VOLUME 2 NUMBER 2 MARCH/APRIL 2006 MICA(P) 094/10/2005 ISBN 1793-0561

AQUA Culture AsiaPacific

Interview with Gold Coin Group CEO

Focus on aquafeed production

Product diversification in Thailand

Guangdong company expands

Reviewing marine finfish cage culture

Controlling parasitic diseases in marine fish

Investing in Vietnam's seafood industry

FAQs on mycotoxins in aquafeeds

Nucleotides for better shrimp health

AQUA 2006 show preview

www.aquaasiapac.com

Grow with Gold Coin

GOLD COIN 金錢 SPECIALITIES

Since 1984, GOLD COIN is committed to research, sustainability and good customer service.

visit our website
www.goldcoin.ws

At **GOLD COIN**, we are committed to provide superior shrimp feeds to ensure your business success. Using only the highest quality raw materials and manufactured under strict quality controls, we offer a range of feeds* to consistently meet the various levels of production systems. Our strict policy of opposing the use of antibiotics in our feed is congruent with the growing demand by consumers for traceability.

- **GOLD SUPREME** for superior growth and feed efficiency. Health enhancement with proprietary ENCAP® Immune enhancer
- **GOLD FORTE** is specially formulated for the intensive culture of white shrimp *Penaeus vannamei* in Asian conditions
- **GOLD CLASSIC** is our flagship product that meets all nutrient requirements of *Penaeus monodon* shrimp under normal conditions
- **GOLD ROYALE** is used in highly intensive conditions by the most discerning farmer
- **ENCAP®** Hatchery Feeds have prime quality ingredients micro-encapsulated within a digestible yet water stable membrane

Some products may not be available in your country. For details on Gold Coin range of shrimp feed and other Gold Coin Aquaculture products, please contact our regional offices.

SINGAPORE *(HEADQUARTERS)*- Gold Coin Services Singapore Pte Ltd, 99 Bukit Timah Road, #05-05/07, Alfa Centre, Singapore 229835, Tel: +65 6337 4300 Fax: +65 6337 6911 email: general@gcss.goldcoin.ws

MALAYSIA *(JOHOR)*- Gold Coin Specialities Sdn Bhd/Gold Coin Biotechnologies Sdn Bhd, Tel: +607 237 0695 Fax: +607 236 1143 email: sp.koh@gcssb.goldcoin.ws

INDONESIA *(NORTH SUMATRA)*- P.T. Gold Coin Specialities Medan, Tel: +62 61 415 5115 Fax: +62 61 451 2748, email: I.mariyanto@gcsimd.goldcoin.ws

INDONESIA *(WEST JAVA)*- P.T. Gold Coin Indonesia, Specialities Division, Tel: +62 21 885 3668 Fax: 62 21 884 1947 email: z.pasaribu@gcsibk.goldcoin.ws

THAILAND *(SONGKHLA)*- Gold Coin Specialities (Thailand) Co Ltd, Tel: +66 74 483 600/5 Fax: +66 74 483 493 email: s.pisit@gcst.goldcoin.ws

INDIA *(CHENNAI)*- P.T. Gold Coin Specialities India, India Branch. Tel: +91 44 2620 4716/0651 Fax: +91 44 2622 0260 email: goldcoin@md2.vsnl.net.in

Contents

Volume 2, Number 2 March/April 2006 MICA (P) 094/10/2005

Editor/Publisher
Zuridah Merican, PhD
Tel: +603 2096 2275 Fax: +603 2096 2276
Email: zuridah@aquaasiapac.com

Editorial Coordination
Corporate Media Services P L
Tel: +65 6327 8825/6327 8824
Fax: +65 6223 7314
Email: irene@corpmediapl.com
Web: http://www.corpmediapl.com

Design and Layout
Words Worth Media Management Pte Ltd
wworth74@singnet.com.sg

AQUA Culture AsiaPacific is published bimonthly by **Aqua Research Pte Ltd**
3 Pickering Street,
#02-36 Nankin Row,
China Square Central, Singapore 048660
Web: www.aquaasiapac.com

Editorial and advertising enquiries
Request for reprints and articles
Email: zuridah@aquaasiapac.com
Tel: +603 2096 2275 Fax: +603 2096 2276

Subscriptions
Online: www.aquaasiapac.com
Email: enquiries@aquaasiapac.com
Tel: +65 9151 2420 Fax: +65 6223 7314

Annual Subscription by airmail (6 issues a year)
Asia (excluding Japan & Korea): SGD70
Other zones: SGD100

WRITE TO THE EDITOR
We want to hear from you. Write your comments on the industry to the editor.

Send by fax to Zuridah Merican at +603 2096 2276 or email: zuridah@aquaasiapac.com

Letters may be edited prior to publication

From the editor

A low risk tolerance

In this issue, the focus is on aquafeed production in Asia. The production of shrimp feed is increasing to meet demands and many aqua feed companies are moving into the production of fish feeds, in particular for the commodity species such as tilapia and catfish. In marine shrimp culture, many medium size feed producers, predominantly in Thailand and Indonesia, are intensifying their role upstream by also expanding hatcheries facilities for the supply of postlarvae. Production of feeds for the marine finfish sector still remains in the pipeline or a dream for many feed producers.

The industry review on the cage marine finfish culture evidently shows it is years behind that of marine shrimp farming. What are the bottlenecks that are deterring its growth?

The farming of finfish in cages is segmented into two distinct sub industries. These are the supplier of hatchery fry and the grow-out operator. The cycle for a hatchery averages 20 days for the seabass to 35 days for the grouper. It is the farmer rearing the fish to the marketable size for 6-9 months (depending on species) who bears the higher level of risk. His cash is locked in for a longer time. He endures high risks as his stock is subject to uncontrolled environmental conditions. When trash fish is used, payment is on a cash basis. In contrast, marine shrimp farming has a shorter cycle (3-4 months) and credit for feed can be extended to the end of the cycle. Shrimp culture is restricted to two main species where better known culture knowledge mitigates the risks. In the case of the marine fish, a farmer can have 3-4 species at any one time comprising a 'flavour of the month species', traditional species (such as seabass) and potential new species.

Heavy mortality normally occurs during the rearing of fry to fingerling and when the fish are weaned onto pelleted feeds. Would a three- stage production process which spreads the risks be a solution? We already have well developed first and third stages and what will be needed is to introduce a second stage which grow the fry (2.5cm) to fingerling (15cm) in about a period of 2-3 months. During this period, the fish can also be weaned onto pelleted feed. The weaned fingerlings can be readily placed in cages for grow-out. This removes a major obstacle in the industry as evidenced by cage farmer Stuart Keable who said that having larger sized fry has helped him overcome some of the mortality problems in his operations. As mentioned, this stage is plagued with high mortality but the loss at this stage costs the industry much less in terms of investment and time compared to mortality in the grow out cages. Furthermore, the culture can be done in cement tanks or ponds where water quality and environmental conditions can be better controlled.

This additional 2nd second stage requires R&D, investment and commercial excellence. This operation also provides a ready market and opportunity for feed companies. It makes commercial sense for feed companies with their resources to develop and produce weaned and healthy fingerlings for supply these to the farmers. This certainly helps market their feed.

Many in the industry may not agree with this suggestion as it forces allegiance to specific brands of feeds. However, if we look at success stories, this was the way shrimp culture was developed to its current level. Institutional research and government support can only take the industry to a certain level. We have to look toward feed companies as *de facto* leaders to take the marine fish industry to the next level.

Zuridah Merican

What it should have been

In the January/February 2006 issue in the article "Marine shrimp farming in Asia today, pp 10-12, there were several errors. Page 11, paragraph 6, line 4, the figure 10,5 tonnes should read 100,500 tonnes. Page 12, Table 1- figures for columns 1-3 are in tonnes and % for column 4. We apologise for these errors.

Feed Efficiency, Reliability, Safe
Traceability, Genetic Potential,
Profitability, Product Quality, So
Nutritional Value of Food, Natu

Alltech ...naturally

Aquafarmers know healthy animals bring healthy returns and that a combination of good husbandry, good feed and good environment are the best guarantees of success.

For over 25 years, Alltech® has been at the forefront of researching and producing highly effective, all-natural solutions that benefit animal health, performance and productivity whether on the farm or in the feed.

Alltech's cutting-edge brands – De-Odorase®, NuPro®, Aqua-Mos®, Mycosorb®, Bio-Mos®, Bioplex® and Sel-Plex® – are unique examples of how all-natural technologies, backed by dedicated research, can move the aquaculture industry forward ***...naturally.***

Alltech® aqua ...naturally

aquasolutions@alltech.com

AQUA 2006 - MAY 9-13, 2006, FLORENCE, ITALY
Visit us at our booth, no. 110, 112 and 114.

SYMPOSIUM 2006 - APRIL 23-26, 2006, LEXINGTON, KY, USA
Alltech's feed industry symposium will feature a series of talks on aquaculture nutrition.

Vietnam is first with multiplication centre for BT shrimp

Facitilies for the trial production and sales of SPF (Specific Pathogen Free) black tiger *Penaeus monodon* postlarvae will be set up in South Vietnam. This follows the signing of agreements between Vietnam's Ministry of Fisheries and Moana Technologies LLC (MTL) from Hawaii. This is a joint development project with the Research Institute for Aquaculture Number 1 (RIA1) directed by Dr Le Luu. On November 17, 2005 seven delegates of the Vietnamese Government visited the Moana Nucleus Breeding Center (NBC) in Kona, Hawaii.

Delegates form Vietnam visited the Moana Nucleus Breeding Center (NBC) in Kona, Hawaii U.S.A..

In Vietnam, the black tiger shrimp accounts for 90% of farmed marine shrimp production. Vietnam is currently the largest producer of this species in the world. In 2005, estimated production of *P. monodon* in Vietnam will exceed 250,000 tonnes. At present, no domesticated or genetically improved stock is available commercially.

Both the Vietnamese Government and MTL consider this new venture a keystone project which will help to map a new and improved path for the farming of the black tiger shrimp in Vietnam. The final goal is to help the entire industry to reach greater efficiency and stability and to provide a fully traceable, high quality product to the international market.

The development of grandparent and parent stocks is taking place in Hawaii (MTL) while the product for sales to aquaculture farms will take place locally in the multiplication centers (MC). This project will be the first multiplication centre for black tiger shrimp. After initial production trials and a market testing period of three years, it is foreseen that a joint venture company for the industrial production of SPF black tiger postlarvae will be set up.

In a first phase, SPF postlarvae will be produced. This will be followed by genetically improved breeds of *P. monodon* in the near future. The improved traits that will differentiate these stocks include absence of specific diseases, hardiness to aquaculture conditions, improved growth rate, disease tolerance/resistance and other traits which enhance farm performance of the shrimp. Consumer oriented traits such as improvement in color and taste are also on MTL's genetics program.

Moana Technologies LLC (MTL) is a genetic improvement company with its principal business in the selective breeding and genetic improvement of this shrimp. MTL, created in 2001 established the first and world largest quarantine and Nucleus Breeding Centre (NBC) for the black tiger shrimp in Kona, Hawaii. MTL is currently active in setting up domesticated pedigree families of black tiger shrimp. The company also owns the world largest and most diverse gene pool of domesticated black tiger. These founding stocks were bred and their progenies have gone through two consecutive quarantine processes, before being transferred to the NBC located on Hawaii Island. From that genetic pool, animals are selectively bred and used to produce improved lines of shrimp. Selected commercial lines will be sent to multiplication centers to be set up in the major black tiger shrimp producing markets including Vietnam, where they will produce large numbers of improved postlarvae for use by the local hatcheries and farms.

MTL is currently discussing similar projects with the Governments of Thailand, Indonesia, India and China.

ISO-22000 for Uni-President, Taiwan

Uni-President Enterprises Corp., the biggest food and feed group in Taiwan has formally received an ISO 22000 certificate, issued by SGS Taiwan on 17 January 2006. This was carried out first in the aqua and livestock feed manufacturing units of the company. SGS group is one of the recognized international laboratories to implement this new certification.

ISO22000 integrates the principal of the Hazard Analysis and Critical Control Point (HACCP) system. It specifies the requirements for a food safety management in the food chain where an organization needs to demonstrate its ability to control food safety hazards in order to provide consistently safe end products that meet both the requirements agreed with the customer and those of applicable food safety regulations.

The company was the first to apply HACCP in Taiwan at the beginning of February 2005. The facility is comprehensively equipped with advance equipment and machinery. Its highly skilled employees were trained by the Taiwan Animal Technology Institute and the Taiwan Provision Foundation.

Uni-President's export markets cover Madagascar, Mozambique, Malaysia, Australia, Indonesia, India, Iran, Sri Lanka. The seafood markets of its customers' are the EU, Japan or USA. Food traceability will be required in these major seafood markets. SGS Taiwan will apply for UKAS certification for Uni President and the results will be released during March/April 2006.

From left: Ryan Huang, Specialist - Lead Auditor and Waynee Lee, Project Manager-Lead Auditor, SGS, Long-Hong Lu, Vice President, Technical Group Head and Ping-Liang Lai, General Plant Manager, Technical Group Head, Uni-President.

Positions announcement

Intervet International BV (with its headquarters in The Netherlands and a business unit of the Akzo Nobel group) is the third largest animal health company in the world. Intervet has over 20 years of experience in fish vaccine development and is the global market leader in this segment. The success of the salmon industry, in particular the minimal use of antibiotics and the traceability of the final product, has been achieved to a large extent by the widespread use of vaccines.

In 2000, Intervet set up an R&D centre in Singapore, Intervet Norbio Singapore, entirely dedicated to the development of novel vaccines and other products for warm water aquatic animal species. In 2005, two Intervet fish vaccines have been successfully launched in the Asia-Pacific region and more are in the R&D pipeline.

To cope with the rapid growth of our business, we now need a dedicated and dynamic person to join our Technical Service team to better service the warm water aquaculture industry. Therefore, we invite applicants for the following position:

Technical Officer or Manager – Aquatic Animal Health, Intervet Norbio Singapore

Candidates must possess

- a basic university degree (or higher) in aquatic animal health, aquaculture, marine biology or veterinary medicine and
- a minimum of 3 years experience in warm water aquaculture production and ideally having hands-on experience with tilapia and common Asian marine species.

The successful candidate will actively participate in field studies relating to disease investigation and epidemiology and field trials for the development of aquatic animal health products. Other responsibilities will include technical support to Intervet's local companies and customers. A practical knowledge of fish diseases is required. Good verbal and writing skills in English are essential and good knowledge of at least one other important Asian language is desirable. He/she should have a strong sense of responsibility, commitment and resourcefulness and be a team player. The person must be capable of professional interaction with a diverse audience across the region and be willing to undertake frequent travel. Candidates who apply for the level of Technical Manager must in addition have considerable supervisory experience, business skills and have preferably worked with a multinational company for at least 5 years. We offer

- A competitive remuneration package commensurate with qualifications and experience
- Training on the job (internationally when required)

Interested applicants are invited to post or email their full resume with personal details, qualifications, experiences and salary expectations to:
Intervet Norbio Singapore Pte Ltd
1 Perahu Road, Singapore 718847
E-mail: info.aqualNS@intervet.com

Applicants are also requested to support their application with a short note as to why they feel the position is suitable for them. (Only short-listed candidates will be notified.)

US may ease C-bond on Thai shrimp

At present, Thai shrimp exports to the US are subjected to antidumping tariffs from 5.79-6.82% and exporters must post a 100% continuous bond (C-bond) before they can ship to the US. In 2006, Thai shrimp exporters are expected to have to put up USD100 million for the C-bonds, compared with USD50 million in 2005. The Nation reported that the United States may consider revising the bond.

Somsak Paneetatyasai, president of the Thai Shrimp Association, said revising the C-bond would allow shrimp exporters to have more liquidity to develop their farms instead of having money tied up in the guarantee. He added that the changes could also reduce the burden on exporters with regard to export risk and trade obstacles to the US.

Somsak also said that increased rainfall this year in the south, where the bulk of country's shrimp industry are located, has caused a 1-2 month delay in stocking shrimp ponds. Harvesting will not occur until June or July and exports will be delayed.

"Production could be 50% lower than in 2005 resulting in increased shrimp prices from now until mid-year. Prices per kg for white shrimp in January for the 50, 60, 70 and 80 pcs/kg sizes were Baht 175 (USD 4.6), Baht 145 (USD 3.8), Baht 120 (USD 3.2) and Baht 110 (USD 2.9) respectively, while 50, 60, 70 and 80 black tiger shrimp sizes were trading at Baht 150 (USD 3.9), Baht 140 (USD 3.7), Baht 135 (USD 3.6) and Baht 130 (USD 3.42), respectively. According to Customs Department figures, the volume of exports rose 21% to 260,426 mt in 2005. Its value increased 8.5% to Baht 65.7 billion (USD1.72 million).

Shrimp Health Management Training Workshop

Alltech and the Network of Aquaculture Centers in Asia-Pacific (NACA) will hold its next Shrimp Health Management Training Workshop for 5 days from 24 to 29 July, 2006 in Bangkok, Thailand.

"Modern shrimp farming places greater demands on producers as increased requirement and volatile prices force them to re-evaluate production technologies to compete.", said Daniel Fegan, Regional Technical Manager Aquaculture of Alltech Inc." More attention to postlarval quality and biosecurity, better cost control and better environmental management are now central in today's shrimp production business".

Last year, more than 50 participants attended the workshop which also included 2 days of farm visits. The cost of attendance is USD 550 comprising course fee, materials and accommodation during the field trip. Contact: shrimp-school@alltech.com to make reservations and for details on the workshop.

Brief news

Review on AD shrimp tariffs

The US Department of Commerce (DOC) will randomly select exporters in Thailand, India, China, Vietnam, Ecuador and Brazil for a review on the shrimp antidumping (AD) tariffs on March 8, according to Thanh Nien daily. Vietnam Association of Seafood Exporters and Producers (VASEP) said all 54 Vietnamese shrimp export companies to the US submitted applications at a cost of USD 75,000 each to join the lawsuit to petition for the antidumping tariff review. India's Seafood.com said that 25 big shrimp exporters submitted petitions.

Under the review, the DOC would examine the prices from selected exporters from July 2004 to January 2006 to finalize their new rates and come up with an average rate for other companies, according to VNagency.com. Lawyers familiar with the antidumping review said during the process, the DOC tends to lower tariffs.

Test for feed industry in Indonesia

The position of the feed industry in Indonesia is being challenged with rising prices of raw materials. Kompas reported that since January 2006, prices rose 15-28%. Their production costs also increased due to the 100% increase in fuel from October 2005. With low prices for shrimp, feed producers cannot increase feed prices for the vannamei shrimp which has remained at RP8,000/kg. To help the industry, producers are delaying price increases until the farmers reconcile costs of production and income and improve on export markets for shrimp.

BAP for three companies

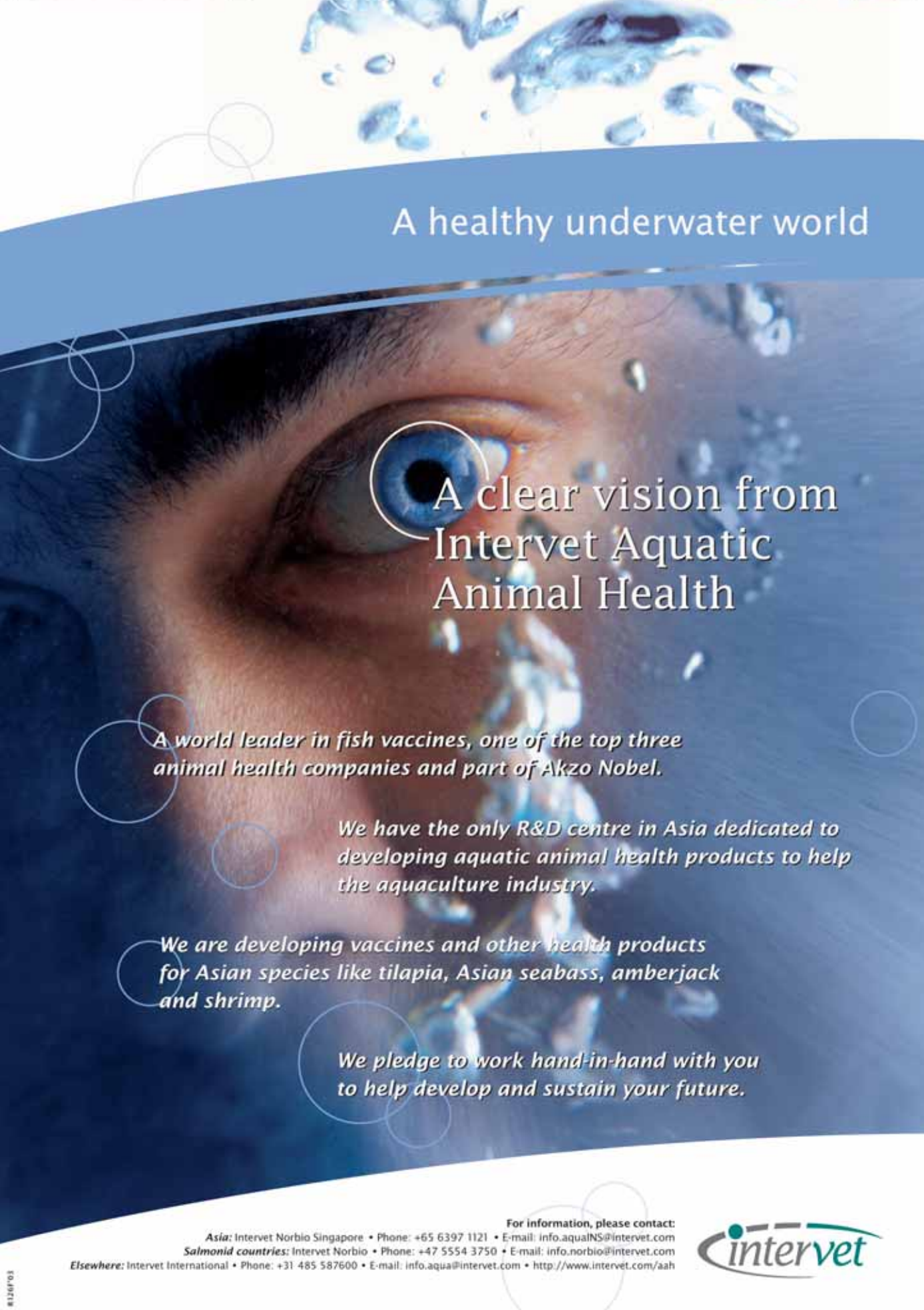
In its newsletter, the Aquaculture Certification Council announced that Wal-Mart, Darden and Rubicon Resources are adopting Best Aquaculture Practices certification (BAP) developed by the Global Aquaculture Alliance. Following this, 16 processing plants (most in Thailand), 10 farms, and four hatcheries have lined up to be BAP certified, with an additional 32 facilities requesting information.

New highs for US shrimp market

New records for shrimp imports are likely in the US market although prices are still low compared to previous years. Fish Infonetwork reported that during the first nine months of 2005, volumes of shrimp imports increased 4% to 359,430 mt.

Asian suppliers dominated 72% of market volume and Latin American supplies declined 23%. Thailand was the leading supplier despite a slow start to the year. Indonesia and Ecuador overtook China as the second and third largest suppliers. Behind them were India and Malaysia. The top three supplied 52% of the market.

Ecuador was the only country in Latin America to export more than 10,000 mt and increased market share in Spain, Italy and France in 2005. At the recent Global Shrimp Outlook meeting, delegates said that with the ongoing recovery in Ecuador's farmed shrimp industry, significant increases are projected for 2006. Production estimates showed volumes up some 30% during 2005.



For information, please contact:
Asia: Intervet Norbio Singapore • Phone: +65 6397 1121 • E-mail: info.aqualNS@intervet.com
Salmonid countries: Intervet Norbio • Phone: +47 5554 3750 • E-mail: info.norbio@intervet.com
Elsewhere: Intervet International • Phone: +31 485 587600 • E-mail: info.aqua@intervet.com • http://www.intervet.com/aah

intervet

A new beginning for Indonesian shrimp

The objective for the farmed shrimp industry is to increase production to 350,000 mt in 2006 but there are obstacles…by Iffa Suraiya

Shrimp together with tuna and seaweed are the three export commodities for the Indonesian fisheries and aquaculture industry. From 2000 to 2004, the increase in shrimp export volumes was 5.58%. This was 143,550 mt in 2004 as compared to 116,187 mt in 2000. However, in 2005, volumes dropped to 124,985 mt.

As the target was not achieved in 2005, the government had to take some action. Amongst the three commodities, shrimp is the main focus because of a potential contribution of USD 1 billion. This revitalization, according to Dr Made Nurdjana, Directorate General of Aquaculture, Department of Fisheries and Marine Affairs, means a redevelopment of the shrimp culture business. "A clear direction will be very helpful in deciding whether we want to rebuild the intensive or semi intensive farms or maintain the extensive nature of culture".

Dr Made Nurdjana

Targets in shrimp production are 350,000 mt in 2006 and increasing to 540,000 mt by 2009. The rebuilding will start with traditional farms to increase production yields to 1 mt/ha/year and the next step will be semi intensive ponds to increase production to 5 mt/ha/year.

According to Dr Nurdjana, if the program is implemented as planned, there would be an increase of 17.6% in production volumes, 16.6% in consumption, 16.7% in exports and 18.5% in demand for labour.

The president of the Shrimp Club Indonesia, Iwan Sutanto said that the target would not be impossible as the country has several advantages. "Prospects for Indonesian shrimp are bright. Geographically Indonesia has a good location, ideal climate and year round production is possible. We do not have calamities like typhoons faced by China, Vietnam and the Philippines. Our waters are less polluted and labour is available".

However, with the competitive international markets, Iwan said that farmers will need to pay attention and act to certify their farms. "The quality of shrimp postlarvae also needs to be upgraded and they should come from certified hatcheries".

He said that Indonesia farmers have tried to implement the principles of 'Good Aquaculture Practices-from farm to table'. "We do not use antibiotics during the culture process. We fully understand the strict requirements of international markets. These are the technical, sanitation and hygiene conditions that are required from preproduction, production, processing and marketing".

Vannamei villages

Since 2004, PT CP Prima Surabaya has begun to implement the Shrimp Culture Health Management transformation technology to several traditional farmers in Gresik, Lamongan, Tuban, and Madura areas. Firmansjah, Vice President of PT. CP Prima said, "These pioneer farms are good examples of pilot projects in technology transformation, starting from farm preparation, fry quality, vannamei species usage, water management, feed intake, harvest activities and biosecurity implementation".

Mr. Ainur Rofiq and H. Amin, two farmers in a Kranji village, Lamongan, have already achieve success. With stocking density of 15 pcs/m^2, they have managed to harvest 1.2 – 1.7 mt/ha of 100-70 pcs/kg in 60-80 days. As for the semi-intensive farmers, at a stocking density 40 pcs/m^2, harvest were 5.3 mt-6.4 mt/ha with culture period of 90-110 days.

The success of these projects is being seen by other farmers. A number of farmers groups in certain area have created 'Kampung Vannamei' or Vannamei Villages. This village concept is developed based on a farm territorial security concept that uses the same SOP (standard operational procedures) in order to have a secure farms complex.

"With this Vannamei Village, farms located in one area/complex helped us to monitor, train and educate farmers, increase coordination among them and support for a thorough SOP implementation. It also gives them access to farmer productions facilities", said Nonot Tri Waluyo, Sales Manager Shrimp Feed.

Diesel prices

The recent hike in prices is a great burden for the farmers especially as selling prices continue to drop. Nefo Ng, a farmer in Bali and Lombok has calculated that cost of production has increased 16.3% with the increases in diesel prices. He said, "The cost of production for the vannamei shrimp (for size 50/kg) was only Rp 30,020/kg before the hike in diesel prices. Now the production costs in Lombok have increased to 34,930/kg. For intensive shrimp farming, I would need 1.5 to 2.0 litres of fuel for every kg of shrimp".

Until October 2005, prices have been relatively stable. The prices for size 40 pcs/kg were Rp 49,000 (USD 5.33) and Rp 42.000-43,000 (USD 4.6-4.7) for 50 pcs/kg and Rp 37,000 to 38,000 (USD 4-4.1) for 70 pcs/kg. However, by mid November, prices had decreased to Rp 32,000 (USD 3.48) for 60 pcs/kg and Rp 37,000 (USD 4) for 50 pcs/kg.

Hardi Pitoyo

Farmers are hoping that any government regulation pertaining to fuel will benefit them. "Shrimp is a strategic commodity and fuel or electricity is the 'soul' of the culture activity. The higher the intensity of culture for higher production, the higher would be the energy needed," said Hardi Pitoyo, a farmer in Banyuwangi.

Although the increase in fuel prices is understandable following the recent highs in global oil prices, farmers are still hopeful that these would gradually implemented. "We want the government to assist and ensure that fuel and electricity is always available. Price increases will not be a problem as long as it is just. We also request support and assurance that in buying of the fuel, regulations are followed", said Ali Kuku, a farmer in Lampung.

Launch of the program to revitalise industry

The 5th Shrimp Congress in the Philippines

"New challenges and frontiers of the Philippine shrimp industry."

This is in preparation for the eventual commercialisation of the Pacific White Shrimp Litopenaeus vannamei in the country. It will be held from 21–23 June, 2006.

At the last Shrimp Congress in 2004, the industry agreed on a lifting of the ban on the importation and culture of *L. vannamei*. It also decided that the Bureau of Fisheries and Aquatic Resources (BFAR) will run experimental trials on the hatchery and grow-out potential of the species. This will form the basis for the lifting of the ban.

"The first shipment of broodstock arrived on August 19, 2005 and was placed in a bio-secure nucleus hatchery facility at a BFAR National Fisheries Center in Dagupan City, Northern Luzon. In December 2005, the first batch of postlarvae was released to accredited shrimp grow-out facilities for field trials. With the assurance of getting high health fry from the nucleus hatchery and near completion of the grow-out trials, the industry is now moving towards a controlled introduction of *L. vannamei* into the country", said Dr. Juan D. Albaladejo, Fish Health Section, BFAR.

The 5th Shrimp Congress is in preparation for this. It will be held in Bacolod City, Negros Occidental. Organisers are BFAR and the Philippine Shrimp Industry Association (PHILSHRIMP). Tentative topics include

- Updates on global shrimp farming and on the farming of black tiger shrimp *Peneaus monodon* in the Philippines
- Recent advances in shrimp farming in Asia-Pacific region and Thailand, which will include farming technologies and health management practices for *P. monodon*
- Introduction of new products in aquaculture and feed additives
- Philippine regulations on importation, accreditation for hatchery and grow-out of L .vannamei
- Hatchery, culture, feeds and feeding technologies for *L. vannamei*
- Marketing strategies: government programs to support white shrimp industry, export potential, processing and value addition in Pacific white shrimp products
- Updates on the EU and Japan import regulations

There will be an exhibition of products at the Pavilion premises. A field trip to shrimp farms will be on the last day of the congress.

More information: Dr. Juan D. Albaladejo and Maria Abegail Apostol-Albaladejo, Fish Health Section, Bureau of Fisheries and Aquatic Resources (BFAR), Central Office. Address: 860 Arcadia Bldg., Quezon Avenue, Quezon City. Telefax: +63 02 3725055. Email: jalbaladejo@bfar.da.gov.ph; jalbaladejo99@yahoo.com or mariaabegail11@yahoo.com. Web: www.bfar.da.gov.ph

For registration, contact the congress secretariat at Negros Prawn Producers Marketing Cooperative, Inc., NEDF Bldg., 6th Lacson St., Bacolod City, Negros Occidental, Philippines. Tel: +63 34 4332131, 4342559. Fax: +63 34 4332131 Email: nppmci@mactan.ph

Pursuing core competence

Gold Coin's new CEO, JC Filippi unveils his vision for the aqua feed division.

The Gold Coin Group is a pioneer in the formulation and manufacturing of commercial feeds for the livestock and the aquaculture industry, with more than 50 years presence in Asia. The Company has played a unique role in Asia's food industries by initiating much of the research, development and marketing of scientifically formulated feeds in the region. Besides the manufacturing of grow out feed, the Group also produces micro encapsulated and micro particulate feed for the shrimp hatchery industry.

The Gold Coin name is synonymous with shrimp feed as it was one of the first companies to develop and market shrimp feeds in South East Asia. In 1984, Gold Coin started its first shrimp feed factory in Singapore, which was subsequently relocated to Johor, Malaysia in 1986. Today, the group operates aqua feed mills in Medan and Bekasi in Indonesia, Songkhla in Thailand in addition to the pioneer mill in Johor. These mills have a combined annual production of more than 60,000 mt of shrimp feeds. These are also servicing the export markets in India, Brunei, Sri Lanka, Bangladesh, Vietnam and Myanmar. Gold Coin also has a specialty factory in Malaysia producing encapsulated and micro particulate hatchery feeds for the marine shrimp.

Increased production, the imposition of tariff barriers, and occurrence of diseases has made the shrimp culture industry very challenging. As they vie for market share, some feed producers have embarked on upstream and downstream integration. Amidst these developments, Gold Coin still believes in focusing on its core competence: The production of quality feed.

In this interview, the new Group CEO, JC Filippi explains Gold Coin's vision and its plan to work together rather than in competition with other professionals in the shrimp culture industry.

"Whilst others have their own expertise, our core competence is in feed production and feed management..."

JC Filippi became Gold Coin Group's CEO 18 months ago. With 17 years of marketing and business development experiences in the livestock and food Industries in Asia, JC Filippi brings with him vast experiences to add onto the Gold Coin Group's strong brand name.

With staff and customers from India at the Gold Coin seminar held during World Aquaculture 2005 in Bali. From left; Ajay Mulchandani, Xexus Aqua Culture Pvt Ltd, Sam Soh, Ravinthar, Gold Coin India, M.Sudhakaran, Aqua Life System, S.A.D.Annamalai, SADA Aqua Tech and JC Filippi

AAP: How do you see the contribution of the aqua feed business to Gold Coin's overall business?

JC Filippi: Our vision is to double the size of Gold Coin by 2010 partly through organic growth coming from our current markets, but the major driver will be through significant mergers and acquisitions in new markets such as China, Vietnam and India. I see the aqua feed as an exciting driver for the group's business growth, although our livestock feed will still remain as the main stay business for the company.

We are already very strong in the shrimp feed business and we are now moving to other varieties of aqua feed products. But along the way, I emphasize that growth will not be at the detriment of quality. Therefore, if we acquire a company, it should have a good brand name and a similar corporate culture that is able to integrate into Gold Coin.

The philosophy and spirit of the company is always to strive for a leadership position in its markets. This does not necessarily mean in terms of sales volumes but in brand image and all those that go with it such as quality and the adaptation of product to meet market requirements. In the various countries where our product is present, you will see that Gold Coin is well established and associated with consistent quality feed and a close presence and relationship with its customers. I think this is essential to stay in this business in the long term.

AAP: In the last four years, some aqua feed producers in the region are either expanding or adopting vertical integration. What is your vision for the aqua feed business of Gold Coin?

JC Filippi: The industry in Asia is relatively "young" and one could say that the integration model has been associated with the success of farms and feed companies. This has helped farmers with services and logistics arrangements.

However, Gold Coin believes in the co-existence of farmers and other integral parts of the industry as well as their ability to make their own choices. Integration obliges the farmer to work with only one company and does not allow them to choose to work with the best hatchery (broodstock and post larvae), the best feed company and the best processing plant.

Our alternative model is simple. We aim to create alliances with experts or professionals in the 4 fundamental pillars of the aquaculture industry, that is, hatchery production, feed mills, farms, and processing. In hatchery production, our view is that the control and improvement of genetic stocks is only possible through intensive R&D. As such, an alliance with well-established and experienced professionals is the best way. The decision to integrate backwards or forward is left open but it will only be done on a joint venture basis with proven entities, which can add value in their respective fields, to support and enhance competitiveness of the farmers.

This is a more workable platform for the independent farmers in shrimp farming. Whilst others have their own expertise, our core competence is in feed production and feed management and we will provide technical support in this area. This is in line with the Group's position and vision of providing quality feed and leadership in the countries where we operate.

Even as white shrimp culture is rapidly introduced in many countries, it remains a learning process for many in the farming circuit. I believe that it is important that farmers are encouraged to share ideas such as best practices and that knowledge should not be camouflaged. Neither should farmers be constrained by targets imposed by processing plants. Through technical support from all parties, farmers will have access to independent information and make informed choices.

In a fully integrated model, product traceability is simple as the shrimp buyers need to work with only one company to check on the traceability. In this alternative model, all parties will have to share the responsibility in ensuring proper product traceability and that each party conforms to best aquaculture practices. As a feed company, we need to partake in all the steps towards traceability, as feed is one of the important components in the shrimp farming cycle.

AAP: You have a steady growth in aqua feed volumes in some countries. What have been your strengths in these markets?

JC Filippi: We consider ourselves as a key player in the free markets of Malaysia and Indonesia. Our core business is in shrimp feed manufacturing and this has created a good level of loyalty amongst our customers and distributors, as I noticed during recent meetings

with farmers in the region. Clearly, the non-competition with farmers resulted in such loyal attachment to our products and enabled us to achieve a good position in the shrimp markets throughout the region.

When I joined the group, I saw that the Gold Coin brand is well known not only in the livestock market but also in the aqua feed market. How we reached this level is by manufacturing products with consistent quality. Product quality depends first on proper selection of raw material and a strong manufacturing process. We make no compromises in these areas. I want to emphasize this because when raw material prices shot up, we could have been tempted to change the raw material just to bring down the cost of the product. But we stuck to our stand and continued to procure quality fish meal from Peru and Chile for example. In our research programs, however, we have gone forward to look at substitution for fishmeal with the intention to reduce the dependence on fishmeal.

We have also put in a lot of efforts and resources into improving process and technology in our production lines; our factory in Thailand has just recently been equipped with another production line using the latest technologies and we are expanding our factory in Bekasi to be operational in the second half of 2006. This is to meet the increased demand from the markets for our products.

AAP: The region's farmed shrimp industry is not expanding but changing. What are your views on these markets?

JC Filippi: Gold Coin has a very positive outlook for the region. The industry in **Indonesia** is expanding. It is one of the top shrimp exporters to Japan and the US. We have seen how the government is emphasizing on the industry and there will be plenty of room to grow for shrimp culture, although it is probably not as structured as in Thailand. We are confident on further improving our already strong position in this growing market.

We also see some very interesting potential in **India**, simply because of its long coastline and the industry's commitment to the culture of the black tiger shrimp. We hope that the industry will remain patient and overcome problems with diseases and work on the domestication and improvement of black tiger shrimp broodstock. Today, we see so many countries culturing the white shrimp and India can possibly occupy a niche market as its good size black tiger shrimp can shield it from the price competition prevailing amongst the smaller sized white shrimp.

We are also bullish on the developments in **China**. What we are seeing now is nothing compared to what can come in the future, especially when we look at the potential growth in domestic consumption. Some 20% of the population is consuming seafood today and this is limited to the coastal areas. Any potential expansion in marine shrimp production can cater to the demand from the domestic market. China is a well-known market for Gold Coin as we are producing livestock feed there since 1987. Even though we may be going into a very competitive market, I believe that our consistent approach and long term view will be our competitive advantage.

We also see the success achieved in **Thailand's** shrimp culture industry and its current leading position. The country is far ahead of its competitors in culture technology and will continue to lead with many countries looking closely at the developments in Thailand. For example, it was early in certifying shrimp for the EU market. The industry is a key pillar of the economy and the government positions itself with industry. Gold Coin aims to strengthen its presence in this country by growing our alliances.

AAP: What will be Gold Coin's focus in growing its activities?

JC Filippi: One of our strengths is our product quality, which I have explained earlier. We will continue to focus on this area and our brand value. R&D is focused on applied aspects in feed development and is conducted in research facilities in Thailand and Indonesia. The establishment of an in house R&D facility is also in the pipeline.

GC has a strong culture of customer service. Whereas, this may be similar to the strategy employed by other companies, our strong point is the "proximity" to the customers, meaning not only in distance but also in understanding. We listen to the needs of the farmers and continually talk to them to address and solve problems quickly. This permeated through the whole organization, from the General Manager to the mill operator. We also attribute our success in the last ten years to the Customer Service oriented approach of Mr. Sam Soh, who heads the aqua business.

Shrimp culture is a complex activity with many interactions. Our idea is to facilitate the learning process for farmers and we use experts to provide technical inputs when required. We also introduce new ideas and effective technologies. When farmers in Medan wanted to start culture of white shrimp, we brought them to our customer's farms in East Java to see how this is carried out. When the culture of the white shrimp was opened in Malaysia, we took teams to Thailand and Indonesia.

AAP: What will be the major challenges for the shrimp culture industry in the future?

JC Filippi: One of the most critical aspects is the need for the Industry to work on genetic improvement and development of shrimp broodstock, such as in resistance to diseases and improvements in growth rates. Feed companies like us will be required to formulate in tandem with the genetic potential of the new species or improved genetic stock. We will need to link these with culture conditions and systems in the various countries.

For the past 18 months, I have seen the industry moving from culturing black tiger shrimp to that of white shrimp. Aside from culture practices, we also have to look at the feed requirements. The industry is young and new ideas will evolve constantly. We will need to keep with the flow of information and keep our customers updated.

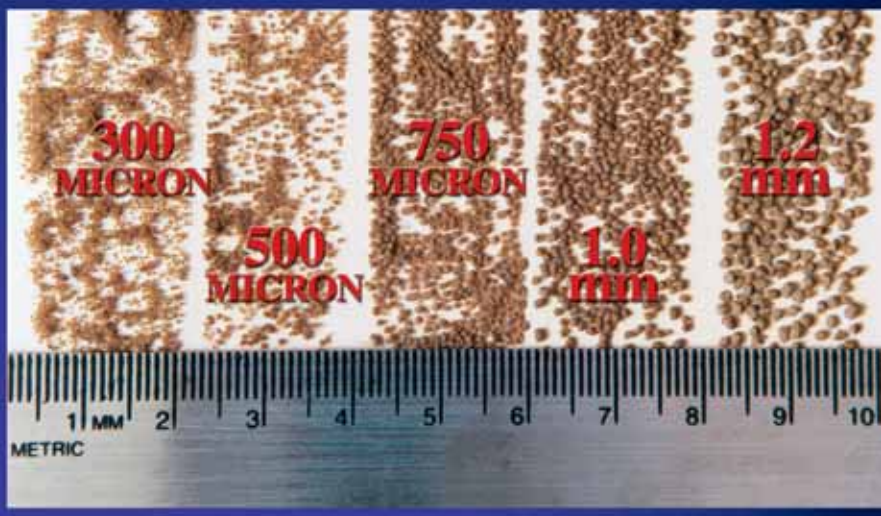
Another challenge is the source of quality and affordable fishmeal. It is also important to ensure that the fishmeal come from managed sources and meet the current needs of traceability programs. Apparently, in Peru and Chile, there is a consolidation in the fishmeal industry and this will change the way we source our material. At the same time, we will need to be able to adapt to the global increase in demand for fishmeal while fishmeal supply remains steady. As such, our R&D focuses on suitable substitution of fishmeal with appropriate ingredients.

The cost of shrimp is a critical issue for the industry as we are constantly challenged by increasing raw material prices and most recently energy costs. Farmers have to look at increasing production efficiency. As a feed producer, we have to always look at the costs of feed with respect to the overall cost of production. We do not believe in cheap shrimp feeds as these may not be in line with the nutritional requirements of the shrimp and may pose a threat to the sustainability of the industry.

Most shrimp producing countries are exporting their production and product traceability is fast becoming an important requirement. Gold Coin has anticipated the requirement and since 2004, has embarked on the exercise to obtain HACCP (ISO 22000) for all its mills.

WORLD-CLASS
AQUATIC FEEDS

- Extrusion Systems
- Horizontal Dryers & Coolers
- Vertical Coolers
- Feeding Systems
- Conditioning Systems
- Control Systems
- PDU (Product Densification Unit)
- SAS™ (Sphere-izer Agglomeration System)
- Liquid/Powder Coating Systems
- Pneumatic Conveying Systems
- Multi-Color Extrusion Die Assemblies
- Replacement parts for major brands of extruders
- Re-manufactured extruders and dryers
- Re-conditioning Services



Achieving optimum success in aquaculture requires the ability to tightly control the nutritional uniformity and float/sink characteristics of the fish feed. The revolutionary Sphere-izer Agglomeration Systems™ (SAS) is designed to produce starter fish feed with nutritionally homogenous particles sized as small as 300 microns. The SAS™ process produces particle sizes smaller than traditional single or twin-screw extrusion technologies. The exclusive SAS™ process was pioneered by Extru-Tech®, Inc. and is currently producing superior aquatic feeds around the world.

Agglomerations are sized and shaped utilizing a high speed centrifugal process.

20 YEARS OF GROWTH
1985 to 2005
EXTRU-TECH, INC.
1985 to 2005

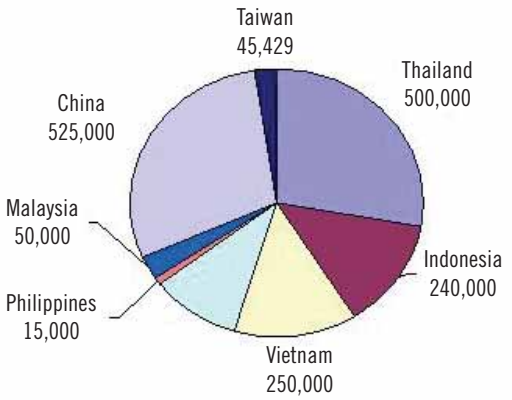
CORPORATE OFFICE
Extru-Tech, Inc.
P.O. Box 8 • 100 Airport Road
Sabetha, KS 66534, USA
PHONE 785-284-2153 • FAX 785-284-3143
extru-techinc@extru-techinc.com
www.extru-techinc.com

Better sales of shrimp feeds and expansion into fish feeds

By Zuridah Merican

According to industry sources, the production of feeds for the marine shrimp in China, Taiwan, India and South East Asia continues to grow, increasing by 10% in 2005. The estimated total production was 1.8 million mt as compared to 1.63 million mt in 2004. China's production of 525,000 mt was based on an industry estimate of shrimp production of 350,000 mt and FCR of 1.5 (Wang Xiaodong, pers comm.). The top 10 mills in South China produced an estimated 292,000 mt in 2005.

Estimates of shrimp feed production in 2005 (mt)
Total production = 1,805,429 mt



In Indonesia, the annual production for shrimp feed was quoted at 90,000-120,000 tpy in Trobos (January, 2005) whereas industry estimated 240,000 mt for 2005. As the actual production of shrimp totalled 238,000 mt in 2004 (SPB, 2005), this production for shrimp feed is most likely that for the open market only. Published figures for Taiwan's shrimp feed production totalled 45,429 mt in 2004, mainly for *P. monodon* shrimp. Figures for 2005 are not available but industry in Taiwan estimated the same level of production because of higher freight cost, fuel cost and changes in currency exchange.

As feed sales increased in 2004, many producers prepared for increases in demand by adding capacity for both shrimp and fish feed production in 2005 and 2006 (see pages 10-19). CP's Asia Aquaculture in Malaysia will start production at its new shrimp and fish feed mill from March 2006. This is mainly to meet the demand for *P. vannamei* culture. In Thailand, Thailuxe, a major aqua feed producer doubled capacity for fish feed production with a new factory in 2005. Inteqc Feeds launched its range of feeds for herbivores in March 2006. In Vietnam's Mekong Delta, some of the new mills are Uni President Vietnam's fish and shrimp factory and Cargill's fish feed factory in Cantho.

The annual production of fish feeds from Indonesia range from 360,000 to 480,000 tpy (Trobos, 2005) and in 2006, increases of 15-20% in production is expected. In Vietnam, the expansion of feed capacity since 2004 is to meet significant production increases of catfish and tilapia. According to an industry source, catfish production increased to an estimated 400,000 mt in 2005. The top six fish feed companies produced an estimated 400,000-500,000 mt of feed in 2005. In 2006, this is expected to expand to 600,000-700,000 mt.

A good potential for feed in Vietnam

The demand for feeds for the black tiger shrimp will remain high in the next few years, according to Chen Fu Chi of Grobest & I Mei Industrial Vietnam. This is because of improvement in the technological knowledge of farmers. The major feed suppliers provide seminars and training as well as field extension services. Grobest, with a 25% share of the shrimp feed market in Vietnam has planned for hatcheries in three locations to supply postlarvae to farmers. It has also increased production capacity for shrimp feed by 20% in June 2005. In China, Malaysia and Thailand, Grobest is involved in the supply chain from production to processing. However in Vietnam, the shrimp supply is from contract farms.

It will also expand production of fish feeds. For the culture of the basa catfish, the emphasis will be on the exclusive use of commercially produced feeds. For the feed company, this means that prices have to be aligned to ex farm prices of fish. Grobest has the expertise to reformulate. According to Pao Cho Chang, "the company has some 30 years of experience in aquafeed production and will be able to find solutions".

He added that Vietnam has ideal conditions for the culture of the cobia but the weakness is the lack of culture technology and hatchery supply of seedstock. In Taiwan, where the company produces cobia feeds, one in six cobia farmers use pelleted feeds. But in Vietnam, cobia is still cultured using trash fish. Similarly, Vietnamese farmers use a mixture of mash and trash fish feed for groupers. This is because growth is faster compared with feeding the fish solely with pelleted feeds. However, "Ultimately, it is for the feed company to encourage farming and set standards for the farmers to follow", said Shen Yen Ling.

The Grobest team from left; Pao Cho Chang, Factory Manager, Shen Yen Ling, Vice General Manager, Chen Fu Chi, Plant Manager

WENGER®

Wenger Aquatic Feed Systems . . .
versatility to cover the water column.

There are nearly 20,000 species of fish in the world. Fortunately, Wenger Aquatic Feed Systems offer the versatility to feed them all, not to mention crawfish, frogs, shrimp and eels, too. Wenger extruders produce a full range of feeds for both fresh and salt water species with products that range in pellet sizes from 0.6 to 50 mm.

Unique extruder features also permit precise control of finished product density, so you can produce floating, fast-sinking or slow-sinking feeds as needed. Durability of feeds for bottom dwellers has shown stability of up to 24 hours without binders. Special applications that require even up to 5 days of water stability are possible.

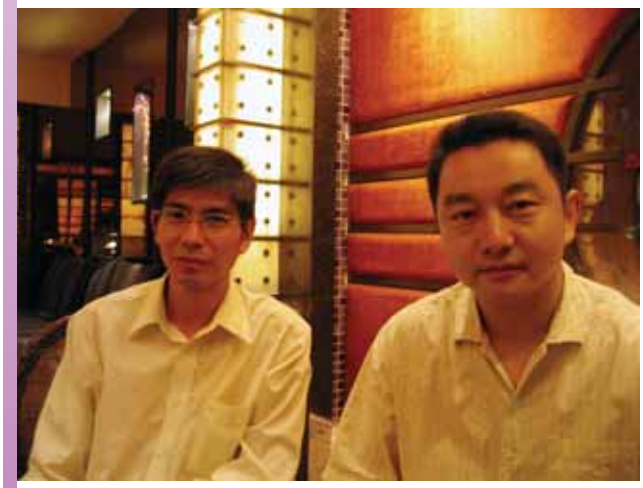
Wenger's time-tested extrusion equipment allows you to incorporate up to 45% total fat for high energy feeds like salmon pellets. Naturally, we also offer one of the broadest lines of equipment on the market, including single- and twin-screw extruders, dryers, coolers and blenders with capacities ranging from 0.1 to 22 tons/hour.

From top to bottom, shrimp to catfish, we're ready to fill your specific aquatic feed specifications.

USA 816 891 9272 / EUROPE 32 3 232 7005 / ASIA 886 4 2322 3302 / WWW.WENGER.COM CE

Reaching new heights in China

As farmed shrimp and fish production continues on its upward trend in China, Guangdong Haid is expanding to supply the demand for aqua feeds. In 2005 alone, eight factories were set up. By Zuridah Merican



Dr Wang Xiadong and Mr Xue Hua

Guangdong Haid Industrial Group based in Panyu district, outside Guangzhou is a privately owned enterprise with its main business in the production of aqua, livestock and poultry feeds. It was established in 1997. Today, it has 11 feed mills in the different regions of China in Hubei, Fuzhou, Jiangsu, Sichuan and Guangdong provinces, a research centre, three experimental bases and a total staff of 1,500. Within a span of 7 years, it has grown from a small factory to one of the top ten enterprises in the feed industry in China. In 1998, it started the Haid scholarship program in universities and schools.

In Guangdong alone, it has 5 feed mills which supply farms in Hainan, Jiangsu, Guangxi, Guangdong and Shanghai. During the last three years, the company has been expanding production with the addition of new pelleting lines, both for fish and shrimp feed. In 2005, a 10,000 mu (15 ha, I mu=650m^2) production base was set up.

In 2005, feed sales reached RMB 2 billion (USD 250 million) from a total production of 800,000 mt of feeds and 64% of this production was fish and shrimp feeds. A historical high in the production of fish feeds was reported which increased by 42% in 2005 compared to 2004 which in turn was 16% higher than the volume in 2003. Some 35,000 mt of shrimp feed was sold in 2005.

Guangdong Haid produces a large range of feeds for the markets in South China. These are mainly extruded feeds for the marine fish and freshwater fish such as the large yellow croaker, grass carp, tilapia and channel catfish. For the market in North China, it is mainly pelleted feeds for the grass carp and common carp. Some 80% of shrimp production in the south is *P. vannamei* shrimp in various culture environments. Thus, the company produces feeds for the inland culture of the species and for the coastal regions of Guangdong, Fujian, Zhejiang, Guangxi and Hainan. It supplies fish feed to traditional and

Guangdong Haiwei Feeds

This is one of the factories in Guangdong. Located in Zhongcum, Panyu district, the annual production of aquafeeds is over 60,000 mt per year. The factory was started in March 2003 and now has 3 extrusion lines for the production of floating and sinking feeds for freshwater and marine fish and two pelleting lines for shrimp feeds. It also has 2 lines for livestock feeds. The pelleting equipment and extruders are of Chinese and Taiwanese origin. The dryer was fabricated in house by the company.

Three types of shrimp feeds are produced and the FCR of the feeds are 1.0 to 1.1:1. The average selling price of shrimp feed is USD 700/mt. Other feeds produced are those for the catfish (USD 450/mt), grass carp (USD 400 /mt) and marine fish (USD 850/mt) such as for the seabass, red drum, yellow croaker, grouper, pompano and spinefoot Siganus sp.

R&D at Haid

The Guangdong Haid Research Centre of Husbandry and Aquaculture Centre was established in 1997 and is responsible for all the scientific activities on livestock and aquatic species of the company. The four laboratories with more than 20 tanks for feeding trials carry out work on nutrition, fish diseases, microbiology and biotechnology. The centre has 40 researchers, 6 of them are PhD holders and 38 with Masters degrees and more than 100 undergraduates.

The R&D studies are extensive and cover both basic and applied research. Field research and the testing of feed formulations, improvements to feeds and the use of farm and feed additives and other ingredients in feeds are conducted at the experimental bases in Shantou, Zhuhai.

Studies in nutritional requirements comprise work on the digestive rate of feed ingredients, optimal protein energy ratio in the grass carp and tilapias under different culture systems and the influence of different feed formulations on the biochemical composition of flesh in large mouth bass. In feed additives, work covers the effects of cholesterol in shrimp growth, bioactive peptides on feed intake in shrimp which can replace antibiotics in feeds and on using Chinese medicaments on several aquatic species. There are also studies on the replacement of Japanese fish meal with chicken and meatbone meal in eels and on the use of fermented soybean and rapeseed meals.

Some of the future work will explore different nutritional requirements for marine fish according to culture models, the influence of feed on meat quality, new sources of protein and development of feed additives through genetic engineering.

extensive fish farmers in the surrounding areas such as those culturing big head and silver carps.

Dr Wang Xiaodong, from Guangdong Haid Research Centre of Husbandry and Aquaculture said that their extruded feed for the grass carp and tilapia are favoured as they have higher feed conversion ratios (FCR) of 1.1 to 1.3:1 as compared to 2.0-2.5 with pelleted feeds. However, these are more expensive at RMB 3,000 to 3,500 /mt (USD 375/mt) as compared to RMB 2500/mt (USD 312.5/mt) for pelleted feeds.

"Most of the raw materials are local but soybean meal and fish meal are imported. Since 1997, we started to add additives which are extracts from plants and are traditional medicaments. Because of these ingredients, at the same cost, the farmer gets better feeds".

The formulations for livestock and aqua feeds as well as mineral and vitamin premixes for aquatic species are developed in house by teams of technical and sales personnel at the research centre. They have developed different types of aqua feeds of the 'Hailong' brand to suit different aquaculture models, i.e. ponds, cages and pens.

Mr Xue Hua, Chairman said, "It is clear that China's feed industry is facing its most difficult time as the profit margins of farmers are being eroded with lower prices. Farmers have the challenge to be more efficient and we at Haid should support the industry with our products and specialised services. Our technologies will need constant improvements and we will need to increase investments in R&D".

Haid has a sales and service team of 400 specialists in aquaculture and animal production and nutrition.

"In marketing our feeds, we advocate the use of technical personnel with a rich experience in shrimp and fish culture. Through 'technical marketing', we can pay attention to customers' demands and can achieve our objective of customer satisfaction", said Xue.

As for its future goals, Haid is exploring markets in Chongqing, Fujian, Zhanjiang, Hainan and Hunan. In the next 2-3 years, it will go international and seek global market for its feeds. In its development program, the aim is to build up an international company and integrate all components of aquaculture, upstream to hatchery production and downstream to processing. It will continue to make investments to be a leading company in aquaculture in technological research and innovations.

The Guangdong Haiwei Feed mill does not have to go far to market its feeds for tilapia. In the foreground are ponds with integrated culture of ducks and tilapia.

Shrimp feed bags

A diversification to fish feeds

Thailand's number one seafood processing group, Thai Union Frozen Products Co Ltd's integration into the shrimp culture industry began in 2000 with an acquisition of a feed mill. Today, Thai Union Feedmill Co. Ltd. has become one of the top three shrimp feed producers in Thailand. Soon it will diversify into fish feed production and integrate vertically with its own shrimp hatchery.

Thai Union Feedmill (TUF) Company Limited's entry into the shrimp farming industry in Thailand began in 2000 when it took over the Aqua Star feed factory in Songkhla, Southern Thailand. Earlier, it had taken over the processing facilities of the latter. With feed production, the company gained a foothold in the shrimp feed market of Southern Thailand and also that of the northern part of Peninsula Malaysia. Subsequently, it expanded with a new factory in Samutsakorn, outside Bangkok in January 2001.

Bunluesak Sorajjakit, Managing Director of Thai Union has 16 years of experience in the region's livestock and shrimp feed industry.

In the following years, new lines for shrimp feed production were added to both factories. In 2005, a new line was added to the factory in Songkhla, increasing capacity to 5,500 tonnes per month. In the factory in Samutsakorn, the capacity was also increased to 5,000 tonnes per month with two new lines. In 2004, it also entered the market in India through a joint venture with Avanti Feeds.

In Thailand, the company can classify itself as one of the top three shrimp feed producers. It produces various types of feed for the black tiger *P. monodon* and white shrimp *P. vannamei*. The most well known feed for black tiger shrimp is ProFeed which is marketed outside Thailand and is the brand name for the feed produced through the joint venture with Avanti Feeds in India. Today, about 60% of the total production is feed for the white shrimp.

Bunluesak Sorajjakit, Managing Director said, "As the company is relatively new, there has been limited ventures into the countries in the region. We have a presence in neighbouring countries through exports of shrimp feed. Some 15% of the total production is exported to Vietnam, Malaysia, Indonesia and Myanmar. With import taxes in some countries –Vietnam has a 5% import tax- exports are not very profitable but nevertheless, they are carried out for brand recognition".

New moves

The company is moving along with recent changes in the culture industry. Some three years ago, feed companies began to form alliances with large and reputable postlarvae suppliers to complete the supply chain for seed and feed to its contract farmers or feed customers. According to Bunluesak, "Our strategy is to develop into a well integrated company and adhere to the company's policy of total support for its customers. We already have joint ventures with two major hatcheries in Songkhla and Phuket (see the story on the Chanisa Hatchery). These hatcheries also supply the open market. We also support the small scale nurseries in the region by sending nauplii from the hatchery in Phuket".

Recently, TUF acquired 40 acres (16ha) of land to construct a new hatchery with an annual production capacity of 300 million postlarvae in Phang Nga. The hatchery is scheduled for operations in June 2006. This is part of the total integration package – from hatchery to shrimp feed and from grow out to processing.

In contract farming, Bunluesak said, "We have a 6 month project with a group of large farms that can produce about 10,000 mt of white shrimp annually. This is preferable to working with several small farms where it is difficult to control product quality as well as size of the animal".

"We want to choose farms with good management records, good aquaculture practices (GAP), Code of Conduct (CoC) and for the future, with traceability programs and most importantly, do not use any chemicals in the production process. Then we can supply the feed and they work with our technicians to achieve targets".

Previously, the group's processing plants buy raw materials from its customers and the auction market. Since it has become important to ensure the traceability of the products, the company has to work closer with producers. The processing plants are located in Songkhla and Samutsakorn.

In 2006, Bunluesak said that the company has planned for major investments in the fish feed and hatchery segments. A new fish feed plant costing 230 million baht (USD 5.9 million) currently under construction will have a capacity for 6 lines. Initial operations will commence with 2 lines for a 3,000 tonnes per month production by April 2006.

"We realise that the fish feed market in Thailand is already crowded with many producers and the open market is small but we see that demand for fish from aquaculture will continue to increase. The additional volume will also give us better bargaining power when purchasing raw materials".

There are also many types of feeds and for many species that will require R&D but for the moment, the company will concentrate on feeds for the tilapia and catfish. Also in the pipeline is research on the replacements of fish meal with poultry and animal by products, which are mostly imported. Most of the R&D work is outsourced to universities. As for local ingredients, local fishmeal with at least 62% crude protein is used for some feeds. This is possible because of the quality criteria imposed by TUF on the supplier and both work closely to maintain specifications.

"The next step will be to develop feeds for the marine fish but first we may need to promote marine fish farming in Thailand. To do this, we will look at setting up a hatchery and work on the R&D of developing a full fledged marine fish culture industry to increase demand for fish feeds. As I see it, the marine fish feed sector is interesting as volumes of wild catches are declining and prices are increasing. The possibilities of expansion in the fish business are numerous as there are several species of fish being cultured".

Changing shrimp business

Over the years, there have been many trials and tribulations for the company. The company bought the factory in Songhkla for 60 million baht (USD 1.5 million). A return on investment with this factory was only possible after 5-6 years as Thailand's and the region's shrimp culture industry went through its traumatic years. (The culture industry was affected

Feed samples are stored for three months in the quality control lab.

by disease, declining prices for shrimp and the devaluation of currencies, all of which reduced profit margins). Since 2001, shrimp prices have been on the decline. Today, prices are around 225 baht/kg for 40 pcs/kg or USD 5.76/kg to 135 baht/kg for 100 pcs/kg or USD 3.46/kg.

As white shrimp culture demands higher stocking densities for higher yields, the use of feed corresponds. The company encourages the use of quality feed at the early stages of culture to support good growth and high survival rates. Farmers continue to use feed formulated for black tiger shrimp for the early stages of culture i.e. for postlarval stages 1, 2, 3 and then move on to using feed formulated for white shrimp culture which contains a minimum of 38% crude protein.

Naturally, the lower prices and US antidumping tariffs have had impacts on the shrimp culture business in Thailand. Bunluesak said that small farm continue to find it difficult to survive with the low prices in comparison with the larger farm. With the higher stocking rates, ponds need higher aeration and therefore higher costs. Good performances are in farms near the coastline, especially in the Andaman coast (ranging from 2 mt/rai or 3 mt/ha to a maximum of 4-5mt/ha or 6-7.5 mt/ha. The best result quoted from its customers was 6 mt/rai (9 mt/ha) of size 40/kg and 80% survival.

The imposition of antidumping tariffs of 5.9% for Thai shrimp imports into the US has affected all in the shrimp supply chain as the US market is a leading one for most producers. The new requirement for the customs bonds has particularly affected the small and medium processors as they usually buy shrimp in cash from farmers but supply processed shrimp on credit to importers. On top of this, the payment for the customs bonds have increased and money is not available as they have been locked in.

However, Bunluesak said, "But as with any sector we have to work around the trade barriers. We are fortunate that we now have lower rates on the GSP (Generalised System of Preferences) for exports to the European Union (EU). We may have problems with the bonds but countries like China and India, may be in a worst situation than us. The estimated production of the marine shrimp in Thailand has remained unchanged at 350,000 tonnes in 2005. In 2006, an increase of 10-20% in production may be possible".

"In Thailand, we do not expect much from the review on these antidumping tariffs scheduled for 2006. On the positive side, we hope to develop the EU market which is mainly frozen head on shrimp, as well as to the chilled shrimp market in Japan. Competition from China may ease as their domestic market is expanding. Our government is also expanding our domestic market".

Feed traceability

TUF is taking the initial steps of maintaining records as part of a wider traceability program. In November 2005, they sent personnel to study a traceability program with a company in France. It is also working with the Department of Fisheries Thailand (DoF) on feed traceability from feed

The ProFeed brand

to seafood under a program sponsored by the European Commission. In 2006, they plan to implement a program now being negotiated. As for GMOs (genetically modified organisms), he said that at this time, they need to be vigilant and be aware when problems arise in the near future.

Bunluesak added, "We are also fortunate now that farmers understand the consequences of using banned chemicals during production. The Government is also giving attention to this and has stopped imports of antibiotics. We are encouraging the use of probiotics which is supplied by a subsidiary company, Marine Bio Tech Co Ltd.

Bottom line

For the farmers, this is the cost of production which is related to survival rates and production yields. How to reduce costs and increase profit margins is the main goal. The keys to success are breeding, feeds and feeding, management, sanitation and hygiene.

"Amidst an extremely competitive shrimp industry in Thailand, TUF's concern is with quality produce. This is through working with customers and to produce quality feed to the best of our knowledge", said Bunleusak.

A supporting hatchery

This new hatchery in Phuket has merged with Thai Union Feedmill to supply customers and farmers in the Ranong, Andaman and Haadyai areas. Today, the goal is to increase production from the current 480 to 600 million postlarvae/year.

From left: Narin from the Phuket Coastal Fisheries Research and Development Centre, Payom Ouamdang, Thaksin Chemchom and Thongchai Sungsri, Thai Union Feedmill

The owner of Chanisa Hatchery, Mr Thaksin Chemchom started this hatchery in Thalang District, Phuket two years ago with a potential output of 5,400 million nauplii per year of the white shrimp *Penaeus vannamei*. He is also a farmer with 200 ponds in Ranong, Phuket and Andaman and a shrimp feed dealer with Thai Union Feedmill.

In 2004 and 2005, it produced 480 million postlarvae (PL12). As part of the requirement in the Code of Conduct (CoC) for the company, Thaksin has designated three zones for the production process. These zones separate the broodstock rearing from PL production. One of these is the quarantine area for new broodstock. The hatchery was designed by Thaksin and his staff with participation from Thai Union Feedmill.

The broodstock are Hawaiian in origin and certified as TSV (Taura Syndrome) resistant. Additionally, it is pathogen free from white spot syndrome (WSSV), Infectious hypodermal and hematopoietic necrosis (IHHNV) and yellow head virus (YHV). In selecting the best source for their broodstock supplies, hatchery staff visited the DOF accredited supplier in Hawaii. Following regulations, imported broodstock are checked for diseases and quarantined for 15 days.

Broodstock are kept at 29°C and are used for 4 months. The hatchery is also experimenting the use of a close recirculation system with charcoal and sand filters. To prevent *vibrio* infections, probiotics are used twice a week in the broodstock tanks. After 5-7 days, 35g (male) to 45g (female) broodstock shrimp are used for spawning. Feed comprises polychaetes worms produced in Satun province, squid, oysters and krill. Eggs are collected and hatched 13-14 hours later.

At the hatchery, the filtration system includes a high speed sand filter and five cartridge filters of 20 microns, ultraviolet (UV) filtration and filter bags of 100 microns. Furthermore, throughout the hatchery, there are intermediate filters called "rocket filters" attached to inlet and outlet piping.

Mr Payom Ouamdang, the hatchery manager for production in describing the process said weather conditions is a great influence. For example during the recent haze, the hatching of eggs was delayed by a day. At 29°C, nauplii will develop after 36-40 hours. The development from mysis to the zoea stage is after 3-4 days. Feeding is with *Chaetoceros, Skeletonema* and *Artemia*. Artificial feeds from Cargill and Inve are used. Although relatively expensive, Payom said that as long as sales are good, they will continue to use these feeds. PL are sold at baht 0.12 per piece.

According to Payom, a fisheries graduate who worked previously in a hatchery in Petchburi, "The average survival rate achieved at the hatchery is 60 to 70% to the nauplii stage. However, it is always important to ensure good environmental management and improvements on seawater quality. This also depends on the season. We have experienced low productivity during the summer and early rainy season".

In addition to the standard requirements for PL quality, the hatchery uses a quality criterion of more than 10mm length for PL8. It also acclimates the PL for the various culture conditions (in terms of salinity) as demanded by the farmer. PLs are packed at a density of 1,500 PL per bag and temperatures are kept low at 21-25°C.

The hatchery collects back fast growing shrimp from farms which it supplies PLs to. These are then grown as part of the local domestication program which each accredited hatchery has to start under the terms of agreement with the Department of Fisheries (DoF). The farm is regularly audited by teams from the DoF in PhangNga. The team also provides training to hatchery staff.

Water is cleaned by a series of filters

View of the hatchery

P. vannamei broodstock

a DSM Product

RONOZYME® P

UNLIMITED INNOVATION

RONOZYME® P ADDS VALUE TO FISH FEEDS

RONOZYME® P hydrolyzes phytates and thereby increases the availability of phosphorus and other nutrients in aquaculture feeds. This reduces the need to supplement feeds with mineral phosphorus and reduces the excretion of plant phosphorus into the water.

RONOZYME® P is the first phytase registered in the EU for use in salmonids.

novozymes®

DSM Nutritional Products Asia Pacific Pte. Ltd.
78 Shenton Way #21-01, Singapore 079120
Tel.: +65 6325 6200, Fax: +65 6220 1976
www.dsmnutritionalproducts.com

Rovithai Limited
Aquaculture Centre Asia Pacific
17/1 Fl., Maleenont Tower, 3199 Rama IV Road
Klongton, Klongtoey, Bangkok 10110, Thailand
Tel.: +66 (0) 2264 9800, Fax: +66 (0) 2264 9899

Unlimited. DSM

Marine finfish cage culture

Some of the strengths, weaknesses, opportunities and threats facing this expanding yet fragmented industry in China and Southeast Asia. By Zuridah Merican

The culture of marine finfish mainly in cages is developing fast. The industry moved to its current status rapidly in the past 5 years, helped specifically by the availability of hatchery produced seed stock of groupers and snappers from Indonesia and local hatcheries. The Asian production of various marine finfish in 2002 was 980,643 mt (FAO, 2005), which included 316,469 mt from Japan and Korea. China's production including data from land based farms rose 3% to an estimated 580,000 mt of finfish 2004 from 560,404 mt in 2002. Indonesia's production increased from 2,249 mt in 1999 to 11,717 mt in 2002. The production of groupers alone is estimated at 12,590 mt in 2004. Thailand, Malaysia, Philippines and Singapore together produced 38,044 mt in 2002.

Nevertheless, as an industry, it is still some several years behind that of the marine shrimp according to an industry player.

"Ideally it would be best if marine aquaculture is seen as a business venture with good Aquaculture Practices (GAP) similar to what we see in the marine shrimp business. Prices for the marine fish are much higher than that for the shrimp".

Cage farm in P.Ketam, Malaysia. Picture by Khoo Eng Wah

Strengths

Consumer demand

In the region, the species of fish cultured is strongly affected by the changing demands of consumers. Farmers quickly adapt and diversify to the culture of new and higher value species with high profit margins as and when hatchery or wild seed stocks are available. Some 70 species are cultured in China and the top species in 2004 was the sea bass *Lateolabrax japonicus*, yellow croaker *Pseudosciana crocea*, flounder and turbot, seabream, red drum *Sciaenops ocellatus* and the groupers *Epinephelus spp*. In Southeast Asia, 40 species are cultured and the current high value species are the blue spotted grouper *Plectrophomus maculatus* followed by the humpback grouper *Cromileptes altivelis*.

Hatchery production

The driving force behind the expansion of finfish grow-out operations in Bali, elsewhere in Indonesia and Southeast Asia is the year round supply of grouper juveniles, mainly the humpback *Cromileptes altivelis* and tiger *Epinephelus coioides* groupers from the Gondol Research Institute for Mariculture (GRIM) and Bali's backyard hatcheries. However, as demand for a particular species changes, these hatcheries, originally designed for milkfish fry production, can be changed easily to produce juveniles of the new species. The newest species is bar-cheek grouper and next will be the giant grouper *E.lanceolatus* (Wira Cahyadi, pers comm.).

Local hatcheries in other countries are also adding new species to their breeding programs. Sizes of locally produced juveniles are also larger than the imports resulting in better survival rates during grow out. R&D in hatchery production of various grouper and snapper species and the cobia are ongoing in several countries. Thailand's coastal fisheries centres have reported success in the breeding of the tiger grouper, green grouper *E. coioides* and coral trout *Plectropomus leopardus*. In 2005, the centre in Batam, Indonesia started the production of pompano *Trachinotus blotchi* juveniles and is now encouraging farmers to culture this species.

Transfering fish to a well boat. Picture by Khoo Eng Wah

Extruded Feeds

The industry is already well supported with commercial extruded feeds for marine fish produced by feed companies in Indonesia, Malaysia, Thailand, Taiwan and China. An estimate of current feed usage by Orachunwong (2005) is 260,00 tonnes at an FCR of 2-3. China has 6 aquafeed companies that produce quality marine fish feeds. There are also imports of feeds (grow out and larval feeds) from Europe and USA (Zhang and Rortveit, 2004). Finisher feeds available in Malaysia contain 40-43% crude protein.

Information on the nutritional requirements of three grouper species, the humpback, tiger and green grouper is available through research conducted under the ACIAR project. Juveniles require at least 45% crude protein. The research also showed that different groupers respond to different formulations. In contrast to the seabass, which responds to protein-lipid levels by growing faster, the grouper responds by depositing fat. It also said that grouper juveniles readily accept dry pellets (Williams and Rimmer, 2005). Researchers from the Marine Aquaculture Centre (MAC) in Singapore and Tropical Marine Science Institute are developing larval feeds.

Off shore cages culturing seabass off Jawa Island, Indonesia.

Lim Huan Sein, AVA Singapore

Finisher feeds used in Kukup, Malaysia

R&D

Conducting research is expensive which is beyond the scope of these small farms. Thus the industry is dependent on institutional research. The Agri Food and Veterinary Authority (AVA) in Singapore is developing technologies in several areas and uses this to develop a regional industry around its southern waters. The top priority in R&D is to develop culture and cage technologies through collaboration with local and overseas institutions. Their work with a genotyping of Asian seabass *Lates calcarifer* with Temasek Life Sciences Laboratory will help in the heritability of important traits.

Lim Huan Sein, AVA said, "We will also want to see the industry in the Asia efficient with a proper vaccination for disease control, well developed management of operation and good post handling infrastructure. This should be accelerated. Our focus is to fully understand the biology of the seabass and use this information to increase culture efficacy similar to what we see with the salmon. We will then extend this information to other species".

Weaknesses

Overcoming diseases

The intensification in finfish cage culture has increased incidences of bacterial, viral, fungal and pathogenic parasitic infections (Leong et al., 2006). Unpredictable mortalities (10 to 60%) are common in most cage culture areas. In Vietnam, the mortality for the cobia depends on the life stages and can reach 40% at the mid stage, which could also be due to handling during transfer. Experts say that there is a general lack of attention to a total health management program but the more progressive farmers say that they will consider vaccination as an option. The development and marketing of an effective vaccine against *Streptococcus iniae* in the seabass by the Singapore-based Intervet Norbio is a step towards more controlled production of the species.

Demand and supply of juveniles

The negative aspect in the demand and supply of juveniles is that as interests in a particular species wane, so do prices and production is reduced. Hatcheries must quickly adapt and shift to another species. Another issue is the reluctance of operators to nurse fry to larger sizes because of the high costs of larval feeds. In China, although hatchery development is supported by the government, achievements in R&D for hatchery production of several species are still lacking and this will remain a bottleneck for the future development of finfish production (Zhang and Rortveit, 2004).

Live fish markets

The smaller grow out farms depend wholly on sales of live fish as without any post harvest handling facilities, there is no other alternative market. For local markets, small numbers are harvested and sold daily. Producers in Southeast Asia depend on Hong Kong buyers to collect fish in well boats for markets in Hong Kong and South China. A concern is the increasing production in China to supply its own local markets.

Feeding with trash fish

This is a main cause of pollution within and outside the cage environment. Despite this, the practice will likely remain for some time. In some instances, it is the non availability and the relatively high costs of dry feeds, such as for cobia culture in Vietnam. Trash fish is a likely, directly or in directly, source of diseases (Williams and Rimmer, 2005). There is also the issue of sustainability and the concern with the spread of diseases. Authorities such as the AVA in Singapore are encouraging farmers to use moist feeds as a first step to the use of pelleted feed.

This is a difficult choice as farmers have the perception that trash fish is the cheapest source of feed. The issue is compounded by their negative perceptions of the efficacy of pelleted feeds. Some have indicated that the groupers fed dry pellets lose their appetite and that the quality of the feeds are far from optimal in terms of growth rate, texture and palatability.

Lack of investments in the industry

In general, cage culture in China and Southeast Asia is a still a family owned businesses. There are few large commercially run farms. The exception is in China, where farms can be state owned. Farmers concentrate on the operations of the farms and have limited capital for improving facilities. *Ad hoc* investments are made to increase the number of cages and for net replacements. Huge losses mean withholding of a culture cycle.

Opportunities

Expanding markets

The live fish market in Hong Kong is estimated at 10,000 tonnes in 2006 and volumes transhipped to China may be decreasing as culture activities increase in China (Sudari Pawiro, pers comm.). In 2002, some

Young tiger groupers at Mina Budidaya, Kukup, Johor

40% of the products are transhipped to China (Johnston and Yeeting, 2003). A major component of the market is reef fish which is non sustainable. As these become depleted, the future demand for groupers, snappers and other marine species will be increasingly met by production from mariculture. Besides Hong Kong, the market in Korea is registering growth due to the strong demand for raw fish.

Developments in cage technology

To overcome the congestion of cages and adverse water conditions in coastal bay areas, authorities encourage farms to move further offshore. This requires the use of cage materials able to withstand conditions in deeper waters. In China, offshore cage culture, started since 1998 has expanded with some 6,000 large cages. China's local cage manufacturer, Qingdao Shenbon Seacage Manufacturing has installed large and submersible cages in Quangxi, Jujian and Hainan provinces. Malaysian based Fusion Marine has set up cages off Qingdao. There is another advantage in using the cages, according to Changhou Yang, its General Manager.

"Fish quality is being emphasized and industry is realizing the benefits of offshore fish culture. An interesting development is fish cultured in these cages taste better compared to those in traditional cages, command a premium price of 10-20% and are sought by buyers from Japan and Korea".

Also in China, ocean cage culture technology is also being developed by USSEC with checkoff and USDA funding. These are less expensive typhoon resistant and submersible cages. So far the fish species being cultured are the golden pompano *Trachinotus ovatus* fed with feeds containing 35% soybean meal. (USSEC, 2006). In 2006, the program will expand with 10 farmers in Hainan using these cages, according to Bridget Owen, Global Aquaculture Manager, USSEC. Future work will focus on the stocking density and environmental and seasonal factors which may affect fish growth.

Threats

Environmental conditions

As cage culture develops, intensive farming, over feeding with trash fish and more cages constrained in small areas have lead to poor water conditions. The degradation of water quality from the cages themselves often leads to outbreaks of diseases and high mortalities of fish.This is a constant problem for cages located in these areas. Although farmers are becoming more aware of disease problems, the industry is no where close to finding solutions.

Pricing

High price for many species sold live in Hong Kong is an opportunity for the industry but fluctuations in prices are unsustainable for small producers. High wholesale market prices in Hong Kong are for fish in demand such as the coral trout *Plectropomus leopardus* (USD40/kg) followed by tiger grouper (USD 16/kg) and green grouper USD 11.5/kg (FMO, week 7/2006). Prices are much lower for snappers *Lutianus russelii* and *L. malabaricus* (USD 5/kg). In the case of cobia where production is expanding rapidly and markets is still developing, ex-farm prices of USD 5/kg are close to production costs for the traditional farmers in Vietnam.

Seed stock from Taiwan

As the region's hatcheries improve on their production technology, the industry in Taiwan, once the market leader in seed production is being threatened. It will however remain a producer of certain species. Currently, Taiwan still has an edge in the breeding technology of the pompano and giant grouper. To retain markets, some companies have set up breeding facilities outside Taiwan such as in Hainan Island, China and using technology exported from Taiwan (Su, 2005).

Investing for the future

The general outlook is that the short term nature of traditional farms that disregard the effects on the environment, is threatened by high mortalities and market uncertainty, is not sustainable. For cage culture to see itself as a sustainable business enterprise, it will need to ensure favourable culture conditions and mitigate problems. This is also required to maintain supply for export markets.

Some several new large business models focusing on one or two species are already evolving in Vietnam, Malaysia and China. Nha Trang started in 2003 with 25 circular cages located offshore in Vietnam's central coast has a production output of 1,000 mt/year of cobia. Off China's coast, the National Petroleum Company has planned for an output of 10,000 mt/year of cobia. Marine Farms Norway ASA which has developed cobia cage culture technology in Vietnam plans to produce 5,000 mt/year with local investors.

There are also examples of downstream integration to expand product range to frozen, valued added and look beyond Asia for markets. Although exporting live fish to China is the main target, a group of producers from Bali and Sumatra in Indonesia will also work with seafood processors to export frozen fish to Japan, Korea, EU and USA (AAP, 2005). Newly listed Malaysian company Borneo Aqua Harvest will enter into downstream integration and process its products into fish fillet for export.

*(Related article in this issue: **Going to the next level, page 37**)*

References

FAO, 2005. FishStatPlus. Aquaculture Statistics up to 2002.

FMO, 2006. http://www.fmo.org.hk/page4eng.html

Johnston, B.and Yeeting, B., 2005. http://www.spc.int/coastfish/news/LRF/15/LRF15-Johnston.pdf

Leong, T.S., Tan, Z and Enright, W.E., 2006. Important parasitic disease in culture marine fish in the Asia-Pacific region. Aquaculture Asia Pacific, Vol 2(1), 2006.

Orachunwong, C.,S. Thammasart and C. Lohawatanakul, 2005. Aquafeed for caged marine fish in some Asian countries. Presented at Asian Aquafeeds 2005, 12-13 April, Kuala Lumpur, Malaysia

Su, H-M., 2005. Marine fish hatchery production-the Taiwan model. Aquaculture AsiaPacific, issue Jan/Feb, 2005, pp24-25.

Williams, K.C. and Rimmer, M.A., 2005. The future of feed and feeding of marine finfish in the Asia-Pacific region: the need to develop alternative aquaculture feeds. Paper presented at the Regional workshop on low value and trash fish in the Asia-Pacific region, Hanoi, Vietnam, 7-9 June, 2005.

USSEC,2006. US Soy Export News. January 2006.

Zhang Jiwu and Jostein Rortveit, 2004. Aquaculture in China. Innovation Norway, Beijing Office.

Part 2 – Control measures

Important parasitic diseases in cultured marine fish in the Asia-Pacific region

by Leong Tak Seng, Zilong Tan and William J. Enright

In the first part of this article (Jan/Feb 2006, pp 14-16), the authors described the most important parasites causing problems in fish mariculture in the Asia-Pacific region. In this second and final part, general considerations regarding control are discussed.

A successful parasitic diseases control programme consists of the selection of healthy fish, quarantine, good husbandry practices, preventive measures, correct diagnosis and, if necessary, therapeutic treatment. Unfortunately, under farming conditions in the Asia-Pacific region (especially in South East Asia), farmers often do not have technical expertise in proper health management at farm level under local farming conditions. An experienced farmer might know that the fish are not well but may not know the cause and what needs to be done. Technical support for accurate diagnosis and for recommending appropriate treatments is generally lacking.

As outlined in Part 1 of this article, a variety of parasites infect fish at different stages of the production cycle. The pathogenicity of each parasite differs for each species of fish, as well as for each stage of the growth cycle. For example, the protozoa *Amyloodinium ocellatum* is very pathogenic to fry in the hatchery, but may not have any effect on adult fish. Furthermore, most parasites (except for the sanguinicolid digenean blood flukes) have direct life cycles, i.e., they do not require an intermediate host for development to maturity.

Given the large variety of parasites pathogenic to fish at various stages of the grow-out cycle, how can one prevent disease outbreaks?

It is impossible to totally avoid parasites as they usually exist as part of the aquatic ecosystem. A few parasites on a fish usually cause no harm. Disease occurs only when the parasite-host balance is upset. To maintain the healthy balance and to minimize the chance of outbreaks, health management procedures must be practiced. Health monitoring and early diagnosis is a key for control of parasitic diseases. When unusual symptoms are first observed in a particular fish cage, actions must be taken to quickly reduce, if not eliminate, the number of parasites on fish and in the aquatic ecosystem.

Many parasitic diseases reported in farmed fish show similar disease signs (see Table 1 in Part 1). Therefore, it is difficult for farmers to identify what is the primary cause of the disease. As outlined in Part 1, the parasites in marine fish can be broadly grouped into the following: protozoa, diplectanid and dactylogyrid monogeneans (on the gills), capsalid monogeneans (on the body surface), sanguinicolid blood flukes, parasitic copepods, parasitic isopods and leeches. Usually only protozoa (particularly *Cryptocaryon irritans* and *Trichodina* spp.) and capsalid monogeneans on the body surface (particularly *Neobenedenia* spp.) are problematic and pathogenic to fish, especially to newly stocked juveniles in cages.

Considerations regarding drug/chemical treatments

It must be emphasized that prevention is the key and treatment is a last resort. Very often, when disease occurs in the farm, chemotherapeutic treatment is too late and often ineffective.

In most countries, very few drugs and chemicals have been registered for treatment of food fish. Indeed, many biocides (e.g., malachite green) are actually banned from use in most countries (including all the major fish-importing countries) and severe measures are taken against exporters of fish and shellfish that contain residues. Therefore, the drugs/chemicals used must be safe to fish, the environment and humans. For food safety, guidelines on the withdrawal period for each chemical must be observed.

When disease occurs, treatment is usually administrated by bath immersion. However, chemicals (e.g., copper sulphate) added to the water in recirculation systems may disturb the biological filter system and cause erosion to equipment. Frequent addition of chemicals to the water can also lead to the induction of resistance in parasites.

This article will not discuss specific treatment recommendations as such information is available from many other sources and drug/chemical usage is always subject to local regulations. In general, freshwater, hydrogen peroxide and formalin are commonly used as bath treatments against protozoa and capsalid monogeneans (see box)

Tips for bath treatment of fish

- For safety reasons, always first try the chemical, at a given dose and treatment time, with a small number of fish. Fish of different species and sizes under different water conditions (salinity, alkalinity and temperature) may well react differently. In general, lower water temperature requires a longer treatment duration and *vice versa*.
- Follow the correct dose and treatment time. Pay close attention to concentration of the active ingredient and adjust the dose accordingly if the chemical is not pure (<100% active).
- Add the chemical to a small portion of the water in a small container and make sure it is dissolved completely before use. Then pour this 'concentrate' into a fish holding tank/container to reach the desired final concentration and mix well before placing the fish into it.
- Withhold feed for 8-24 hours depending on the fish size.
- Treat during the coolest part of the day.
- Monitor water oxygen levels before, during and after treatment; if necessary, aerate as required.
- Keep a close eye on the fish during treatment and be prepared to stop treatment immediately if adverse reactions (e.g., gasping for air, strange swimming behaviour, etc.) are noted.

1. Prophylactic treatment given during fish grading

2. Bath treatment for control of skin flukes using a tarpaulin sheet for large number of fish

A strategy for integrating treatment into routine farm activities

With a general understanding of multi-species fish farming and their diseases, a strategy for disease control can be developed and integrated into routine fish farm activities. The following steps are recommended for implementation:

- A supervisor/manager/health monitor should be trained and routinely updated on disease diagnosis and control measures.
- Specific net-cages (ideally set apart from the main farm area) should be set aside as a quarantine area for new fish arrivals.
- After placement in the net-cages, newly-arrived fish should be observed closely; some fish species are more susceptible than others.
- Within the first week, susceptible fish (such as groupers and red snapper) should be given a prophylactic treatment.
- Prophylactic treatment consists of immersing fish for 10 - 30 minutes (depending on the tolerance of the fish species and their size) in freshwater mixed with formalin (100-200 ppm).
- Grading fish should be routinely undertaken within the first 3-4 months of stocking, and prophylactic treatment (as mentioned above) should be incorporated into the process of fish grading (see photos 1 and 2).
- When high mortality occurs, moribund fish should be sent to a fish health laboratory to determine the cause(s) of mortality.
- In the event that a parasitic disease outbreak occurs, a second freshwater treatment should be carried out three days after the first one, followed by a third one five days later.

The above steps should be incorporated into routine fish grading activities throughout the production cycle as parasitic diseases could occur, especially with capsalid monogeneans, at any time of the year. The purpose of these steps is to reduce the rapid build-up of monogenean parasite populations

An experienced supervisor or farm worker would know that a disease outbreak is about to occur if observations indicate the fish are not well (from a reduction or a cessation of feeding), are dying, have abnormal swimming behaviour (such as swimming slowly on the water surface), or have haemorrhages, red boils or patches of scales showing dryness or lesions from rubbing (Photo 3), typically due to skin irritation caused by monogeneans. These signs may appear concurrently in one or more net-cages with the same species of fish. If the farmers are slow to implement treatments, fish of the same species in other net-cages could also show similar signs a few days later. High mortality of fish could then be expected, even if one (belatedly) starts treatments.

The need for safe and effective anti-parasitic medicines

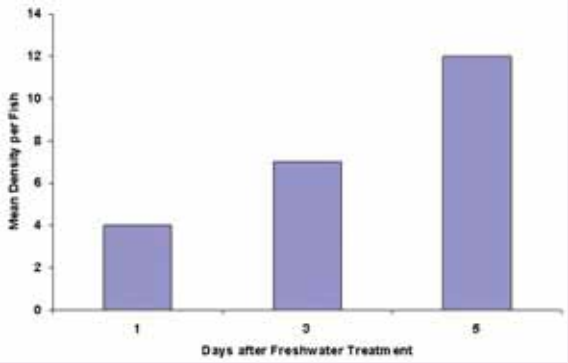
Although the freshwater (with or without formalin) prophylactic treatment is very effective against most of the parasites, it is a tedious process. Also, freshwater is not readily available to most marine fish farms and a large amount has to be transported to the farms whenever it is needed.

3. Skin lesions caused by skin flukes and subsequent rubbing against fixed objects in the net-cage in a grouper (top) and red snappers (bottom)

Current observations of floating net-cages indicate that capsalid monogenean infections are the most serious and pathogenic amongst all parasitic diseases in the Asia-Pacific region.

Examination of red snapper after freshwater treatment during a capsalid monogenean outbreak indicates that very rapid re-infection occurs (Figure 1). In this study, all monogeneans recovered were very young, indicating infection of the monogeneans occurred after they hatched from the eggs. The capsalid monogeneans are not host specific for fish but rather infect all fish species in the surrounding net-cages. Some fish species are more susceptible than others, resulting in greater frequencies of parasitic disease outbreaks for that fish species.

Figure 1. Recurrent infection of capsalid monogenean in red snapper after freshwater treatment



A number of "microbiocides" or other compounds have been tested and/or used against fish parasites. They include various disinfectants (such as chloramine-T and formalin), hydrogen peroxide, anthelminthics (such as praziquantel and fenbendazole), organophosphates (such as dichlorvos), pyrethroids (such as deltamethrin), avermectins (such as ivermectin) and chitin synthesis inhibitors (such as diflubenzuron). More recently, there have been several papers published by Japanese scientists on the effect of caprylic acid, either administered orally or by immersion, on ecto-parasites, including *Benedenia*. Praziquantel is available on the market in some countries against skin flukes. While certain efficacy has been shown, palatability (bitter taste) and high cost are problematic for its application. For monogenean infestation, freshwater treatment is the safest and most effective method available at present but the process is indeed tedious. A safe, effective and economical anti-monogenean drug needs to be developed. Ideally, the drug could be incorporated into the feed for routine prophylactic treatment for a broad range of parasites in all species of fish.

Apart from chemotherapeutic treatments, emphasis should be given to health management practices, including biosecurity and optimization of the culture environments. The poor but still common practices of overstocking, using trash fish, mixing species and overlapping generations in the same cage must be stopped or improved. In recent years, things have improved a little by optimization of cage placement to reduce the incidence of parasitic diseases.

Like the control of bacterial and viral diseases, vaccination is an attractive and sustainable (but challenging) option to tackle parasitic pathogens. Such research is ongoing at several locations; for example, the development of *Cryptocaryon* and sea lice vaccines. While progress has been slow due to the complexity of host immunity and pathogen interactions, we remain hopeful for a breakthrough.

In summary, freshwater treatment is the safest and most effective method available at present but the process is tedious. A safe, effective and economical anti-monogenean drug needs to be developed. Ideally, the drug could be incorporated into the feed for routine prophylactic treatment of all species of fish.

Suggested reading

Kartharios, P., N. Papandroulakis and P. Divanach. 2006. Treatment of Microcotyle sp. (Monogenea) on the gills of cage-cultured red porgy, *Pagrus pagrus* following baths with formalin and mebendazole. Aquaculture 251:167-171.

Kim, K.H., Kim, C.S. and J.W. Kim. 2001. Depletion of praziquantel in Plasma and muscle tissue of cultured rockfish *Sebastes schlegeli* after oral and bath treatment. Diseases of Aquatic Organisms 45:203-207.

Hirazawa, N., T. Ohtaka and K. Hata. 2000. Challenge trials on the anthelmintic effect of drugs and natural agents against the monogenean *Heterobothrium okamotoi* in the tiger puffer *Takifugu rubripes*. Aquaculture 188:1-13

Hirazawa, N., T. Mitsuboshi, T. Hirata and K. Shirasu. 2004. Susceptibility of spotted halibut *Verasper variregatus* (Pleuronectidae) to infection by the monogenena *Neobenedenia girellae* (Capsalidae) and oral therapy trials using praziquantel. Aquaculture 238:83-95.

Intervet International B.V. 2003. Guide to veterinary antimicrobial therapy. 4th edition.

Johnson, N.C. and L. Margolis. 1993. Efficacy of ivermectin for control of the salmon louse *Lepeophtheirus salmonis* on Atlantic salmon. Diseases of Aquatic Organisms 17: 101-105.

Kim, K.H, S.I. Park and B.Y. Jee. 1998. Efficacy of oral administration of praziquantel and mebendazole against *Microcotyle sebastis* (Monogenea) infestation of cultured rockfish (*Sebastes schlegeli*). Fish Pathology 33:467-471.

Secatdal, S., L. Copley, C. Wallace, D. Jackson and T.E. Horsberg 2005. Monitoring of the sensitivity of sea lice (*Lepeophtheirus salmonis*) to pyrethroids in Norway, Ireland and Scotland using bioassays and probit modeling. Aquaculture 244:19-27.

Sommerset, I., B. Krossoy, E. Biering and P. Frost. 2005. Vaccines for fish in aquaculture. Expert Review Vaccines 4: 89-101.

Treves-Brown, K.M. (ed.) 2000. Applied Fish Pharmacology, Kluwer Academic Publishers, The Netherlands.

Dr. Leong Tak Seng

Dr. Leong Tak Seng was a founder and former Chairperson (1986 – 1989) of the Fish Health Section of the Asian Fisheries Society. He was Professor of Parasitology at Universiti Sains Malaysia. Since 1999, he is a consultant at LTS Consultancy. Email: mhpg@streamyx.com

Dr. Zilong Tan

Dr. William J. Enright

Dr. Zilong Tan is Manager of Technical Services with Intervet Norbio Singapore and **Dr. William J. Enright** is Marketing & Pharmaceutical Manager with Intervet International B.V., The Netherlands.

Some FAQs on mycotoxins in aquafeeds

During his visit to Asia for ALLTECH's Asia Pacific Lecture Tour in November, Dr Peter Spring provided answers to some frequently asked questions on mycotoxins in aquafeeds. As plant based ingredients are being used at higher inclusion levels in aquafeeds, he explains that producers will need to conduct more risk assessments for mycotoxins.

Born in Switzerland, Peter Spring studied at the Swiss Federal Institute of Technology in Zürich (ETHZ) and then obtained his PhD in animal nutrition from the University of Kentucky, USA. On returning to Switzerland in 1999, Peter was appointed Professor for monogastrics at the Swiss College of Agriculture. Currently, some 60% of his time is spent working with the college and the remaining 40% is spent conducting consultancy work for the feed industry. His experience in the feed industry spans over 15 years.

What are mycotoxins?

Mycotoxins are naturally occurring toxic compounds produced by moulds. There are over 250 known mycotoxins produced by a wide range of moulds. Mycotoxins can be present in very minute quantities, often in the range of milligrams to micrograms/kg (ppm and ppb).

The most well known mycotoxin is aflatoxin. Aflatoxin is of great importance in Asia because it is produced in rather humid and hot climates. Ochratoxins are a second very important group of mycotoxins. Another important group is the Fusarium toxins. Among them, the trichothecenes can exert significant negative effects on aquaculture. Tricothecenes are produced in more moderate climates and pose a significant risk when wheat, corn, barley and soy are imported and used in aquafeeds.

How do mycotoxins enter aquafeeds?

There are several sources of mycotoxin contamination in feeds destined for aquaculture. Mycotoxins can be formed either on the crop in the field or post-harvest during storage. This means that on buying in ingredients to make a feed mix, the grains could be contaminated. It is not easy to detect contaminated grains as mycotoxins are not visible to the naked eye. Therefore it is not easy to judge the quality of the grain without further tests.

Mycotoxins can also be formed during grain storage. This can be minimised by the proper control of moisture content during storage. In addition to moisture control, mould growth and further mycotoxin production can be inhibited by the use of propionic acid.

All plant-based ingredients, including soy are potential sources of contamination. Mycotoxins can also occur in all grain seeds. The current discussion has centered around grains, in particular corn as corn is often used at high inclusion levels in the animal feed industry

In the case of oilseeds, contamination would mostly occur when meals are used. If oil is added by itself, from the extraction process then there would be a smaller "risk" as the mycotoxins will primarily remain in the press cake.

Can contamination continue to be a problem even in extruded feeds?

Mycotoxins are very heat stable and so even with extrusion the contamination level cannot be significantly altered. Extrusion can have an effect on the presence of mould in the feed. However, this sometimes leads to a confusing situation as some people analyse feeds for moulds after extrusion and find very low counts but the mycotoxins can still be present. Mould concentration is not a good indicator of mycotoxin levels. That is why we always recommend that if you are in a high risk situation, you analyse for mycotoxins and not for moulds.

What is the impact of mycotoxins on aquaculture?

In situations where there are high levels of contamination, mortality and an immediate depression in growth are often visible. In these situations the economic impact is obvious. The more complex issue is that most mycotoxins affect the immune system and thus make the animals more susceptible to disease. As a result sometimes when disease arises it is not always obvious that mycotoxins are the underlying cause. (See box)

What preventive measures can be taken during the production process?

Prevention needs to focus on three main areas. Firstly, it is important to carry out a proper ingredient selection. Secondly, grains must be stored correctly and thirdly careful on-farm feed storage is required.

Once mycotoxins are present in feed, there are very limited possibilities to remove them. Thus the only effective way to control the negative impact of contaminated feed is through the inclusion of adsorbents to the feedmix. Adsorbents work by binding the mycotoxins to their surface in the gastrointestinal tract (GIT). The mycotoxins are not absorbed by the animal and so do not exert a negative effect on the metabolism of the animal.

What are the potential solutions available to the aquafeed producer?

Recognizing the problem is the first step to solving it. Creating awareness of the problem opens the producer to the information available to help him solve the problem. Producers must look for symptoms on farm, such as poor performance, bad feed conversion ratio and high mortality. As mycotoxins also cause histological changes (e.g. in hepatic tissue) mycotoxins must be considered as a causative factor when such changes are observed. However, a careful evaluation is always needed as many other factors can lead to such symptoms.

All producers should carry out proper risk assessments. This is especially important in warm climates and when including higher levels of plant ingredients. Risk assessment has to be carried out in ingredient selection, storage, manufacturing practices and storage on farm in addition to the health and productive status of the animal.

All control programmes must start with proper raw ingredient selection. It is best to avoid mouldy corn or oilseeds. In the case of high risk situations, it may be best to carry out regular analyses of the feed.

The use of a proprionic acid can prevent the formation of mould during storage. Controlling the moisture content below 12% will limit the formation of moulds. Above 12% moisture content, it is recommended to add 1kg proprionic acid per tonne for each percent of moisture. If moisture levels rise above 15-16%, it becomes more difficult to stabilise the situation using proprionic acid. It is also important to consider drying the feed first and then applying proprionic acid. During storage in the silo, formation of condensation can occur when during the day one side of the silo is exposed to sunlight. During the night, the temperature inside the silo will cool, this results in silos with 11 % moisture on one side and 13% moisture on the other side. Therefore it is vital to survey the conditions throughout the silo and to regularly control the quality of feed.

"We can dry ingredients to prevent the further formation of mould. However what was produced before drying will remain in the feed. Moisture levels of 14% or more will pose an extreme risk of high mycotoxin concentrations being produced."

A slight reduction in contamination can be achieved by cleaning ingredients. Often mycotoxins are concentrated on broken and shrunk kernels and research shows that if they are sieved out, a reduction in the levels of contamination can be achieved. However, it must be remembered that the efficacy of cleaning is limited.

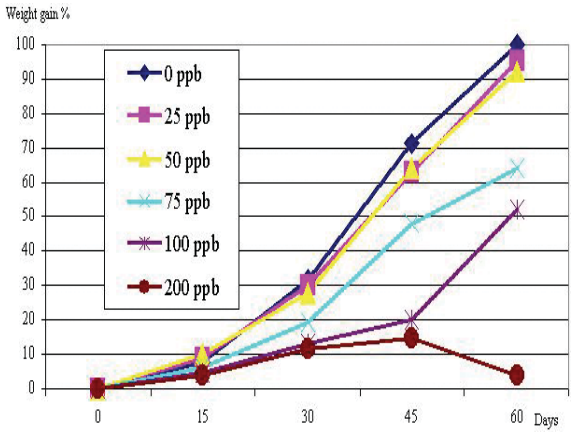
If 1% of the grain is removed, the reduction in contamination achieved is limited. If 10% is removed, the effect is better. However, a lot of contaminated material simply cannot be used.

High risk ingredients should only be included in lower amounts in the diet. The dilution process can help to reduce the risk of exposing animals to high mycotoxin concentrations. However, as it is often difficult to judge grain quality deciding on inclusion levels is more often guesswork than science.

Awareness is the key. It is both frustrating and economically expensive for the producer when there is case of mycotoxin contamination and either the producer or the advisor are not aware of the issue of mycotoxicosis. The tendency is to analyse for all types of nutritional problems and diseases when it may be a case of mycotoxin contamination.

This leaves adsorbents as an effective control tool. When deciding which adsorbent to use, one should consider properties such as, speed of adsorption, range of adsorption, inclusion levels, potential interactions with the digestive and absorptive process and safety. It is important to base any decision on *in vivo* research as *in vitro* trials do not accurately reflect the conditions in the gut. The most extensively studied mycotoxin adsorbents include clay binders and a glucomannan-containing yeast product (Mycosorb, from Alltech) Although clay binders are relatively low priced, they offer very limited protection against mycotoxins (van

Figure 1: Percentage weight gain of shrimp fed diets contaminated with 0, 25, 50, 75, 100 and 200 ppb of aflatoxin B1 (Bautista et al., 1994)



Kessel and Hiang-Chek, 2001) as they are often limited in the types of toxins they can bind as well as the security of the bond, and they often need to be used at very high levels of inclusion. They may also bind essential nutrients as well as toxins.

Recent progress in yeast biotechnology and carbohydrate chemistry has opened new avenues for tackling mycotoxin problems. In 1993, researchers supplemented an aflatoxin-contaminated broiler diet with to 0.2% live yeast and reported significant improvement in the weight gain and feed efficiency (Stanley et al., 1993). Subsequent research demonstrated that the inner cell wall fraction of yeast (Mycosorb®) was responsible for adsorbing mycotoxins and preventing mycotoxicosis.

"By adding an adsorbent, the absorption of mycotoxins and the damage they cause will be minimised. Adsorbents should not be misused as a strategy to keep feed in storage longer and to extend the shelf life of the feed. Adsorbents do not replace the need for proper feed storage"

Bottom line

The ideal is to combat mould growth in the field, prevent the build up of mould during the production process and during storage, and to minimise the risk of mycotoxin absorption by including an efficient mycotoxin adsorbent such as the glucomannan-containing yeast product (Mycosorb, Alltech Inc.).

References

Bautista, M.N, C.R. Lavilla-Pitogo, P.F. Subosa and E.T. Begino. 1994. Afflatoxin B1 contamination of shrimp feeds and its effect on growth and hepatopancreas and pre-adult *Penaeus monodon*. J. Sci. Food Agri. 65: 5-11.

Spring, P. 2005. Mycotoxins –a rising threat to aquaculture. Feedmix Vol 13 no 5, 2005.

Stanley et al 1993. The use of *Saccharomyces cerevisiae* to suppress the effects of aflatoxicosis in broiler chicks. Poult. Sci. 72:1867-1872

Van Kessel and Hiang-Chek, 2001. Aflatoxin binders - How to get the best value for money. International Poultry Production 12(4):33-35

Mycotoxins in aquafeeds

Plant ingredients pose a high risk of mycotoxin contamination and as more plant ingredients are being used to replace animal and marine meals, the risk to aquaculture increases. The risk is increased due to the perception that freshwater fish are hardy species and may be able to tolerate the use of lower quality plant meals in their diets. This may affect the sustainability of the industry.

Information on the effect of mycotoxin contamination in shrimp and fish is scarce. What is known is that susceptibility does vary between various animal species and within species and these depend on age and health status of the animal. Also the time of exposure can greatly influence the severity of symptoms. The fact that symptoms of mycotoxicosis are often unspecific also makes accurate diagnosis difficult.

In the warmer parts of Asia, where most aquafeeds are produced, aflatoxin contamination can pose a major threat. Various surveys of commercial shrimp feeds have revealed the presence of high concentrations of aflatoxin B1 with values up to 1000 ppb. As aflatoxin is transferred at low rates into edible tissue, this also becomes a concern to human health. The key target organ of aflatoxin is the liver. Long term exposure of less than 1 ppb of dietary aflatoxin has been known to cause hepatomes. The carcinogenic or toxic effect depends on species and age of the fish. In shrimp, histopathological changes in the hepatopancreas of shrimp have been observed at aflatoxin concentrations as low as 25ppb. These changes in liver function will affect health and growth performance of the shrimp. In juvenile black tiger shrimp aflatoxin concentrations of less than 100 ppb have been shown to reduce growth (see figure 1). Reduced diet digestibility impaired immune function and with it a higher susceptibility to diseases has been observed.

In the case of the ochratoxins, which are also mainly produced in warmer climates, the key target organs are the kidneys. Changes in protein metabolism and reduced weight gain have been reported. Studies on the effects of deoxynivalenone (DON) which is a toxin in the trichothecene group showed that the trout is very susceptible. American catfish are more capable of tolerating dietary DON but they are more susceptible to another mycotoxin in the group, T-2 toxin. Levels as low as 625ppb have been shown to decrease weight gain and higher levels will reduce feed conversion and survival rate. In shrimp, DON concentrations as low as 0.2ppm can lead to reductions in growth rates (Table1).

Table 1. The effect of different concentrations of DON on performance of shrimp in a 16 week trial (Trigo-Stockli, et al., 2000). (Adapted and extracted from; Spring, 2005)

Parameter	0 ppm DON	0.2 ppm DON	0.5 ppm DON	1.0 ppm DON
Final weight, g	11.22a	10.63ab	10.43b	9.67c
FCR	3.25a	3.15a	3.66a	3.79a
% Survival	86.4a	90.9a	81.8a	83.3a

A Rabobank report on Vietnam's seafood exports

Frederick Tan

"Nhat canh tri canh vien"
This Vietnamese saying which means "first profitable activity is aquaculture and the second is agriculture" reflects the current situation in the country. Today seafood is the largest and most significant agricultural export for Vietnam and it is poised to grow at 8% per annum over the next five to six years. Foreign investments in its seafood processing industry will soon provide the catalyst to increase its overall competitiveness in world markets. By Frederick Tan*

The seafood sector in Vietnam has been experiencing one of the fastest growth rates. The compound annual growth rate (CAGR) was 13% during 2000 to 2004. It accounted for 4-5% of GDP and employs more than 3 million workers. Vietnam has 405 seafood processors mostly geared towards exports and 171 plants have qualified to export to the European Union (EU) and more are applying for HACCP.

Seafood is the fourth largest export commodity after crude oil, textiles and footwear. Several factors have contributed to this growth. The sector has been receiving the government's focus. There is an abundance of low cost labour and availability of locally available aquafeeds for the aquaculture sector.

Riding the storm

However, it has not been entirely smooth sailing for the sector. The challenges parallel those faced by the global industry. Over the last few years, there have been tariffs and non-tariff barriers imposed by large importing and developed countries and regions. The US imposed anti-dumping on two main Vietnamese seafood exports, namely catfish and shrimp. The EU required sanitary and phyto-sanitary (SPS) measures and some exports to the EU were returned after products were found to be contaminated with antibiotic residues.

Vietnam exported USD778 million of shrimp to the US in 2003. But by 2004, this dropped 22% to USD 202 million for the first seven months of 2004 when the US anti-dumping tariffs were imposed. Initial anti-dumping margins range from 12.11% to 93.13%. This was reduced to the current 4.6% and a handful is assigned the country wide rate of 25.8% in early 2005. More recently, Vietnamese producers faced a further trade and financial burden under a new US custom bond requirement in order to gain entry to US markets.

During this period, whilst Vietnam's exports to the US dropped, her exports to the EU and Japan grew by 98% and 32% respectively. The first half of 2005 also saw an increase of seafood exports to Canada, Australia and Switzerland. In September 2005, anti-dumping duties imposed since 2003, were reduced to 38.8% and 7.2% for two of the four mandatory exporters of catfish.

A changing and dynamic trade

As a result of the US anti-dumping duties and custom bond requirements, Vietnam's seafood trade flow is changing. The exports to Japan are projected to reach USD 750 million and increase to USD 1 billion by 2010. With USD 414 million, the rest of Asia, namely China and Korea, is currently the third largest buyer. During the first five months of 2005, Vietnam's exports to the EU grew by a whopping 220% to USD 40 million. However, in spite of current challenges, the US still remains a lucrative market as demand for seafood; especially shrimp is increasing and still commanding attractive prices.

Way to go through aquaculture

At home, the government was able to stabilize production by promoting aquaculture. According to the Ministry of Fisheries, farming area will increase to 3 million ha by the end of 2005. The increase was 300% to 1.1 million ha from 1986 to 2001. Aquaculture has almost caught up with capture fisheries and will constitute almost 60% or 2 million tonnes over the next few years. The total seafood production is expected to reach 3.4 million with an export value of USD 3.5 billion by 2010. Tra and basa catfish and shrimp together contribute half of the seafood exports and will remain as the two major seafood products for some time. The production of shrimp and fish is projected to reach 360,000 tonnes and 380,000 tonnes respectively by 2010.

Focus on specialty and quality exports

Vietnamese seafood producers are known for producing what customers want. As such the majority of exporters trade in a variety of seafood products from finfish to mollusks and crustaceans. To differentiate, processors should focus on specific product categories and offer more value added options. Importers in developed countries tend to be very specific in their purchase and prefer to deal with specialty exporters.

Vietnamese seafood and hygiene standards have reached international standards and since 2002, the use of antibiotics has been prohibited in farming. However, stringent adherence will need to be consistent. Some producers have invested in modern analytical equipment to check for chemical residues before harvest. So far more than 130 aquaculture areas are controlled under the residue monitoring programme.

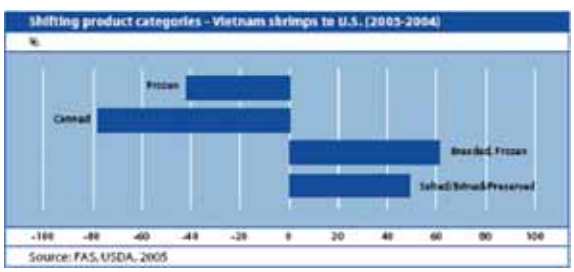
Cooperation and foreign investments

To ensure broad base success, the Government is heading in the right direction by being supportive rather than offer subsidies. They work in close collaboration with SOEs (State Owned Entreprises), private enterprises and VASEP (Vietnamese Association of Seafood Exporters and Processors). Its privatization programme will create the impetus for SOEs to be more competitive and provide the seafood industry an added boost.

The Ministry of Fisheries is seeking investments in aquaculture and shrimp hatcheries as well as the upgrading of value adding processing facilities. These will provide the catalyst for Vietnam to increase its overall competitiveness in the world market. Foreign interest has been encouraging and is expected to garner more strength.

In conclusion, despite the challenges posed by trade and non-trade barriers of major seafood importing countries and the current shortcomings on domestic infrastructure, the future of the industry looks bright. The sector will no doubt continue to brave any storm as it has proven its export resilience on numerous occasions.

This information was extracted from A Review and Outlook of Vietnam Seafood Exports, Industry 159-2005, F&A Research and Advisory, Rabobank International, November 6pp



Nucleotides: The performance promoter

By Shravan K. Mishra and Joachim W. Hertrampf*

After the ban on the use of antibiotics for shrimp culture in the region, new strategies in feeding and health management have to be developed. Since January 2006, the European Union has also stopped the use of several antibiotics with growth promoting properties. The use of feed probiotics in health management is now widespread in the region, although there are doubts as to their role in replacing antibiotics in aquaculture feed.

A relatively new way to combat diseases in shrimp culture is the supplementation of feed with immunostimulants or immnunostimulatory substances. They have the ability to activate cells in the immune system and by doing so, they strengthen the immunity of animals. This is particularly important for shrimp because they lack a specific immune system and are dependent on non-specific immune mechanism to resist infections (*Söderhäll and Cerenius*, 1992). Generally, immunostimulants have been classified by Raa (1996) as follows:

- Glucans
- Nucleotides
- Bacterial products
- Products from mycelial fungi
- Peptides from animals products
- Cytokines

Among these, nucleotides and glucans are probably the most promising substances for strengthening the immune system. They provide resistance to diseases and help overcome stress situations in the animal.

The specific difference between both substances is their origin. Both are extracted from yeast cell walls. While nucleotides are derived from the "insides" of yeast cells, glucans are derived from the "outside' cell wall (*Ancieta-Pröbstl et al.*, 2005). According to *Smith et al.* (2003) the immunostimulatory effect of glucans on shrimps may be limited and under certain situations also detrimental. These observations are supported by findings by *Scholz et al.* (1999) and *Chang et al.* (2000).

Nucleotides as feed additives

Immunostimulants influence the immune system of cultured shrimp by application via the feed. Nucleotides are the basic building blocks of the nucleic acids DNA and RNA. Recent research suggests that nucleotides are "semi-essential" nutrients (*Carver and Walker*, 1995; *Devresse*, 1998.). Dietary sources of nucleotides appear to be important for supporting optimal growth and the function of metabolically active cells such as lymphocytes, macrophages and intestinal cells (*Rudolph et al.*, 1990). Nucleotides are now used commercially as feed additive for the improvement of animal growth or disease resistance (*Portmouth*, 1993).

A number of trials have demonstrated that nucleotides in shrimp feed has positive effects on growth, feed conversion and survival (*Promchaiwong*, 1995; *Applebaum*, 1999; *Achupalas*, 2000).

The stress elevating properties of nucleotides were investigated in aquarium trials. By changing periodically the salinity or maintaining a permanent high salinity situation as an induced stress, nucleotide fed shrimp (*Penaeus monodon*) fared much better than the group fed the control diets without any nucleotide. In Hertrampf, (2003), it was shown that weight gain improved by 17.8% to 24.7%, depending on the inclusion rate of nucleotides. The feed conversion improved by 27.9 to 34.8% better. More importantly, mortality was low at 14.3% Nucleotides have also been successfully used as the only food for post larval rearing and thus replacing Artemia (*Hertrampf et al.*, 2005; *Mishra et al.*, 2005).

Nucleotides in pond farming

Aquarium trials provide basic information. However, it is not a guarantee that findings from such aquarium trials can be repeated under pond conditions. A pond trial under research conditions, therefore, was conducted.

The ponds used for these trials were 0.3 ha (control) and 0.4 ha (treatment) respectively. The net stocking rate was 23 pieces/m^2. Post larvae of *Penaeus monodon* had an initial liveweight of 0.1 g. The pond trial lasted for 98 days. Contrary to normal practice, only one pelletised shrimp feed for semi-intensive culture was used (Table 1). Nucleotides were added to the feed at a level of 0.2%.

Table 1: Nutritional value of trial feeds

Composition	Unit	Control	Treatment[1]
Moisture	%	11.4	12.2
Crude protein	%	44.3	44.7
Digestible crude protein[2]	%	91.6	91.8
Calcium	%	2.11	2.18
Phosphorus	%	1.56	1.63
Ca:P ratio	1:	1.35	1.33
Digestible energy[3]	MJ/kg	14.2	14.2

[1] *Fortified with 0.2% Vannagen, a nucleotide product of Chemoforma A.G., Augst / Switzerland*
[2] *Hydrochloric-pepsin test 3 Calculated*

The culture conditions suffered from high salinity which ranged from 35 ppt to 41 ppt with a mean value of 38 ppt (Table 2). This was higher than the 18 ppt to 25 ppt recommended salinity by *Boyd* (1998).

Table 2: Water quality parameters during the trial period of 98 days

		Control		Treatment	
		Mean	SD±	Mean	SD±
Temperature[1]	ºC	31.0	2.5	31.0	2.5
Salinity[1]	ppt	38.0	2.53	8.0	2.5
pH[1]		8.1	0.3	8.2	0.3
Dissolved oxygen[1]	ppm	3.9	0.7	3.7	0.6
Alkalinity[2]	ppm	135.0	10.0	140.0	12.0
Ammonia[2]	ppm	0.02	0.01	0.03	0.01
Green colonies[3]	cfu/ml	95.0	12.0	75.0	15.0
Yellow colonies[3]	cfu/ml	480.0	115.0	255.0	150.0

[1] *n = 98 samples per group*
[2] *n = 14 samples per group*
[3] *n = 7 samples per group*

The weight gain of the nucleotide-feed fed animals was 9.8% statistically higher ($P<0.05$) than that of the control shrimps by 9.8%. This corroborates with the findings by *Promchaiwong* (1995) and *Achupalas* (2000) in pond trials. The results found by both authors were better than the 9.8% in this trial.

However, from the early stage of the trial there was a severe bioluminescence problem in the pond of the nucleotide fed animals. Due to this, it was difficult to maintain a proper and stable phytoplankton bloom. This was also the reason for the better transparency of the pond water (55 cm) which was only 40 cm in the control pond. Bioluminescence problems and the frequent collapse of phytoplankton bloom causes stress to shrimps and results often in very poor growth and low survival (*Amamath*, 2004).

The fact that shrimp could overcome this situation indicated that the nucleotide-enriched diet has a positive impact on shrimp performances under stress conditions. This was related to the findings that nucleotide treatment increases the number of granulate hemocytes as stated by *Fegan* (2002) and *Ancieta-Pröbstl et al.* (2005). Hemocytes avoid the invasion of pathogens.

Since both ponds are not of equal size and for making the results comparable, the biomass production was converted into yield per ha. The nucleotide-diet group produced a statistically significant difference of +15.8% biomass than the control group (Table 3).

Table 3: The effect of feeding nucleotide supplemented feed on the growth performances of *Penaeus monodon*

		Control=100%	Treatment[1]	Control=100%
Pond area	ha	0.3	0.4	
Net stocking rate	pcs/m²	23	23	
Initial liveweight	g	0.1	0.1	
Final liveweight	g	12.54[a]	13.77[b]	109.8
Biomass produced	kg/ha	1,959.0[a]	2,269.3[a]	115.8
Feed consumed	kg/ha	3,950.0[a]	3,432.5[b]	89.9
Feed conversion ratio	1:	2.02[a]	1.51[b]	74.8
Protein efficiency ratio	1:	1.01[a]	0.77[b]	76.2
Survival rate	%	68.0	71.5	105.4

Different letters in the superscript denotes statistcal significance between means (P<0.05)

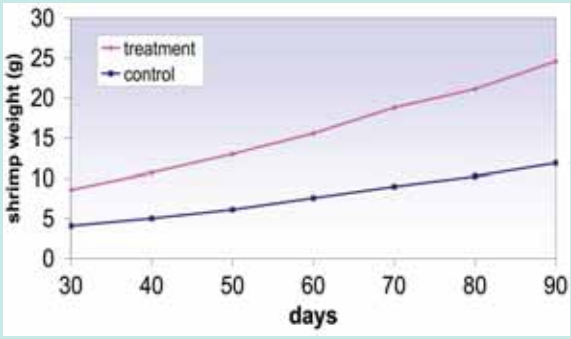
The nucleotide group consumed 13.1% less feed than the control. This was reflected in the feed conversion rate, too. The difference between both groups was 25.2% in favour for the nucleotide group. The latter also utilised the feed protein more efficiently. Expressed as protein efficiency ratio the difference was 23.8%. The differences of all parameters were statistically significant (P<0.05)

Last but not least, the nucleotide-enriched feed resulted in a higher survival rate. This was 5.4% higher in the treatment group. The impact of nucleotide-supplemented feed on the carcass composition and the chemical composition of shrimp meat also showed some analytical differences. However, they are statistically non-significant. Therefore, these differences, cannot be referred to an effect of nucleotides.

Bottomline

Shrimp feed supplemented with nucleotides enhanced the immune system and promoted the performances of the animals as demonstrated in aquarium trials. Also under less optimal pond conditions (high salinity, poor bloom stability) the nucleotides used demonstrated its properties as a stress reliever and at the same time its performance promoting capacity.

Figure 1: Weight development of *Penaeus monodon* when fed with nucleotide supplemented feed



References

Achupalas 2000. Quoted from: Hertrampf (2003).

Armanath, 2004. Pers. comm.

Ancieta-Pröbstl, D.K.; Smullen, R.P.; Barnes, A.C., 2005. Enhancing growth performance of shrimp with nucleotide sypllemented diets. Aqua Culture AsiaPacific Magazine, 1(4), 26-28.

Applebaum, S., 1999. Pers. comm.

Boyd, C.E., 1998. Effect of water quality in shrimp farming. L. World Aquac., 29., 7-73.

Carver,J.D.; Walker, W.A., 1995. The role of nucleotides in human nutrition. Nutritional Biotechnology, 6, 58-72.

Chang, C.-F. ; Chen, H-Y., Liao, I.-C., 2000. Fish Shellfish Immunol. 10., 505-514.

Devresse, B., 2000. Nucleotides – A key nutrient for the immune system of shrimp? International Aqua Feed, 2, 35-39.

Fegan, D., 2002. Effectiveness of NuProTM as immune enhancer for shrimp, *Penaeus monodon*. Shrimp Biotechnology Business Unit (SBBU), Mahidol University, Bangkok / Thailand.

Hertrampf, J.W., 2003. Less stress with nucleotides. Asian Aquaculture Magazine (6), 22-24.

Hertrampf, J.W.; Mishra, S.K.; Biswal, P.K., 2005. Nucleotides as the only feed for larval shrimp. Aqua Culture AsiaPacific Magazine, 1 (1), 27-29.

Mishra, S.K.; Venu Gopal Krishna, G.; Hertrampf, J.W., 2005. Evaluation of the feeding value of nucleotide products in comparison with the Artemia in early post larval stage in cultured black tiger shrimps (*Penaeus monodon*). Trial Report 90/94, TWL, Nellore/India.

Portmouth, J., 1993. Feeding for better immune status. World Poultry, 9., (10), 39-47.

Promchaiwong, 1995. Quoted from: Hertrampf (2003).

Raa,, J.,1996. The use of ummunostimulatory substances in fish ans shellfish farming. Rev. Fish. Sci., 4., (3), 1-60.

Rudolph F.B.; Culkatni, W.C.; Fanslaw, R.P.; Pizzini, R.P. (1990):Role of RNA as a dietary souce of pyridins and purines in immnune function. Nutrition, 6., (1), 45-52.

Scholz, U.; Garcia-Diaz, G.; Rique, D.; Cruz-Suarez, L.E.; Vargas-Albores, F.; Latchford, J.,1999: Aquaculture, 176, 271-283.

Smith, V.J.; Brown, J.H.; Hauton, C., 2003. Fish Shellfish Immunol., 15, 71-90.

Söderhäll and Cervinus (1992): Quoted from Ancieta-Pröbstl et al. (2005).

Shravan K. Mishra

Dr. J. W. Hertrampf

Shravan K. Mishra is Assistant Manager of the R&D-Unit of the Waterbase Ltd., Nellore, India. Email: shravankumarmishra@yahoo.co.in

Dr. J. W. Hertrampf is a Consultant on animal production and aquaculture, based in Kuala Lumpur, Malaysia. Email: trampf@tm.net.my

A balanced view

This is the new approach to the annual DSM conference. In the conference held in November 2005, discussions were on seafood marketing into Europe and consumer attitudes aside from nutritional strategies to reduce disease occurrences and aquaculture developments and systems.

From left, Jacques Gabaudan, Prof Shunsuke Koshio, Fred Schwenke and Robert Redman, DSM Thailand

Jacques Gabaudan with A. Indra Kumar and C.R. Rao of Avanti Feeds Ltd India.

Dr Gudrum Gallhoff (right) and Pekka Pentilla, Business Information Coordinator, European Union, Delegation of the European Commission, Bangkok

From left Dr Renu Yashiro, Rayong Coastal Fisheries R&D Centre, Dr David Fletcher and Dr Supis Thongrod

This is the 11th year of commitment to the industry in Asia by the Aquaculture Centre Asia Pacific, DSM Nutritional Products based in Bangkok. In earlier meetings, presentations focused on nutrition and feeding management. This time, a holistic approach on industry was adopted as in the new aquaculture agenda, the goal for a high performance and efficient industry must also take into consideration animal welfare and environmental impact.

Fred Schwenke, Animal Nutrition and Health Asia Pacific Area Manager, DSM said that a regard for sustainability of the industry is crucial. Performance from technological advances must create products that meet consumer expectations.

"DSM has recognized the need for this balance and in the 5 year plan called "Vision 2010-Building on Strengths", we will strengthen on innovations, the emerging economies of Brazil, Russia, India and China (BRIC) and operational excellence. The platform is already here for aquaculture in Asia, but we will need to focus on SHE- Safety, Health and Environment".

Jacques Gabaudan said, "In the last year, we had to adapt to many issues. We have learnt to adjust to the antidumping litigations but problems with diseases and postlarvae quality persist. As the trade with Europe is gaining momentum, we would like to know what customers in the EU demand in products from Asia. It is fitting that we understand the rational of regulations by the European Commission on Health and Consumer Protection".

Health and Nutrition

Prof Shunsuke Koshio from the Faculty of Fisheries, Kagoshima University in Japan presented some strategies on disease prevention in marine fish and marine shrimp. He said that protection or prevention is found to be more important than the cure or treatment due to concerns on the use of antibiotics and other chemicals. An alternative is to control feed provided during culture operations. But, while information on nutritional requirements for normal growth and survival is available, requirements for the avoidance of diseases and immunological resistance remain limited.

The use of optimal feeds is to create healthy and greater stress resistance but the effectiveness of the feeds will depend on the formulation, ration size, growth rate, genetic variation, culture conditions and other factors. The use of nutrients can bring forth changes in immune responses. The focus of their research is how to combine nutritional studies i.e. those on growth performance and survival rates with pathological effects. Some examples were given.

In the Atlantic salmon, a dose of 4,000 ppm of Vitamin C provided resistance against *Aeromonas sp* whereas in the carp, the levels were 500-1,000 ppm. In the channel catfish, doses of 1,000 to 3,000 ppm were effective against *Edwardsiella sp*.

With Vitamin E, doses of 240-600 ppm gave a survival of 73% against *Pseudotuberculosis* in the yellowtail. More than the requirement for Atlantic salmon did not give any effect but a 1,200 ppm dose activated serum and phagocytes in the seabream. There are the synergistic and antagonistic effects of Vitamin C and E. A combination of Vitamin C and E at 2,000 ppm and 800 ppm, respectively in the rainbow trout and 300 ppm Vitamin C and 1,200 ppm Vitamin E in seabream provided resistance against infections.

The effects of glucans, polysaccharides such as chitin and chitosan, nucleotides, bacteria and proteins such as lactoferin can promote non specific disease resistance were discussed. Among these, in Japan, beta-glucans are generally believed to be better. A tolerance to vibrio

Benoit Vidal-Giraud

was shown with 500 ppm in seabream diets. However, sometimes, they do not work. Therefore the efficacy is still dependent on conditions.

The effects of glucans and vitamin C in the marine shrimp *Litopenaeus vannamei* on a some parameters were also given. Levels of glucose, lactic acid bacteria and cholesterol declined. In Asia, the effect of *Lactobacillus sp* on the marine shrimp is quite well defined whereas less information is available on its effect on the fish.

The current focus of their research is also whether Lactoferin, the sugar protein from mammals with antibacterial activity can enhance non specific defense systems in the marine shrimp. Working with the kuruma shrimp *Marsupenaeus japonicus*, they showed that growth improved with 700 ppm of lactoferin. In larval red sea bream fed varying levels of lactoferin, stress resistance improved. In adult fish, growth was not influenced by the levels of lactoferin but by measuring the levels of cholesterol (an indication of health conditions), it was found that health condition of the fish improved.

Recirculation technologies to improve disease control

In Europe, recirculation aquaculture systems (RAS) is a topical issue due to the increasing demand within the EU to improve the sustainability of aquaculture particularly in terms of effluent management but also due to the need to diversify the range of species farmed. Dr David Fletcher of Môn Aqua Tech Ltd based in North Wales, said that RAS are becoming increasingly popular within the industry due to the greater flexibility of site location, reduced pumping costs and improved production performance. Farms may be located on sites where conflict with other coastal activities is reduced. RAS have also allowed for the culture of new species, such as Asian seabass, *Lates calcarifer*, in some EU countries. The stable environment encourages an optimum growth rate of the fish irrespective of the ambient environment conditions.

In some Mediterranean areas, inclusion of some components of recirculation technology in hatcheries is well established and has increased production of healthy fry and reduced occurrences of diseases. In parts of Asia, Canada, UK and the US, RAS have been used to produce market size fish although production of marine species still remains limited while the technology is further improved. Other than for specific areas such as broodstock management, the use of RAS in shrimp hatcheries remains undeveloped.

However, the chances of success with any RAS require certain prerequisites. David listed some of these as the prior experience of the operator in commercial marine aquaculture, a good understanding of water chemistry and good research support. The latter is because marine recirculation technology remains a new approach to fish production and will require continuous development to improve performance. He warns participants not to believe in the 'cowboy salesmen' selling unproven recirculation systems for marine applications.

The composition of a simple marine RAS can include a range of instrumentation to monitor and control water quality parameters such as pH and temperature at predetermined values which can be species specific. It will also have equipment for UV disinfection, oxygenation and solids filtration. Each company has their own approach to construction of a RAS. A system can be delivered as a complete turn-key project or retrofitted from existing systems although this approach can create new problems rather than improve production. A recirculation system demonstrated to be adequate for freshwater is not necessarily applicable for marine species. Wherever possible, potential RAS investors should visit commercial farms where a specific technology package is already in operation.

David said that in a comparison with sea bass cultured in cages, they found that FCR was 1.3 in RAS as compared to 1.9-2.3 for fish in cages, mortality was much reduced despite higher stocking densities and the culture period was almost halved compared to sea cage production. Economies of scale play a significant role in the success of land based production of market size marine fish species. This is particularly so in terms of the energy consumption per kg production and associated labour costs. Further savings are made through improved FCRs and significantly better survival.

The marine hatchery industry in Greece has made significant improvements in fry production in recent years with production doubling to 340 million fry between 1998 and 2002. This has been achieved through improved hatchery management involving better nutrition but also through application of water quality management procedures. The use of this technology in hatchery and nursery systems improves the stability of the culture environment, reducing the incidence of disease outbreaks and particularly importantly drives down production costs when market prices for farmed product are already depressed.

Flesh quality evaluations of turbot and seabass farmed in RAS were extremely positive but only where the technology was capable of producing clear water without the 'brown' colouration so common in many RAS packages. In terms of sustainability of the farmed product RAS allow total waste management, a reduction in 'food miles' associated with seafood trade and far greater traceability. These are the issues which increasingly aware consumers are demanding.

Exporting to the EU – The regulations

Dr Gudrun Gallhoff from the European Commission, Directorate General of Health explained what the EU market wants in terms of aquatic products from Asia. Food and feed entering the EU must comply with existing EU legislation to ensure a high level of human health protection for its population. These have been developed after thorough scientific evaluations. Essentially, what is being imposed on imports of seafood are the safe levels specified for local products and has to be SPS (Agreement on Sanitary and Phytosanitary Measures of the World Trade Organisation) compliant.

The EU Food Law first requires that the exporting country has a functioning control system. The competent authority in the country is required to ensure compliance and this means amongst others that it is required not only to analyse exports but to have a regulatory system that especially include a sampling program for residues. They also have to determine what are the authorized substances. Reporting to the EU is then required. (related websites: 1 and 2 for requirements concerning residue)

Those countries which are not importing to the EU but wish to do so, will need to request to be an exporter. The EU can request the country to provide information on phytosanitary regulations within the country. A list of establishments will be required and finally an acceptance by the standing committee on Food Chain and Animal Health.

Dr Gallhoff said that according to the results of the EU's Food and Veterinary Office inspection results some of the deficiencies in fisheries products are in the hygiene of operation, cold chain, use of water, traceability, certification of health status of staff and number of official/own check analyses. (related website: 3). Serious deficiencies or non-compliance of imported products means the whole country is at risks to be taken under increased scrutiny or at worst be 'delisted' The EU may send inspection teams to the field. Delisting means that establishment or country is removed from the list and the agreed imports. The food business intending to import non compliant consignments pays for the cost of rejection.

The checklist for aquaculture products includes organoleptic, parasites, chemicals and microbiological substances. These include veterinary/medicinal products and pesticides and additives that enter through feed. Some of the substances not tolerated in the EU are nitrofurans, ronidazole, furazolidone, chloramphenicol, and malachite green. Substances evaluated as safe are listed in Annexes I to III of Regulation 2377/90 (related website:4). Under contaminants (MRLs 466/2001), there are the heavy metals (lead, cadmium, mercury) organochlorides, arsenic and mycotoxins (related website: 5).

In the EU's rapid alert system (related website 6), 20% of notifications in 2004 were from seafood products and up to 14 November 2005, the two largest group of notifications were microbial contaminations and residues of veterinary drugs. Some of the notifications on exports from Asia contain banned substances such as Sudan red, lead, malachite green and chloramphenicol.

List of relevant websites

1. http://europa.eu.int/comm/food/international/trade/index_en.htm
2. htttp://europa.eu.int/comm/food/food/chemicalsafety/residues/third_countries_en.htm
3. http://europa.eu.int/comm/food/fvo/index_en.htm
4. http://pharmacos.eudra.org/F2/mrl/index.htm
5. http://europa.eu.int/comm/food/food/chemicalsafety/contaminants/legisl_en.htm
6. http://europa.eu.int/comm/food/food/rapidalert/index_en.htm

Exporting to the EU – Consumer attitudes

Benoit Vidal-Giraud from Via Aqua, France gave an interesting insight into perceptions of the consumer in Europe on seafood and their buying criteria. The EU is a large market of 457 million consumers with a diverse seafood consumption of 6 to 60kg/capita/year. Seafood consumption totals 11 million tonnes. The EU's self supply of seafood, currently at 40% is declining rapidly. However, seafood consumed at home accounts for only 7% of the 17% of the household budget allocated for food. In the 1990s, the household budget was 20%. Thus, today, food producers compete aggressively for market share.

One of the major trends influencing food consumption is the changes in consumer behaviour. Demographic changes and changes in working habits means more value added products are preferred. However, expectations are higher in terms of health, safety concerns and ethical issues. There is also the growing interest for regulatory frameworks. Thus, what the consumer demands can be a bunch of contradictions, according to Benoit. They want both price and sophistication or naturalness and convenience.

Due to the cross cultural differences it may be wrong to stereotype the European consumer, but according to Benoit, numerous trends of modern food habits clearly favour seafood over other protein sources. The evolution in the market chain organisation and continuous changes in consumer expectations towards their food indicate a bright future for products based on fish, shellfish and crustaceans.

Share of aquaculture products within total seafood supply to the EU is 15% (in terms of volumes), and is increasing. Nevertheless, the consumer has perceptions of farmed versus wild seafood. The level of trust in farmed seafood is lower. The image of aquaculture is less robust than that of wild fish and predominantly negative or uncertain. It is fuelled by fears but also based on little knowledge about actual fish farming. In contrast to farms for pigs and poultry, the consumer usually never sees aquafarms. In a DSM led survey in 2003, it was clear that some of the consumers' concerns are in feed issues, sustainability of fish meal and fish oil and safety control of contaminants.

Benoit summarized that there is huge potential for aquaculture products in Europe as consumption is expanding and fisheries cannot supply the demand. But harsh competition between food suppliers means that aquaculture market chain has to adopt rules and weapons of the competitors. And the doubtfulness of the consumers vis-à-vis farmed seafood will need reassurance. As the market chain gears up, more information and communication is essential. Together with in depth understanding of consumer reality, these challenges are the very essence of marketing.

New aquaculture species in Thailand

Thailand will be focusing on the culture of the grouper, catfish and sea snail, according to Dr Supis Thongrod from the Coastal Aquatic Research Institute, Department of Fisheries. In grouper culture, the target species are the leopard grouper, *Plectropomus leopardus* and humpback grouper *Cromileptes altivelis*. Thailand produced only 1,038 tonnes of groupers from cage culture in 2004, mainly the orange spotted grouper. Currently most of the 7,000 tonnes of the leopard grouper marketed to Hong Kong are exports from the Philippines and Indonesia and are wild caught.

The second new species with economic potential is the catfish, in particular *Pangasius bocourti*. DoF has already succeeded in the production of the fry and its culture is well developed in Vietnam. Commercial catfish feeds are used and the FCR is 1.8-2. Markets are available in Europe. Prices are high at Baht 70-85/kg with high profit margins. Fillet prices in Vietnam are USD 2-2.5/kg. The target production is 333 tonnes in 2005 to 667 tonnes by 2008.

Third on the list is the marine snail *Babylonia areolata*. These are already cultured in the Eastern provinces of Trad, Chantaburi, Rayong and Chonburi and in Chumphon in the south. Market prices are 320 Baht/kg. The demand in Guangdong province alone is 2,000-3,000 kg per day which is met by supplies from Vietnam, Thailand and China.

Next is the climbing perch which has imports markets in China, the Middle East, Pakistan and Bangladesh. Prices depend on sizes and average 25-33 baht/kg. The culture uses feeds formulated for the catfish with 25 to 30% crude protein. Also in the list is the swimming crab *Portunus pelagicus*. DoF has already succeeded in producing the crablets but a commercial larval feed is yet to be developed. Other targets species are marine ornamentals such as anemone fish.

Going to the next level

A three year learning curve in marine fish farming in cages in Kukup is now leading to plans for more investments in a new and larger farm

In 2003, Stuart Keable acquired a marine fish cage farm in Kukup, Johor located at the southernmost tip of Peninsula Malaysia. With no previous background in aquaculture, he was very realistic about the short-term goals. His choice of Kukup suited his requirements. It has a well-developed marine cage industry with a 20 year old history. It is also close to Singapore, a major market and distribution centre for live fish.

Today, Stuart has doubled the capacity of the farm to 80 wooden cages, each measuring 4m x 4m and generally holding up to 1,000 fish, depending on species. At the moment, the main species at the farm are the tiger grouper *Epinephelus fuscoguttatus*, green grouper *E.coioides*, red snapper *Lutianus malabaricus* and golden snapper *L.russeli*. These are sold in the local Malaysian market and the nearby Singapore market. Some are exported to Hong Kong.

"With the right partnerships in place and a supportive government, tax regime and investment environment the way is now open to take things to the next level".

The popularity of the species for culture is determined by large markets such as Hong Kong and China. Brokers collect fish in well boats which ply the area at irregular intervals. They buy mainly the tiger grouper for markets in Hong Kong and China. However, Stuart said, "Prices for this grouper have dropped 25 to 30% this year to RM30/kg or USD 7.9/kg. Thus these slow growing fish which are fed mainly trash fish are no longer an attractive culture species. The upside to this trend is that the fish are now within a price band that makes them more viable in the local market".

"Ideally, we should concentrate on one or two species and fully develop their culture technology. But today, it is the markets that determine the species that we culture. Having many species requires a lot of adjustments such as in-stocking density, feeds and feeding frequency and the intervals for changing of nets".

At the farm, the stocking density is lowest for the groupers, followed by the red snappers. In the case of the pompano, feeding is three times a day whereas feeding is once a day for the other species, due to the variable water conditions in this mangrove area. Nets in cages holding golden snapper have to be replaced every week in comparison with fortnightly intervals for the tiger grouper.

The farm uses a mixture of trash fish and pelleted feed. Commercial pellets with up to 43% crude protein are available and used for some species, and Stuart would like to see their use for all species. The red snapper, for example is fed either pellets or trash fish but groupers have to be weaned off trash fish on to pellets. Feed costs are around RM3.00/kg or USD 0.8/kg and FCR is around 2.5:1. Feeding trays are used to reduce feed losses.

Today, he is looking at a larger picture for the future of the industry. In the plans is a larger scale commercial grow out facility to meet the demands of the local and Singapore markets and ultimately the export market. He plans to combine the tried and tested local species with the increased efficiencies offered by more evolved production systems from around the region and beyond.

Kukup and its vicinity remain ideal for cage culture. There are several factors in his favour including a steady supply of fingerlings, pellets and trash fish. Skilled and semi-skilled labour for construction and maintenance of the cages, net making etc is easy to find. Local hatcheries are producing larger and better quality fingerlings such as those of the red snapper, golden snapper and even pompano. They are also expanding production to more species. This has reduced the dependence on fry imports from Taiwan. In addition, locally produced fry are sold at a larger size and this generally means stronger fingerlings and subsequently lower mortality during grow out. This helped farms in the area to improve yields.

The knowledge base for successful production of many species in SE Asia is still relatively weak and fragmented amongst both companies and individuals, according to Stuart. There will always be room for improvements. Some practices will need to change such as the often highlighted issue of trash fish usage. Experts in fish diseases are already making advances in developing vaccines for marine fish and this will lead to further improvements in revenue.

"If we look at the larger global export market, we have to go on to establish protocols for fish production that are fully sustainable and that the products comply with international standards, particularly with regard to product health and traceability issues. These are what a future investor will be looking for in marine fish production in SE Asia", said Stuart.

"Ultimately marine fish production in cages can move to the next level if we have a greater control over the production cycle and particularly in regulating the water environment", he added.

Stuart can be contacted at email: fishboy_67@hotmail.com

Feeding trays in cages can reduce feed wastage

The target species will be red snappers (left) and seabass in the next project.

Aquaculture specialist for Biomin in Singapore

Biomin is expanding operations to the aquaculture industry. To face the challenge of this new strategic business, it has appointed Dr. Pedro Encarnação as the aquaculture specialist. Pedro will be based in Singapore to serve the thriving Asian market. As head of the aquaculture department, he will be responsible for product development and application and a key person between the R&D department and customers.

Pedro has an extensive background in aquaculture and nutrition and has conducted several research projects focusing on the improvement of feed formulations for aquaculture species. He has an Honours Degree in Marine Biology and Fisheries and an MSc in Aquaculture from the University of Algarve in Portugal, where he was also an associate researcher with the Crustacean Research Group. He obtained his PhD in Animal Nutrition from the University of Guelph, Canada. His extensive involvement and experience in aquaculture and research will be a strong asset for Biomin's successful development in the aquaculture industry. Email: pedro.encarnacao@biomin.net

Aquaculture advances at Alltech's 22nd Symposium

This 22nd International Feed Industry Symposium to be held on April 23-26, 2006 in Lexington, Kentucky will explore the key issues affecting the aquaculture industry. It will look at current and emerging markets, fish health, innovations in aquaculture and species development.

Topics and speakers will include:

- Vaccines and immunity - Craig Browdy, Waddell Mariculture Centre, USA.
- Oceanic Institute goals and structure - Warren Dominy, Oceanic Institute, USA.
- Nutrigenomics/aquanomics - Ewen McLean, Virginia Tech Aquaculture Centre, USA.
- Protein sources/enzymes - Trond Storebakken, Agricultural University of Norway.

Other speakers will be David Faulkner and Dan Fegan of Alltech, USA; Patricio Bustos, ADL Diagnostic, Chile; Steve Craig of Virginia Tech University, USA; John Sweetman, Ecomarine Ltd.,Greece and Phillip Thomas of the Scottish Food Advisory Committee, Scotland.

"Research in aquaculture has grown significantly in the past several years and we are excited to host an event in which we explore the most recent innovations."said Dan Fegan, Regional Technical Manager, Alltech Thailand.

"The most successful businesses in the future will be the ones adapting quickly to innovative technologies in order to maintain a competitive advantage. We are delighted to welcome speakers and attendees from around the world to learn more about some of these technologies" said Dr. Pearse Lyons, president of Alltech.

More information: Contact your Alltech representative or visit www.alltech.com/symposium

Complete solutions for PCR

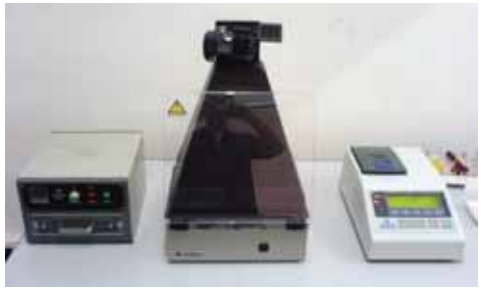
PCR (Polymerase Chain Reaction) is a molecular technique where small copies of unique genetic fragments can be selectively amplified into high copies for detection. It is therefore, a rapid, sensitive, specific and reliable detection tool. The normal constraint with PCR is the high set-up cost and requirement for trained personnel.

To address the above, Malaysian company, LIR Biotech, has established an economical and functional PCR package for routine laboratory work. In 2005, they have established an in-house PCR lab for testing, R&D and training. Next will be a 'mobile PCR lab' concept for field applications.

"In commercial shrimp and fish aquaculture, PCR is now indispensable for aquatic health monitoring, surveillance and management of viral/bacterial pathogens. These have direct impact on production performance at all levels i.e. broodstock selection, hatchery and grow-out. Monitoring is also essential during quarantine and for import/export permit applications. PCR is gaining acceptance for detection of food-borne pathogens in sea-food products/processing within a HACCP environment", said Robin Liew, Business Development Manager.

LIR Biotech is a regional niche player and leader in providing complete solutions for PCR aquaculture application. They have completed turnkey projects and provided hands-on training for customers in Malaysia, Brunei and Indonesia. The company offers services in PCR and micro array detection kits for the detection of bacteria and viruses in shrimp and fish (WSSV, TSV, YHV/GAV, MBV, IHHNV, HPV, IMNV and NHP in shrimp and KHV, VNN and IridoVirus in fish), viruses found in seafood (Hepatitis A, NLV) and the 10 types of bacterial pathogens in food. It also conducts seminars and hands on training on PCR applications, consultancy and turnkey projects for PCR and testing services for specific clients.

More information: Email: info@mylabind.com; website: www.mylabind.com



Equipment for PCR testing

AQUA2006

Congress Center, Fortezza da Basso, Firenze-Florence, Italy, May 9-13, 2006

This is the annual World Aquaculture Society (WAS) Conference and Trade show. This year it will be held together with Aquaculture Europe 2006, the annual meeting of the European Aquaculture Society (EAS). At press time, organisers said that more than 125 booths with exhibitors from more than 25 countries are confirmed. A preview of selected exhibitors is given below.

Trade show schedule: Wednesday May 10th to Friday May 12th: 10:30-18:30
Conference schedule: Tuesday May 9th to Saturday May 13th: 9:30-18:30

More information click on the AQUA2006 logo on **www.was.org.**

More information on the Trade show, contact: Mario Stael - European Exhibit sales manager, Tel/fax: +32-9-2334912. email: mario.stael@scarlet.be
www.was.org

Highlights

Plenary speakers at the Conference

Dr Dietmar K. Flock-"Survival strategies in the Global Food Market: Can we learn from experiences in the poultry industry?" Dr. Yngvar Olsen-"Nutrient loading from cage fish farming and its impact on pelagic ecosystems"

Industry/Producers Day on Friday May 13th will be chaired by Dr Reid Hole. The following topics will be discussed: Sustainability in fishmeal production for aquaculture, Aquaculture and the media, Potential investment in the Middle East, Production of new non-native species to service quality niche markets, Changing roles of agents in the marketing chain and the potential impact to the aquaculture sector and Issues that affect producers outside the EU who wish to export to the EU.

AQUA 2006 Conference

Sessions include shrimp/fish breeding and genetics, offshore production systems, shrimp/finfish nutrition, fish hatchery and juveniles, aquaculture engineering, fish live feeds and larval nutrition, cobia, probiotics, fish meal and fish oil replacements.

Feed additives and pond management

Alltech Inc
P.O Box 1856, Bowral, NSW Australia, 2576
Tel: + 612 48624077
Fax: + 612 48624088
Web: www.alltech.com/aquaculture
Email: aquaculturesolutions@alltech.com
BOOTH: 110-112-114
Contact: Ms. Cindy Hart

Alltech Inc, one of the fastest-growing feed ingredient suppliers in the world offers a range of internationally researched products including yeast cultures and extracts, enzymes, organic minerals, biologically active proteins, flavours and direct-fed microbials. For more than 25 years, Alltech's core competency has been yeast and natural enzyme technology, and the company has applied those years of experience in innovative technologies to provide a range of natural solutions to the aqua feed sector.

Consumers demand safe, nutritious and affordable aquaculture products, better animal health, the use of new and better raw materials and responsible production practices, which have lead to the adoption of many new initiatives to promote the healthy and safe production of aquaculture products. To meet these new initiatives, improvements in the nutritional quality and the cost-effectiveness of aquaculture feeds are key. With its focus on the ACE principle - producing products that care for the animal, are safe for the Consumer, and beneficial for the Environment - Alltech and its products are an important part of effective, efficient and safe aquaculture production.

GePro Gefluegel Protein
Im Moore 1, 49356 Diepholz, Germany;
Web: www.ge-pro.de
Email: info@ge-pro.de
BOOTH NO: 716
Contacts: Ashish Kulshrestha
Level 8, Zuellig House, 1 Silom Road, 10500
Bangkok, Thailand. Tel: +66-2-231 80 00 Email:geproasia@yahoo.co.uk
Dr. Franz-Peter Rebafka
Email: franz-peter.rebafka@ge-pro.de
Tel: +49 54 41 59 25 14

GePro Poultry Protein Company is part of the PHW group, Germany. For more than 40 years, the company produces high-quality poultry protein and poultry fat products with balanced ingredients. The products are distributed in the EU, USA, South America, Asia, Mid East and South Africa.

GePro has taken a strong position in the aquaculture business and will introduce its 100% poultry based, 100% BSE-free and 100% aqua biosecure products at the show. Aquatrac® specialities for fishfeed have various functions, such as attractants, binders and soluble, high-value proteins. Several trials in various regions of Asia have shown an outstanding performance of Aquatrac® in fish and crustacean species. The final products offer both an excellent amino acid and fatty acid profile, both important for animal nutrition.

New products: Through the new fat raffination process based on physical means (vacuum), GePro can now supply poultry fat, with a low FFA (Free Fatty Acid) level of < 1%. Under "PetCom" customer specific blends will be co-manufactured. These blends can range form a simple mixture of two or more raw materials to a complex and complete dry mix which is ready for extrusion. The mixing accuracy is 1 part in 100,000 parts. PetCom is supplying blends with a controlled particle size, ranging from the largest size of 1,250 microns to the smallest of 400 microns.

Daka Proteins
Bragesvej 18
DK-4100 Ringsted, Denmark
Tel: +45 76 74 51 11 Fax: +45 57 68 47 55
Web: Email: daka@daka.dk
BOOTH 737
Contact: Ms. Charlotte Sørensen, Export Manager
Email: cbs@daka.dk

Daka Proteins produces spray-dried porcine blood meal, a superior feed ingredient in modern aqua feed production. Daka porcine blood meal is a healthy and eco-friendly product with a high nutritional value. This product is made purely of blood from healthy pigs at Danish pig slaughterhouses.

Biomin GmbH
Industriestrasse 21
130 Herzongenburg, Austria
Biomin Laboratory Singapore Pte. Ltd.
3791 Jalan Bukit Merah #08-08
E-center@Redhil, Singapore 159471
Web: www.biomin.net Email: aqua@biomin.net
BOOTH: 609
Contact: Pedro Encarnação
Tel: +65 6275 0903
Fax: Fax: +65 6275 4743
Mobile: +65 9159 8079
Email: pedro.encarnacao@biomin.net

Biomin, an international company active in the feed industry is customer oriented with the objective to enhance productivity and unlock the performance potential of livestock animals, the natural way. Biomin develops and produces feed additives and premixes with the latest know-how and state of the art technology. Recently we have expanded our products lines in aquaculture, particularly in South Esia Asia and in Latin America.

Biomin® Aqua-Specials is the new line of line of products for modern sustainable aquaculture. These include premixes, nutraceuticals and probiotics for shrimp hatcheries, pond grow-out and pond water treatment. These products contain single-strain fermented bacteria strains and cell wall fragments for immune support and were field tested in SE Asia.

New Products: Mycofix® Plus3.0 the complete solution with 5 modules to deactivate mycotoxins and general health improvement. BIOMIN® IMBO is a unique combination of ingredients based on natural raw materials that combine the beneficial effect of probiotics, prebiotics and macrophage-activating substances. Recent trials attest to the beneficial effects of this product in shrimp growth and health condition.

Feed Manufacturing

Wenger Manufacturing Inc
714 Main Street
Sabetha, Kansas 66534 U.S.A.
USA: +1 785 284 2133
EUROPE: +32 3 232 7005
Web: www.wenger.com
BOOTH 420
Contact: Doug Baldwin
Email: dbaldwin@wenger.com

Wenger staff will be available to discuss all aspects of efficient extrusion processing of aquatic feeds. Consistent with a long track record of extrusion innovations, Wenger Manufacturing is introducing the MAGNUM ST series of twin screw extruders. This new extruder series has been designed for unique processes that require extreme operating parameters. Production capacities are 50% higher, with more than twice the available power for a given screw diameter. A number of new processing tools have also been developed in conjunction with these extruders, and can be applied as necessary, depending on the desired final product characteristics.

Additionally, our sister company, Extru-Tech, Inc., has recently introduced the E-800 single screw extrusion system. This economical, inline system includes a bin/feeder combination and newly engineered conditioning cylinder specifically designed for aquatic feed production. The E800 is designed for expansion to accommodate higher capacity production rates in the future without loss of the original investment. To meet the evolving demands of the aquatic industry, the E800 Extrusion Cooking System has been designed as an economical means to meet the manufacturing capacity requirements for production of safe, high quality aquaculture feeds for a broad range of species.

Aquaculture equipment and supplies

DSM Dyneema
Mauritslaan 49, Urmond
P.O. Box 1163, 6160 BD Geleen
The Netherlands
Tel. +31 46 4767931
Web: www.dyneema.com
Email: info.dyneema@dsm.com
BOOTH B9
Contact: André van Wageningen
Tel: +31 46 4767973
Email: Andre.Wageningen-van@dsm.com

DSM Dyneema,the inventor and manufacturer of Dyneema®, the world's strongest fiber, will showcase the benefits of this innovative and ultra-reliable polyethylene fiber in net applications for aquaculture. Dyneema® fibers can resist predatory attacks and biting from both the outside of a net and abrasion from the inside caused by fish. They also feature outstanding resistance against wear and tear, as well as UV light, but they are also much lighter than traditional materials. It provides less tension on the mooring systems, better net shape stability and improved water flow through the cages. Nets and cages made with this yarn deliver significant economic and handling benefits saving maintenance time and cost and provide a less stressful and healthier environment for fish. This attractive solution is not only intended for existing applications but also future netting developments, larger cages as well as farming in exposed or off shore locations.

YSI Inc
1700/1725 Brannum Ln, Yellow Springs, OH 45387 USA
Web: www.ysi.com/environmental; www.ysi-china.com
Email: environmental@ysi.com
BOOTH 626-628
Contact: Patrick Higgins
Tel: +1 937 767 7241x521
Email: phiggins@ysi.com

YSI is an employee-owned company that designs and manufactures sensor technology, instrumentation, and real-time environmental monitoring systems for the global ecosystems market. Our instruments help customers meet critical water testing requirements and maintain healthy aquatic environments. Products for aquaculture include continuous monitoring and control systems (YSI 5200) as well as handheld multiparameters sampling instruments (YSI 550A & YSI 556). Parameters include conductivity, chlorophyll, dissolved oxygen, pH, ORP, salinity, chloride, turbidity, TDG, flow, temperature, level and more.

New products: YSI has launched two new product lines to reach different customers. The first is a Professional Series family of handheld instruments with extreme versatility. These eight products were designed based on customer feedback and have many additional features than current YSI handhelds. The second line is called EcoSense. This is an economical family of compact, easy-to-use water sampling instruments – pen-style and handhelds.

Sino-Aqua Corporation
22f-2, No.110, Santuo 4th road, Ling-Ya District, Kaohsiung 802, Taiwan
Web: www.sino-aqua.com
Email: sales_dept@sino-aqua.com
BOOTH 623
Contact: Jerry Hsu, Assistant Manager
Email: jerryhsu@sino-aqua.com

Sino-Aqua Corp is a prominent manufacturer of equipment for the aquaculture business in Taiwan for more than 19 years. It has an established R&D department. Exports are to major aquaculture countries-USA, Central and South America, Indonesia, Thailand, India, Philippines, Malaysia, Australia/Oceania and Europe. The product list includes equipment & machinery for the grow out of fish and shrimp such as paddlewheel aerator, air-injector, automatic feeder, aspirator aerator, biochem aerator, splash aerator and HDPE shrimp/fish pond liners. It has supplies for the hatchery industry such as seedstock, hatchery supplies and equipment. Other products are roots/ring blower pump, whole plant equipment, sea cage accessories, feeds and raw materials.

New Products: 'AquaRev' is the world's first aerator supplying oxygen directly from the bottom of the pond.

Hatchery

Kona Bay Marine Resources, Inc.
3465 Waialae Avenue, Suite 240
Honolulu, Hawaii 96825 USA
Web: www.konabaymarine.com
Email: info@konabaymarine.com
Booth No. 631
Contact: Brian Goldstein
Tel: +1808 732 1500
Fax: +1808 356 0203

Kona Bay Marine Resources is a marine biotechnology company with advanced technology in the production of SPF (Specific Pathogen Free) shrimp broodstock and bivalve seed. Kona Bay supplies the global aquaculture industry with high quality, certified disease free products. , which are produced in a proprietary, state-of-the-art, bio-secure facility, which is located at NELHA (Natural Energy Laboratory of Hawaii Authority), Kona, Hawaii. The location and our technology allow us to deliver SPF and SPR-Taura™ *L. vannamei* broodstock and juvenile clam seed (*Tapes philippinarum* and *Mercenaria mercenaria*) year round.

Aquaculture systems

AquaBioTech Group
KBIC Facility,
Kordin Industrial Estate, Kordin PLA 08
MALTA G.C.
Tel: +356 2398 014-3
Fax:+356 2167 6649
Web: www.aquabt.com
Email: info@acquabt.com
BOOTH 627

The AquaBioTech Group is an international aquaculture and fisheries consultancy firm based in Malta with experiences across Europe, the Mediterranean and Middle East. It is rapidly expanding its client base globally to over 30 countries. It comprises ABT Aquaculture, ABT Innovia, ABT Environmental and ABT Arabia and provides design and support services, as well product sourcing for marine and land-based aquaculture, including cages, hatcheries, recirculation systems. It has also received a number of large designs, construction and management contracts ranging from fish and shrimp hatcheries to an entire shrimp farm and a fisheries processing facility. The team of consultants total more than 25, all specialists in their relevant fields of work and are recruited from over 10 countries.

New Products and services: The AquaBioTech Group has spent the last three years perfecting its new highly compact and cost effective recirculation system for freshwater and marine species. In 2003, it entered into a development and testing programme for marine larval rearing with a recirculation system that required only 2%/day water exchange. The system is now being offered commercially. The group also undertakes research and feasibility studies into the development of an SPF shrimp hatchery, a feed mill, various cage farm developments and more unusual projects such as microalgae farming.

Health and Diagnostics

Aquatic Diagnostics Ltd
Institute of Aquaculture, University of Stirling
Stirling FK9 4LA, Scotland, UK
Tel: +44 1786 467910
Fax: +44 1786 472133
Web: www.aquaticdiagnostics.com
Email: aquaticdiagnostics@stir.ac.uk
BOOTH 216
Contact: Prof Alexandra Adams (Chief Executive Director)
Dr Kim D Thompson (Technical Director)

Aquatic Diagnostics Ltd is a Scottish based company which develops cutting edge technology designed to fill the gap in immunodiagnostics for aquaculture. The products assist in the management of a diverse range of diseases in fish from fresh water and marine environments, including carp, catfish, cobia, cod, grouper, giant gourami, halibut, salmon, sea bass, sea bream, sturgeon, snakehead, tilapia, tuna, turbot and trout. Aquatic Diagnostics provides the tools necessary for the rapid detection of a wide range of pathogens responsible for disease outbreaks, such as Koi herpes virus (KHV) nodavirus in fish and white spot virus in shrimp. In addition, the company markets antibody reagents that can be used in vaccine development for over 20 fish species, including new species such as cobia and cod. These products are invaluable in screening for viruses in broodstock.

New products: An exciting new range of RAPID kits has just been launched that will compliment the reagents already available. Such sensitive, user-friendly kits will be of great assistance to fish health specialists in identifying pathogens in the field as well as the laboratory.

2nd International Symposium on Cage Aquaculture in Asia

This symposium will be held in Hangzhou, China to discuss the recent advances, potentials, challenges and problems of cage aquaculture in Asia. The organizers have announced that there will be two keynote presenters at the opening address. Dr Meryl J Williams from ACIAR will present "Who will supply world demands for fish". Prof. Xu Junzhou and Dr Liu Jiashou, Zhejiang Fisheries Institute of China will discuss "How to meet the future demand of fisheries products in China".

Dr Meryl Williams

Prof Xu Junzhou

There will also be a joint CAA2 and FAO session which will be the first comprehensive review of cage aquaculture in the world. This and the keynote address together with the group of high-power keynote speakers invited to CAA2 will make the symposium a must attend event for all serious scientists, R&D organizations, businesses and farmers involved in cage culture. The deadline for early bird registration is 31 March 2006.

Scientific sessions will cover

- Recent advances and innovations in cage culture technologies
- Cage design and construction
- Marine/freshwater cage culture
- Nutrition, feed, feeding technologies and management
- Chemicals/drug use and food safety
- Disease prevention and health management
- Sustainable management and development
- Policy and regulation
- Economics and marketing
- Constraints to cage culture development

The deadline for abstract submission is 31 March 2006

FAO Session on review of the global cage aquaculture

In this special session there will be 8 major reviews covering all current cage aquaculture activities around the globe. Dr A.G.J. Tacon, University of Hawaii, System Aquaculture Coordinator, USA will give a global overview of cage culture and the others will provide reviews of selected regions.

- Asia Pacificby Dr M.J.Phillips, NACA, Thailand and Prof S. De Silva, Australia
- China by Jia Xin Chen, Yellow Sea Fisheries Research Institute, China
- Latin America and the Caribbean by Dr Alejandro Rojas, Chile
- Northern America by Dr Michael P. Masser, Texas A&M, USA
- Northern Europe by Dr Jon Arne Grøttum, Norway
- Oceania by Dr Michael Rimmer, Australia
- Sub-Saharan Africa by Patrick Blow, Lake Harvest Group, Zimbabwe
- Mediterranean by Dr Francesco Cardia, Italy

29-30 March
Mahseer 2006
Kuala Lumpur, Malaysia
Contact: Malaysian Fisheries Society
Tel: +603 8946 8288
Fax: +603 8948 8246
Email: myfisoc@time.net.my
Web: www.vet.upm.edu.my/~mfs

23-26 April
Alltech's 22nd International Feed Industry Symposium
Lexington, USA
Web: www.alltech.com/symposium
(Attendance is by invitation)

9-13 May
World Aquaculture 2006
Florence, Italy
Tel: +1 760 432 4275
Email: worldaqua@aol.com
Web: www.was.org
(Show preview pages 40–42)

14-16 June
Vietfish 2005
Ho Chi Minh City, Vietnam
Contact: Vo Thai Phong
Tel: + 84 8 511 0930/511 0932
Fax: +84 8 511 0931
Email: vasep-org@hcm.vnn.vn
Web: www.vietfish.com.vn

21-23 June
5th National Shrimp Congress
Bacolod City, Philippines
Contact: Dr. Juan D. Albaladejo; Maria Abegail Apostol-Albaladejo
Telefax:+63 2 372 5055.
Email: jalbaladejo@bfar.da.gov.ph; jalbaladejo99@yahoo.com; mariaabegail11@yahoo.com
Web: www.bfar.da.gov.ph

21-23 June
Shanghai International Fisheries and Seafood Exposition 2006
Shanghai, China
Contact: Kim Yang
Tel: +86 21 3414 0855/ +86 21 64512629 Ext 8004
Fax: +86 21 6451 6467
Email: chinaseafoodexpo@sina.com
Web: www.sifse.com
(see page 39)

3-8 July
The Second International Symposium on Cage Culture in Asia
Hangzhou, Zhejiang Province, China
Tel/Fax: +68 571 86971960
Email: CAA2@zju.edu.cn
Web: www.caa2.org
(see page 43)

24- 29 July
Shrimp Health Management Training Workshop
Bangkok, Thailand
Email: shrimp-school@alltech.com

27-30 August
Australasian Aquaculture 2006
Adelaide, South Australia
Contact: Claudia Metti
Tel: +61 8 8226 2269
Fax: +618 8226 0330
Email: metti.claudia@saugov.sa.gov.au
Web: www.australian-aquaculturereportal.com

24-29 September
13th Annual - Aquaculture Feed Extrusion, Nutrition, & Feed Management
Aquaculture Feed Extrusion, Nutrition and Feed Management
Texas A&M University, USA
Contact: Dr Mian Riaz
Tel: +1 979 845 2774 Fax: 979 458 0019
Email: mnriaz@tamu.edu
Web: www.tamu.edu/extrusion

2006

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

Australasian Aquaculture 2006

InnovationinAquaculture

Australasian Aquaculture will be one of the largest aquaculture events in 2006 and will take place in South Australia from 27 to 30 August 2006. The National Aquaculture Council of Australia (NAC) in partnership with the World Aquaculture Society's Asia-Pacific Chapter (WAS-APC) and the South Australian Aquaculture Council (SAAC) will host the event. It is supported by Primary Industries and Resources, South Australia (PIRSA) and the FRDC.

In their press release, organisers said that the conference and trade show will bring together over 1,000 local and international delegates to share knowledge and showcase aquaculture's best innovations. Some exciting developments in the Asian-pacific region will be presented.

Participants will also have the chance to meet with Australia's inventing celebrities Gavin Partridge and Ian McRobert – the masterminds behind a unique system originally designed to revolutionise production of fish in salt-water affected areas. Another innovation is the 'Semi Intensive Flotation Tanks System' or SIFTS which has great potential for use throughout the world.

"This kind of development will make aquaculture more accessible to everyone," said Bruce Zippel, industry icon and Chair of the organising committee. "The SIFTS technology has already proven its benefit to the environment. It also makes it possible for traditional land-based farmers to broaden their horizons beyond current practices."

A major attraction for the event will be the trade show. Over 160 trade booths are planned. Almost 25% have already been sold. More information: Claudia Metti Tel: +61 8 8226 2269; Fax: +61 8 8226; Email: metti.claudia@saugov.sa.gov.au; Web: www.australian-aquaculturereportal.com

Linking Tradition & Technology

AQUA 2006

Highest Quality For The Consumer

MAY 9-13, 2006

FORTEZZA DA BASSO CONVENTION CENTRE
FIRENZE (FLORENCE), ITALY
INTERNATIONAL CONFERENCE & EXHIBITION

Including:

AQUACULTURE EUROPE 2006

The Annual Meeting of the European Aquaculture Society

WORLD AQUACULTURE 2006

The Annual Meeting of the World Aquaculture Society

Conference Chairman: Patrick Sorgeloos (Belgium)
Steering Committe: Johan Verreth (Netherlands), Marco Saroglia (Italy), Yngvar Olsen (Norway), Joe Tomasso (USA), Mario Stael (Belgium)

Programme Chairs: Gavin Burnell (Ireland), Geoff Allan (Australia)
Programme Committee: Wagner Valenti (Brazil), Michael Schwarz (USA), Denis Lacroix (France), Marco Saroglia (Italy), François René (France)

Local Organizing Comittee: Marco Saroglia, Biancamaria Poli, Mario Tredici, Mario Falciai, Silvano Focardi, Pierantonio Salvador, Agostino Barbi, Marco Gilmozzi

Tentative List of Sponsors:

University of Florence
University of Siena
Chambre of Commerce Toscana
Federation for European Aquaculture Producers (FEAP)
Network of Aquaculture Centers in Central-Eastern Europe (NACEE)
Russian Federal Center of Fish Genetics and Selection
Provincia di Firenze
University of Insubria
University of Pisa
AquaTT
Il Pesce
Regione Toscana (ARSIA)
Many Other Government and Commercial Sponsors To Be Confirmed

Hosted By: Italian Fish Farmers Association (API)

For More Information Contact:

Mario Stael – For Exhibits
Begijnengracht 40
9000 Gent Belgium
Tel/Fax: +32-9-2334912
mario.stael@scarlet.be
www.was.org

Conference Manager EAS
Slijkensesteenweg 4
B-8400 Oostende, Belgium
Tel: +32 59 32 38 59
Fax: +32 59 32 10 05
ae2006@aquaculture.cc
www.easonline.org

Conference Manager USA
2423 Fallbrook Place
Escondido, CA 92027 USA
Tel: +1-760-432-4270
Fax: +1-760-432-4275
worldaqua@aol.com
www.was.org

Gold Sponsor

SKRETTING

統一(越南)有限公司
UNI-PRESIDENT VIETNAM CO., LTD.

Tel: (84-650) 790811 ~ 6
Fax: (84-650) 790819
Email: aquafeed@upvn.net

cost effective prawn feed

Your Reliable Partner In Aquaculture

AQUA Culture AsiaPacific

Be updated on developments in the fast expanding aquaculture industry in Asia Pacific with industry trends, technical information and features, company and product news and show reports.

Do not miss an issue... Subscribe NOW

A one year subscription of six issues (airmail delivery) costs:

❒ Asia (excl. Japan and Korea) – SGD 70

❒ Japan/Korea and Rest of World – SGD 100

(one SGD =0.625 USD)

How to subscribe:
For online subscription go to www.aquaasiapac.com

OR Complete the form below and fax/mail to **Aqua Research Pte Ltd**
3 Pickering Street, #02-36 Nankin Row, China Square Central, Singapore 048660. Fax +65 6223 7314

Name: _____

Company /Association: _____

Position: _____

Mailing Address: _____

_____ City: _____ Country: _____ Postal Code: _____

Tel: _____ Fax: _____

Email: _____ Website: _____

Payment by credit card *(Note: your card will be charged in Singapore dollars)*

❒ Visa ❒ Mastercard

Credit Card No: _____ V Code No : _____ *(three digits after card number at back of card)*

Name of cardholder: _____

Expiry date: _____ Signature: _____

Billing Address (if different from mailing address) _____

Telegraphic Transfer: Email/Fax for details

Payment by cheque
We accept only cheques/drafts in Singapore dollars drawn on a Singapore bank.
Make cheques payable to **Aqua Research Pte Ltd**

❒ Please send me a receipt.