AQUA Culture
AsiaPacific

Volume 1, Number 3 May/June 2005 MITA(P) 136/10/2004 ISBN 1793-0561

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AQUA Culture AsiaPacific is published bimonthly by Aqua Research Pte Ltd
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Subscriptions
Annual subscription rates (6 issues a year)
Asia: SGD70
Rest of the World: SGD100
(one USD = SGD1.6)

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Letters may be edited prior to publication

From the editor

Food Safety – Seek and amend the weakest link

Recent events in April have brought to the forefront food safety and traceability issues in aquaculture. The European Union is concerned with the level of hygiene in seafood products and have sent a team to Vietnam. In India, processors are asking farmers to ensure that their harvest conform to standards, after the industry was put on alert. The US FDA had stopped consignments from 13 companies in India, China, Peru, Venezuela, Thailand and Vietnam suspected of containing chloramphenicol. Thus, it only takes one rotten apple to give the whole country a bad name.

This brings up the question of where the responsibility lies within a country in the production of healthy and wholesome products. Should this be that of the government or producers? This is also a question of preventive versus punitive measures.

In any primary production system, the aim is to produce products that meet the health requirements of governments and major importers. In the case of shrimp, it is the EU, US and Japan that have forced producers to look at food safety. With increasing pressure from environmental groups, the farmed shrimp industry must consider the effects of culture activity on the environment too. Thus in the current shrimp business, the end product together with each step in the production process and its environs is being scrutinised. To be competitive, cost is is no longer the critical driver.

Governments are doing their part. In Thailand, the CoC and GAP programs were initiated in 1998 with assistance from the World Bank and were implemented in 2000 (see pages 12-13). However, the fragmented nature of farms throughout Asia also means that an effective traceability program from grower to processor is not an easy task for many governments to enforce. In contrast, fully integrated companies with contract farms can easily have internal traceability programs.

This means that it is time for the industry to regulate itself. It is the associations, large processors and feed companies that have the resources to bring all farmers to a minimum threshold level of understanding to meet standards. It does not matter if feed companies can guarantee customers the quality and safety of raw materials through an audit system, when at the pond level, farmers supplement these feed with various “growth promoters”. Essentially on an industry level, “we are as weak as our weakest link.”

Zuridah Merican
Editor

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White shrimp culture legal in Malaysia

From 1 April 2005, Malaysia has allowed the importation of SPF/SPR brood stock of *Penaeus vannamei*. This will lead to the culture of this species from 1 May 2005.

Ideally, shrimp producers in Malaysia would like to continue culturing the larger sized black tiger shrimp for the 'head-on' niche markets, but this has been impeded by disease problems. The alternative is to culture the white shrimp *P. vannamei*, but the Department of Fisheries (DOF) had imposed a ban on its culture. DOF was concerned with the spread of diseases, in particular the Taura Syndrome Virus. To stop any illegal culture it outlined a range of penalties for offenders effective from 1 June 2003.

Syed Omar Syed Jaafar

Syed Omar Syed Jaafar, Chairman of the newly registered Malaysian Shrimp Industries Association (MSIA) said that the association had been urging the Department of Fisheries to reconsider its ban on white shrimp culture.

"In certain areas, shrimp farmers have been experiencing many problems in culturing the black tiger shrimp. Encouraged by the DOF they have tried other species such as *P. merguensis* and *P. indicus*, but encountered problems with the quality, lack and inconsistency of postlarva supply. Prices of SGD 25-35/kg (USD 16.6-21.8/kg) were good for *P. merguensis* in the live shrimp markets of Singapore", said Syed Omar.

"They also tried the culture of vannamei shrimp but illegally. The profits margins of around RM10,000/ha/crop (USD 2,600) were small but what was important for them was that they could achieve consistent harvests".

The decision to allow the culture of the vannamei shrimp was announced on March 24 by the Minister of Agriculture and Agro-based Industry. A major reason for this decision was that the government has set a target production of 150,000 tonnes of farmed marine shrimp by 2010, with an expansion of new culture areas. So far, this has been constrained by problems in land acquisition and disease outbreaks.

The current production is around 27,000 tonnes and the productivity with black tiger shrimp culture is less than 3 tonnes/ha/ cycle. With the vannamei shrimp, DOF anticipates that the current productivity can increase to an average of 10 tonnes/ha/cycle. With about 9,000 ha of existing ponds, the target is achievable. By end of 2005, production may double to 50,000 tonnes which will comprise of black tiger:vannamei in a 60:40 ratio.

The decision was also influenced by developments in the region, in particular, Thailand and Indonesia, where a revival in culture activities with the white shrimp is providing economic benefits to farmers.

"Ideally, we should emulate developments in shrimp culture in Brazil", said Syed Omar. "In 1998, production was only 400 tonnes and this increased to 58,455 tonnes within five years and in 2004, the production reached 90,190 tonnes. Since 2001, the area under culture has remained relatively stable and productivity increased from 1.7 tonnes/ha/yr to 6.8 tonnes/ha/yr".

However, it is also important to be aware of the negative repercussions of this approval according to Syed Omar. The vannamei shrimp goes into further processing which is labour intensive. These processing costs are much higher for Malaysia as compared to China, Indonesia and Thailand. In addition, cheaper imports, such as from China, if not restricted will compete with locally produced shrimp.

MSIA made several proposals to overcome this issue such as strict quality checks on the food safety status of imported shrimp similar to those implemented by the EU and FDA. It also suggested that perhaps all containers could be held pending laboratory test, as is practiced in Thailand and Vietnam. Processing plants could be given quota systems based on their capacity. They could start with 80% imported shrimp content and progressively reduce this to arrive at a 100% local shrimp content within a period of time.

Although vannamei culture is now permitted, this is not the end of the road for black tiger shrimp culture in the country. The DOF started a domestication program with a private shrimp farm in 2002. Alternatively, MSIA has suggested an incentive scheme to encourage the continued culture of the black tiger shrimp.

Ismail Abu Hassan

At a gathering of 150 hatchery operators and shrimp farmers, Ismail Abu Hassan, Director of Aquaculture Development, DOF said, "The culture will only be carried out using postlarvae from hatcheries licensed to import specific pathogen free (SPF) or pathogen resistant broodstock (SPR). The suppliers of these broodstock should be certified by the relevant authorities and as such this implies that only the import of broodstock from Hawaii and Florida will be allowed".

It also said that only hatcheries equipped with quarantine facilities and trained personnel can apply to import broodstock. They should not undertake the production of *P. vannamei* postlarvae alongside that of *P. monodon*. All broodstock must undergo PCR (polymerase chain reaction) and histopathology tests. Application for import permits will be on a year to year basis.

The Department has calculated that each hatchery will require 2 broodstock/m^2 and that only 10% of the existing 100 hatcheries may be able to carry out this program. Through branch offices at district levels, DOF will conduct regular checks but ultimately, DOF would like to see the industry self regulate.

Thai DOF approves Molokai for SPF and SPR *P. vannamei*

Molokai Mariculture Incorporated which does business as Hawaii Broodstock Breeding Company and Molokai Sea Farms International has been granted approval for the importation of SPF and SPR *Penaeus vannamei* broodstock into Thailand. This approval was granted after a site inspection of the breeding facility and broodstock grow-out site in Hawaii by the Thailand Department of Fisheries (DOF) in April.

Steve Chaikin who founded the company in 1988 on the island of Molokai said, "As a result of past shortages of Hawaii SPF and SPR broodstock during the past several years we have substantially increased production in 2004 to meet demand. We now have the largest supply of broodstock available in Hawaii. Current inventory of SPF broodstock includes families selected for fast growth as well as TSV resistant families. Stock origin is from the Oceanic Institute's Marine Shrimp Breeding Program".

The company has been active in the Asian marine shrimp culture industry since 1998. The culture facility is located in an isolated area of Molokai Island which is sparsely populated. This provides ideal conditions for maintaining disease free shrimp stocks.

The culture of the white shrimp began two years ago in Thailand with a limited number of SPF broodstock. Worried about diseases, DOF stopped imports in 2003. In 2004, it reopened the importation for SPF broodstock. To date, some 4 other companies in Hawaii and Florida have been granted approvals to import SPF and SPR P. vannamei broodstock into the country. DOF has indicated that the demand for broodstock will be 70,000. Web: www. broodstock.com

China: Domestic shrimp market increasing

In its report for Globefish, INFOYU reported, that in 2004, the volume of shrimp in China's domestic market increased as exports declined. China exported 154,115 tonnes of shrimp in 2004, compared to 188,399 tonnes in 2003. Exports to its traditional markets (USA, Japan, South Korea) declined by 73%.

According to Chinese customs records, in 2004, the total exports to Mexico, Indonesia, Malaysia, Singapore, Australia and Canada increased to 50, 032 tonnes from 20,291 tonnes in 2003. Large increases in volumes were recorded for Mexico and Indonesia. Exports to the EU increased to 3,255 tonnes following the lifting of the 100% testing on shrimp for banned antibiotics in July 2004. This will continue into 2005 as China's tariffs into the US under the antidumping action are high.

The dominant species was *P. vannamei* and the production of other species (*P. japonicus* and *P. chinensis*) was stable. Prices of *P. vannamei* decreased to a low of 10-12 yuan/kg (USD1.2-1.4/kg), a decline of 25% compared to prices in 2003. In 2005, it is envisaged that production will be at 2004 levels*. It added that even though shrimp prices will affect economic returns to farmers, operations are likely to be profitable due to technological improvements. It foresees that prices will increase as shrimp gains popularity in the domestic market. (www.globefish.org) (*estimated by industry at 312-350,00 tonnes).

Philippines company expands

The Sta Clara Estate Inc which has two farms located at Bo Banago, Bacolod City and in San Carlos City is now operating at peak capacity. The farm at Bacolod City has 42 ponds whilst the one in San Carlos has 22 ponds over a total area of 35 ha. Sta Clara Estate started operations in 1996.

President, Alec Lustre said, "We are operating at our peak capacity and we are exceeding the best since we started. This year we are developing new ponds in our farm in the other side of our island in San Carlos City, Negros Occidental". He added, "We may not be leaping to the level of our neighbouring countries in terms of technology but we are definitely improving to make a impact". The company wants to complete the expansion in two years which may result in tripling production. Additionally the company has leased 2 farms in 2005. Stocking will begin soon.

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Review on black tiger shrimp and scampi farming in India

Aqua India 2005 was a review on the farming of the black tiger shrimp and freshwater prawn *Macrobrachium rosenbergii* (scampi), organized by the Society of Aquaculture Professionals (SAP). It was held in Nellore, India from February 25-26, 2005. Some 200 participants representing a cross-section of the aquaculture sector in India attended the two-day review meeting. Sixteen speakers presented topics focusing on the present trends in shrimp and scampi farming in India including hatcheries, pond production and marketing.

Welcome address by SAP president Mr. S. Santana Krishnan

India is estimated to have produced about 145,000 tonnes of shrimp and scampi in 2004 which was a growth of 2.1% from the production of 142,000 tonnes in 2003. Factors such as the scarcity of water in early 2004, low purchase price for shrimp due to the then impending antidumping duty on shrimp exports to the US and a marked reduction in scampi culture in Andhra Pradesh contributed to this lower production. The production in 2005 is likely to be lower than that in 2004 due to the effect of the tsunami and because there has been no improvement in early stocking patterns.

The meeting noted that the existing infrastructure in India for shrimp production, mainly in the form of hatcheries and feed plants, is more than adequate to support current production and future growth. However, continuing problems with diseases need better management. In particularly, there is a need to develop pathogen free shrimp brood stock. There is also a need to focus on the loose shell problem, which is a unique disease problem in India but which causes significant losses of revenue for farmers. An update on the Loose Shell Syndrome workshop conducted by SAP was presented. The large number of small and medium farmers should organize themselves to implement good farm management practices and manage the common water source so that outbreaks of diseases can be contained.

On markets, India remains a major producer of medium and large size black tiger shrimp, which is a unique and lucrative market. However, the country needs to leverage on this strength to gain market share. A number of emerging trade issues such as traceability, antibiotic residues, antidumping, etc. has to be managed proactively and creatively. The country also needs to address local problems such as muddy and moldy smell to improve market appeal for its shrimp products.

Value added and development of domestic markets will play a key role to ensure that India remains a market leader in the long run. Various players in the shrimp sector and government and research institutions will have to develop closer linkages and work for a common agenda. This is to strengthen shrimp and scampi farming based on scientific and sustainability principles.

A complete report of Aqua India 2005 is being prepared and is expected to be available in June 2005. The Society of Aquaculture Professionals (SAP) is a non-profit, non-government organization established in 2003 by a group of aquaculture professionals in India. Web: aquaprofessional.org

A section of the audience

Vietnam: USD 800 million from tra and basa by 2010

Vietnam has targeted an annual production of 1 million tonnes of the catfish tra and basa by 2010. Exports will be worth USD 800 million, according to the Fisheries Ministry. In 2004, Vietnam produced 500,000 tonnes, valued at USD 300 million in 2004. The country will seek markets in the US, EU and China. It will also pay more attention to meet hygiene requirements set by these markets. Vietnam still faces anti-dumping duties on its tra and basa imposed by the US in July, 2003.

CCR voted for Thailand and India

The US International Trade Commission (ITC) will conduct changed circumstances reviews (CCR) on imports of shrimp from India and Thailand. In January, it had determined antidumping duty orders for shrimp imports from six countries, including India and Thailand. Citing damages caused by the December 26 tsunami on their shrimp industries, the two countries had filed a joint appeal for a CCR.

After the December 26 tsunami, according to the most recently compiled statistics, US shrimp imports from India dropped 57% in January and February 2005 compared to the same period in 2004. Shrimp imports to the U.S. from Thailand dropped 27% during the same timeframe. The Commission will conduct six-month reviews and will make its determinations by October 31, 2005.

Marine aquaculture and seafood markets in China

The Asia-Pacific Marine Finfish Aquaculture Network has announced that it will conduct a study program on Marine Aquaculture and Seafood Markets in China. This will take place from 4-15 July 2005 and is intended to introduce participants to the demand side of the live marine seafood trade and latest developments in marine fish farming and seafarming in China, the world's biggest aquaculture producer. Through the tour, participants will have a unique understanding of the Chinese (Southern China & Hong Kong) live marine seafood markets, including preferred species, market organization, market chains and market/consumer trends. They will learn about hatcheries, new technologies, aquaculture farming systems and trends and have opportunities to develop valuable business and scientific contacts with aquaculturists, buyers, traders, industry groups and scientists. More information: Mr Sih Yang Sim (grouper@enaca.org) web: www.enaca.org

Plant to remove dioxin from fishmeal

The Danish Fish meal producer TripleNine has recently installed a new extraction plant, which can remove dioxin from fishmeal. This is unique in the world, according to its newsletter. For many years, TripleNine has extracted dioxin from fish oil by means of a carbon filtration plant. However, this new extraction plant can remove dioxin from fishmeal, although the amount in question is small. The company said that in a normal year, where TripleNine treats 1 million tonnes of fish, the total amount of dioxin is less than 1 gram, of which the major part is found in fish oil. It said that now it can assure that customers receive raw materials that fully meet their demands. With this plant, it also means that they can clean dioxin from the lots of other manufacturers.

TSV outbreak in Venezuela

In April, the International Office of Epizootics (OIE) informed of a heavy outbreak of Taura Syndrome Virus among Venezuelan shrimp stocks. It was estimated that 90 percent of production was hit, a total of 2 billion are expected to get infected and mortality was 700 million.

These occurred in three states in Venezuela. In these cases, mortality was observed in shrimps after they had shown clinical signs of red points in the telson, vacillating swimming and soft carapace in shrimps weighing less than 5g. RT-PCR (reverse transcriptase - polymerase chain reaction) was used to detect the infections.

The source of the contamination has yet to be determined. Health authorities said that to prevent the spread of the disease, the importing of shrimp into Venezuela will be limited and the creation of zones is being considered. Tanks in Zulia, Falcon, Trujillo and Nueva Esparta are being drained to prevent the virus's spread. Species prone to TSV include the *Penaeus vannamei, P. stylirostris* and *P. setiferus*.

Breeder shrimp center in Vietnam

Saigon Agriculture Inc. has started work on a centre in Can Gio, outside Ho Chi Mihn City to produce 200 million postlarvae annually year, according to the Saigon Times. This will meet the 30% of the demands of farmers in Can Gio and neighbouring Nha Be District. The breeder shrimp centre with a total area of 14,500 m^2 is scheduled for completion end 2005, according to Phan Huu Dung, director of Viet Long Saigon Fisheries Company, the company assigned to carry out the construction work.

Malaysia acts to stop white shrimp imports

The Minister of Agriculture and Agro-Based industries announced end March that steps will be taken to prevent the importation of *P vannamei* shrimp from other producer countries in Asia for re export labelled as products of Malaysian origin. However, imports and repacking for export will be allowed if labels indicated the original producer country.

Update on Brackishwater Pond Culture of Tilapias in the Philippines

by Rafael D. Guerrero III

The Philippines is a major producer of farmed tilapia. In 2003, the country produced 135,996 tonnes of tilapia from freshwater ponds and cages and brackishwater ponds.

While 50% of the tilapia production in the Philippines is from freshwater ponds followed by 37% from freshwater cages, only 7% of the production is from the country's more than 230,000 hectares of brackishwater ponds. The main tilapia species cultured are the Nile tilapia *(Oreochromis niloticus)* for freshwater ponds/cages and the Mozambique tilapia *(O. mossambicus)* in brackishwater ponds.

With the potential of increasing tilapia production in brackishwater ponds along with milkfish and shrimp, research efforts in developing salt-tolerant and high-yielding tilapia strains have been promoted by the Philippine fisheries authorities since the mid 1970s.

A fish market in Pampanga, the largest tilapia- producing province with brackishwater ponds in the Philippines

Saline tilapia

Studies conducted at the Brackishwater Aquaculture Center of the University of the Philippines in the Visayas, showed that the most salt tolerant tilapia species during 1975-1987 was the Mozambique tilapia followed by the red tilapia hybrid and the Nile tilapia. The best growth rate was attained by the red tilapia hybrid but the Mozambique tilapia had the highest survival rate.

Using the red tilapia hybrid, a potential yield of 1,385 kg/ha in four months was experimentally projected with a stocking density of 1/m^2, stocking size of 8.4 g, survival of 82.7%, and average weight of 179 g at harvest in fertilized brackishwater ponds with salinities of 31-32 ppt.

More recently, the commercial production of sex-reversed Mozambique tilapia and the tilapia hybrid of *O. mossambicus x O. niloticus*; and the all-male hybrid of *O. mossambicus x O. hornorum*, came about with the initiative of the private sector and assistance of government extension officers.

A yield of 2,269 kg/ha for sex-reversed Mozambique tilapia was reported at a stocking density of 1.5/m^2 , stocking size of 1.5 g, growth rate of 2.2 g/day, survival of 82.5% and average weight at harvest of 275 g in a fed pond with water salinities of 20-35 ppt after 125 days of culture.

For the sex-reversed *O. mossambicus x O. niloticus* hybrid, a production of 6 tons/ha was obtained with a stocking density of 1/m^2, size at stocking of 1.5 g, growth rate of 1.7 g/day, survival of 86% and average weight of 305 g after 180 culture days in a 0.35-ha fertilized and fed pond with water salinities of 25-35 ppt.

In the intensive culture of the all-male hybrid of *O. mossambicus x O. hornorum* stocked at 10/m^2, stocking size of 1.5 g, growth rate of 1.6 g/day, survival of 80% and average weight of 300 g at harvest, a yield of 10 tons/ha in 180 days in fed ponds with a water salinity of 22 ppt was recorded.

An interesting development is the use of salt-tolerant tilapias for "green water" in the control of the vibriosis disease of the black tiger shrimp *(Penaeus monodon)* in brackishwater ponds. The technique, adapted from Thailand by local shrimp farmers, is believed to suppress the disease-causing organism with a tilapia biomass of at least three tonnes per hectare in cages within the shrimp culture pond or in a separate pond.

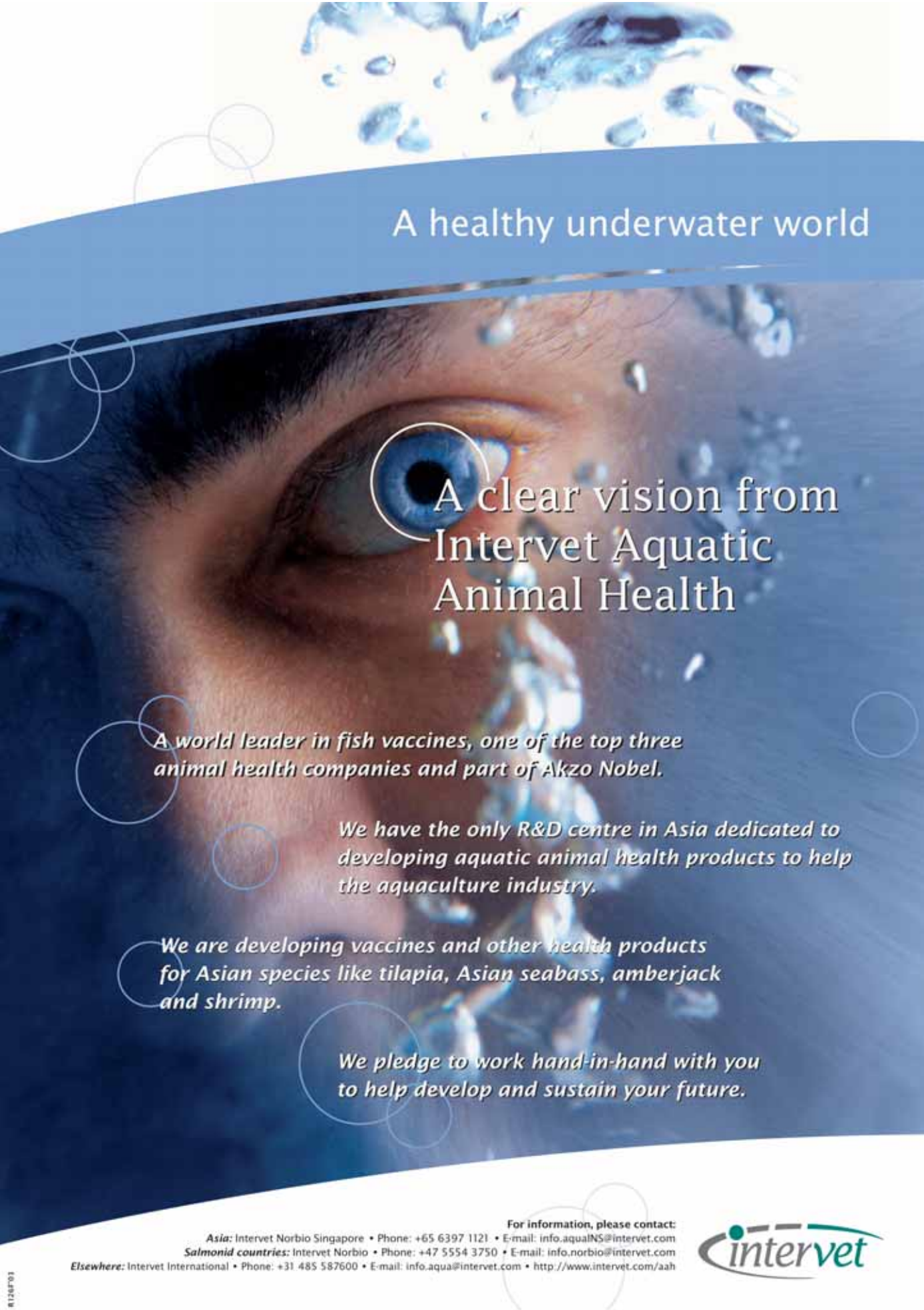
Molobicus tilapia

A large-sized Molobicus tilapia raised in brackishwater pond in Carcar, Cebu (Philippines)

At present, research work has focused on the further improvement of tilapia hybrids with high salt-tolerance, fast growth and good survival. Researchers of the National Integrated Fisheries Technology Development Center of the Bureau of Fisheries and Aquatic Resources (BFAR) in Dagupan City, Pangasinan with support of the CIRAD of France and the Philippine Council for Aquatic and Marine Research and Development have come up with the Molobicus *(O. mossambicus x O. niloticus)*. The hybrid is as salt-tolerant as the *O. mossambicus* parent.

Recent studies at the National Freshwater Fisheries Technology Center of the BFAR in the Science City of Muñoz, Nueva Ecija with support of the Bureau of Agricultural Research have shown positive heterosis (hybrid vigor) in the crosses of *O. spirulus x O. aureus* and *O. niloticus x O. mossambicus*. While the pure cross of the *O. niloticus* (FAST strain) had the highest gain in weight, the hybrid of *O. niloticus* (GIFT strain) *x O. aureus* had the highest survival in tests conducted in different saline environments.

Dr Rafael D. Guerrero III is currently Executive Director, Philippine Council for Aquatic and Marine Research and Development (PCAMRD – Department of Science and Technology. He is also Scientific Adviser, International Foundation for Science. Dr. Guerrero is recognized for his pioneering work on tilapia sex reversal technology that contributed significantly to world aquaculture. He has authored some 120 technical papers on aquaculture. Email: pcamrd@laguna.net; Web: http://pcamrd.dost.gov.ph



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From farm- to- table

In recent years, aquaculture as a major supplier to the seafood industry is increasingly being subjected to more stringent regulations. Food safety issues are gaining prominence as markets demand that food should not just be safe to eat but production systems are based on respect for the environment. To meet these demands, authorities in many countries are putting in place programs, mainly at the production and processing levels.

It was the major importing markets that have set the pace with regards to food safety in Asia. Since 2000, the European Union (EU) has embarked on an integrated approach to food safety which aims to assure a high level of food safety, animal health, animal welfare and plant health within the EU. This is a coherent farm-to-table measure with adequate monitoring. As many Asian countries such as India, Indonesia, Malaysia and Vietnam enjoy the benefits of the Generalised System of Preferences (GSP) scheme, it is important to adhere to all the food safety and health requirements for imports.

According to the US FDA, its food safety system is guided by the principle that only safe and wholesome foods may be marketed and that regulatory decision-making in food safety is science-based. As a result, this system has high levels of public confidence. Additionally, the US has introduced country of origin labelling (COOL) at the retail level.

In aquaculture production, food safety measures have been extended to the whole production process and all stakeholders now have a role to play. In 2002, the concern was that in aquaculture, antibiotics have not always been used in a responsible manner (Sofia, 2002), as evidenced by the number of reports on the presence of residues in exports of farmed marine shrimp. To date, the issue of contamination from the use of unapproved antibiotics remains a constraint for aquaculture in Asia to produce "safe and wholesome food".

Moreover, there are now more changes in consumer perceptions. Consumers are changing their attitudes towards "eating the correct fish that can help preserve the aquatic environment and is environmentally safe food". These new attitudes may result in an increase in the demand for fish that is considered environmentally safe, or healthy, but at the same time, it may also lead to reduced demand for fish that are not considered as such (SOFIA, 2004).

Certification programs

Today, we see governments as more proactive and are working with the industry towards assuring buyers and society that their respective aquaculture industries are not only sustainable but a responsible means of food production. At the processing level, HACCP (Hazard Analysis of Critical Control Points) is mandatory and compliance is required for international trade.

In primary production systems, the general trend is to follow international guidelines set up by FAO. In food safety, it is *Codex Alimentarius* that covers health, hygiene, permitted additives and sampling procedures and the Sanitary and Phytosanitary (SPS) Agreement of the World Trade Organisation (WTO). These are on top of local food safety and quality regulations.

Under the Thai Quality shrimp program, Thai shrimp producers have the CoC (Code of Conduct) to harvest high quality shrimp using standardised production methods in an environmentally friendly manner. This is followed by Good Aquaculture Practices (GAP) that deals with general pond management and record keeping, amongst others. A chain traceability is planned when feed traceability measures are put in place (see box).

In Malaysia, the acronym for the CoC plus GAP program is SPLAM, launched in 2004. In the Philippines, efforts are underway by the government and industry to institutionalize traceability after it was discovered that imported shrimp laden with antibiotics were being re-exported. This is at a preliminary stage but a certification process for best aquaculture practices is being developed and will be in place in early 2006. Fully integrated aquaculture businesses with farm, feeds, hatchery and processing plant can expect to implement this sooner (P. Cruz, pers comm., 2005).

In Vietnam, the new focus is GAP to ensure food safety all along the chain. Its processing industry has reached international standards for food safety with ISO 9000, GMP, HACCP and European certificates. In contrast, primary production is still a developing sector as farmers are small holders using simple yet efficient technologies. They are able to meet the demand of the market in terms of quantity, but still lack standards. Vietnamese farmers have taken a proactive approach to these food safety issues and are now working toward more sustainable

Organic aquaculture in Vietnam

Organic shrimp has been developed in an area of 6,500 ha in Ca Mau. Based on a Swiss Import Promotion Program (SIPPO) initiative, the project has been delivering certified shrimps to Switzerland's retail chain, COOP, a market leader in organic and fair trade products. New markets are, however, being sought as the international organic market goes mainstream. The first batch of organic Pangasius was delivered in January, and production is expected to reach 600 tonnes in 2005.

production schemes at farm level, such as organic aquaculture (see box). In April, stakeholders agreed to join an alliance for sustainable aquaculture to help farmers apply GAP. The German Cooperation Agency (GTZ) has pledged to help the sector develop these standards in collaboration with importers from Europe. (G. Poisson, pers comm.2005).

As antibiotics are generally administered in culture during outbreaks of diseases, some developed countries have used HACCP to control hazards at the pond level since 1990. This introduction of HACCP has been widely recommended in Asia (Sofia, 2002), even though it is not mandated at the primary animal production level.

At the feed supply level, the use of HACCP means a management method to prevent chemical contaminants and physical contaminants (adulterations) and biological contaminants (bacteria, pathogens and mycotoxins). Responding to the need to provide quality feed, many feed companies have implemented good manufacturing practices in feed production such as ISO 9001:2000, GMP and HACCP for its shrimp feed production facilities.

It is apparent that through most of Asia, the implementation of food safety programs remains fragmented. The next step is for producers in the region to decide on a full cycle traceability program covering primary production to processors to markets to consumers or programs that will be adequate enough to avoid any food safety problems in the future.

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A holistic approach in Thailand by Siri Tookwinas

The government has a strong policy to prevent negative aspects from affecting the marine farmed shrimp culture industry that contributes USD 3.9 billion annually to the Thai economy. More than 95% of shrimp produced is exported. Shrimp farming is a small- scale industry as most farms (65%) are 0.16-1.6ha in size. Backyard hatcheries using simple but efficient technology account for more than 80% of the national shrimp fry production. There are 25,000 shrimp farmers.

Environment

The target of the Department of Fisheries (DOF) is for marine shrimp farmers to be proactive and provide a healthy environment for the shrimp. Preventives measures include the minimization of shrimp farm effluents on the coastal environment as water quality is the main limiting factor in shrimp operations. Ideally, there should be water storage and treatment areas accounting for 40% of the culture area. In a concept of seawater irrigation, the plan is to provide a shared supply of appropriate quality water for the shrimp ponds. After the construction of the system, the farmer's association will need to maintain and operate the system. The community is also encouraged to be responsible for mangrove reforestation and protection. An example is that in Kung Kraben Bay, Chantaburi, Eastern Thailand.

CoC

The Code of Conduct for responsible marine shrimp farming was implemented in 2000. The key issue is the safety from farm to table. Some of the prerequisites are that the culture area would be out of the mangrove conservation area. The culture practices will be conducted along strict environmentally friendly culture techniques and the product is free from chemicals to meet international regulations. Effluent quality must comply with requirements prior to discharge. Farm sanitation should follow guidelines. Farm records must be kept for purposes of certification. Shrimp cultured from CoC certified farms have a 15% premium in price as compared to those from a non certified farm. In the national plan, 50% of farms or 15,000 farms will be CoC certified by 2006.

Product traceability

This was initiated in 2002. The traceability is done through an issuance of raw product movement document (MD). In the first step, post larvae from hatcheries will be issued a fry movement document (FMD) by the provincial fisheries office. When shrimp is harvested, a movement document (MD) will be issued for raw product transported to the market or processing plant. FMD is needed for the issue of a MD. When the finish product from the processing plant needs to be certified for export, a MD of raw material is needed for finish products certification procedures.

Through this process, the traceability can be effective followed. The quantity of raw products, farm license, farm identification number and others are shown on the MD. If the finished product is found to be contaminated with antiobiotic residues, farmers producing this product can be identified. They can then be queried on their farming techniques, raw material inputs and others to identify the contamination.

Dr Siri Tookwinas is Senior Expert, Department of Fisheries,Thailand

Feed traceability

In food safety in feed, the Freshwater Feed Research Institute, the department in charge of the registration and quality control of aquafeed manufacturing at DOF has recently included the control of feeds made at farm level in. In all feeds, there has been an increased monitoring for the presence of drugs in feeds and premixes in 2003 and 2004. These are for chloramphenicol and nitrofurans. Samples are collected from manufacturing plants, farms and hatcheries. In the near future, the plan will be to link on line with the with DOF Feed control center. The Q-mark will be certified on feed packaging for those totally traceable (Unprasert, 2005).

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Turning 12, Lab Inter of Thailand promotes green feed

Lab Inter Team

To celebrate its 12th anniversary, Lab Inter of Thailand gathered customers and suppliers for a one- day technical symposium *"Green feed to Food …Challenge of the Industry"*. This was held on March 15 in Bangkok prior to VIV Asia.

Philippe Demarest of DÈsialis and Fiona Lee of Nice Garden, Taiwan donned the red T-shirts ready for the dinner cruise to end the day.

Lab Inter is the distribution arm of the INTEQC group which was set up 16 years ago. The group is involved in the manufacturing, research & development, marketing and distribution of products, feed additives and supplements for the livestock and aquaculture industries. A subsidiary, Prima Tech deals with instruments and chemicals. Some 5 years ago, the group started the production of shrimp feeds and currently it has the second largest share of the local market. Currently its feeds are marketed to Vietnam, Myanmar, Malaysia, Indonesia and India.

As the theme suggests, presentations were on raw materials and feed additives that were, biological in nature. In the aquaculture and pet sessions, Quentin Brouet of Ajinomoto Foods Europe introduced Protorsan, dried bacterial proteins derived from the fermentation of L-Glutamic acid by *Corynebacterium melassecola*. The dried cell has more than 67% crude protein and has been shown as suitable for use in aquafeeds. Its non GM status is assured since as in France the planting of genetically modified (GM) strains of sugar beet in France is not allowed, in order to conform with requirements in the human food industry.

Although it has been in the feed market for since 20 years ago, its applications in the feeds for shrimp, eel and carp are more recent. In Japan, by replacing 4% LT fish meal, the feed conversion was similar to that of carp- fed fish meal diets. The company continues to run trials to compare its efficacy against fish meal. Additionally, this single cell protein has 4.5% betaine and 12% free glutamic acid which makes it a feed attractant. As the cell walls contain a high level of peptidoglycan, the company is investigating its immunostimulatory properties.

Didier Coulmier

Another "green" product was presented by the Désialis team from France. PX Aqua, marketed for aquaculture is an extract from alfafa. It has complete traceability and is guaranteed as non-GMO, according to the company. It is a complex rich in proteins (52% dry matter basis),

carotenes and a source of minerals, vitamins and omega3 fatty acids. With a high concentration of xanthophylls (1.14 ppm as fed basis), carotenes (455 ppm as fed basis) and lutein as the main pigment, it has been successfully used to colour eggs.

Didier Coulmier said that PX Aqua, marketed for aquaculture use is already replacing *Spirulina* in ornamental fish feed. In shellfish, its addition at 8% improved the colouration to 30 on the DSM scale as compared to the control value of 26 after 21 days of consumption. On pigment stability, their test showed that on extrusion, about 25% of the pigment was lost. Some 84% of pigment remaining after extrusion was retained after 80 days of storage. As the incorporation at 4% significantly improved the weight of shrimp and that it is rich in 18:3n-3 (linolenic acid), the company is looking at the possibility of it being used as a fish meal replacement.

Prebiotics in aquaculture

Through the enzymatic biosynthesis of sugar beet, Beghin Meiji, France obtains a natural short chain fructo-oligosaccharide (scFOs) called Profeed. Due to the mode of action of this raw material, Florence Rudeaux, said that it is a prebiotic which when added allows for changes and for activity in the gut flora that will benefit the well- being and health of the host. A decrease in pH will result in reductions in pathogenic bacteria composition in the intestinal microflora.

As for its applications in aquaculture, she said that the product has been tested in salmon and trout in Europe and in the tilapia and shrimp in China. Experiments with marine shrimp, showed that feed conversion efficiency improved and growth rate of shrimp increased by 2.8% when the scFOS was added at 0.04%. Additionally when challenged with *Vibrio parahaemolyticus*, there was a significant reduction in mortality with the addition of 0.04% scFOS.

Florence Rudeaux

Biosecure 100% poultry soluble protein

GePro, Germany has hydrolysed proteins, specific by-products from the parent company's (PHW) integrated poultry business. The AquaTrac® range has been developed specially for the aquaculture industry. These are either in liquid or spray dried form. To enhance the acceptance for shrimp and fish, the products are combined with natural/natural identical flavours such as squid, squid liver, tuna and fish.

According to Dr Franz-Peter Rebafka, all the 100% poultry- based raw materials used are declared "fit for human consumption" products according to EU regulations, 1774/2002. He added that the products under the range are biosecure and comes with a BSE certification.

Aqua Trac products have attractant, binder and soluble protein properties. The company also sees the hydrolysed product with 70% crude protein and 9% ash as a good replacement for fish meal, to decrease the pressure on marine protein meals. It is also favourable to the environment as it is highly digestible at 98%. As a binder, it has demonstrated 90% pellet stability. As an attractant, studies showed that the palatability of pellets was higher when compared to control diets containing wheat gluten and other protein sources.

Franz-Peter Rebafka

Disease prevention measures in coastal aquaculture: Part 1

by Pornlerd Chanratchakool

Experiences from Thailand on farm level disease control and prevention measures

In this two part article, the author explores the current trend in the shrimp aquaculture industry to move away from the use of chemicals and antibiotics towards the use of microbial and biological products for disease prevention and control. Taking the case of Thailand, part one will deal with the different measures adopted today for disease control.

Diseased (top) versus healthy shrimp

Coastal aquaculture accounts for the highest share of the fisheries production in Thailand. Its production has distinctly increased since 1998 after the rapid expansion of the black tiger shrimp culture industry. Pond productivity increased to 3,500 kg/ha in 1999 with intensive culture systems but with it came disease problems. Then to prevent and reduce losses from diseases, several types of drugs and chemicals were used.

In 2001, some importing countries started to monitor for the presence of antibiotic residues in shrimp products. Batches which tested positive were destroyed. The Thai government has tried to solve the problem by routine inspections and by imposing a ban on the imports of certain antibiotics.

Simultaneously, this required a mandatory testing of the final product for antibiotic residues before export. However, some countries today demand product traceability at all levels, from seed in the hatcheries to the exported shrimp. From the food safety point of view, the use of chemicals and drugs for disease treatment in aquatic products (especially from aquaculture) will not be permitted in the near future.

Disease prevention at a national level

Along with the ban on the use of certain antibiotics and the mandatory checks on all imported product, the government has also tried to check imports of live aquatic species which were being moved within and across countries. Exotic species have been introduced and cultured in the new environments. These movements introduce and spread diseases into new regions or countries. The White Spot Syndrome and Taura Syndrome Virus in shrimp are prime examples of this.

Biosecurity in farms

Farm biosecurity is very important and essential to reduce the introduction of pathogens from the outside environment as well as to reduce the spread of pathogens within the facility. The concept of this system is to provide a cleaner environment for the specific pathogen free (SPF) seed or for a disease free zone. This is becoming increasingly important at the provincial/national level where a quarantine system should be implemented.

Under this system, the specific disease free area or zone should be identified following a monitoring program. Simultaneously, a quarantine area should be developed especially at the point of entry/exit, to prevent the external introduction of diseases.

A quarantine area on a smaller scale could be encouraged in farms. However, to implement this, it will be necessary to have the support from authorities through regulations, since the infected culture must be destroyed or the farm must be closed to prevent the spread of the disease.

In order to prevent and control diseases in any aquaculture system, it is important to not only treat or control diseases at the ponds or farm level but also to consider controls at the provincial/national level. Proper planning should be developed and implemented by the government together with the aquaculture industry.

Disease prevention at farm level

This does not only involve finding chemicals or drugs to treat the pathogen present in the animal but also the management and improvement of disease causing factors. Therefore, the farmer should understand the relationship between the disease occurrences and the pond environment, which is specific to the culture species.

The first step for disease prevention is to develop general guidelines for farm management for each species being cultured. The information in a manual form should include guidelines on pond preparation and management, disease prevention and chemical or drug treatment. For disease prevention or control, the emphasis should be on improving the health of the culture animal by maintaining appropriate environments rather than aiming to treat the disease with chemicals or drugs. The stocking density should also be based on the farm conditions. The seed used must be tested against the significant diseases before stocking.

In general, there are common disease prevention measures such as:

Chemical or drug treatments

As mentioned earlier, chemical and drug treatments used for control or prevention of disease in aquaculture will be less significant since many of them have been removed from the "drug of choices" list. These chemicals or drugs did not solve the primary cause of disease occurrence and left residual traces in the product. Today only approved chemicals and drugs can be used for disease control.

Vaccination

Vaccines are becoming increasingly important and can ideally replace the use of antibiotics in aquaculture. However, the use of vaccination has developed slowly in Asia. Among the possible reasons for this is that aquatic species in Asia do not suffer from serious diseases as we see in the salmon industry. Secondly, backyard operations do not favour fish vaccination as most establishments have little scientific support. They focus on treatment rather than prevention. Low production costs allow farmers to stock more to compensate for losses. Third, there is lack of information on the immune system of Asian aquatic species.

Additionally, there are too many species under culture and hence research resources are spread thin. These factors have contributed to a limited use of vaccination for disease control and prevention. However, efforts are ongoing to develop vaccination for specific diseases in high value species and in brood stock.

At the farm level it is important that the farmer understands the relationship between the shrimp and the pond environment

Medicinal herbs

Medicinal herbs have been used in livestock and humans successfully. Most of the ongoing research for their use in aquaculture is focused on improving health and providing indirect protection against the disease or the pathogen in shrimp. Currently most medicinal herbs are prepared as a crude extract which needs to be used at a very high dosage for pathogen treatment. An area of future development is to identify an effective component in the herb, which can be extracted and concentrated for better results.

Bacterial products and probiotics

In the past five years, the concept of switching the aquaculture production system into a more organic or biological type system is gaining popularity. Two major microbiological products have been introduced and used in aquaculture system. Pond/ water probiotics are used for maintaining a good pond environment whilst feed probiotics are used for improving the health of the cultured animal.

Pond probiotics focus on reducing the organic wastes, toxic substances in the system rather than reacting with the pathogen. By providing better pond conditions, they reduce risks of disease occurrences. Feed probiotics on the other hand act as immunostimulants and focus on improving the health of the cultured animal directly. So far, however, many of the immunostimulants have shown a relatively short-term response in the aquatic animal and do not show repeatable success, especially in the field trials.

More research is required to demonstrate the benefit and cost effectiveness of probiotic products. These products also need to be controlled and regulated in terms of standards, quality and safety. They can then well replace drugs and chemicals in the future.

Next: Part two will deal with the role of biological products in improving pond conditions and helping in disease preventio

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At Asian Aquafeeds 2005

Expanding markets driving nutrition to the next level

By Zuridah Merican

Presentations on the status and outlook for the industry in the region demonstrated an increasing demand for aquafeeds, particularly of fish feeds. Developments in aquaculture nutrition are being outpaced by growth in feed volumes.

The gathering of industry for the Asian Aquafeeds 2005 held in Kuala Lumpur, Malaysia on 12-13 April attracted 135 participants from 17 countries from the Asian region and beyond. The Malaysian Fisheries Society, the main organiser, indicated that 60% of delegates were from the aquafeed industry.

In his keynote address, Prof Sena de Silva, Deakin University, Australia, discussed 'Reducing Feed Costs: Are we feeding our fish too much?' In the feeding of tilapia, carp and common carp, the use of formulated feeds is on the rise and there are concerns on the continued use of fish meal in fish feeds. In 2000, carp feeds used 17% of the fish meal supply and by 2010, the substitution of fish meal with plant protein sources will be vital. Pressure from lobby groups for aquaculture to decrease the use of fish meal is also increasing.

Prof Sena de Silva

The general approach is also to reduce costs by developing feeds which are nutritionally suitable but by reducing the fish meal component. There is also a need to consider feed wastage and its effects on the environment. According to Prof. Sena, in culture management, what is crucial is not to have a higher weight at harvest but to be economically viable. He gave an example of the calculation of the economically optimal dietary protein level, derived from published data on tilapia and carps, and went on to suggest that in most practices fish are being fed "too good a diet". Equally good, economically viable results could be obtained by feeding the fish significantly lower protein diets.

He also questioned the practicality of feeding a group of fish a high protein (and expensive) diet on a daily basis. As there is a hidden rhythmicity in daily protein digestibility in fish, can diets be manipulated to match this rhythm? This means feeding low protein diets alternated with high protein diets. Studies show that with this mixed feeding schedule, growth performance and the carcass quality are not compromised.

From left Jacques Gabaudan, Brett Glencross, Ng Wing Keong, Chairman of Organising Committee, MFS and Philippe Serene, Vietnam

Formulation

In formulating for shrimp feeds, Dr Victor Suresh, Consultant, India in his presentation on "Nutrient delivery: concepts for consideration in aquafeed formulation", said that the goal of the nutritionist is to get the most of the nutrients in the feed.

However, aquatic animal nutritionist are faced with a number of nutrient delivery paradoxes in designing feeds for slow-feeding species like shrimp. On one hand, they need to minimize wasting of nutrients through leaching in water. On the other, it is the leaching of some of the nutrients that signal the presence of feed to the animals. Further, water solubility of some nutrients such as phosphorus are directly related to their availability in the gut. Solutions include producing a highly water stable diet, protecting water-soluble nutrients through physical and chemical stabilization and increasing the rate of feed consumption through the use of highly concentrated attractants.

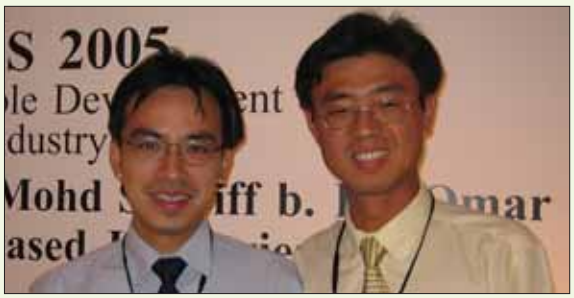
On the use of attractants, Victor said "We need to address three critical aspects. Firstly, the need to have an objective and easy-to-measure index for attractability of ingredients and additives. Secondly, the quantification of ingredients and additives in terms of attractability including replacement values. This is how much of one ingredient can be replaced by another and finally, the verification of the additivity of the index so it can be used in linear programming based formulation". He also presented data from on-going studies by one of his clients, Bentoli, Inc., that seeks to address the above aspects.

On the formulation for micro ingredients, Dr Jacques Gabaudan,

From left, Rutchanee Chotikachinda and Dr Dhanapong Sangsue, Inteqc Feeds, Thailand, Mark Tucek, Grain Pool, Australia and Brett Glencross.

From Cargill Vietnam, Le Minh Man (left) and Do Thanh Muon (second from right), with Ng Siow Leng (second from left) and Lim Heng Boon, Cargill Malaysia

Athisak Kliangpradit, BASF (second left) with (front from left) Dr. Sonkphan Lumlertdacha, Betagro Group, Ms.Siriporn Plyhirun, Inteqc Feed, Dr Nanthiya Unprasert and Rutchanee Chotikachinda



Ming Hsu Wu and Hou Hsu Kuang, Uni President

Mohd Zaini, Wan Adnan and Mohd Aris from LKIM and Maju Feeds, Malaysia

DSM Nutritional Products said that it is important that nutritionist know the properties of micro nutrients and its interactions before deciding on the form and type of micro nutrients to be used. Depending on the substance, some of them such as Vitamin A and C are affected by oxidation and humidity. Alkalinity and pH affect others and so it is important to keep this in mind when organic acids are used in the diet. Stable ones may have poor handling and flowability properties. In product formulation, the idea is to strike a proper balance and to recognise the properties such as stability, bioavailability, handling and flowability. To achieve these, different processes such as encapsulation, spray dried or simple coatings are being developed.

Alternatives to fish meal

Two presentations discussed the alternatives to fish meal in aquafeeds. Dr Brett Glencross, Department of Fisheries, Australia, in his presentation on the use of grain protein resources, in particular lupin meals, emphasised on the importance of being able to manage ingredients to optimise their applications in aquafeeds. With volatility in price and supply as well as contaminant issues, being dependent on one ingredient is a risk. Although alternatives can also bring in new risks, minimising these risks can lead to better security.

Dr Y. Yu from the National Renderers Association in Hong Kong presented information on the use of non marine proteins meals, principally poultry by products meal (PBM), meat and bone meal (MBM) and hydrolysed feather meal(FeM) as effective substitutes for fish meal. Typically, they are priced at 50-70% of fish meal and the cost of feeding can be reduced by 5-15%.

He said that it is also important to understand the role of proteins and lipids in fish and shrimp diets. Work on the Asian seabass in Australia showed that with high protein and high lipid diets the FCR was less than 1. Some data on the digestibility of protein and amino acids were given for marine species. In the cobia, amino acid digestibility was 91-94% for PBM and protein digestibility was 91%. For MBM, amino acid digestibility was lower at 85-92% and protein digestibility was 87%. Some recommendations for the fish meal replacement included 80% of the fish meal component in tilapia, catfish and carp yearlings. Some 70% of the fish meal can be replaced in grouper to provide 30% PBM in the diet. Generally, according to Dr Yu, the substitution of less than 50% of the fish meal with PBM, MBM and FeM does not affect feed consumption or survival rates of most fish and shrimp but the feed protein efficiency utilisation is reduced by 5-10%.

Study on feed as resource for sustainable aquaculture development

The Fisheries Department of FAO has taken up a new initiative on the use of feed and nutrients as resources for sustainable aquaculture development. According to Dr Mohammad R. Hasan, Fisheries Resources Officer, there are various issues to be addressed with respect to feeds and feeding if aquaculture is to be sustainable.

"Among these is the use of marine protein and oil sources in feeds. Further, can feed based aquaculture be supported by existing resources and what are the constraints of these on its future developments? It will also look at the adequacy of the existing database. Another issue is the biological and economical feasibility of using plant protein sources and animal by products as alternatives to fish meal for intensive aquaculture".

Specifically, the initiative will analyse the status and trend of accessibility and utilization of fertilizers, feed ingredients and feeds for aquaculture, including farm-made aquafeed. It will also assess the availability and nutritional composition. At the industry level it will look at the current feed manufacturing practices. The output most beneficial to the industry will be a web based information system on aquaculture species, feed and nutrient resources at a global, regional and country level. The initiative is expected to be completed by 2007.

Establishing a regional aquafeed network

The meeting ended with discussions on the formation of an aquafeed network for the region. A small group was selected to prepare the groundwork for this network.

Prior to this, Pedro Bueno, Director General of NACA- Network of Aquaculture Centres, suggested that this network will include nutrition, feed development and feed management. This idea received the support from farmers and industry who attended the Aquabusiness Seminar 2002.

Pedro suggested that the way forward to start this network will be to adopt the structure of the Marine Finfish Network which has been proven to be successful. Members will include feed manufacturers, suppliers, NGOs.farmer associations and government inspectors and regulators. Small specialist groups should be organized to tackle emerging issues and members should be linked electronically.

Industry outlook at the Asian Aquafeeds 2005

Development of Aquafeed and its Challenges in Vietnam

Dr Le Thanh Hung

Dr Le Thanh Hung, University of Agriculture and Forestry said that the industry is still in its infancy as activities only started in 1998. Nevertheless, the demand for shrimp feed has reached 250,000 tpy and that for the fish feed is 350,000 tpy. This requirement is expected from local production although some 3-5% of the total demand for shrimp feed is still imported.

For the production of shrimp feeds, 10-12 multinational companies dominate the market. These are Uni-President, Charoen Pokphand (CP), Grobest, Tomboy and Uni-Long and together they have 60-70% of market share. There are 12-15 local producers with capacities of 5,000-10,000 tpy.

"Their total capacity of shrimp feed production is around 300,000-400,000 tpy. A general over capacity is expected but during high peak season during the summer months when demand exceeds installed capacity", said Le.

He said that shrimp farming in Vietnam is fast developing. Production increased to 200,000-210,000 tonnes of shrimp in 2003, according to figures from the Ministry of Fisheries (2004). As the intensive shrimp area is less than 10-15% of the total surface area, there is consequently a huge potential for growth of the shrimp farming industry.

As for the fish feed market, he said that it is dominated by feeds for the catfish. The five top producers are Proconco, Cargill, Uni President, Green Feed and Woosung. There is also a significant number of local companies producing catfish feeds with an average capacity of 30,000-50,000 tpy.

Fish production was 300,000 tonnes in 2004. In 2010, it is estimated that 500,000 tonnes will be produced which may require 500,000 tonnes of feed if 50% of production use commercial feeds and 700,000-800,000 tonnes if the percent is 70-80%. There is already a surge in the production of catfish feeds with 20-30 mills being installed.

Dr S Vasudevan

Aquafeed Industry in India

Dr S Vasudevan of Hi Line Aqua Pvt Ltd said that imported shrimp feed totalled 10,000 tonnes in 2004 which equalled 6% of the total demand of 174,000 tonnes in 2004.

This is despite there being 8 large companies producing top brand name feeds. In addition, there are 64 small feed mills, mainly localized in Andhra Pradesh and catering to the needs of small farmers. These formulate and produce feeds around 15,000 to 40,000 tonnes of feeds and sell at low prices.

In his assessment of the feed usage, Dr Vasudevan said, "Brand is important for the farmer. CP is the most preferred brand throughout India. It has 43% of the market share. This is followed by Avanti with 14% and Waterbase with 11% of market share. In other areas, the preference is with the locally produced brand".

"The strong selling points of individual companies are dealer networks, support services and quality of starter feeds. For Avanti, the success was also attributed to the direct dealing with farmers by top management".

An expansion of culture area is anticipated as currently only 15% of the potential areas are being used for culture. New technologies are being adopted to improve survival rates and yields.

"The aquaculture bill is still pending with the Supreme Court but once the bill is passed in parliament, the corporate sector may venture again into aquaculture. Another boom in shrimp culture is expected in the near future", said Vasudevan.

Aquafeed for cage marine fish

Chawalit Orachunwong and Dr Nanthiya Unprasert, DOF Thailand. Dr Nanthiya presented developments in the aquafeed industry in Thailand

An overview of the marine fish culture industry in China, Thailand, Vietnam, Malaysia and Indonesia was provided by Dr Chawalit Orachunwong of Charoen Pokphand Foods. He said that their annual production of cultured marine fish is approximately 550,000 tonnes, 85% is from cage culture. The major producer is China with 94 % of production.

Although commercially produced extruded floating or sinking feeds, have been available since the 1990s, the usage is low relative to marine fish production. The estimated consumption is 260,400 tonnes. By countries, it is 500,000 tpy in China, 300 tpy in Thailand, 100 tpy in Indonesia and 10,000 tpy in Malaysia. No figures are available for Vietnam. He attributed the low usage of manufactured feeds to the well established chain supply of trash fish, inadequate information on the use of pelleted feed and limited supply of weaned seed stock.

Chawalit also discussed some data from trials conducted since 1985 by the company. Using extruded pellets with 35% crude protein (CP) and 16% fat, the ADG (gm/fish/day) was 3.33 and FCR was 1.17. Whereas with 45% CP and 12% fat, ADG was 3.06 and FCR was 1.26. A marginal improvement in FCR from 1.05 to 1.0 was achieved in estuarine grouper fed 45%CP and 12% fat instead of 40% CP and 8% fat. Generally feeds for the Asian seabass contain 40-45%CP and 12-16% fat whereas those for the grouper contain 45-50% CP and 10-14% fat.

He concluded that the future challenges are to educate farmers on best farming practices and management as well as implement regulations of water use. This will lead to a high usage of manufactured feeds.

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A new business concept in marine fish farming

Tiger grouper juveniles

According to Yi Yuan Wah, the industry can be profitable and sustainable if done in the right way. An important criteria is a consistent supply of fingerlings to support the grow out industry which in turn has to meet market demands.

To gain a competitive advantage in the production and marketing of high value marine fish, Singapore-based Swee Chioh Aquaculture Holdings is introducing an integrated approach to modernize the industry in the region.

The production of high value marine fish in South East Asia is characterised by the culture of a range of species of fish. The choice of which is related to the availability of seedstock and the ever- changing preferences of consumers in Hong Kong to Singapore. Farmers also switch species when current stocks are affected by bacterial or viral diseases which may occur because of disease pathogens compounded by adverse environmental conditions.

This is the scenario which Swee Chioh Aquaculture Holdings Pte Ltd wants to change. It strongly believes that the industry has a tremendous potential but needs knowledge driven techniques to increase productivity and technological level of fish farming in the region. Its vision is an industry not based on traditional farming concepts but a sustainable one based on sound production protocols which continuously takes into account the culture environment and market demands.

Production models

Swee Chioh's, Managing Director, Yi Yuan Wah said, "The best way for the industry to develop is to move away from traditional small scale systems to large economic models. For this, the industry needs new

This part of the hatchery has 20 tanks, each with a capacity of 5 tonnes. A closed recirculation system is used to provide a better control of water quality and parameters.

During the short journey from the farm to the jetty, fingerlings are well attended by technicians and water in the tanks is continuously infused with pure oxygen.

blood with new ideas from technocrats to run it as a business rather than as subsistence farming".

He added, "An integrated approach is essential. We cannot continue to depend on imported seedstock. There should be a consistent supply of fingerlings. In operations, the idea is to have a clear division of work and specialization to achieve better efficiency".

The concept has already attracted local investment, some of them from ex-middle managers. A 100- cage farm is currently being installed in waters off Changi Point on the East Coast of Singapore and will be operational in April 2005.

Yi also acknowledges that a current dilemma faced by producers is the changing demands of markets which had led to a need for multi-species production at hatchery and grow out levels. This is unavoidable as the industry is still considered in its pioneer stage.

"Eventually, in the future, we may be able to develop and produce one or two species well, consistently and at competitive costs but by not sacrificing quality for quantity", said Yi.

Fingerling production

Supporting the production units are two land- based hatcheries. An 11 ha hatchery is located in Loyang Agrotechnology Park and a 3 ha hatchery located in Neo Tiew Crescent. Marine fish seed production is the core business of the company. It has successfully bred 16 different species of fish and is one of the few in the world to successfully breed the four finger threadfin *Eleutheronema tetradactylum*, batfish *Platax orbicularis*, triple tail, spotted croaker *Protonibea diacanthus* and big eyed trevally *Caranx sexfasciatus*. Currently, the production capacity is 200,000/cycle of fingerlings of the tiger grouper, red snapper, golden trevally and golden snapper.

Currently the current market for fingerling marine fish in Asia is dominated by Taiwan. However, producers from countries such as Singapore, Malaysia and Indonesia have the advantage of year round production.

In addition, Yi said that, "production of fingerlings from local broodstock fish means that fish are acclimated to the same environmental and water conditions as in cage farms. Our proximity to grow out farms also means that we can assure farmers higher survival rates of the fingerlings. This also allows us to sell larger size fish (5-6cm) at competitive prices as compared to the smaller (4cm) imported from Taiwan".

R&D support

From its early years, developments in the breeding of several species of marine fish have been achieved with the support provided by the Marine Aquaculture Centre of the Agri Food Veterinary Authority (AVA). The company continues to work closely with the centre to bring about more breakthroughs in marine fish breeding.

At the moment, the priority is in operational R&D in culture techniques and disease management at both the hatchery and farm levels. Top on the list is to improve survival rates and production volumes of fingerlings.

Disease management is an important service offered by the company to farms. The next step is to develop disease management protocols, educate farmers on a systematic approach to disease prevention and to provide fast diagnosis and remedies to farmers.

Marketing

As part of its marketing strategy, Swee Chioh has a distribution and trading arm for fish produced at its farms. At present, the company has targeted the region's live fish markets. About 50% of its production, mainly of the tiger and humpback groupers, snappers and trevally are sold in the live fish markets in China and Hong Kong. These are transported using well boats from Hong Kong.

The local market is also important for the company. However, the pricing of the fish is being challenged by supplies from regional producers and by the 'wal- mart' effect (the purchasing power of supermarkets who buy large volumes, hence pushing down prices). Their objective is to seek product differentiation and premium prices for their products which meets traceability requirements.

Expansion

The company has already expanded into the region's marine culture industry. Besides its own cage farm off Pulau Ubin producing fish for

Some 108 units of cages are being installed off Pulau Ubin in Singapore. The expected production will be one tonne per cage. The total production per cycle will be 60 tonnes as 20% of the cages will be used as nursery cages.

Nursery ponds.

the local and export markets, the company also has its first contract farm in the Riau Islands of Indonesia. Under this contract farming arrangement, the company provides fingerlings, technical support and its standard operational procedures. The company will be responsible for marketing and distribution of harvested fish.

It also needs to forge ahead to read markets trends and seek opportunities in other markets. In the long term, Yi would like to see this model for high valued fish production established in the waters around Singapore extended to other parts of Asia. Recently, the group has signed a land lease agreement to establish a hatchery in the Da Nang Province of Vietnam. This will supply offshore cages in the same area.

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The vision

Back in the 1980s, Yeo Kiah Hong started Swee Chioh Farm, a small floating farm off the coast of the island of Ubin producing several species of marine fish, mainly the Asian seabass. Yeo had worked closely with the then Primary Production Department based at Changi Point to close the cycle of many marine fish species. In 1999, Yi who had left his top management position with a communications company in China, returned to Singapore and decided to pursue his hobby in fish culture. He started a small hatchery.

In 2003, Yi joined Yeo and together, they developed this strategy to break out of the traditional mould and run a more corporate operation for Swee Chioh Aquaculture Holdings Pte Ltd. They brought in specialists from Taiwan and Malaysia. Later, after a road show, specialists from China were added.

The strategy was also in line with that of the Agri Food Veterinary Authority (AVA) and the Economic Development Board of Singapore (EDB). Through the Marine Aquaculture Centre (MAC), AVA is promoting the application of modern technology to expand marine aquaculture in Singapore and increase the local supply of fish. Singapore consumes 100,000 tonnes of seafood but less than 5% is from local production (Chou, 2004).

Today, Swee Chioh Aquaculture has three subsidiaries. Its aim is to be "A leading aquaculture group in Asia-Pacific endeavouring to produce top quality seed supplies to the farming industry and premium food fish for consumers".

Lagging behind in marine cage culture

Trash fish is widely used in marine cage culture in Thailand, Indonesia, Malaysia, China and Vietnam. This remains a major constraint in bringing the industry to the next level.

The main cultured species in marine cage culture are sea bass, sea bream and groupers. China alone cultures around 70 species. The popularity is determined by consumers' preferences and hatcheries (usually multispecies) develop and produce seedstock based on this downstream demand. This means that the ex farm price for a once popular species may drop drastically.

In 2004, the production of marine fish from coastal and offshore cage culture was estimated at 467,000 tonnes (Orachunwong, C., et al., 2005) for these countries. Approximately 90% of production is from China from one million cages.

In China, the most popular species in China is the sea perch *Lateolabrax japonicus*, which is farmed in the north and south of the country. This is followed by the large yellow croaker *Pseudosciaene crocea*, red drum *Sciaenops ocellatus* and various species of bream and snappers. In Indonesia, 90% are groupers. In Thailand and in Malaysia, the Asian seabass is most popular (Zhang & Rortveit, 2004; Orachunwong, C.et al., 2005).

In most countries, families run small to medium size cage farms. They usually concentrate on the grow out activity, leaving seed production to others. Cages are located in near shore areas with easy access to land based facilities. The scale of production is relatively small and farmers have limited capital. Generally, there is a lack of control in production methods. Farmers take a short- term view of the business and of any investments to improve on hygiene and the efficiency of production in farms, according to a regional producer.

Recently, there have been changes as far as cage culture technology is concerned. Larger cages are being located further offshore to take advantage of better water quality. These are set up by large companies or the governments on pilot trial basis or for research and development. In many countries, the use of these cages is not being optimized due to problems ranging from the lack of sufficient seed and technical skill to manage the cages.

One of the main issues in the industry is the feeding of marine fish in cages. Despite the availability of commercially produced dry pelleted feeds, trash fish remains the major feed type for the industry in the region. This is a cause of concern as it affects the long- term sustainability of the industry.

Why trash fish?

According to Orachunwong, et al., (2005), 85% of current production in the region is based on the use of trash fish and the food conversion ratio varies from 8-15:1, depending on quality of fish. Farmers have quoted several reasons for the use of trash fish. The main reason is the cheap price of trash fish and that the supply is readily available. Usually, the supply chain for trash fish is well established in an area and some suppliers are also the fish broker and/or seed stock supplier. The farmers believe that trash fish is the best feed based on his own observations on the feeding behavior of fish fed trash fish versus those fed with dry pellets. To the farmer, commercially produced feeds are expensive, be it imported or domestically produced.

Sama-Ann Bensa-Add of Trang province on the Andaman coast, south of Thailand said that depending on the type of trash fish and quality, the price may vary from 8-12 baht/kg. Prior to the tsunami, he used to operate 50 cages in the area. The general supply of trash fish is steady but he faces a problem with the supply of small mackerels, ideal for the feeding of the groupers. He would use pellets if these were available in the market.

Feeding cobia with trash fish in Vietnam

In an economic analysis, Orachunwong et al., (2005) showed that feeding with dry feeds provided better gross margins that were 32.9% of the income as compared to the lower 14.3% when trash fish was used as feeds. Parameters that favour the use of dry feeds were survival rates (80% for fish fed dry feeds versus 65% for fish fed trash fish). The FCR was 1.5 for dry feeds and 10:1 for trash fish.

Nevertheless, it has been difficult to convert farmers to using dry pellets. Thus, more effort is required to demonstrate to farmers the cost effectiveness of dry feeds and its long term benefits. Cost remains a major constraint. Prices for dry feeds are 38-45 baht/kg (US 1.00-1.15/kg). In China, the price of feed is around 9-10 RMB/kg (USD 1.1-1.20/kg) whereas in Indonesia, prices are around 12,000 Rp/kg (1.33USD/kg).

Biosecurity in production

This continued use of trash fish not only undermines the sustainability of the industry but brings to the forefront, the polluting effects of trash fish on the cage environment. Industry has always attributed the spread of bacterial and viral diseases into cage production systems to the use of trash fish. In the future, as consumers become more discerning and focus on food safety issues, the way forward will be to switch to dry feeds in addition to improvements in production systems.

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Related articles: From farm to table, pp 12-13; Industry outlook at the Asian Aquafeeds 2005, p 20)

Mesocosm technology advances grouper culture

By Elizabeth Cox, Peter Fry, Anjanette Johnston*

Juvenile flowery cod Epinephelus fuscoguttatus at 92 days post-hatching (average weight = 16g, TL = 9.4cm)

Researchers in Northern Australia are using this protocol to produce fingerlings of two grouper species with difficult early life stages.

At the Queensland Department of Primary Industries and Fisheries (DPI&F) in Cairns, Northern Australia, researchers have succeeded in producing juvenile flowery cod (*Epinephelus fuscoguttatus*) for the first time in Australia. The fish, known as 'tiger grouper' in Asia, is in great demand in the live reef fish trade.

Development of flowery cod larvae cultured at Northern Fisheries Centre, Cairns. Top: Day 16 after hatching and bottom, Day 35 after hatching.

Demand for flowery cod, and other reef fish species such as gold-spot cod (*Epinephelus coioides*), is focussed on the live fish markets of Hong Kong and China. Flowery cod retails for AUD55 to 75/kg (USD 43-58) in these markets. While flowery cod is farmed in many Asian countries, many of the fingerlings used are caught as undersize juveniles in the wild. Hatchery production of fingerlings, as developed by DPI&F researchers, is essential to ensure the long-term sustainability of the aquaculture of the flowery cod.

The Reef Fish Aquaculture Project is based at Northern Fisheries Centre (NFC), Cairns. The recent upgrading of NFC, through the construction of a new aquaculture and stock enhancement facility, provides a purpose-built, marine aquaculture research facility that supports the development of tropical aquaculture in Queensland.

Finfish research at this centre is currently focussed on the production of high-value reef fish species including barramundi cod (*Cromileptes altivelis*), flowery cod and gold-spot cod. Research focus is on the development of methodologies for rearing larvae of these species, including the production of novel prey species such as copepods. The project is funded by the Queensland Government. Associated projects, funded by the Australian Centre for International Agricultural Research (ACIAR) have been valuable in providing opportunities for collaborative research in the Asia-Pacific region, particularly Indonesia and the Philippines.

Larval rearing

Rearing methodologies were initially developed from small-scale replicated experiments used to address issues during the early larval stages. However, larval survival in small scale recirculation systems has been poor with 100% mortality commonly occurring by day 10. Physical parameters identified during small-scale trials were then transferred to a larger pilot scale rearing trial using mesocosm technology. The same protocol is being used to produce fingerlings of two grouper species with difficult early life stages.

Mesocosm is a semi-intensive technology integrating both intensive and extensive aquaculture principles. It applies semi-intensive rearing principles which provide more diverse conditions during the early development phase, when larvae are highly sensitive and easily stressed. As larvae mature and become more robust, intensive rearing methodology can be introduced.

Tank management

Fertilised eggs were stocked (30/l, day 0 = hatch) into a 6m≥ fibreglass mesocosm system. Water was exchanged during days 1-2 at 5% tank volume per hour during the day. No water was exchanged on days 3 to 4 to prevent the removal of prey, particularly copepod nauplii, from the tank during the critical first feeding period. From day 5, water was exchanged overnight starting at 5%/hr increasing to 11%/hr and a continuous flow from day 17 post-hatching.

Squid oil was added to the water surface twice daily from day 1 to 6 post-hatching to prevent larvae from becoming caught in the water surface tension. A photoperiod of 12L:12D was supplied by two overhead daylight fluorescent tubes supplemented by a low level of natural light. Light intensity ranged between 300 and 700 lux across the tank water surface.

Feeding Schedule

Four microalgal species (*Tetraselmis sp., Cryptomonad sp., Isochrysis sp.* (T.ISO) and *Nannochloropsis oculata*) were added daily from day 0 to 22. They were added on an equal ration (organic weight) basis to maintain an *algal concentration equivalent to 2.2 x 10^5 N. oculata* cells/ml. (Organic weight is an ash free dry weight calculation which the team has profiled for each algal species.)

On day 2 post-hatching, copepods *(Acartia sinjiensis)* and SS-rotifers *(B. rotundiformis)* were added at densities of 1.25/ml and 10/ml, respectively. Enriched rotifers (Algamac 2000) were added from day 6 until day 16 to maintain a density of 15 to 20/ml. Artemia nauplii were introduced from day 9 – 13 and enriched (Algamac 3050) meta-nauplii from day 13 to 28. Artificial diets were introduced from day 9 onwards as detailed in Table 1.

Metamorphosis/cannibalism

The first metamorphosis of larvae to juveniles was noted on day 29/30 for both species and the majority had metamorphosed by day 40. Growth rates were similar for both species during the larval phase with a slight increase in gold-spot cod growth rates compared to that of flowery cod during the juvenile phase (Figure 1). Cannibalism coincided with the start of metamorphosis and was the major cause of mortality.

Figure 1. Total length (mean value and standard error) of flowery cod (open circles) and gold-spot cod (closed squares).

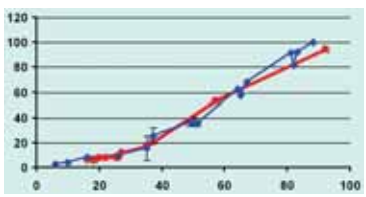
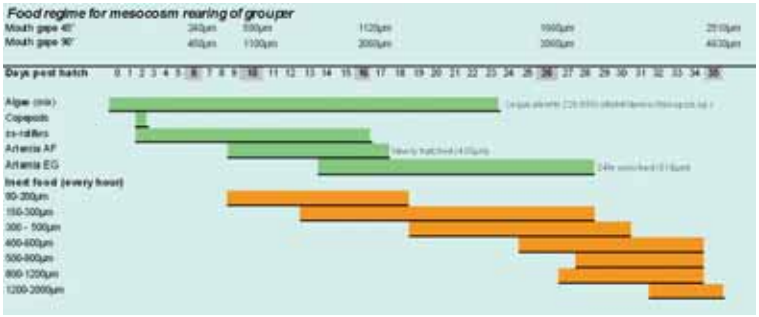


Table 1. Succession of feed types used to rear larval flowery cod and gold-spot cod.



Grouper larvae are very sensitive to handling stress prior to metamorphosis and grading is not possible. This results in very high levels of cannibalism of larvae during the metamorphosis window. On day 43, surviving juveniles were transferred into a raceway tank where they were graded into three size classes (<5.5, 5.5 - 6.5 and >6.5 mm bar width). Grading reduced cannibalism from 26.9 to 13.7% and cannibalism ceased altogether from day 65 onwards when the total length of juveniles averaged 5.7 to 6.3cm.

Behaviour

During metamorphosis (around day 30-35), larval behaviour changed from an active swimming, surface-oriented feeding pattern to a less active and benthic feeding behaviour. Artificial hides were introduced to correspond with this behavioural change and juveniles rather than larvae that had not yet metamorphosed, used them predominantly.

Juveniles were increasingly prone to startling in response to stimuli such as activity around the tank. They began to display behaviour similar to that of the adult fish around day 95 – 100. Territorial and dominant behaviour involved individuals displaying a pale underside to other fish or head to tail pushing and mouthing. The provision of adequate hides remained an important factor in reducing this aggressive behaviour.

Future application

This initial success in rearing of two grouper species indicates the application of mesocosm technology to rear multiple marine finfish species that have sensitive early life phases. Mesocosm systems provide a broader physical parameter range for the sensitive early larval phases reducing the need for strict control over conditions essential in small-scale intensive systems. The system can be changed to more intensive management once this early phase has passed.

Research into production of juvenile grouper continues to focus strongly on resolving problems occurring during the early larval feeding stages. The current success represents a breakthrough that will allow the concurrent development of techniques for production of juveniles. The recent progress in this area forms the basis of the next project phase, where the more active transfer of outcomes to industry proponents can commence.

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Anjanette Johnston is a Fisheries Technical Officer working on the development of innovative techniques to enhance larval rearing for several species including grouper and sea cucumbers.

Peter Fry works as Hatchery Manager and is responsible for all larval marine finfish operations, including the current development of larval rearing technology for several species including grouper and sea cucumbers.

Quality criteria for fishmeal in fish and shrimp feeds

*by Ian Pike**

The quality criteria for fish meal in shrimp and fish feeds depend on the species being fed and the degree of substitution with non marine products. Carnivorous species have the most exacting quality standards for both fish meal and fish oils. In this article, the author discusses fish meal quality and the methods of checking processing and handling procedures to meet this aim.

Fishmeal is produced by removing part of the water and oil from fish. A small proportion of world fishmeal (around 10%) is produced from fish trimmings which are remains after meat is removed from fish. The aim in producing fishmeal is to preserve as much as possible of the original nutritional value of the fish. The quality of fishmeal is affected by the following:

- The species of crustacea or fish being fed
- The type of raw-material – particularly of fish or trimmings
- The freshness of raw-material
- The processing temperature exposure
- Fat stability
- Hygiene
- Purity

The species being fed

This governs quality requirements. For example, in the feeding of carnivorous species compared with omnivorous species, the former are more critical in terms of the quality criteria. The more carnivorous species of shrimp, for example, *Penaeus monodon* has more exacting requirements in comparison to *P. vannamei*.

Type of raw material

Proximate analysis shows that fishmeal contains protein, fat, ash and moisture. The sum of these should be close to 100% if the analysis is accurate. Species of fish and season of catching affect protein and fat content. Meals from South American fish such as anchovy typically have 65 to 68% protein; meals from European fish such as capelin typically have 70 to 72% protein.

Protein has traditionally been determined using Kjeldahl digestion. Combustion methods such as Dumas have been found to be more accurate, recovering more of the nitrogen which can be utilised by the animal. Fat is best determined using solvent extraction with petroleum ether or hexane.

Whole fish, when fresh, generally has an amino acid composition of its protein which, when expressed as a percentage of the protein, is similar. For example, South American anchovy-type fishmeal and European herring-type fishmeal would each contain 7.7% lysine and 4.0% methionine+cystine expressed as a percentage of the protein. Meals made from trimmings generally have 10% less amino acids.

The fat in fishmeal, typically 8 to 10%, is rich in omega 3 polyunsaturated fatty acids. Provided it has been correctly stabilised with antioxidants to avoid oxidation, the content of omega 3 fatty acids would typically be around 35% in South American fish meals and trimmings meal, and 27% in European fishmeal. Of these fatty acids approximately 50 to 60% are docosahexanenoic acid-DHA.

Freshness of raw material

From the time of catching, fish starts to spoil. This causes the breakdown of protein and fat, the former producing biogenic amines and ultimately ammonia and the latter giving free fatty acids. Determining these breakdown products will provide a measure of the degree of freshness. The longer the period between catching and processing, the greater will be the degree of spoilage.

Preservation methods can reduce spoilage, the most successful being those which involve reducing temperature through the use of either ice or refrigerated water. Caution has to be taken with chemical preservatives to avoid residues which might have adverse effects on the species being fed. In this respect, low levels of acetic acid have been used successfully without any deleterious effects on the animals being fed.

Trials have been undertaken by the fishmeal industry to establish the effects of the quality of raw material on the growth and feed efficiency of carnivorous shrimp and fish. Using raw material that was processed either fresh, moderately fresh or stale (Figure 1) the effects of the biogenic amine content of the fishmeal produced and also on the different species of shrimp being fed can be seen.

The reduction in growth and poorer feed efficiency as fishmeal raw material deteriorates are evident. Similar work has been done with salmonids and white fish (halibut) showing comparable results. From this work it has been concluded that for fish meal for carnivorous aquaculture species, the sum of the biogenic amines, histamine and cadaverine should not exceed 2000 ppm of for the best results.

Figure 1. Effect of freshness of raw material (anchovy) used in fish meal production on final weight (g) of shrimp receiving these meals in their diets

	Fresh (F)	Moderately	Stale (S)	Significance
Centre: Nuevo Leon	Shrimp: *P. vannamei*			
Trial 1 (15 days)	0.59	0.50	0.47	F>MF&S*
Trial 2 (28 days)	1.92	1.64	1.63	F>MF&S*
Centre: Tahiti		Shrimp: *P. monodon*		
Trial (30 days)	3.3	3.1	2.8	F>S*
Centre: Tahiti		Shrimp: *P. stylirostris*		
Trial (31 days)	6.7	6.0	5.6	F>MF&S*

**Significance = 0.05*

Processing temperature exposure and digestibility

In the process of producing fish meal, the fish is first cooked, typically to 90°C, then pressed, fat centrifuged from the liquid and the remaining so-called 'stick water' added back to the press cake and dried at 90°C to produce fishmeal. In this process, using for example, a rotary drier with indirect steam heating, the protein digestibility of the resulting fishmeal would typically be around 89 to 90%.

With low temperature processing, for example drying with indirect hot air, digestibility would typically be three or four units higher. Trials with carnivorous fish and shrimp show that this fishmeal can result in better growth by 10% or more.

Although extensive work has been conducted to develop a laboratory technique of measuring digestibility, a simple method that is accurate has not been found. Probably the most commonly used technique is to determine solubility of the protein in dilute pepsin solution (0.0002%). This is not a sensitive method and is not accurate enough to detect differences of less than three to four per cent units; that is, it would not distinguish a regular from a low temperature product.

On the other hand, in vivo techniques involving target species such as the salmon or the use of an indicator species such as mink have

been much more successful. Digestibilities so determined have been correlated in all carnivorous species to a relatively high level of accuracy compared with chemical methods. A procedure involving the determination of sulphydryl groups combined with d-aspartic acid determination has been shown to be the most accurate chemical procedure developed so far, according to results obtained in an inexpensive programme financed by the European Union. Details of this procedure are available from the final report of this European project.

Quality specifications of special fish meals

As the quality of a fishmeal is all important to optimise the growth and feed efficiency of carnivorous species, the fishmeal industry has developed special products for this purpose. Emphasis is placed on freshness of the raw material and low processing temperatures. The effects on the quality criteria are illustrated in Figure 2.

Taking a standard or FAQ fishmeal as the basis, quality specifications are better as we progress from special to Prime to Super Prime/LT as indicated in the table. For example, special products will generally have less than 2,000 ppm of histamine plus cadaverine. Super prime/LT products will generally have protein digestibilities of 90% or more based on in vivo determinations.

Figure 2. Quality specifications for special fish meals (changes compared with standard fish meal)

	Special	Prime	Super/LT
Freshness (TVN in raw material)	↑	↑↑	↑↑↑
TVN and Ammonia in Meal (% nitrogen)	↓	↓↓	↓↓
FFA in meal (% of fat)	↓	↓↓	↓↓
Histanmine in meal (ppm max)	↓	↓↓	↓↓↓
Total amines in meal (ppm max)	↓	↓↓	↓↓↓
Mink digestibility (min)	–	–	↑
Pepsin digestibiliy (min)	↑	↑↑	↑↑↑
Botox score (max)	↓	↓↓	↓↓↓
Ash	↓	↓	↓
Fat	↓	↓	↓
Salt	↓	↓	↓

Fat stability

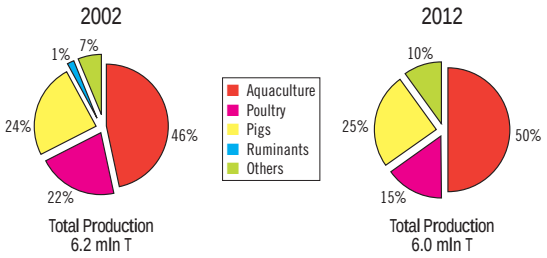
The fat in fishmeal contains a high proportion of polyunsaturated fatty acids which are susceptible to oxidation and thus the use of antioxidants is recommended. Typically, ethoxyquin is added at a level which is generally determined by the degree of unsaturation. The higher the level of omega 3 fatty acids, the greater is the degree of unsaturation, as indicated by the iodine value. Measuring the degree of oxidation of fat in fishmeal is difficult in the laboratory. In the absence of facilities to do a detailed fatty acid profile to check if fat oxidation has occurred, testing for the presence of ethoxyquin is an alternative. Even low levels of a few parts per million would indicate absence of oxidation.

Alternatively, if the fat is determined by chloroform/methanol extraction and the solvent extraction value is expressed as a percentage of former, it should be 80 per cent or higher in the absence of oxidation. A low figure suggests oxidation has occurred, which renders the fat less extractable with solvents petroleum ether or hexane.

Hygiene

When fish is handled from conveyors to catch holds, storage bins or pits these should be clean to minimise the proliferation of spoilage bacteria. During the processing heat will destroy bacteria. Subsequently reinfection during storage and transport is possible if hygiene is not of a high standard. Avoiding any contamination from dirty water, animal droppings etc., is essential to avoid contamination. Routinely, hygiene can be monitored by measuring the content of *Enteriobacteriacea* and checking for absence of *Salmonella*.

Summary of global fish meal use for the period 2002 and 2012



Purity

Fishmeal is produced in plants which are dedicated to the handling of fish and not for handling other materials. Fishmeal is produced entirely from marine products. However, once produced, there is always a risk that contamination from handling may occur. This is avoided through hygiene procedures and correct handling as specified by quality assurance systems such as HACCP and good manufacturing practices. The EU is now demanding traceability and encouraging suppliers to be part of a quality assurance scheme which ensures both traceability, good manufacturing practice and handling at all stages to ensure no contamination occurs.

Due to the outbreaks of BSE in Europe, America and Japan, there is now a demand for testing fishmeal to ensure the absence of any land-animal material. An IFFO project organised through the EU has developed an improved feed microscopy procedure which is capable of detecting land animal protein in fishmeal at levels as low as 0.1 per cent. Further details of this test are given in the EU directive number Fair-CT96-1329.

Conclusion

Using fresh raw-material coupled with gentle processing temperatures, high quality fishmeal can be produced. Their nutritional value is very close to that of the original fish. Ways of ensuring that this is achieved in the manufacture and handling of fishmeal are outlined above along with tests to ensue this has been achieved. In so doing, the product obtained has high nutritional value for carnivorous aquaculture species and which is the closest feed available to their natural feed.

This paper is based on a presentation titled "Fish meal in shrimp feeds and fish feeds: quality criteria and methods to quantify quality parameters" at the Tenth Aquaculture Conference Asia Pacific, DSM Nutritional Products, 25 November 2004, Bangkok, Thailand.

Typical Proximate Analysis Of Various Fish Meals

Fish Meal Source	Protein	Fat	Ash	Moisture
S. America	65.0	9.0	16.0	10.0
Europe	72.7	9.1	10.1	8.1
U.S.A.	62.6	10.1	19.2	8.1
Europe/Asia	65.0	5.0	20.0	10.0

Ian Pike was formerly Technical Director and is now a consultant with IFFO. IFFO is the International Fishmeal and Fish Oil Organisation, an international non-governmental organisation representing fish meal and fish oil producer companies in 34 countries and related trades in the world. It was created in 2001 by the merger of two organizations, the International Fishmeal and Oil Manufacturers Association (IFOMA) and the Fishmeal Exporters Organisation. Address: IFFO Limited, 2 College Yard, Lower Dagnall Street, St. Albans, Hertfordshire, AL3 4PA, United Kingdom. Email: Ianhpike@aol.com

Seed production of the giant freshwater prawn

*By S. T. Indulkar, S. G. Belsare and P. C. Raje**

Success for M/S Priya Prawn Hatchery

In India, more than 50,000 ha of unproductive saline sugarcane land of the western part of Maharashtra state offers potential for the farming of the freshwater prawn farming. The constraint is the availability of sufficient quality seed to meet an estimated demand of 750 million to a billion postlarvae. In this article, the authors describe the success story of a woman entrepreneur who established a backyard hatchery with an annual capacity of 5.0 million postlarvae.

The freshwater prawn *Macrobrachium rosenbergii* commonly known as "scampi" is widely distributed in the rivers joining to the Arabian Sea on the west coast of India. Trials in freshwater ponds using wild juveniles collected from natural waters were initiated in the northern part of the Konkan region of Maharashtra State about two decades ago. From then on, its farming has stimulated interest among the fish farmers of the Maharashtra state, mainly due to the higher price as compared to the culture of the Indian major carps.

This awareness of freshwater prawn culture has increased the demand for quality prawn seed which has been estimated at more than 750 million to a billion even if 25 per cent of the total potential area is used for freshwater prawn culture. Hence, there are opportunities for the setting up of around 50 to 100 backyard hatcheries, each with a capacity of 10 to 20 million post larvae in the region. Up to 2001, there has been no commercial hatchery.

Scientists from the Faculty of Fisheries, Ratnagiri, a constituent of Dr. Balasaheb Sawant Konkan Agricultural University, Dapoli, Maharashtra then developed the seed production technology of *M. rosenbergii* suitable for this area (Raje & Joshi, 1992; Chavan, *et al.*,1995; Indulkar *et al.*, 1998; Indulkar,1999). The technology was then transferred to M/s Priya Prawn Hatchery, Sawarde, Dist. Ratnagiri (Maharshtra).

This is a success story of a woman entrepreneur in this remote coastal village of Maharashtra state who ventured to integrate prawn seed production with other important production technology suitable for this area such as ornamental fish breeding and culture, poultry, horticulture nursery for mango, coconut, cashew nut, ornamental plants and flowers.

The first backyard hatchery

The hatchery in Ratnagiri was set up in 2001 with a production capacity of 5million seed (PL 20) annually. The hatchery complex, spread over an area of 0.8 ha comprises of brood stock raising ponds, main hatchery shed, seawater storage tanks, mixing tank, filtration unit etc.

There are two brood stock ponds, each of 0.07 ha. They are stocked with PL 20 prawn at a stocking density of 3,000 per pond. This is for a regular supply of spawners. In addition, new broodstock are collected regularly from the creeks situated along the nearby coastal areas.

The hatchery shed measuring 30m x 10 m has a capacity to produce 5.0 million postlarvae per year. The main activities such as hatching, larval rearing and nursery rearing of post-larvae are carried out here. The flooring of shed is made up of stone tiles and the roof is covered with asbestos cement sheets interspersed with one transparent fiberglass sheet after every three sheets. Length-wise, brick walls are constructed up to a metre high to allow proper ventilation of the shed.

This design helps to maintain higher temperatures from March to November and accelerate moulting of larvae. There is a gradual slope in the floor to facilitate the transfer of larvae from the upper rearing tank to the lower rearing tanks by gravity. This also helps in the maintenance and cleanliness of floor. A central drainage is provided along the central portion of the shed.

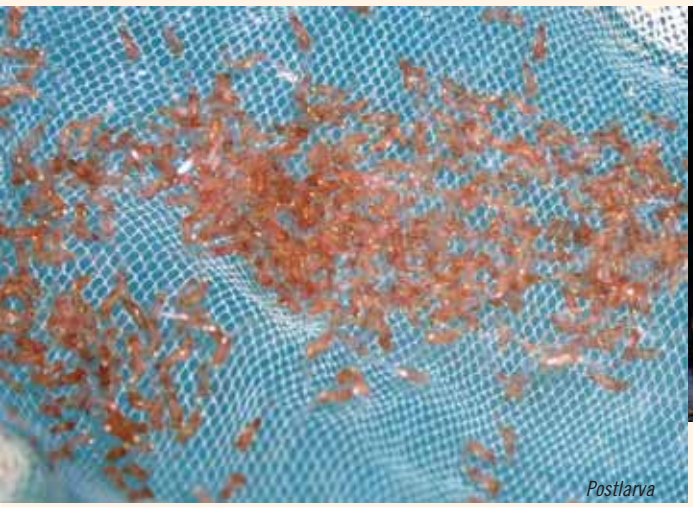
View of the larval rearing unit

Spawners

Sea water is brought inland by tanker from a distance of 40 km and stored in three tanks. Two tanks have a capacity of 35,000 litres each and the other has a capacity of 75,000 litres. A filtration unit consisting of two biological filters with a flow of 1,000 litre/hr is used. Mixed water with a salinity of 13±1 ppt is filtered and stored in the collection chamber of the filter unit and then supplied to the main hatchery shed. Freshwater is directly pumped from the bore well. The tank for preparation of required saline water (13 ppt) has a capacity of 20,000 litres and is located below the sea water storage tanks.

The hatching, larval and nursery rearing of postlarvae are mainly carried out in circular plastic tanks of various sizes (1.2m in diameter x 0.6m in height, 1.8m x 0.6m and 1.8m x 0.9m). Two cement tanks, each with a capacity of 5,000 litres are constructed for the collection of water siphoned out from the larval rearing tanks. A biological filtration unit is provided to each tank. The water thus collected is filtered before storing in the collection tanks.

After a period of 5-6 days in the collection tank, the water is transferred to the mixing tank and thus re-circulated. The sea water storage tanks, mixing tank, filtration unit, main hatchery shed and waste water collection tanks are positioned in such a way that the water can pass through the piping from one unit to other by gravity.



Postlarva

The total period for a completion of larval cycle is 30 to 32 days. The first post-larva appears on day 16-17. The survival from the first zoeal stage is more than 80 per cent.

Hatchery Techniques

Pond reared or wild caught berried females are gradually acclimated to 6 to 8 ppt brackish water and kept in hatching tanks of 500 litres capacity. The spawners are fed with chopped clam meat or prawn meat *ad libitum*. Feed and faecal wastes are siphoned out daily. Water exchange is 20 to 30 %. After hatching, the females are removed from the plastic tank.

Larvae are reared in 13±1.0 ppt seawater in the hatching tank up to IV – V stage and then transferred to 1,000 litre capacity tanks containing 750 to 800 litres of water and reared in the same tank up to postlarval stage. Thus, the initial stocking density of larvae is maintained at 100 to 120 per litre up to IV – V stages and thereafter, the density is gradually reduced to 50 to 60 per litre. The larvae thus obtained from single female are reared in separate tank to reduce mortality and uneven growth.

Feeding of larvae is carried out three to four times during the day at 0800, 1200, 1600 and 1900h. The feeding schedule for the different stages of prawn larvae is given below.

The prepared feed for the purpose of larval rearing consisted of ribbon fish meat powder (30.0%), dried shrimp shell powder (1.5%), milk powder (12.0%), corn flour (8.0%), agar (1.5%), poultry egg (wet weight - 45%) and Baker's Yeast (1.0%). These are mixed thoroughly and cooked for 20 minutes and cooled to room temperature. Vitamin and mineral mixtures (1.0%) are added in the cooked mixture. The proximate composition of this feed is 45.5 % crude protein, 7.8 % crude fat and 6.5 % ash. This was found to be the most suitable and effective feed for larval rearing.

Larval rearing tanks are provided with continuous aeration to maintain sufficient oxygen level as well as to keep the food particles in suspension and motion. Three to four hours after each feeding, waste and left over food are siphoned out. The water exchange at 30 to 40% is done twice daily.

Production trials

The first trial was from June to December 2001 and nearly 0.45 million of postlarvae -20 were produced and sold to local farmers. Production was stopped from December 2001 to March 2002 to allow for the completion of construction works.

Larval Stage	Age of larvae (days)	Feeding Schedule (hrs)				Quantity of food per 10,000 of larvae	
		0800	1200	1600	1900	Artemia nauplii (nos l-1)	Prepared feed (wet weight g/time)
I to IV	1 to 6	Artemia	Artemia	–	*Artemia*	5 to 6	–
V to IX	7 to 16	*Artemia* + Prepared feed	Prepared feed	Prepared feed	*Artemia*	8 to 10	25 to 40
X to PL	17 to 30	Prepared feed	Prepared feed	Prepared feed	*Artemia*	3 to 4	50 to 60

Table: 1 Post-larval production in circular plastic tank (1000 L) at a backyard hatchery

Trial No.	Female Weight (g)	Larvae/Tank		First post-larva observed on (day)	Total period (days) for larval cycle	Post-larva produced		Survival (%)	Temperature during larval cycle (°C)
		Total	No./L			Total	No./L		
1	106	58,700	59	18	32	48,684	49	82.9	28.0 - 31.0
2	114	49,500	50	17	28	42,320	42	85.5	28.5 - 31.5
3	128	60,000	60	18	30	49,211	49	82.0	27.0 - 31.0
4	78	46,300	46	17	29	36,355	37	78.5	27.5 - 30.5
5	64	35,000	35	20	34	30,927	31	88.4	28.5 - 30.5
6	72	43,200	43	20	36	34,042	34	78.8	28.0 - 31.0
7	80	49,500	50	21	32	36,603	37	73.9	26.5 - 29.0
8	115	60,000	60	22	36	46,620	47	77.7	26.5 - 29.0
9	68	31,800	32	19	31	26,509	27	83.4	27.5 - 30.5
10	84	48,000	48	20	33	35,172	35	73.3	26.5 - 29.0

Scampi ready for markets

From March to November in 2002 and 2003 respectively, 1.2 million and 2.05 million of PL-20 was produced and supplied to the farmers. During the subsequent year (2004), 3.8 million of seed was produced. The production of post-larvae, which was carried out during 2004 in circular tanks (1,000l capacity) in this hatchery is shown in Table1.

The postlarval rearing method described above has resulted in the production of 27 to 49 postlarvae prawn per liter. The first postlarvae appeared after 17 days and the 80-90% conversion is completed within 30 days. A maximum of 36 days is required to complete the entire cycle. Data indicated that survival of postlarvae ranged between 73.3 to 88.4% from the first larval stage when the initial stocking density of larvae ranged between 32 to 60 larvae/l.

The environmental and water quality parameters at the site are found to be very suitable for larval rearing. Temperatures ranged from 26.5 to 31.5°C throughout the year except during the month of December to February when the temperature drops below 24°C which is not conducive for freshwater prawn larval rearing (Gabriel, 1987 and Indulkar, 1999) and hence the larval rearing is suspended during this period. Gibson (1975), Lee (1982) and Indulkar (1999) have highlighted the effectiveness of higher temperature in prawn culture. According to these researchers, the optimum temperature for *M. rosenbergii* larviculture is 24 to 31°C. Thus, the temperature range of 25 to 31°C observed at the hatchery site is found to be suitable for better survival and faster rate of growth. Other water quality parameters such as, pH (7.8 to 8.8), nitrite (0 to 0.01 mgL^{-1}) and nitrate (0.5 to 2.0 mgL^{-1}) levels are within the tolerance limit of *M. rosenbergii* larvae (New & Singolka, 1985).

Salient points

It must be emphasized that whatever food is given during larval rearing, the efficiency of the feeding process depends largely on the routine observations of the workers. The amount of food left unconsumed should be carefully examined every morning in order to adjust the feeding quantity in the subsequent days.

It was also observed that feed quality and feeding schedule are inseparable and essential for successful larval rearing. To minimize the use of *Artemia*, an introduction of a suitable locally available feed became imperative. The larval feed developed at the Research Station was found to be the most suitable, resulting in better growth and survival (>80%) from first larval stage to post-larvae.

More importantly, this feed was found to be most cost-effective. The use of larval feed described here only increased the survival of post-larvae but also reduced the cost of production of post-larvae. Aniello & Singh (1982), Alam *et al.* (1993), Sebastian (1994), Reddy (1997) and Indulkar *et al.* (1998) have successfully tried *Moina sp.* as principal larval diet in combination with *Artemia* nauplii and reported 50 to 85% larval survival.

More over, the continuous maintenance and supply of any live food is rather difficult and labourious. Live foods have also some drawbacks in that they may carry external parasites and other diseases. Thus, the present practice of larval rearing is found to be most efficient and successful under the existing environmental conditions and the observed management practices. It is also observed that the prepared larval feed has an advantage over live food as large quantities can be prepared at any given time by incorporating locally available ingredients with less cost.

Finally, it needs to be emphasized that this production method supported by good managerial practice resulted in more than 80 per cent survival from first stage to post-larvae.

Acknowledgements

The Authors are grateful to Dr. S. S. Magar, Vice-Chancellor, Dr. B. S. Konkan Agricultural University, Dapoli, Dist: Ratnagiri - 415 629, India for his constant encouragement during the establishment of this hatchery. The authors are also thankful to the owners of M/s Priya Prawn Hatchery for their interest in establishing the hatchery.

A list of references is available from the editor

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Alltech turns 25

In March, Alltech Biotechnology, celebrated its 25th anniversary with a party in Bangkok attended by their customers and the company's livestock and aquaculture teams from all over Asia. This coincided with the VIV Asia exhibition.

Alltech was founded in 1980 by Dr Pearse Lyons whose vision was the use of natural yeast fermentation as natural alternatives in the animal feed industry. The success with the first product Yea-SaccA[1026] was followed by a constant stream of innovative animal health solutions. This then made the company one of the world's leading biotechnology companies with a presence in 85 countries. Current turnover is reported at USD 200 million.

In Bangkok, celebrations were led by Steve Bourne, Vice President, Asia Pacific and Mark Lyons, International Projects Director. Via video, Dr Lyons reflected on the developments that have brought Alltech in the forefront of the animal feed industry.

As for aquaculture, Mark Lyons, International Projects Director said, "The next 25 is really where things are going to get exciting, especially in aquaculture. I think we have a new focus and new expertise to be able to help the market with emerging problems. At the same time we are absolutely committed to our mission of being a global company, but acting very much like a local one".

Steve Caskey (Regional Sale Manager-Asia) with Tep Tepsatit, Charoen Pokphand, India. Steve who was on holiday in Pangnga Province, survived the tsunami

Tsunami Relief Project

Whilst in Thailand, Mark Lyons visited tsunami victims in the vicinity south of Phuket to see first hand the benefits of the Tsunami Disaster Fund started by Alltech's employees. Here the company is focusing mainly on providing new houses, new boats and a few shops to the villages of Koh Pu and Koh Sri Boya in Krabi, Province. It is doing this through the local Pattanarak Foundation.

...and to a bigger office in Malaysia

To fulfil the need for more space and in line with its expansion plans, Alltech Malaysia has moved to larger premises in Shah Alam. A ribbon cutting ceremony was held in March. This also coincided with the 25th anniversary celebrations for Alltech Malaysia.

Cutting the cake by Mark Lyons (left) and Steve Bourne

Ribbon cutting at the new Malaysia office by David Faulkner, GM, South East Asia and Richard Chong, GM, Malaysia-Singapore

Bunluesak Sorajjakit, Thai Union Feedmill flanked by Dan Fegan, Regional Technical Manager of Aquaculture (left)and Chris King, GM-South Asia.

From left Alltech's Noel Cuyno and David Faulkner (third from left), with Filipino distributors Cherry Lim and Jose G Albelliana

Bacteria probiotics

At VIV Asia, Canadian company Lallemand Animal Nutrition which specializes in yeast bacteria and yeast derivatives introduced its range of products for aquaculture applications. These are yeast & bacteria probiotics, mannan oligosaccharides (MOS) purified nucleotides and mineral enriched yeast.

According to Vincent Usache, Aquaculture Technical Manager, currently the focus is on probiotics and Bactocell, in particular. This is a concentrated live lactic acid producing bacteria specifically selected to enhance nutrition & health of fish and shrimps. The strain is *Pediococcus acidilactici* MA 18/5 M registered at the Pasteur Institute in Paris, France.

Vincent Usache (left) and Pattana Thonking, Nuevotec Co, Thailand at VIV Asia 2005

Bactocell has been most developed for aquaculture with numerous trials conducted with salmonids, marine fish, shrimp, tilapia, large mouth bass and eel. The environments covered freshwater, seawater, high and low temperatures. In the case of the shrimp, species studied were *P. vannamei* in China, *P. monodon* in Vietnam and *Litopaenus stylostris* in New Caledonia.

In Vietnam, in trials with shrimp, the probiotic was fed to postlarva through the enrichment of Artemia and then through application on the compound feed. Results showed a significant increase of 52% weight gain after 8 weeks of treatment from PL 15 up to 2 month age shrimps. Furthermore, when the additive was provided in feed at a rate of 100g/tonne for 21 days, the mortality of more than 1,200 juvenile tilapia fish fed the feed, declined by half and growth increased by 30%.

Vincent said, "Further work in research institutes (IFREMER New Caledonia & Pearl River Research Insitute, China) with Bactocell have shown that beyond 'the natural growth & health promoter' concept, the improvements are mainly in a better feed digestibility, immune system stimulation and gut structure".

The aquaculture applications of other Lallemand's specialties were also demonstrated. Agrimos, (Mannan Oligo Saccharides Product), Alkosel (Selenium Enriched Yeast) and Laltide (Purified Nucleotides) complete the aquaculture range and provide natural solutions to industry concerns.

More information: Vincent Usache, Lallemand Animal Nutrition-Aquaculture. Tel: +33 (0) 562 745 555; Fax: +33 (0) 562 745 500; Web: www.lallemand.com; Email: aqua@lallemand.com

More for aquaculture innovations at Annual Feed Symposium

To elevate the aquaculture industry, in particular aquaculture nutrition, Alltech will have industry leaders look at current issues facing the industry at the Aquaculture Nutritional Technologies session of Alltech's 21st Annual Feed Industry Symposium in Lexington Kentucky, May 22-25, 2005.

David Byrne, former EU Commissioner for Health and Consumer Protection will give the keynote presentation on "Food safety, front and centre: the consumer's ultimate concern. Why traceability, both globally and nationally, must become one of any company's mandates."

Dan Fegan, Asia-Pacific Regional Technical Manager for Aquaculture said, "Consumer demand for traceability and high-quality nutrition, coupled with the need to maximize feed efficiency and performance mean the aquaculture industry must be willing to break the boundaries of traditional feed methods to remain competitive and cost effective".

Other presentations during the event will feature concepts on creating new products, taking advantages of innovative technologies and elevating production, performance and returns. Well known consultants and academics will look at issues such as antiviral immunity, the organic aquaculture movement, alternatives to antibiotics, nutritional aspects of pigmentation and controlling mycotoxins. (More information from the local Alltech representative or Kim Levernier at klevernier@alltech.com)

Effective solutions for sustainable aquaculture


Dr. Christian Lückstädt

Biomin, one of the key players in the international feed additive business, has developed a new line of products for modern aquaculture, including probiotics for shrimp hatcheries and pond grow out. Biomin® START*grow* is a probiotic premix for shrimp hatcheries, Biomin® GROW*out* is a probiotic premix for shrimp pond grow-out and Biomin® POND*life* is a probiotic premix for water treatment in shrimp grow-out.

"The recent scandals concerning antibiotic misuse in aquaculture draw public attention on production methods. Both public opinion and regulation authorities in most of the export countries have a negative attitude on the misuse of antibiotics in aquaculture", said Dr. Christian Lückstädt, Biomin's Product Manager for Aquaculture. "The 'Biomin Specials' product line for aquaculture offers sustainable, effective and profitable solutions for the aquaculture industry in South East Asia. These have been developed after intensive research in our laboratories, cooperation with universities and research centres around the world as well as trials under field conditions".

Biomin was founded in 1983 by Erich Erber with the idea of supporting animal health to ensure high performance and sustainable production. Constant improvement in R&D as well as a strictly monitored quality assurance programs (ISO and HACCP) form the basis of the products for customers. In the 1990s, Biomin started to expand worldwide and in Asia, offices were set up in Malaysia, Singapore, Vietnam, Korea, the Philippines, India and China.

More information: Dr. Christian Lückstädt, Email: christian.lueckstaedt@biomin.net; Web: www.biomin.net

12th Annual Practical Short Course on "Aquaculture Feed Extrusion, Nutrition and Feed Management"

This one-week practical short course will be held on September. 25-30, 2005 at Texas A&M University by staff, industry representatives and consultants.

This program will cover information on designing new feed mills and selecting conveying, drying, grinding, conditioning and feed mixing equipment. Current practices for preparing full-fat soy meal; recycling fisheries by-products, raw animal products, and secondary resources; extrusion of floating, sinking, and high fat feeds; spraying and coating fats, digests and preservatives; use of encapsulated ingredients and preparation of premixes, nutritional requirements of cold and warmn water fish and shrimp, feed managements and least cost formulation are reviewed. Practical preparation of sinking and floating feeds and, pellet durability, are demonstrated on four major types of extruders – (dry, interrupted flights, single and twin screw), using various shaping dies.

Reservations are accepted on a first-come basis. For more information, programs and application forms, contact: Dr. Mian N. Riaz, 2476 TAMU. Food Protein R&D Center, Texas A&M University, College Station, TX 77843-2476, Tel: +001 979/845-2774; Fax: +001 979/458-0019, E-mail: mnriaz@tamu.edu, Web: foodprotein.tamu.edu/extrusion

Asian fish vaccines launched

Five years after setting up its first and only private aquatic animal health R&D center in the Asia-Pacific region, Akzo Nobel's Intervet has introduced its first two Asian fish vaccines. This represents a major achievement for the Singapore-based facility, which began operations in 2000.

Norvax® Vibrio Mono is Intervet's first fish vaccine to be registered in Japan. This is an immersion vaccine against *Vibrio anguillarum* infections of Japanese yellowtail. Norvax® Strep Si, is an immersion and injection vaccine against *Streptococcus iniae* infections in warmwater fish. Full registration of the product is expected in Indonesia and Singapore later this year, while registration in several other countries is anticipated over the next few years.

"Asia has been responsible for close to 90 percent of world aquaculture production in recent years and the region will continue to dominate global aquaculture for decades to come," said Dr William Enright, Marketing Manager for Intervet's Aquatic Animal Health business. "So, just like with the salmon industry, vaccination will become a critical factor for economically viable and sustainable aquaculture in Asia."

Intervet's R&D center in Singapore focuses on the temperate and warm water species found in the Asia-Pacific region, such as grouper, Asian seabass, Japanese yellowtail, amberjack, tilapia and shrimp. In addition to disease epidemiology and vaccine development, investigations are underway to develop new, high quality and safe pharmaceuticals for responsible use as part of an overall health care management plan for fish farms. The Asian-based center fully complements Intervet's well-established and successful R&D center in Bergen, Norway, which focuses on coldwater fish species such as salmon.

Aquaculture at VIV Asia 2005

The recent VIV Asia exhibition, held from 16 – 18 March in Bangkok, Thailand attracted some 470 international and national exhibitors and 22,651 visitors from 87 different countries. While the main focus of exhibitors at this year's show was in the feed and livestock industries, there was also a significant presence of products, notably from Europe, being marketed for the fast expanding aquaculture industry in Asia. Most were feed ingredients and additives.

Dr Klaus Hoffman (left) and Dr Peter Koeppel of Chemoforma

Sam Soh (right) and J C Filippi of Gold Coin Singapore

Santana Krishna, Maritech (left) and Y. Krishna Reddy, Geekay Hatcheries Pvt Ltd., India

Dr Budi Tangendjaj, ASA Consultant, Indonesia and wife

According to a survey conducted by the organisers, there was a sizeable interest in aquaculture among the visitors. Some 12% of the 53% involved in the feed sector had interests in aquafeeds and 16% of the 64% interested in feed ingredients, additives and raw materials were looking for information on fish.

The expanding aquaculture business in Asia, particularly the expansion of the aquafeed industry in Vietnam, is a potential market. Established companies in the livestock industries of Europe have developed applications in aquafeed and aquaculture for products long marketed in the livestock industry, whilst those with well established products for the salmon and trout industry of Europe are looking into the region for new applications and for new markets.

Feed additives

The PSB-Complex from Swiss based Chemoforma is already well used in the grow out shrimp feeds in Asia, mainly for its immunostimulatory properties. Recent results from trials in India by using Vannagen in shrimp larval feeding may mean that the complex has a larger role in improving growth performance at early stages, according to Consultant, Dr Joachim Hertrampf. Earlier research has already indicated that under such stress situations, simulated by varying water salinity, the inclusion of PSB-Complex improved the survival rate.

Dr Klaus Hoffmann, Manager Scientific Services said that by feeding optimum levels at the early stages, nutritionist may be able to push for a faster growth at early stages. The aim is to shift forward the growth curve. As for the use of PSB-Complex in fish feeds, he said that in Europe, the PSB-Complex has been in use in feed formulations for the salmon and other marine fish for several years since 1999. In Asia, the company is now marketing it for inclusion in local marine fish species. Initially, it will commence with trials in Thailand and will use the data already established for European marine fin fish species to compare results.

Vitalac is a market leader in France in the production and commercialisation of feed additives, acidifiers, nutri-functionnal ingredients, nutraceuticals and health products in specialist nutrition (young mamalians and aquatic species). Karno-Lab, a division of Vitalac operating from HCM City, Vietnam has been very active in Asia in promoting Panga, a range of specialities designed to replace the use of growth promoters and antibiotics whilst improving productivity and health in aquatic species. The range includes a very effective preparation of lipothrolic agents designed for optimal fat digestion and the prevention of yellow fat deposits in harvested fish especially catfish. A specific blend of organic acids is being proposed as an enhancer of fed efficiency. The company is actively seeking marketing agents to distribute this range in the Philippines, Malaysia, Indonesia, Thailand, Bangladesh.

Danisco, a major supplier of enzymes for the poultry and pig feed industry has been marketing betaine for use in aquafeeds. The Betafin range has been developed for use in aquafeeds at varying humidities. The crystalline products containing 91% calcium stearate for flowability, is suitable for home mixing. Finnstim is a highly purified feed grade anhydrous betaine and beet protein hydrolysate. Betaine is well known as a feed attractant but is also useful in protein and energy metabolism in fish and shrimp as it is a donor of the methyl groups in energy reactions.

Also, new in the aquaculture market is Lallemand Animal Nutrition. The Canadian company is well known with yeast- based products. Currently the focus is on developing the use of bacteria- based probiotics Bactocell in the region. Similarly, Biomin, which markets feed additives for the livestock feed industry has introduced a range of probiotics mixes for shrimp hatcheries and culture in ponds. More details on these are given in the section on product news.

Steven Goh of Delst which markets mold inhibitors for the feed industry said that, they have started to work with aqua feed producers two years ago and now the advantages of their products are being realised. The use of DMX-7, their third generation mold inhibitor has shown promising results with high moisture feeds and especially in aquafeeds where it is essential to maintain the right water content.

Steven Goh, Delst, Malaysia and Candra Yanuartin, PT Sinta Prima Feedmill, Indonesia

From Taiwan, Chen Ching Hung, DSM (left) and Eric Wang.

Feed ingredients

At the show, Thailand's Vet Superior launched its new Soy Hydrolyse which has a minimum protein content of 50%, for the livestock and aquaculture industries. For fish and shrimp feeds, the recommended levels are 5-10% and 5-25%, respectively. Another product is Golden Soy Lac which has a minimum protein level of 52% and high in available phosphorus. Another ingredient is hydrolysed shrimp protein which the company has been marketing for the human food, animal and aqua feed markets.

Also marketing soybean based feed ingredients was the Danish company Hamlet Protein A/S. The soya product, HP 300 is recommended for general aquafeed whereas for fingerling feed, the very finely ground HP 100. The process used has efficiently removed anti- nutritional factors to provide a protein digestibility of 90 %.

Although the products are being used in fish feeds in Vietnam, the general usage of plant proteins such as these soybean derivatives to replace fish meal still remains low. The industry in Asia is still dependent on fish meal, according to a local aquafeed producer. Nevertheless, the company said that there are studies which have indicated that shrimp and fish can replace up to 50% of the fish meal component with plant protein products.

Dr Winai Chottianchai, Vet Superior Aqauaculture Co Ltd, Thailand and team.

The team from Thailuxe Feeds Enterprise, Thailand

Pond management

Mexican company, Agroindustrias El Alamo S.A. de C.V. has industrialized the production of *Yucca schidigera*. It has to market several products that are widely used in the food, cosmetic and farm industries. At the show, Alfredo R Loperena demonstrated the use of BioaquaL as an additive in shrimp ponds. The product, in a liquid form helps to control and reduce ammonia levels in the water. Improvements in water quality then leads to higher weight gain, better feed conversion and reduction in the mortality rate. The liquid extract acts by bonding the ammonia molecules and transforming them into other nitrogenated non-toxic compounds for the shrimp and that are utilized by the phytoplankton and zooplankton as a source for nitrogen. Another product presented as a powder is used as a natural ingredient for shrimp feed.

DAA VI- 6th Symposium on Diseases in Asian Aquaculture

The Fish Health Section (FHS) of the Asian Fisheries Society has announced this symposium with the theme "Aquatic Animal Health – Facing New Challenges" to be held on 25-28 October 2005 in Colombo, Sri Lanka.

It will have a workshop, a training course, an expert consultation and the 7th Triennial General Meeting (TGM-7) of FHS in conjunction with this symposium.

At the five previous symposia (Bali – 1990, Phuket – 1993, Bangkok – 1996, Cebu – 1999 and Brisbane – 2002) more than 200 aquatic animal health scientists, students, government researchers and industry personnel from some 30 countries gathered to discuss disease-related problems affecting aquaculture production and to find solutions for them.

The International Scientific Programme Committee has developed a comprehensive program covering a wide range of keynote addresses, each to be delivered as a review by a core group of experts comprising some of the most important authorities in the field of aquatic animal health. Tentative keynote addresses are:

Technology: A review on recent technological advancements in aquatic animal health and their contribution towards reducing disease risks.
Biosecurity: Maintaining biosecurity in aquaculture systems: a constraint or a challenge?
Risk Analysis: Pathogen risk assessment: a must for transboundary movement of aquatics?
Food Safety: Challenges for improving safety of aquatic food: an aquatic animal health perspective
International Trade: Aquatic animal health and international trade: quo vadis?
Finfish Health: How to be prepared to handle aquatic animal disease emergencies?
Molluscan Health: Effective mollusc health management: do we need a new approach?
Shrimp Health: Shrimp disease control: the past, present and future.
Shrimp Health: Codes of practice and better management: a solution for shrimp health management?
Stakeholder Participation and Regional Cooperation: Aquatic animal health management: a shared responsibility?
Stakeholder Participation and Regional Cooperation: Regional and international co-operation in aquatic animal health management: the future.
The Way Forward: Veterinary responses to aquatic animal health and disease: Applications to Asia and elsewhere.
The Way Forward: Fish Pathology Certification Scheme – a necessity or a reality for Asian fish health workers?
The Way Forward: Insurance against disease and health: a reality for Asian aquaculture?

The FHS/AFS will provide financial assistance for up to 15 students from the Asia-Pacific region to attend the Symposium. Students requesting assistance must be registered as a student at a recognized university or institute of higher learning or have completed a post-graduate degree within the past 2 years. The deadline for applications is 31 May, 2005 and should include:

- abstract of DAA VI presentation
- short (1 page) curriculum vitae
- request and justification for financial assistance signed by academic supervisor
- a statement of importance of attending the symposium

More information: Dr. Melba B. Reantaso at Melba.Reantaso@fao.org(quote the subject: DAA VI) Web: www.daasix.org

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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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Aquarama 2005
Singapore
Contact: Linda Tan
Tel: +65 6887 9316
Email: linda_tan@cmpasia.com.sg
Web: www.aquarama.com.sg

30 May - 3 June
13 th Annual ASA Feed Technology and Nutrition Workshop,
Kota Kinabalu, Sabah, Malaysia
Contact: American Soybean Association Singapore
Tel: +65 6737 6233
Email: asaspore@pacific.net.sg

8-10 June
China International Seafood and Fisheries Exposition
Dalian, China
Tel: +86-411 8480 9622
Fax: +86 411 8480 9628
Email: seafood@dxceczch.mail.sohu.net; seafoodexpos@yahoo.com.cn
Web: seafoodexpos.com

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

28-30 June
China Seafood Exposition
Shanghai, China
Contact: Pauline Chee
Tel: +65 6372 1379
Fax: +65 6222 7526
E-mail: pcdivcom@singnet.com.sg
Website: chinaseafoodshow.com

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

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/

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VIETFISH 2005, June 14 - 16, 2005, Ho Chi Minh City, Vietnam

This is Vietnam's annual seafood and fisheries show and also one of the very few international seafood shows in the Asian region. The previous exhibition in 2003 attracted more than 20,000 visitors and 191 exhibitors from 14 countries. About 170 foreign and domestic businesses displayed their products and services at the Vietfish 2004. The number of foreign firms taking part in the fair had increased considerably in comparison with Vietfish 2003.

According to the organizers, Vietnam Association of Seafood Exporters and Producers (VASEP), Vietnamese aquatic products and potential marine resources are gaining popularity. The export value was USD 850 million for 1998, US$ 957 million in 1999 and the target in 2005 is USD 2.5 billion for the year 2005.

More information: E-mail: vasep-org@hcm.vnn.vn Web: www.vasep.com.vn

GSOL 2005

Iso in Ho Chi Minh City, Vietnam will be the Global Shrimp Outlook 2005 organised by the Global Aquaculture Alliance. This is an invitation only meeting for major shrimp producers, processor, buyers, and marketers. It will start with a welcome reception on October 23 and proceed through three days of focused presentations on global production output and shrimp market demands. Conference participants are encouraged to participate in the GSOL panel discussions on seafood safety, antidumping, and other issues. To be considered for an invitation, contact the GAA office at +1-314-293-5500 or e-mail: gaa1@attglobal.net.

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