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A s i a P a c i f i c



Selective breeding of vannamei shrimp in Lombok

Streptococcal diseases in tilapia

The Spanish perception on pangasius catfish

Breakthrough in extruded shrimp feeds

Nitrifiers and denitrifiers-Myths & Facts

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2 From the editor

Review 2009 – Were we relatively unscathed?

4 News

A successful Asian-Pacific Aquaculture 2009, Kuala Lumpur, Malaysia

6 News in brief

Shrimp Hatchery

8 Creating value for vannamei shrimp in Asia

The selective breeding program of Global Gen in Lombok integrates genetics with environment. By Zuridah Merican

Feed Technology

14 Optimizing the application of a novel feed additive in Pangasius catfish farming

Alexander van Halteren, Vo van Phong, Nguyen Van Lam, Huyen Dieu Nguyen and Peter Coutteau show how a digestibility enhancing additive in the feed improves utilisation and fillet yield.

20 Breakthrough in extruded shrimp feeds

The production of smaller diameter feeds with heavier densities at higher capacities.



21

21 Marine fish aquaculture in Southeast Asia

The role of ASA-IM in South East Asia is not only through aqua feed but also by improving conditions of culture by Lukas Manomaitis

Health Management

26 Streptococcal diseases in farmed tilapia

The dominant pathogen of tilapia has two distinct Biotypes and vaccination trials indicate that immunity is Biotype-specific. By Brian Sheehan, Lauke Labrie, Yeng-Sheng Lee, Wee Keng Lim, Felicia Wong, Jasmine Chan, Cedric Komar, Neil Wendover and Luc Grisez

30 Diseases in catfish farming in India

The culture of sutchi catfish is plagued by severe disease problems and raises the question of food safety and sustainability. By A.K.Singh, K Phani Prakash and W.S.Lakra

Culture Technology

32 Nitrifiers and denitrifiers - Myths and Facts

Recent research also shows that a newly discovered group of single-celled microorganisms that are not bacteria are important nitrifiers. By David J.W. Moriarty

Marketing

36 Consumer behaviour in purchasing Pangasius catfish in Spain

José Fernández Polanco, Ladislao Luna and José Luis Fernández show that Spanish consumers do not have a good knowledge of the product and its origin.

39 Barramundi in Vietnam

LiG Products, Vietnam started with the development of the Asian sea bass brood stock and hatchery production and began exporting fish to the US by 2007.

Developments

40 Fish supply in the Arab States

The first of a two part series on the development of fisheries and aquaculture in the Arab World. By Izzat H. Feidi

Company/Products News

42 Cargill/ Skretting/Addcon

45 Dream team in Malaysia

46 The Inve Group is set for growth in China and expands R&D

48 At WA 2009, Veracruz, Mexico/ Ocialis

Forthcoming Events

50 In 2010, Australasian Aquaculture, Aquaculture Europe, Victam Asia and Aquafeed Horizons

52 Listing of events in 2010

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From the editor

Review 2009 – Were we relatively unscathed?

Due to the economic downturn, we entered the year in a bearish mood without being able to forecast or see light at the end of the tunnel. Amidst effects of the falling value of the US dollar, the year is marked with continued low demand for shrimp and catfish as household expenses dropped, controversies on aquaculture, issues on food safety and the debate on certification.

The prediction that the generally slower US economy and high employment rates would affect shrimp imports into the US held true as first half import volumes were 236,076 tonnes, 4% lower than in the same period in 2008. The trend has seen lower consumption of high end seafood in restaurants and preference for cheaper products, such as peeled frozen shrimp and house brands. In the EU, data up to March 2009 showed an overall decline in volumes for shrimp although with higher consumption during the summer months, volumes may increase. The interesting aspect is that India's market share, despite her woes in farming black tiger, grew 24% to be the largest supplier to the EU. Vietnam's shrimp exports to Japan rose 7% whilst export of catfish to the markets in the EU and US, declined in September 2009.

Thai producers announced in the early part of the year that they would reduce production by 20% to maintain prices. 2008 production was 495,000 tonnes. However, this did not manifest itself as production figures revealed in October showed production increasing 5% in 2009 to 520,000 tonnes. Exports are also up 5% to about 390,000 tonnes. Somsak Paneetatyasai, the President of the Thai Shrimp Association told the Bangkok Post that the industry had been left relatively unscathed by the global financial crisis. "Earlier this year we planned to cut local production by 20% to 396,000 tonnes to cope with the expected shrinking demand... but until now, the world's shrimp consumption has remained strong,"

Producers of catfish, tilapia and shrimp continue to battle several diseases, but none as widespread as the white spot syndrome virus in high intensity vannamei shrimp culture. The combination of several diseases is apparently bringing down production in Indonesia. Disease prevention and management is now the focus of experts in the region, as they seek ways to educate small scale farmers on biosecurity similar to that we see in the livestock industry. As disease brings down production, seafood processors look for alternative raw materials and in Indonesia, the Government pondered on bringing in imports, which may bring down prices as imported shrimp are sold at IDR 5,000 less than locally produced shrimp.

As issues on food safety in aquaculture permeate all markets, so does the controversy that aquaculture is not an environmental friendly production method. Crustaceans from India will now enter the European Union only on presentation of negative results for nitrofurans and other unauthorized residues. Bangladesh increased exports by 26% to the UK market but had to implement a voluntary six-month suspension of exports following the detection by the EU of contaminants in its shrimp and prawns.

Slowly, farmers in Asia understand that certification is a future requirement for products, whether for local or export markets and at whatever scale of operations. Catfish processing plants in Vietnam have seen the necessity to backward integrate and have some control over the farming and feed areas of the value chain. The dilemma remains which certification body as each has different strengths. A session at World Aquaculture 2009 in Mexico in September debated this. It is generally recognised that Global Gap will be the more popular certification body for European markets and ACC in American markets.

Nevertheless, the parting thoughts of the Darden team during a seminar in Malaysia were that "The U.S. market demand for seafood will grow, sustainability certification programs will be harmonized and the future is bright." The overwhelming response at the recent Asian Pacific Aquaculture 2009 conference and trade show is also a good testimony to this. Through this economic downturn, we have seen consolidation in the industry which places it in a good position for the next phase of growth. We believe we can look forward to a better year in 2010.

We wish all readers a HAPPY NEW YEAR.

Zuridah Merican

WRITE TO THE EDITOR

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

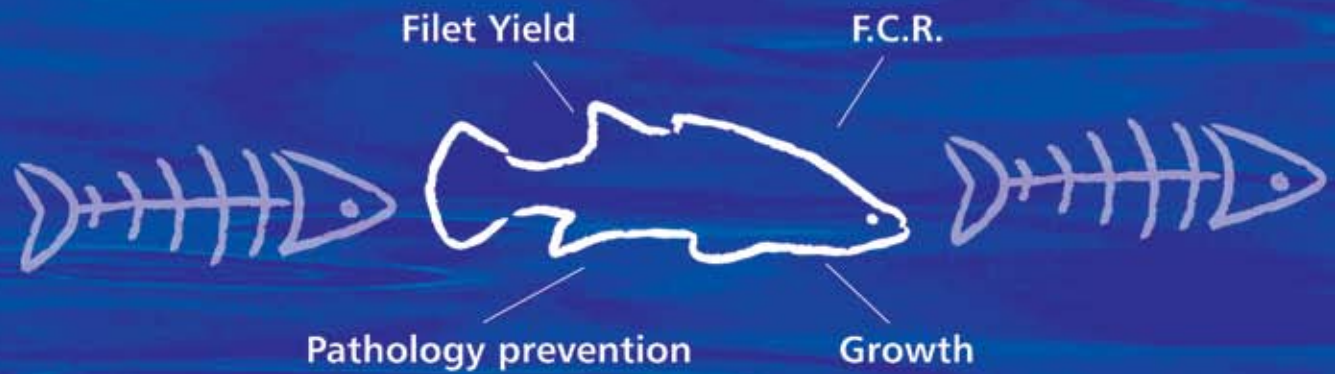
Send by fax to Zuridah Merican at +603 2096 2276 or email: zuridah@aquasiapac.com

Letters may be edited prior to publication

Correction

Mr S. Chandrasekar, India has emailed and brought to our attention the misinformation in the News in Brief "Stranded with vannamei shrimp" in issue September/October 2009 (page 6). He has indicated that 'India could produce around 70,000 tonnes of marine shrimp and prawn in 2009 and as such the possibility of 60,000 tonnes of vannamei alone is incorrect. He added that production of vannamei post larvae at the hatcheries approved by Coastal Aquaculture Authority have recently began and may only result in the production of 30,000 tonnes of vannamei shrimp by 2010.

We have agreed with his comments and stand corrected and we apologise for this error.



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Asian Pacific Aquaculture 2009

This conference and trade show exceeded all expectations, demonstrating escalating interests in the region's aquaculture.



During the visit to the trade show Tan Sri Muhyiddin Yassin (second right) with Dato' Noh Omar (right), Nguyen Thi Hong Minh, Honorary President of VASEP (left) and Franky Lee.

Organisers were encouraged by the huge response and active participation at the Asian Pacific Aquaculture 2009 conference and trade show. The landmark attendance of more than 1,800 conference participants and trade show visitors from 50 countries makes this the most successful event since its inception in Bangkok in 2003. Asian Pacific Aquaculture 2009 was held from 4-6 November at the Putra World Trade Centre, Kuala Lumpur. It was hosted by the Department of Fisheries Malaysia (DOF), Ministry of Agriculture and Agro-Based Industry, Malaysia (MOA).

The conference had 17 sessions with the major focus on marine shrimp and tilapia. The trade show comprised 70 booths. At the same venue, DOF organised the Malaysia International Seafood Exposition (MISE 2009) with 105 booths featuring seafood importers, producers and processors.

The one day Malaysian Farmer's day drew more than 500 attendees with 330 of them sponsored by the DOF. Exhibitors were very pleased with the constant flow of local and foreign groups, coming from as far as Africa and Middle East. With the year end approaching, companies also took this opportunity to conduct sales meetings, training sessions and meetings with distributors, thus increasing participation to the conference and trade show.

Asian Pacific Aquaculture 2009 is the biennial event of the Asia-Pacific Chapter of the World Aquaculture Society and was jointly organised by the Malaysian Fisheries Society, World Aquaculture Society, DOF, and Universiti Putra Malaysia. The sponsors of the event were Uni President (Gold Sponsor), Novus Aqua (Shrimp session), Cargill (Tilapia session) and Intervet Schering Plough Animal Health (Health session).

The Deputy Prime Minister of Malaysia, Tan Sri Muhyiddin Yassin officiated the joint opening of the two events. He said, "Malaysia's per capita consumption of seafood is currently at 50 kg, one of the highest in the world. Our objective is to rely on aquaculture to "put

fish on the table". Our strategies moving forward are to develop more sustainably managed aquaculture zones for private sector investment in the value chain from hatchery, grow out, processing and marketing. The government will continue to provide business support services and facilitate private sector investment in the industry".

The Minister of Agriculture and Agro-Based Industry Malaysia, Dato' Noh Omar said, "The Malaysian seafood industry is undergoing a planned, responsible and sustainable program that will further enhance her fisheries portfolio to beyond the current USD 2.5 billion. Malaysia is gearing her efforts to ensure all fisheries products meet international standards through upgrading the farming system and upstream activities".

Malaysia's growth potential

Two plenary presentations discussed prospects of aquaculture in the host country. Dato' Junaidi Che Ayub, Director General of Fisheries Malaysia said that commodities of interest for the country for national food security and export are marine shrimp, seabass and groupers as well as tilapia, catfish and carps. The production target for food fish and shrimp has been set at 400,000 tonnes. Shrimp production increased 45% in 2008 as compared to that in 2007. Ornamental fish is the top revenue earner, with growth averaging 20% annually. Part of the strategy for increased production is to encourage local and foreign stakeholders to invest in industrial aquaculture in Malaysia within the North and East Corridor Economic regions and in designated aquaculture zones. Here the focus is on modern and biosecure production systems for high productivity.

The potential development in aquaculture will require support with feeds, said Franky Lee, General Director of Uni President Vietnam. The major feed company in Vietnam sees opportunities in Malaysia's feed market. However, any future development will require the feed company to have traceability to ensure the fish to food security issue.



Dato Junaidi Che Ayub (left) and Nik Wahab Mat Diah, DOF

A clear-cut traceability program encompassing hatchery, feeds and feed ingredients, production environment and the final processed products will determine the future of aquaculture.

Environmental integrity and social harmony for sustainability

In his plenary presentation, Professor Sena De Silva, Director General of NACA brought to the attention of participants, some stimulating aspects of the aquaculture in the Asia-Pacific. It is generally accepted that farms need to have economies of scale to survive but industry in Asia with almost 85% comprising small scale farms are still continuing operations. He presented the relevant statistics on farm size for leading aquaculture producing countries and the production. His take home message is that the backbone of Asian aquaculture will continue to come from small scale operations. This is similar to other primary production sectors in the region.

Success, according to Professor de Silva is measured by several criteria. However, in the case of the aquaculture sector, perhaps the main criteria of success are economic viability, biodiversity conservation, environmental integrity, social harmony and overall, sustainability. In the case of shrimp, 70% of shrimp sold in global markets come from Asia (mainly Thailand and China) and mainly due to the change of species to vannamei shrimp. The lessons learnt are the resilience of the small farmer, who has changed hatchery and farming technology to another species. However, in the case of shrimp farming, continued success has been challenged by the emergence of two new viruses and high carbon emission where it has been estimated that one kilogram of vannamei shrimp produces more CO₂ than that for monodon shrimp. Adoption of Best Management Practices (BMP) by groups of shrimp farms is a good example of social harmony. Through cluster approach, the use of a common resource, such as water is accompanied by social responsibility.

Another success story is in tra catfish farming in the Mekong Delta where production is more than 1.2 million tonnes. This is equivalent to 67% of the total aquaculture production in Europe. It employs 200,000 people and tra catfish is the white fish of today. This industry has learnt to overcome market challenges. There have been adverse reports on the environmental impact of this farming but Professor de Silva said, "There can never be a situation where aquaculture, or any farming system, will not perturb the environment. The sector's responsibility is to keep such perturbations to a minimum".

He emphasised the fact that the discharges of nitrogen and phosphorous from catfish farming, per unit production is no different to any other cultured species, and that the current discharges into the Mekong River, with the world's tenth highest flow rate, is within acceptable limits and is miniscule in relation to that from other anthropogenic activities in the delta. However, he said this is no reason for complacency and we have to look for improvement, perhaps through the adoption of BMPs and a cluster approach in the tra catfish farming in the Mekong Delta.

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The next Asian Pacific Aquaculture Conference and Trade Show will be held in Kochi, India from 17-21 January 2011 with Giant Prawn 2011, as a 3 day session from 19-21 January 2011.

News in Brief

Asean certification for shrimp

The ASEAN Shrimp Alliance (ASA) plans to set up a regional certification body to verify the quality and standards of shrimp produced for export in the ASEAN region. This is to help improve farming practices and overcome export obstacles for producers in member countries. Some importing countries have imposed restrictive standards which not only protect consumers but also add costs to farmers, said Somying Piumsombun, Director-General of the Thai Fisheries Department in the Bangkok Post. She added that the certification body will take some time to establish. Thailand, Vietnam and Indonesia have helped transform the region into the world's 'shrimp basket', accounting for 80-85% of global production. Currently, producers depend on international certification bodies.

Revocation of AD for Thai shrimp

On November 2, the US and Thai shrimp industries agreed to settle the antidumping (AD) order against Thai shrimp imports. In exchange for revocation of the antidumping order and related duties, the Thai industry has agreed to endow a special fund to help the domestic shrimp industry adjust to import competition as well as make certain commitments with respect to anti-circumvention of US trade laws and other trade-related measures. Both parties will submit to the Department of Commerce (DOC) a joint request for a changed circumstances review ("CCR"), an administrative procedure by which DOC determines whether appropriate circumstances exist to justify the removal of antidumping duties.

Call to lower shrimp feed prices

Farmers are seeking lower prices for shrimp feed to match lower ex farm prices for shrimp. In Indonesia, almost all the shrimp feed is produced locally but about 40% of the ingredients such as fish meal and soybean flour is imported. The stronger rupiah is having a major impact on ingredient prices. The domestic price of feed, currently at IDR 10,000/kg (USD1.04) is 15% higher than that in other countries, making the export of shrimp from Indonesia less competitive in international markets, said Iwan Sutanto, chairman of the Shrimp Club in the Jakarta Globe. Ex farm price for shrimp ranged from IDR 41,000 to IDR 42,000/kg (USD 4.35 to USD 4.45) for shrimp of 50 pcs/kg. The government was urged to reduce the 5% import tariff on shrimp feed ingredients but the request was denied.

GAP is a must for exports

Brett Lawson Koonse of the US Food and Drug Administration (US FDA) said in the New Nation that to continue exporting shrimp to the US and other countries, Bangladesh producers must follow strictly Good Aquaculture Practices (GAP). This is being practiced by many other countries such as Brazil, the Philippines, India, Thailand, China and Indonesia. The US imports 85% of her yearly shrimp consumption. Imports totalled 236,076 tonnes for the first half of 2009 and Bangladesh supplied only 5,200 tonnes (Globefish, 2009). In November, the FDA sent

an eight-member team to train the trainers in a five-day course, jointly organized by the Bangladesh Shrimp and Fish Foundation (BSFF) and the Bangladesh Frozen Foods Exporters Association.

Approval for US offshore marine fish farming

Despite objections from environmentalists and fishermen, the Obama administration has endorsed offshore aquaculture in the Gulf of Mexico. This will be for the production of tilapia, red snapper, shrimp and other marine species. Proponents say offshore aquaculture is a safe way to produce high-quality seafood for American consumers. In Hawaii, regulators have approved for Hawaii Oceanic Technology, a Honolulu startup company, to build the nation's first tuna farm in waters off the Big Island. The project would also be the world's first commercial big eye tuna farm whose products will be channelled to the global sashimi market. The company will use artificially hatched big eye tuna fingerlings produced from the University of Hawaii. The farm is expected to produce 6,000 tonnes of the fish for markets in Hawaii, Mainland USA, Japan and other parts of Asia. (www.hioceanictech.com)

First feed with approved probiotics

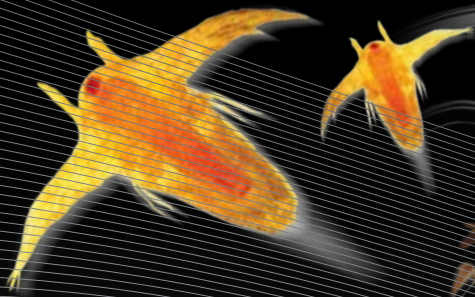
In Europe, fish feed producer BioMar has developed an innovative probiotic fish diet and introduced the first trout and salmon feed containing probiotics. A long term R&D project, initiated through the OFIMER program between BioMar, French research institutes IFREMER and INRA, and the industrial company Lallemand, has resulted in the first EU-approved use of probiotics for salmonids. The use of probiotics in feed for salmonids has been shown to have significantly improved fish health and has also benefited the environment by reducing the need for medication. In a series of trials, both in laboratories and in the field, the utilisation of probiotics showed a reduced amount of fish deformities. The trials also demonstrated a positive impact on reducing the risk of gastroenteritis, a disease with high mortality, which has caused major outbreaks in several European countries in recent years. In order to achieve the best results, the probiotics must be introduced from first feeding. It was emphasised that including probiotics is not a standalone measure and that the right feed formulation is critical for securing optimal healthy growth. Factors such as farm hygiene and general disease prevention are also equally important in order to achieve the desired performance. (www.biomar.com)

CPF in Philippines

Charoen Pokphand Foods announced in August that it will be investing THB 1.4 billion for aqua feed mills and will set up CPF Philippines Corp. In the Nation, Adirek Sripratak, president and chief executive officer, said that CPF's aquaculture business comprises a shrimp feed mill to be set up in Cebu, with a production capacity of 30,000 tpy. In addition, a fish feed mill will be set up on Luzon, with a capacity of 60,000 tpy. The company expects to complete both projects in 2010.

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AQUACULTURE

Creating value for vannamei shrimp in Asia

By Zuridah Merican



Mature female broodstock at Global Gen Indonesia, Broodstock Multiplication Centre on Lombok Island.

This comes with post larvae from SPF brood stock integrating genetics with environment, adjusting to climatic and culture conditions in Asia. After a successful test marketing period of one year with farms in Indonesia, Global Gen has launched international sales of post larvae originating from the breeding centre in Lombok.

Commercial production of the shrimp *Penaeus vannamei* developed in Asia from 1996 onwards with introductions of the shrimp into China and Taiwan from Hawaii, USA (Briggs et al., 2004). Other Asian countries followed and from 2001, the spread of vannamei shrimp culture in Asia was unstoppable. Today, the major farmed marine shrimp producing countries in Asia, namely China, Thailand, Indonesia and Vietnam account for 50% of the global production of this species. The early apprehensions with this species, originally from the Pacific Coast of Latin America and known to carry the Taura Syndrome virus, were put aside with imports of specific pathogen free (SPF) brood stock from Hawaii and Florida.

The trade in vannamei brood stock to feed Asia's demand further escalated as vannamei production in the Asian way allowed

stocking densities ranging from 80 to 300 post larvae/m². In 2008, the requirement of brood stock by the main markets in Asia, China, Thailand and Indonesia was calculated as 430,000 pieces. This was based on production volumes, taking into account a 30% loss in production due to diseases.

Push for local selective breeding programs

This idea of a local selective breeding program came about during World Aquaculture 2005 in Bali when it dawned upon Leonardo (Bong) Tiro and several stakeholders in the feed and hatchery sector, that a dependence on imported brood stock is not sustainable for the country's industry. The main problem was not the quality of imported brood stock but the supply and difficulties in transporting brood stock with unreliable transit times in Korea or Taiwan by the cheapest airline. Bong also said that a massive delay in delivery during one hurricane season was shattering for him. At that time, he had 18 hatcheries under a partnership agreement.

"From a business and industry point of view, this was an example of what we could face in the future. We were worried for the supply of brood stock, as one of the keys to the success in our business is a reliable supply of breeders. We then shopped around for tie-ups to produce brood stock locally. Many companies were not keen on cooperation and were just happy riding the waves with demand from China, Taiwan and other Asian companies," said Bong.

"In Asia, we understand market needs and trends better and having full control over brood stock supplies definitely makes sense. Furthermore, all we need is an appropriate genetic breeding program which integrates genetics with environment to improve performance", he added.

"Starting a breeding program here in Indonesia makes commercial sense, in particular now that the FOB prices of imported brood stock have been steadily increasing from USD 30 to the current USD 45/brood stock, depending on supplier. Another push factor for us was when our main supplier was bought by Asia's largest integrated aquaculture



Leonardo Bong Tiro, Jr (right) is Director of Global Gen. He also manages PT Komindo Trading Utama, a shrimp hatchery business operation in Indonesia. Within two years, he developed 20 joint operation hatcheries into the largest vannamei post larvae producer in Indonesia for the free market. He is pictured with the Jeff (middle) and Purnomo Hadi at the NBC.



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company. This really opened our eyes on being dependent on one supplier and from one region”.

Without hesitation, Bong and a group of shareholders identified Lombok as the ideal location and embarked on being self sufficient.

“In 2007, Dr Hein Van der Steen, shrimp breeding specialist and geneticist was brought in to develop a breeding program. We had already accumulated the best founder stocks from all over the world. The current team now includes Jeff Prochaska, Program manager who used to work with Dr van der Steen and the focus is on combining commercial environmental conditions with superior genetics. In July 2008, we had already developed the first generation brood stock and subsequently tested the post larvae in commercial ponds”.

“Now at the Nucleus Breeding Centre (NBC) we are starting our third generation shrimp. We are actually better off than most suppliers of brood stock in Hawaii to Asian hatcheries, which have just started their breeding program recently and to date, have been commercially producing brood stock using the lines provided by Oceanic Institute in Hawaii. We want to go further than what is being offered by these companies. Now we are ready to publicise our brood stock.”

Nucleus Breeding Centre (NBC)

The hub of the company's selective breeding program is the NBC, located on the north coast of Lombok. The site was chosen as it was 30 m above sea level and away from any shrimp culture activity on the island. The NBC has completed its second generation production of almost 300 families per year. This second generation shrimp has the capacity to grow up to 3g/week at the NBC. The average growth is 1.5g/week with good culture and feed management. It shows that the animal has the potential to grow much faster than the currently farmed strain. We need to fine tune farm management to enable the animal to grow to its full potential.

“We use a new batch and place a batch of 24 families to test every month, an expensive exercise, because of the tagging requirements. The team of 6 people takes 4 days to tag 8,400 animals for each batch with elastomer tags. This is more than what the major shrimp breeding companies are practising. This is possible partly because we are in Indonesia, where labour costs are not as prohibitive as in other locations. Our strength here is the diverse founder and SPF stocks, selection of the top 8% for each generation and the molecular genetic tools that we use. The testing capacity is 350 animals X 288 families per year. The NBC has a large capacity and has the flexibility to adjust to new concepts”, said Jeff.



At NBC, green water tanks for growth and survival performance assessments. Overhead fans improve working conditions and control water temperature as air temperature can reach more than 40°C during the daytime.

The performance testing at the NBC is conducted in large circular tanks with green water and controlled water temperature of 28°C to 32°C and 30 ppt salinity. In phase 1, growth from 2g to 20g of tagged juveniles from 350 animals/family is measured. In phase 2, the measurement of growth is from 20-30g. At the end of Phase 1 and Phase 2, testing data are collected (family and weight) for all individual animals and smaller animals are culled based on a pre-determined cut-off weight. Concurrently, post larvae also undergo field trials. From 1,000 – 30,000 post larvae per family are tested side-by-side in commercial raceways or ponds. The final selection index of families is based on the NBC data integrated with results from field trials and disease challenge tests.

SPF certification

This second generation is specific pathogen free for 9 diseases. There are now 7 OIE-listed diseases and two are under consideration for SPF status. Global Gen has gone ahead with SPF shrimp, being free from all 9 diseases, namely WSSV- white spot syndrome virus, TSV-Taura syndrome virus, YHV-Yellow head virus, BP -Baculovirus penaeid, MBV-Penaeus monodon-type baculovirus, IHNV-infectious hypodermal and haematopoietic necrosis virus, NHP-necrotizing hepatopancreatitis, IMNV-infectious myonecrosis and HPV-hepatopancreatic parvovirus disease.

In the industry, there is no certification body to certify the SPF status and companies self certify and exports are supported by health certifications issued by the government. In the case of Global Gen, their SPF status follows a two-year diagnostic surveillance testing of the shrimp at the OIE certified reference laboratory of Dr Donald V. Lightner, University of Arizona, USA. This consists of twice-yearly complete screening of the breeding facilities. The Department of Marine Affairs and Fisheries Indonesia has conducted inspection of the facilities and will now issue health certificates for Global Gen's exports.

Integrating genetics and environment

The extra value in the selective breeding program conducted at the NBC is the inclusion of environmental parameters such as growth performance in the field into the selection index to identify the most superior families and develop improved lines.

Jeff said, “The importance of the environment in which you run your selective breeding program, is the reason why we run our breeding program in Indonesia. The proximity allows us to do field trials in Indonesia, i.e. the ‘real’ culture environment. In comparison, this is much more difficult for those programs located far away from Asia.



At the NBC, all juveniles for the performance tests are tagged to denote family.

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Maturation tanks in Nauplii Center in Lombok Island.

Data gained in the NBC and outside in the field are grouped into an index that we use to select families in our program.”

“In the tank, we have some control over water quality and temperature. At the NBC, exhaust fans are used to maintain tank water temperature between 28°C and 32°C during the performance tests. If animals are tested at water temperatures never above 29-30°C, it is possible that selected families could show poor temperature tolerance and this could be a factor in the case of muscle cramping observed in shrimp in ponds in Thailand. Water quality, culture temperature and other parameters, including those measurable or not, fluctuate during the day and affect the environment for the shrimp in the pond. Because our animals are tested in an environment more comparable to that of commercial ponds, we select animals with more tolerance to high temperatures and other environmental stress factors. As a result, the genetic progress will have direct value for the shrimp producer”.

“However, one might say that the shrimp could, to some extent, adapt to the higher temperature. But this adaptation can be improved if temperature tolerance is heritable. Similarly, we acclimatize the post

larvae produced in high salinity to low salinity to prepare them for low salinity production systems. This stresses the animals. If some form of heritability exists, we could select for animals with a tolerance to low salinity. First indications are that salinity tolerance is heritable and we are now developing products with an in-built low salinity tolerance”

Broodstock Multiplication Centre

This Broodstock Multiplication Centre (BMC) is also located along the northern coast of Lombok, some 20 km away from the NBC. All phases in brood stock grow-out are carried out in biosecure indoor tanks. There are four grow-out modules in two sections. Brood stock growth is conducted in three phases, in round, HDPE-lined tanks. The final size of the brood stock is 45-50g, achieved after 7 months culture at the BMC itself. Throughout the production cycle, shrimp are fed commercial post larval and a custom, biosecure grow-out diet produced by Global Feeds.

Biosecurity

The highest level of biosecurity and its adherence is critical for the success of any breeding work. At the NBC and BMC, respectively, there is a three-step water treatment process. Reservoirs are enclosed indoors. The treatment starts with pressurised sand filters, disinfection with ozone and UV and activated carbon to remove by-products of ozonation. Relevant staff is required to shower on entering and leaving the area. In addition, they are not allowed to travel between facilities or visit other shrimp or aquaculture facilities unless approved by management. Proper down-times between facilities must be obeyed. The consumption of crustaceans is banned at any of the sites.

Two biosecurity threats are visitors, which the company limits and frozen maturation feeds (squid, bloodworms, and artemia biomass). Polychaete worms are imported from the UK and cold water squid and artemia from the US. Pelleted feeds are custom-designed and produced by Global Feeds.

The business model

Since June 2009, Global Gen has been supplying brood stocks to the Indonesian hatchery market. Besides this, for the Indonesian local



Bong (second from left) with staff at the BMC. Strict biosecurity requires all staff shower and change out of street clothes before entering facilities.

market, the company only sells post larvae through 17 associate hatcheries all over the archipelago. It produces an average of one billion nauplii/month at the NC (nauplii center) and distributes to these hatcheries for the production of post larvae (PL10) for sale to farmers in the free market (non integrated aquaculture farms).

Global Gen has alliances with three feed companies, namely CJ Feed, Matahari Sakti, and Luxindo for the hatcheries to supply post larvae to their feed clients. This helps as the feed millers have a large customer base and also provide farmers with technical support. This strategy enables the feed mill to have an advantage as their feed is supported with quality post larvae resulting in high performance at the farm level. According to Bong, the company and associates are the market leaders in the free market for post larvae in Indonesia.

"In Indonesia, we have been selling post larvae at IDR 35 each (USD 3.5/1000) since 2005 although our competitors have been reducing prices to as low as IDR 18 each. We have not increased prices in spite of the improvement in quality and higher survival and growth rate. We only work with 45g males and 50g females that are 8 months old. We use the shrimp for only 4 months in comparison with other hatcheries that use brood stock for 7-12 months. Each brood stock can spawn twice a week and ablation is sometimes used".

In February 2009, the company began to export brood stock to Global Gen China, which was established in 2009 in Baguang, Guangdong Province. Post larvae from this hatchery are sold at RMB 180-200 (USD26-29) per 10,000 post larvae as compared to RMB 15-35/10,000 by other suppliers. Its forte is not only quality of post larvae but also that the post larvae are produced from brood stocks developed through a selection program unlike other local brood stocks in China. Currently, Global Gen China has 7 hatcheries producing 150 million

post larvae/month and the target is to increase to 25 hatcheries to produce 500 million post larvae/month. The annual demand within Guangdong Province is 100 billion post larvae/year.

"Our motto is to create value for the producer through improved post larvae. Improving post larvae quality is our main focus. Our production in China which needs 60,000 brood stocks for a 100 billion nauplii/year production, supports the breeding work at the NBC and our foray into using genomics work.

"As we have reached our full fledge marketing stage, we seek partnerships with feed millers in the region. Our current research in genomics with an Australian genetics provider is to sequence the vannamei shrimp genome. This work will enable Global Gen to look for genetic markers for growth, survival, disease resistance and other traits for which it is difficult to create genetic improvement with traditional technologies. This cutting edge technology will enable the company to develop better brood stocks in the future".

Lastly, Bong emphasised that what is critical for the company is 'Creating Value' through investing in technology to produce high performance brood stocks. Post larvae cost only around 6% of vannamei selling price and it strongly contributes to farm productivity. After China, it is seeking markets in Malaysia, Thailand, India and Vietnam. (More information: Email: lbtirojr@yahoo.com)

Reference

Briggs, M., Funge-Smith, S., Subasinghe, R and Phillips, M., 2004. Introductions and movement of *Penaeus vannamei* and *Penaeus stylirostris* in Asia and the Pacific. RAP Publication 2004/10, NACA, Bangkok.

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Optimizing the application of a novel feed additive to improve feed utilization and fillet yield in *Pangasius* catfish farming

By Alexander van Halteren, Vo van Phong, Nguyen Van Lam, Huyen Dieu Nguyen and Peter Coutteau

The demand for quality products at low prices ironically forces producers to reduce feed costs by using cheaper ingredients and lower feed specifications. The overall economics in pangasius catfish production can be improved with the addition of digestibility enhancing additives in the feed.

Pangasius catfish production has grown very rapidly in Vietnam to reach more than a million tonnes in recent years. This rapid growth has resulted in the industrialisation of feed production as well as in culture technology. Traditionally, catfish farmers produce farm-made feeds by mixing and cooking raw materials in large kettle cookers fuelled by rice bran and using local raw materials. Recently, the larger integrators have installed state-of-the-art extrusion lines producing high volumes of feed following stringent quality control schemes and meeting international processing standards.

Since the beginning of 2009, Vietnamese farmers have been under heavy financial pressure. The farm gate price of the fish has declined to around VND 13,500–15,500 (USD 0.75 to 0.87/kg), making production unprofitable. Therefore, farmers and feed producers are continuously searching for ways to improve feed performance and optimize fillet yield to maintain profitability under such current market conditions.

The nutrient values of raw materials used in feeds for the *Pangasius* catfish are still poorly documented. Also, nutrient requirements are mostly adapted from other species of catfish or other fresh water species. It is only recently that researchers have started to document the digestibility of typical raw materials used in *Pangasius* catfish feeds (Hien et al., 2009). However, most raw materials are known to be of poor nutritional quality (e.g. rice bran, cassava, local fish meal).

Feed additives

In livestock production, a wide variety of feed additives are currently being investigated to fully utilise valuable raw materials since supplementing sub-therapeutic levels of antibiotics as growth promoters is banned in the European Union. Alternatives to antibiotics



Harvesting pangasius



Overview of a test pond

that would have at least similar effects on growth and food conversion without causing bacterial resistance are sought among organic acids, enzymes, probiotics, prebiotics, highly available minerals, essential oils and natural plant extracts. This active search for natural growth promoters is starting to extend into fish farming where continued consumer pressure may bring about a ban on antibiotics during production in most countries.

In some recent screening work under controlled laboratory conditions at Caditec Testing, Spain and at the Department of Marine Affairs and Fisheries, Sukabumi, Indonesia, has revealed the potential of several innovative additives based on synergistic blends of digestive phytobiotics, natural emulsifying agents and co-factors of digestion for improving the feed utilisation and reduce fat deposition in liver and viscera in fish (Coutteau et al., 2009; Ceulemans et al., 2009).

Although some of these additives have the potential to improve the utilisation of typical raw materials used in *Pangasius* catfish feed formulations, the optimal application of these novel feed additives requires field evaluations to provide information in terms of farm economics and processing qualities of the fish. This article reports on the effect of different application regimes of a novel digestibility enhancer in extruded feeds in different farms culturing *Pangasius hypophthalmus* (better known as “Tra”) in the Mekong Delta.

Field trials

The evaluations were carried out in several farm locations of Hung Vuong Mien Tay Breeding Joint Stock Company in the Mekong Delta. The results of two farm locations will be discussed in this article (Tra Vinh and Sa Dec). Three earthen ponds of approximately 5–6,000 m² were selected for the trial in Tra Vinh, Mekong Delta. In Sa Dec, the pond size was 8,500–12,000 m². The ponds were stocked with juvenile *P. hypophthalmus* with an average size of 15g at a density of 45–50 fish/m² in Tra Vinh. In Sa Dec, 30g fish were stocked at 34–38 fish/m².

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Table 1. Trial Set-Up.

	Stocking density (fish/m ²)	Average size of the ponds (m ²)	Stocking size (g)
Trà Vinh	45 - 50	5,500	15
Sa Dec	34 - 38	9,500	30

Table 2. Feeding Table for *Pangasius hypophthalmus*.

Fish size (g)	Feeding (% of body weight)	Feed specifications (% crude protein)
20 - 100	5 - 7 %	28
100 - 200	3 - 5 %	28
200 - 500	2 - 3 %	26
> 500	2- 4 %	22

Feeding and treatments

The feeds were produced by Hung Vuong Tay Nam feed mill. Fish were fed in the early morning and late afternoon. The amount of feed was calculated daily based on the estimated body weight (Table 2). The ponds were harvested when fish reached an average size of 850g.

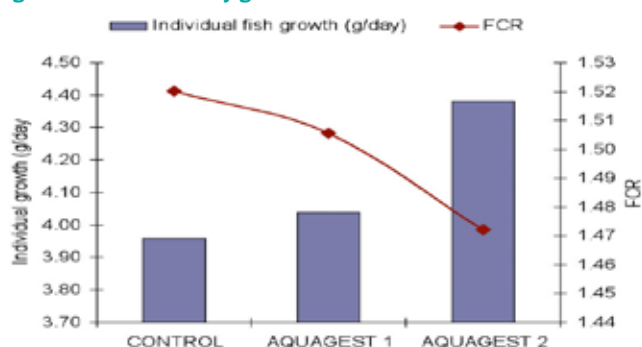
The various feed formulations differed only in the inclusion level of the digestibility enhancer (AQUAGEST OMF, Nutriad, Belgium). The same nutrient specifications were used for the different treatments. The additional cost of the feed additive in the feed formulation was taken into account in the different profit calculations. The first treatment consisted of adding the feed additives at 1 kg/tonne of feed only during the first stage of the culture period (20-300g fish). The second treatment received a higher dosage during the first period (2 kg/tonne of feed for 20-300g fish), a lower dosage during the second period (1 kg/tonne of feed for

300-500g fish) and the control feed during the final period of the culture (0 kg/tonne from 500g to harvest).

Table 3. Treatments.

Fish size (g)	Feed specifications (% crude protein)	Control	Aquagest 1	Aquagest 2
20 - 100	28	-	1 kg/tonne Aquagest	2 kg/tonne Aquagest
100 - 200	28	-	1 kg/tonne Aquagest	2 kg/tonne Aquagest
200 - 500	26	-	-	1 kg/tonne Aquagest
> 500	22	-	-	-

Figure 1. Individual daily growth and FCR at Trà Vinh.



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Growth, feed conversion and production cost

The daily growth and feed conversion ratio (FCR) were calculated over the total culture period and are shown in Figure 1 and Table 4 for the trials at Trà Vinh and in Figure 2 and Table 5 for the trials conducted at Sa Dec. The duration of the culture until harvest is shown in Table 4 and 5. Reducing the time to harvest can yield a significant reduction in production cost and could increase the number of yearly culture cycles.

Table 4. Trial location – Trà Vinh.

Treatments	Days of culture (days)	Individual fish growth rate (g/day)	FCR
Control	210	3.96	1.52
Aquagest 1	207	4.04	1.51
Aquagest 2	199	4.38	1.47



A static feeding pond

Figure 2. Individual daily growth and FCR at Sa Dec.

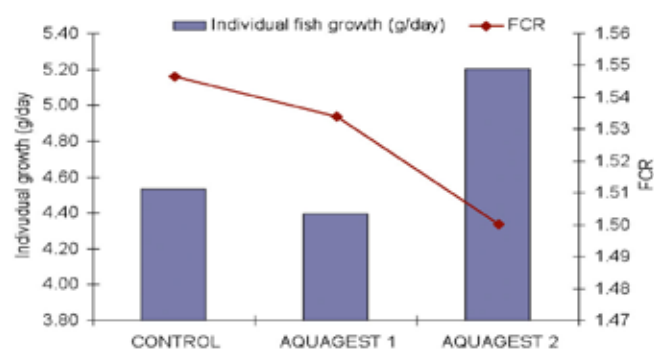


Table 5. Trial location – Sa Dec.

Treatments	Days of culture (days)	Individual fish growth rate (g/day)	FCR
Control	171	4.53	1.55
Aquagest 1	171	4.40	1.53
Aquagest 2	143	5.20	1.50

Growth performance

Overall, the results obtained for FCR and individual daily growth rate were excellent compared to the industry average in Vietnam (FCR: 1.6-1.8; 4-5 g/day). The results from both trial locations showed improved growth, food conversion and culture duration with the application of the feed additive. The improvement on growth performance was

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Alexander van Halteren with a catfish harvest

modest for the lowest dosage applied only during the initial period. However, very significant improvements were obtained for the second treatment compared to the control, including improvements of FCR by 3.3-3.2%, daily weight gain by 10.6-14.8% and a reduction of the culture duration by 5.2-16.4 %.

All farm results showed better economics because of the use of a digestibility enhancer. This was a combination in the improvement of feed cost per kg of fish produced and the shortening of the culture cycle. The reduction of feed cost per kg of whole fish produced, compared to the control amounted to 0.2-0.7 % for the lowest application (Aquagest 1) and 1.4-2.4 % for the highest dosage (Aquagest 2).

Table 6. Effect on feed cost per kg of whole fish.

Treatment	Difference in feed cost per kg of whole fish (percentage compared to control)	
	Trà Vinh	Sa Dec
Control	100 %	100 %
Aquagest 1	-0.7 %	-0.2 %
Aquagest 2	-2.4 %	-1.4 %

Filleting yield and cost per kg of fillet

The fillet ratio is an important criterion for the processor in the Pangasius industry as the main market is sales of fillet. Improvements in fillet yield will directly translate into better profits as less fish is needed to produce that same 1 kg of fillet. The fillet ratio was determined in the fish processing plant of Hung Vuong Joint Stock Company after harvesting the ponds.

Pangasius fillets are obtained in three stages, first the total fillet is cut from the fish (1.9-2.2), secondly the skin is removed from the fillet (1.1-2.2) and finally the fillet is adjusted to the market demands (less



Vo Van Phong

or more fat left depending on the destination country (1.52- 1.6) The first stage “whole fillet” ratio is reported in Table 7 and 8.

Table 7. Processing results from Sa Dec trial (VND, percentage compared to control).

Treatments	Fillet ratio (kg whole fish needed for 1 kg of whole fish fillet)	Raw material cost (*) to produce 1 kg of whole fillet (VND)	Gain per kg of whole fillet (VND)
Control	2.16	30,240	
Aquagest 1	2.06 (- 4.6 %)	28,840	1,400
Aquagest 2	2.00 (- 9.25%)	28,000	2,240

Table 8. Processing results from Tra Vinh trial (VND, percentage compared to control).

Treatments	Fillet ratio (kg whole fish needed for 1 kg of whole fish fillet)	Raw material cost (*) to produce 1 kg of whole fillet (VND)	Gain per kg of whole fillet (VND)
Control	2.14	29,960	
Aquagest 1	2.09 (-2.4 %)	29,260	700
Aquagest 2	1.98 (-7.5 %)	27,720	2,240

(*) assume whole fish at 14,000 VND per kg

Overall, the whole fillet yields obtained in the current trials were excellent in comparison to the industrial average in Vietnam (1.9-2.2). Nevertheless, whole fillet yield improved drastically in all trials because of the addition of the digestibility enhancer.

In the calculation of fillet cost in Table 7 and 8, it was assumed that the processor purchases fish at a hypothetical farm gate price for whole fish of VND 14,000 (USD 0.77), independent of the production cost for whole fish at the farm. In this case the raw material cost for whole fillet production improved by 2.4 to 4.6 % for the lowest application (Aquagest 1) and 7.5-9.25 % for the highest dosage evaluated (Aquagest 2).

Conclusion

Digestibility enhancing additives have the potential to improve nutrient utilization from cheaper ingredients and stimulate the conversion of nutrients into meat gain and less into fat accumulation in muscle and viscera. The current results showed that significant improvements can be obtained by optimising application and dosage of digestibility enhancing additives under field conditions. The optimized application resulted in economic gains both for the farmer (up to 2.4% reduction of feed cost per kg of whole fish produced and 16.4% shortening of the production cycle). The benefit to the fish processor was up to 9.25 % improvement in fillet yield.

References are available on request.

Alexander van Halteren is Aquafeed expert at the Nutriad Technology Center, providing specialized customer support for the Nutriad portfolio of aquaculture additives for farmed fish and shrimp. Vo Van Phong is R&D manager of Hung Vuong Tay Nam aqua feed mill. and Nguyen Van Lam is Director of Hung Vuong Tay Nam Aqua feed mill, operational since August 2008. They cooperate with Hung Vuong Joint Stock Company and Hung Vuong Mien Tay breeding joint stock company, presently one of the biggest integrators in the Pangasius industry in Vietnam. Huyen Nguyen Dieu is Country Manager for Nutriad Asia in Vietnam and Peter Coutteau, PhD is Business Development Manager Aquaculture for Nutriad. Email: a.vanhalteren@nutriad.net (Alexander van Halteren).



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Breakthrough in extruded shrimp feeds

The production of smaller diameter feeds with heavier densities at higher capacities.

In June 2009, Wenger, USA had announced the modifications to the single screw extruder barrel which allowed it to increase capacity by 3 to 5 times. These breakthroughs announced in aquafeed.com means that capacities are up for small diameter floating and sinking feeds. The limitations of extruders in the production of smaller feeds have been in the open area availability in the final die. Past attempts at increasing this open area have often resulted in uneven die flow or non uniform pellet sizes.

At the World Aquaculture 2009 trade show, Joe Kearns, Aquaculture Process Engineering Manager, Wenger Manufacturing, Inc. said that technology is now available for Wenger and Extru-Tech extruders. He also explained how the Wenger Technical team achieved this breakthrough and that they have completed worldwide patents on these developments.

“What we have eliminated is the idea that the extruder has die limitations. The same extruder that used to make 5 tonnes per hour of standard feeds of more than 3mm in size can now make 5 tonnes per hour for feeds of less than 3mm in diameter. A new final screw area at the end of the extruder barrel with a diverging cone screw and special die devices has allowed us to make small diameter floating feeds as well as small diameter sinking feeds at higher capacities. With shrimp feeds a major target for this breakthrough technology, industry requires increases in product density due to the use of feeding trays for shrimp. Feeding trays require feeds generally in the 650 to 690 gram per litre range to allow feeds to stay on the trays when placed in the water. Problems occurred with lower density shrimp feeds placed on feeding trays as they were floating off during the submerging of the tray. These heavier feeds are more user friendly”.

Table 1 gives the new capacity in production according to the extruder model.

Wenger Extruder model	Previous capacity range		New capacity range with improvements in cone screw technology	
	1.5mm sinking feeds tonnes/hour*	1.8mm sinking feeds tonnes/hour*	1.5mm sinking feeds tonnes/hour*	1.8mm sinking feeds tonnes/hour*
X-165	1.0 to 1.5	1.5 to 2.0	3.75 to 5.0	3.75 to 5.0
X-185	2.0 to 3.0	3.0 to 5.0	7.5 to 10.0	7.5 to 10.0
X-235	4.0 to 5.0	4.0 to 5.0	11.25 to 15.0	11.25 to 15.0

*The rates are tested for model X-165 with 165 mm diameter single screw extruder and projected to the larger model for small diameter feeds.

Kearns added, “What we now can achieve is producing smaller diameter feeds with heavier densities at higher capacities as with pellet mills but with distinct advantages. Increased production rates with a more uniform pellets size stand out but extrusion technology also allows for least cost formulations, increased use of vegetable proteins, lower levels of starch required, use of liquid ingredients while not requiring any additional premium binder for water quality and pellet durability.

In general, Kearns believes that extrusion should be reviewed on a total cost basis for shrimp feed production and has the benefits of lower total costs of formulations, eliminates the use of expensive binders and increases options on ingredients selection. All these have less impact on the environment.



Photo of the typical evenness of a 1.5mm shrimp feed produced with the new technology.

“In summary, these give lower feed costs with better results due to use of advanced production machinery. Obviously smaller feed diameters are not limited to shrimp feeds and also not limited to single screw extruders either”, said Kearns.

“These same developments have also been applied to twin screw extruders and similar 3 to 5 times increases in production rates for small diameter feeds are now also achievable on twin screw extruders. This was achieved by taking the time tested single screw technology and apply it in a twin screw machine combining the best of both into one extruder for small diameter feed production. This is the positive pumping and mixing action of a twin converted into proven single screw extruder technology at the discharge end of the extruder barrel.”

In the future, Wenger continues to work towards production of extruded feeds in general with improved equipment designs which will reduce overall energy inputs, produce the same feed or better feeds while lowering the overall or total cost of extrusion”. More information: www.wenger.com Email: Joe Kearns (jkearns@wenger.com)



Joe Kearns (left) and Osvaldo Muñoz at the Wenger booth during World Aquaculture 2009, Veracruz, Mexico.

Marine fish aquaculture in Southeast Asia

By Lukas Manomaitis

Marine fish aquaculture is being developed in Southeast Asia not only through aqua feed but also by improving conditions of culture.

With increasing competition for land and limited water resources restricting the likelihood of a continued expansion of land-based aquaculture, mariculture appears to offer the greatest potential to meet a growing demand for farmed fish products. To ensure the sustainability of this industry, renewable and efficient ingredient sources for fish feeds will be needed. Since the late 1990's, the American Soybean Association International Marketing (ASA-IM) Program has been promoting the development of marine-based aquaculture. These efforts which started in China are now being expanded to other areas of the world, including Southeast Asia (SEA). As the world's second largest aquaculture producing region, Southeast Asia offers great potential for mariculture development due mainly to its diversity and the vast water resources available.



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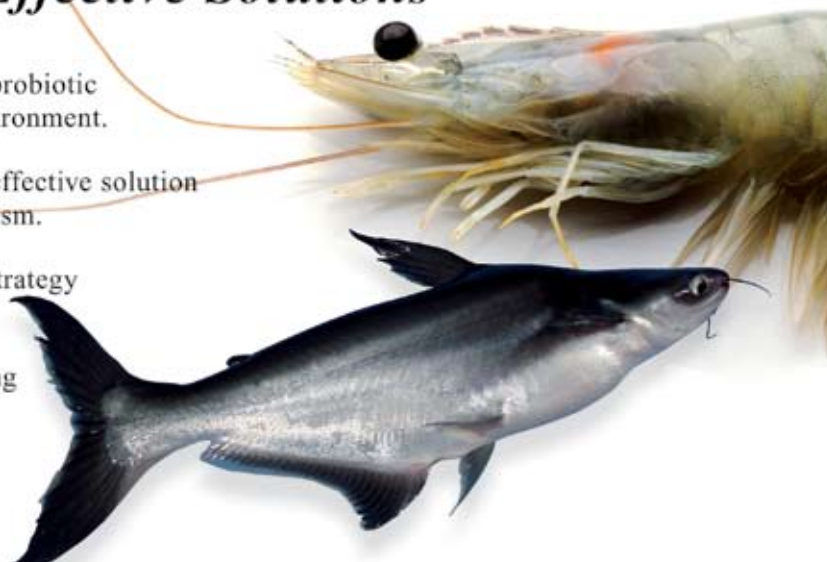
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Group of sea hatchery stakeholders on an organized trip to Taiwan.

A multi-level approach

The ASA-IM program through the Soy-In-Aquaculture (SIA) project has been working closely with the aquaculture industry since 2002 in Indonesia, Philippines and Vietnam to demonstrate the benefits of using soy-optimized aqua feeds and better technological approaches in the freshwater and marine sector. In late 2007, it highlighted and expanded the efforts to aid the aquaculture industry in five target countries namely Indonesia, Malaysia, Philippines, Thailand and Vietnam.

Recent efforts in the marine sector have focused on improving the conditions for aquaculture production based on a multi-level approach to address the following issues. These help ensure sustainable growth for the marine-based aquaculture industry in the region, and consequently encourage higher demand and consumption of soy-optimized aqua feeds in the future.

- Enhancement of fingerling supply (including hatcheries and nurseries)
- Expansion of knowledge and management about formulated feeds
- Development of profitable, effective and sustainable culture systems
- Advancement of sustainable development models and planning
- Improvement of fish and shrimp health and disease management practices

To support the improvement of the marine fish sector in Southeast Asia, Hsiang Pin Lan, China ASA-IM Marine Aquaculture Specialist, is assisting the ASA-IM SEA office in transferring and adapting to the region the soy-optimized marine aquaculture technologies which were successfully developed and applied by the ASA-IM in China.

Aquaculture without Frontiers (AwF)

is an independent non-profit organisation that assists in the alleviation of poverty in developing countries by supporting projects designed to provide fish for food and income through sustainable small-scale aquaculture. AwF has also assisted in tsunami relief work.

So far we have project activities in Bangladesh, India, Indonesia, Malawi, Nepal and Thailand and our AwF Volunteers have provided assistance in several other countries including Ghana, Kenya, Liberia, Papua New Guinea and Peru.



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Feed-based systems

The program has worked in the aquaculture sector since the mid-1980s (initially under Dr. Dean M. Akiyama, based out of the Singapore regional office). The majority of the work and research was accomplished in China under the direction of Dr. Michael Cremer, the Global Technical Director for the SIA, starting in the early 1990s. A long lasting partnership with the Chinese National Extension Service to develop more efficient, sustainable and feed-based aquaculture systems, beginning with pond systems was established.

This alliance has contributed to moving fish farmers from low input, low biomass, high nutrient load, polyculture pond systems to more profitable, efficient and sustainable systems. This initial work in China resulted in the development of the 80:20, or feed-based, pond aquaculture system. In the late 1990's the program began to focus on cage culture systems for freshwater, brackishwater and nearshore marine areas. A technological approach, called the Low Volume, High Density (LVHD) Cage Culture System helped farmers utilize better approaches to cage culture of fish. In the early 2000s, an effort to develop the technologies required for offshore cage culture led to the development of the Offshore Cage Aquaculture Technology (OCAT) System.

Performance and profitability

The basis for all these technologies is to demonstrate to farmers all the factors involved in the grow-out of fish in the target system. Each system has specific guidelines on culture unit size, target biomass, feeds appropriate for the species cultured, feeding techniques and record keeping. The objective has been to provide farmers with techniques

and approaches that reduce risks and promote sustainability while maintaining performance and profitability.

Aside from working with the fish farming industry, the program also works closely with the feed milling industry to ensure that high quality soy-optimized feeds are available to the global aquaculture industry, starting with the farmers that implement ASA-IM's soy-optimized feed systems. By working with feed millers, it has created new markets for aquaculture feeds while also educating feed mill formulators on the optimal use of soy in aquaculture diets.

Since 2002, the reach of these aquaculture efforts in China have been expanded to India, Southeast Asia, Latin America, the Middle East, and Mediterranean Europe, under an umbrella program known as Global Soy-in-Aquaculture (SIA) Project.

In addition to these international marketing efforts, the ASA-IM, through the United Soybean Board (USB) New Uses program has also been moving forward on the development of more targeted aqua feeds for various marine species as well as the optimization of soy products in feeds for these species. The target species of interest for research are cobia, pompano, milkfish, Asian sea bass and giant grouper. Some work has been completed and some are ongoing at various research facilities around the world. The results of this research will be freely shared with the aquaculture industry.

Recent and future efforts

In order to address the limitations in supply of the appropriate quantity and quality of fingerlings required by a rapidly expanding marine fish aquaculture sector, ASA-IM recently brought government and hatchery stakeholders from Southeast Asian countries to Taiwan



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Pompano grown on soy-optimized feeds in a demonstration project.

to tour the hatchery industry. The short term objective was to develop business links in the trade of high value marine fish fingerlings in the region. Participants learnt how the Taiwanese industry has developed its hatchery and nursery industry. We expect to continue such visits in future to help this critical sector of the marine fish aquaculture industry.

The first aqua feed formulation workshop to discuss better approaches on formulating aquaculture diets to a group of feed mill ingredient purchasers, nutritionists and formulators was held early in 2009. This program is expected to be repeated several times in all five target Southeast Asian countries in 2010.

The ASA-IM has been presenting technologies and methodologies for marine fish culture to audiences in the region since 2002 and will continue this work. With Hsiang Pin Lan in the program, we have the opportunity to continue improvements in pond, LVHD and OCAT production approaches to marine fish culture. In particular we have the opportunity to learn the positive and negative experiences by the high value marine fish culture industry in China and avoid a repeat of negative aspects.

In late 2008, the a successful seminar series “Disease issues in cage culture of high value marine species” with presenters discussing marine fish health/disease issues and integrated coastal management was conducted. This was followed by smaller audience seminars on diseases. In 2009, a large dissection workshop for marine fish was held in Philippines. These initial events are expected to be repeated with greater frequency.

Through these demonstrations and research projects in Southeast Asia, the value of new production approaches, and specifically feed-based approaches, to the marine fish aquaculture sector has been demonstrated. In working with leaders in the marine fish farming community and with target aquaculture feed mills, we try to show directly the approaches farmers can take to make their farms more profitable, efficient and sustainable. Often demonstrations are linked to “farmer field days” to bring surrounding farmers to view the progress

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Hsiang Pin Lan inspecting diseased fish.

and results of these projects. We also bring cooperating demonstration farmers to other locations to speak to new audiences about their experiences. Through working with feed millers, the ASA-IM shows the optimization of soy use in their formulations and works with sales and technical staff to help improve knowledge transfer to farmers on how to correctly use feeds.

The ASA-IM is planning its first regional aquaculture meeting, tentatively planned in late March 2010 in Bangkok, Thailand. This meeting will be geared toward bringing together aquaculture stakeholders in Southeast Asia and international experts to learn about better approaches for aquaculture production, looking at issues at all levels of the industry.

Information on all the ASA-IM technologies and work done by the ASA-IM in aquaculture may be found on the ASA-IM SIA website at www.soyaqua.org. The ASA-IM Singapore Regional Office can be contacted at asaspore@pacific.net.sg or through their website www.asaimsea.com.



Lukas Manomaitis is Technical Director for Aquaculture in the ASA-IM SEA office. He has a BS in Biology from Carnegie Mellon University and MS in Fisheries from Auburn University. He has worked professionally in the aquaculture and seafood industry for almost 15 years and has been based

in Bangkok for almost eight years. Prior to this, Lukas was the Regional Technical Manager for the ASA-IM Soy-in-Aquaculture Program in India, Indonesia, the Philippines and Vietnam from 2002-2007.



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Streptococcal diseases in farmed tilapia

By Brian Sheehan, Lauke Labrie, Yeng-Sheng Lee, Wee Keng Lim, Felicia Wong, Jasmine Chan, Cedric Komar, Neil Wendover and Luc Grisez.

***Streptococcus agalactiae* with two distinct Biotypes is the dominant pathogen of tilapia and vaccination trials indicate that immunity is Biotype-specific.**

The tilapia (*Oreochromis* sp) is relatively easy to breed, grows well in a variety of habitats and provide year round yields. The rapidly expanding international trade of this popular species is leading to intensification of farming systems. However, with intensification, it has become apparent that the tilapia is susceptible to a variety of infectious diseases with bacterial or viral etiology, with potentially devastating consequences for the farmer. Foremost amongst these, is streptococcosis, a septicaemic disease responsible for significant morbidity and mortality in farmed tilapia (Garcia J.C et al 2008).

Two species of streptococci, *Streptococcus agalactiae* and *S. iniae* are generally considered to be the most important etiological agents of streptococcal disease in farmed tilapia. Tilapia infected with either *S. agalactiae* or *S. iniae* exhibit similar clinical signs (Figure 1) including lethargy, abnormal swimming, C-shaped body posturing, unilateral or bilateral exophthalmia and lack of appetite (Eldar A et al 1995, Chen C.Y et al 2007, Pasnik D.J et al 2007). These similarities make on-farm diagnosis difficult and require the analysis of bacterial isolates by conventional phenotypic methods or by PCR-polymerase chain reaction, using species specific oligonucleotide primers.

During the last 9 years, we have identified over 1,000 bacterial isolates from tilapia reared at 74 sites in 14 countries to better understand the relative importance of these two pathogens to industry. In common with other investigators in this field, we found streptococcal species to be the dominant bacterial pathogens, accounting for more than half of all bacteria identified.

A prevalent pathogen

However, interestingly, while *S. iniae* is the most commonly reported streptococcal pathogen of fish, analysis of our data showed that *S. agalactiae* is the more prevalent of the two streptococcal pathogens in tilapia. While the reason for this apparent predominance of *S. agalactiae* in tilapia is still unknown, a recent comparative histopathology study of *S. iniae* and *S. agalactiae*-infected tilapia has revealed subtle differences in the pathogenesis of these two bacteria. This suggests that tilapia may control natural infections with *S. iniae* more effectively than those caused by *S. agalactiae* (Chen C.Y et al 2007).

S. agalactiae is the only streptococcal species that carries streptococcal the group B antigen and as such is often referred to simply as group B streptococcus (GBS). Although more commonly associated with disease in human or bovine hosts, where it causes neonatal sepsis and mastitis, respectively, fish-pathogenic *S. agalactiae* have been documented from as early as 1966 when a non-haemolytic group B streptococcus was identified as the cause of two epizootics in golden shiners (*Notemigonus crysoleucas*) (Robinson & Meyer 1966).

In recent years there has been a significant increase in the number of reports and investigations on, *S. agalactiae* disease in tilapia published in academic or trade journals. In 1994, Eldar and colleagues reported the identification of a new, serologically untypeable, streptococcal pathogen of tilapia for which they proposed the name *S. difficile*. Later the species epithet was corrected to *S. difficilis* (Euzenby J.P 1998). However, subsequent studies have conclusively demonstrated that *S. difficilis* is a variant non-haemolytic group B streptococcus that is genetically identical to and shares whole-cell protein characteristics that are indistinguishable from, *S. agalactiae* (Vandamme P et al 1997). In 2005, Kawamura and co-workers proposed that *S. difficilis* is a latter synonym of *S. agalactiae*. Nonetheless, the name *S. difficilis* is still occasionally used in the field.

Figure 1. Some clinical signs of Streptococcal diseases in farmed tilapia.



Typical pinpoint petechial hemorrhaging caused by *Streptococcus agalactiae*.



3 gram juvenile tilapia with bilateral exophthalmia



Late stage bilateral exophthalmia

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Regional prevalence of Biotypes

Our detailed analysis of tilapia *S. agalactiae* isolates suggested the presence of two distinct clusters which differ in a variety of biochemical and phenotypic characteristics. We refer to these distinct clusters as Biotypes. Strains of Biotype 1 are typically β -haemolytic, ferment a variety of sugars including trehalose and galactose and grow well at 37°C. In contrast, all strains of Biotype 2 that we have tested are non-haemolytic, more restrictive in their utilisation of sugars and they grow poorly, if at all, at 37°C. Indeed the phenotypic characteristics of our Biotype 2 strains closely resemble those described previously for *S. difficilis*.

Furthermore, our analysis suggests that the *S. agalactiae* Biotypes are present in distinct geographical zones (Figure 2). From our sampling of tilapia worldwide, *S. agalactiae* Biotype 2 is the most prevalent and geographically diverse of the streptococcal pathogens. In Asia we find *S. agalactiae* Biotype 2, in China, Indonesia, Vietnam, and the Philippines and in Latin America we have found it in Ecuador, Honduras, Mexico and most recently in samples from Brazil.

In contrast we find *S. agalactiae* Biotype 1 to be the dominant streptococcal pathogen of tilapia in Thailand, Malaysia, and Singapore. We find *S. iniae*, often in association with *S. agalactiae* Biotypes 1 or 2, in China, Ecuador, Honduras, Indonesia, the Philippines and Thailand. Only in the Philippines and in Vietnam have we observed *S. agalactiae* Biotype 1, *S. agalactiae* Biotype 2, and *S. iniae* in tilapia in the same country.

Efficacy of vaccines

Vaccines to protect against *S. agalactiae* infection in tilapia have been described by various authors (Eldar A et al 1995, Evans et al 2004 and Pasnik et al 2006). However, it is difficult to conclude from these studies if the vaccine and challenge strains were from the same, or different, Biotypes. To determine if our classification of the fish pathogenic *S. agalactiae* has consequences for the development of vaccines to control this devastating disease, we assessed in a laboratory challenge the ability of biotype-specific vaccines to protect against lethal challenge with *S. agalactiae* Biotype 1 or Biotype 2 strains.



From left, Robin Wardle, Technical Services, UK, Neil Wendover, Technical Service Manager Asia-Pacific and Mario Aguirre Plaza, Technical Service Manager, Latin America at the vaccination table.

Live demonstration of practical intraperitoneal vaccination

Intervet/Schering-Plough Animal Health illustrated the ease of intraperitoneal (IP) injection vaccination at their booth during Asian Pacific Aquaculture 2009, held from 4 to 6 November, Kuala Lumpur, Malaysia.

Juvenile tilapia were vaccinated using AquaVac® Strep Sa, the first oil adjuvanted *Streptococcus agalactiae* Biotype II vaccine now being launched across Asia and Latin America. Asian seabass can be used as a target species in the same system and vaccinated with Norvax® Strep Si which is a multi species, water based, *Streptococcus iniae* vaccine.

The vaccination table was designed as a model farm replica to allow fast efficient vaccination with minimal stress to the fish. The table, along with the full technical support package, will be available for parties venturing into a collaborative vaccination program.

Intervet/Schering-Plough Animal Health were also sponsors of the health session at the Asian Pacific Aquaculture 2009 Conference. Presentations on the two vaccines were made by Neil Wendover who discussed Streptococcosis in tilapia: epidemiology and vaccine development and Dr Tae Sung Jung from the Laboratory

of Aquatic Animal Diseases, Gyeongsang National University, Korea who gave a presentation on the examination of safety and efficacy of Norvax® Strep Si against *Streptococcus iniae* in olive flounder (*Paralichthys olivaceus*).



Figure 2. Regional prevalence.



In Table 1, tilapia vaccinated with an experimental *S. agalactiae* Biotype 1 vaccine were protected against lethal challenge with a virulent *S. agalactiae* Biotype 1 strain. However no protection against challenge with a virulent Biotype 2 strain was observed in the Biotype 1-vaccinated fish.

Table 1. Sa1 vaccines do not protect against Sa2 challenge.

<i>S. agalactiae</i> vaccine strain	<i>S. agalactiae</i> Challenge strain	Treatment Group	% mortality	RPP
<i>S. agalactiae</i> Biotype 1	<i>S. agalactiae</i> Biotype 1	Vaccinates	7	93%
		Control	93	
	<i>S. agalactiae</i> Biotype 2	Vaccinates	87	0%
		Control	80	

*RPP, relative percent protection (includes mortality and recovery of challenge organism from surviving fish at the end of the observation period. RPP is calculated as $RPP = (1 - (\text{infection in vaccinates} / \text{infection in controls})) \times 100$

Similarly, fish vaccinated with a *S. agalactiae* Biotype 2 vaccine were protected against lethal *S. agalactiae* Biotype 2 challenge (Table 2). However no protection against challenge with a virulent Biotype 1 strain was observed in the Biotype 2-vaccinated fish. Thus, vaccination with Biotype-specific bacterin vaccines induces Biotype-specific protection against mortality caused by *S. agalactiae*.

Table 2. Sa2 vaccines do not protect against Sa1 challenge.

<i>S. agalactiae</i> vaccine strain	<i>S. agalactiae</i> Challenge strain	Treatment Group	% mortality	RPP
<i>S. agalactiae</i> Biotype 2	<i>S. agalactiae</i> Biotype 1	Vaccinates	53	0%
		Control	53	
	<i>S. agalactiae</i> Biotype 2	Vaccinates	13	80%
		Control	67	

*RPP, relative percent protection (includes mortality and recovery of challenge organism from surviving fish at the end of the observation period. RPP is calculated as $RPP = (1 - (\text{infection in vaccinates} / \text{infection in controls})) \times 100$

Conclusion

Our data suggest that *S. agalactiae* and to a lesser extent *S. iniae* are the principle agents of streptococcosis in tilapia. Detailed analysis of our tilapia *S. agalactiae* isolates suggests the presence of two Biotypes which differ in a variety of biochemical and phenotypic characteristics. In our experience these two *S. agalactiae* Biotypes cause subtly distinct disease syndromes, with *S. agalactiae* Biotype 1 infecting fish throughout the production cycle from juvenile to grow-out, while *S. agalactiae* Biotype 2 causes disease predominantly in larger fish.

Moreover, and most significantly from a health management perspective, we have demonstrated that immunity is Biotype-specific. To our knowledge there are no obvious geographical, physiological or environmental explanations for the country to country distribution of *S. agalactiae* Biotypes 1 and 2. As such it is prudent that we consider the possibility that this will breakdown over time, probably through trade in live fish.



Brian Sheehan (left) with Cedric Komar (middle) and Neil Wendover.

Brian Sheehan, Ph.D., Lauke Labrie, MSc, DVM, Yeng Sheng, Lee, BSc, Wee Keng, Lim, BSc, Felicia Wong, BSc, Jasmine Chan, BSc and Cedric Komar, DVM, MBA and Neil Wendover, BSc are with Intervet/Schering-Plough Animal Health, Singapore. Luc Grisez, PhD, is with Intervet International, The Netherlands. Email: neil.wendover@sp.intervet.com

Diseases in catfish farming in India

By A.K.Singh, K Phani Prakash and W.S.Lakra

Sutchi catfish in monoculture systems is facing severe disease problems with heavy mortalities and raises the question of food safety and sustainability.

Pangasius catfish is one of the fastest growing aquaculture species in the world. According to FAO, the global production of this fish is targeted at over 1,000,000 tonnes by 2010 but this target was already achieved in 2007. About 90% of Pangasius production comes from Vietnam alone.

The farming of *Pangasius sutchi* in India particularly in the states of Andhra Pradesh and West Bengal has increased in recent years. The annual aquaculture production of this species has been estimated to be over 200,000 tonnes in the country. *P. sutchi* was introduced into India through Bangladesh. It is cultivated both for food as well as for the aquarium trade.

Farmers are culturing the fish either in polyculture systems with Indian and Chinese carps or in monoculture systems. Monoculture is the preferred practice and the production ranges from 20 to 25 tonnes/ha/year which is higher than carp production. Market access is good and prices are low at INR35-40/kg as compared to INR60-70/kg for the rohu and catla. It is observed that *P. sutchi* grows faster and requires less management.

Rising concerns on diseases

These are severe problems faced by farmers. Heavy mortalities have been noticed and the fish exhibited off-feeding, circular motions, edging and other morbid conditions. All sizes of fish ranging from 5 g to 1.5 kg have been infected, resulting in heavy losses. Water quality and soil characteristics of the farms with disease occurrences indicated that high levels of carbon dioxide (25-60 ppm), chemical oxygen demand (COD) (2.9 to 4.9 ppm) ammonia (unionized) (0.1-0.5 ppm), and nitrite (0.03-0.2 ppm) associated with low dissolved oxygen (2.9-4.5 mg/l) prevailed in the infected farms.

Exophthalmia, haemorrhagic conditions on the body, hole in the head region, necrosis in the tail region and bulging of caudal peduncle have been observed in samples of diseased fish. In many ponds, mortality lasted for 15-17 days after the first appearance of the symptoms which multiply many times within 3-4 days.



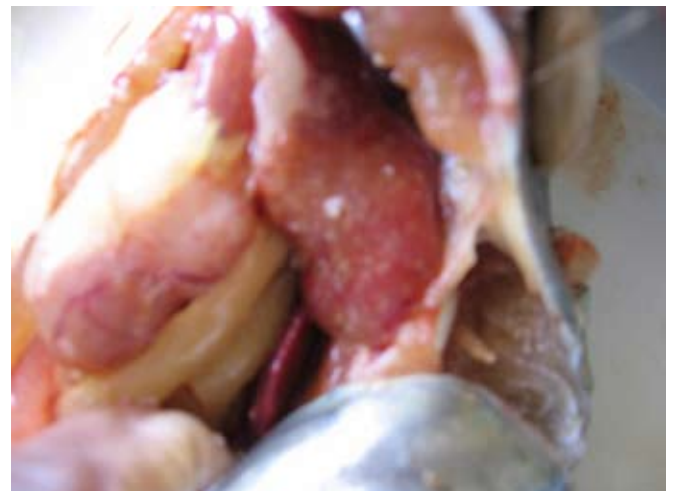
A harvest of Pangasius sutchi

The occurrences of 'red disease' in sutchi catfish from grow out farms have been confirmed to be 'Haemorrhagic Septicemia'. In a few specimens, swelling of liver has been observed. Microscopic examinations of gill by squash preparation of infected fish revealed the presence of Trichodina parasitic infection of moderate degree.

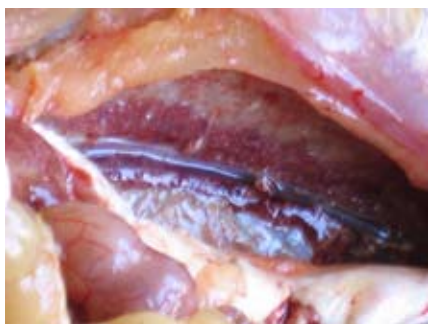
In general, farmers use antibiotics (oxytetracycline, entofloxacin, furazolidon) at the rate of 10g/kg feed for 'red disease' while others use iodine based water sanitizers (virudine, microbites, iodophore, micodine etc.). Use of probiotics (*Nitrosomonas*, *Nitrobacter*, Redwin, Bactowin etc.) is also practiced for improving the water quality and as a prophylactic.



Pseudomonas infection



Liver infection



Kidney infection



Examination of gill fluke



Necrosis in head region

Gill flukes

Gill fluke infection is commonly seen in all *P. sutchi* farms with infection rates varying from 60% to 90% (Arther, 2006; Buchanan and Bresciani, 2006; Das et al. 2006). The highest mortality due to gill flukes is manifested during the first week after stocking. The visible infection in the spawn and early fry at the hatcheries is low except for gas bubble disease which is probably due to high ammonia levels and eutrophic conditions. Farmers pay attention only to the direct economical loss from diseases other than that from gill fluke infection. In fact, gill fluke is understood to contribute significantly to the loss due to secondary bacterial infection which was followed by the initial infections with the parasite.

Sutchi catfish diseases have been considered as the major problem in its culture. Due to the open nature of *P. sutchi* culture, the risk of disease and parasite transfer to wild stocks would be possible. Recently, the bacteria *Edwardsiella ictaluri*, a disease native to North America and reported from ictalurid catfish, was identified in farmed *P. sutchi* cultured in the Mekong River Delta (Yuasa et al 2003). This is the first instance of this disease being observed in pangasiids. *E. ictaluri* has been isolated from *P. sutchi* in Vietnam, which has not been reported in the co-habitant *P. bocourti* (Crumlish et al. 2002).

Risk assessment

A previous report of bacillary muscle necrosis from Vietnam (Ferguson et al. 2001) has now been identified as being attributable to *E. ictaluri* (Crumlish et al. 2002). It remains unclear as to whether the bacteria was introduced or present locally but previously unknown. However transmission of pest could be an issue in the future. A report from New Zealand on risk assessment of Vietnamese *P. sutchi* has highlighted the possible transfer of *E. ictaluri* in the aquaculture areas in Vietnam which is a concern of OIE listed disease (Christine Reed, 2008).

It is pertinent to mention that infection of *P. sutchi* does not result in clinically apparent disease. Therefore, septicaemic fish are quite likely to be harvested for human consumption. There remains the possibility that some fish could be carrier of *E. ictaluri* without displaying clinical signs. In India, the septicaemic fish infections were observed in some of the *P. sutchi* farms. If such infected fish is harvested and processed for consumption, it will have a serious concern with human health. Further, there is no treatment of the effluent water from culture ponds and with the lack of knowledge of farmers, dead fish and/or diseased fish from aquaculture and aquarium facilities are released directly into public canals and rivers. Hence, there is a prevailing threat of disease risks associated with this culture of *P. sutchi*.

The unplanned rapid development of sutchi catfish aquaculture in India raises the question of its sustainability. The issues of concern are culture of *P. sutchi* in fishery sensitive areas, replacement of local fish species with *P. sutchi* and the introduction of diseases. A strategic technical training and awareness program for farmers is a necessity to mitigate the problem and to avoid future food safety issues.

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Nitrifiers and Denitrifiers — Myths and Facts

By David J.W. Moriarty

Both *Nitrosomonas* and *Nitrobacter* species have been revered in ammonia detoxification, but it is the bacteria in the *Nitrospira* group that oxidises more nitrite than *Nitrobacter*. Recent research also shows that a newly discovered group of single-celled microorganisms that are not bacteria are important nitrifiers and a new anaerobic process is involved in the conversion of ammonium to nitrogen in marine sediments.

Ammonia and nitrite concentrations are key aspects of applied microbial ecology that all aquaculture producers and aquarium users have to manage. Some producers of fish and shrimp use commercial products that are claimed to have nitrifiers- bacteria that oxidise ammonia or ammonium to nitrite and nitrate – in the hope that they will enhance removal of ammonium and nitrite. *Nitrosomonas* and *Nitrobacter* species have a revered place in the mythology of ammonia detoxification in aquaria and aquaculture and the removal of nitrogen wastes from aquatic environments by conversion to molecular dinitrogen (N_2). In fact, work by many scientists over the last 20 years has shown that these species play a minor role in most environments. Bacteria in the *Nitrospira* group oxidise more nitrite in aquaria than *Nitrobacter*.

We know now that Archaea, not bacteria, are the major nitrifiers in the oceans and freshwater and furthermore, that a new process of anaerobic ammonium oxidation and denitrification by a group of Planctomycetes accounts for around half of the conversion of ammonium to nitrogen in marine sediments, and probably in other

anoxic environments, including shrimp pond sediments. Some heterotrophic bacteria, e.g. *Bacillus* species, also nitrify ammonium.

Nitrification-Autotrophic

Nitrification is the process of oxidation of ammonium to nitrite and nitrate and during which energy is released. Autotrophic bacteria utilise that energy for growth; they use the energy of nitrification to fix carbon dioxide into organic matter. Nitrifying autotrophs, which are always present naturally, increase in number and activity as ammonium concentration increases and oxidise it to nitrate, which is not toxic. They require good aeration; about 30% of total oxygen demand in intensive ponds is due to the action of nitrifiers that oxidise ammonium (NH_4^+) to nitrite (NO_2^-) and finally nitrate (NO_3^-).

Ammonium and nitrite oxidation in both marine and freshwater environments is due to different groups of Archaea (single-celled microorganisms) and Eubacteria (the true bacteria). Recent work with DNA sequencing has shown that most nitrification in the oceans

Figure 1. The “Tree of Life” with evolutionary distance determined from DNA sequencing. The evolution of living organisms is often depicted as a branching tree, with the earliest organism as the root and the most recently evolved at the furthest extremities of the branches. All life is classified into three domains: Bacteria, Archaea and Eukarya.

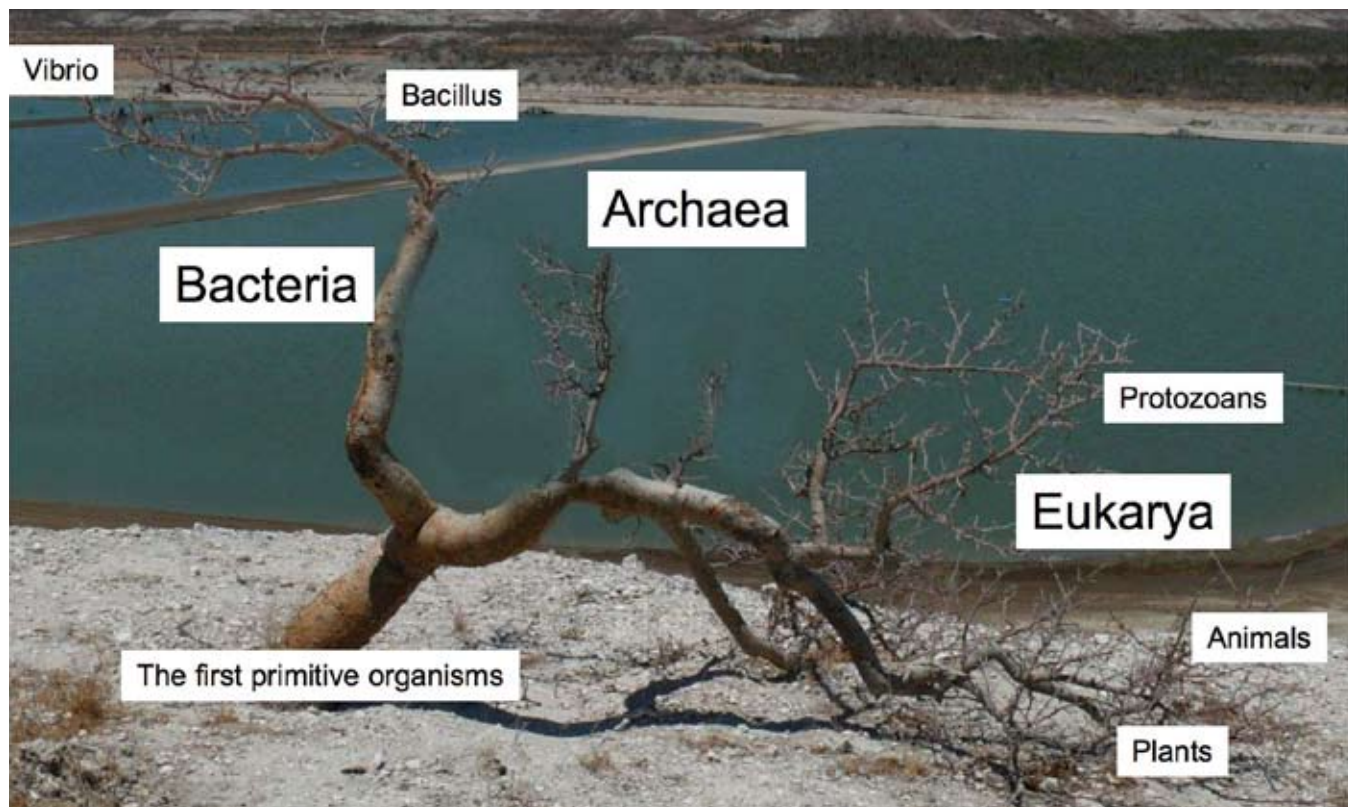
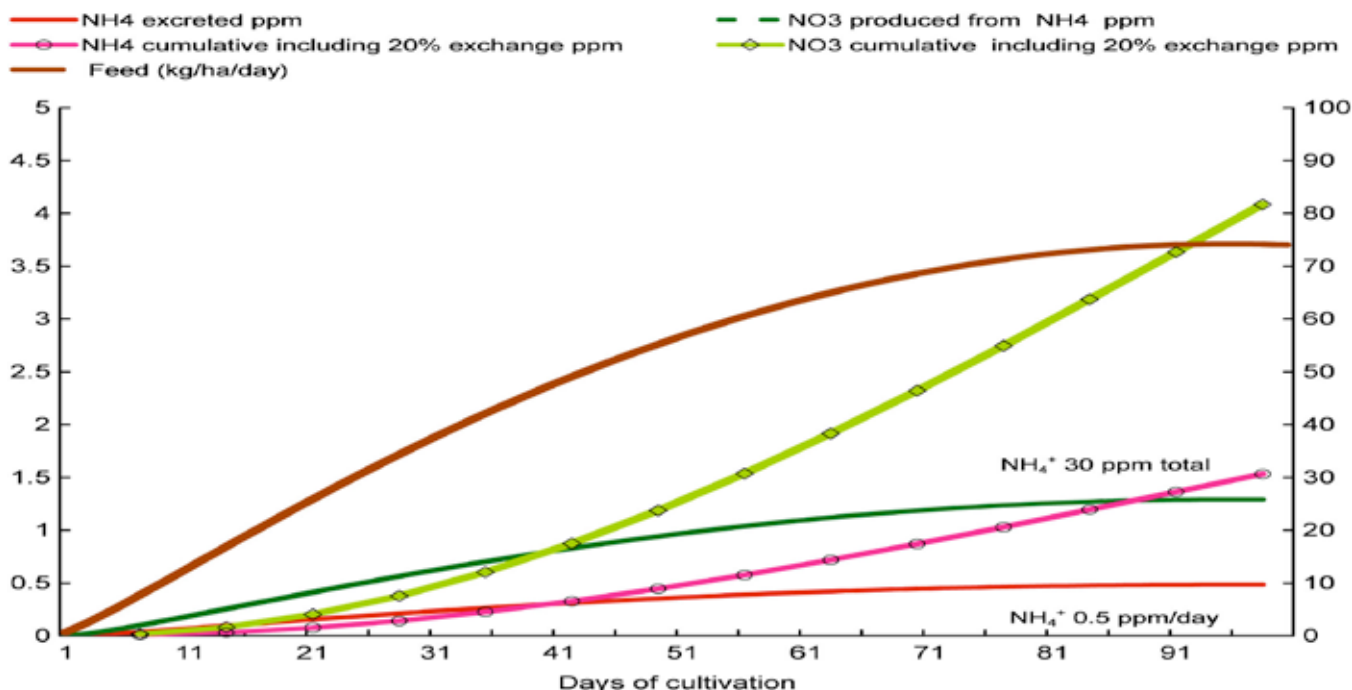


Figure 2. Ammonium production per day and cumulative totals, if there were no nitrification. Nitrate production per day and cumulative totals, if there were no denitrification.



is mediated by the Archaea, not bacteria; the first evidence for this came from studies of nitrification in a marine aquarium (Wuchter et al. 2006). Species of *Nitrosococcus oceani* and *Nitrosomonas marina* are the predominant ammonia-oxidising bacteria found in marine environments (Koops et al. 2006). Probably, most ammonium and nitrite oxidation is due to autotrophic nitrifiers, which use the energy released for biosynthesis; however, many heterotrophs, including *Bacillus* and *Pseudomonas* species, also nitrify ammonium to nitrate.

Archaea were discovered in 1977. They comprise a group of organisms that look like bacteria, but in fact are more closely related to eukaryotes as shown by DNA sequence similarity (Figure 1).

Nitrosomonas europaea and *Nitrobacter agilis* have been studied in detail because they are relatively easy to grow in the laboratory, not because they are the principal nitrifiers. Hovanec et al. (1998) used DNA technology to show that *Nitrospira* or related organisms were more important than *Nitrobacter* species as nitrite oxidisers in freshwater and marine aquaria. Even in aquaria where commercial products of *Nitrosomonas* and *Nitrobacter* were added, those bacteria did not grow, but instead large populations of *Nitrospira*-like bacteria developed.

Nitrification-Heterotrophic

Heterotrophic bacteria utilise fixed carbon, i.e. organic carbon compounds, for their energy and cellular carbon. Some of them also nitrify ammonium to nitrite and reduce that to nitrogen, so they are both nitrifiers and denitrifiers. Several strains of *Bacillus subtilis* and *B. licheniformis* have been reported to nitrify ammonium, as well as strains of *Alcaligenes* and *Pseudomonas*. Their contribution to the budget for ammonium removal is probably low.

Denitrification

The nitrate should not be allowed to accumulate in ponds, as it will cause algal blooms to become too dense and would limit production by causing low oxygen concentration at night, especially if a 'crash' occurs.

It is important therefore, to eliminate nitrate, and this is done by bacteria that reduce it to nitrogen gas and nitrogen oxides at the sediment surface and in particles floating in the water column- as oxygen concentration is low inside particles.

The bacteria that reduce nitrate are known as denitrifiers, and they use nitrate in place of oxygen for respiration when oxygen is limiting. In ponds with a low density of animals, the natural denitrifiers, such as some species of *Pseudomonas* and *Bacillus*, will cope with the rate of ammonium production from feed and its subsequent nitrification to nitrite and nitrate. However, at intensive scales of production, denitrifiers need to be added as feed rates increase during culture. Strains of *Bacillus* in the Sanolife® PRO-W (INVE) are very good denitrifiers and thus assist in maintaining water quality (Figure 3). They work in a consortium with nitrifiers and anaerobic ammonium oxidisers.

During the process of denitrification, the Sanolife® PRO-W strains speed up the degradation of waste organic matter from faeces and feed as well as dead algae. They have been selected also for the action in secreting exoenzymes that attack waste particles. The *Bacillus* are much better at breaking down large molecules and organic particles than vibrios and pseudomonads, due to the nature of their cell wall and secretory processes. This is because they release a much larger range of digestive exo-enzymes. At intensive feeding rates, the natural bacteria like vibrios cannot keep up with the rate of waste accumulation, so we have to assist the balance of the food web in the ponds by adding bacteria that can do so. This is why we recommend larger rates of Sanolife® PRO-W addition at higher stocking and therefore feeding rates.

Anaerobic ammonium oxidation

Fifteen years ago (1994) a new process for removal of ammonium from aquatic environments was discovered: anaerobic ammonium oxidation (Anammox) in which nitrite is used by a group of anaerobic bacteria to oxidise ammonium, with hydrazine as an intermediate. Nitrate is also used as an oxidant for ammonium, after it is first reduced to nitrite by denitrifying bacteria (Thamdrup and Dalsgaard 2002). The Anammox process accounts for 30 to 70% of ammonium conversions to nitrogen in the world's oceans (Penton et al. 2006). No studies on the quantitative role of anaerobic ammonium oxidation in shrimp ponds have been published, but from what we know of the importance of this process in natural marine sediments, it is likely to be an important contributor to removal of ammonium in ponds, in combination with the activity of denitrifiers.

Table 1. Variation with pH of concentrations of free ammonia in relation to total ammonium concentrations.

Concentrations of Toxic Ammonia (NH ₃) at 30 °C (ppm)											
Total NH ₄	pH										
	7.8	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8
0.1	0.004	0.006	0.010	0.015	0.021	0.030	0.041	0.052	0.063	0.073	0.081
0.2	0.008	0.013	0.019	0.029	0.043	0.060	0.081	0.104	0.126	0.146	0.162
0.3	0.012	0.019	0.029	0.044	0.064	0.090	0.122	0.156	0.189	0.219	0.243
0.4	0.016	0.025	0.039	0.058	0.085	0.120	0.162	0.208	0.252	0.292	0.324
0.5	0.021	0.032	0.049	0.073	0.107	0.150	0.203	0.259	0.316	0.365	0.406
0.6	0.025	0.038	0.058	0.088	0.128	0.180	0.243	0.311	0.379	0.438	0.487
0.7	0.029	0.045	0.068	0.102	0.149	0.210	0.284	0.363	0.442	0.511	0.568
0.8	0.033	0.051	0.078	0.117	0.171	0.240	0.324	0.415	0.505	0.584	0.649
0.9	0.037	0.057	0.088	0.131	0.192	0.270	0.365	0.467	0.568	0.657	0.730
1	0.041	0.064	0.097	0.146	0.213	0.300	0.405	0.519	0.631	0.730	0.811
1.1	0.045	0.070	0.107	0.161	0.235	0.331	0.446	0.571	0.694	0.804	0.892
1.2	0.049	0.076	0.117	0.175	0.256	0.361	0.486	0.623	0.757	0.877	0.973
1.3	0.054	0.083	0.127	0.190	0.277	0.391	0.527	0.675	0.820	0.950	1.055
1.4	0.058	0.089	0.136	0.204	0.299	0.421	0.567	0.727	0.883	1.023	1.136
1.5	0.062	0.096	0.146	0.219	0.320	0.451	0.608	0.778	0.947	1.096	1.217
1.6	0.066	0.102	0.156	0.234	0.341	0.481	0.648	0.830	1.010	1.169	1.298
1.7	0.070	0.108	0.166	0.248	0.362	0.511	0.689	0.882	1.073	1.242	1.379
1.8	0.074	0.115	0.175	0.263	0.384	0.541	0.729	0.934	1.136	1.315	1.460
1.9	0.078	0.121	0.185	0.277	0.405	0.571	0.770	0.986	1.199	1.388	1.541
2	0.082	0.127	0.195	0.292	0.426	0.601	0.810	1.038	1.262	1.461	1.622
2.2	0.091	0.140	0.214	0.321	0.469	0.661	0.891	1.142	1.388	1.607	1.785
2.5	0.103	0.159	0.243	0.365	0.533	0.751	1.013	1.297	1.578	1.826	2.028
3	0.124	0.191	0.292	0.438	0.640	0.901	1.215	1.557	1.893	2.191	2.433

Ammonia Toxicity

Safe = <0.03

Chronic toxicity (0.03 - 0.23)

Acute toxicity (0.23 - 0.4)

Lethal (>0.4)

Ammonium in ponds

Most of the nitrogen compounds in ponds come from protein in feed, and the amount added per day increases as culture proceeds (Figure 2). About 30% of protein is converted to shrimp biomass in ponds with an efficient feed conversion ratio. Ammonium is excreted by shrimp, zooplankton, small fauna and by bacteria that degrade the waste material. In a pond with good aeration and mixing, and when feed is managed well, and the pH is less than about 8.2, ammonia toxicity should not be a problem.

Postlarvae and juvenile shrimp are more sensitive than adults to ammonia (NH₃) the toxic unionised form. The proportion of ionised ammonium (NH₄⁺) that dissociates into free ammonia increases as pH increases and/or as temperature increases. For post larvae, it is important to keep the free ammonia concentration below 0.03 ppm for best results (i.e. fast growth and no mortality).

As shown in Table 1 free ammonia concentrations at 30°C for different pH values and total ammonium concentrations. From this table, we can see that in a pond where pH is 8.6 and total ammonium is 1.1 ppm, the free ammonia concentration will be 0.23 ppm, which is acutely toxic. Post larvae are sensitive and may die and in older shrimp that survive, growth will be slower. If urea is used as a fertiliser after stocking and 1 ppm is applied to a pond with pH 8.6, bacteria will convert it to 2 ppm ammonium and thus free ammonia will rise to 0.4 ppm, which is lethal. This is why urea is not recommended as a fertiliser after stocking.

The NO₃-based inorganic fertilizers (e.g. Nutrilake®) or organic fertilizers should be used. For example, at 30 °C, a total ammonium concentration of 0.5 ppm is safe at pH 8.0, and then at increasingly higher pH values, it causes stress and at pH 9.2 toxicity is acute. At higher temperatures, ammonia dissociates more readily, so as temperature rises, lower concentrations of ammonium dissociate to cause stress and toxicity to shrimp.

Nitrifiers and water quality management

When ammonium is supplied, either directly as a fertiliser or indirectly via degradation of protein in shrimp feed, the natural populations of nitrifiers develop. Many estuarine areas have excess nutrient loads in the water from agricultural land and therefore, a community of nitrifiers would be present when the pond is filled from that estuarine water. In ponds that are filled with oligotrophic water (i.e. low in nutrients) from the sea or lakes and rivers in the case of freshwater ponds, time must be allowed for nitrifying populations of microbes to develop sufficiently in abundance to deal with ammonium from waste feed and excretion when shrimp or fish are stocked.

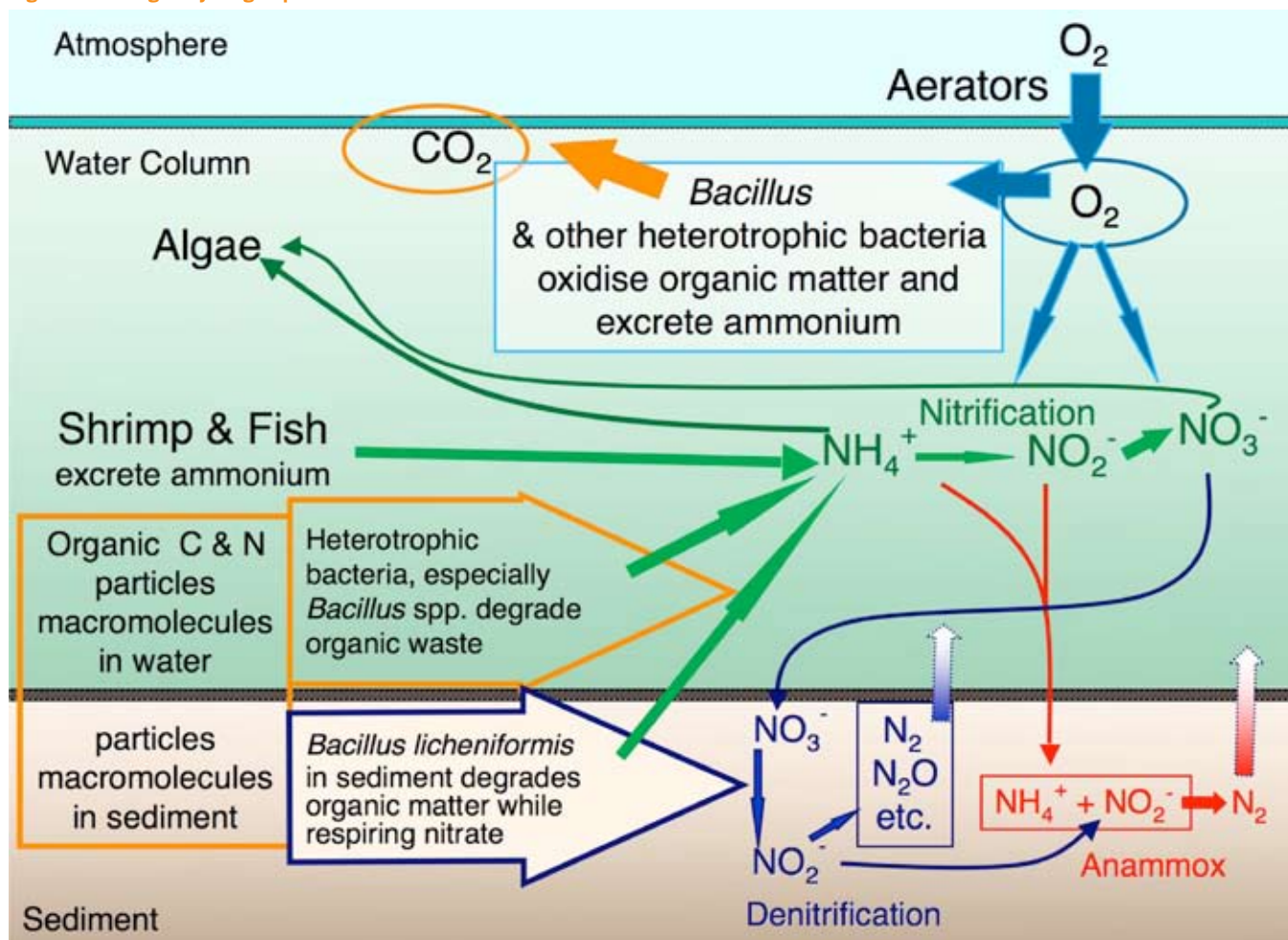
Nitrogen is usually applied as inorganic fertilisers or urea or it may be applied as an organic fertiliser, such as in shrimp feed. In fact, a combination of organic N and inorganic N fertilisers is recommended to stimulate the nitrifiers and the microbial nitrogen cycle as well as to provide inorganic N for algae to take up. The inclusion of urea or an ammonium fertiliser before stocking will promote the development of nitrifiers.

Organic fertilisers are beneficial, especially when fermented with the Sanolife® PRO-W. When organic fertilisers are used, phytoplankton populations are generally more stable as nutrients are being continually recycled. Concentrations remain low and do not stimulate the growth of algal species that are adapted to high nutrient concentrations. Thus they grow quickly for a short period while the nutrients are available and then dies, allowing other algae to take over using nutrients recycled by zooplankton and bacteria.

Nitrosomonas and *Nitrobacter* might be appropriate as water conditioners, but not as feed additives as they would not survive in the intestinal tracts of fish or shrimp. These are special bacteria packed with fragile membranes and they do not form spores. They die when dried, unless a special cryoprotectant is used during freeze-drying, but that is expensive and there is a loss in viability. They can be supplied

The main source of ammonium is the protein in shrimp or fish feed; it is excreted by the shrimp or fish and by the bacteria that degrade the wastes. Ammonium may be taken up by algae or oxidised by nitrifying bacteria to nitrate. Nitrate does not accumulate; it is taken up by algae or is denitrified by many aerobic bacteria in floc particles and in the sediment where oxygen diffusion is restricted. *Bacillus licheniformis* is an important constituent of flocs and the sediment, as it produces a range of degradative enzymes that breakdown the large macromolecules and then it can respire them completely to carbon dioxide with the nitrate as electron acceptor. The denitrifiers include other bacteria like *Pseudomonas* spp. Ammonium is also converted to nitrogen gas by a special group of anaerobic bacteria, which use nitrite as the oxidising agent; these bacteria remove both nitrite and ammonium anaerobically: the Anammox process. The final products of Anammox and denitrification are nitrogen gases, which are released into the water or atmosphere.

Figure 3. Nitrogen cycling in ponds.



as viable cultures in liquid at 4°C, with a shelf life of only a few months under ideal conditions. The cost of adding a consortium of viable nitrifiers to a pond is too high to be economical; it is cost-effective only in aquaria and hatchery tanks with high value species, eg for a rapid colonisation of new or sterilised biofilters and water.

Low cost, powdered products in the marketplace for ornamental fish aquaria, with claims on the label for the presence of *Nitrosomonas* and *Nitrobacter*, are misleading. In fact, tests of several of these products have shown no activity for oxidation of ammonia or nitrite. The only products available with a demonstrable activity of viable bacteria are relatively expensive, and indeed too expensive for regular applications in shrimp ponds when shrimp prices are low.

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Consumer knowledge and behaviour in purchasing Pangasius catfish in Spain

By José Fernández Polanco, Ladislao Luna and José Luis Fernández

The catfish, Pangasius is now a popular seafood product in Spanish markets. However, this does not mean that Spanish consumers have a good knowledge on the product and its origin.

Since 2004, imports of Pangasius fillets from Vietnam have increased considerably in the southern European countries. Spain imported more than 49,000 tonnes in 2008, while imports from Italy have exceeded 30,000 tonnes. With these levels of consumption, it could be expected that among consumers, there should be sufficient knowledge on the product, its origin and harvesting methods. However, incomplete or incorrect labelling and sales of defrosted Pangasius fillets have contributed to the confusion on the product. Retailers and consumers also have limited access to correct information.

Authorities have continuously monitored the mislabelling of Pangasius. The media on the other hand, has highlighted these malpractices where Pangasius fillets were passed off as sole in Italy, or flounder, in Spain. Apart from the deliberate mislabelling, defrosted fillets were illegally passed off as fresh fish fillets.

This paper presents the results of a survey covering seafood buyers from a regional capital in Spain. Different issues on the consumption of Pangasius fillets were included in the questionnaire. Knowledge of the respondents on the region of origin and harvesting methods were recorded. This article is a follow-up to a previous survey on the Pangasius market in Spain, published in Volume 5 (1) in the January/February 2009 issue.

About the survey

The results presented here were obtained from a sample of 812 seafood household purchasers (Sample error = ± 3.5 ; $Z = 1.96$; $p=q=0.5$) collected in the city of Santander, North Spain, in November 2008. Santander is the capital of Cantabria, which ranked fourth as a destination for fish fillets imported to Spain from Vietnam in 2008



Mislabelling Pangasius (flounder) from a promotional bulletin.

(Table 1). Cantabria imported 4,565 tonnes of Vietnamese fish fillets in 2008, according to data from the Spanish Customs. With a population of 532,138 inhabitants, imports were equivalent to a consumption rate of 8.58 kg per person/year.

Consumption and knowledge on Pangasius

Respondents were asked whether they were familiar with the name Pangasius or the common mislabelled name, 'flounder fillets' (see photo), at the market place. A total of 601 respondents (74%) answered in the affirmative and 25.7% of all respondents were familiar with the mislabelled name (Figure 1). Some 58.1% of the respondents had purchased Pangasius fillets, under both names in the last 3 months (Figure 2). The average purchase frequency was 1.38 times per month, and the average price they were willing to pay for a kilo was Euro 8.4. When only

respondents purchasing Pangasius were considered, the percentage identifying the fish by the mislabelled name 'flounder fillets' increased to 37.3%. The product was acquired defrosted by 60.8% of the buyers and most thought that the product was fresh (Figure 3). Only 25.3% had knowledge on the country of origin and only 17.9% were familiar with the harvesting methods (Figure 4).

Differences among respondents

Two variables exert influence over the purchaser's knowledge on Pangasius. The education level of purchasers and retail format affect differently the topics included in the survey.

Knowledge on the country of origin and harvesting method was dependent on the education level of the respondents (Table 2). Better knowledge is observed in those respondents with High School education.

Figure 1. Knowledge of Pangasius and the mislabelled 'flounder fillet' among seafood household purchasers.

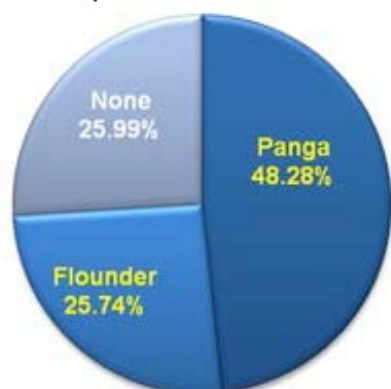


Figure 2. Purchase of Pangasius and the mislabelled 'flounder fillets' among seafood household purchasers.

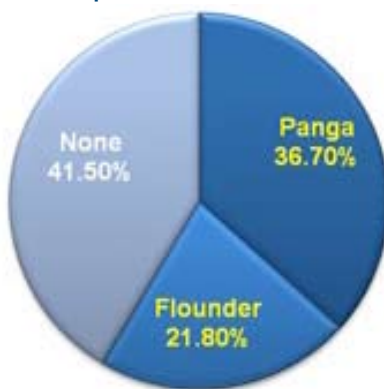


Figure 3. Presentation of Pangasius purchases.

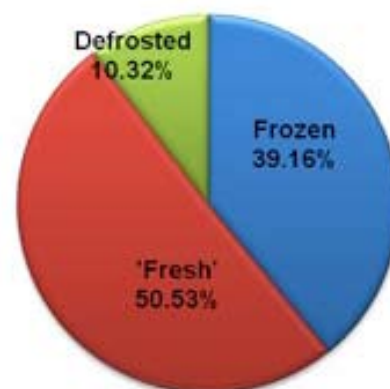
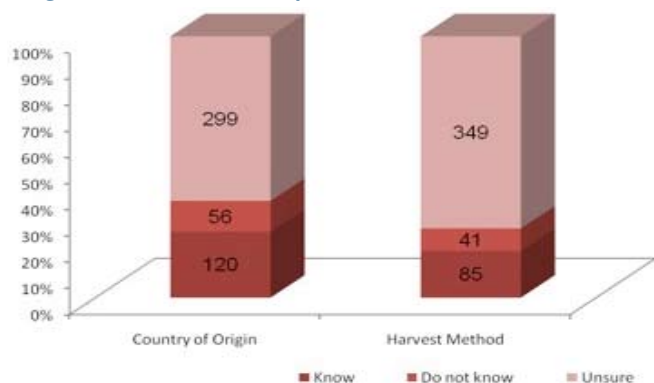


Figure 4. Knowledge on the country of origin and harvest method of Pangasius from 475 respondents.



However, differences between this group and the rest of the sample are more relevant in the case of the harvesting method. Close to 25% of the respondents with a secondary school education indicated that Pangasius is mainly produced by aquaculture techniques. Responses to differences in the name and presentation of the fillets purchased were not statistically significant among respondents with different education levels.

Table 1. Top 5 importing Spanish regions of fish fillets from Vietnam in 2008 (TARIC code 0304).

	Tonnes	1,000 €	Operations
Valencia	15,737.00	28,158.90	688
Galicia	8,646.20	19,474.50	436
Canary Islands	5,003.80	9,855.70	247
Cantabria	4,565.80	8,162.10	211
Cataluña	4,433.30	7,448.00	205
Other regions	10,900.60	20,232.20	508
Total	49,286.70	93,331.40	2,295

Source: Spanish Customs office. Base de datos de Comercio Exterior. Available at: <http://aduana.camara.org/>

Table 2. Knowledge on country of origin and harvest method according to level of education.

	Know	Do not know	Unsure
Country of origin			
Primary	13.64%	9.09%	77.27%
High School	16.89%	11.49%	71.62%
University	30.81%	12.43%	56.76%
Harvest method			
Lowly educated	29.17%	10.83%	60.00%
Primary	9.09%	4.55%	86.36%
High School	13.51%	8.11%	78.38%
University	24.32%	7.03%	68.65%

Retail formats

Retail outlets in Spain take four main forms. The traditional channels are represented by fish markets and fishmongers, while self service channels



Sales display at a Spanish traditional fish market.

include supermarkets and hypermarkets. Supermarkets have increased their market share considerably in the last few years and account for more than 50% of the total seafood sales in the country. Traditional channels have declined in numbers as supermarkets increased.

Final product labelling is dependent on the retail channels. Even if all retailers receive their products with the regulatory label, the amount of information available to the consumers varies, depending on the different seafood retail channels. Supermarkets and hypermarkets use mechanized and standardized labelling systems, which allow them to print a large amount of information in a short time. In contrast, traditional fishmongers must write the labels by hand, and for the majority of products, these are limited to the name of the species and the price (see photo).

There was no significant difference in the knowledge of the purchaser on the geographical origin and harvesting method among the different retail outlets. However, in terms of name and presentation of the fillets purchased (Table 3), results show that confusion is greater at traditional channels, with higher percentages of consumers identifying Pangasius products as 'fresh flounder fillets'.

Table 3. Differences with the name and presentation according to retail formats.

Name	Pangasius	Flounder fillets
Fish Market	44.93%	55.07%
Fishmonger	58.99%	41.01%
Supermarket	68.91%	31.09%
Hypermarket	70.27%	29.73%

Presentation	Frozen	'Fresh'	Defrosted
Fish Market	34.78%	60.87%	4.35%
Fishmonger	33.09%	57.55%	9.35%
Supermarket	41.45%	46.63%	11.92%
Hypermarket	48.65%	37.84%	13.51%

Conclusions

Consumption of Pangasius fillets is widespread among the population observed, but not knowledge on the product. Retailers told the authors that the main advantage of this fish is the presentation in fillet form. Price and convenience appear as the main competitive edge of Pangasius, while information about where and how it is produced is limited to a small educated portion of respondents.

In our opinion, this is not an advantageous position, as consumers could replace Pangasius fillets with any cheap and convenient product appearing in the market at any time. Producers should start to consider strategies for niche development at their destination markets, if they want to avoid these risks in the future.



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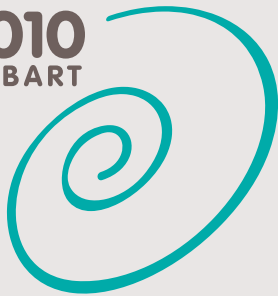
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Barramundi in Vietnam

The project was started in 1995 with the development of barramundi or the Asian sea bass brood stock which then led to the hatchery production of sea bass fry four years later. Since 2007, LiG Products started exporting fillet to the US.

Vietnam is a very far away place for Gil J Watts, Managing Director of LiG Products, despite coming from a seafaring family in Long Island, New York. After a stint in the army which brought him to the Philippines and later Vietnam, Gil stayed on to start a shrimp farm. However, this farm was destroyed by an oil spill and recovery took a rather long time.

In 1995, Gil and his brother, started a hatchery in Nha Trang and by 1998, they supplied grow out farmers with fingerlings, mainly in the central region to culture the sea bass in ponds and in sea cages. They also supplied nurseries to grow fry in ponds to 10cm fingerlings. These cost VND 3,000 each.

LiG Products uses the strategy that as farmers learnt to culture the fish, they teach others and today there are more than 100 farmers involved in sea bass culture. LiG Products only buy back the sea bass grown in sea cages. Grow out period is one year in seawater cages around Nha Trang. The company assures the quality of the cultured sea bass by sending technicians to the farms to advise on production protocols. Prior to harvest, fish are checked for quality. Ex farm prices for sea bass grown in ponds were around VND50,000/kg (USD 3/kg; June 2009).

Exporting sea bass as barramundi

“For the past two years, we have been exporting to the US to a particular customer. We started marketing the fish using the name of sea bass but later changed this to barramundi on request. We intend to expand production as we have potential customers in Europe and the Middle East”, said Gil at Vietfish 2009. This was the first exhibition for the company to introduce its products and to seek new markets.

“Our customers see the sea bass fillet as replacement for white meat fish such as the cod and pollack. The sea bass is more expensive than the catfish but much cheaper than the grouper. The grouper is too delicate a fish for the fillet market. Whole cleaned barramundi is the substitute for the grouper”.

“The sea bass fillet has a sweet and buttery flavour and is delicate in texture. It is low in fat. Our quick chilling method, Deepchill from Sunwell keeps the freshness of the fish. The system delivers ice as a pumpable liquid or slurry and can chill the fish to zero degrees and maintain freshness with minimum damage. The fish is transported for processing in Nha Trang and Ho Chi Minh City”, said Gil.



Gil (left) at the booth during Vietfish 2009 in Ho Chi Minh City. This was the first exhibition for the company.

“We get a third of fillet per fish, depending on the belly flap. We like to keep the red line which identifies the sea bass. Some processors have tried the sea bass but they faced problems as they did not emphasise on the culture system. We need to guide the farmers well. The quality of fish is dependent on the feed. I akin our feeding process to that in the production of kobe beef versus regular beef”.

The products are IQF barramundi fillets, skinless or with skin packed in IVP bags, with five size range (either in imperial ounces or metric grams) or whole cleaned IQF barramundi packed in PE bags in sizes from 250g to more than 3kg per fish.

The outlook for the future will depend on the market but Gil says that there is potential to grow sea bass to fill the gap left by the declining wild catches of fish with white meat. In the UK, consumers seek alternatives such as the barramundi.

NEXT ISSUE

January/February 2010 issue will feature

- Focus on Aqua Feed Production
- Industry Review-Marine Shrimp
- Processing Technology
- Animal/Plant Meals

Show issue: Victam Asia 2010, March 3-5

Deadlines: Technical articles – November 21, 2009
Advert bookings – December 5, 2009

Contact information: Email: zuridah@aquasiapac.com ; enquiries@aquasiapac.com

Fish Supply in the Arab States

By Izzat H. Feidi

Arab fisheries resources, capture and farmed, are considered very important sectors for development. If rationally and scientifically exploited, fisheries could play an important role in meeting increased demand for food and in spearheading the economies of several Arab states. This two-part article reviews the development of fisheries in general and aquaculture in particular in the Arab World and discusses the challenges ahead for sustainable aquaculture.

Collectively the Arab region consists of twenty-two Arab states with more than 23,000 km of shoreline and 707,000 sq km of continental shelf area. It has access to two oceans, three major seas, several gulfs, lagoons and a large expanse into the Economic Exclusive Zones (EEZ). They also have within their borders fresh and brackish natural and man-made lakes, rivers and several tributaries. In spite of this environment, fisheries production does not satisfy the demands for fish and fishery products.

In recent years, several Arab states resorted to aquaculture to increase local fish supplies. While some states made significant progress in this endeavor especially Egypt and Saudi Arabia, overall the Arab states are net importers of fish and fishery products. The 2007 average annual per capita fish consumption as estimated by the Food and Agriculture Organization of the United Nations (FAO) was less than 10 kg versus the international average of 16.7 kg. In order to increase the average per capita consumption and to reduce imports, opportunities to boost local production is vested in expanding aquaculture projects in marine and inland waters.



Farmed and wild fish on display in Cairo fish market



Fresh fish on display in a supermarket in Egypt

Fish production

The latest FAO fisheries statistics for 2007 indicated that the Arab states produced a total of 3.1 million tonnes of fish by capture fisheries and aquaculture. Of this quantity 2.5 million tonnes (79.1% of total production) were from marine and fresh water capture fisheries and 688,000 tonnes (21.9%) from aquaculture. The major fish producers are Egypt with one million tonnes, Morocco with 894,000 tonnes and Mauritania being a distant third with 202,000 tonnes. The small producers were Djibouti with only 265 tonnes, Jordan with 1,015 tonnes and Palestine with 2,702 tonnes (Table 1).

Table 1. Aquaculture and capture fish production in 2007 (tonnes).

Arab states	Aquaculture	Capture	Total
Algeria	405	148,437	148,842
Bahrain	1	15,013	15,013
Comoros	-	16,000	16,000
Djibouti	-	265	265
Egypt	635,516	372,492	1,008,008
Iraq	15,810	57,779	73,589
Jordan	509	506	1,015
Kuwait	348	4,373	4,721
Lebanon	803	3,811	4,614
Libya	240	31,924	32,164
Mauritania	-	201,588	201,588
Morocco	1,636	892,820	894,456
Oman	90	151,744	151,834
Palestine	-	2,702	2,702
Qatar	36	15,190	15,226
Saudi Arabia	18,410	70,000	88,410
Somalia	-	30,000	30,000
Sudan	1,950	65,516	67,466
Syria	8,425	9,456	17,881
Tunisia	3,367	103,194	106,561
U.A.E.	570	87,000	87,570
Yemen	-	179,916	179,916
Total	688,116	2,459,725	3,147,841
Percent	22.0	78.0	100

Between 2000 to 2007, capture fisheries (marine and inland waters) landings in the region peaked in 2006 but declined in 2007 mainly due to over-fishing of commercial species, fleet over-capacity, pollution, environmental effects, and indiscriminate fishing causing depletion of targeted fish stocks. In 2000, fish landings from capture fisheries were 2.1 million tonnes increasing in 2001 to 2.4 million tonnes and continued to increase moderately reaching 3.2 million tonnes in 2006 but dropped to 2.5 million tonnes in 2007.

Conversely, according to FAO latest published fisheries statistics, aquaculture production pattern during the same period (2000-2007) has shown an annual rising trend. In 2000 fish production rose from 361,000 tonnes to 688,000 tonnes in 2007. The annual increase in aquaculture has been from 2% to 14% or an average annual growth rate of 8% (Table 1, Figure. 1).

Developments in aquaculture

Aquaculture is a relatively new activity in these countries but has made significant progress since 1984. It is, however, to be noted that the



Seafood products on display in a Dubai supermarket



Saudi farmed shrimp in Kuwait market



Dried fish products in Dubai market

practice of freshwater aquaculture in Egypt, Iraq and Syria has existed for many years. In recent years, mariculture has been attempted in several other states such as Kuwait, Saudi Arabia and Qatar where freshwater is very scarce.

Egypt leads

The main producer of fish from aquaculture is Egypt which in 2007 produced 636,000 tonnes accounting for 92.4% of the total aquaculture production. All other Arab states combined produced 52,600 tonnes (7.6%) in 2007. Most of Egypt's aquaculture production is from brackish water areas, the delta lakes and lagoons. Other important Arab states practicing aquaculture are Saudi Arabia (18,400 tonnes), Iraq (15,800 tonnes) and Syria (8,400 tonnes).

Tilapia leads

In the Arab states, aquaculture production consists almost entirely of finfish, with the common carp, Nile tilapia and silver carp as the main cultured species. Shrimp farming has thrived only in Saudi Arabia along the eastern shores of the Red Sea in the last few years. In Egypt, shrimp culture has been attempted and common carp culture is carried out in rice fields. The culture of marine finfish is conducted mostly in intensive culture systems such as near shore cages and to a lesser extent, in coastal raceways and brackish water lagoons. Aquaculture production continues to grow well above global rates and there is good

potential for expansion not only in Egypt but also in most other Arab states where extensive research and development of mariculture is underway and where production is well below its potential.

The main species farmed in the Arab states are those that are indigenous and/or traditionally popular. Tilapia (*Oreochromis niloticus*) is the most important of these, especially in Egypt where production in 2007 from capture and aquaculture reached 368,000 tonnes or 54% of total aquaculture output (Table 1). Mulletts are second in importance followed by the carp species. A distant fourth and fifth in importance are rainbow trout and shrimp whilst production of sea bass and sea bream and other commercially important breams are of little significance.

Consumer preference, fish marketing and trade

In general, consumer preference is for captured fresh whole fish. However, in the last few years, whole fresh farmed fish as well as frozen fish and value-added seafood products have become widely available and accepted in most states. Cured fish (mostly dried) is also popular for certain dishes in remote areas. The larger demersal species such as grouper, snapper, mullet, emperor and various breams are traditionally popular marine species and the larger pelagic species such as tuna and Spanish mackerel are also popular. Fresh water species such as tilapia and Nile perch are most popular in Egypt and Sudan (Figure 2) while carp species are most popular in Iraq.

The trade in fish and fishery products show that the region as a whole is a net fish importer. Although the collection and dissemination of fishery statistics has generally improved, information on the volume of trade in fish for each state as well as between states is still not sufficient to provide a reliable picture. The region does not contribute substantially to the international fish export trade, except possibly for canned products from Morocco. The largest importer is Egypt mostly for low priced fish especially sardines and mackerel for popular consumption. Imports of higher value seafood products are mostly in the richer oil-producing states and the tourism sector.

Overall, the demand for fish, captured or farmed, is expected to increase in the Arab world. There is increasing demand for high quality products and increasing awareness by consumers of the nutritional value of seafood products.

Figure 1. Arab states aquaculture and capture fish production 2007 (tonnes).

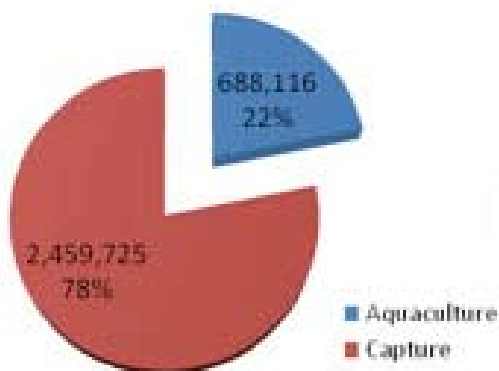
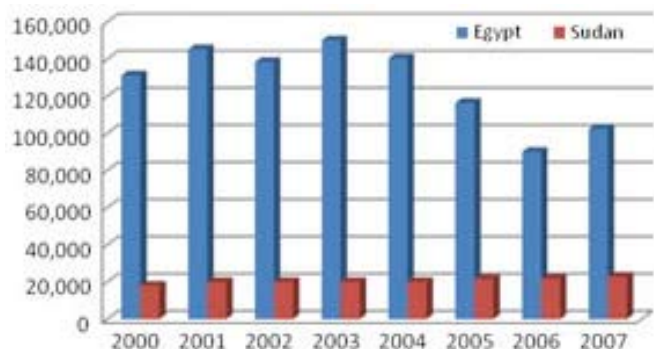


Figure 2. Production of tilapia by capture fisheries in Egypt and Sudan in 2006-2007 (tonnes).



Next Issue: In part 2, the global challenge for aquaculture to close the fish supply gap extends to the Arab region. Opportunities for expanding aquaculture exist and that the selection of species for farming should be those species which have high rate of growth, easy to grow, versatile, acceptable to consumers, affordable in price to the general public and adaptable to various water salinities and temperatures to ensure sustainability.



Izzat H. Feidi is Fisheries Development Consultant based in Egypt. He has served with FAO in several countries for over 30 years in various technical and managerial capacities. His last posting was Chief, Fish Utilization and Marketing Service, FIU, FAO, Rome, Italy. Email: ifeidi@thewayout.net

Cargill

New aqua feed mill in Dong Thap

In September, Cargill Animal Nutrition announced the opening of its new aqua feed mill in the Mekong Delta province of Dong Thap. This is Cargill's sixth feed mill in Vietnam. "This new investment demonstrates Cargill's commitment to serving Vietnamese livestock and aquaculture farmers," said Stoney Su, general manager for Cargill Animal Nutrition-Vietnam.

The feed mill is designed to have an annual capacity of 60,000 tonnes of aqua feed. Initially, it will produce only catfish feeds and in the future, a shrimp feed line will be added. The company also produces fresh water fish and shrimp feeds at its feed mill in Dong Nai and is one of the top five players in the industry in Vietnam.

"Cargill is committed to the development of Vietnam's livestock and aquaculture industry," Su added. "In these uncertain times, our customers are looking for reliability. Cargill will be part of their solution. The new Dong Thap plant will allow Cargill to more effectively deliver the best and latest feed technologies and services to our local dealers and aquaculture farmers throughout the Mekong Delta."



Cargill has approximately 560 employees in Vietnam and has been in the Vietnamese market for over 12 years. A wholly owned subsidiary of Cargill, Cargill Vietnam Limited established a presence in Vietnam when the United States and Vietnam normalized relations in 1995. Today it operates six animal feed mills, a cocoa business, a ferrous trading business. More information: Web: www.cargill.com; www.cargill.com.vn.

Skretting

New fish feed plant in Turkey

Skretting has opened a new fish feed production plant in Güllük, in the Bodrum area, to serve the expanding Turkish aquaculture market. The plant will produce feeds for freshwater trout and marine species such as sea bream and sea bass. Most of the output is for domestic sales but some will be exported.

Levent Kayi, General Manager of Skretting Turkey said, "We are starting production with one extruder line, newly-built to meet latest

standards. Using quality raw materials and established Skretting formulations, we will provide feeds that match the high nutritional and physical quality our customers expect from Skretting. I have no doubt we will expand our market share. A modular design for the plant means infrastructure is in place to add second and third extruder lines quickly as demand increases."

The plant will also benefit from the international procurement expertise and power of the global Skretting organization and this applies both to the marine raw materials, where Turkey has a small but high quality production, and plant raw materials. Additionally, the micro ingredients come from sister company, Trouw Nutrition Turkey.

Turkey is already one of the leading aquaculture producers in Europe and aquaculture developments in her neighbours and the potential markets in the Middle East, means that the plant can serve aquaculture production for over 250 million people. The company has a firm belief in the long-term success of aquaculture in Turkey and in the surrounding areas and that demand will expand rapidly when the economic crisis is over.



Addcon

Presentations at IFFO

In October, Dr. Christian Lückstädt, R&D Coordinator, ADDCON shared his experience on improving fish quality for fishmeal production at the Annual Conference of International Fishmeal and Fish Oil Organization-IFFO in Vienna, Austria. The annual event was held from October 5-8 2009.

In the technical session, Dr Lückstädt presented 'Utilisation of organic acids for the preservation of fish prior to processing into fishmeal'. Addcon has 3 main products intended to be used in aquaculture and for fisheries in order to help the industry with quality and performance enhancers - Aquaform, EnsiloX and Fishform.

"When we talked to the organisers on our approach with Fishform, we were asked to share our knowledge at the conference. The products, which have been used in Scandinavia for some years already, are now

exported to Asia and South America. At the conference, we highlighted some recent large-scale commercial trials from Thailand".

Addcon also joined IFFO as an associate member, in order to be able to focus on the needs of the fishmeal and fish oil industry. The German based Addcon group specializes in organic acids and its salts such as potassium formate. The products are used in various industries such as the feed and food industry but also for technical applications. For the aquaculture and fisheries industry Addcon produces a range of products in one of its site in Porsgrunn, Norway. More information: Email: info@addcon.net



Dr. Christian Lückstädt

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Dream team in Malaysia

Improving productivity with pond water quality management

Syndel Asia Sdn Bhd in co-operation with Bayer Thai Ltd carried out their 'Dream Team Road Show 2009' to three locations in Peninsula Malaysia; Sungai Petani, Manjung district and Johor Bahru in July. The target audience was shrimp grow-out farms as well as shrimp hatcheries. The focus was on shrimp farm management and disease control practices using technology developed by Novozymes and Bayer. These three areas are the main shrimp producing regions in the country. The Manjung district in Perak contributes almost 30% to the national shrimp production, although most shrimp ponds in these areas are more than 15 years old. Disease management is a dilemma for farmers in these areas.

In his presentation on how to maintain good water and soil quality, **Dr Pornlerd Chanratchakool**, Aquaculture Technical Manager, Novozymes Biologicals explained graphically the succession leading to the potential production problems. The potential risks are highlighted as follows. During the first 20 days, it would be a clear or unstable water colour with low water alkalinity. Benthic algae can grow well on pond bottom soil. Later with less penetration of sunlight, there will be a phytoplankton bloom. Once sunlight does not reach the pond bottom, benthic algae will die and cause oxygen depletion at the soil level, leading to poor pond bottom soil/water quality. This may provoke slow growth or dead shrimp or disease during these 25-45 days of culture. Another risk period is during the last 80-120 days, when there is plankton over bloom and water colour changes with high ammonia, nitrite and hydrogen sulphide build up. Farmers attempt at early harvest of shrimp smaller than the target size. Overall the damage is high FCR and lower profits or even a loss.

"In the early days of culture, farmers may see that the colour is slow to develop and will try to add more fertilizer. But it will only feed the filamentous algae at the pond bottom especially when the pond is 10 years old or older. Water sampling at the feeding area is deceiving when the area is well aerated and results show optimal water quality parameters. A tricky problem is the detection of hydrogen sulphide as the test kits in the market are not sensitive enough to detect low levels. When it is detected, the amount is already at toxic levels. There is a time bomb when damage to the pond liner permits water to penetrate into the soil. Some 15 years ago we see these problems and eradicate them with water exchange. This option is no longer available to us as zero exchange of water is the norm".

Pornlerd continued with the criteria for using the products from Novozymes Biologicals to remediate some of these problems. PondPlus is used for water and soil maintenance, PondProtect for ammonia and nitrite control and PondDtox for hydrogen sulphide control. In the case of Pond Protect, problems with ammonia and nitrite appear at 20-40 days after stocking and after 70 days of culture. PondDtox has *Paracoccus pantotrophus* for the anaerobic oxidation of H₂S in presence of nitrate and applied during pond preparation, early days and after 90 days of culture.

Dr Jirasak Tangtrongpiros of Chulalongkorn University, Thailand discussed some issues on shrimp diseases and its prevention. The general symptoms of shrimp diseases seen in the feeding tray are empty gastrointestinal tract (GI), disorderly movement, appendage rot and dead shrimp. Outside the feeding area, symptoms are shrimp at the sides of the ponds, cuticle discolouration, scaly cuticle and surface swimming. Non infectious diseases are caused by water quality imbalances, low quality post larvae and feed due to vitamin deficiency and fatty liver, incorrect feeding techniques and biological toxins such as dinoflagellates and insecticides. The fatty degeneration of the hepatopancreas can be seen in a smear. A dysfunction of the hepatopancreas is a reflection of feed quality.



Members of the roadshow. From left: Sugania Vijayan and Erin Tan, Syndel Asia Sdn.Bhd, Tavatchai, Dr Jirasak and Dr Pornlerd.

Parasitic infections such as *Zoothamnium* could occur when shrimp feed on infected molluscs. *Gregarine* and *Thalamia* are usually undetected as few farmers look at intestinal contents. Jirasak elaborated on bacterial infections ranging from *Vibrio harveyi*, *V. parahaemolyticus*, *V. vulnificus*, *V. damsela* to *Rickettsia* sp and on the various viral infections. In prevention of these infections, Jirasak said that proper biosecure and farm managements procedures are adhering to the optimal conditions for culture, water and soil quality monitoring, regular shrimp health monitoring, using healthy larvae shrimp after confirmation with the I-screen test kit, control and elimination of carrier with Dipterex and using disinfectants.

The half day seminar was completed with an introduction by **Tavatchai Chidchomsrichantra**, Bayer Thai on products for aquaculture. As there is no cure for any of the viruses affecting shrimp, a biosecurity program is essential, said Tavatchai. Aside from the physical structures in biosecurity and screening of post larvae before stocking, he named Neguvon (Trichlorfon 97%) to eliminate disease carriers without affecting the pond ecosystem and the broad spectrum disinfectant, Remedor Aquatic to efficiently control virus and bacteria. More information: Email: sugania@syndelasia.com (Sugania Vijayan)



The winner of a hamper of products and friends at the seminar

INVE group

Set for growth in China and expands R&D

After the shareholding and management changes in late 2008, the INVE Group is now fully dedicated at supporting and strengthening the leading positions of the core businesses of hatchery nutrition and aquaculture health of INVE AQUACULTURE and high end feed specialty additives of NUTRIAD.

It will step up the presence of Inve Aquaculture in China with an alliance with China's leading integrated seafood producer Guangdong Evergreen Group and in support of this alliance, there will be a portfolio of nutritional and health products specifically designed for the Chinese market. In a report in Fish Farming International (October 2009), Dan Chen, Chairman Guangdong Evergreen Group said that the company sells fry and feed to contract shrimp farmers. It also intends to expand culture areas from 2,000 ha to 3,000 ha. It will expand hatchery production from the current 10 billion to 20 billion post larvae/year and will build 7 more hatcheries.

At Inve Aquaculture, the research department has been strengthened with a new R&D Director, Dr. Christian Vermote and will continue to focus on delivering innovative and sustainable solutions for top larval nutrition and health management in aquaculture production. As a result, a completely new line of enrichment and specialty feeds for marine fish larvae is now being marketed.

Additionally, a step change and environmentally friendly process for the Artemia has been launched worldwide. Prof. Dr. Patrick Sorgeloos remains Inve Aquaculture's highly valued senior scientific advisor. The business unit is ready to fully invest as innovation leader in the growing aquaculture industry globally. In order to improve the efficient and customer oriented service, it was decided to concentrate the production in its state-of-the-art Plant in Pitchit, Thailand. This plant will supply customers globally through its worldwide distribution network. The distribution management is fuelled by the modern requirements for an efficient and customer oriented service.

The Global Supply Chain & Operations activities are now centrally managed by Luk Van Nieuwenhove, Director. Business reviews and portfolio management in health and larval nutrition are now managed by Business Development Managers Dr. Patrick Lavens and Pepino Candreva, both well known aquaculture experts.

Inve aquaculture business unit, with over 25 years of dedication to the marine fish and shrimp industry, is now geared at its strengths, providing nutritional and health products for aquaculture. At present, it serves more than 1300 customers in 73 countries over the four continents. This is achieved through worldwide sales and technical support team, the Inve shops and a network of loyal distributors. More information: Web: www.inve.com



New corporate identity and logo for Nutriad

Belgian feed additive company Nutriad is a specialist and industry leader developing, manufacturing and marketing feed and water additives worldwide. It launched its new corporate identity and logo on October 1, 2009. The main reason for the refreshed global corporate style is to continue to show its commitment to innovation, clearer communication and an enhanced value added offering to the animal health and nutrition sector. The new logo captures the company's pedigree and symbolizes its commitment to delivering efficacious, natural, sustainable programs and product offerings.

Strong organic growth along with targeted acquisition and investment has enabled to Nutriad become one of the industry leading specialists in the development, manufacture and marketing of feed additives worldwide. Nutriad operates through 16 own legal entities, delivers products and services to over 80 countries worldwide supported by 4 application laboratories, 3 research centres and 5 manufacturing facilities located in 3 continents. More information: m.enderink@nutriad.net

Nutriad

New Appointments



Dr Ian Partridge

Nutriad also announced two new members to its Asia-Pacific Team. **Dr Ian Partridge** is now Business Manager for Australia and New Zealand. Dr Ian Partridge has a strong technical background in applied animal science research and has considerable experience in the global feed ingredients industry.

Dr Sirpha Chen has been appointed as Business Unit Executive for Taiwan, Korea and Japan and will strengthen and support Nutriad's advanced portfolio of aqua additives on the regional level. Dr Sirpha Chen has built up extensive experience in biotechnology and biochemistry in research as well as in the feed industry. The appointment of Partridge and Chen is in line with Nutriad's commitment to develop and provide specific solutions and innovative concepts.



Dr Sirpha Chen

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At World Aquaculture 2009 in Veracruz, Mexico Improving palatability and more

Cargill has introduced its Hoplite™ yeast product at the World Aquaculture Show 2009 in Veracruz, Mexico, held from 25 to 29 September. The all-natural yeast product, free from fillers or antibiotics, is designed to provide health benefits for fish and shrimp and to improve feed palatability. It contains essential nucleotides, beta glucans and mannan oligosaccharides which support the immune system and cell growth. In addition, the product acts as a partial replacement for fish meal.

At the trade show, Ivan Soltero, Business Development Analyst, said that the company conducted research during 2008 and 2009 to determine the application of Hoplite both in the poultry and aquaculture industry. These have been reviewed and verified and the company is ready to market the feed additive.

In research trials, fish fed on diets containing Hoplite™ showed increased feed intake over fish on a regularly prescribed diet. When added to a feed formulation, Hoplite™ can improve palatability which in turn encourages weight gain and overall increase in productivity. In one of their trout studies, research showed that partial replacement of fish meal with the product was appropriate at levels of 1.5% and 3.0% diets. The light brown to tan coloured additive typically contains 35% crude protein and 0.10% crude fat and comes in powder form that requires no special handling. The nucleic acid composition in a typical analysis is 2.5 to 3.0%. Hoplite is sourced from the brewing industry and has kosher certification.

"Hoplite™ is a new, differentiated, yeast product for the animal and aquaculture industry that offers a bundle of essential nutrients and most importantly, functional benefits. Based on the excellent response from producers, feed manufacturers, consultants and researchers who



Ivan Soltero (middle) with Bill Achor, Sales Manager and Roger Morrison, Technical Sales Manager, marketing Hoplite at the trade show.

attended the World Aquaculture Show in Veracruz, Mexico, our Cargill team strongly believes in the added value our product delivers to the animal nutrition industry worldwide", said Ivan.

Another benefit for the industry is that Hoplite™ has been sustainably sourced. As it acts as partial replacement for fish meal, it has a role in the search for sources of nutrients to be used in the sustainable production of seafood. For more information: Web: www.hoplitenuitration.com; Email: hoplite@cargill.com



WAS Exemplary Service Gold Medal

Michael New, OBE has been awarded the World Aquaculture Society Exemplary Service Gold Medal at the World Aquaculture 2009 meeting in Veracruz, Mexico. This award has been given out only ten times in the 40- year history of the Society and has only been conferred on one other European. Michael New is also the founder of the international NGO Aquaculture without Frontiers. The Exemplary Service Gold Medal is conferred upon any individual who has made extensive contributions that have significantly altered the nature or direction of the (World Aquaculture) Society.

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Biofloc Technology Session

A whole-day session on biofloc technology (BFT) took place in WA 2009, Veracruz, Mexico. A large number of papers were presented (17 papers) by pioneers in BFT technology in the US, Tahiti and Indonesia. This was in addition to other papers on BFT presented in other sessions. Even though the BFT session took place during the last day of the conference, the large conference room was packed with participants. All this is an indication of the interest people show in this technology as a sustainable method to increase production, according to **Yoram Avnimelech**, the session chair.

In addition to the contributed papers, two time slots were devoted to discussion. The first followed a number of papers on algae and bacteria dominance, which dealt with the differences between the two systems. In addition to a call for more research in the field, it was made clear that the issue is actually not a choice between the two but of the proper balance between the use of different algae and bacteria consortia.

At this WA 2009 conference, most of the presentations dealt with BFT and its effects on *Penaeus vannamei*. Malaysian-based **Dr Nyan Taw** said that the commercial interest in the bioflocs technology is three fold: high productivity, low feed conversion ratio (FCR) and stable culture environment. He also described some of the prerequisites for the application of BFT in Indonesia and in partial harvesting. A study applied partial harvest and biofloc technology on the east coast of northern Sumatra, Indonesia using 27 ponds of various sizes, shapes and types (lined and earthen). Production performance of the combined technologies was higher than expected with one 2,500m² pond producing 12.37 tonnes (49.48 tonnes /ha) through six partial harvests with feed conversion ratio of 1.11 in comparison with FCR of 1.6 using the conventional systems. Similarly, a 4,702 m² pond using six partial harvests recorded a 17.96 tonnes (38.23 tonnes/ha)



Dr Addison Lawrence

production with FCR of 1.12. The major advantage of combining partial harvest and BFT is improved power efficiency. The carrying capacity of conventional BFT ponds was known to be 680 kg/hp. In the combined system, power efficiency increased to 1,124 kg/hp energy input.

On behalf of David Kuhn and colleagues, **Dr Addison Lawrence** presented "Bioflocs produced by biologically treating fish effluent is a suitable replacement ingredient for soybean and fishmeal". Two types of bioflocs were used in 35- day feeding

trials. Bioflocs were produced in sequencing batch reactors (SBR) using carbon supplementation and in a membrane biological reactor (MBR) without carbon supplementation. These were substituted for fish meal protein and/or soybean protein. A control diet (without bioflocs) was compared against four diets with MBR bioflocs (at 10, 15, 21 and 30% inclusion levels) and SBR bioflocs (at 10, 15, and 21% inclusion levels). Growth was 2.5 g/week when MBR bioflocs were used. The control and biofloc diets were formulated to be equivalent for levels of crude protein, total fat, crude fiber, calcium, magnesium, phosphorus, potassium, and sodium. It was concluded that bioflocs could reduce soybean and fish meal requirements and offers a sustainable protein option for shrimp culture.

A number of other papers demonstrated the unique nutritive value of bioflocs. Avnimelech said that there are many indications of this process, yet, there is almost no understanding on the specific contributions or on the control technologies.

Most of the presentations can be accessed from the biofloc Website: www.aesweb.org/bioflocs. It was also recommended that more research and papers on this important topic be conducted. Several presentations on this topic have been submitted to another BFT session to be held during World Aquaculture 2010 in San Diego, USA.

Ocialis joins GLOBALGAP

In November, Ocialis, the aquaculture brand of Evialis, has announced its membership to GlobalGap, a private sector body that sets voluntary standards for the certification of agricultural products globally.

This decision is in line with the commitment of Ocialis to bring safety and openness to its partners. Ocialis offers the seafood network its specific measurements, verifications or training tools. These tools have been developed to be near as possible to aquaculture production sites. The strategy is to sell economical results rather than just a product. However, this needs research innovations which are well applied and understood at farm level. This is a reason to develop specific tools for use at production level. It has also developed specific training courses and teams to assure that knowledge is well transmitted where it should be, i.e. on the farm. The company added that this everyday partnership with farmers, their knowledge, practical experience and these specific tools are now available for a safer and more transparent seafood network.

GlobalGap is a private sector body that sets voluntary standards for the certification of agricultural products around the globe. The aim is to establish one standard for Good Agricultural Practice (G.A.P.) with different product applications to fit into global agriculture. In aquaculture, the species involved are shrimp, tilapia, pangasius, salmon and trout.

Ocialis, the aquaculture brand of Evialis, manufactures and sells feed for shrimp and fish in Vietnam, Brazil, Mexico, France and Indonesia. It also manufactures and sells aquaculture premixes and additives in France, China, India and South Africa. Ocialis has a



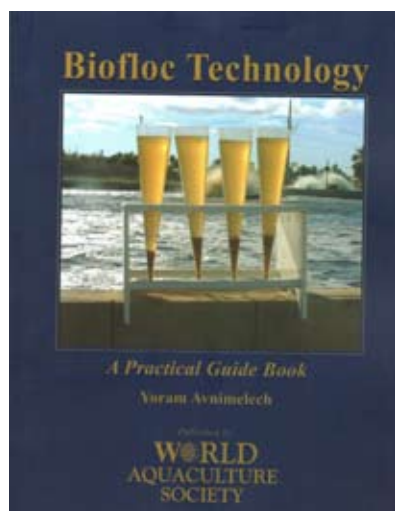
Laboratory at the Fish House.

leading position on its main market and ranks third, behind Cargill (USA) and CP (Thailand) in the tropical aquaculture feed market. The company works with main producers and processors, in production and research, in the countries where it is present. More information: www.ocialis.com or www.evialis.com; Email: ocialis@ocialis.evls.net

Book review

Biofloc Technology: A practical guide book by Yoram Avnimelech

ISBN:978-1-888807-16-5, 180 pp, soft cover.



The idea behind this book published by the World Aquaculture Society is to help aquaculturists, farmers, students and scientists all over the world to understand biofloc technology (BFT), first described in the mid 1990s. The book also provides a source of references on this technology. BFT fulfils the target of sustainable systems with little impact on the environment and provides more efficient feeding programs and lower energy demands. However, this is a new field with unknown variables and requires more research and information. In approaching the subject, the author chose to 'talk' through the subjects. Each chapter ends with practical tips and needs for future research. In this way, it is hoped that the reader will be able to understand the technology in simple terms.

Prior to embarking on the technology itself, the author explains the microbial processes and communities in pond systems, in terms easily understood by most aquaculturists. The introduction to BFT systems is followed by chapters on the nitrogen syndrome: problems and solutions and how BFT can be used to control inorganic nitrogen build up. In the chapter on feeding with bioflocs, the author explains the potential of microbial protein. A very high level of productivity can be obtained in super intensive BFT ponds and subsequent chapters deal with aeration of ponds as management and control in BFT ponds. Oxygen distribution in the pond is well covered. Next are chapters dealing

with pond management, construction and control of disease in BFT ponds. The latter discusses the possibility of controlling diseases using BFT technology, although these still need further research. Overall, the coverage on BFT is comprehensive and the book should fulfil the objective as a practical guide on BFT. However, there is a large group of farmers worldwide keen on adopting BFT but lack a complete understanding of BFT which requires considerable knowledge of microbial processes and pond chemistry. This book would better serve this group of farmers if it had more illustrations. - Zuridah Merican



A need to keep pace with change

The value of aquaculture production in Australia continued to rise to AUD 868 million during 2007-2008, according to an Australian Bureau of Agricultural and Resource Economics (ABARE) report. It highlighted an 8% and AUD 63 million increase in the value of aquaculture production. The leading commodities are prawns, oyster, tuna and salmonids.

The value of finfish aquaculture rose to AUD 546.3 million. Tuna, salmonids and barramundi accounted for 95% of the gross value of finfish production. All three registered increases in value. In contrast, the value of crustacean production fell by AUD 1.7 million as a result of declining prawn production and the value of mollusc production also fell driven by an 8% decrease in the production of pearl oysters.

While the value of aquaculture has grown, challenges faced by the industry must continue to be addressed. Increased demands on aquaculture due to lower fishery production and consumer desire for 'Australian' produce further amplify the need for production improvement. The increase in aquaculture production is positive, however there is a need to keep pace with the changing environmental and economic factors that challenge the aquaculture industry.

This 'Keeping Pace with Change' relates to governments as well as industry. This is the theme for the 2010 Australasian

Aquaculture International Conference and Trade Show to be held in Hobart from 23 to 26 May 2010.

Conference Chairman, Roy Palmer said 'Keeping Pace with Change' will address the challenges faced by the aquaculture industry including environmental concerns, economics and the need for technological adaptation. Exploring the issues that affect future increases in aquaculture production in Australia, the conference will provide a forum in which every aspect of aquaculture is discussed and challenged. Palmer acknowledged the importance of government support in order to continue to increase its aquaculture production.

"While the news of increased aquaculture production is very good news for Australia, we are still slipping in terms of total tonnages when compared to international competitors. In order to meet the increasing need for supplies, Australia must, with government support, continue to build on its successes. Seafood is one of the most nutritious foods and it is essential for Australia's food security", said Palmer.

More information: Web: www.australian-aquacultureportal.com; Email: sarah-jane.day@aquaculture.org.au (Conference Coordinator Sarah-Jane Day) or mario.stael@scarlet.be (Mario Stael) for European companies.



A bigger FIAAP and Victam Asia 2010 trade show

Victam Asia 2010 is an biennial event within South East Asia for manufacturers and suppliers of technology and equipment used for the production animal feed, petfood and aquafeed. It will be held at the Queen Sirikit National Convention Centre, Bangkok, Thailand from 3 to 5 March 2010.

This year the trade show is supported by Thailand's Ministry of Agriculture & Co-Operatives, Department of Livestock Development, Department of Fisheries, Feed Mill Association, Rice Milling Association, Petfood Industry Association, Chamber of Commerce and Conventions & Exhibition Bureau.

Victam International General Manager, Henk van de Bunt said in a press release said that the Feed Ingredients & Additives Asia Pacific (FIAAP) and Victam Asia 2010 are already larger than the last show also held in Bangkok in 2008. He added, "The markets within South and South East Asia had not been so badly affected by the economic

slowdown. Local industries were also able to respond more easily and quickly to the strengthening markets factors now influencing the region and the industries served by the shows".

The number of exhibitors booking space at the shows was greater than in 2008 but interestingly many of the exhibitors had increased their exhibit stand area, said van der Bunt.

"This was a statement of confidence by the exhibitors in the future investment and expansion of the feed and dry petfood markets of South, South East Asia and indeed China. It was also a sign of confidence that visitors to the shows were of the right calibre, comprising nutritionists, feed formulators, mill and production managers, veterinarians, CEO's etc."

The full list of current exhibitors and also the series of technical conferences and workshops are available at these websites: www.victam.com and www.fiaap.com



Aquaculture Europe 2010 (AE2010) will take place from October 5-8, 2010 at the Centro de Congressos da Alfândega in Porto, Portugal. The conference will be accompanied by an international trade exhibition.

The organisers of the Aquaculture Europe 2010 have announced that online abstract submission and registration for conference is now available. AE2010 encourages the online submission of high quality oral and poster presentations and these may be submitted. Detailed guidelines for abstract preparation are also provided in the online submission module.

Aquaculture Europe 2010 will address the general theme of 'Seafarming Tomorrow' – covering many topics related to inland, coastal and ocean aquaculture, but also covering the production of freshwater species. Parallel conference sessions include land-based

systems, estuarine, coastal lagoon, coastal and offshore aquaculture and encompass many species from shellfish to fish to marine plants.

At the plenary, thematic sessions include the future of marine aquaculture in a changing environment; aquaculture governance and regulatory frameworks; how to integrate aquaculture with other coastal activities; consumer demands and consumption trends and the development of a sustainable sector based on the ecosystem approach.

More information: Web: www.easonline.org. Deadline for abstract submission: **April 15, 2010**

What to expect in AQUA CULTURE Asia Pacific Magazine in 2010

Volume 6 2010						
Number	1	2	3	4	5	6
	January/February	March/April	May/June	July/August	September/October	November/December
Issue focus <i>Current trends and challenges</i>	Aqua feed Production	Hatchery	Sustainable & Responsible Aquaculture	Health & Biosecurity	Cage Culture	Food Safety & Traceability
Industry review with profiles and outlook	Marine Shrimp	Marine Fish	Catfish	Freshwater Fish	Tilapia	Marine Fish
Feed Technology	Processing Technology Animal & plant meals	Larval feeds & processing Feed additives	Feed standards Feed enzymes	Pre and Probiotics Immunostimulants	Processing Technology Feed additives	Nutrition Novel meals & oils
Production Technology	Aeration & Disinfection Technology	Brood stock & genetic Improvement	BMP, Standards and Certification	Recirculation aquaculture technology	Feed management	Health management
Shrimp/Fish culture developments	Coverage on experiences from industry, including role models, benchmarking and opinion articles.					
Markets	Contributed reports on market trends, product development, issues and challenges.					
Show Preview/Issue	Victam 2010, Bangkok, Thailand 3- 5 March World Aquaculture 2010, San Diego, USA March 1-5	Australasian Aquaculture 2010 Hobart, Tasmania 23-26 May Ildex Vietnam 2010 Ho Chi Minh City, Vietnam 25-27 March	Vietfish 2010, Ho Chi Minh City, Vietnam 12-14 June		Aquaculture Europe 2010, Porto, Portugal 6-8 October	

Aquafeed Horizons Asia 2010

This along with FIAAP Asia and GRAPAS Asia, is a dedicated industry conference that will take place during Victam Asia 2010. This will be held on 3 March 2010.

As at press time, the program for the one day Aquafeed Horizons Asia 2010 will be as follows:

Chairman: Dr. Geoff Allan

Welcome and introduction

Dr. Juadee Pongmaneerat, Senior Expert in Fishery Product and Inspection, Thai Department of Fisheries, Bangkok, Thailand

Reassuring the value-chain as to the sustainability and purity of fishmeal and fish oil

Dr. Andrew Jackson, Technical Director, International Fishmeal and Fish Oil Organisation, U.K.

Rendered products in aquafeeds

Dr. Geoff Allan, Research Leader, Aquaculture, Director, Port Stephens Fisheries Centre, Australia

Harvesting the benefits of grain application in aquafeeds

David Smith, CSIRO Marine and Atmospheric Research, Australia

Stabilizing formulation cost and performance of aquafeeds require innovative approaches

Dr. Peter Coutteau, Business Development Manager Aquaculture, INVE Nutri-Ad, Belgium

Trends in aquafeed in South East Asia and China: relevance and technical solutions

Urs Wuest, Head Engineering & Fulfilment, Buhler, Switzerland

Increasing the ingredient possibilities for floating feeds

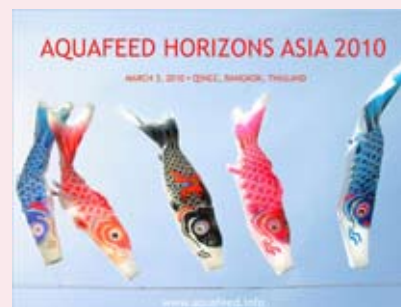
Will Henry, Director of Technology and Research & Development, Extru-Tech, USA

Improving plant efficiencies

Galen Rokey, Process Manager, Applications Group, Wenger Manufacturing, USA

Extrusion of micro aquatic and shrimp feeds

Joe Kearns, Aquaculture Process Technology Manager, Wenger Manufacturing, USA



The organizers have indicated that pre-registration is required and that walk-ins will only be accepted on a space available basis. More information: www.feedconferences.com with links to conferences blogs.

November 27–30

1st International Symposium on Aquaculture and Fisheries Education (ISAFE)

Pathumthani, Thailand

Email: aarm@ait.ac.th

December 9–12

4th Shanghai International Fisheries & Seafood Exposition

Shanghai, China PRC

Email: daniel@sifse.com

Web: www.sifse.com

February 19–21

17th India International Seafood Show

Chennai, India

Email: premchandran@mpeda.cm

Web: www.mpeda.com

February 24–26

Urban Aquaponics Conference

Brisbane, Australia

Email: wilson.geoff@optusnet.com.au

March 1-5

World Aquaculture 2010

San Diego, California, USA

Email: worldaqua@aol.com

Web: www.was.org

March 3–5

Victam Asia 2010

Bangkok, Thailand

E-mail: expo@victam.com

Web: www.victam.com

March 21-25

2010 ASAIM Aquaculture Conference

Bangkok, Thailand

Email: organizer@soyevents.com

Web: www.soyevents.com

March 25-27

Ildex Vietnam 2010

Ho Chi Minh City, Vietnam

Email: sk@sptmrk.com

Web: www.ildex.com

May 5–7

International Conference and Exhibition On Shrimp Aquaculture 2010

Jakarta, Indonesia

Email: donedwin@bimatama-inka.co.id

May 19-21

Offshore Mariculture 2010

Dubronik, Croatia

Email: iroberts@mercatormedia.com

Web: www.offshoremariculture.com

May 23–26

Australasian Aquaculture 2010

Hobart, Australia

Email: sarah-jane.day@aquaculture.org.au

Web: www.australian-aquacultureportal.com

October 5-8

Aquaculture Europe 2010

Porto, Portugal

Web: www.easonline.org

Web for exhibition: www.marevent.com



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