

AQUA Culture

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Health Management

Preventing toxic pond conditions

**Fish vaccination in improving
production efficiency**

**Monodon Slow Growth
Syndrome in Thailand**

**Extrusion of
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From the editor

WRITE TO THE EDITOR

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

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Letters may be edited prior to publication

The limits of aquaculture

The US National Oceanic and Atmospheric Administration released a draft proposal this week for legislation that would open extensive new territory to fish farming. This proposal acknowledges the promise and the sobering limitations of aquaculture. The Commerce Department hopes to quintuple the amount of fish farming in the next 20 years, yet it has barely begun to come to terms with the health and environmental problems caused by the “fish farms already operating”. It seems all too likely that the temptation to expand fish farming swiftly will overwhelm the need to create rigorous environmental guidelines.

It's worth remembering, too, what the backdrop to this proposal really is: The collapse of wild fish stocks in the world's oceans, the decay of the fishing industry and, ultimately, an inability to regulate commercial fishing in a way that protects oceans' health and sustainability. Fish farming may look like a way to increase the global food supply, but it pales next to the catastrophic decline in wild fish stocks caused by overfishing.

As fish farms are run now, in fact, they themselves pose a threat to wild fish. Farmed fish frequently escape into the wild, creating a kind of genetic pollution, and carnivorous species like farmed salmon are fed protein from wild fish, a practice that does nothing to reduce our dependence on the overfished ocean. Any kind of farming that leads to a close concentration of animals – on the land or in the sea – also creates a source of pollution and a nexus for disease.

The only responsible way to expand fish farming is to establish a stringent environmental framework that takes the health of the wild ocean as seriously as the economic potential of the domesticated ocean. The success of the one must not be premised on the collapse of the other.

IHT-International Herald Tribune, 11-12 June 2005

My Say – the future of aquaculture is up to us

Reading the above article published in the IHT was certainly a wake up call for me, although one might say but we are far away in Asia. The circumstances remain the same.

Being trained as an aquaculturist (University of Stirling, 1982), I was always under the impression we had the mandate to feed the world (and there was nothing wrong with making money while doing it).

‘The limits of aquaculture’ is indeed an accurate snapshot of the industry today and I hold nothing against the author. Imagine the perception of the laymen and the general population of the developed world who represent more than 80% of the industry's high valued salmon and shrimp consumers – to say it is negative would be an understatement. One only has to look back to a BBC report 4 years ago which turned consumers against the salmon industry in Europe.

I would like to add to the above article that the limits of aquaculture is the industry itself. After more than 15 years of research on fishmeal replacement as a protein source, we are no closer to removing it from the feed formulation. The critical path is formulating to amino acid requirement of the species but yet no feed company in Asia I know of is comfortable practicing this today. Imagine the bonus of least cost formulation when we can do this.

The onus of responsible aquaculture falls on the industry itself. Self-regulation, be it in the area of antibiotic usage (and disease control), environmental conservation or even over production should be one of the mission statements of industry groups and associations. If we do not want to be regarded as a ‘fly by night’ industry, we owe it to ourselves not to practice ‘fly by night’ actions.

In AAP's recent issue, I mentioned that we are as weak as our weakest link. The industry associations should act as a professional body to rid the industry of the shenanigans that could destroy the image of the industry. It is critical to adopt the mindset of the fast moving consumer goods (FMCG) industry where negative perception can wipe out decades of brand building and loyalty.

In this issue, we focus on health management. At the seminar on fish vaccination (page 12), the message from FAO's Dr Rohana Subasinghe was clear. Aquaculture in Asia has to be sustainable and control of disease is essential to increase the efficiency of production. In shrimp farming, the same message was presented by Dr Bambang Widigdo at the World Aquaculture conference in Bali (pages 32) on biosecurity in a shrimp farm. The ideal situation will be when *P. vanammei* farmers integrate health management into their intensive culture operations. Once we can take the holistic approach of controlling health, nutrition and culture management, perhaps then we will be able to say that we have arrived.

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Thai shrimp farmers seeks action against falling prices

Thailand's shrimp culture industry has been hit by a 30% slide in prices for white shrimp because of the new custom bond requirements for shrimp exports to the US. The industry is seeking the government's intervention to push up the prices.

Due to the slide in prices in the last two months, white shrimp farmers have delayed stocking ponds. Prices for 100 pcs/kg of *P. vannamei* have declined almost 30% to 75 baht from 105 baht. The latter is almost the current cost of production. As the industry expects this to continue for another six months, it is seeking the help of the government to push up prices and keep the culture industry afloat.

Pinyo Kiatpinyo, President of The Thai White Shrimp Association said, "Surprisingly, this is not the result of an oversupply in the country. At the Talay Thai market, we see half the usual number of trucks bringing in shrimp. Since the US customs requires cash bonds which only a small number can provide, many have indicated that they can no longer absorb the additional costs and have stopped buying shrimp".



Pinyo Kiatpinyo

"Now, it is only a small group of processing plants that are buying and are determining prices. The effect is largely felt by independent farmers whereas those involved in contract farming have price guarantees".

On March 15, US Customs adopted this new bond rule requiring guarantees to be posted for all agriculture or aquaculture products liable to anti-dumping duties. The bonds which are valid for a year, and recalculated on a yearly basis are redeemable only during the third year. This means that processing and export companies would have two to three bonds running concurrently. As few can afford this, many have stopped buying shrimp.

Based on the export values, firms exporting shrimp must put up a bond equal to a total of 2.1 billion baht (USD 52 million). This is based on the volume of exports for the previous year multiplied by the antidumping rate of 5.95%. In 2004, Thailand exported 240,000 tonnes of shrimp worth 36 billion baht (USD 0.9 billion). The US market accounted for half of the export value.

In Thailand, the effect of this is significant as 50% of the shrimp production is channeled to small and medium size packers whereas large companies such as CPF, Thai Union and the Rubicon group process the rest. Over the last four months, Thailand exported 128,000 tonnes of frozen shrimp, a 24% drop from the same period last year, to all markets. Shipments to the US declined 28% to 37,000 tonnes.

Declines in prices for *P. vannamei* shrimp (baht)

Size (nos/kg)	1-15 April	May 16 to 27 May
110	100	70
100	105	75
80	115	85-90
70	125	105

The domino effect of this is that hatchery producers cannot find markets for postlarvae produced. This came at an unfortunate time as many have shifted into full gear into hatchery production of *P. vannamei* postlarvae. Others have converted their hatcheries, previously producing *P. monodon* to that of the vannamei shrimp. The country was set to produce 400,000 tonnes of harvested shrimp in 2005.

Since May, producer associations and clubs have been urging the government to solve this problem. On June 7, shrimp farmers gave the government one month to settle this chronic slump in prices or face a mass protest of industry workers in front of Government House, reports TNA news.

The government has come up with a three prong strategy. The Deputy Commerce Minister, Suriya Lapwisuthisin has asked two state-owned banks and the Thai Banks Association to provide guarantees for exporters to the key US market. The state-owned EXIM Bank, Krung Thai Bank, and the Thai Banks Association would offer export guarantees to ensure the shrimp industry's continued survival. Details would will be worked out by the banks.

Thai Trade Representative, Pravij Ratanapian has been assigned the task of urging the European Union to restore preferential tariff rates to Thai exporters from 1 July. Under the preferential rates, the import duties for shrimp from will be reduced from 12% to 4.2%. This will place Thailand on par with India, Malaysia, Vietnam and Indonesia.

On the domestic front, the government will soon launch a scheme to buy shrimps at guaranteed prices. The producers have also asked the government to expand the domestic market in the northern region of the country. They are also seeking ways to encourage domestic consumption of shrimp.

"Alternatively, at the production level, farmers will be encouraged to practice partial harvesting which will allow them to initially harvest shrimp of 100-110 pcs/kg followed by successive harvests of larger size shrimp. In this way, the farmers will have the working capital to continue the culture. It may also push prices up", said Pinyo.

Thailand to take bond case to WTO

Thailand, claiming unfair treatment, will seek a World Trade Organisation (WTO) ruling on this US requirement, reports the Bangkok Post. Since the exporters who are putting up the funds for the importers are delivering goods after paying the duty, such an additional bond requirement is highly discriminatory and tantamount to a non-tariff barrier, according to the Thai industry. Presently, there are about 40 Thai shrimp exporters to the US market, but only six with local agencies in the US may be able to comply with the bond requirement.

Harvest at Vietnam's largest cobia farm

Nha Trang Pearls Limited (NTPL) has successfully harvested its first batch of the marine fish cobia *Rachycentron canadum* in December 2004. The farm is located in the pristine waters off Bai Lach in the central region of Vietnam. The harvest was processed into various forms of fresh and frozen cobia and fillets. Exports markets were in Japan, US and Taiwan. The outstanding attributes of cobia flesh for sushi and shashimi (raw fish) was displayed at their booth during Vietfish 2005 in Ho Chi Minh City in June.

The company has a total of 25 seacages ranging from 10 to 25 metres in diameter. Cobia grow out is carried out in eight large circular cages, each of 25 metres in diameter. The maximum production capacity is 1,000 tonnes per year. The company has leased five sites covering 900 ha which will enable it to expand production from the current 1,000 tonnes. It has 3 onshore bases.

The company was established in 1993 and construction of the off shore and onshore facilities for the cobia project was started in 2003. Cage technology and conventional HDPE cage materials were imported from Taiwan and locally assembled in Vietnam.

Kevin Chang, general manager said, "We import fingerlings of 9cm from Taiwan. These have been weaned at 7cm onto dry pellets. Fish reach 6-8 kg in 12-14 months. Pelleted feeds are used throughout the culture period. This not only protects the environment but our Japanese customers are pleased with the better taste of the flesh".

In Vietnam, traditional cobia farms in Vietnam use trash fish with a feed conversion ratio (FCR) of 6:1 to 7:1 whereas NTPL reported a FCR of 1.5 to 1.8 for pelleted feeds. Feeds are imported from Taiwan. A major problem in the culture of the cobia is mortality of fingerlings which is related to the source of fingerlings. To overcome this, the company plans to produce fingerlings at its own hatchery later this year.

(More information: NTPL, Tel: +84 58 817 571, Fax: +84 58 824 252, E-mail: tony_ntpl@dong.vnn.vn)



From left: Tony Tseng, NTPL, Kent HP Chen, Fandso International Corp, Taiwan and Kevin Chang in their booth at Vietfish 2005



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Farmer seminar for INTEQC

As part of an ongoing activity to stay in touch with customers, Inteqc invited a group of farmers from the area around Samut Sakorn to a seminar on updates on the culture of *Penaeus vannamei* shrimp. It also included a tour of the plant and laboratory facilities. Customers also saw demonstrations of NIR (Near Infrared Reflectance) and other laboratory analysis of feed and raw materials and the types of raw materials used in feed preparation.

Dr Dhanapong Sangsue, Technical Manager said, "Customers are our most valuable assets. We have invited them here to see how we keep improving our products and services to suit their needs. Inteqc is short for 'IN – innovation, T – Technology, E – Excellency, Q – Quality'. In fact we have customers that continually attend our seminars and plant tour".

At the seminar, Saksahakorn Khongsamut, farm project manager, shared some of his experiences with participants. He said that in *P. vannamei* culture, the possibilities of increasing yields and thus profits, vary with stocking density and feed types. Cost of



Farmers at the Inteqc seminar with Factory Manager Narath Plythirun, (front row, third from left)

production will depend on the density of the feeds used.

Yields of 45-55 pcs/kg can be achieved after 120 days of culture when the stocking density is 100,000 PL/rai (60 PL/m²). At a higher stocking density of 200,000 PL/rai (120 PL/m²), 60-65 pcs/kg shrimp can be harvested if two partial harvest are carried out and at a stocking density of 300,000PL/rai (180 PL/m²), 3-4 partial harvests will be required to harvest 65-70pcs/kg shrimp. Partial harvesting can commence 80 days after stocking and from then on at intervals of 10 days. Shrimp from the first harvest are 120 pcs/kg.

AwF- Aquaculture without Frontiers

At World Aquaculture 2005 in Bali, "Aquaculture without Frontiers" (AwF) called for an evening meeting. AwF was launched at the last World Aquaculture meeting in Hawaii in March 2004 with the aim of assisting in the alleviation of poverty in developing countries through responsible and sustainable small scale aquaculture. For this purpose, money has to be raised from the general public to provided expert volunteers to assist in small scale aquaculture field work in developing countries.

Chairman Michael New, OBE reported on the progress which has been achieved in the last 12 months. The organization has been registered in the UK and US. The tax free status has been obtained and the trustees have been appointed. So far AwF has 69 volunteers.

Mini projects in tsunami shaken Aceh have been started. However, all activities are dependent on funds. The more funds the organization receives, the more projects can be materialized. All work is done by volunteers. Additional details are available from the website: www.aquaculturewithoutfrontiers.org). AwF requires more volunteers and any donation will be highly appreciated. AwF has a useful task and should be supported –not with words but with funds. ~ Joachim Hertrampf.

YSI restores small holder 'tambaks' in Aceh

AwF has reported that over 50,000 people in Aceh Province, Indonesia, depended directly on aquaculture for livelihood. To help Indonesian farmers recover from the long-term effects of the December 26 tsunami, YSI Incorporated has donated over USD 75,000 under its "Fund for rebuilding aquaculture in tsunami-affected areas".



From third on left: Officials from Indonesia's Ministry of Marine Affairs and Fisheries, Kevin Fitzsimmons (WAS, past president) Michael New, Tim Grooms, Geoff Allan (WAS, past president) with delegates at the YSI booth in Bali

Tim Grooms, Water Quality Product Manager for YSI Environmental said, "We felt that the best way to respond was to offer aid in the specific area of aquaculture rather than making donations to a general aid organization. Aquaculture is an important market for YSI and we wanted to give something back to this community."

YSI coordinates with the WAS which administers the funds directly to organisations in Indonesia, such as AwF and the Ujung Batee Regional Brackishwater Aquaculture Development Centre, Ministry of Marine Affairs and Fisheries. These groups are working with farmers in villages in the Pidie District of Aceh on the restoration of tambaks and canals.

YSI raised more than \$25,000 in private donations from its employees, directors, retired employees, and suppliers and in addition to this amount, YSI's non-profit Foundation has donated \$50,000. (www.ysi.com/environmental)

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Bearish sentiments as catfish and shrimp prices fall

The industry in Vietnam attributes declines in prices for catfish and shrimp by 20 and 25%, respectively as an abnormal situation. Processors are not buying because of the new US custom requirements. The current situation is dire as the production season is from June to November.

In March, the US Customs and Border Protection imposed a general bond requirement for products subjected to antidumping duties. In the case of Vietnam, this means the catfish (*tra* and *basa*) and shrimp. The imposition of antidumping duties on *tra* and *basa* began in July 2003 and that for shrimp in July 2004.

This is a double blow for the processing industry. Importers will have to post a general customs bond at the full annual level of projected duties in addition to the antidumping duties (FFI, 2005). On the sidelines of Vietfish 05 in Ho Chi Minh City, Dr Nguyen Huu Dung, Secretary General of Viet Nam Association of Seafood Producers and Exporters (VASEP), said that this means that based on the volumes of exports of last year for Vietnam and multiplied by the antidumping rate, the amount will total USD60 million for three years.

"This is totally new to us. What we have is a situation whereby we now have to pay to enter the US market and pay for the duties for both catfish and shrimp exports. The situation now is that importers want the exporters to post the bond. However, we need to ask the importers to share this", said Dr Nguyen Huu Dung.

"Since Vietnam is not a member of WTO, she does not have a similar route to appeal as Thailand nor of India, which has brought the case to the Court of Trade. VASEP is working with importers on the legality of such requirements, but unfortunately this will take time. In the case of the review on the catfish antidumping, it will only be completed end July".

Prices for the *tra* and *basa* fish have fallen to VND10,000/kg. In An Giang Province, farmers have suffered losses of VND250bil (USD16 million) per 100,000 tonnes of catfish harvested in the first half of the year, reported the Vietnam Economic Times. According to Tran Vu Khanh of QD fish, prices were 13,500 VND/kg two months ago and are continuing to decline.

This is the third time An Giang and greater Mekong River Delta farmers have been affected by price decreases since the US imposed antidumping tariffs on its catfish exports in July 2003. To counter this, Vietnamese processor then looked at other markets. Although the volume of exports of the *tra* and *basa* catfish to the US has decreased, it however, still remains a major market for Vietnam.

Prices for the black tiger shrimp have declined to 80-90,000 VND/kg for 30-40 pcs/kg. In comparison prices were 120,000 VND/kg in 2002. In Ben Tre Province, farm manager Ho Duc Hung said that shrimp are usually harvested in June. However, if prices remain low, they may delay



A wait and see at these ponds in Can Gio District.



Dr Nguyen Huu Dung

harvest until shrimp reach sizes of 10-15 pcs/kg which will fetch 120,000 VND/kg. If the situation continues, culture will continue but he may be forced to reduce the stocking density from the current 30 pcs/m².

Nevertheless, Tran Vu Khanh as well as Phan Hong Hop, a shrimp farmer from the Can Gio district is hopeful that the matter will be settled amicably by Vietnam's Prime Minister during his meeting with the US president.

Feed producers are also concerned over the situation. Usually as prices decline, especially with catfish farming, farmers will revert back to using cheaper farm made feeds. This then introduces doubts on the issue of traceability of products, which many in the industry have been strengthening to gain consumer confidence. An industry source said that as farmers may ask for lower prices for feeds, the government can assist by lowering taxes on feed production.

Freshwater Fisheries Committee established

On 13 June, members of VASEP have set up a Freshwater Fish Committee of Viet Nam (VFFC), reports the Vietnam Economic Times. This committee is responsible for coordinating activities of VASEP members in freshwater fish processing and export. It will also develop a trademark for Viet Nam's freshwater fish products in the world market. It will cooperate with the Viet Nam Management Board of *tra* and *basa* catfish production and sales to strengthen ties between member businesses and fish farmers.

Revision on catfish targets

Following recent developments, the Ministry of Fisheries has decided to revise its targets for catfish farming for the 2005 to 2010 period. Originally the output was set at 1 million tonnes/year. This is being revised to only 500,000 tonnes. However, from the Mekong delta region, the country's main producer of the catfish, *tra* and *basa*, the suggestion is for an output of 600,000-700,000 tonnes/year.

References

FFI, 2005. A giant sucking sound in Boston, Fish Farming International, April 2005. p8.

New premix plant in Taiwan

In May, Taiwan's Nice Garden Industrial Co., Ltd. announced the construction of its new factory in the Tainan Technology Industrial Park. This was planned and set up with the assistance of DSM Nutritional Products. Production specifications are in accordance to the requirements of the latter. Under this strategic alliance with DSM, Nice Garden becomes now a DSM authorized manufacturer and DSM will then stop its own production of feed premixes in Taiwan.

DSM Nutritional Products will provide recipes, production processes and the technical know how necessary for the manufacture of DSM's Rovimix® feed premixes as well as technical support for the formulation and manufacturing of Nice Garden's future macro premixes.

The new feed premix plant will have 3 production lines with a total capacity of 5,000 tonnes per annum. It will be HACCP and ISO 9000 accredited. It will provide customers in Taiwan and surrounding markets with the traceability and quality systems required for the international market with increased focus on food safety. The new plant will commence operation by end December 2005.

Nice Garden was established in 1984 to focus on nutrition and health products for the aquaculture and livestock industries. Recently in aquaculture they have expanded into biotechnological aspects including test kits and larval feeds for fish and shrimp. The company also represents Trace Tracker, the Norwegian company supplying a global traceability network.



Artist impression of the new factory for Nice Garden

Restructuring of PT Dipasena Citra Darmaja

The Indonesia agency in charge of the restructuring of the world's largest shrimp farm PT Dipasena Citra Darmaja, said that the exercise will be completed in August 2005, reports Kompas. The amount to revitalise the farm is estimated at Rp 1.2 trillion (USD120 million). The government is handling the assets of the farm after the Gajah Tunggal Group surrendered them in 2002. The farm had debts of Rp 357.2 billion (USD 36 million) in 2003.

The restructuring is in its due diligence stage with 28 creditors eligible. Among the 18 foreign creditors are companies from Japan and USA. There are 10 local creditors, among which is Centralpertiwi Bahari. The government is in favour of companies already involved in the shrimp business.

PT Dipasena Citra Darmaja was granted its first concession to develop 16,250 ha of previously uninhabited tidal swampland in Lampung Province, South Sumatra in 1987 which the company converted into an integrated aquaculture facility with 18,064 ponds (totaling 3,613 ha). It has processing and cold storage facilities, set up in 1990. It acquired the shrimp feed mill of PT Bestari Indoprima in 1996. It had 11,000 farmers in its plasma farming scheme.

China increased aquaculture production in Q1 2005

China's marine aquaculture production increased by 5.84% in the first quarter of 2005 (Q1) compared to the first quarter in 2004. In a special report in efeedlink.com, figures from the Aquaculture Association also indicated that freshwater aquaculture production increased 5.3% during the same period. Prices of

freshwater fish rose 15.9% whereas that for marine crustacean products increased marginally at 2.7%. Prices for freshwater crustaceans were lower by 28%. Exports of eels to Japan decreased because of low prices in Japan. Exports of whole shrimp to the US declined by 60% but value added shrimp exports increased by 24%. (www.efeedlink.com)

India turns to the EU

US policies have directed Indian exporters to the EU. For the 2004 to 2005 period, exports of marine products, comprising 63% frozen shrimp, increased 18% to the EU making it the largest importer for India. The share of the EU increased to 27% out of the total export value against 24% in the preceding year, said K Hari Babu, former vice-chairman, Marina Products Export Development Authority (MPEDA) in the *Business Standard*. Exports to US and Japan, decreased by 8%.

Urge to increase tilapia output

The Philippines Department of Agriculture is encouraging the culture of tilapia in Mindanao as the demand for tilapia in the United States, Asian and European markets increases, reports the SunStar. Philippines, along with Indonesia, is among the lowest cost producers of tilapia, at USD0.80 compared to Taiwan at USD 1.05. It said that the potential areas for production in the island are in Central Mindanao, Northern Mindanao, Autonomous Region in Muslim Mindanao and Davao region. However, along with expansion, processing plants for value-added tilapia products such as white fish fillet are needed.

East Malaysian company stirs interests

A Sabah based company attributes its success in the high value marine fish industry to its logistic advantage over its competitors. Several breakthroughs in breeding are the result of extensive R&D on behavioural patterns and artificial spawning techniques. Reports Khoo Eng Wah

Plentiful Harvest Sdn Bhd was incorporated in 2001 as a wholly owned subsidiary of Borneo Aqua Harvest. Its main business is the breeding and culture of high value species at its hatchery located in Sandakan at Mile 7 and in 208 cages for fish culture and broodstock rearing off Pulau Berhala. As a marine biotechnology company, Borneo Aqua Harvest is set to list on the Mesdaq market of the Malaysian Stock Exchange later this year.



Cages at Pulau Berhala

In their press release, the company said it has mastered artificial spawning techniques and applied them for the successful commercial production of marble grouper *Epinephelus fuscoguttatus*, red snapper *Lutianus argentimaculatus* and as well as coral trout *E. leopardus*. This is a first for Malaysia. Next in line are the giant grouper *E. lanceolatus* and the barred cheek coral grouper *Plectropomus maculatus*.

In addition, the company has more than 20 species of brood stock at its rearing centre and some of these stocks are near production stages. Due to its location, it has the advantage of the rich marine life in Sabah's coastal waters, which makes it easier to obtain wild brood stock of various species

Datuk Lo Fui Ming, CEO of Borneo Aqua Harvest said, "This success has attracted investors from Australia, Japan & Korea. The most recent team was led by Dr David Whyte from Skretting, Australia, part of Nutreco's fish feed division. The group was impressed with its location citing suitable environmental, climate, temperature, geography and that it was in the least risk area among the many other countries visited".

"We use artificial feed for fry as we would like to be the top supplier of healthy and good quality fingerlings of these three species to the local fish culture industry as well as for export markets. Our main market for harvested fish is Hong Kong and our next target will be Korea. The market for fry and fingerlings are local fish farmers".

In 2005, the company reported a profit after tax of RM3.3 million (USD 0.86 million), according to the Star. Lo expects that the sales of fry and adult fish for the financial year 2006 will increase. Currently, marble grouper fingerlings of 6-7 cm are sold at RM3.50 per fish (USD

0.92). Coral trout fingerlings are priced at RM8.00 to RM10.00 per fish (USD 2.10-2.6). Fish sold to the Hong Kong market is relatively stable at RM40.00 to RM45.00/kg (USD 10.5-11.8) for marble grouper and RM80.00 to RM120.00 per kg (USD 21-31.5) for coral trout. The profits margins are high at these prices.

Lo is confident that the culture of high value marine fish will expand in Malaysia.

This is because of tax incentives provided by the Government. These are for a period of up to ten years commencing from the year in which a company has made a profit. Such incentives augur well for the Borneo Aqua Group as in addition to it being eligible for the exemption, it will encourage more fish farming in Malaysia. There will also be greater demand for its products.

Another advantage is the low production cost in Sandakan, as compared to its competitors in other countries such as Taiwan. In particular, the costs of land and labour. Trash fish are not only easily available but cost less. This gives the company more flexibility in the pricing of its products.

In Sandakan, the breeding is all year round. This advantage not only increases the volume of the production of eggs but also provides flexibility for optimizing the usage of available ponds.

Lo said, "Borneo Aqua Harvest is committed to further improve and develop the marine aquaculture industry in Malaysia by creating opportunities within the aquaculture industry. We can develop activities such as marine fish feed production and processing of value-added fish products such as fish fillet for export markets".

Khoo Eng Wah is the Chairman STAC, a practical-based training school in aquaculture. Material for this article was also provided by an alumnus of the training course on marine cage farming.



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The Intervet logo features the word "intervet" in a lowercase, sans-serif font. A green swoosh underline is positioned beneath the letters "i", "n", and "v".

Intervet seminar on fish vaccination at World Aquaculture 2005

To mark the launch of its first vaccine against *Streptococcus iniae* infections in farmed warm water fish in Asia, a technical seminar on fish vaccination in the Asia Pacific region was held on May 11. Presentations covered issues from challenges in ensuring the sustainability of Asian aquaculture to the role of vaccination in aquatic disease management in the region.

Fish vaccination as a key element in managing diseases for sustainable aquaculture

The seminar was organised by Intervet's Aquatic Animal Health (AAH) R&D centre in Singapore and Intervet Indonesia. It was chaired by Dr Zilong Tan, Manager, Veterinary Services, Intervet Norbio, Singapore. There were over 70 participants from 12 countries, representing fish farmers, governmental and inter-governmental agencies, research institutes, universities and fish health practitioners. It also coincided with the introduction of the first fish vaccine, Norvax® Strep Si, in Indonesia.

In his opening address, Dr M Fatuchri Sukadi from the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries (DGA-MMAF), said, "Finally we have a solution to combat diseases in the Asian seabass industry and this may be a starting moment for the application of fish vaccination in Indonesia. In 2002, the aquaculture industry in Indonesia lost USD 15 million to fish diseases, particularly to the Koi Herpes Virus (KHV). Up to now, we are still working hard to fight this disease and save the industry".

The registration of the vaccine is also expected in Singapore by year end. As the *Streptococcus* pathogen (Table 1) affects many marine and freshwater fish species throughout the region, the company expects that registration of the vaccine in other countries to be completed over the next few years.

Table 1: Incidence of *Streptococcus iniae* infections in fish in the Asia-Pacific region

Fish species	Pathogen found in
Asian sea bass (Barramundi)	Australia, China, Indonesia, Malaysia, Singapore, Thailand
<i>Lates calcarifer</i>	Malaysia
Four-finger threadfin <i>Eleutheronema tetradactylum</i>	Malaysia
Grouper <i>Epinephelus</i> spp.	China, Malaysia
Japanese flounder <i>Paralichthys olivaceus</i>	Japan, Korea
Pompano <i>Trachinotus</i> spp.	China, Malaysia
Seabream <i>Plectorhynchus</i> spp., <i>Rhabdosargus</i> spp., <i>Sparus</i> spp.	China
Snapper <i>Lutjanus</i> spp.	China, Malaysia
Tilapia <i>Oreochromis</i> spp.	China, Indonesia, Philippines
Yellow croaker <i>Pseudosciaena macrocephalus</i>	China



Dr. Rohana Subasinghe, FAO

Dr Rohana Subasinghe of the Food and Agriculture Organisation (FAO) in his presentation on challenges for sustainability of aquaculture in Asia, said that, at the same time as Asia's contribution to the production of farmed fish continues to rise, the methods of fish production are under scrutiny. The rapid development of aquaculture has, for some commodities, outstripped planning and regulatory activities.

This has in turn evoked a bad reputation for aquaculture as a means of fish production.

In Asia, readily available antibiotics have provided a certain level



At the Intervet booth, from left; Dr. Darnas Dana, Director of Fish Health and Environment, (DGA-MMAF), Dr William Enright, Dr M. Fatuchri Sukadi and Dr Endhay Kusnendar, (DGA-MMAF), Dr Zilong Tan and Dr Cedric Komar, Technical Officer, AAH, Intervet Norbio Singapore.

of protection against bacterial diseases in fish. However, consumers are concerned with antibiotic residues and the health risk they present. In addition, there are increasing concerns on the resistance to and decreased efficacy of antibiotics.

"Today, our challenge is not only to look at efforts to maintain sustainability but also at the production of safe and quality aquatic products. Issues on ethical means of production will soon follow. Our farming systems should assure food safety and meet demands on traceability".

Rohana added that Asian producers need to increase production efficiencies. Improvements in husbandry must be linked with total disease management to increase survival rates. It is pleasing to hear that in disease management, R&D on vaccines for diseases affecting Asian aquaculture species has accelerated in the last few years.

"However, although aquaculture is expanding in terms of volumes, there is the need for more consistent yields. We need to learn from experiences in the salmon industry in Norway which, over a period of ten years, increased efficiency of production exponentially. This was achieved by vaccination replacing antibiotics and through concurrent developments in production, feeds and feeding", said Rohana.



Dr. Sylvie Quiniou

Dr. Sylvie Quiniou, Research Molecular Biologist and Immunologist at the Catfish Genetics Research Unit of the USDA, presented an elaborate talk on fish immunology and vaccinology. She covered the key aspects of the immune response in fish and explained innate and adaptive (humoral and cellular) immunity. She also examined the many similarities and few differences in the immune

system between mammals and teleost fish, and described what vaccines contain, how vaccines act and key factors involved in the response to vaccination. Regarding the types of vaccination in fish (injection, immersion and oral), Sylvie said that, with current commercial vaccines, only the first two types offer real protection. In conclusion, she emphasised that vaccination must be an integral part of a total health management programme. (Related article: Understanding Fish Vaccination, Aqua Culture Asia Pacific, Nov/Dec 2004, pp 24-27)

Factors affecting fish vaccination

- Species
- Ontogeny of immune system
- Production cycle/life history
- Timing of diseases
- Farming technology and husbandry
- Environment (temperature, salinity, contamination)
- Stress factors (crowding, handling, transport, photoperiod, season)

According to Dr William Enright, Marketing Manager, AAH Division, Intervet International B.V., The Netherlands, Atlantic salmon farming has led the way for many developments in intensive fish farming, particularly in the field of vaccination. Since 1993, there



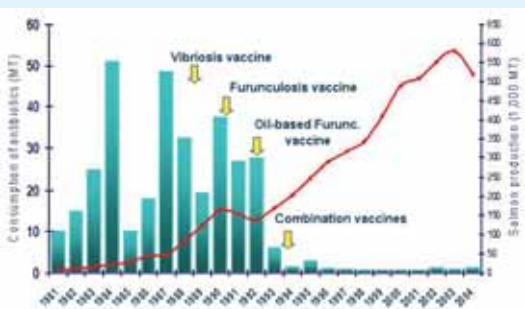
Dr William Enright

has been a rapid rise in production yields and this has coincided with various vaccine introductions leading to a concurrent decline in the use of antibiotics. For example, since 2002, virtually no antibiotic use was reported in Norway for salmon production.

Developments in feeds and feeding, selective breeding, husbandry practices and health management have led to increases in production efficiencies. The acceptable survival rate is more than 95% in comparison to the less than 50% acceptable for marine fish in Asia. With relatively low costs of production, salmon has shifted from being a luxury product to that of a commodity. The industry has also gone through several phases of consolidation and, at present, 80% of world production of salmon comes from ten companies.

Regarding vaccine development for salmonids, resources have focused on a single family of fish (as compared with dozens in Asian aquaculture). This has allowed for good disease information and knowledge of the immune system to be established, resulting in vaccines now being available for most of the bacterial and viral pathogens affecting salmonids. Indeed, the most widely used vaccine, Norvax® Compact 6, is a combination vaccine against six bacterial and viral pathogens.

Figure 1: Increase in salmon production with declining use of antibiotics



Assessing the cost-benefit ratio of vaccination for the Asian seabass industry



Dr. Luc Grisez

In his presentation on the role of vaccination in managing diseases in Asian aquaculture, Dr Luc Grisez, Research Manager at Intervet Norbio Singapore, said that many diseases are prevalent in warm water fish in the region. However, to date, except for Japan, no commercial fish vaccines are available in Asia.

“Asia accounts for 90% of global aquaculture production and does represent a potential market for fish vaccines. However, the many and varied fish species cultured and the lack of etiological and epidemiological data on most of them have resulted in the absence of fish vaccines for its aquaculture to date. However, through the research centre in Singapore, Intervet is now launching its first Asian fish vaccine”.

The ideal vaccine, according to Luc, has to be safe and efficacious when applied. It is also important to balance easy application methods with a long-lasting effect. For the farmer, it is important to determine an acceptable level of mortality and the cost-benefit ratio of using a particular vaccine to reduce mortalities.

The farmer will usually simply compare the cost of vaccination against the cost of antibiotics which that are readily available. However, Luc emphasized that antibiotics are only effective against acute bacterial infections and, even then, only if the correct antibiotic is used. They are only a curative measure and work only against bacterial infections. In contrast, vaccination is a preventive measure and, if designed as such, can act against bacterial, viral and even parasitic infections.

In the case of losses due to *Streptococcus* infections in Asian seabass, Luc added, “It is important to look at the stage when the pathogen affects the fish. Losses due to mortality of fingerlings at the initial stocking stage may not cost much as fingerlings are cheap and easily replaceable. But cumulative mortality over the culture period can reach 70%”. In an example shown in Figure 2, an acute outbreak that occurred 68 days prior to harvest resulted in losses of more than a tonne of fish. It was a significant loss and vaccination would have saved the crop.

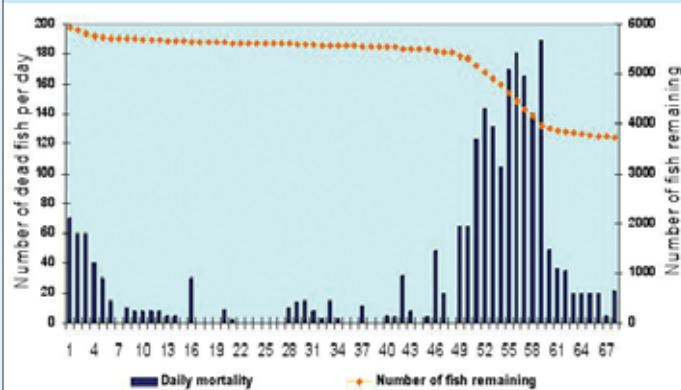


Infected seabass with internal septicaemia

In his discussion on the optimal vaccination window, Luc said that, if infections occur in 10-g Asian seabass, a full protection programme will require immersion vaccination for fish at 3-5g plus injection vaccination for fish at 20g. This can then give protection throughout the production cycle.

Nevertheless, as did Dr. Quiniou, Luc reiterated that, for vaccination to be effective, it has to be carried out together with good management strategies. Vaccination must be part of the overall health management and production process.

Figure 2: Effect of *Streptococcus iniae* on the last 68 days of culture of *Lates calcarifer*





Culture period (days) – 118 ± 13
 Water salinity (ppt) – 11 ± 8
 Average body weight (g) – 12.5 ± 3.4
 Average daily growth (g/day) – 0.11 ± 0.03
 Coefficient of variation of body weight (%) – 66 ± 39

Search for solutions for MSGS in farmed black tiger shrimp

By Boonsirm Withyachumnarnkul

Throughout Thailand in 2001 to 2002, farmers reported unusual growth retardation in farmed black tiger shrimp. Samples from infected shrimp showed single and multiple infections of known pathogens. Since a small proportion gave negative results for these pathogens, researchers at Centex Shrimp, Mahidol University suggested that viral infection was a contributing but not the overriding factor responsible for MSGS. Recent reports have now indicated that the disease may be appearing in other countries.

In 2001, the production of the black tiger shrimp *Penaeus monodon* dropped 40% to 160,000 tonnes mostly due to the widespread appearance of an unusual and unexplained slow growth of shrimp from about one month in ponds. Farmers reported low average daily weight gain of 0.11g as compared to the normal growth of 0.2g/day. Average sizes of shrimp was reduced from to 12.5g from 24-40g after 4 months of culture (Chayaburakul *et al.*, 2004). This became known as Monodon Slow Growth Syndrome (MSGS).

The accumulated damage caused by this phenomenon was estimated at Baht 13 billion (USD 300 million) and since rearing practices have not changed, it was considered possible that the problem arose from a new pathogen (Chayaburakul *et al.*, 2004). The symptoms of these infections were distinctively yellow bands not evident in normal shrimp.

Table 1. Incidence of multiple pathogens in samples of shrimp samples for 35 commercial farms in eastern, central and northern Thailand. Normal shrimp were defined as those with body weights (BW) of 24 g or more while small shrimp were defined as those that weighed 16.8 g or less.

	% of normal size shrimp	% of small size shrimp
Single infections	58	52
MBV	38	30
Microsporidian	13	6
Gregarine	1	5
HPV	0	2
Bacteria	6	9
Dual infections	15	26
MBV/HPV	7	10
MBV/Microsporidian	7	6
MBV/Gregarine	1	6
HPV/Microsporidian	0	2
M icrosporidian/Gregarine	0	2
Triple infections	9	7
MBV IHPV/Microsporidian	7	5
MBV/HPV/Gregarine	1	1
MBV/Microsporidian/Gregarine	1	1
Quadruple infections	1	1
Any of the tested pathogens	83	86
None of the tested pathogens	17	15
Dual to quadruple infections	31	39
Overall prevalence for each pathogen		
MBV	63	60
Microsproidians	29	23
HPV	16	21
Gregarines	5	16

In affected ponds, there was a $66 \pm 39\%$ variation in size with an average of 20% undersize shrimp.

A large scale screening program by Centex Shrimp, Faculty of Science, Mahidol University then revealed that a combination of new or existing infectious agents could be the cause. Viral pathogens were detected with specific polymerase chain reactions (PCR). Monodon baculovirus (MBV), Heptopancreatic parvovirus (HPV) and infectious hypodermal and hematopoietic necrosis (IHHNV) were present in infected shrimp as well as a previously undescribed microsporidian (Table 1).

Causative agents

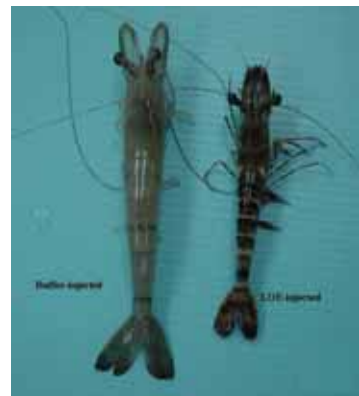
Most shrimp were infected with at least one of these viruses but many had dual to multiple infections. The prevalence of MBV and HPV was higher than 50%. However, none of these were significantly correlated with the slow growth phenomenon. Some 13-15% of shrimp were clean of any pathogens but yet exhibited slow growth. This may then signify some non-pathogenic factors. A genetic factor resulting from inbreeding of domestic stocks was ruled out as this will manifest at a gradual pace in all shrimp stocks.

As the prevalence of HPV and combined HPV/MBV infections in the small shrimp was significantly higher than in the normal shrimp, the findings suggested that HPV infection was a contributing factor but not the overriding factor responsible for MSGS. It is possible that MSGS is caused by an unknown pathogen or by some other presently unknown, non-pathogenic factor. In addition to the viruses, a new microsporidian species, gregarines and bacteria were also observed but were not significantly associated with the MSGS problem (Chayaburakul *et al.*, 2004).

Induced infections

Lymphoid organs spheroids of affected shrimp also indicated unusually, large, magenta cytoplasmic inclusions which under transmission microscopy then revealed the presence of five types of potential viral particles. The phenomenon was then induced in the laboratory to determine the affects of these viral particles.

Bacteria free lymphoid organs extracts (LOE) from slow growing shrimp in commercial farms were injected into 300 healthy, specific



Decreasing size of LOE injected shrimp

pathogen free (SPF) *P. monodon* of 1-2g in weight. The control was buffer injected. The general morphology, growth and survival were observed at 2, 3 and 4 months of culture in tanks. Within the first two months, severe growth retardation and extreme size variation was apparent. After three months, darker colouration appeared in the pleopods.

The CV for the weight of shrimp injected with LOE varied from 20 to 45% as compared to that of control shrimp where the variation was 17 to 24%. Similarly, survival of the shrimp injected with LOE was 50% in comparison with more than 80% for control shrimp with a lower CV (Sang-oum, 2003).

Further work on the determination of the causative agent indicated the presence of bluish inclusions. The virus detected was YHV (yellow head) similar virus, previously unreported in Thailand. This has 82% identity with the YHV from Taiwan. A primer to detect this virus has been developed and has been used to detect the presence of the virus in wild broodstock from Malaysian waters and in slow growing 90 day old, 2.6 g shrimp from Chantaburi Province (Sang-oum, 2003).

As to the actual causative agent, field results only indicated that less than 5% of slow growth shrimp were infected with this virus, and it was deduced that this virus may not be entirely responsible for the growth retardation. This also brought up the possibility that not only one causative agent is responsible. Attempts are ongoing to try and sequence this virus named MSGA (Monodon Slow Growth Agent).

Recently another causative agent was identified as the lymphoid organ vacuolization virus (LOVV). This was first described in several captured *P. monodon* broodstock from Thailand in late 2002 (Flegel and Withyachumnarnkul, 2005).

The role of domestication programs

The growth retardation may be the response of the shrimp to the presence of the virus. In general, farmers had reported good growth performance of domesticated SPF shrimp. However this was marred by the results from a pond in Suratthani. Here four families (identified by microsatellite) of domesticated shrimp were cultured in a pond. Their growth was then monitored.

Out of the four families cultured in a single pond, good and consistent growth performance of one family continued after 126 days of culture. This contrasted with the proportion of the two other families which declined at 126 days but where growth rates were better than the larger population group. The population from one family disappeared at 60 days of culture.

Several possibilities exist, for instance, the varying response may be related to the degree receptors response to the virus. The group that died probably had a high density of receptors with a high response factor whereas the group that survived but with low growth rates had a partial response. The group not affected by the virus might have no receptors.

The different level of responses of shrimp to the virus can then be used to develop more resistant strains in a domestication program (Withyachumnarnkul, 2004).



Dr Boonsirm Withyachumnarnkul (centre) with Mr Prayoon Hongrath at the Sureerath Farm, Thailand

What is MSGS

A case definition of the slow growth has been developed. The suspected population must have a coefficient of variation (CV) of weight is more than 35% and an absence of hepatopancreatic parvovirus (HPV) infection or of other severe hepatopancreatic (HP) infections. Additionally, affected shrimp should comply with any three out of five following gross criteria.

- unusually dark colour
- average daily weight gain of less than 0.1g/day at four months
- unusually bright yellow markings
- bamboo segments
- brittle antennae.



Unusually dark colour or bright yellow markings and bamboo segments on infected shrimp

Bottomline

The shrimp culture industry in Thailand needs to maintain both small (*P. vannamei*) and large (*P. monodon*) shrimp markets. That means we should have both types of shrimp culture in the country. Our job is to make sure that the culture of one species does not adversely affect another species. For instance, we have to make sure that IHNV from *P. monodon* does not spread to *P. vannamei* and MSGV from *P. vannamei* does not spread to *P. monodon*. The cultivation of both species should be in separate farms, not only in separate ponds. The reason is not only to prevent disease spreading but the cultivation method of the two species is quite different. I believe, there are different specialisations to be achieved.

Another function that we need to take on is to actively run a selective breeding program for *P. monodon*, and one which is commercially viable. The difficulty seems to be at the Nucleus Breeding Centre, which should be the responsibility of the government because it requires huge budget. Private companies may be willing to set up a Broodstock Multiplication Center because it requires a small budget but huge returns on profit. The problem is that the latter could not be born without the existence of the former.

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Disease prevention measures in coastal aquaculture: Part 2

by Pornlerd Chanratchakool



Experiences from Thailand
on farm level disease control
and prevention measures

In this two part article, the author discusses different aspects of disease management in shrimp aquaculture. Part one dealt with the different measures adopted today for disease control. This part will deal with the specific causes of toxic conditions in the pond and the role of biological products in alleviating this problem.



Shrimp farmers are aware that health problems in the shrimp ponds are caused by a multitude of factors such as seed quality, pond soil management, water management, feed management and pathogens. Disease prevention needs an understanding of the dynamic interactions between these factors. A failure to manage one can have negative impacts on the others and lead to severe problems in the pond culture system.

The critical grow-out period in shrimp culture

As farming practices move towards limited water exchange or closed system farming, maintaining the optimal water and soil quality has become even more critical. A glance at pond history and water quality data reveals that farmers commonly face health or disease problems during two peak periods. The first is during 30-40 days and the second beyond 80-90 days of the culture cycle. During this period, water quality fluctuates and very often, ammonia or nitrite levels increase, causing stress to the shrimp and making them vulnerable to diseases. Maintaining the pond environment during this critical grow-out period (CGP) is therefore essential.

Causes of toxic condition in ponds during the CGP

"Stress" is the most common terminology used to describe an animal with poor health. The major cause of stress is usually due to the toxic conditions in the pond. During early stages of the production cycle, in an unstable bloom or clear water pond condition, benthic algal growth is usually seen because of the waste accumulation inside the soil from previous harvests. When phytoplankton starts to bloom, usually around 20-30 days after pond filling, benthic algae die due to lack of light. The dead algae along with uneaten feed and dead phytoplankton decompose





Pond with dead phytoplankton

and accumulate on the pond bottom.

In this scenario, the pond soil deteriorates rapidly if conditions are not aerobic. This causes a build up of ammonia, nitrite or hydrogen sulphide creating toxic conditions for the shrimp at around 30-40 days post stocking. A similar situation occurs during the later stage of the cycle. A phytoplankton over-bloom in limited water exchange systems leads to high pH. To prevent this, most farmers tend to use disinfectants or algacides. In the absence of oxygen, the resulting dead phytoplankton and other organic wastes cause similar toxic conditions at around 80-90 days of the culture period.

Under normal aerobic conditions, the ammonia is oxidized to nitrite and nitrite to non-toxic nitrate by natural bacteria. However this nitrification process is often hampered by a limited availability of the oxidizing bacteria in the pond. Therefore, ammonia and nitrite levels in the pond increase causing severe stress to the shrimp.

Physical methods to prevent toxic conditions

Since ineffective pond water and soil management causes toxic conditions and affects shrimp health, precautions are necessary right at the pond preparation stage. The residual organic waste in the soil from previous harvests should be removed during pond preparation to reduce the source of fertilizer from the soil surface. It is also necessary to provide optimal conditions like increasing water alkalinity to over 80 ppm, maintaining pH in the 7.5-8 range, maintaining dissolved oxygen at above 4 ppm at all times to promote phytoplankton growth, prevent benthic algal growth and prevent toxic gas accumulation through the oxidizing process.

During the cycle, a large proportion of the plankton dies (crash). This can have several consequences for the pond environment. The lack of phytoplankton stops the absorption of toxic gases or nutrient. Moreover its decomposition produces additional organic sediment and oxygen depletion. The accumulated organic layer on the pond bottom produces an environment that is very harmful to the shrimp.

Therefore, it is vital to take immediate action following a bloom crash to minimize these adverse effects. This can be done by scalping the top soil using metal chain or other means, to keep the top soil in aerobic condition and try to eliminate the dead plankton by enhancing the decomposition process. It is necessary to establish the bloom again after a bloom crash.

Biological methods to prevent toxic conditions

The treatment of water to eliminate potential pathogens, disease carriers and other wild animals from the incoming water during the early stages of production can kill or reduce the natural bacterial population in the pond. This then requires an addition of certain bacteria population into the pond to re-establish the new consortium.

However, these bacteria can only be beneficial if they can survive and continue to grow in the pond conditions. The selected bacteria should therefore be tolerant to high salinity conditions and provide specific enzymes to react with organic wastes for example; protease for protein elimination; cellulose for cellulose elimination, etc. If the amount of organic substance in the early stage is minimized, the ammonia, nitrite or hydrogen sulphide can be controlled.

"The critical issue is how to get the right bacteria, with the right activity and strength to work in the right conditions at the right time"

However, in some cases, in spite of the low organic matter, toxic conditions still build up if the oxygen in the pond is not sufficient or the number of normal nitrifying bacterial population is limited. Therefore, addition of the specific bacterial consortium can be beneficial to speed up the nitrogen oxidizing process. The critical issue is "how to get the right bacteria, with the right activity and strength to work in the right conditions at the right time". An appropriate bacterial consortium can control the toxic substances in the pond, minimize stress and reduce the risk of disease in the shrimp.

Summary

Maintaining the optimal pond conditions to reduce the risk of disease is not easy. In the first place, the farmer needs to pay more attention to reduce accumulated organic waste during pond preparation. The next important step is to get the phytoplankton bloom before a benthic algal bloom so as to prevent a potential source of toxic condition buildup.

Here, microbial products can be used to minimize the waste in the pond or to reduce the build up of toxic conditions during culture. For efficacy of the microbial product, it is necessary to provide the right pond conditions for the right bacterial consortium with the right strength.

A point to take note is that using the microbial product without an understanding of the product, how it works and what it requires to sustain itself will not provide any benefit at all.



Dr. Pornlerd Chanratchakool is the Technical Manager (Asia-Pacific) for Novozymes Biologicals. His experience in the field of aquaculture spans over the last two decades. He has served as an academician, consultant and conducted training programs for the shrimp aquaculture industry across the region. Dr Pornlerd has written several books and publications in the field of shrimp farming. He has a PhD from the Institute of Aquaculture, University of Stirling, Scotland.



Show review at World Aquaculture 2005

Offerings from Asia's top companies

As the show returned to Asia this year, it was an opportunity for Asian industry leaders to shine. Some 175 exhibitors were at the trade show in Bali, held from May 10 to 12.



At the Uni-President Booth, from left, Jeff, Jie-Cheng Chuang, Uni-President Vietnam, Ming Hsun Wu, Uni-President Enter. Corp., Lin Chen Lung, Uni-President Vietnam and Jimmy Wang, Uni-President Enter. Corp. Seated from left, Cheng Wen Chin, DG Uni-President Vietnam, Dr. & Mrs S. Y. Shiau, Dr. I-C Liao and Dr. J-C Chen, all from National Taiwan Ocean University and Leon Chen, Richvigor Taiwan.



At PT Centralpertiwi Bahari, Soetresno Sentosa, COO (second right) and team with Khazali Din, Kedah Aquaculture, Malaysia (second left) and Lee Low, Asia Aquaculture, Malaysia (right).

This year, 45% of these companies were from Asia, mainly from Indonesia, Thailand and Taiwan. Asia's industry leaders, mainly feed companies from Indonesia, Thailand and Vietnam, attracted the most interest.

The slogan at the booth of fully integrated shrimp company, PT Centralpertiwi Bahari was from 'pond to plate' emphasizing its traceability program and commitment to the aquaculture industry in Indonesia. The company is part of the large Charoen Pokphand Indonesia Group. It exports from its farm in Lampung, South Sumatra. At the conference, its technology team presented several updates on the industry in Indonesia (see pages 32-35).

PT Suri Tani Pemuka, part of the large poultry and livestock company, PT Japfa Comfeed Group, displayed its range of shrimp and fish feeds. It has the second largest market share in the freshwater fish market in Indonesia. Recently, the company has set up facilities for hatchery production of specific pathogen free (SPF) postlarvae for its customers. This completes the link for the company to be a fully integrated aquaculture company. It already has feed production, farm and processing facilities in East Java. A relatively recent introduction to the company's range of feed is feeds for the pond and cage culture of groupers. The feed development was a joint effort with the Marine Research Centre in Gondol.



Ravinthar Veellu, Gold Coin Specialties, India (left) and customers from India with S.Santhana Krishna, Maritech, India (right) at our Aqua Culture Asia Pacific booth.

Vietnam's Uni President Co Ltd, part of the Aquatic Business of Uni President Enterprises Corp of Taiwan was there to present their range of feeds for the marine shrimp. A market leader in Vietnam, both for feeds for the monodon shrimp and catfish, the company is looking at the potential of regional markets. In January 2005, it launched a new range of feeds, HiAqua, supplemented with astaxanthin and immunostimulants. It also has feeds for the freshwater prawn with 42 to 33% CP which is recommended for culture based on the Taiwan model. There are 11 ranges for catfish *Pangasius sp* feeds with CP levels of 40% to 20%.

In Vietnam, the company is now expanding production as well as setting up a shrimp hatchery and laboratory facilities (see news AAP, March/April). The focus will also be tilapia and catfish feeds at this new plant in the Mekong Delta. The aquatic business of the parent company has production facilities in Shanghai and Sichuan where it markets feeds for the vannamei shrimp, freshwater fish, tilapia and common carp. In Qingdao, the company produces feed for the seabream and flounder.

Making their presence felt with a large booth was Cargill Indonesia, supported by teams from Cargill USA and Malaysia. The company introduced the new 'Omega' feeds for red tilapia. This is in addition to its range of pelleted sinking feeds and extruded floating feeds for freshwater fish. The formulation for all these feeds was based on digestible amino acids, energy and phosphorus. As such, their feeds are eco-friendly with low outputs of P into the water environment.

One of Thailand's leading shrimp feed producers, Inteqc Feed presented its range of feeds for the marine shrimp. These are INTEQC with 40% protein for *P. monodon*, the Wave series for *P. vannamei* shrimp and Neofeed with lower protein levels for other marine shrimp. The feed for the freshwater prawn *Macrobrachium sp* is called Fresh and has 30% protein. These feeds marketed regionally. The company is also expanding feed lines at its mill in Samut Sakorn. It also markets larval and hatchery feeds and aquaculture health products under the Inteqc group of companies.

Call for investments

The show was also an opportunity for 16 of Indonesia's provincial fisheries department to present aquaculture activities in the region and investment opportunities. At the West Jawa provincial booth, was COLISA, a cooperative which handles the production and marketing of ornamental fish and water plants to domestic and export markets.

It also exports glass eels *Anguilla bicolor* to Hong Kong, China and Taiwan besides supplying fingerlings of eels, Pangasius, gourami, tilapia and common carp to domestic markets. The annual production is 11 billion fry. The region was also the first to culture *Colossoma macropomum*, native to Brazil and now marketed as a food fish to Hong Kong and USA. Production is 700 million fry/year.

The Aquaculture Centre in Kalimantan promoted the culture of *Mytus nemurus*, the green catfish to farmers. The grow out is recommended in cages of 6m² for 4-6 months to a market size of up to 325g. The Bandung Regency in Bali invited investments to develop its freshwater ornamental fish industry, alongside its ornamental marine fish. It also called for investments in the culture of the freshwater prawn *Macrobrachium rosenbergii*.

Feed additives

Among those marketing these were the Asia Pacific team from Alltech Biotechnology, represented by Dan Fegan, Regional Technical Manager, Aquaculture, David Faulkner, South East Asia Manager and Haris Muktdadi, Technical Sales Manager, Aquaculture, Indonesia. Products included the yeast-based nucleotide Nu Pro which has both nutritive and immune enhancing functions in shrimp. Aqua-Mos is for better growth performance achieved through improvements in gut functions. Another product is De-Odorase which has ammonia binding properties and is effective in pond water management.

At the DSM Nutritional Products, Jacques Gabaudan from the Aquaculture Centre in Bangkok presented the phytase Ronozyme P series which can enable a greater use of plant raw materials as it releases phosphate from phytic acid. Ronozyme P (CT) is for use in pelleted feeds whereas Ronozyme P (L) is for aggressive feed milling processes.

Pond and tank management

New at the Codel of Thailand's booth was Mo'Tech, a natural mineral with particles sizes less than one micron. It is a combination of Ca:Mg:K (7:1:1) for the control of soil and water quality in ponds. In several trials, the company demonstrated the benefits of alkalinity control on pond productivity. The company also has Taibac and F-1, probiotics containing *Bacillus subtilis*, for shrimp grow out and in the hatchery, respectively. Welltech Biotechnology from Thailand introduced a new disinfectant called Verotech.



Cynthia A Wijono and the team at the West Jawa Booth



PT Suri Tani Pemuka's team. From right, Hidayat, Vice President, Aquafeed operations, Widyatmoko, R&D Manager (centre) and Indang, (left)



Jacques Gabaudan and Yohannes Irianto, DSM Indonesia



At the Intervet seminar, from left: Indonesia, Prof Dr Ir Kamiso, HN. Gajah Mada University, Henry Edy, Fisheries Academy Sidoarjo, Moch Nurhudah, Fisheries University Jakarta, Dr Ir Muhammad Murdjani, Jepara and from Thailand, Kidchakan Supamattaya, Biomin

Biomin, from Singapore presented its Aqua Specials range of probiotics. Taiwan's **Team Aqua** showed their new probiotic range composed from strains of *Bacillus subtilis*, *Aerobacter* spp along with suitable activators in VC-7. At a seminar for farmers, **INVE** Aquaculture Health introduced their Sanolife MIC for use in hatcheries and Sanolife PRO for rapid decomposition of waste products in ponds. The product contains a diverse mixture of microbes developed for suppressing pathogenic bacteria (see page 36).

Health solutions and disease diagnosis

At the show **Intervet Norbio** Singapore launched its new Norvax Strep Si, an immersion and injection vaccine for seabass. It also held a seminar on fish vaccination on May 11 (see page 12-13 for details). **Farming Intelligence** of Taiwan announced the publication of its first newsletter 'IntelliGene News' as part of its efforts to provide updated information on diseases in the shrimp and fish farming industry. The main article in this issue is on infectious myonecrosis (IMN) by Dr D.V. Lightner. Leo Liu, President also introduced their most popular IQ2000, a cost efficient and reliable virus detector. Vietnam's **NTL Biotech** Ltd introduced Microcin to treat microbial disease in aquaculture and livestock. It can be used as direct liquid mixing to the feed, oral application and injection to the animal, according to Dr Ho Nhan, General Director.

Feed equipment

At **Wenger**, USA's booth, Joseph Kearns and Paul Chen, the latter from the Asia Pacific office in Taiwan, introduced their new Wenger External Density Management System or EDMS which give feed producers control on feed densities. They are also authors of an article on floating fish feeds in this issue. **Aeroglide**, USA which manufactures conveyor type fish feed dying and cooling systems was represented by its team from the Asia Pacific office in Malaysia. **Leader Sea** from Korea showed its rotary feeder for flatfish for the dispersal of moist pellets. Another feeder is the air feeder for the automatic feeding of mullet, rockfish etc in cages.

Pond/cage/tank equipment

Malaysian Olefins promoted its deep sea floating cage in the ETER range. According to Managing Director, HW Hooi, they now have cages with flexible structures more suitable for deep sea locations. Cages are also larger and comes in blue or black. The latter has a longer lifespan. Bluey Chew of **Rotomas** displayed his new circular aquaculture system which comprised of filter propeller and wash bead filter and sand fluidized biofilter and foam fractionator/protein skimmer for recirculation systems. Bluey commented that unlike in Australia, the industry in Asia is slow to pick up the use of recirculation systems.

SPF/SPR *P. vannamei* broodstock

The demand for genetically improved *P. vannamei* broodstock supplies is increasing in Asia and thus creating market opportunities for Taiwan's **Team Aqua** and the new biosecurity facilities in Singapore for Florida based **Shrimp Improvement Systems** (SIS). SIS is already supplying SPF/SPR broodstock to major hatcheries in Asia. Their proprietary lines of broodstock have enhanced disease resistance and growth at 2g/week. According to Henry Clifford III, Technical Manager, 8g shrimp can be shipped to the biosecurity facilities in Singapore and then reared as broodstock. This will reduce stress for large shrimp during transport to regional locations.



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SludgeNil: PondPlus® degrades a wide variety of excess food and organic waste material and reduces sludge from the pond bottom.

Oxygenator: Planktons thrive in ponds treated with PondPlus®. These planktons in turn boost the oxygen levels in the pond.

StressBuster: PondPlus® reduces stress on shrimp as indicated by prophenyloxidase (PPO) levels.

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New directions in the production of floating fish feeds

The flexibility in extrusion cooking allows for both floating and sinking feeds to be produced on the same basic equipment. Significant advancements have been made over the last few years for the production of a wide range of aquafeeds, as reviewed by Joseph P. Kearns and Paul Chen

The past few years have seen a rapid increase in aquaculture in the Asian countries with the majority of this on fish species that require floating feeds. The largest tonnage of floating fish feeds produced world wide is for the catfish, carp and tilapia.

Currently, within our organizations of Wenger and Extru-Tech Inc., research is geared towards developments in the extrusion processing of aquafeeds for new species such as sea urchin, abalone and tuna. Our focus is also on the production of all sinking feeds, including those for the shrimp, water stable specialty feeds, neutrally buoyant feeds, medium fat and high fat feeds, as well as all aquatic starter diets.

Another important area for clients is support work to keep up with varying and new ingredient sources, their interactions with each other and their effect on production methods for the full range of extruded aquafeeds.

Changing formulation with extrusion cooking

Extrusion cooking of floating fish feeds used to be one of the simplest things to do with an extruder. One simply added a selected formulation and the pressure and cooking effect caused the material to expand off the extruder die. Following a series of processes, a feed that floated was produced.

Later, as aquaculture developed and as nutritionists researched and developed ideas to make more exacting feeds, these simple tasks became more complicated. However, these more difficult processes on the extrusion cooker usually meant better feeds for the industry due to lower ingredient costs or improved nutritional benefits. But then, these ever changing ideas required improvements in the control of the manufacturing equipment in order to meet the needs of the industry, and to do so at a profit.

A typical formulation for catfish has 32% protein that generally includes 8% fishmeal, 48.2% soybean meal, 29.2% corn and 10% rice bran or wheat midlings with the balance being minor ingredients (NRC, 1983). This type of diet is a refined mix of ingredients after years of work on reducing the use of fishmeal. This is also proof that soybean meal can be an acceptable ingredient for catfish. Tilapia diets do not vary greatly from this formulation.

However, the reduction in the use of fishmeal did create some changes that were needed in the production process for the feeds. Many of these types of feeds are relatively low in protein content. Some of the ingredients used in the formulation are mainly low cost fillers. This may vary from region to region as usually what feed manufacturers look to least cost formulations.

Feeding trials are also changing the view and the idea that the lowest cost feed is not necessarily the cheapest way to culture a kilo of fish. They see the fish grow with the lower cost feeds without realizing that the feed which is more completely balanced would actually give them a higher profit margin in many cases. This demand for lower cost feeds require that equipment suppliers address the needs or the ability to make these feeds in a simple way. They also require optimization of the process.

Work has shown that the traditional need for a minimum of 20% starch in a floating fish feed diet has changed. The reduced supply of fishmeal and the increase in its cost have resulted in the use of other protein sources. The use of soybean meal to partially replace fishmeal is a result of the use of least costs in feed formulations for aquatic animals.

It should be noted that soybean meal as well as fish meal are produced in various methods where some processes use more heat than others. If the soybean meal or fishmeal is not overheated in the oil extraction process then it has better functional properties. These functional properties allow for a cross linking of protein chains in the extrusion cooker at specific temperature and pressure ranges and thus assists in holding the pellet together.

Studies have shown that if a good functional protein source is used for every 2% function protein added in the formula, the minimum starch requirement can go down by 1%. A standard floating fish feed requires a minimum of 20% starch in the formula to have good feed characteristics. For example, if we include a protein source with good functional characteristics at 20% level then the minimum starch level can be reduced to 10% for good binding and pellet quality.



Floating aquafeeds: 1-0.8mm die opening yielding a 1.0 mm product, 2-1.3mm die opening yielding a 1.5 mm product, 3-3.0 mm pellet, 4-4.0mm pellet, 5-6mm pellet, 6-8mm pellet, 7-10mm pellet, 8-25mm pellet made for an Amazon Basin Large Catfish

About "floating fish feeds"

About 40 years ago, most feeds for any land or water-based animal was prepared in a traditional pellet press. The density of these products was normally high enough so that they sank in water. Then it was discovered that the extrusion cooker was able to produce a "floating fish feed" which floated in water.

It was soon noticed that if the species fed did accept a floating feed there were advantages. Fish farmers noticed that the floating feeds attracted fish to the surface. This allowed the farmer to observe fish behavior and the general health of his stock during feeding. Floating feeds allowed for evaluation of the volume of feed consumed over a time period. Feeding regimes improved FCR and lowered overall feed costs.

This led to better pond conditions and water quality with less waste or uneaten feed in the pond. Methods of feeding floating feeds into the ponds also used the visual effect to its advantage. The farmer could take advantage of the wind direction to help in feed dispersal over the pond surface by introducing the feed on the windward side of the pond.

Results with these feeds justified the continuation of aquaculture farming but the tide was about to change as developments proved that these new devices, namely extrusion cookers, did have some merit.

What is new in extrusion cooking?

Before we look at new advancements in this area, a review of extrusion cooking for the production of a floating feed is necessary.

The process starts with the preparation of the raw materials. Assuming these have been selected based on the nutrient needs of the animal, the material is ground to a size fineness that is acceptable for the diameter of the size feed being prepared. Typically the extruder can handle a wide range of particle sizes but the largest particle needs to be less than 1/3 of the die opening. If you are making 1.5 mm feeds, then the largest particle should be 0.5mm or less. On larger diameter feeds, a minimum of grinding through a 20 mesh screen or to a particle size of 840 microns is also a good starting point for grinding.

The extrusion system generally can handle this kind of ingredient but will the farmers be satisfied with large particles in the feed? If you are doubtful, it is advised to understand the market you will be serving, and modify the grinding to meet the expectations of the farmers you will serve.

Once ground and mixed to the coefficient of variance suitable for the feed size being produced, the mix is introduced evenly into the extrusion system via a live bin and variable speed feeder. These devices ensure an even flow of feed into the preconditioner and extruder barrel resulting in a stable process out of the extruder die.

Conditioning cylinders that have been around since the construction of the first commercial extrusion cooker have also changed over the years. The emphasis is on the control of the retention time and thus, the quality of the conditioned feed out of the cylinder before the extruder barrel. This has been optimized up to this point by machine design with feeding trials pointing the correct direction.

Early conditioning cylinders had retention times of 20 to 30 seconds. Typical retention times in the area of 180 seconds are now the standard allowing for the elevated moisture levels. If low levels of moisture are used in extrusion then the feed is what is considered to be cooked in a dry fashion.

Feeding trials showed that the increased amino acid destruction associated with dry extrusion reduced the feed performance. The use of elevated moisture levels such as above 35% also showed reduction in feed performance as the added water in the extrusion process acts like a lubricant and the cooking process is reduced.

A conditioner retention time of a maximum of 240 seconds is used to keep the destruction of amino acid at a minimum. New developments in this area have centered on the ability to better control the system and be able to vary the retention time for each species resulting in the optimization of the preconditioning phase of the process. Additional benefits of using a retention time control package are to reduce down time and waste between different extruder production runs.

Steam, water and other liquid ingredients are added in this device



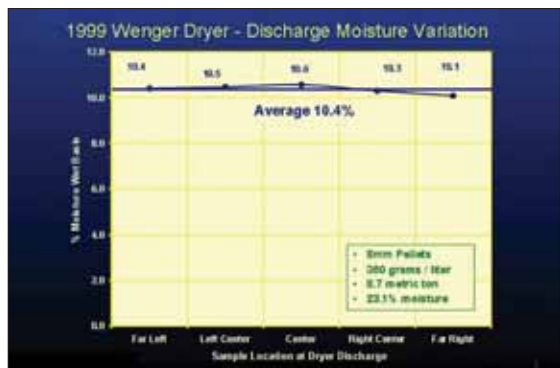
Conditioner Retention Time Controlling Device

resulting in a homogenous free flowing mass delivered to the extruder barrel. Free flowing can be defined as a material that does not cake and build up in the transition between the conditioner and the extruder barrel.

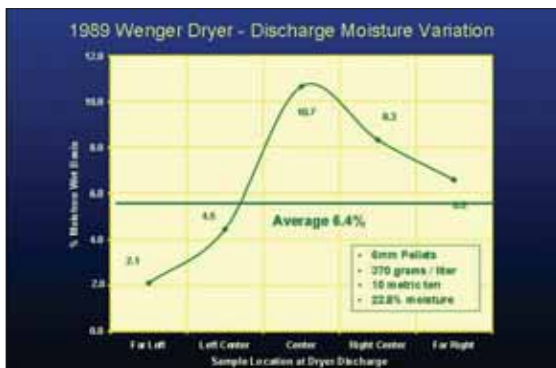
We had a simple test for this. Collect a hand full between the cylinder and extruder barrel and if you squeeze the material in your hand and it sticks to your fingers like wet raw pie dough, then the retention time is most likely too short. This is because the retention time is too short to allow the moisture added in the conditioning cylinder to be absorbed fully. The moisture is on the surface of each particle causing it to be sticky. If the material after squeezing breaks up and falls apart again without any stickiness, then the system should run without interruption. This is a result of enough time for the particles to absorb the water into the interior of each particle reducing stickiness.

The extruder barrel itself has evolved with modifications resulting in higher capacities by profile adjustments or improved extruder screw geometry. Mainly the biggest advancements have been with the addition of controlling devices to the end of the extruder barrel. This resulted in improvements of operation of the equipment. In expansion control and especially with floating aquafeeds, the development of the Back Pressure Valve (BPV) is at the forefront of this new wave of technology. Other devices have also developed to be used in conjunction with the BPV for improved control of sinking aquatic feeds.

The back pressure valve is a device which takes some of the expansion control off the actual final die and allows for the process to be controlled with this valve. By closing the valve, the pressure in the barrel increases. This results in more cooking effects and thus, a greater expansion rate out of the final die. This can be controlled during the operation of the equipment and does not require the machine to be stopped for changes. Density control with this device is $\pm 20\%$. Therefore, the operator of the extruder can make an evaluation during production.



Left: Discharge moisture variation chart of a present day highly efficient dryer at the discharge



Right: Discharge moisture variation chart at the discharge of an older Wenger dryer or what is expected from lower cost dryers at the present time

If the pellet is too small or does not have enough expansion, one can close the valve. If the product is too big or too light in density, the valve can be opened and the expansion will be reduced. This device is designed to be added to existing equipment but does require a system evaluation for confirmation of the expected capacity rates of $\pm 20\%$ density control on any given machine.

Extruder die technology has also changed based on the use of the BPV. Improvements in the number of holes and the spacing in the dies themselves have developed for these high pressure devices so as to ensure safe operation and improved flow characteristics. The more beautiful the pellets, the more the farmers like them as it shows care in the feed manufacturing process. **After all, the first thing a fish farmer looks for is pellet quality.**

Drying

The next most important device in the system is the dryer. As the need for these types of feeds increase, the capacity requirements of plants also increase. Currently, it is common to see a plant that can produce between 10 and 20 tonnes/hr of floating fish feeds. This would equate to 20,000 to 40,000 tonnes per year on a one shift per day basis. Around the clock, this would be 60,000 to 120,000 tonnes per year.

It is usual to see older and existing dryers or low technology dryers that result in a finished feed with a 2 to 3% moisture variance. In contrast, present dryers designed correctly have the capacity to dry to within a 0.5% moisture variance.

Older and inefficient dryers use can then equate to 1,500 to 3,000 tonnes per year of lost water in the finished feed on an around the clock production basis. This is assuming one dries to a safe moisture level for the dryer design when compared to a dryer that can hold the variance to 0.5%. It also means you purchase an additional 1,500 to 3,000 tonnes of dry raw materials for the same yearly production.

This is a substantial amount of money that can be saved if this aspect of production was studied more closely. Additional dryer advancements have focused on additional efficiency control by monitoring the humidity of the exhaust air that reduces fuel costs. The Wenger ASR Control (Adiabatic Saturation Ratio) US Patent # 6,484,417 system will enable the dryer to exhaust air at a pre-set saturation (humidity) level lowering energy consumption.

The above discussion on drying also has an effect on coating. When adding oil to a feed with a moisture variance, the pellets with more water pick up less oil or do so unevenly than evenly dried pellets. Special considerations are needed for the low level oil applications in order to get a good even coating. Typically in a standard atmospheric reel applicator the low limit of application with accuracy is in the 2% addition range. Lower levels can be done but the equipment gets more advanced for better application control.

Developments continue in this area as liquid ingredient applications at low dosage levels are becoming more common in the feed industry. These have to be in line with developments in probiotics, enzymes and vitamin additives.

Starter fish diets

The additional specialization in the production of floating aquafeeds is in starter fish diets and aquarium fish feeds. Feeds produced through a die opening of 0.8 mm in diameter have been made on our smallest single and twin screw machines at low production rates. The smaller machines are more ideally suited for this kind of production. However, feeds in the 0.8 mm or 1.0 mm are produced on larger production models.

When micro aquatic feeds, starter diets or the feeds where the diameters range from 300 microns up to 1.2 mm are required extensively, we would recommend the Extru-Tech Sphere-izer Agglomeration System (SAS™). These feeds are not expanded but agglomerated and thus they have short time floating characteristics due to low mass and the inability to break the water surface tension. When they are finally wetted after introduction into the water they sink relatively slowly. Special considerations to the raw material preparation are important due to the small die openings for these small feeds. Fine grinding is recommended with a sifting operation to insure uniform raw material particle size.

Cooler

The final major device in the process is the cooling of the dried or coated feed pellets. Farmers hate fines in the feed. Development from Extru-Tech Inc. has yielded a cooler design with no moving parts to control the passage of the feed through the cooler resulting in less fines generation. Efficiency is high and the controllability is also excellent for most feed in the aqua sector except for feeds below 2.4 mm where we presently recommend a horizontal cooler. Work is now focused on cooling products down to near 1.0 mm diameter ranges with this vertical cooler design.



Extru-Tech vertical cooler with no moving discharge parts

“The state of the industry for floating aquafeeds is good and improving with emphasis on additional profits for both the feed producer and the farmers with the ability to make the feeds at higher rates with lower costs and control at time of production”



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Joe Kearns (left) with Paul Chen, Wenger booth at WAS 2005, Bali

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Whether you are a hatchery operator, production manager or processor, you are most important to us. We know that you can move the industry forward if you have access to information and if you share your success with others.

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As an aquafeed producer, feed ingredient and equipment or provider of diagnostic health services, you will need to know your market well. You have information on products and on your company that you want the reader to be aware of. Send these in (in less than 100 words) and we will help you free of charge.

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You, the industry specialist, have done the trials and research and wish the industry to learn from it. We will help you present these in an easy to read manner so that your research does not remain within the laboratory only. Email the editor for guidelines.

NEWS

Thai shrimp farmers seeks action against falling prices

Thai shrimp farmers are seeking action against falling prices. The industry is seeking the government's intervention to pay up the price.

The Thai shrimp industry has been hit by a 20% fall in prices in the last few months because of the government's intervention to pay up the price. The industry is seeking the government's intervention to pay up the price. The industry is seeking the government's intervention to pay up the price.

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SHRIMP HEALTH

Search for solutions for MSGS in farmed black tiger shrimp

Throughout Thailand in 2001 to 2002, farmers reported unusual growth retardation in farmed black tiger shrimp. Samples from infected shrimp showed single and multiple infections of various pathogens. There is a urgent programme to search for solutions for MSGS in farmed black tiger shrimp.

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WORLD AQUACULTURE 2005

At World Aquaculture 2005, Bat Recapturing the international role of aquaculture

It was an international gathering of stakeholders in the industry of the annual World Aquaculture 2005 conference and trade show, held from 5-11 May, 2005, in Batavia, Indonesia.

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WORLD AQUACULTURE 2005

At World Aquaculture 2005 Trade show, Bat Biosecurity solutions from DuPont

DuPont Animal Health Solutions has announced a series of new aquaculture products. The company is the creator of the Aquaculture 2005, Asian International and Bioscience, both of which are global leaders in biosecurity, especially in the pig and poultry industry.

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Enhancing growth performance of shrimp with nucleotide-supplemented diets

By Daniel K Ancieta-Pröbstl, Richard P Smullen and Andrew C Barnes*

Marine shrimp farming dominates the global marine aquaculture industry in terms of value per tonne production. In 2002, production was 2.1 million tonnes valued at USD 10.8 billion (FAO, 2004). Crustaceans also represent the highest sustained growth in marine aquaculture, averaging 18.1% growth per annum since 1970 (FAO 2004). However, growth of the industry in Asia and South and Central America slowed in the decade from 1990 to 2000, largely as a result of major losses to disease in the late 1990s (Villamar, 2002). In the late 1990's shrimp production in South and Central America contracted by 17%, whilst in Asia, estimated losses of USD3 billion per year were attributed to viral disease (FAO, 1995).

At the farm level, short term solutions to minimise losses to diseases include emergency harvests at the first sign of disease. The disadvantage is that shrimp harvested early naturally fall into the smaller end of the market with lower market prices. The use of antibiotics to control bacterial infections was widespread in the shrimp industry, but efficacy is falling as resistance develops and residues threaten export markets. Furthermore, antibiotics are of little use against viral infections and may even aggravate the problem.

With losses of this magnitude, research into potential solutions has also intensified. Whilst disease control in finfish aquaculture has been revolutionised by the use of routine vaccination, this is not feasible in prawn farming at present, and may not be possible at all. Thus, in-feed supplements including antibiotics, probiotics, immunostimulants and lately, nucleotides have all been investigated and adopted to varying

degrees with equally varying success rates. In-feed solutions not only have the potential to improve disease resistance, but also to promote growth. The accelerated growth rates achieved also raises the prospects of producing larger sized shrimp commanding higher values at market, shortening the grow out period and reducing the opportunity for development of viral and bacterial infections.

Limitations of traditional immunostimulants

Commercial in-feed immunostimulants rely on the activation of PRRs and the associated antimicrobial cascades. Lipopolysaccharide, glucans and peptidoglycan have been widely studied and are available as commercial dietary immunostimulants. All of these immunostimulants reportedly result in a typical process; degranulation of the semi-granular and granular haemocytes, thus activating the immune systems "fuel stores" – the prophenoloxidase and peroxinectin systems, which, in turn, elevate the levels of toxic reactive species (anti microbial factors) present in the hemolymph and hemocyte populations.

However, the immunostimulatory effect of glucans and peptidoglycan on shrimp is limited. In a review, Smith et al., (2003) said that it may also be detrimental. They highlighted the lack of statistical rigour in testing the immunostimulants and speculated on possible reasons for detrimental effects of immunostimulatory feed additives. Under normal circumstances, the immune system of all animals is tightly controlled to prevent damage to the host animal. It is only activated in the

The invertebrate immune system

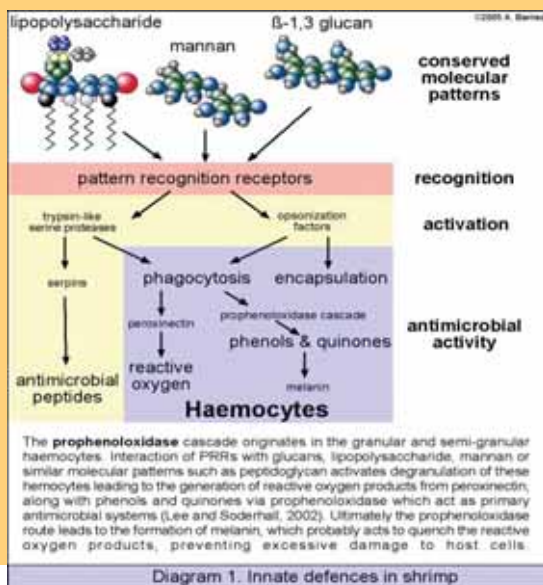
When discussing the immune system in aquatic animals there are two terms that need to be defined. These are 'specific' or 'adaptive' and 'innate' immunity. Adaptive is where an animal develops its immune system to combat a specific pathogen. For example, vertebrates such as fish may produce antibodies in response to the presence of a pathogen. This is the simplest method by which vaccines work. Vertebrates have an immune memory, which allows the animal to 'remember' a previously encountered pathogen and respond more rapidly and with greater magnitude on future exposure. However, the presence of a specific immune memory in shrimp is still in dispute (Venegas et al., Wittefeldt et al., 2004a,b).

It is known that invertebrates have a highly evolved innate immune system. This innate immune system does not seem to induce any form of immune memory. It is triggered identically each time the same molecular pattern is encountered by the animal. The system is characterized by a pattern recognition system that causes a cascade of cellular signals resulting in the release of antimicrobial factors (Hoffman et al., 1999, see diagram 1). It is this innate system that is activated by the presence of invading pathogens.

In any immune system, there is the ability to distinguish between an invading pathogen and those cells belonging to the animal itself. Microorganisms have conserved molecular structures associated with their cell walls or present during their replication that are not generally found in their hosts. It is these patterns that the immune systems of higher animals recognise. The patterns act like an early warning system to alert the animal that a pathogen or other non-self entity is present.

Such molecular sign-posts or patterns include cell wall components such as β 1,3 glucans from yeasts, peptidoglycans, mannan and lipopolysaccharide from bacteria and from the processes of viral replication (double stranded RNA). None of these patterns are found during the normal lifecycle of the host and should only be present during infection.

Specialised receptors (Pattern Recognition Receptors - PRR) within the shrimp interact with these patterns and activate a cascade of reactions involving stimulation of phagocytic cells and generation of toxic agents to eliminate the invading pathogen. In essence, pathogens and their conserved molecular patterns activate the synthesis of antimicrobial substances by the shrimp. Critical components of key antimicrobial pathways are generated from a 'fuel' stored as granules within the hemocyte cell populations (Lee and Soderhall, 2002, Smith et al., 2003).



continuing presence of pathogens or what the host sees as non-self patterns. Activation in the absence of disease-causing agents can result in auto-immune defects such as damage or rejection of self tissues, nutritional disorders and allergies.

More specific studies have also shown detrimental effects of immunostimulants. Following immersion of post-larval shrimp (*Penaeus monodon*) in aerated beta-glucan suspensions, concentrations of 1 and 0.5 mg/ml of beta-glucans offered protection against *Vibrio vulnificus* the first 10 days. However, more prolonged exposure after 43 days showed that survival controls was higher than that in the group exposed to glucans (Sung et al., 1994). A similarly, marked decrease in survival was observed by Scholz et al. (1999) after feeding juveniles of *P. vannamei* with glucan-supplemented diet for 7 weeks compared with controls.

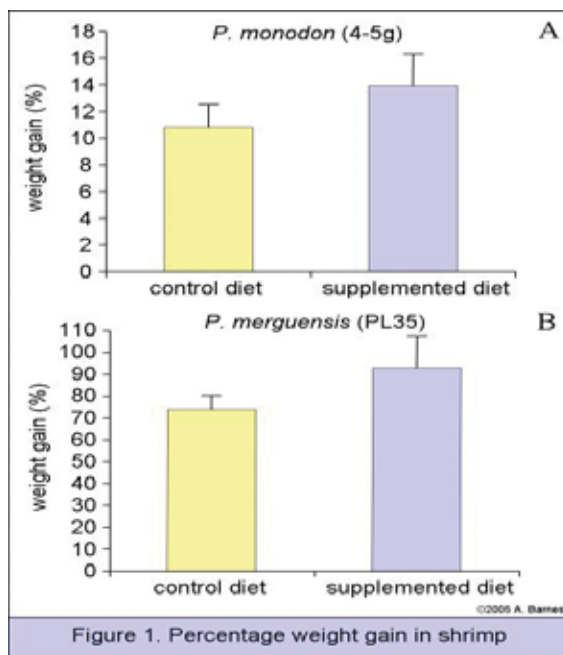
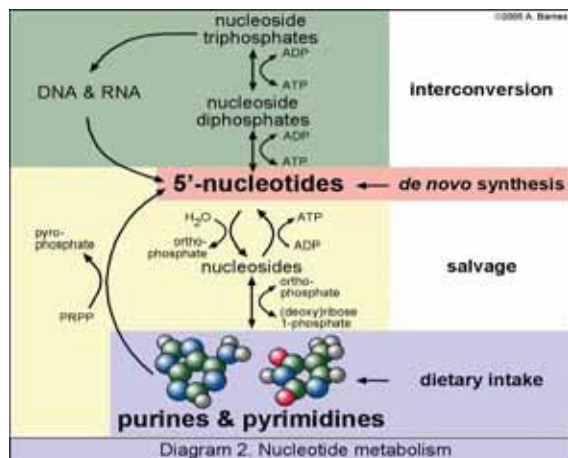
Chang et al. (2000) suggested that the administration of β 1, 3-glucan diet must be limited to 3 weeks, after which they reported a clear decrease in reactive oxygen production by haemocytes, a key component of the shrimp's defence against invading organisms, which may explain increased susceptibility to disease. In simple terms, the prolonged presence of molecular patterns activating antimicrobial processes, 'crying wolf' in the absence of a genuine threat, may result in depletion of the 'fuel' required for a rapid response when infection is present.

Dietary nucleotides

Nucleotides are typically derived from the "insides" of yeast cells, being phosphorylated N-glycosides derived from nucleic acids that reside in the cells core. By contrast, glucan and mannan products are derived from the "outside" cell wall of yeast cells. Nucleotides and their derivatives are multifunctional in nature; they are used for short-term energy storage, for intra- and extra-cellular signalling, as enzyme cofactors, and for the synthesis of DNA and RNA.

Nucleotide metabolism and synthesis is complex, but is reviewed by Zalkin and Dixon (1992) and summarised in diagram 2. Availability of nucleotides may be rate limiting in rapidly dividing tissue. In juvenile animals *de novo* synthesis is insufficient to meet requirements and in the immune system whose cells are not able to synthesise nucleotides (Quan, 1992) and where the onset of cell proliferation is integral to the rapid response to a pathogen. It can be envisaged, therefore, that addition of the correct balance of purines to the diet can ameliorate this situation at critical stages of growth or during immune response.

In fish, non-specific and specific humoral immune responses may be markedly enhanced. Sakai et al (2001) reported increased phagocytic activity and respiratory burst in common carp fed purified nucleotides from yeast RNA. They also noted increased clearance and thus reduced infection of *Aeromonas hydrophila* from experimentally infected carp that had been fed nucleotides, compared to controls (Sakai et al., 2001).



Similar observations have been reported in farmed Atlantic salmon (*Salmo salar*) with improved seawater transfer including better osmoregulation, growth rates and immune response. Vaccination efficiency and disease resistance were also increased (Burrells et al., 2001a, b).

In turbot, *Scophthalmus maximus*, elevated secretion of IgM was noted in the spleen and gills, but decreased in the kidney. This was mirrored by RAG-1, a gene involved in somatic recombination associated with antigen receptor recognition (Low et al., 2003), also essential to humoral adaptive immunity. The authors (Low et al., 2003) speculated that nucleotides may have a more a more pronounced effect in the peripheral sites such as the gut associated lymphoid tissues (GALT), as retained dietary nucleotide has been found associated with gastrointestinal tissues (Mosley and Klein, 1992). This may be of particular relevance where there is a known oral route of infection as proposed for *Streptococcus iniae* in barramundi *Lates calcarifer* (Bromage et al., 2001).

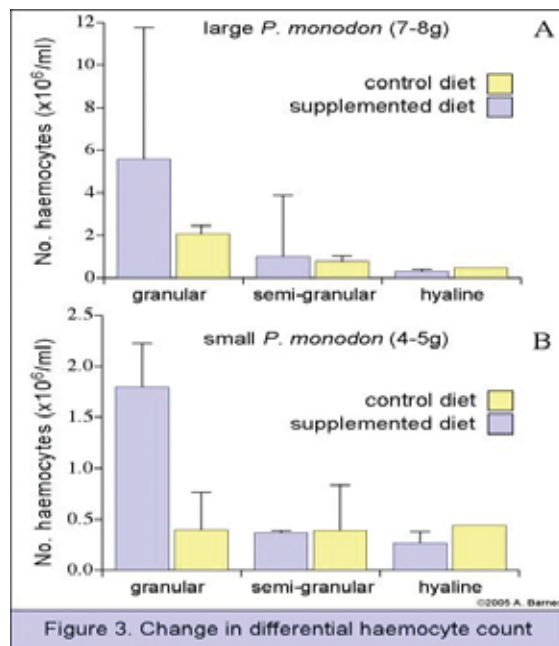
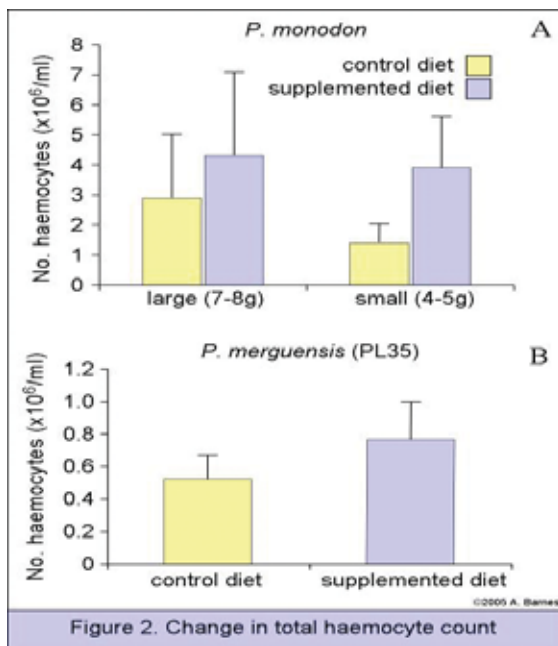
Effects on shrimp

Nucleotides, therefore, offer a potentially promising and easily applicable solution to problems encountered by shrimp growers. We investigated the effect of dietary nucleotide supplements in feeding trials in tiger shrimp, *P. monodon*, and banana shrimp, *P. merguensis*. In common with other studies on invertebrate immunity, we found high variability amongst individuals and set about designing trials to account for this diversity amongst individuals within a population.

Diets were prepared from commercial prawn feed mash. In test diets, highly purified nucleotides (Vannagen, Chemoforma, Switzerland) were incorporated at an inclusion rate of 0.2% into the mash with minimal water. Control diets were reconstituted in an identical manner, omitting the nucleotides. The diets were pelleted using a commercial mixer/mincer, steamed at 110°C for 5 min and dried at 60°C. The dried diet was finished to a uniform size, depending on the size of the animals under investigation, using a blender and sieve.

In each experiment, there were six replicate systems per diet, each containing 10 animals. Mean growth, total haemocyte count and differential haemocyte count were analysed per replicate treatment 6 weeks after commencing trials. Growth rate increased in small shrimp when fed supplemented diets for a 6 week trial period (Fig 1).

We observed increased mean growth rates in all six replicate tanks



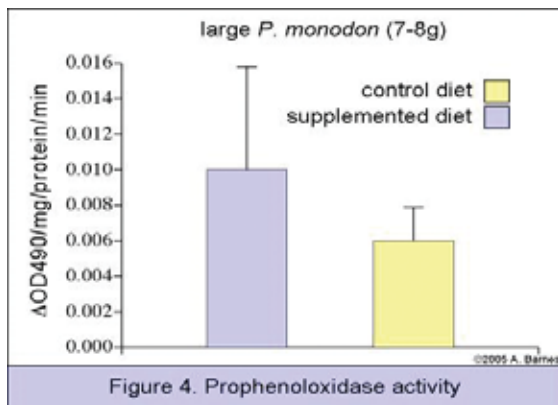
of both *P. monodon* and *P. merguensis* fed the nucleotide-supplemented diets. However, due to high variability between individual animals we could not say that the effect was statistically significant ($P=0.12$).

The haemocyte counts provided more conclusive support for effect of nucleotide supplemented diets. In both small and large shrimp, total haemocyte counts increased in shrimp fed the nucleotide supplemented diets compared to shrimp fed control diets (Figure 2). This effect was seen in both *P. monodon* (Figure 2a) and in *P. merguensis* (Figure 2b).

The haemocytes are key cells for mopping up invading pathogens, so this result is commercially important. Again the effect was more pronounced in juveniles with increases in total haemocyte counts of more than 100% and this may be expected given that nucleotides will be in high demand in rapidly growing animals. In larger shrimp the effects were also notable. There were increases in total haemocyte count per ml of haemolymph up to 30% higher in test subjects as compared to controls.

The increase in haemocyte number was almost entirely due to vast increase in numbers of granular cells in nucleotide-fed shrimp compared to controls (Figure 3), and was replicated in groups of shrimp with high initial weight (7-8g, Figure 3a) and low initial body weight (4-5g, Figure 3b). This is particularly relevant as the granular and semi-granular haemocytes are reported to contain the 'fuel' required for both the oxidative and prophenoloxidase defence cascades.

The impact of nucleotides on these processes was further corroborated by replicated, but not statistically significant, increases in prophenoloxidase activity amongst isolated haemocyte populations from nucleotide supplemented shrimp compared with controls (Figure 4).



Haemocytes isolated from replicate (6) test animals and 6 controls were standardised for cell number using a haemocytometer and the ProPO cascade was initiated by addition of laminarin.

Conclusion

Thus our results (standardized per haemocyte), indicated greater specific activity per cell. Coupling these data with the observed increases in cell number the results become more pronounced. This raises the very real prospect of shrimp being more resistant to disease when fed nucleotide-supplemented feeds.

It also suggests that it may be less risky to use traditional PAMP-based immunostimulants such as β 1,3-glucans for longer periods if shrimp are also routinely fed nucleotides, as the reserves of fuel for the immune cascades would appear to be significantly higher.

Acknowledgements

The authors would like to thank Chemoforma, Switzerland for their support and supply of Yannagen nucleotide supplement. We also thank Simon Tabrett of CSIRO Marine Research, Cleveland, Queensland, Australia for assistance in preparing trial diets; Gold Coast Marine Aquaculture for supply of animals; Dr Ian Andrew, Queensland Centre for Clinical Trial Design, Princess Alexandra Hospital, Brisbane, Australia for statistical advice. Shrimp feed mash was supplied by Ridley Aquafeeds.

References are available on request from the editor.



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Probiotics versus prebiotics-clarifying the confusion



Dr Joachim Hertrampf

The era of antibacterial performance promoters (antibiotics as feed additive) is more or less something of the past. For about 60 years the world-wide animal production industry has used antibiotics, obtained good results and was satisfied. Nevertheless, the mode of action of antibiotics as feed additive was never really understood. Although this was never properly established, feed antibiotics were efficient.

Perhaps due to other rather than scientific reasons, these feed additives have been banned or are on the way to be banned in most countries. The industry is searching frantically for suitable replacements of antibacterial growth promoters.

For more than 30 years, numerous types and brands of "probiotics" are in the market. However, these substances have not been successfully used. This is because available data are not convincing, either using probiotics as additive for aquaculture feed or for water treatment in aquaculture farming. There is also a lack of information of the mode of action of probiotics. By using feed antibiotics the mode of action was not clear but the effect by using them was visible - with regard to probiotics both matters are rather confusing than clear.

In the May/June 2005 issue (page 15), I read with interest the brief note on "Prebiotics in aquaculture". I am thus encouraged to write this letter. For many, the term "prebiotics" has been used in many technical magazines. However, so far I have not found a clear explanation of the difference between "probiotics" and "prebiotics". Are prebiotics more efficient than the former? Is the thermo-stability improved? Is the mode of action established?

These are some of the questions which I am sure many readers of the magazine would also like to be enlightened about—the differences between probiotics and prebiotics.

Dr. Joachim W. Hertrampf, Kuala Lumpur. (received on 16 June 2005)
Email: trampf@tm.net.my

The Reply

Fructo-oligosaccharides are thermo-stable carbohydrates (120° C, 20 min), naturally present in a number of vegetables and cereals. They belong to the family of prebiotic compounds. Prebiotics are selectively fermented ingredients that allows specific changes composition and/or activity in the gastrointestinal microflora that confers benefits upon host wellbeing and health (Gibson et al., 2004). In contrast to probiotics, yeast or bacteria that are not necessary usual inhabitant of the gastrointestinal tract, prebiotic compounds have an action through the natural flora of the animals. Scientific studies in different species showed that they are able to promote the growth of bifidobacteria and lactobacilli, which induce a higher production of volatile fatty acids within the lumen and a decreased growth of the potentially pathogenic bacteria.

Ms Frederique RESPONDEK
Feed Unit Scientific Manager, Beghin-Meiji
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Efficacy of VSH, VSLP, on the Performance in Fish and Shrimp

Trial in Hybrid catfish
Total weight gain (g)

Treatment	Total weight gain (g)
Control	88.8
VSH	105.0
VSLP	105.8
VSH+VSLP	125.8

Trial in Penaeus vannamei
Feed conversion (feed/gain)

Treatment	Feed conversion (feed/gain)
Control	1.88
VSH	1.88
VSLP	1.73
VSH+VSLP	1.66

Trial in Sea-Reversed Nile Tilapia
Highest weight gain Total weight gain (g)

Treatment	Highest weight gain Total weight gain (g)
Control	88.8
VSH	105.0
VSLP	105.8
VSH+VSLP	125.8

Trial in Penaeus monodon
Highest weight gain Total weight gain (g)

Treatment	Highest weight gain Total weight gain (g)
Control	1.88
VSH	1.88
VSLP	1.73
VSH+VSLP	1.66

VSLP = Vet Soy Lac P, VSH=Vet Soy Hydrolyse, DEBM=Dehulled Soybean meal fermentation from Taiwan

The nutritive value of hydrolysed dehulled soybean meal for postlarvae of marine shrimp

By Jowaman Khajareern, Aruneepong Srisathaporn, Sarote Khajareern, Winai Jaikan, Pornchai Jaruratjamorn and Adilak Lebnark*

Thai researchers investigated the effects of three pre-processed dehulled soybean meal, produced in Thailand, on the growth performance of postlarvae black tiger shrimp *Penaeus monodon* and white shrimp *P. vannamei*. They concluded that the best growth was obtained for shrimp fed diets with dehulled soybean meal hydrolysed by proteolytic enzymes, followed by that hydrolysed by a combination of phytase and *Lactobacillus*.

Crustacean and fish diet formulation are generally based on high protein raw materials such as fish meal. The potential high cost of fish meal and occasional lack of supply are reasons for a strong interest in the use of oilseed protein sources especially soybean meal.

The use of biotechnology by using beneficial bacteria and enzymes in pre-processing dehulled soybean meal offers some advantages. These include the enhancement and more constant nutritional characteristics of the product. It can also provide for predigestion of the ingredient to improve digestibility. There is the production of organic acidifier (lactic acid) for enhancing the digestive enzymes and to inactivate the antinutritional compounds in the gut of the animal.

In these series of experiments, five isonitrogenous and isocaloric diets were prepared to contain 45% protein and 3,066 kcal kg⁻¹ metabolizable energy (ME). The control diet contained 15% soybean meal and in each of the test diets (T2-T5), 15% of the soybean meal was replaced with 10% of each pre-processed dehulled soybean meal sources (Table 1). Diets were prepared and stored as described by Lim and Dominy (1992).

Four different sources of dehulled soybean meal sources were used. Vet Soy-Lac (VSL) is a dehulled soybean meal fermented with *Lactobacillus*, Vet Soy-LacP (VSLP) is a dehulled soybean meal fermented by *Lactobacillus* in combination with the enzyme phytase and Vet Soy Hydrolyse (VSH) is a dehulled soybean meal fermented with proteolytic enzyme. All three ingredients were produced in Thailand. These were compared with a soybean meal fermented with *Lactobacillus* from Taiwan.

Experimental procedures

Post larvae of *Penaeus monodon* and *P. vannamei*, were obtained from a commercial shrimp farm and acclimated to laboratory conditions for 3 days. During this period, they were fed a commercial feed six times daily. After acclimatization, shrimp were selected and stocked into glass aquaria. (Table 1). Three aquaria arranged in a randomized complete-block design, were assigned to each of the experimental diets. Aquaria containing artificial seawater were provided with tight-fitting netting covers and continuous aeration. Each test diet was fed to satiation six times daily for 4 weeks. The quantity of feed consumed per aquarium was measured daily.

All aquaria were cleaned daily in the morning by siphoning out accumulated waste materials. Feed wastage was also recorded.

Table 1. Composition of the experimental diets.

Ingredients	T1-Control	T2	T3	T4	T5
Wheat flour (13% CP)	13.0	13.0	13.0	13.0	13.0
Fish meal (72% CP)	41.0	41.0	41.0	41.0	41.0
Dried fish soluble (69%CP)	2.0	2.0	2.0	2.0	2.0
Shrimp shell meal (30% CP)	6.0	6.0	6.0	6.0	6.0
Squid liver meal (48%CP)	3.0	3.0	3.0	3.0	3.0
Soybean meal (44%CP)	15.0	4.0	4.0	4.0	4.0
Broken rice (7.5%CP)	8.8	8.8	8.8	8.8	8.8
Rice bran (12.5% CP)	4.0	5.0	5.0	5.0	5.0
Squid meal (78% CP)	2.0	2.0	2.0	2.0	2.0
Squid oil	2.0	2.0	2.0	2.0	2.0
Soybean oil	1.0	1.0	1.0	1.0	1.0
Lecithin	0.1	0.1	0.1	0.1	0.1
Monocalcium phosphate (P21%)	1.0	1.0	1.0	1.0	1.0
Vet Soy-Lac (VSL)*	-	10.0	-	-	-
Vet Soy-LacP (VSLP)*	-	-	10.0	-	-
Vet Soy Hydrolyse (VSH)*	-	-	-	10.0	-
DSBMF**	-	-	-	-	10.0
VitaminC	0.1	0.1	0.1	0.1	0.1
Vitamin-mineral premixesa	0.1	0.1	0.1	0.1	0.1
Calculated composition					
Crude protein, %	45.15	45.23	45.23	45.23	45.23
ME, kcal / kg	3,066	3,069	3,069	3,069	3,069

^a Supplied the following (mg kg⁻¹ diet): vitamin A, 80000 IU; vitamin D3, 2000 IU; vitamin E, 200; vitamin K, 20; thiamin, 60; riboflavin, 60; pyridoxine, 100; pantothenic acid, 150; niacin, 300; biotin, 2; folic acid, 20; vitamin B12, 0.1; inositol, 300; ascorbic acid, 600; choline chloride, 3000 Salt mixture, 2512; CaHPO₄•2H₂O, 35.80; K₂HPO₄, 16.30; NaCl, 9.0; MgSO₄•0.6•ZnSO₄•7H₂O, 0.17; KI, 0.006; NaSeO₃, 0.001; CoCl₂•6H₂O, 0.002.

* Vet Superior Consultant Co., Ltd, Thailand

** Dehulled soybean meal fermentation from Taiwan

Mortality was observed and dead shrimp were immediately removed and recorded. Water temperature, salinity and pH were measured in three randomly selected aquaria two times per week.

Shrimp in each aquarium were counted and weighed at two weekly intervals. When shrimp were removed, the aquaria were thoroughly cleaned, drained and refilled. On sampling days, shrimp were fed once in the afternoon with 60% the amount of feed consumed the previous day to minimize cannibalism.

Data for all variables were analyzed by using GLM procedure of SAS (1985). Duncan's Multiple Range Test (Duncan, 1955) was used to determine treatment difference. All statements of significant are based on the probability level of 0.05.

Growth of *P. monodon*

The average final weight gain, feed conversion and survival of shrimp fed diets containing different sources of pre-processed dehulled soybean meal are presented in Table 3. Shrimp fed diet T4 had the highest weight gain and lowest feed conversion (the best feed efficiency) which were significantly higher ($P < 0.05$) than those of shrimp fed

Table 2

Post larve	<i>P. monodon</i>	<i>P.vannamei</i>
Initial weight	28.1± 0.5 mg	3.8± 0.05 mg
Tanks volume (l)	28	28
Water volume (l)	20	20
Stocking density (nos)/tank	50	100
Duration of trials	4 weeks	4 weeks

the control diets. The mean weight gain of shrimp fed diet T3 was the second highest and diet T5 was third highest but was not significantly different ($P>0.05$) from that of the shrimp fed the diet with dehulled soy bean meal fermented by *Lactobacillus* in combination with enzyme phytase (Diet T3).

No significant differences were found among the survival rates and average total weight gain of shrimp receiving the four different sources of pre-processed dehulled soybean meal. Shrimp fed control diet with soybean meal (T1) had the lowest weight gain and the highest feed conversion or the poorest feed efficiency. This suggested that it is necessary to pre-process soybean meal to remove or inactivate the antinutritional compounds and digest fiber of the hull and improved palatability before the meal can be used in feeding shrimp or fish during the early stages.

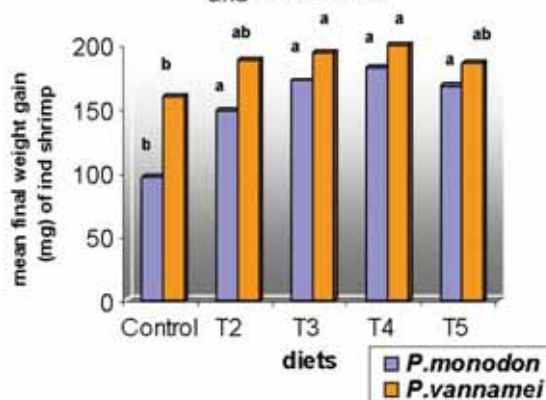
Growth of *P. vannamei*

The average final weight gain, feed conversion and survival rate of shrimp fed diets containing different sources of pre-processed dehulled soybean meal are presented in Table 4. Shrimp fed T4 had the highest weight gain and best feed efficiency which were significantly higher ($P<0.05$) than those of shrimp receiving the other diets. The mean weight gain of shrimp fed diet T3 was the second highest and diet T2 was the third but was not different ($P>0.05$) from that of the shrimp fed the dehulled soy bean meal fermented (Diet T5) from Taiwan. Percent survival range from 62 to 67%.

Conclusion

These results demonstrated that the use of hydrolytic enzymes in pre-processed soybean meal can enhance the nutritive value of the product of soybean meal. It also provides for better digestibility and removes or inactivates antinutritional compounds. It has a growth enhancing effect on shrimp postlarvae. Dehulled soybean fermented or hydrolysed,

Growth performance of diets on *P. monodon* and *P.vannamei*



offers a way to increase the use of plant protein sources in feeding post larvae shrimp.

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A list of references is available on request



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Table 3. Effect of four different sources of pre-processed dehulled soybean meal on weight gain, feed conversion and survival of *Penaeus monodon* in a 4 week feeding trial

Diets	Mean final weight gain (mg) of individual shrimp	Total weight gain (g)	FCR	Survival %
T1-Control	96.61b	5.51b	2.00a	38
T2	148.45a	8.76a	1.65b	39
T3	171.83a	10.65a	1.45b	41
T4	181.89a	10.55a	1.39b	38
T5	167.36a	9.04a	1.53b	36

a-c Means with different letters in the same column are significantly different ($P<0.05$)

a Values reported are means of three replicates

Table 4. Summary on the effect of different sources of pre-processed dehulled soybean meal on performance of *P. vannamei* postlarvae in a 4 week feeding trial

Diets	Mean final weight gain (mg) of individual shrimp	Total weight gain (g)	FCR	Survival %
T1 -Control)	158.98b	29.89	1.85a	62.67
T2	187.92ab	35.70	1.80abc	63.33
T3	193.52a	38.51	1.72bc	66.33
T4	199.80a	40.16	1.69c	67.00
T5	185.32ab	36.32	1.82ab	65.33

a Values reported are means of three replicates.

a-c Means with different letters in the same column are significantly different ($P<0.05$)



At World Aquaculture 2005, Bali Recognising the international role of aquaculture

It was an international gathering of stakeholders in the industry at the annual World Aquaculture 2005 conference and trade show, held from 9-13 May in Nusa Dua, Bali. According to the organisers, the World Aquaculture Society and the Indonesian Ministry Marine Affairs and Fisheries, some 3,000 participants from 87 countries attended the trade show and conference, despite travel warnings issued by American and Australian authorities as well as rumours that an earthquake and tsunami were imminent. However, visibly absent were the usually vast contingents from Thailand, Philippines and China.



The theme was "International Peace and Development through Aquaculture" and for the first time in the history of the conference, it was opened by a head of state. In his opening address, President Susilo Bambang Yudhoyono of Indonesia said that the focus of Indonesian aquaculture is not only to improve its performance but to increase its contribution to the economy and its social role. He also thanked organisations linked with the society which have worked hard at helping tsunami victims reconstruct their lives in Aceh.

The plenary speaker was Dr George Chamberlain, President of the Global Aquaculture Alliance who reviewed shrimp farming in the region. Reminiscing through the years, from 1996 when shrimp aquaculture was then threatened by NGOs questioning the sustainability of shrimp culture, to the present, George said that we have moved ahead. There have been improvements in disease management, shrimp becoming a commodity with an annual growth in production at 15-20% globally and consolidation and integration of the industry. "As now we have to contend with market protectionism, our value to the industry is when we are 'stronger together than in competition,'" he added.

The conference which spread over four days had 10-15 concurrent sessions, covering the numerous aspects of aquaculture. The FAO/NACA/WAS workshop on aquaculture management practices was well attended. The session was chaired by Dr Rohana Subasinghe, FAO and Dr Mike Philips, NACA and the presentations included an overview of the marine finfish aquaculture in the Asia Pacific region by Dr Mike Rimmer, shrimp in China by Dr Wang Qinyin and as well as several other presentation on market issues.

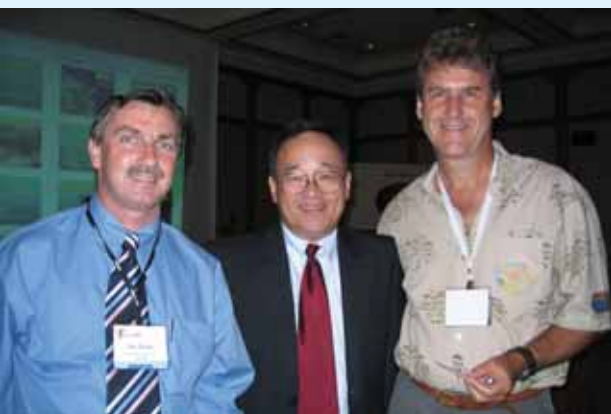
Concurrent with national and regional interests, it was obvious that the highly frequented presentations were those on general shrimp production and shrimp biosecurity and health management. Presentations by industry leaders with novel methods of culture drew crowds. Interests were also on new developments in marine fish hatchery and grow out production.

Indonesian farmers' session

It was standing room only at the session on shrimp production. Dr Dean Akiyama, Senior Vice President, Aquafeed Technology at CP



The audience



Dan Fegan, Dean Akiyama and Werner Jost

Indonesia chaired the session which was sponsored by PT Centralpertiwi Bahari (CPB), part of Charoen Pokphand Indonesia (CPI). The audience was an international mix, although the majority comprised Indonesian farmers. Translation services were provided.

Dr Nyan Taw from the CPB technology team gave an overview of industry in Indonesia. The production is expected to reach 213,000 tonnes in 2005. In Indonesia, farm sizes and culture systems vary. Conventional technologies are used for *P. monodon* culture whereas there have been adaptations to new technologies with *P. vannamei* culture. At present these range from simple conventional to zero water exchange (bacteria floc) systems with high inputs of aeration.

Based on their work in the module style ponds in Lampung, South Sumatra, Nyan gave some figures on yields. Ponds are 0.5ha in size with sedimentation ponds for affluent water. Each module comprises of 40 to 60 ponds and six ponds are reservoir ponds. Pond are either semi or fully lined with HDPE. Zero water exchange is practised which ensures biosecurity and traceability.

In the selection of postlarvae, the criteria used is postlarvae 10 (PL10) *P. vannamei* of 8mm and PL12 of *P. monodon* of 10 mm and tested free of TSV (Taura syndrome virus) IHNV (Infectious hypodermal and hematopoietic necrosis) and WSSV (white spot syndrome virus).

The performance of 14 HDPE lined ponds in Lampung indicated that productivity per ha of *P. vannamei* can reach 10.9 tonnes/ha with an average daily growth (ADG) of 0.16g/day with harvested weight of 17.6g. The survival rate was high at 93% with stocking at 62 PL/m². With *P. monodon* cultured in 10 ponds, results showed yields of 4.2 tonnes/ha of 23g shrimp with an ADG of 0.19g over 120 days and at a stocking density of 37 PL/m². Survival was 48%.

In *P. vannamei* culture, he said that for a sustainable production, the stocking density was 60-80 PL/m² and production ranged from 8 to 12 tonnes/ha of 16-20g shrimp. In the case of *P. monodon*, the assumption would be a stocking density of 40-60 PL/m². Survival is estimated at 50% and the harvest range from 4 to 6 tonnes/ha of 20-25g shrimp. However, high density culture of *P. vannamei* which incurred high energy inputs, resulted in 14-18 tonnes/ha of 14-18g shrimp at a stocking density of 100-150 PL/m².

Increased pond productivity was achieved with partial harvesting. The yield increased to 25-35 tonnes/ha of 12-20g shrimp when stocking density was increased to 200-260 PL/m². With bacterial floc coupled with increased biosecurity and production efficiency, yields increased to 20-24 tonnes/ha of 17-20g shrimp and their record was 49.7 tonnes/ha. Stocking density was 130-150 PL/m².

Brazil's industry

The situation in Brazil was presented by Werner Jost, Director of Camanor Produtos Marinhos Ltda who is a 28 year veteran in the industry. The increase in shrimp production in Brazil has been phenomenal and it took the country 5 years to achieve the 90,000 tonnes level in 2003 from the 1998 level of 10,000 tonnes. Two northern states contribute 80% to this production. However, a decline in production occurred in 2004. The industry has been plagued by disease since 1982. It was IHNV in 1982, TSV in 1994, NHP (Necrotizing Hepatopancreatitis) in 1996, IMNV (Idiopathic Muscle Necrosis Virus) in 2003 and lastly WSSV in 2004.

In comparison with Asian countries, the industry is less fragmented. Large and small farms share the same level of technology with similar yields. Big farms are more than 50ha in size and small farms are 10ha in size. In general yields are 12.5 tonnes/ha of 12-13g shrimp at a stocking rate of 40 PL/m² and with 70% survival. There are 2.5 cycles per year and FCR range from 1.4 to 1.8:1.

Feeding is 2-3 times per day with feeding trays. The advantage of feeding trays is the control of feed consumption but its disadvantage is that it is labour intensive. Feeding is only possible during daylight hours, vulnerable to human error as well as to strong winds and waves. It is, however, a better alternative to broadcasting where the wastage contributes to high levels of sludge.

The main challenge for the industry in Brazil is to maintain its competitiveness. It still has the advantage of cheap land, relatively low salaries, few diseases and good infrastructure and cheap energy at 0.04 US\$/kWh. Negative aspects are the labour laws, inefficient legal systems and negative image on environmental issues although there are already mangrove recovery programmes. Large farms are also difficult to manage. Lastly, Werner said that Brazil producers has the capacity to produce large volumes of shrimp but is not cost competitive at USD 3.58/kg. He concluded that the industry is in a consolidation process and he does not expect volumes to increase. The challenge for the industry is to change from a farming activity to an industrial process with predictable production cycles.



Members of the Shrimp Club Indonesia, from left, Wira Cahyadi (Bali), Prajadi Agus Winakto (Lombok), Nefo Ng (Lombok), Setyawan (Bali) and Iffa Suraiya, executive secretary.



At the Institute of Aquaculture, Stirling University get together, from left: Dr Johannes Hutabarat, Diponegoro University, Semarang, Indonesia, Syamsul Akbar, Head, Aquaculture Research Centre, Batam, Indonesia, Dr Mohan, India and Dr Carlos A Martinez Palacios, Director, Mexico, Darwin Initiative.

Dan Fegan, current President of the World Aquaculture Society and Technical Manager for Aquaculture, Alltech Biotechnology reviewed some trends in Thailand's shrimp production industry. In general, he said that there is an ongoing consolidation of farms. Feed companies are playing more important roles. Core groups of farmers have formed associations with the objective of ensuring that "Thai shrimp is well marketed". However, health management is lead by the government as farms are generally small and operators have diverse educational standards.

The industry has suffered from yellow head virus (YHV) in 1992 and WSSV since 1996 affecting the then black tiger shrimp culture industry. This pushed culture to that of the white shrimp in 2002.

Dan looked at practical biosecurity. In biosecurity, measures range from simple ones such as closed or low water exchange to high level biosecurity with specific pathogen free breeding programs. He questioned the level of exclusion required in a particular farm situation. Should this be only 50% or 100%, as then it is important to consider the cost of biosecurity measures against the cost of the threats.

Thus, he said that the level of biosecurity depends on the disease threats. For example, in the case of MBV infections, the impact on production is low. On the other hand, the adoption of preventive

measures has reduced the threats from WSSV in many farms.

In Asia, the option was also in species selection. This was made possible by opportunities offered by *P. vannamei* shrimp which is well domesticated with SPF and SPR shrimp. Dan clarified that SPF shrimp are specially bred in high biosecurity conditions and constantly screened and selected to eliminate specific pathogens whereas specific pathogen resistant (SPR) shrimp are selected from lines of SPF shrimp that have shown better survival to specific pathogens in challenge tests.

Overall, the route to control disease threats is from biosecurity in broodstock to equipment in the farm to staff training. Farm workers have to be well trained to detect diseases and understand the essence of biosecurity. In all, it is important to know that biosecurity on a single farm is less effective than taking a joint approach.

Dr George Chamberlain, President of the Aquaculture Global Alliance presented innovations in *P. monodon* production technology based on his 5 years of experience operating a farm in Malaysia's East Coast. As WSSV is a major limiting factor in the production of black tiger shrimp, the initial challenge was to eliminate WSSV and other viral disease affecting growth rate and size uniformity. The team looked at different growth rates of the shrimp and correlated with incidences of viral infections. The implementation of screening of postlarvae together with PCR reduced the risk of diseases. This was followed by the adoption of pond management techniques which included zero water exchange and water filtration with fine filter.

The next step is the use of SPF stocks for a breeding program with fast growth as the main criteria. This required laboratory facilities complete with PCR diagnostic equipment and primary and secondary quarantine facilities, which are separated from hatchery and grow out facilities. In the selection process to develop SPF families, tests are conducted at 15 day intervals on stocks and disease free shrimp are then moved to secondary quarantine facilities for maturation and consequently, larval rearing and grow out in new maturation ponds.

In preliminary trials with genetically selected stocks, George said that growth performance has increased with the use of postlarvae which have been screened for diseases. Growth was 1.07g/week in comparison with earlier figures of 0.93g/week and survival rates were 71%. Pond harvest reached 5.4 tonnes/ha due to the higher survival rates. He concluded that developing SPF programs is an ongoing journey which will give improved performances. However, a new challenge is the monodon slow growth syndrome which is already in Malaysia and Indonesia. (See this issue, pp14-15)

Biosecurity as management tool in a large farm

In the session on shrimp biosecurity and health management, Dr Bambang Widigdo, PT Centralpertiwi Bahari (CPB) presented information on biosecurity as a recent management tool to prevent disease outbreaks in Indonesia. He said that the shrimp culture industry in Indonesia has been affected by outbreaks of MBV (1990-1993) and since 1996, WSSV. Outbreaks of TSV in East Java due to the movements of non SPF broodstock have been reported since the second half of 2002. The impact has been a drastic decline in production to less than 70,000 tonnes for the 2000/2001 period and 90% of more than 350,000 ha of shrimp ponds abandoned. Today, TSV remains as the most serious disease in the region of West and Central Nusa Tenggara, Bali and Banyuwangi in East Java while the

other regions continue to be dominated by WSSV.

A biosecurity program was initiated in 2002 at the CPB integrated shrimp farm covering 3,500 ha of 0.5ha ponds in Lampung, Sumatra. The farm was set up in 1995. Biosecurity measures consisted of changing ponds to that based on a module design, closed recirculation to semi closed, with minimum or zero exchange system and installation of physical barriers and filter screens of 250 microns to prevent entry of virus carriers. Only selected postlarvae of *P. monodon* and SPF *P. vannamei* were stocked.

A strict control on the movement of equipment, workers and visitors was applied. The protocol for disease monitoring included the setting up of 2 net cages (4m³) at the inlet points and stocked with 100 shrimps of 10-15g. Mortality was observed daily and PCR tests were conducted when necessary. The microbial community which affects shrimp quality was monitored closely. Similarly, feed usage was measured with feeding trays.

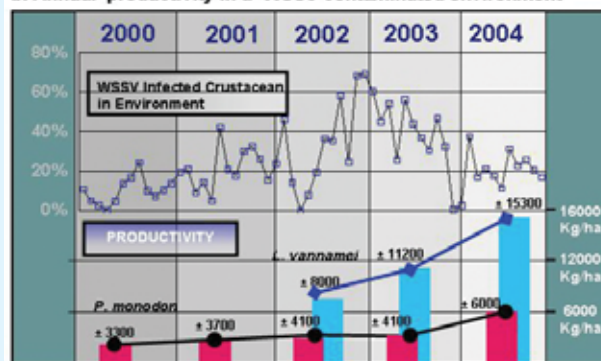
The effectiveness of such a program was demonstrated by the increase in production despite the prevalence of WSSV infected crustaceans in the environment. Yearly production of *P. monodon* increased from 3.3 tonnes/ha/crop in 2000 to 6.4 tonnes/ha/crop in 2004 at a stocking density of 35-40 PL/m². For *P. vannamei* which was recently introduced, the production reached 16.8 tonnes/ha/crop in 2004 from 8 tonnes/ha/crop in 2002.

However Bambang said that constraints remain in that the degree of complexity of any biosecurity program is related to farm size and full biosecurity implementation in large shrimp farm is impossible. Nevertheless, biosecurity measurements have been helpful to protect the farm from diseases outbreaks.

Polyculture of *P. vannamei* and *P. monodon*

Dr Nyan Taw from the CPB Technology team presented results from trials on the polyculture of *P. monodon* and *P. vannamei* in ponds in

b. Annual productivity in a WSSV contaminated environment



Lampung. Polyculture utilizes the total pond system as the two species have different habitats and feeding habits. Three trials were conducted in ponds of 0.4 to 0.5ha in size, fully lined or semi lined with HDPE. Postlarvae of *P. monodon* were selected after PCR tests and SPF postlarvae of *P. vannamei* were used.

The ratio of *P. vannamei* and *P. monodon*, were varied as detailed in Tables 1 and 2. In the trials, postlarvae of *P. monodon* were stocked initially followed by those of *P. vannamei* after a nursery phase of 21 days. In another study, they studied the effects of either stocking *P. vannamei* directly in the pond together with *P. monodon* or kept in pens or cages for a 7-day nursery period prior to release into the ponds.

From these studies, the conclusion was that two species can co exist and the optimal total density 70PL/m². In the 30:40 stocking density ratio (Table 1), *P. monodon* grew to 25.9g whereas *P. vannamei* grew to 22.7g after 127 days of culture in semi HDPE lined ponds. The culture of *P. vannamei* postlarvae in nursery pond from 7 and 21 days gave better results than direct pen and cage culture.

Table 1: Growth performance of *P. vannamei* and *P. monodon* shrimp in semi HDPE ponds (note two colours for the shrimp)

Polyculture	20:50		30:40		35:35	
	<i>P. vann</i>	<i>P. mon</i>	<i>P. vann</i>	<i>P. mon</i>	<i>P. vann</i>	<i>P. mon</i>
Days of culture	114	136	108	130	106	128
Mean body weight (g)	24.7	23.8	22.7	25.9	22.9	26.8
Survival rate %	93	83	100	90	96	99
ADG (g/day)*	0.22	0.17	0.21	0.20	0.22	0.21
Production	4,667	9,837	6,872	8,230	7,697	9,340
Total Production (kg/ha)	14,504		15,102		17,036	
FCR	1.67		1.57		1.40	

Table 2: Growth performance of *P. vannamei* and *P. monodon* shrimp

Polyculture	60:10		50:20		40:30	
	<i>P. vann</i>	<i>P. mon</i>	<i>P. vann</i>	<i>P. mon</i>	<i>P. vann</i>	<i>P. mon</i>
Days of culture	100	120	100	120	107	127
Mean body weight (g)	16.95	27.50	16.44	26.48	18.29	23.48
Survival rate %	89	97	93	98	91	84
ADG (g/day)*	0.17	0.23	0.17	0.22	0.17	0.19
Production	9,062	2,759	7,714	5,241	6,719	5,989
Total Production (kg/ha)	11,821		12,955		12,708	
FCR	1.34		1.38		1.53	

Adapted from: Nyan Taw, Saenphon Chandaeng, M. Hardoyo Edi and Wayan Suaryanto, 2005. Studies on polyculture of *L. vannamei* and *P. monodon*. Book of Abstracts, World Aquaculture 2005, Bali, Indonesia.

At World Aquaculture 2005 Trade show, Bali Biosecurity solutions from DuPont

DuPont Animal Health Solutions has announced its entry into aquaculture. The company is the creation of two acquisitions in 2003- Antec International and Biosentry, both of which are global leaders in biosecurity, especially in the pig and poultry industry.

Mark Blackwell, Global Marketing Director, himself a veterinarian, said, "Combined with the resources and reach of DuPont, we are using our more than twenty years of experience in the livestock industry and expertise to develop programs and products for the aquaculture industry".

"One of the products is Virkon Aquatic, a traditional disinfectant which has tremendous abilities to kill pathogens, viruses, bacteria and fungi. It is also environmentally friendly, creating no residue problems. For example in shrimp ponds, it is effective against white spot and taura viruses and Vibrio bacteria. In salmon, it is

effective against IPN (infectious pancreatic necrosis). Therefore it lends itself well to aquaculture", said Mark.

Mark said that the company is ready for its entry into aquaculture as it has the vast resources of DuPont and is well represented globally. For the Asian region, the company is led by Supornchai Sri-Nhonghang, Technical Manager, ASEAN based in Bangkok, Thailand.

More information: Mark Blackwell, Global Marketing Director, Tel: +44 1787 377305, Fax: +44 1787 310846 e-mail: mark.blackwell@gbr.dupont.com; Web: www.ahs.dupont.com

Shrimp disease prevention seminar by INVE

Concurrent with the release of its innovative solutions, specifically developed to support sustainable shrimp hatchery and grow-out production, INVE Aquaculture Health conducted a seminar titled "Cost-Effective INVE Solutions on Disease Prevention for the Whole Production Cycle". Some 70 farmers attended the seminar.

Recently, INVE enlarged its scope of action towards specific and preventive interactions to maintain various stages of fish and crustaceans in a state of being well and free from illness. The business unit INVE Aquaculture Health has developed a range of solutions targeting 3 areas: hygiene (Sanocare range of products), control of microbiota (Sanolife range), and enhancement of immune response and stress resistance (Sanoguard range).

At the seminar, Dr. Patrick Lavens, Business Unit Manager, INVE Aquaculture Health presented the essentials of health management. Dr. David Moriarty, Senior Microbiologist, INVE Aquaculture Health gave a very detailed and well appreciated study on the development, effectiveness and cost of true probiotics in hatcheries and shrimp farms, documented with field evaluations using INVE's innovative probiotics Sanolife MIC (for hatcheries) and Sanolife PRO (for grow out).

More information: Inve Asia Services, Tel: +66 2 960 0200 Fax: +66 2 960 0499; Email: iass@inveasia.com.th Web: www.inve.com.



Patrick Lavens and Nisarad Adsawapornwasin, Business Manager for Asia at WAS 05

Aquaculture feed technology workshop

In association with Victam Asia 2006 and supported by the Department of Fisheries, Thailand, Aquafeed.com will conduct this one-day technical workshop on March 8, 2006 at the Queen Sirikit National Convention Center Bangkok, Thailand. This will be a one-day technical workshop to help feed professionals optimize formulations and production processes to create quality aquafeeds. The target audience also includes suppliers seeking to understand the needs of their customers and feed manufacturers interested in learning more about aquatic feed processing technology

"As it is a gathering of experts in one place, industry should take advantage of some of the best in the business, start optimizing their feed operations and improve the bottom line", said Suzi Fraser, editor of Aquafeed.com.

The focus of the workshop will be on practical issues faced by aquafeed manufacturers in Thailand and the Asia Pacific region. It will also provide solutions that participants can apply to their own commercial aquafeed production to improve efficiency

and increase profitability.

There are Early Bird Specials and 10% discount for groups of 5 or more. Registration fees are as follows: Before September 30, 2005, USD 100; October 1-December 31, 2005, USD 150; January 1-March 1, 2006, USD 175. Participants must register for Victam Asia 2006. Free registration will be available online at: www.victam.com.

More information: Suzi Fraser, Email: editor@aquafeed.com; web: www.aquafeed.com

New at World Aquaculture 2005 trade show, Bali

Specialty feeds for larval shrimp and fish

Taiwan based Nice Garden Industrial Co., Ltd. introduced its Fantai series of speciality feeds for larval shrimp and fish. The shrimp flake larval feed is made of fermented ingredients for better bioavailability. It is supplemented with highly unsaturated fatty acids (HUFAs) and lecithin and is suitable throughout the larval stages from zoea to PL20. The Supertemia, an encapsulated feed with astaxanthin and spirulina, among other ingredients, is only for zoal and mysis stages. There are four particle sizes from 30-90 microns to more than 250 microns.

Their Gromate-S for shrimp and Gromate-F for fish larval are micro particulate feed produced by a brand new 'dry and wet' processing technique. Containing 57% and 55% crude protein, respectively, feed particles range from the smallest 40-80 mesh sizes to more than 250 mesh size. The feed is fortified with vitamin C and HUFAs.

At the show, the company also introduced their new product line for disease and antibiotic residue screening. The Biotex Elisa kit is for the testing of nitrofurans (AOZ) in fish and seafood at levels of 0.05 parts per billion. Also new is a white spot virus detection kit for use at a farm site.

(More information: Tel: +886 2 2560 3566 Fax: Tel: +886 2 2560 3888; Email: aqua@nicegarden.com.tw; www.nicegarden.com.tw)

Extra compressed water oxygenation

Richvigor Enterprises of Taiwan displayed a model of its extra compressed water oxygenation equipment for pond aeration.

According to Leon KH Chen, this is the most advanced energy saving high flow oxygenating system to date. This also gives a strong water flow at a rate of 50-86m³/hr maximum and water flow of 100m. The system works by absorbing air from the air tank inside the body of the equipment and compresses the air whilst mixing with water and then pushes out the air. Three model sizes are proposed from 0.75KW to 1.100 KW.



More information: Tel: +886 2 2741 5351; Fax: +886 2 2771 0326 (email: leonlionchen@hotmail.com)

New probiotic range

VC-7 is a new range of probiotics developed for water treatment and vibrio control and introduced by Team Aqua Corp, Taiwan at the trade show. According to the company the probiotics for water treatment was developed with Japanese and Taiwan technology and its effects can be seen within 3 days of application.

The probiotic for vibrio control is designed for use in shrimp hatcheries and grow out farms. The company said that it inhibits the population and growth of vibrio in ponds and tanks whilst maintaining optimal water quality. It minimizes ammonia and nitrate levels in the water. Nitrite levels of over 2.0 can be reduced to 0.1 in three days and vibrio is reduced from 4,800 counts to 212 counts within the same period. The probiotics is composed from strains of *Bacillus subtilis*, *Aerobacter spp* along with suitable activators and carriers.

More information: Tel: +886 6 637 6752 Fax: +886 6 637 6745 Email: teamaqua@ms13.hinet.net www. Aquaculture-product.com.tw

Book Review

Handbook on Ingredients for Aquaculture Feeds

By Joachim W Hertrampf, DSc and Felicitas Piedad-Pascual, PhD, 2000. Kluwer Academic Publishers (www.wkap.nl), 624 pages (ISBN 0-412 627604), USD279.00

In the prologue of the book, the authors said that although there have been remarkable developments in the general knowledge in physiology, nutrition and feeding of aquatic species, there are still gaps in information required for the high performance feeding of commercial species. With this in mind, the approach taken by the authors is to compile available information on ingredients for aquafeeds and provide a better understanding of feed components. Their research has been exhaustive if one looks at the list of references for each raw material.

It is important that one differentiates this book from a feed formulators guide such as an NRC publication, which discusses ingredients by function and tabulates the feeding value of feedstuffs. These usually follow the format for the formulation of land animals where information from protein levels to metabolic energy values are almost complete and there is regard for genetic selection and environment for high performance feeding.

Neither does the book try to categorize feedstuffs into protein and energy sources or divide it into traditional and novel ingredients. According to the authors, in contrast to livestock feeds, there is a fine line between what are novel ingredients and essential ingredients. Thus, the approach adopted is to present feedstuffs in alphabetical order. This makes it easier to seek information on a particular feedstuff.

The book starts with a chapter on nutrition at a glance which discusses general nutrition in aquatic species. There are also sections on feed supplements covering attractants, antibiotics and antioxidants. The rest of the book goes on to analyze the use of each ingredient or group of ingredients. For example, the chapter

on vegetable oils covers cotton seed oil, linseed oil to sunflower oils, again in alphabetical order. Fish protein hydrolysates and squid meal are covered separately. There are also chapters on immunostimulatory substances and on carotenoids.

For each ingredient, there is a discussion on the rationale followed by a short explanation on manufacturing and processing, chemical and physiological and other properties, feeding value, recommended feeding rates and legal aspects. In rationale, there is a description of the ingredient as well as sources. In the last item, the authors listed out the legal requirements such as those specified in EU directives. It also lists alternative legal names for the feedstuff.

In all, the book is comprehensive, as it covers 49 single or groups of ingredients. It does not however have a summary feed table as nutritive values are given in each chapter. It is recommended as a quick reference guide for feed formulators and nutritionists in a feed mill or in academia. As new ingredients are constantly being introduced, it does not claim to be a complete review.

by Zuridah Merican

Aquaculture feed extrusion, nutrition and feed management

This is part of the series of training provided by the Food Protein and Research and Development Center, Texas A&M, USA. It will be held from September 25-30, 2005 in the campus of Texas A&M University

The aim is to train production personnel in principles and characteristics of extruders and support systems for effective operations. It will also review current practices for aquafeed preparation.

This is an informal course and among the topics are material handling and establishment of feed mills, modular plants by Gerry Leukam and common grinding problems by Bill Bliss. Phil Erickson will talk on ultra fine grinding for aquafeeds. Galen Rocky will also explain single and twin screw extrusion applications in aquafeed production and how to ensure a smooth running extrusion operation and trouble shooting. In nutrition and formulation, various speakers will cover nutrition and management of feeds for shrimp and fish, least cost formulation and use of rendered products in feeds.

Among the demonstrations, will be the use of dry extruders and interrupted flight expander use for aquafeed production and the use of twin screw extruders for ultra fine feed. It will also include the production of high fat yellow tail feed using a twin screw extrusion and vacuum infusion of fat in feeds for the salmon.

More information: Dr. Mian N. Riaz; Tel: +1 979/845-2774; Fax: +1 979/458-0019; Email: mnriaz@tamu.edu; Web: www.tamu.edu/extrusion

Tenth anniversary event at China Aquaculture 2005

China Aquaculture is a trade show for China's rapidly expanding aquaculture industry. China is the world's largest aquaculture producer. In 2002, production totalled 27.7 million tonnes. In 2003, aquaculture contributed 65% to the total fisheries production. The annual production increase of aquaculture is 7.8% (Sofia, 2004). Aquaculture contributes to the 27.7 kg per capita consumption of seafood in China. To meet the demand for seafood, China's aquaculture is a national priority with the Government and is rapidly upgrading technology to produce various marine species in particular.

This year's show will be held in Guangzhou and is supported by the Ministry of Agriculture, People's Republic of China and organized by the China Council for the Promotion of International Trade and Sea Fare Expositions, Inc.

The show will be held together with China Fisheries and Seafood Expo 2005, an annual seafood and aquaculture show which was started in 1996. It will feature an exhibition of seafood processors, processing equipment and aquaculture products and suppliers. Several seminars have been planned. According to the organizers, this is Asia's biggest seafood show.

At the ninth annual show in 2004 in Qingdao, there were 686 exhibiting companies from 48 countries. It also featured more than 500 Chinese exhibitors and national pavilions from Europe, the Americas and Asia. A record 15,000 qualified buyers from throughout China and 52 other countries attended the show in 2004.

Venue:
Chinese Export Commodities Fair
Pazhou Complex Guangzhou, China

Dates:
10-12 November 2005

Guangzhou, capital of Guangdong Province is located in the heart of Pearl River Delta just 170 kilometers from Hong Kong and is two hours from Hong Kong by express train. Guangzhou's brand new airport is serviced by many international airlines. Guangdong is a major aquaculture producing area. Guangzhou is home to the famous Huangsha Seafood Market, where more than 500 tonnes of live seafood is sold each day.

More details from
Sea Fare Expositions, Inc.
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Seattle, WA 98107
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AQUACULTURE CHINA 2005

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Chinese Export Commodities Fair
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会

Chinas aquaculture industry is making substantial investments in better equipment, technology and services to increase its production of high-value aquatic products. Aquaculture China has been organized by Chinas Ministry of Agriculture to make it easier for Chinas aquaculture industry to purchase the latest products and services from Overseas Companies. If you want to increase your sales to the largest aquaculture industry in the world, make plans now to exhibit at Aquaculture China, Chinas largest international aquaculture exhibition.

For Exhibiting Information Contact:
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E-mail: aqua@seafare.com
Web site: www.aquaculturechina.com

Supported By:
The Ministry of Agriculture,
People's Republic of China

Overseas Co-Organizer:
Sea Fare Expositions, Inc.

5-9 August

Aquaculture Europe 2005
Trondheim, Norway
Email: ae2005@aquaculture.cc
Web: www.easonline.org/agenda/en/AquaEuro2005/default.asp

5-9 September

Larvi 2005- 4th Fish & Shellfish
Larviculture Symposium
Gent, Belgium
Fax: +32 9 264 4193
Email: larvi@UGent.be
Web: www.UGent.be/aquaculture

11-17 September

6th World Congress Seafood Safety,
Quality & Trade
Sydney, Australia.
Tel: + 61 2 6257 3299
Fax: +61 2 6257 3256
Email: iafi2005@ausconvservices.com.au
(with IAFI in the subject line)
Web: www.iafi.net/congress

21-22 September

Aquaculture Technology Conference
and Exposition
Fukuoka, Japan
Tel: +81-3-5775-2855
Fax: +81-3-5775-2856
Email: kajj@exhibitiontech.com
Web: www.exhibitiontech.com/aquaculture/e_index.html

25-30 September

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

27-28 September

Value Added Seafood 2005
London, UK
Tel: +44 1892 511807
Fax: +44 1892 527758/544895
Email: conferences@agra-net.com
Web: www.agra-net.com

19-21 October

Second International Sustainable Marine
Fish Culture Conference and Workshop
Fort Pierce, Florida
Email: kriley@hboi.edu
Web: www.sustainableaquaculture.org

25-28 October

6th Symposium on Diseases in Asian
Aquaculture (DAA VI)
Colombo, Sri Lanka
Contact: Melba Reantaso, FAO
Email: Melba.Reantaso@fao.org (quote
subject:DAA VI)
Web: www.daasix.org/

10-12 November

China Fisheries and Seafood
Expo/Aquaculture China
Guangzhou, China
Tel: +1 206 789 5741 ext. 334 /
+86 10 58672620
Fax: +1 206 789 0504 /
+86 10 58672600
Email: seafoodchina@seafare.com /
info@seafarechina.com
Web: www.chinaseafoodexpo.com

8 March

Aquafeed.com Technical Workshop
"Optimize for Profit"
Bangkok, Thailand
Email: editor@aquafeed.com
Web: www.aquafeed.com

May 9-13

World Aquaculture 2006
Florence, Italy
Tel: +1 760 432 4275
Email: worldaqua@aol.com
Web: www.was.org

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or email to the Editor at zuridah@aquaaasiapac.com, Fax: +603 2096 2276

Aquaculture Technology Conference and Exposition

There are three events organized by the Asian Fisheries Society Japan Branch, to be held at the Fukuoka International Congress Centre from September 21-22, 2005. This follows their previous meeting in 2002.

The International Symposium on "New Technology and Science for Aquaculture" will feature speakers from Japan and Asia-Pacific. This will be on September 21. A workshop "Aquaculture Professional" on September 22 will discuss current and future situation in aquaculture. This will be in Japanese with direct translation services. Simultaneously, there will be the Third Aquaculture Technology Exposition from 21-22 September, 2005. This will have exhibits on the latest technology in fish farming for marine fish culture, freshwater farming and land based aquaculture.

Takafumi Arimoto, Chairman of the organizing committee said, "Improvements in culture technologies has helped in the promotion of aquaculture but insufficient distribution channels, excessive production and increase in aggressive imports result in lower prices in Japan and elsewhere. The convention will introduce academic and practical information on the current situation in Asia, American and Europe, for fish farmers in Japan and other fish farming countries".

More information: http://www.exhibitiontech.com/aquaculture/e_index.html



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