. This and the higher income levels helped to

increase local consumption. This demand from domestic markets has continued into 2005 and 2006 and currently supports the industry. Prices are rising slowly. Prices to the farmer for white shrimp currently range from USD 2.79 /kg for 80pcs/kg shrimp to USD 4.44/kg of 50/kg shrimp (INFOYU, 2006).

Price declines were also due to the high US anti dumping tariffs (AD) imposed on shrimp exports from China, which dropped from 80,000 tonnes to 30,000 tonnes in 2005. Duties on Chinese shrimp are the highest (country wide rate of 53.96 to 112.81%) among the four countries subjected to antidumping duties. For three years, China also faced a ban on imports into the EU because of antibiotic residues.

Prof Chen Jiabin said, "In 2007, the total output of farmed shrimp will be at the same level as 2006 because there will be problems with trade barriers. However, the basic target of our government will be to improve the quality of fishery products as well as protect the environment. The domestic market is important and output will increase to meet the increasing demand".

"However, I would like to see the industry produce better quality aquatic products to meet increasing demand both domestic and abroad".

In 2006, Thailand's production of vannamei shrimp was estimated to be 95-97% of production, according to Bunleusak Sorajjakit, Thai Union Feedmill Co Ltd. He added that most of their farmers could harvest shrimp of sizes of 40-45 pcs/kg, achieved through partial harvesting.

Vietnam has officially allowed the culture of vannamei shrimp only in the Central and Northern regions. However, the Department of Fisheries emphasised that white shrimp should be just an additional cultured species to increase the total shrimp production. It will not replace the black tiger shrimp, long considered as the main cultured species in Vietnam. By 2007, Jie Cheng Chuang, Uni President, Vietnam expects that 50% of the country-wide production will be that of vannamei shrimp.

India's production of black tiger shrimp has remained relatively stagnant. Industry in India had been debating the issue of the introduction of vannamei shrimp for the last two years. To increase farmed shrimp production from India, the Seafood Exporters Association (SEAI) has asked that it follow the other countries and allow this shrimp to be cultured (Fishing Chimes, December 2006).

Increasing profit margins

Although still low, global shrimp prices have shown marginal increases in 2006. Chuang, Uni President, Vietnam said that prices of black tiger shrimp are increasing. Similarly, Indra Kumar, Avanti Feeds, India expects farm gate prices to increase to INR 350 /kg (USD 7.90) from INR 330 /kg (USD 7.4) for 30pcs/kg. Prices for 40 pcs/kg have already increased to INR 265 /kg (USD 5.98) (Fishing Chimes, December 2006).

In most countries, production costs per kg have been increasing because of higher feed and energy costs. In Indonesia, production costs in 2005 was as much as IDR 30,000/kg (USD 3.33) with the main components being the cost of feeding at 48%, energy costs (fuel and electricity) at 26%, fry costs at 17% and the other costs including labour at 9%. With current fuel prices, production costs may increase by as much as 16.3%.

Table 2. Marine shrimp production in Asia in 2004, according to species (FAO, 2006)

	Production in 2004 in tonnes				% vannamei shrimp/total shrimp
	Black tiger	Vannamei	Others*	Total	
China	60,579	735,055	99,553	895,187	82
Thailand	110,000	276,600	23,100	409,700	68
Viet Nam	185,569	40,000	50,000	275,56915	15
Indonesia	131,399	53,217	53,725	238,34122	22
India	127,802		5,218	133,020	
Bangladesh	58,044			58,044	
Philippines	35,917		2,030	37,947	
Malaysia	25,721		5,117	30,838	
Taiwan	1,469	10,918	526	12,913	85
Total	736,500	1,115,790	239,269	2,091,559	53

**Ferropenaeus chinensis*, *P. vannamei* and *P. japonicus*, *P. indicus*, *Metapenaeus* spp

"Feed cost is critical in determining cost of production. With current prices for the vannamei shrimp, we cannot increase prices. We realised that we need to cut down on fish meal in shrimp feeds but the dilemma for feed producers is that farmers cannot accept lower growth performance".

"For example in India, for every 30% increase in feed costs (such as for wheat flour), costs of production will rise by one INR. The contrast is in China where costs are low. The average feed costs are about USD 910/tonne with FCR of 1.2 to 1.3. This goes down to 1:1 in the production of small shrimp".

However, with a large proportion of production (more than 80%) destined for export markets, the depreciating US dollar against Asian currencies in recent months is not helping industry either.

Dr. Chen said, "In general, costs of production in Thailand are around THB 90/kg (USD 2.5) whereas ex farm prices are around THB 125/kg (USD 3.5) for the large size shrimp. The Thai baht which has

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Prof Chen Jiaxin is formal Director at the Yellow Sea Fisheries Research Institute, Qingdao, China. He is pictured here with Mr Tomohiro Asakawa, NOAA/NMFS at the China Fisheries and China Aquaculture 2006, Qingdao.

Dr Chen Ming Dang is Vice President, Charoen Pokphand Public Foods Ltd. He is based in Bangkok, Thailand.



strengthened at a faster pace than other Asian currencies is also working against farmers in Thailand. We are encouraging farmers to produce larger sizes of 20g so as not to compete with producers in China. This means reductions in stocking density."

Although cost of production is the key factor, it is more important for the farmer to obtain higher profit margins.

Dr. Chen said, "In Hainan, Guangdong, Guangxi and Fujian Provinces of China, we are working with farmers to improve on culture concepts. In Guangdong, the stocking density is high at 220/m² i.e. 150,000/mu (666m²). Ideally, if stocking rates can be reduced to 75-80/m², shrimp can reach 15g instead of the current 10g. Farmers gain with higher prices for shrimp of this size".

2007 and beyond

In most countries, the focus will be on the vannamei shrimp. Generally, there has been little interest in other species, according to Dr. Chen.

In China, Prof Chen Jiaxin, Yellowsea Fisheries Research said that the production of the Chinese shrimp *Ferropenaeus chinensis* has shown a slight increase. More vannamei will also originate from Asian farms now that the Philippines has officially approved its culture (see page 4). In Vietnam, more than 100,000 tonnes is estimated to be vannamei shrimp in 2007. This will double by 2010, said Chuang. Dr. Chen also expects a boom in production from Vietnam in 1-2 years.

The size of vannamei shrimp is also important. As costs of production are high in Thailand and Vietnam, the strategy in these two countries will be to produce larger size shrimp. Vietnam's production is in 15-25g shrimp, mainly of black tiger shrimp whereas 90% of Thailand's production is shrimp of less than 15g. In June, the price in the Japanese market was USD 15 for 13/15 size black tiger from Vietnam whereas that for vannamei shrimp from Thailand was USD6/kg for 31/40. The potential is in larger vannamei shrimp.

Quality continues to be the main issue affecting exports from Vietnam, China, Indonesia, India and Bangladesh. SEAI and MPEDA (Marine Products Export and Development Authority) are working on the muddy smell problem in shrimp exports to Japan, according to AJ Tharakan, President of SEA. Shidi Muslim of the Indonesian Shrimp Commission said that the quality control system in Indonesia is not equivalent to the system used in the EU based on inspection results in April 2004. Despite this, Indonesia has taken steps to improve such as adoption of methods and operational techniques which will be inspected and verified by EU authorities.

Several top buyers at the Thai Fish Show in June, 2006 spoke well of the quality of shrimp from Thailand. Generally, importers pay more for higher quality shrimp. Its export potential is due to the good food safety management with control plans on heavy metals and contamination by the Department of Fisheries, according to Poj Aramwattananont, President of the Thai Frozen Foods Association.

To further increase its competitiveness, Leonard Minster, from the Red Chamber Group, USA said, "Sustainability, traceability and innovation have increased Thailand's competitiveness. To be a leader, Thailand must set standards before they are set for the country and enforce the standards energetically".

This should be applicable to all countries in the production of quality shrimp.

** References are available on request*

The impact of US antidumping duties and tsunami

Two uncontrollable challenges to the industry in Asia were the US antidumping duties (AD) imposed on China, Vietnam, Thailand and India since December 2004 and the tsunami of December 2004 which affected parts of Indonesia, Sri Lanka, India, Malaysia and Thailand.

In 2005, the Network of Aquaculture Centres in Asia (NACA) assessed the positive and negative impacts on the shrimp industry in selected countries for the period from January 2004 to December 2005. Indonesia was chosen for the assessment on the impact of the tsunami and Vietnam for that on AD. Bangladesh was used as an example of a country not subjected to either event.

In Vietnam, farmers complained that the AD brought down prices. They reduced investments by cutting down on stocking density, crop/year and production costs. This brought down yield per crop. To mitigate the negative impacts, industry reduced production and marketing costs, improved shrimp quality and produced more valued added products. There was, however, a better understanding of international trade issues. The industry has gradually recovered and has maintained a stable growth with wider export markets.

In Indonesia, the tsunami destroyed hatcheries and mainly interrupted broodstock and postlarvae supply to other parts of the country. Respondents believed that lower prices were because of the perceived contamination with human pathogens from the massive human casualties. This brought down the image of Indonesian shrimp. The report said that, "In general, Indonesian shrimp appeared to be facing several problems, not simply associated with these unusual events but also due to a limited capacity to supply international markets requesting quality products".

Although the tsunami brought massive devastation to Indonesia's Aceh Province, it also allowed Indonesia to restructure and invest in shrimp aquaculture. This will probably increase the long-term sustainability of the sector and image of Indonesian shrimp to give it a competitive advantage.

Bangladesh took the opportunity of the AD to sell products in the US market. Prices were generally better but this appeared to be short lived as concerns on quality appeared. (Source: Evaluation of the Impact of the Indian Ocean tsunami and US Antidumping duties on the shrimp farming sector of South and South East Asia. Case studies in Vietnam, Indonesia and Bangladesh, NACA, October 2006.)

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Progress with managing shrimp diseases



Using pond liners to mitigate diseases in Indonesia

Fewer sporadic reports of disease outbreaks may indicate that strategies in shrimp health and disease management have helped many in the farmed marine shrimp segment to improve survival rates for a more sustainable production. However, a continuous vigilance and preventive management is still required, according to industry experts. Whereas bacterial and fungal diseases can usually be controlled by good management, viruses are the major problem. The recent emergence of IMNV in shrimp culture in Indonesia may pose a new threat.

It has been over 15 years since reports of white spot syndrome virus (WSSV) disease in farmed black tiger shrimp first emerged in Asia. By 2002, WSSV was no longer causing as many major losses compared to previous outbreaks. However, more intensive culture systems have brought new threats in the form of other viral diseases. The restoration of highly intensive production models common in the 1980's may be impossible but the goal is now simply "success with good survival rates and sustainable production".

The true cost of damage from WSSV and other viral diseases has been difficult to quantify. Flegel (2006) reported that the damage could be around USD 15 billion over the last 15 years. It is this profound economic loss which the industry needs to avoid.

Aside from WSSV, other major virus diseases are yellow head virus (YHV), Hepatopancreatic parvovirus (HPV), Monodon baculovirus (MBV), Infectious hypodermal and haematopoietic necrosis (IHNNV) and Taura syndrome (TSV). In Thailand, Withyachumnarnkul (2006) said that WSSV continues to cause mass mortalities. Although YHV is deadly, outbreaks are fewer than WSSV. TSV and IHNNV affect *P. vannamei* more than *P. monodon*. The major problem facing *P. monodon* at present is Monodon slow-growth syndrome (MSGs) which may be due to a new virus or viruses. In Indonesia, farmers face the threat of Infectious Myonecrosis virus (IMNV, see page 17) which has recently been reported.

Lessons learnt

Reported success stories indicate that farms following "Best Management Practices" (BMPs) such as using certified and specific disease free postlarvae, employing good soil, pond water and shrimp

management practices, biosecurity measures as well as probiotics are doing fairly well in many regions.

The advent of better diagnostic tools has also enabled more diseases to be detected earlier, according to Robin Liew (pers comm.). One positive aspect is that there is generally a greater awareness about viral diseases and the benefits of BMPs, PCR screening tests and implementation of good biosecurity measures among farmers in the region.

Farmers now have a better understanding of the science of shrimp culture. According to Limsuwan (2005), management protocols developed in the Thai shrimp industry are applicable elsewhere and are being adopted by the rest of the region. In the Philippines, several organisations have collaborated to develop a revised manual of strategies to reduce the risks of WSSV (see box).

With WSSV, it has been the combination of knowledge in pathology and epidemiology that has facilitated the investigation and diagnosis of the disease and allowed the development of better measures to prevent the spread of the disease at farm level, according to Dan Fegan, Aquaculture Technical Manager, Alltech.

Ongoing work by the group led by Dr Peter Walker, CSIRO is also helping industry in India through a collaborative epidemiology study with MPEDA. This study looked at the ability of labs in India to conduct PCR tests for WSSV and provided data on the validation of the method. The study, which involved many different labs, showed that all could successfully detect viral contamination and were capable of undertaking molecular studies. It also shed more light on the question of why the PCR approach in Thailand has been successful in preventing the spread of disease while this has not been the case in India by showing that this was not due to Indian labs not being able to do the test successfully.



Dan Fegan (left) with participants at the study tour of the shrimp health management workshop held in July, 2006



Mr Banchong (centre), Banchong Farm showing Dr Pornlerd Chanratchakool, Novozymes (right) and a participant of the study tour, the sea weed, *Caularipa* sp. which he used as biological treatment in his farm.

"What we appear to have in India is similar to what we see in South America where there are large areas with lots of farms. If we remove the post larvae as the major source of WSSV entering the farm, the next highest risk is from wild crustaceans. Where there are large farms or areas of farms, these can represent a significant reservoir of infection even where PL are clean", said Dan.

Pond management and risks


We still have along way to go in managing risks successfully although it is clear that the problems with diseases are a lot less than we experienced in the mid 1990's, leading to fewer failures and cost savings in the industry, according to Dan.

Although it is common knowledge that stocking is best done when the temperature is higher and stable, many farmers continue to take risks by stocking early in the year. Studies show that the rate of mortality in shrimp infected with some virus diseases such as WSSV and TSV is affected by water temperature. If shrimp are infected, either as PL or older shrimp, they can survive reasonably well as long as the temperature remains above 30°C. However, if the temperature drops below around 27°C, mortality rates increase creating problems for the farmer. Thus, the right time to stock ponds is when the temperature has risen and has stabilised.

"However, we still see farmers across the region trying to stock early in the hope of an early harvest to get better prices. However, set against this is the higher risk of failure if the temperature drops. For example, in one area of India some years ago, farmers stocking before the temperatures were stable had total crop failures unlike those who stocked later when the temperature was high and stable. Stocking early for better prices is a business decision but the main concern is that farmers are aware of this and understand the risk that they are taking. In my experience we still need to educate farmers in managing these risks".

Many farmers also take risks from the introduction of new or exotic viruses. The recent threat from IMNV can be severe and financially damaging for the farmer as affected shrimp may continue to feed, increasing FCR and production costs. This disease may be more problematic than WSSV and further underlines the need to be very careful with the movement of live crustaceans into and around the region (see page18).

"The two-pronged approach combining pond management and health monitoring has worked for many farmers. However, epidemiology, the study of disease in populations, remains one area which is under-represented. Epidemiological studies have helped us to understand how diseases can spread within the population in a single pond, between ponds in a farm and between farms and areas in a country or region. It



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has also helped us to better identify the risks and their relative importance. This approach was particularly useful as epidemiological analysis of white spot outbreaks allowed us to quickly determine that the post larvae were an important factor in the spread of the disease even before we knew it was caused by a virus. This allowed us to focus on the PL as the major risk rather than looking at every single potential cause”.

“Successful epidemiological analysis requires good records of the various parameters that may be associated with a disease. Unfortunately, this is another area where we lag behind. Although we have the tools for tracking diseases, few farmers maintain adequate records that can be used to quickly identify the risks and allow us to focus our efforts on the major ones. To overcome this will require further education of farmers in keeping records as well as using them for making good management decisions”, added Dan.

According to Liew, although there has been progress, there should not be any let up in vigilance. The use of clean and certified shrimp has helped the industry but there is still a lot of confusion in the industry regarding the definition of SPF (specific pathogen free) shrimp. Many farmers still do not know that when SPF stocks leave the SPF nucleus breeding centre (NBC), their SPF status cannot be guaranteed and are designated as “high health” shrimp. A false sense of security has also been created with the terminology SPR (specific pathogen resistant).

Managing risks and biosecurity

The highest risk of introducing diseases is through the import of live animals (broodstock and fry) from infected areas (Flegel and Fegan, 2002). Prior to the removal of restrictions on the culture of *P. vannamei* in Malaysia, Indonesia, Vietnam and the Philippines, the private sector had already illegally imported broodstock and postlarvae with little consideration on the risks of disease introduction. As a result, TSV was reported in Indonesia in 2004 and several viral pathogens, including TSV, were introduced into China (Briggs et al., 2004). Most governments were unprepared for these outbreaks.

Following the introduction of *vannamei* into Asia, a survey was carried out to look at issues on transboundary movements of shrimp and potential problems (Briggs et al., 2004). Broodstock imports are currently an indispensable part of the shrimp farming business and, although many countries have procedures and regulations covering responsible movement, most imports are carried out through illegal or illicit channels. Problems arise when regulatory authorities lack resources to enforce the regulations and it has been suggested that the industry should be more aware of the potential risks of pathogen transfer to better understand the consequences of such actions.

The same report also suggested that imports of SPF supplies of *vannamei* shrimp from Hawaii and Florida must still be done cautiously



Tim Flegel (second from left) with participants from Indonesia and Malaysia

since non-SPF animals, even if they are resistant to a virus may still act as carriers and introduce pathogens into areas currently free of the disease.

A clear example of managing risks is seen in the proposed draft on import analysis by Biosecurity Australia which analyses the potential risks and asks for stronger risk management measures. Australia currently allows imports of shrimp and shrimp products for human consumption compliant with its quarantine conditions such as country or zonal freedom from disease, removal of the head and shell, and testing for WSSV, YHV and IHNV. Five disease agents of potential concern (WSSV, YHV, IHNV, TSV and necrotising hepatopancreatitis bacterium) require quarantine risk management measures if imports are to be permitted.

References

- Briggs, M., Funge-Smith, S., Subasinghe, R. and Phillips, M., 2004. Introductions and movement of *Penaeus vannamei* and *Penaeus stylirostris* in Asia and the Pacific. FAO, Bangkok, 2004. RAP Publication 2004/10 Biosecurity Australia (www.biosecurityaustralia.gov.au)
- Flegel, T., 2006. Principles of disease and disease diagnostics. Presented at the Shrimp Health and Management Training Workshop, 24-29 July, 2006.
- Flegel, T and Fegan, D., 2002. Preventing the Spread. Part 3. Asian Aquaculture, May/June 2002. p17-19.
- Liew, Robin, pers comm. Business Development Manager, Lab Ind Resource Sdn Bhd, Malaysia
- Withyachumnarnkul, B., 2006. Research and development in *Penaeus monodon* Hatchery. Presented at the First UK-Asia Pacific Workshop on Sustainable Aquaculture, August 22-24, 2006, Singapore.

A manual to restore culture in the Philippines

In this manual, the authors, Roselyn C Usero, Juan D Albaladejo and Maria Abigail G Apostol – Albaladejo provide information on the semi closed and closed culture systems which replaces the green water culture technology previously used in the industry in the Philippines. It also explains the biosecurity measures and the use of microbes in soil and water treatments. The manual is divided into two sections.

The first deals with the essentials during the pre stocking phase of culture such as the checking of disease status of crustaceans in the intake water with PCR two months prior to land preparation and water filling. The paragraph on fry selection explains the steps in fry screening which begins at PL10. Criteria for fry quality are detailed in appendices. Several figures explain the fluctuations to be expected during the culture cycle such as the effects of liming on total alkalinity and pH.

The second section on management strategies details out the steps when ponds are infected with WSSV and how to control its spread. Preventive measures to avoid recurrence are also given in the following paragraphs. Overall the manual does serve as a useful guide for farmers intending to secure better and consistent yields. For more information: Email: jalbaladejo@bfar.da.gov.ph



Infectious Myonecrosis-IMNV

An Indonesian experience by Iffa Suraiya

Yani Lestari, researcher at the Brackishwater Aquaculture Centre in Situbondo, East Java said that IMNV was first discovered in *P. vannamei* shrimp in June 2006. The pathogen was verified as IMNV with nested PCR, using primers from IQ 2000 (Farming IntelliGene, Taiwan). This infection was detected in shrimp of 60-70 days old. In the beginning, colouration of the tail muscle was white. Infection then moved from the sixth segment towards the fifth and to the fourth segments. In severe cases of necrosis, shrimp had an appearance of cooked shrimp.

Then in September 2006, outbreaks from other areas in East Java (Banyuwangi, Blitar, Jember, Malang and Tuban) surfaced and these were later confirmed as IMNV. Here shrimp were infected much earlier at 30 days. Shrimp were from local and imported (SPF) broodstock. More recent incidences have now been reported from farms in Bali, Lombok, Sumbawa and Lampung.

In an interview, Chamdan Yasin, a farm manager from Jember in East Java, said that the farm was hit by the disease in October when shrimp were 30 days old. Nevertheless they still managed to harvest after 80 days. FCR was 1.15 and the average shrimp size was 11g and the total production was 15 tonnes/ha. The farm has 8 ponds with an average water area of 4,600m²/pond. The stocking density was 140 PL/m² and the postlarvae came from local broodstock.

He explained that he managed to control IMNV with careful management of water quality. There should be no fluctuations in water quality parameters. Minimum water exchange was practised. By removing soil from the pond bottom and using pond bioremediation products to reduce the organic load in the ponds, he has managed to ensure a healthy plankton bloom. Aeration was increased. All dead or moribund shrimp were removed from the bunds. He physically removed those on the pond bottom by diving into the pond. To improve the health and immune status of shrimp, he added Vitamin C at 3 gram/kg feed as well as a feed additive. Biosecurity was improved by fencing the ponds to prevent the entry of crabs and by using sterile scoop nets and cast nets and other equipment.

In Trobos (August 2006), the Director of Aquaculture, Department of Fisheries and Marine Affairs, Made L Nurdjana said that the damage from these outbreaks can be significant. Despite a quick harvest, surviving shrimp do not have any market value because of the change in appearance. Otherwise, after two months of culture, shrimp are 80/kg in size. Ketut Sugama, Head of Aquaculture Research said that they have determined that transmission is vertical from the broodstock



Fifth and sixth segments of vannamei infected



White meat of vannamei

Vannamei infected by IMNV

All pictures courtesy of Yani Lestari, BBAP, Situbondo,

to postlarvae and horizontally in the ponds. What is being recommended is that imports of live shrimp are quarantined and tested for IMNV. Infected shrimp should be destroyed and the facility disinfected.

The first outbreak of IMNV was in Northeast Brazil in 2002. By 2003, the estimated loss was around USD 20 million. The causative agent of this disease was confirmed by Dr. Donald. V. Lightner from the University of Arizona (UAZ). Lightner reported that outbreaks of the disease seem to be associated with certain types of environment and physical stresses (i.e. extremes in salinity and temperature, collection by cast net, etc.), and possibly with the use of low quality feeds. IMNV has an acute onset of gross signs and elevated mortalities, but can also progress with a more chronic course accompanied by persistently low level mortalities. Affected shrimp has extensive white necrotic areas in the striated muscle especially in the distal segments and tail fan. These may become necrotic and reddened in some individual shrimp.

Based on a licensing agreement signed between UAZ and Farming IntelliGene Corporation (FITC) in 2004, FITC was authorized to develop a test kit for detection of IMNV. IQ2000TM IMNV Detection and Prevention System was then developed and launched in 2004. It is a nested PCR based detection system which also incorporates internal control and semi-quantitative features. The former design eliminates false negative possibilities and the latter one differentiates IMNV infection into 4 levels. (Sources: D.V. Lightner, 2004. The penaeid shrimp viral pandemic due to IHNV, WSSV, TSV and YHV in the Americas and current status. www.lib.noaa.gov/japan/aquaculture//proceedings/report32/lightner_corrected.pdf; Simon Chung, FITC)

Import Risk Analysis for the freshwater crayfish

By Noppadon Sukrakanchana, Suppada Kiriratnikom Suppada and Kidchakan Supamattaya

Indication of high risk of White spot syndrome virus (WSSV), crayfish plague and fungal disease caused by *Aphanomyces astaci* in imported freshwater crayfish

As the farmed marine shrimp industry in Thailand began to encounter several problems leading to unsuccessful harvests and huge losses, some new and non-indigenous aquatic species, such as *Penaeus vannamei* and the freshwater crayfish *Cherax quadricarinatus* were imported into Thailand as alternatives. The favoured choice was the freshwater crayfish which could be cultured further inland in Thailand.

Since 1993, it was possible that the crayfish was already being brought into the country as an ornamental species from North America and Japan and from Australia for culture purposes. It was also probable that the species had entered the country through unofficial avenues. Thus the question raised was whether the species will be harmful to the wild species in Thai waters or to native or imported species already in farms and hatcheries.

An import risk analysis (IRA) can be used to identify any hazard and estimate the risk presented by its importation. It can indicate if the crayfish harbours pathogens of disease potentially hazardous to the billion dollar shrimp culture industry. An IRA is also a requirement to ensure that food is safe for consumers. As Thailand is a signatory to the SPS (Sanitary and Phytosanitary Measures), any hazard has to be accounted for, both qualitatively and quantitatively.

The process involves hazard identification and characterization, risk assessment and risk management. Hazard identification looks at infectious disease agents exotic to Thailand or existing in Thailand but subject to the official control or is OIE (World Organisation for Animal Health) listed and expected to cause significant harm in Thailand.



Crayfish imported from Australia

A high risk to WSSV

The risk assessment using risk evaluation matrix indicates a high risk of White spot syndrome virus (WSSV) and crayfish plague, and fungal disease caused by *Aphanomyces astaci* in imported freshwater crayfish, posing a high risk, while other viral diseases such as CqBV, PIBV, CdSPV as well as bacterial, parasitic and other fungal diseases are excluded from the risk assessment.

This process of risk management has led to a set of acceptable measures or strategies for each identified hazard for which the unrestricted risk is considered higher than the appropriate level of protection. These measures or strategies will reduce risk to a level that is considered acceptable.

The proposed measures include pre-import measures:

- the importers must apply for the import by presenting health certificates from the country of origin that is free from certain diseases;
- effective quarantine measures over a period of time, etc.

Post-export measures include a restriction on farming area, inspection, control and registration of entrepreneurs over translocation and disposal of bloodstocks and larvae. Also necessary are long-term measures for broodstock production centres to commit to domestication of the species and reduce the importation of freshwater crayfish in the future.

**Presented at the First UK-Asia Pacific Workshop on Sustainable Aquaculture, August 22-24, 2006, Singapore.*

Figure 1.

Disease agents whose risk is "acceptable"	Disease agents whose risk is "unacceptable"
Infectious pancreatic necrosis virus (IPNV)	White Spot Syndrome Virus (WSSV)
<i>Astacus</i> bacilliform virus (AaBV)	Crayfish plague (<i>Aphanomyces astaci</i>)
<i>Pacifastacus leniusculus</i> bacilliform virus (PIBV)	
<i>Cherax quadricarinatus</i> bacilliform virus (CqBV)	
<i>Cherax</i> Giardiavirus-like virus (CGV)	
<i>Cherax destructor</i> bacilliform virus (CdBV)	
Spawner -isolated mortality virus (SMV)	
<i>Cherax destructor</i> systemic parvo-like virus CdSPV	
Hepatopancreatic rickettsia like organism (Hepatopancreatic-RLO)	
Nocardiosis	
<i>Psorospermium spp</i>	
<i>Tetrahymena pyriformis</i>	
<i>Hyalophus woffi</i>	



The risk is also in hatcheries in the country



Noppadon Sukrakanchana

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The antiviral effect of algal fucoidans

Fucoidan, extracted from the brown algae *Cladosiphon okamuranus* has been shown to be effective against WSSV in the white shrimp *Litopenaeus vannamei*

By Cruz-Suárez, L. E., Hernández, J., Porchas-Cornejo, M., Coronado-Molina, D. E., Linné-Unzueta-Bustamante, M. L., Nieto-López, M., Tapia-Salazar, M1., Ricque-Marie, D

Various studies in shrimp have shown that the inclusion of brown seaweed meals or algal fucoidans (sulphated polysaccharides) in shrimp feeds reduces White Spot Syndrome Virus (WSSV) infections. Takahashi et al., 1998; Cruz-Suárez et al., 2002; Chotigeat et al., 2004 and Balasubramanian et al., 2006).

The sulphated fucan extracted from *C. okamuranus* has been reported to reduce the mortality caused by WSSV in *Penaeus japonicus* juveniles (Takahashi et al., 1998).

In order to corroborate the antiviral activity of the *C. okamuranus* fucoidan against WSSV in *L. vannamei* juveniles, five diets were prepared with additions of 0, 0.2, 0.4, 0.6 and 0.8% of this fucoidan. Diets were fed for two weeks to WSSV-free *L. vannamei* juveniles (15g average initial body weight, maintained in seawater at 26°C). Ten shrimp from each treatment were infected by force feeding (Figure 1) with a WSSV-positive shrimp tissue extract (infective dose: 1.4×10^3 WSSV copies). An additional group of shrimp, fed a commercial diet without fucoidan, received a WSSV-free tissue extract by the same way (negative control). Mortality was monitored daily for 12 days after the challenge. All shrimp (dead or live) were sampled to analyse the presence of WSSV by PCR (polymerase chain reaction).

Shrimp fed 0% fucoidan diet had 100% mortality five days after infection. Shrimp fed 0.6 and 0.8% fucoidan diets had 60% survival at 12 days, while those fed with 0.2 and 0.4% fucoidan diets had 80 and 90% survival, respectively (Figure 2). The presence of WSSV was confirmed in one of the infected shrimp fed the 0% fucoidan diet, while none of the infected shrimp fed fucoidan diets were positive to WSSV.

This study indicated that a low dietary concentration of the fucoidan extracted from *Cladosiphon okamuranus* can protect the white shrimp *L. vannamei* against a low WSSV infective dose. The effect of fucoidan against higher infective doses remains to be studied.

Figure 1 Viral extract inoculation by force feeding



harina de kelp en la prevención de infección viral (WSSV) en camarón blanco *L. vannamei*. Panorama Acuícola. Mayo/Junio de 2002. Vol. 7 No. 4. Págs. 16-19.

Chotigeat, W., Tongsupa S., Supamataya, K., Phongdara, A. 2004. Effect of Fucoidan on Disease Resistance of black tiger shrimp. Aquaculture 233(1-4), 23-30.

Balasubramanian, G., Sudhakaran, R., Syed-Musthaq, S., Sarathi, M., Sahul-Hameed, A.S. 2006. Studies on the inactivation of white spot syndrome virus of shrimp by physical and chemical treatments, and seaweed extracts tested in marine and freshwater animal models. J Fish Dis. 29(9), 569-572.

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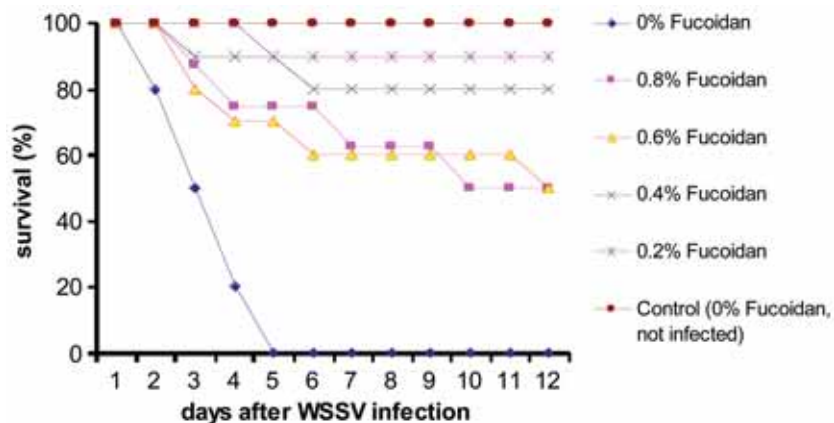
Note: This article is a translation from Spanish from the poster titled 'Antiviral effect of the fucoidan extracted from the brown algae *Cladosiphon okamuranus* against WSSV in the white shrimp *Litopenaeus vannamei*', presented at the VIII International Symposium on Aquatic Nutrition. November 15-17, Mazatlan Sinaloa, Mexico. The article was requested by reader Sim Tze Fang, Sarawak, Malaysia.

References

Takahashi Y., Uehra K., Watanabe R., Okumura T., Yamashita T., Omura H., Kawano T., Kanemitsu A., Narasaka H., Susuki, N., Itami T., 1998. Efficacy of oral administration of fucoidan, a sulphated polysaccharide, in controlling white spot syndrome in kuruma shrimp in Japan. In Flegel T.W. (ed) Advances in shrimp biotechnology. National Center for Genetic Engineering and Biotechnology, Bangkok.

Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Guajardo Barbosa, C., Cleveland, Karyn and Ken Hasson. 2002. Efecto de alimentos con

Figure 2. Survival of shrimp treated with different dietary Fucoidan levels and infected with WSSV infected tissue extract, except control (DC)



Fucoidan was extracted from the Japanese Brown algae *Cladosiphon okamuranus* (Japan)

How to make micro aquatic feed

By Mian N. Riaz and Galen J. Rokey*

Three viable extrusion processes that can be used in the production of micro-aquatic feeds are discussed.

Large pellet extrusion followed by crumbling

The system currently used by many aquatic feed manufactures is to produce a large diameter pellet then break the pellet into smaller pieces through the use of a crumbling roll.

Table 1: Advantages / disadvantages for crumbling process

Advantages	Disadvantages
High capacity	Low yields
Low cost / unit throughput	Final product sifting
Easy recipe preparation	Unattractive appearance
	Poor water stability
	Sinking only
	Sharp pellet edges (could lead to higher mortality)

Sphere-izer Agglomeration System™ (SAS™)

The SAS™ process is designed to produce more uniform and nutritionally homogeneous particles than a traditional crumbling system. A uniformly mixed and pulverized formulation passes through a low shear, low temperature extrusion process where it is conditioned and compressed to form agglomerated strands. The strands enter the Sphere-izer™, a sizing and shaping device that breaks the strands into individual agglomerations and shapes them into spherical particles.

Currently, there are at least three such systems in operation. Due to the low extrusion temperatures, this process is most advantageous for medicated feeds. One of the main disadvantages of the SAS™ process is that the processed feed is not pasteurized.

Table 2: Advantages/disadvantages for SAS™ Process

Advantages	Disadvantages
Low temperature process	No pasteurization
Moderate investment	Final product sifting
	Low rates
	Low product durability
	Requires a dedicated line
	Sinking only

Direct extrusion process

A process that is currently receiving a lot of interest for producing micro-aquatic feeds is direct extrusion. This process allows the feed to be sufficiently heated and cooked to allow pasteurization.

Table 3: Advantages /disadvantages for direct extrusion process

Advantages	Disadvantages
Pasteurization	High cost / unit throughput
Excellent appearance	Final product sifting
Good water stability	Low rates
All internal oil	Requires a dedicated line
Partial floating possible	
Good durability	

The following table outlines the systems and rates for products produced via direct extrusion.

Table 4: Systems / Rates for direct extrusion

Extruder ^a	DDC	Motor hp	Extruder Capacity (kg / hr) @ given die hole size			
			0.6 mm	0.8 mm ^b	1.0 mm ^b	1.5-2.0 mm ^b
X-85	2	40	100	200	250	350
X-165	16	150	N / A	1500	1800	2600
TX-57	2	40	100	200	250	350
TX-85	16	150	N / A	1500	1800	2600
TX115	32	300	N / A	1500	1800	3000
C2TX 8.01	54	250	N / A	1000	1000	2000
C2TX 16.2	108	400	N / A	2000	2000	3000

^a All extruders, except the C2TX, should be equipped with an open vent.

^b 100% sinking product can be guaranteed, product size of less than 2mm cannot be guaranteed to be 100% floating

When producing micro-aquatic feeds via direct extrusion, it is best to use the following flow.

- Pulverizer (100% through 250 microns)
- Rotary sifter (300 micron screen)
- Extruder (with oil injection screened through 250 microns)
- Pneumatic conveying system



Wet strands of micro-aquatic feed diet coming from extruder and before Spherizer



Micro-aquatic feed pellets discharging Spherizer



Micro-aquatic pellets after Spherizer and before drying



Measuring temperature of product coming from extruder



Close-up of extruder die used for forming wet strands of micro-aquatic diets

- Dryer (screen size < 300 microns)
- Recommend a fluidized bed dryer when product size is smaller than 1.0 mm
- Optional sifter
- Packaging

Some guidelines

Extruder manufacturers do not recommend smaller than 1.2mm holes for a single screw extruder system. However, there are a few facilities running 0.8mm holes against extruder manufacturer's recommendations. In order to have a chance of being successful, they must follow the following guidelines:

The production of micro feeds (< 2 mm) requires a specialized, dedicated line which must geared around the small extruder die openings. If the majority of product to be produced on this line is for micro feeds, then there are several critical recommendations to ensure long term production of quality feeds.

1. All mass flow inputs must be free of material that is large enough to block or partially block the die openings. This includes the steam, water, fat, and other liquid inputs. The water and steam lines going to the extruder system need to be fitted with screen filters having 30 mesh (0.6 mm) openings and these should be adequate if maintained. The fat line (and fat source) needs to be filtered to remove debris larger than 30 mesh (0.6 mm) also. All strainers or filters must be easy to clean or they will get removed "in the heat of a run" were liquid flows are interrupted due to plugged filters. It may be necessary to have a dual filter set up. With this being installed if one filter is plugged you can close the valves to the

primary filter for cleaning and open the valves for the second for continued operation.

2. On the same subject, the dry feed must pass through a sifter after the grinder and before the extruder live bin. This sifter must be sized to remove particles the same size or larger than the die openings. High fish meal diets plug vibrating sifter screens very easily and the industry often employs rotary sifters to avoid this bottleneck.
3. Pneumatic conveying is recommended from the extruder die to the dryer inlet for several reasons:
 - For product containment around the die/knife area. The small diameter feeds results in spillage in this area and will cause sanitation problems.
 - For product separation. Floating feeds have a tendency to stick together when wet on belt or HVH conveyors and pneumatic conveying enhances separation.
 - For separation of "tails" from pellets. Pneumatic systems "scrub" the product and remove tails for later separation during sifting.
4. Fluid bed dryers are recommended for products under 2mm diameter in size unless they have special polyester screen in the dryer.
5. Final product sifting after dryer and before coating.

Production procedures.

This small diameter product requires a dedicated line, strict startup and shutdown procedures to avoid die plugging, and thorough cleanup techniques. The extruder and coater areas should be considered as "wet areas" for cleaning. The coater may need to be cleaned between each different pellet size to avoid cross contamination.

Some manufacturers of aquatic feeds follow the philosophy below in choosing the system for aquatic feed production.

SAS System	0.3 to 1.0 mm feeds
Twin screw System	0.8 to 2.5 mm feeds
Single screw System	2.0 to 8.0 mm feeds

The importance of the sifting operation

It is critical for three main reasons

- To remove "over" (large tails and "doubles") for regrind.
- To remove "fines" for regrind. This prevents a mess during coating step where the fines are also coated and cause buildup.
- To separate good pellets into several different diameters depending on the client criteria for size. The expectations from the industry will be for tight specs on pellet size and this can easily be controlled at this point by sifting product and producing several different sizes at the same time and setting the standard for the industry. The primary-sized product can be sent on through the system for coating and into final product bins. The secondary sizes can either be reworked or saved separately in tote bags for coating and bagging later.



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Alltech Bioscience Centre in Bangkok

Focus on SSF technology with local substrates and use of enzymes in aqua feeds

In issue 6, Volume 2, 2006 we reported the opening of Alltech's new Bioscience centre in Bangkok. During Alltech's APLT meeting in Kuala Lumpur, AAP met up with Dr Keith Filer, the head of the centre and Dan Fegan, Alltech's Technical Manager for Aquaculture. Below are their views on the role of the centre and how Asian aquaculture can benefit from their research.



Keith Filer joined Alltech in 1997 as Senior Research Scientist to develop operating procedures for novel enzyme production systems. As Research Manager of the Alltech Bioscience Centre in Bangkok, he is responsible for coordinating all internal and external research in the Asia Pacific region and on the SSF enzyme production.

Dan Fegan joined Alltech Inc in 2004 as Technical Manager, Aquaculture, based in Bangkok. His experience in aquaculture is global, beginning with commercial shrimp production and hatchery technology in Ecuador and subsequently in Asia from 1986.



On the mission and goals of the centre...

KF: Our overall mission is to focus Alltech's research within the Asia Pacific (AP) region and show customers our commitment to the region.

Our primary goal will be to develop solid state fermentation (SSF) technology, using raw materials abundant in the region, to complement the current SSF process.

Compared with our other Bioscience Centres, our goals are focused on the needs of the Asian market. We want to develop close associations with universities in the region and develop local students as we do in our other centres. My vision is to have more space, develop research outside of SSF and add an aquaculture research centre to address more issues in-house.

On the location of the centre...

KF: We lease laboratory space within the BIOTEC (National Centre for Genetic Engineering and Biotechnology) facilities developed by the Thai Government as a Science Park. Bangkok was a natural choice as it is centrally located and we already have a regional office in the city.

DF: For aquaculture work, we have access to facilities at BIOTEC, which already has a strong program in aquatic animal biotechnology, as well as research work with BIOTEC's Shrimp Biotechnology Business Unit (SBBU).

On gaps in aqua nutrition and fitting in enzyme R&D....

KF: In the aquaculture industry, we are still trying to figure out how best to use enzymes. Alltech has also been active in trying to understand the effect of nutrition on gene response, "nutrigenomics", and fundamental physiological processes instead of just looking at survival and growth. With nutrigenomics, we can see the effect of diet at gene level. This could help us understand how, for example, nucleotides in NuPro provide benefits to the animal.

We also want to develop next generation products appropriate to specific aquaculture needs. With enzymes, the issue is more on delivery, which is less a nutritional problem and more a physical constraint.

DF: The biggest constraint to the use of enzymes in aqua feeds is the heat generated during processing which destroys most or all of the enzyme activity. Post pellet addition requires extra equipment and usually requires liquid enzymes. Then there is the problem of enzyme loss and dilution once the feed goes into the water.

Enzymes have specific pH and temperature optima and many enzymes have been developed for animals with a stable body temperature of 37°C. Aquaculture species are cold-blooded so water temperature is important. As it varies away from the optimum, enzyme activity decreases. Gut pH is also an issue as the pH of many aquatic species gut is not ideal for some of these enzymes. One approach is to use enzymes to treat raw materials, improving digestibility before the mash is heated and it is this aspect of Keith's research that will have relevance to the aqua field.

Much of our work focuses on the future reality facing the industry. We are used to formulating diets that are inefficient in terms of protein use. However, the days of cheap fish meal have gone and economic alternatives need to be seriously examined. Our work on enzymes, alternative protein sources and the functional properties of nutrients focuses on efficiency to maximise animal health and production but also other economically important aspects of aquaculture products such as meat quality and yield.

Note: Nutrigenomics studies the effect of nutrients on gene expression to understand the functional interaction between diet and the genome. This can help to identify the association between diet and specific responses such as the immune response and allow nutrition to be tailored to specific needs of the animal.

On information flow to industry and vice versa....

KF: We hold several activities such as this annual Asia Pacific lecture tour (APLT). Our annual symposium in Lexington includes an aqua

section and we are looking to develop a university lecture tour where we can meet researchers and students in aquaculture. Two years ago, we joined with NACA to conduct the shrimp health management workshop, and our sales and marketing teams work well together to take information to the field.

We try to ensure that our research is relevant by staying in touch with the market and through regular contact with our country general managers. If we cannot solve an issue internally, we have a large number of external experts who can assist us.

DF: We are strongly influenced by the market and our strength is having people with many years of industry experience who are in close contact with customers.

On synergies in business and with other centres

DF: We have just completed construction of an aquatic research centre in Kentucky. We did this to focus on key research areas and projects that are easier to do in the USA, close to our main analytical facilities, and to concentrate on new aquaculture product development. This does not rule out putting up an aquaculture facility in Asia at some point in the future.

Keith and I meet frequently with our colleagues working in swine and poultry research and it is interesting how we can borrow concepts and ideas from them. We have already seen how consistent the results are across species so it is clear that there are some fundamental rules involved that are common for all species.

We also have a strong coordination with colleagues working in Europe, Latin America and Asia. This allows us to identify synergies between the shrimp industry in Latin America and Asia and in our experience with a variety of fish species in all regions.

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Performance of selected *Bacillus* probiotics in the rearing of the Japanese flounder in China

By O. Decamp, X. Yu, N. Xin and D. J.W. Moriarty

Haifa Farm

Aquaculture is developing and intensifying in most regions of the world in response to the increasing demand for aquatic food products. In China, the production of marine fish has increased from 33,000 tonnes in 1990 to 732,000 tonnes in 2004. According to FAO (2006), flat fish such as the flounder, halibut and sole represented 41,000 tonnes in 2003 and 65,000 tonnes in 2004.



Japanese flounder

This intensification has led to an increased use and misuse of drugs and chemicals in aquaculture, with resulting food safety concerns. Microbial products are seen as, among other things, alternatives to the prophylactic use of chemicals. As discussed in numerous scientific reviews, selected microbial strains can perform a range of functions, from the control of pathogens to the stimulation of the immune system, an enhanced feed utilization and the improvement of water quality.

In this study, we report the benefits of applying commercial mixtures of carefully selected strains of *Bacillus* on the performance of Japanese flounder *Paralichthys olivaceus*.

The *Bacillus* strains that make up the pre-commercial Sanolife fish products were selected for their ability to inhibit fish pathogens directly. In order to evaluate further the benefits of applying selected *Bacillus* strains in flounder culture, pathogens were isolated from hatcheries and land-based farms. The direct inhibition of the isolated *Vibrio* strains was confirmed by the cross-streaking method in the laboratory.

In addition to their direct effect on pathogens or on potential pathogens, these strains were evaluated for their ability to grow in a wide range of environmental conditions prevailing in aquaculture environments (dissolved oxygen concentration, salinity and temperature) and to degrade organic wastes. The safety of these selected *Bacillus*



Sick flounder

strains to various fish species, but also to humans and the environment, had been reported in other communications.

These trials with Japanese flounder were carried out both in larviculture and on-growing facilities in Tianjin (Haifa Seafood Industrial Development Co., Ltd), China.

Performance in larviculture

The combination of relatively high water temperature, high density of larvae, high amounts of organic matter, and low water exchange rates can quickly result in poor hygienic conditions in the larval rearing tanks.

The addition of safe bacteria can improve water quality conditions by degrading the waste products. Furthermore, the probiotics compete with pathogenic strains.

Several trials were performed in April and October 2006 in 40 cubic meter tanks. The seawater was disinfected with 30 ppm of hypochlorite. Sanolife *Bacillus* were applied at 1×10^6 cfu/ml one day before stocking and then at 5×10^4 cfu/ml on a daily basis.

The addition of the *Bacillus* strains on a daily basis, under commercial conditions, was shown to keep the concentration of *Vibrio* below 10^3 cfu/ml during the first 12 days of larviculture of the flounder compared to 10^4 - 10^5 cfu/ml in the control tanks that had received a prophylactic treatment with antibiotics.

Interestingly, similar results were obtained during a trial with gilthead seabream *Sparus aurata* at the Hellenic Centre for Marine Research in Greece.

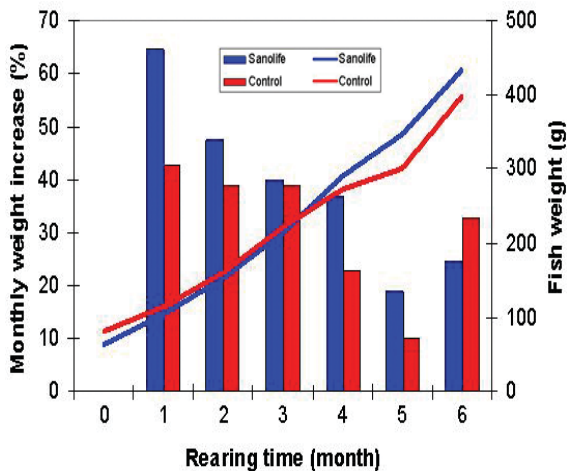
Performance in marine fish during on growing

The fish trial was performed in two separate recirculation systems. Each recirculation system contains 8 fish tanks with an area of 50 m⁴ each. Seawater is pumped from the Sea of Bohai Bay and is recirculated throughout the unit to maintain a high degree of recirculation (approximately 20% daily of water exchange). The process water from the fish tanks flows to screen filters to remove the big particles. The water is then pumped through a protein skimmer where foam fractionation takes place to remove fine particles and organics. At this stage ozone treatment is applied.

The water is then passed through a biofilter of 3 tanks with a volume of 50 m³ each, and CO₂ is stripped in the degassing tank. The dissolved oxygen concentration (DO) of the influent water to the fish tanks is adjusted to 13 mg/l by aeration with pure oxygen from a liquid oxygen station, in order to maintain DO at 8–10 mg/l. The stocking density is maintained at a range of 20–30 kg/m² during the trial.

Flounder (60 - 80g) were stocked in concrete tanks and received 2 separate mixtures of *Bacillus*, one was mixed within the feed pellets and the second was applied directly in the water (once every 2 weeks). The fish were fed 30% of feed pellets and 70% of trash fish. The survival and FCR were good in all tanks. A noteworthy result was the marked improvement in weight gain each month due to the combination of water and feed probiotics (Figure 1). This led to fish reaching market size much faster when receiving the Sanolife.

Figure 1. Fish weight (line - right axis) and monthly weight increase (bar - left axis) of Japanese flounder in control tanks (red colour) and tanks treated with Sanolife probiotics in water and feed (blue colour).



Conclusions

These results show that the addition of selected strains of *Bacillus* has the potential to improve fish production, either by lowering the *Vibrio* concentration in the rearing medium, or by improving the growth rate. The benefits are likely to be due to a combination of functions performed by the selected bacterial strains. Obviously, probiotics are only effective and cost beneficial when they are properly applied together with suitable farm management.

References

FAO, 2006. FAO Fishery Information, Data and Statistics Unit (FIDI). c2002. Fishery Statistical Collections. FIGIS Data Collection. FAO - Rome.



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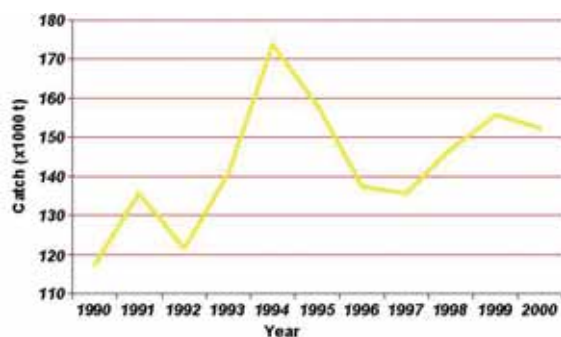
A breakthrough in the spawning of domesticated silver pomfret

By Charles M. James and Sulaiman Almatar

In 2006, researchers in Kuwait have succeeded in spawning a two-year old domesticated silver pomfret. Further refinements in breeding techniques to achieve good quality fertilized eggs will pave the way for successful commercial application of the technology for this high value marine fish species.

The silver pomfret *Pampus argenteus*, is among the species where wild populations are rapidly declining, due to over fishing. The total worldwide catch of silver pomfret showed that volumes reached 173,743 tonnes in 1994 and from then onwards, stocks began to decline (Figure 1). This is evident in the Arabian Gulf, particularly in Kuwait where catches have decreased drastically from an average of 1,000 tonnes per year during the period 1991-1995 to only 120 tonnes in 2000.

Figure 1: Worldwide catch of silver pomfret (FAO)



The fish is a popular high value species and demand for the fish has been increasing. In April 1998, the Mariculture and Fisheries Department (MFD) of Kuwait Institute for Scientific Research (KISR) implemented a research project to assess the technical feasibility of rearing the fish from eggs to marketable size.

In the same year, the project succeeded in larval rearing and fry production of the species under hatchery culture conditions from the eggs collected by stripping wild spawners (Almatar et al., 2000). Since then researchers at the centre have continued successfully to produce several thousands silver pomfret fingerlings for nursery and grow out production to marketable size.

However, spawning the fish under captive culture conditions was a challenging issue and remained elusive over the years until 2006. Overcoming some of the technical constraints, the MFD/KISR, Kuwait has made a breakthrough for the first time, during the 2006 breeding period, in spawning two-year old silver pomfret domesticated in tanks at the centre.

Origin of broodstock

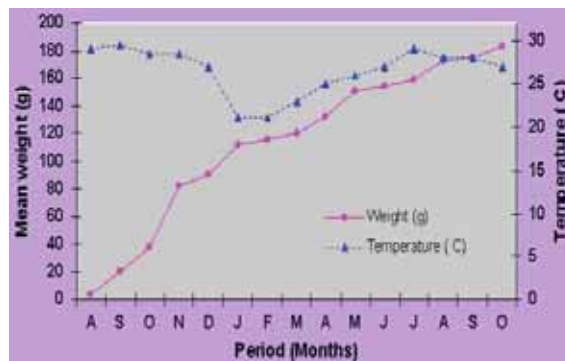
The source of broodstock was from the juveniles produced in the hatchery during the 2004 culture period. These in turn came from eggs collected from wild spawners. The average weight of hatchery produced juveniles ranged from 3 to 4g (45-50 days after hatching). These were reared using 3, 4 and 20 m³ round fiberglass culture tanks at stocking densities of 10-30 fish/m³.

After four months of rearing, fish weighed from 50 to 168 g, with an average weight of 91g. One-year old silver pomfret weighed from 69 to 308 g with an average weight of 172 g. This wide size distribution in the population was due to the smaller sizes of males as compared to females. As males made up 60% of the population, the average fish weight was less than 200 g by the end of year 1. Most of the females



One year old silver pomfret from grow-out tank

Figure 2: Growth of silver pomfret



weighed more than 250 g. After 20 months of culture, the male fish weighed from 86 to 259 g. The average weight was 139 g. Females weighed from 164 to 431g. They averaged 254 g (Figure 2).

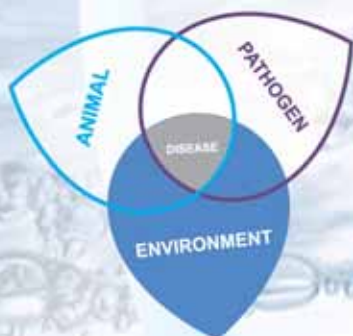
The growth rate of silver pomfret was up to 1.4 g per fish per day in the early juvenile stages when the water temperature was 29-30°C. Growth rate declined to 0.2 g/fish/day during winter (December to March) when the water temperature in the culture tanks decreased to 20°C. When seawater temperature was below 19°C, warm ground well-water (24-26°C), with seawater salinity was mixed with ambient seawater to maintain the temperature at about 20°C in the tanks. With such weather conditions in Kuwait, the favourable temperature for good growth of the fish is only for six months in a year. This is between May to October. (Note: In Kuwait, ground water is either brackish or high saline water. In this case, ground well water used in the hatchery had a salinity close to that of seawater)

Broodstock size and spawning

Based on the size and condition, broodstock were selected from the grow out production tanks on the 14th and 22nd months of the culture period. These were stocked into two 125 m³ capacity outdoor concrete tanks. After two years of rearing, broodstock weight ranged from 137 to 525g with an average weight of 267 g in the first tank (Figure 3).

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Figure 3. Broodstock size distribution –Tank # 1

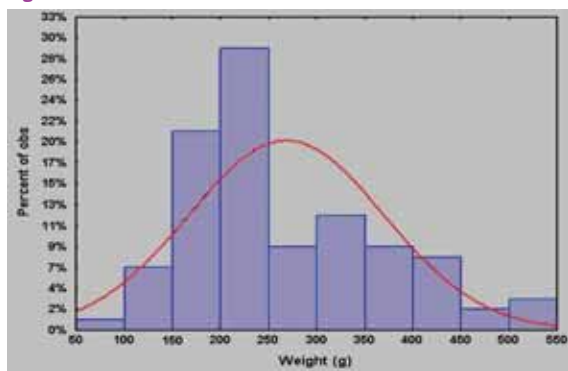
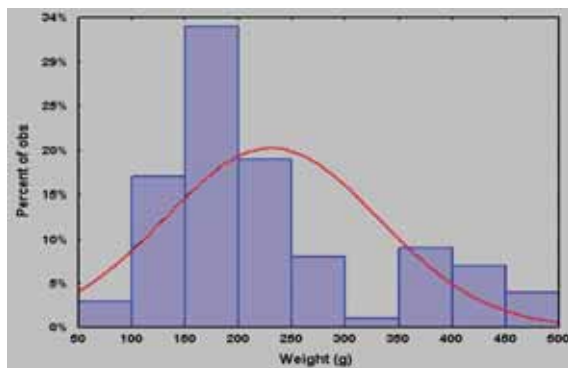


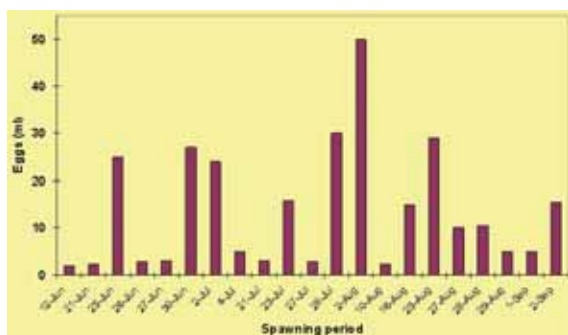
Figure 4. Broodstock size distribution - Tank # 2



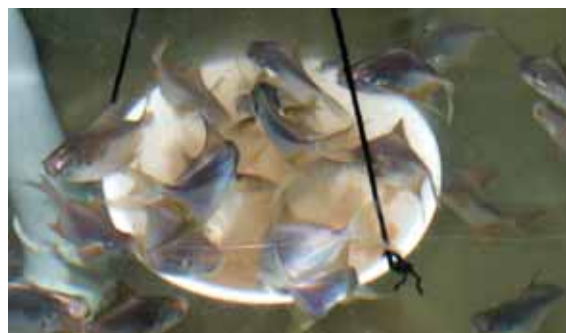
They weighed from 91-470 g with an average weight of 230 g in the second tank (Figure 4). The size distribution of broodstock showed that about 60% of the fish was less than 250 g size, indicating the presence of more males in the population. This was similar to that observed in the wild (Almatar et al., 2004).

Broodstock were fed with re-pelletized commercial salmon feed mixed with broodstock feed additives. This was to enrich the feed with EPA and DHA (eicosapentaenoic docosahexaenoic fatty acids, respectively). Tanks were equipped with an egg collection net at the tank over flow drain for the collection of eggs during spawning. The first natural spawning of silver pomfret in the broodstock holding facility (Tank 2) was observed on June 12, 2006 when the seawater temperature reached 28°C after winter. The second natural spawning was observed on June 21 in the same tank. Thereafter, fish spawned frequently till September 2 at water temperatures ranging from 28-30°C. Peak spawning occurred during the July-August period (Figure 5).

Figure 5. Progress in spawning



Spawning was delayed in tank No 1 until August 4 and then continued until September 15. All spawning occurred in the evening hours between 5-7 pm. All the spawning activities indicated a semi-



Juveniles under grow-out culture

lunar cycle concentrating on the first and the third quarters of the moon period as observed in the spawning of silver pomfret in the wild in Kuwait waters (Almatar et al. 2004). Although matured males were present in the population, the eggs were not fertilized. Further investigations will concentrate on the suitable male:female ratio in the culture tanks to achieve good quality fertilized eggs.

The future

This natural spawning of domesticated silver pomfret showed the possibility of breeding the fish under culture conditions. Further refinements in the breeding technique to achieve good quality fertilized eggs will pave the way for successful commercial application of the technology for this important marine fish species. Furthermore, breeding the fish will assist in meeting market demand for the fish. It will alleviate the pressure on capture fishery and thereby, allow for the recovery of its rapidly depleting wild stocks.

Since most of the commercial aquaculture ventures depend on using earthen ponds and sea cages, further investigations are required to assess the growth and production of this species in earthen pond and sea cage culture conditions. It is also essential to develop specific formulated feed for this species that meets all its nutritional requirements. Commercial feeds available do not yield satisfactory growth and survival rates unless supplemented with feed additives.

References

Almatar S., Al-Abdul-Elah K. and T. Abu-Rezq. 2000. Larval developmental stages of laboratory-reared silver pomfret *Pampus argenteus*. Ichthyological Research 47: 137-141.
 Almatar S., Lone K.P., Abu-Rezq T. and A.A. Yousef. 2004. Spawning frequency, fecundity, egg weight and spawning type of silver pomfret, *Pampus argenteus* (Euphrasen) (Stromateidae), in Kuwait waters. Journal of Applied Ichthyology 20: 176-188.



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Aqua Bounty Technologies Comes to Asia !!

By Henry C. Clifford*

Spawned in the biotech revolution of the 1990's, Aqua Bounty™ Technologies has now emerged as an innovative leader in biotechnological solutions for aquaculture. With its headquarters near Boston, Massachusetts, R&D and bioassay installations in San Diego, California as well as animal husbandry and R&D facilities in Canada, the company is poised to make dramatic advances in the enhancement of aquatic animal health and productivity through biotechnology. Following a successful public offering on the London Stock Exchange, the company has ramped up new product development and the launch of established product line into Latin America. Next is Asia.

Aqua Bounty's commercial and R&D activities are divided into two distinct divisions; the Aquatic Animal Health and Productivity and AquaAdvantage™ Broodstock Program.

Aquatic Animal Health & Productivity

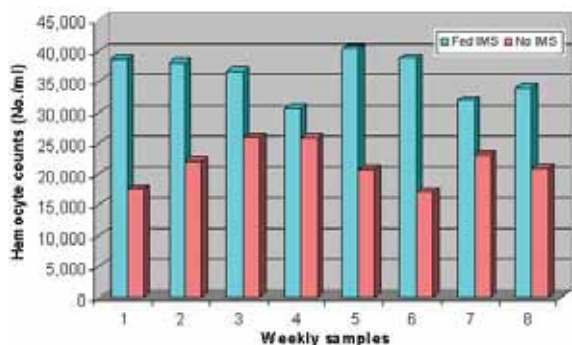
This division encompasses the company's product line of shrimp therapeutics and diagnostic tools, offering the shrimp farmer a layered approach to shrimp health and disease management. The main product lines are Shrimp IMS and VPX Viral Blocker.

Shrimp IMS is a unique, 2nd generation, non-specific immunostimulant that increases the resistance of shrimp to bacterial and viral pathogens by stimulating haemocyte production in the shrimp. Haemocytes are the primary line of defense against invading pathogens in shrimp (Figure 1). Due to its mode of action, Shrimp IMS does not suffer from "immune fatigue", a physiological phenomenon that affects many traditional immunostimulants.



Aqua Bounty's two closed, recirculating, bioassay facilities where existing therapeutic products and new products under development are evaluated using live shrimp challenged with WSSV and other virulent shrimp diseases.

Figure 1. Comparison of total haemocyte counts in IMS-fed shrimp vs control (no IMS) shrimp.



Furthermore, the unique mode of action allows the farmer to evaluate its performance while the crop is in the water, unlike traditional immune boosters which cannot be assessed until harvest. Shrimp IMS has been thoroughly laboratory and field tested in six countries, and is currently marketed in Latin America. This is a feed additive administered prophylactically to shrimp in hatcheries and grow out farms. Farmers utilize this to reduce the risk of disease, to elevate their overall survival rates (Table 1) and to prolong the culture period during disease events, in order to reach larger and thus more profitable sizes of shrimp.

In December, Vietnam's National Aquaculture and Fisheries Quality Assurance Veterinary Directorate (NAFIQAVED) have given approval to begin large-scale testing Shrimp IMS in Vietnam. NAFIQAVED is establishing comprehensive measures to assist farmers since shrimp harvests have been considerably reduced by disease in recent years.

Additionally, the company continues to make substantial progress in securing regulatory approval for Shrimp IMS in its other key target markets in Asia and Latin America. Certificates of Exportability issued by the US Food & Drug Administration (FDA) which confirms that the product is compliant with all US regulations and can be exported from

the US, have been submitted to 14 countries including China, Thailand and Indonesia, the three leading shrimp producing countries in the world.

VPX Viral Blocker is an exciting feed additive and therapeutic for shrimp. It specifically controls infection by the deadly White Spot Syndrome Virus (WSSV) by effectively blocking viral entry into the shrimp. Results of laboratory challenges with injection and oral exposure to WSSV have been very impressive. In early 2007 the product will be beta-tested in shrimp farms in the Americas as the company expands its manufacturing capacity. Commercial roll-out of VPX in South East Asia is anticipated in late 2007. If results at the farm level reproduce the degree of protection observed in laboratory challenges with WSSV, this product could revolutionize the management of WSSV in shrimp farms.

Additionally, Aqua Bounty markets SYBR Shrimp Diagnostic Test Kits which are Real-Time PCR-based diagnostic test kits for the primary viral

Table 1. Comparison of final harvest survival and return on investment (ROI) between IMS protected and unprotected ponds in commercial shrimp farms in Mexico.

Farm	Final survival (%) (IMS ponds)	Final survival (%) (untreated ponds)	Relative increase in survival (%)	IMS Return on investment (USD)
A + B	62.7	51.1	23%	2.65
C	22.7	15.5	46%	2.02
D	94.4	78.4	20%	2.56
E	50.5	30.8	64%	N.D.
F (*)	78.0	80.3	- 3%	N.D.
G	63.0	54.5	16%	N.D.
H	43.4	34.4	26.2%	N.D.
Average benefit			27.7%	2.41 (**)

(*) – Ponds stocked at a low density (6/m²); low disease pressure

(**) – Each USD spent on Shrimp IMS generated a USD2.41 increase in net profit

Figure 2. What is AquAdvantage™ fish.

Atlantic salmon & trout broodstock for commercial aquaculture
Modified to grow faster; not larger!



shrimp diseases: WSSV, Infectious hypodermal and hematopoietic necrosis (IHHNV), Taura Syndrome (TSV), Necrotizing hepatopancreatitis (NHP), Infectious Myonecrosis Virus (IMNV), Gill associated virus (GAV) and Yellowhead virus (YHV). Although the kits are configured for both conventional and Real Time PCR, they are designed to take advantage of the heightened sensitivity and quantitative capabilities of Real-Time PCR. Recently NAFIQAVED has selected the company to supply these test kits for use in a nationwide quality control program for the shrimp farming industry.

Broodstock Program

The AquAdvantage™ Broodstock division of the company is focused on translating quantum improvements in fish genetics into high value lines of fish (salmon, trout, tilapia). Aqua Bounty is best known for its advanced-hybrid salmon and trout broodstock, with initial growth rates that are up to 400% faster than traditional domesticated broodstock (Figure 2).

The improved fish broodstock contains a gene from other edible fish (an "all-fish" transgene) already being consumed by the public to enhance the expression and utilization of naturally occurring salmon growth hormone. Once integrated into the fish genome, the transgene and enhanced-growth phenotype are stably inherited by succeeding generations of fish. Mature AquAdvantage fish are indistinguishable from traditional, wild fish by the consumer, but the fish grow faster and reach mature size earlier than standard fish. Note that they do not

grow to be larger than the standard size of fish of the same species.

This advanced-hybrid salmon has been undergoing a thorough review by the FDA that includes nutritional composition, human health and environmental impact evaluation. In December 2006, it met the requirement by the FDA on the molecular characterisation of the gene used to halve the time required for salmon to grow to market size. Currently under review are all aspects of food safety, including allergenicity, nutrient content and genetic stability through inheritance. Other studies addressing animal health and product efficacy are being completed and will be submitted shortly. Since the approval of the molecular studies, the company has been meeting regularly with the FDA to agree upon procedures and anticipates rapid progress in the review process.

This novel technology offers revolutionary economic, environmental and production advantages to the global aquaculture community. The advanced-hybrid salmon, for example, reach market size eight to ten months sooner than current commercial stocks. AquAdvantage trout can reach harvest size in half the standard time. Application of this technology will allow accelerated production with less of an environmental impact for existing commercial species and a dramatic expansion in the commercialization of species that are currently in development.

Research & Development

What distinguishes Aqua Bounty from many companies offering products to shrimp farmers is the strength of the company's R&D capabilities. The R&D laboratory in San Diego comprises a state of the art molecular research facility paired with a stand-alone aquaculture laboratory and two independent, recirculating bioassay systems. These facilities,

together with our research staff of 10 scientists, allow Aqua Bounty to quickly develop and evaluate numerous promising compounds that can improve the health of farmed aquatic animals.



Henry Clifford is Vice-President, Marketing & Sales, Aqua Bounty Technologies. San Diego, CA. Email: hclifford@aquabounty.com



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Some trends in aquaculture

By Kidchakan Supamattaya

The future is improving current practices of aquaculture, reduce waste loading into the surrounding environment and in food safety

Aquaculture has been the fastest growing food production sector for over three decades. It has shown rapid expansion in recent years with growth rates of close to 8.9% since the late 1980's. In comparison, livestock meat production has been growing at around 3% per year over the same period and the output from capture fisheries has increased only 1.2%.

Aquaculture production in 2003 was around 54.8 million tonnes from 247 species with the value of USD 67.3 billion. The most distinctive characteristic of aquaculture that differentiates itself from other food production sectors is that more than 92% of total production comes from developing countries and around 91.2% come from Asia.

Asia's role

FAO statistics indicated that the top ten aquaculture producing countries are in Asia. China remains by far the largest producer, with a fish production of 44.3 million tonnes in 2002, with 27.7 million tonnes from aquaculture, respectively. This provided an estimated domestic food supply of 27.7 kg per capita as well as production for export and non-food purposes. The country contributed to 70.2% of global aquaculture production in quantity and 50% in value. India is ranked second, followed by Indonesia. Therefore, Asian aquatic exports will continue to expand.

Issues and challenges for aquaculture

Genetic improvement

The present status of research on genetic improvement in aquatic animals is far behind those being undertaken with terrestrial animals. Livestock and plant crops are industries with a long history in selective breeding and genetic improvements leading to advanced breeding approaches. Only a few examples of such breeding program exist for fish e.g. Atlantic salmon in Norway, Nile tilapia in Asia, white shrimp and channel catfish in the USA. Breeding programs and genetic improvement are also being applied to the black tiger shrimp in Asia. The characteristics needed for genetic improvement in aquatic animal production include large size, fast growth, disease and stress resistance, mono-sexing, high quality carcass, and specific pathogen free (SPF) stocks while retaining a high genetic diversity.

Feed

Feed is the most expensive component (contributing 30-50%) in the production process. In addition, feeds also have direct and indirect impact on the environment. The use of fishmeal in aqua feeds has led to depletion of natural fisheries of many pelagic species. The level of



Domestication and genetic improvement in black tiger shrimp is badly needed

inclusion of fishmeal in aqua feeds varies among species. Carnivorous fishes (salmonids and other marine species) use 30-50%, while shrimps use between 25-30% of fishmeal in their diets. Lower amount of fishmeal are used in omnivorous fishes like channel catfish (3-6%) and herbivores such as the carp and milk fish (6-10%).

Several suggestions are in place to reduce the use of fishmeal (FM). The replacement of FM by alternate protein sources that are more abundant, readily available, less expensive and sustainable is the major focus of research. Others solution include research and development on new protein sources, n3-HUFA sources and promoting the culture of omnivorous and herbivorous species.

Intensification of aquaculture has also led to a growing concern on the potential impact to the surrounding environment. The two main output from aquaculture operations are solid waste (uneaten and excess feed, undigested feed and faeces), and dissolved waste (mineral leaching and by product of mineral metabolism). Poor water quality induces fish stress, increasing the possibility of diseases outbreak and leading to off-flavor. This affects both production and product quality.

Since a major share of aquaculture waste is derived from feed, efforts to mitigate environmental impacts should focus on feed and

Production by species in 2004 (FAO, FishStat, 2006)

	Carp	Tilapia & Catfish	Marine shrimp	Freshwater prawn	Salmon
Global production in million tonnes	18.3	Catfish-1.1 Tilapia-2.3	2.47	0.2	1.83
Asian production in million tonnes (% of global production)	7.83 (42%)	Catfish -0.65 (59%) Tilapia-1.1 (47%)	2.16 (87.4%)	0.193 (96%)	0.135 (7.3%)
Major producers	China, India and Eastern Europe	Catfish-Vietnam Tilapia-China, Philippines and Thailand	Asia and South America	China, India and Thailand	Norway and Chile

feeding. Improved feed formulations; feed processing techniques, handling and storage and on-farm management are important strategies for waste reduction from aquaculture.

The environment and sustainable aquaculture

The future of the aquaculture industry largely depends on easy access to natural resources, such as land, water and fish meal for use in aqua feed. For some types of aquaculture activity, including shrimp and salmon farming, potential damage to ocean and coastal resources through habitat destruction, waste disposal, exotic species and pathogen invasions have raised criticisms. Large amounts of fish meal and fish oil requirements may further deplete wild fisheries stocks. Serious impact to the environment can occur through disease contamination of wild and farm stocks, escape of exotic species from farms with a potential effect on wild populations. With the transfer of new diseases through imported alien species, strict quarantine and controls are needed.

Sustainability of aquaculture depends on the maintenance of a good environment. Environmental issues are now part of the global trade. Consumers are becoming more and more aware of issues including limits on using fishmeal and fish oil to produce aquaculture species. These would unavoidably affect the cost of production of fish and other aquatic animals.

Diseases and their control

In intensive aquaculture systems, new diseases emerge almost every 3-5 years. Efficient health management strategies such as rapid diagnosis, prophylactic treatment and bio-security systems are required. Antibiotics will no longer be allowed in aquaculture production in the future. Therefore, other or existing strategies have to be developed for use in health/diseases management such as through vaccination and application of biological active compounds, probiotics, herbs or others natural products. Vaccines and genetic improvement techniques for developing disease resistant strain must be developed.

Traceability and food safety

Similar to other food production sectors, aquaculture is adapting to the new trend of consumers with the issue of food safety and traceability. Traceability gives the consumers or buyers, information on origin of the product, i.e. where it is produced, how it is produced and when it is produced. Thus, the consumers have a chance to select or support ecologically responsible product(s) or producer(s) which leads to minimal

global environmental impact and maintains sustainable production and trading.

The reason for an initiation of traceability is due to the presence of chemicals and/or antibiotic residues in the products during the last few years. With traceability systems, the product can be recalled more rapidly so that the adverse affect can be minimized. Problems can be solved faster and the non responsible producer will be out of business. Traceability is being implemented and will become a global trade requirement in the future.

Oil prices

In aquaculture, increases in oil prices makes energy costs the second most expensive component of the operational costs next to feed. However, crude oil price may come down in 2007-2010, as predicted which may help to reduce the production cost in aquaculture.

Bottomline

Globally, aquaculture has developed at a rapid pace during the last few decades and has now become one of the fastest growing food production sectors. Unlike other food production systems, aquaculture uses a number of species (over 247 species of aquatic animals and plants in 2003) and production systems varying from small household ponds to coastal shrimp ponds and new generation offshore sea cages.

The key therefore is to devise means of improving current practices of aquaculture so as to make them environmentally sustainable including use of environment friendly and fish meal free diets, techniques to reduce waste loading into the surrounding environment and devising innovative strategies for maintaining bio security and food safety.

The article was extracted from the paper presented at World Nutrition Forum, September 6-7, 2006, Vienna, Austria.



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Ruptured hepatopancreas in HOSO shrimp

Cooked shrimp with a darkened cephalothorax area are not acceptable by consumers. Causes and solutions to this problem are presented in this article.

By Hervé Lucien-Brun



A major problem in raw shrimp processed as Head On Shell On (HOSO) for the European cooked shrimp markets is the rupture of the hepatopancreas. This is also called red head or black head, depending on the country where the problem occurs. In cooked shrimp, the whole cephalothorax area darkens.



Cooked shrimp with ruptured hepatopancreas

Commercially, this darkish hepatopancreas is disastrous as consumers will not accept shrimp in this state. The problem is more significant in white shrimp, *Litopenaeus vannamei* where the contrast between the dark areas and the pink body of the shrimp is more noticeable.

In the past, this problem prevailed in Latin America. However, now European importers have reported this in *L. vannamei* produced in the South East Asian farms. On analysis, it is clear that the problem occurs when shrimp are farmed under certain conditions such as with poor pond conditions, stressful harvest procedures, poor post harvest processing and control of the shrimp temperature and poor feed quality.

Water quality and cyanobacteria

Generally the origin of this problem is the presence of cyanobacteria. This occurs when the pond bottom is dirty or when water exchange is low. In the latter case, the pond ecosystem switches from a phytoplankton to a bacteria system, which will then promote the growth of cyanobacteria. This was discussed in detailed in an earlier article (Vol 2 (3) 2006). However, it is also important to realise that this can also occur in new ponds, well managed with good water quality.

To reduce the population of cyanobacteria, one needs to simply increase rate of water exchange. Another way is to increase pond aeration and avoid any dead area. Alternatively, products to treat the water and control the cyanobacteria development such as Water Probiotech, Water Oligo and/or Water control (Aqua Techna) can be used.

Harvesting procedures

The autolysis of the hepatopancreas could be related to the brittleness of the membranes of the cells. This in turn could be related to an oxidative stress with massive contribution of non eliminated free radicals by the animal in stress conditions. During harvesting, shrimp are stressed and thus the rate of respiration is increased which will increase the production of free radicals. These will then attack the unsaturated lipids of the membrane structures. This is more evident in the hepatopancreas because it contains lipids extremely susceptible to peroxidation.

At this stage, it is very important to reduce stress as much as possible. The dissolved oxygen rate must be controlled and maintained to an acceptable level (minimum 3 ppm) but over saturation must be avoided too. It would be also suitable to use a feed enriched in antioxidant (Vit.E, Vit.C, Selenium and carotenoids) during the last few weeks before harvests. Products as the Immutech and/or Pimentech are suggested.

Temperature of shrimp post harvest

As soon as shrimp die, there is autolysis of the hepatopancreatic cells by digestive enzymes. This quickly leads to the rupture of the organ. It is essential that the process be slowed down by chilling the shrimp immediately after harvest. In many cases, the harvesting team will treat shrimp by dipping them in a bath of metabisulfite solution just after the harvest.

Temperature is a critical factor.. A thermometer should be used to monitor the temperature of the tank of treatment. A subjective monitoring with the worker touching the solution is not good enough, because he or she cannot have a clear idea of the difference in temperature of air and the solution.

Furthermore in many countries, such as in Vietnam, shrimp are not treated at the farm. Brokers transport shrimp in boxes filled with ice but usually this is not enough to chill them. It must be understood that ice in a box of shrimp has more a thermal insulation effect. In this case it is important to chill shrimp prior their transfer in the boxes by dipping them in a tank of chilled water (between 1 to 3°C) for two or three minutes.

At the plant, it is difficult to evaluate what will be the situation of the hepatopancreas when the shrimp is effectively frozen.. Enzymatic reactions are slowed down with low temperature but they are stopped only when the temperature is below minus 18°C.

In the case of quick freezing systems such as IQF or brine freezing, this delay is very short. However, with blast freezing, it could be several hours before this temperature is reached. It is extremely important to estimate this duration as usually the temperature in the rooms of the processing plant during grading and sorting is generally not as cold as required. Then the temperature of the shrimp could rise again.

Such conditions during the post harvest process may also induce other problems for head-on shrimps as floppy head, broken head or empty heads resulting of the rupture of the membrane between the cephalothorax and the abdomen. Importers also complain about these. Here, the problem can be easily solved with a good harvesting procedures and adequate quality control from the outlet gate of the pond to the freezers in the packing plant.

Nevertheless, companies known to produce very good quality shrimp are now facing this problem in spite of a very good post harvest process and efficient quality control.

Nutritional origin of the problem

In the past, in Latin America, when this problem occurred, a solution was to switch the feed batch during the last weeks prior to harvest.



Shrimp without hepatopancreas

Recently several authors have showed the importance of the quality of certain components of feed such as fish meal, fish oil and plant meals on the hepatopancreas.

Fish meal quality

In 1999, Gérard Cuzon and the AQUACOP Team, from IFREMER, Tahiti, analysed this problem in *Penaeus stylirostris* shrimp in New Caledonia. They showed the direct impact of the use of low quality fish meal and fish oil on the hepatopancreas. In the European regulations, it is the quantity of Total Volatile Basic Nitrogen (TVBN) which determines if fish is fresh and consumable. TMA (Trimethylamine) is produced by certain bacteria which uses as hydrogen acceptor the trimethylamine oxide present in muscle of marine fish. By proportioning of the TVBN and the TMA, it is possible to determine accurately the freshness of fish. The criteria of quality control are then based on the organoleptic examination (grid of standard quotation the EEC) and the chemical analysis (TVBN + report/ratio TVBN /TMA).

In the last decade, Asian feed producers have improved the quality of feeds for *Penaeus monodon* and have obtained an economical high performance feed. However, when *L. vannamei* was introduced in these countries, the strategy was to use lower quality raw material for this new species. This is because the protein requirement of *L. vannamei* is less demanding than that for the monodon shrimp. However, it is the quality of the raw material which must be equal for both species. Nevertheless, often the fish meals used in the *L. vannamei* feeds are meals and oil locally produced using raw materials without proper preservation on board. Such fish meal and oils have high oxidative rates and have a low pH. They also contain products resulting in peroxidation of the lipids.

This situation is further aggravated by the escalating prices of fish meal. Fish meal prices have more than to double in the last six months but market prices of shrimp have remained more or less low and stable. The situation of the fish meal and fish oil markets will not change and more probably will be aggravated in the future. Ultimately, the best option is not to choose lower quality meal and oil but work to define feedstuffs to substitute and reduce the need of fish meal and its products in the feed.

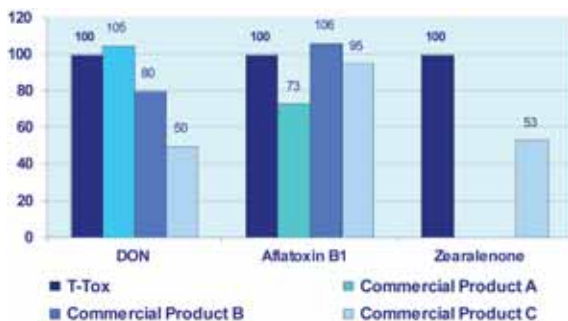
Quality of plant meals

It is common for plant feedstuffs to be contaminated by mycotoxins. This could be on the crop or during storage. In tropical countries, under humid and hot conditions, the most important mycotoxins found in the meal are the aflatoxins which are very resistant to high temperatures and are not destroyed during the pelleting and extrusion process.

Mycotoxins are well recognized by poultry feed producers because their effects are spectacular and could induce dramatic mortalities even at very low concentrations. They also show negative impacts on growth of shrimp (Bautista et al., 1994) even at very low concentrations. Some other histopathological findings indicated hepatopancreas damages by aflatoxin B1, at rate as low as 25 ppb.

The best prevention for mycotoxins in feeds is to avoid the use of contaminated raw material. Feed additives to absorb and deactivate mycotoxins can effectively and economically manage risks from mycotoxins. In figure 1, the absorption of mycotoxins by available commercial products is demonstrated. They must be added to the feed components during pelleting. Once the mycotoxins are absorbed on the surface of the particles of the additive, they cannot be absorbed by the animal and they are rejected in the faeces with no negative impact on shrimp.

Figure 1. Results of the trials showing the absorption of some mycotoxins by several feed additives. T-Tox is a product of Aquatechna.



Bottomline

This problem of ruptured hepatopancreas is becoming more prevalent. It needs the attention of those in the supply chain, viz farmer, packer and feed miller. It is clear that the consumer will not change their demand and shrimp with darkish hepatopancreas will continue to be rejected. The causes are a combination of several factors at different level of production chain.

However, the nutritional factor is probably the most important and yet it is least considered. The shrimp needs high quality feed. If the price of feed raw material is increasing, the only way to balance between costs and feed quality is to improve on feed formulation. Attention should be

on each ingredient to produce a feed able to satisfy the need of the shrimps without waste as it is done for long time for terrestrial animals.

References

- Aquacop, Cuzon, G., Robin, J., Goarant, C. and Saulnier, D., 1999.. Incidence of red heads during shrimp processing: a nutritional origin? Book of abstracts, World Aquaculture 1999, Sydney, Australia. p194.
- Bautista, M.N., Lavilla-Pitogo, C.R., Subosa, P.F. and Begino, E.T., 1994. Aflatoxin B1 contamination of shrimp feeds and its effect on growth and hepatopancreas of pre-adult *Penaeus monodon*. J. Sci. Food. Agr. 65: 5-11.
- Boonyaratpalin, M., Supamattaya, K., Verakunpiriya., V. and Suprasert, D., 2001. Effects of aflatoxin B1 on growth performance, blood components, immune function and histopathological changes in black tiger shrimp (*Penaeus monodon* Fabricius). Aquaculture Research, 32, p388.
- Bintvihok, A., Ponpornpisit, A., Tangtrongpiros, J., Panichkriangkrai, W., Rattanapane, R., Doi., K. and Kumagai, S., 2003. Aflatoxin contamination in shrimp feed and effects of aflatoxin addition to feed on shrimp production. Journal of Food Protection, 66 (5), p 882-885.
- Lucien-Brun, H. and Vidal, F., 2006 - Alfalfa concentrate: natural shrimp color enhancer - Global Aquaculture Advocate, Vol.9 (2), pp35-37.
- Lucien-Brun, H. and Vidal, F., 2006. Quality issues in marketing white shrimp to European markets, Part 1. Aqua Culture Asia Pacific, Vol 2 (3) (May/June), pp32-33.



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Aquaculture at VIV Asia Conference 2007

The VIV Asia Conference 2007, sponsored by Rabobank, will be an excellent educational forum for industry professionals to share their vision on the Asian animal husbandry industry. Of interest to those in aquaculture will be;

Wednesday March 7, 2007

- Non-marine animal proteins as fish meal replacement in aqua feeds and pig starter by Dr. Y. Yu, National Renderers Assn. Inc., China, Room 214, 1300h – 1400h
- Mycotoxins in animal feed, problems and solutions by Mathieu Cortyl, Impextraco, Belgium (all species), Room 217, 1130h- 1230h
- Processing and Use of Soybean Products for the Feed Industry, organized by American Soybean Association – International Marketing (ASAIM), USA, Room 217, 1300h – 1700. Topics will include
 - Processing full fat soy for maximum quality, by Dr Mian Riaz, Texas A&M
 - Express (TM) soybean meal processing and performance, by Dr Nabil Said, Insta Pro Corp.
 - Use of soy protein concentrates for livestock and aqua feed, by Dr Robert A. Swick, ASA-IM, Singapore

Thursday March 7, 2007 (1030h – 1730h) Grand Hall

Aquaculture – Today and Future- by Novus International Thailand Co., Ltd., Thailand. Experts in the industry in Asia will present the following:

- Opportunities and challenges of aquaculture in Thailand by Dr. Yont Musig, Kasetsart University, Thailand

- Organic Shrimp Farming by Prayoon Hongrath, Sureerath Farm, Thailand
- Marine Aquaculture and techniques, Professor Jiaxin Chen, China
- Today's picture of aquaculture in Asia" by Professor Fatimah, Universiti Putra Malaysia, Malaysia

More information: email: Amornrat.Boonchuay@novusint.com; web: www.novusint.com

Thursday March 8 (1450h) Grand Hall

Alltech will sponsor a lecture by Dr John Sweetman, a renowned aquaculture researcher. He will present "The Market for Aquaculture: Opportunities and Threats for the Asian Producer". Dr. Sweetman has more than 25 years of experience in the culture of a wide variety of freshwater and marine finfish. He has worked extensively in Europe, Southeast Asia and the Americas and has designed, constructed and managed a number of marine hatcheries and farms worldwide. His most recent work has focussed on the diversification of marine finfish hatchery production, namely with cod in Norway and Scotland and a number of warm water species in the Mediterranean and America. More information: Email: omcaleer@alltech.com or asangkhasap@alltech.com; Web: www.alltech.com



VIV Asia 2007 features Aquaculture



The show in Bangkok, Thailand has aquaculture as the special theme. VIV Asia 2007 will bring professionals in animal husbandry from the Asian-Pacific region face to face with leading worldwide suppliers.

Asia-Pacific is home to 90% of the world's aquaculture production. With the Aquaculture Walk and Forum, all suppliers active in aquaculture will become clearly visible at VIV Asia for the first time.

At press time, the companies identified for the Aquaculture Walk are Biomin, Novus International, Alltech, DSM Nutritional Products, Inve Asia, GePro Geflügel-Protein, Bentoli, Bayer, Dupont and Intervet International. This will create an excellent opportunity for exhibitors who want to capture the market and visitors who are searching for the latest technologies.

VIV Asia 2007 is already setting a new record in exhibition space by adding an extra hall, according to the organisers. They have indicated that 373 companies have already confirmed their participation. The trend setting countries viz Belgium, China, Israel, Italy, Korea, the Netherlands, Spain and the United Kingdom will have country pavilions.









Trade show – March 7-9, 2007

Event Hall 101–105, Bangkok International Trade and Exhibition Centre (BITEC) Bangkok, Thailand

Dates / Opening Hours

March 7 / 9.30am– 06.00 pm
March 8–9 / 10.00am – 06.00 pm

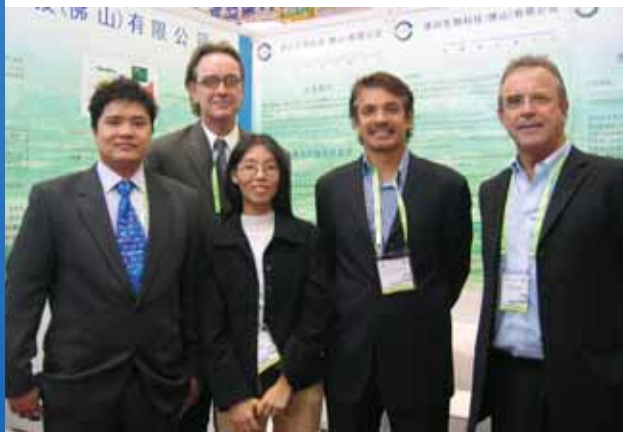
Table 1: Selected exhibitors with products in aquaculture and aquafeed production

	Feed additives	Raw materials	Complete Feeds	Feed Processing equipment/mills	Aquatic Health & Diagnostics	Pond and Water Environment
Alltech Biotechnology Corp., Thailand 	•	•			•	•
Angel Yeast Co., Ltd. China	•	•				
Amandus Kahl GmbH & Co KG, Germany 				•		
Anitox Corporation, USA	•					
Bayer Thai Co., Ltd. Thailand	•					
Biomin Singapore 	•					•
Bentoli Agrinutrition Asia, Singapore	•			•	•	
Berg & Schmidt Asia Singapore	•					
Chemofarma Ltd. Switzerland 	•				•	
CJ Corp Thailand			•			
Chia Tai Bioengineering China				•		
DSM Nutritional Products Asia Pacific, Singapore 	•					
Dabomb Protein Corp. Taiwan	•	•				
Du Pont Limited Thailand						•
GePro Geflügel-Protein, Thailand 	•	•				
Hamlet Protein A/S Denmark	•	•				
Intervet International B.V. Netherlands 					•	
INVE Nutri Ad Thailand 	•				•	
Impextraco N.V. Belgium	•					
Indian Herbs Overseas India	•				•	
ITOCHU Corporation Japan	•					
Jiangsu Muyang Group Co., Ltd China				•		
Novus International Co. Ltd. Thailand	•					
Nutra-Flo Protein Products USA	•	•				
Probiotics International Ltd. UK	•					•
Schering-Plough Animal Health USA					•	
Trouw Nutrition International BV Netherlands	•		•			
Vet Superior Consultant, Thailand	•	•				
USA Dry Pea & Lentil Council USA	•			•		
Wuhan Sunhy Biology Co. Ltd, China	•					
Zagro Singapore Pte Ltd. Singapore	•		•			•
Zinpro Animal Nutrition, Thailand	•					



11th China Fisheries & Seafood Expo and China Aquaculture 2006

China's Shandong Province has again showed itself as the seafood capital of the world. Preliminary figures showed that this show was the largest in Asia with the participation of 1,200 companies from 60 countries. The show was held from 1-3 November in Qingdao.



The team of Australian Aqua Biotech (Foshan)

China is a major player in the global seafood business and has the world largest reprocessing industry. Shandong Province leads with the largest portion of foreign investment in seafood processing, mainly from Korea and Japan. It is also a major producer of farmed seafood. In 2004, the province produced 7.2 million tonnes of aquatic products out of a total of 49 million tonnes for the whole country (Glitnir, 2006).

The first show was held in Qingdao, eleven years ago and the last show in 2005 was held in Guangzhou, Guangdong Province. Peter Redmayne, President of Seafare Exposition, the main organiser of the show said,

"This year's show was 30% larger than that of last year. Participation from Chinese companies grew in proportion over that of foreign companies. We have an increase in buyers from overseas. Some of the new exhibitors are from Estonia and Malaysia. The show was already sold out in September".

"I also see some changes which indicate that the reprocessing industry will not be increasing at a fast pace as before. This time the interest is more in equipment and machinery from China. This indicates that companies in China are also improving their technology and that Chinese processors are becoming more sophisticated with their products, in addition to the inexpensive labour costs. In Aquaculture China portion, I see more products from overseas companies".

New to the show

New to the show was a team from industry in Malaysia. The main business of **Nutri Taste** is the production of traditional Malaysian products such as floss meat. At the show, it was seeking markets in

China for its tuna floss. Also at the show were representatives from the **Seychelles Fishing Authority**. They displayed various species of sea caught fish. It was also a first for Iceland's **Glitnir Bank** which has recently established an office in Beijing. From this office, initially it will concentrate on the seafood industry in China and later will seek out investment opportunities in other parts of Asia. The bank works within all subsectors of the global seafood business including fish processing, aquaculture, fisheries and trading. In 2005, 10% of its loan portfolio was in fisheries and seafood. It has a team of specialist bankers comprising of corporate financiers, industry analysts, credit officers and dealers focusing on the seafood industry.

Shandong companies

One of the largest processing companies at the show was **Qingdao Yilufa Group** which started in 1993 in the reprocessing industry. Today, it has expanded with six subsidiary companies and also into real estate. The annual seafood processing capacity is 40,000 tonnes, mainly of cod, Alaskan pollock, red fish etc. Recently, it has developed 20 breaded fish and seafood products. The **Qingdao Yilufa Marine Co Ltd** produces 15,000 tonnes of feeds of which 5,000 tonnes are feeds for marine fish. Other feeds are for crab and shrimp culture.

Turbot producer **Qingdao Seacull Turbot Research Institute Co Ltd** started in 2000 by growing juveniles fish imported from France in land based tanks. It went on to develop hatchery production of the seedstock and expanded production to three farms in Jimo and Changyi in Shandong Province and in Gangyu, Jiangsu Province. It also produces other species of marine fish species. The company is the distributor of Skretting feeds for flounder, sole and turbot in North China.

Shandong Binzhou Port Youfa Aquaculture Company is a large *Artemia* manufacturer located in Bohai Bay. It produces 400 tonnes of artemia cysts annually and these are exported to Indonesia, Malaysia, Korea to as far as Poland. *Artemia* produced has a 90% hatching rate for grade A and 80% for grade B. Other products are artemia flakes, freeze dried bloodworms, rotifers, spirulina powder, tubifex and artemia. Also in the same business is **Tiajin Jiayin Biology Feedstuff Co Ltd**. It also markets frozen artemia nauplii and feeds for fish and shrimp to industry in South East Asia, Taiwan and South America.

Upstream to ensure product quality

Many exhibitors are integrated companies. **Maoming Chanxing Foods Co Ltd**, based in Guangdong has 2,000 hectares of farms producing vannamei shrimp and tilapia. **Hainan Sky Blue Ocean Foods (SBO)** founded in 2003 is a major production company for the Grobest Group. It is vertically integrated from hatchery, feed, production to processing. **Beihai Hong En Group** said that it has built up farms to produce quality raw materials for its processing plants. It has a 667 ha catfish and tilapia farm. There are 20,000 cages in the tilapia and catfish cage farm. It said that processed products meet USFDA and EU standards.

Zhejiang Taizhou Haierbao Aquatic Products Co was established in 1993 and is now a corporate group with two subsidiaries. Exports total 4,000 tonnes per year to Europe and USA. Jinzhou Tianhe produces crayfish and catfish. The **Guangdong Guolian Group** has several affiliated companies involved in aquaculture, hatchery and biotechnology. **Zhanjiang Guolian** is the largest prawn processing company in China. The aim of the company is to have its own production base to control the production environment.

Market promotion

Also at the show were dedicated associations. China is one of the largest seaweed producers in the world and the annual output is 1.5 million tonnes of dehydrated kelp, undaria, prophyra, gracilaria and sargassum. Usually



At India's Marine Products Export Development Authority (MPEDA)'s booth, from left Sunny John, Shimpo Exports, UK Viswanadha Raju, Ananda Group, Jacob Daniel, Joint Director, MPEDA, U Murali Anand Varma, Ananda Aqua Exports and BC Prasanth, Shimpo Exports. According to Daniel, their attendance at the annual show was to promote seafood exports from India globally.



From left, Kevin Huang, Qingdao Seacull Turbot Research, Tie Teck Lok, Skretting and Ji Wenjuan, Chief Technical Officer, Fujian Dachang Bio-Tech Enterprise.



Shen Xi Shun and son, Eric at their booth



Visitors at the show. Advanced Bionutrition's Larry Giessinger (left) and Gerry Mcquire (AquaBounty Technologies, USA).



Some value added products from the Qingdao Yilufa factory

the products are used in the pharmaceutical and chemical industries. However, the **China Seaweed Industrial Association** wants to see the application of the seaweed in agriculture. The products are seaweed powder for use as animal feed additives to enhance growth and immunity. Seaweed fertilizer extracted from crude seaweed contains fucoidan, mannitol and betaine and can reduce crop stress and improve fruit quality.

The aim of the **China Eel Industrial Association (CEIA)** is to safeguard the interest of the industry and promote the development of the eel industry. China produces 150,000 tonnes of eels, amounting to 70% of global production. Some two thirds are processed as roasted eels and the rest are sold live. CEIA also looks into the balance of supply and demand and how to develop the industry in a healthy and sustainable way.

Hainan CNPC Deep Sea Fishery Technology and Development Co was at the show to promote the consumption of the cobia. They call it sea sturgeon. It claimed nutritional effects of eating this fish such as prolonged life span as evidenced by the Japanese and Eskimo population; 'slimming' effect as it is rich in omega 3 fatty acids; reduction of wrinkles and prevention of heart diseases. The company is a CNY 100 million company managed by CNPC Shenzhen Petroleum Industry. It started with five deep sea cages and in 2006, there were 704 cages with 17,000 cobia and golden pompano. The estimated output was 8,000 tonnes valued at CNY 200 million. In combination with culture facilities, there is a plant to process cobia and pompano into fillet, portions and whole fish.

Roger Camm, **Australia Aquaculture Products Pty Ltd** in Victoria, said that the long fin eel could be a new culture species in China. In Australia, he captures wild glass eels and grows them up to 30 cm elvers in high density conditions. These are sold for grow out and the eels reach marketable sizes after 12 months. He would like to start intensive culture farms in China as it is too difficult and exorbitant to export marketable size eels grown in Australia to Chinese markets. The market price of long fin eels is 19AUD CIF Hong Kong.

Feed, pond and seed stock

Richen International Enterprise Co Ltd brings in hatchery feeds from Taiwan for the Chinese market. Although it pays 17% TVA on these imports, Mulin Lan said that the market in China is large and there are few local producers. **Shandong Shengsuo Aquiculture Feed Company** produces feed for hatchery stages for several marine fish. Feeds are from less than 80 microns to 1.0mm in size.

Feed producer **Nosan** from Japan introduced a range of feeds for marine fish such as yellowtail, seabream eel and salmon to the Chinese markets. At a technical seminar, the company said that aquaculture production is not expanding in Japan. Their concern is also to produce

quality meat and not just to market their feeds. They have a new feed which suppresses discolouration in the red meat portion of flesh. Another product thickens the dermal layer of flesh and prevents skin scale from peeling away. Banana powder is added into feeds for the yellowtail, red seabream, scampi and starter feeds to improve resistance to diseases.

There was considerable interest in the probiotics marketed by **Australian Aqua Biotech (Foshan) Company**. Through microbial technology it has several products under the Eco green range Aqua range which are effective in improving pond water condition. These are a combination of digestive and denitrifying bacteria. In trials with *P. vannamei* cultured in high density (90 PL/m²) in China, better (55%) biomass was obtained with additions of the products to the ponds. In trials with tilapia, the gain was 16% of biomass.

Mr Shen Xi Shun of **Beijing Shuntong Rainbow Trout Centre** promoted rainbow trout farming. His idea was to supply quality eggs and fry of rainbow trout and encourage its culture to as far south as Hainan Island. The company also provides technical support for trout farmers to ensure sustainable culture practices. At their farm in Huairou County, they have hatchery, culture and processing facilities. They also conduct research on cold water fish culture. The annual output is 20,000 tonnes of trout, 1.5 million fry and 10 million eyed larvae.

US-China antidumping practices

Attorneys at **DLA Piper** have successfully represented several Chinese companies in US antidumping cases. At a seminar, they provided some insights into the process of determining antidumping duties (AD). They listed out the short deadlines for investigations by the US Department of Commerce and the International Trade Commission (ITC), respectively. In the case of China, which is considered a non market economy, ITC compares the price of the product in the US with that of a surrogate country. The key issue is the choice of the surrogate value. DLA Piper will undertake exhaustive surrogate value research. With 3,100 lawyers located in 22 countries, the company said that is well positioned to help companies in China.

Next show

The organisers have announced that the next show will be in Dalian, another seafood capital in North China. It is scheduled for November 1-2, 2007.



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Supporting conferences:

1. **Aquafeed Horizons**, organised by Aquafeed.com & the Norwegian Institute of Fisheries & Aquaculture Research. 9 – 10 May 2007

2. **The Provimi Symposium – "Optimize profit through Research & Nutrition"**, organised by Provimi. 9 May 2007

3. **Petfood Forum Europe 2007 – "New products, New opportunities"**, organised by Petfood Industry magazine and Watt Publishing Co. 8 May 2007

4. **"Pellets for bio-energy: addressing the challenges"**, organised by AEBIOM (European Biomass Association). 10 May 2007

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Victam International 2007

Market insights, technical know-how and latest aqua feed science at Aquafeed Horizons

This conference will present the latest advances in aquaculture feed formulation and production technology and explore the trends and direction in which the industry is headed. It will look at cutting edge applied research into aquafeed ingredients and processing and will share the stage with practical feed processing know-how from an international who's who of technical experts.

Organisers are Aquafeed.com, the industry's news and information portal and Fiskeriforskning, the Norwegian Institute of Fisheries and Aquaculture Research. It will be held during Victam International 2007, allowing delegates the opportunity to also view the very latest in feed equipment and ingredients in this important trade show.

- The two most important trends in aquaculture will also be discussed: organic aquafeed production - raising challenges to fundamental organic principles and land-based recirculating aquaculture farming systems
- Several presentations will look into the potential and the technical issues surrounding the utilization of fishmeal alternatives. New information on the differences between marine and vegetable proteins used in aquafeed will be revealed.
- The conference will also take a look at ingredients such as phytase, which is becoming of greater interest to aquafeed formulators as plant-based ingredients are increasingly being incorporated into aquafeeds.

Dr. Ola Flesland, Department Director Aquafeed and Marine Processing, Fiskeriforskning/Norwegian Institute of Fisheries and Aquaculture Research will chair the first day's sessions. Dr. Warren Dominy, Aquatic Feeds and Nutrition Department, Oceanic Institute, Waimanalo, Hawaii, will oversee day two of the meeting.

Brian Plattner, Technical Center Manager for Wenger Manufacturing, Inc will speak on the interaction of ingredients and the extrusion process. The presentation will also cover the production of soft-moist feeds; the effect of extrusion on microbes, insects and toxins; effect of raw material storage on processing; by-product utilization and the effect of rework. Dr Mette Sørensen, Norwegian University of Life Sciences, will show the effect of raw ingredient formulations and extrusion processing parameters on nutritional and technical quality of aquafeeds. Recent research indicates that there is a strong connection between pellet water stability and the degradation pattern of feed particles in the gastrointestinal tract.

List of topics

- Feed industry's responsibility to the development of sustainable aquaculture
- Aquaculture in Central and Eastern Europe – production and markets
- Upgrading of marine raw materials: the importance in finding substitutes for fishmeal
- Innovative technology for farming barramundi in Europe
- Organic aquafeeds - ingredients and ideals
- Physicochemical properties of feed ingredients - impact on feed processing and quality
- Effects of extrusion processing and raw ingredient variation on nutritional and technical quality of the feed raw materials and their impact on the extrusion of aquafeeds
- Parameters affecting the fine grinding of aquafeeds using a hammermill
- Aquafeed drying
- Vacuum coating pelleted feed
- Increasing aquatic feed production through plant optimization
- Krill as a feed source
- Decontamination of fish oil and fishmeal - alternative technologies and challenges
- Current issues in aquaculture feed and formulation
- Fishmeal/fishoil bottleneck and status of replacements
- Formulating for quality: improving animal performance, feeding efficiency and product quality in aquaculture species
- Extrusion Technology in the production of aquatic feed
- Raw materials and their impact on extrusion of aquafeeds

Aquafeed Horizons will take place at the Jaarbeurs, Utrecht, the Netherlands, May 9-10, 2007. Early bird and group registrations are available. For the full program and registration details, visit www.aquafeed.info

Biomin

Enlarges the management team in Asia



The company has announced that David Saunders has joined the team in Singapore as Regional Sales and Marketing Director for the Asia Pacific region from October 1, 2006. This is to facilitate the continuous growth of Biomin in the region, said Erich Erber, founder of Biomin.

In addition to the regional responsibilities, David will directly oversee business development in the markets of China, Korea, Japan and the South Pacific region including Australia and New Zealand. David has worked in the feed ingredient industry for over 22 years, previously with Adisseo in various positions and countries including Canada, USA, France, Australia and Italy.

FishPro 65 Aqua

A fish meal replacement

Australian company, Standard Commodities Group has FishPro® 65 Aqua, a product of equal quality and nutrient specifications to a high protein fishmeal, such as a South American 65% protein fishmeal. This is a high quality protein blend typically of 66-67% crude protein and 7.5% fat. It has high levels of all essential amino acids and a high digestibility of amino acids (range 80-90%). It is also high in available phosphorus and in essential fatty acids.

FishPro 65 Aqua is a blend of fish meal and animal protein meals, with added amino acids lysine and methionine. Ethoxyquin antioxidant and a salmonella protectant have been added. It has in particular, high levels of lysine (5.20%), methionine (1.70%), methionine + cysteine 2.50 %, tryptophan (0.75%) and threonine (2.85%). It is low in ash, low in moisture and high in energy.

The company emphasised that it does not contain feather meal or any material of poultry origin. The product has been developed to replace fishmeal in all fish feeds. This includes carp, tilapia, milkfish and catfish. Suggested inclusion levels are 15% in starter and down to 5% in finisher (last stage grow out). More information: E-mail: info@stancom.com.au; Web: www.stancom.com.au

Sel-Plex

Authorised for use in the EU

Alltech Inc announced in December 2006 that the European Union (EU) has authorised the organic selenium, Sel-Plex as a nutritional feed additive for use in all species diets. This was given under the EU regulation 1831/2003. Sel-Plex is a selenised yeast produced by *Saccharomyces cerevisiae* CNCM I-3060. Sel-Plex is the only organic selenium to receive this authorisation.

Selenium plays an essential role in metabolism, orchestrating normal growth, launching reproductive efforts, neutralising free radicals and supporting the body's normal defence mechanism against infection. Despite the traditional practice of supplementing animal diets with inorganic selenium, selenium deficiencies remain widespread, ultimately costing producers in terms of overall health and reproductive issues.

The selenium in Sel-Plex is presented in the same form that is naturally present in plants. These forms include selenoamino acids and related compounds ideally suited to digestion and metabolism. This means the selenium in Sel-Plex is more digestible and better retained. This allows the animal to build nutrient reserves against periods of increased demand without risking toxicity.

Sel-Plex is also the only organic selenium to have received FDA approval in the USA, in 2000 for use chicken diets, followed by turkey, swine, beef and dairy feeds and most recently for dog diets. Sel-Plex is the only product with safety and toxicity data that has been FDA reviewed and EU approved. More information: www.sel-plex.com

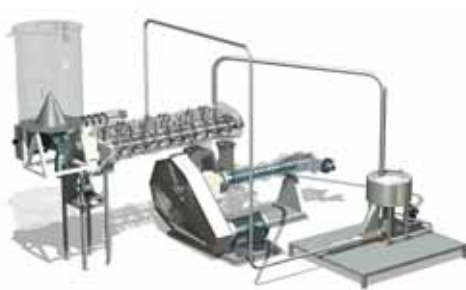
Wenger

New Waste Recycling System

In September, Wenger Manufacturing, Inc. introduced the WRS which promises to improve plant efficiencies through raw material, disposal and energy cost savings.

"By using the WRS system to reclaim product that would otherwise require disposal in landfills or diversion to livestock feeders, we've already seen a documented return on investment in less than 8 months," says Galen Rokey, process technology manager for Wenger. "In addition to raw material cost savings, significant energy benefits are also being realized."

This Wenger WRS system is used to reclaim under-processed product left over from extruder/preconditioner startup and shutdown that is too wet to grind or recycle into the raw recipe mixer. The recovered product is then liquefied and added back into the process in a slurry containing up to 12.5% solids, at a rate of up to 10% of the extrusion dry feed rate.



Make up water to the WRS slurry tank can be recovered from extruder cooling jackets, or from other factory sources where water might be discharged to a drain or otherwise wasted.

As the system can also be used to collect and recycle escaping steam and recipe fines that may be discharged from the preconditioner vent, the WRS can actually reduce energy consumption in the preconditioner by up to 25%. Reduced preconditioner maintenance costs and improved sanitation around the equipment are added benefits.

The press release added that the system is not designed for recycling dry product. For more information contact: info@wenger.com

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Web: www.tamu.edu/extrusion

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San Antonio, USA
Web: www.was.org (IBC)

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Feed Ingredients



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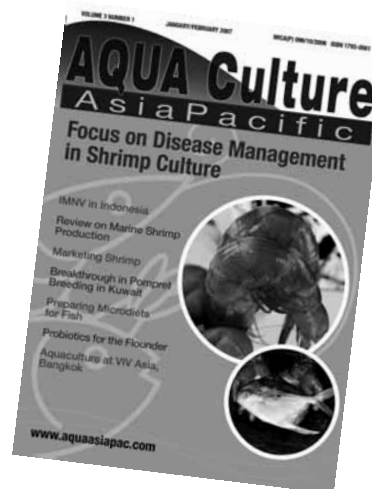
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