

AQUA CULTURE

A s i a P a c i f i c

Night time in shrimp farming

Probiotics in AHPND
challenge model

BFT for efficient and
biosecure shrimp farming

Aqua Feeds 2.0:
From Farm to Plate - Part 2

A closed system for
Macrobrachium larvae
production

Tilapia in the US





Thailand
Indonesia
Malaysia

FEED
FRY
TECHNICAL
SERVICE



RESULTS



SyAqua fry fed with Gold Coin feed will increase your growth rates, improve feed conversion ratios and yield higher harvest weights at less cost.

Our network of field service technicians can help maximize production goals with best management practices, disease management support, pond performance analysis and water quality services.

Reduce your risks and increase your profit. [Grow faster with Gold Coin.](#)

AT YOUR SERVICE



Grow *faster* with Gold Coin
www.goldcoinaqua.com

Gold Coin Group
140 One Pacific Place 19th Floor
Unit 1902-4 Sukhumvit Road
Klongtoey,
Bangkok 10110
Thailand



Shrimp ponds at night in Bali, Indonesia, p8

Editor/Publisher

Zuridah Merican, PhD
Tel: +60122053130
Email: zuridah@aquasiapac.com

Editorial Coordination

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

Design and Layout

Words Worth Media
Management Pte Ltd
Email: sales@wordsworth.com.sg
Web: www.wordsworth.com.sg

AQUA Culture Asia Pacific is published bimonthly by



Aqua Research Pte Ltd

3 Pickering Street,
#02-36 Nankin Row,
China Square Central,
Singapore 048660
Web: www.aquaasiapac.com
Tel: +65 9151 2420
Fax: +65 6223 7314

Printed in Singapore by

Print & Print Pte Ltd
3011 Bedok Industrial Park E
#03-2000, Singapore 489977

Subscriptions

Subscribe via the website at www.aquaasiapac.com or complete the enclosed form and mail with payment. Subscriptions can begin at any time. Subscriptions rate/year (6 issues): Asia SGD 70, Other zones: SGD 100
Email: subscribe@aquasiapac.com
Tel: +65 9151 2420
Fax: +65 6223 7314

Copyright © 2015 Aqua Research Pte Ltd. All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of the copyright owners.

Aqua Culture
Asia Pacific Online
View E-magazine
Download past issues

From the Editor

2 2015 - the good, bad and ugly News

4 Targets set at Vietfish 2015

Shrimp Culture

8 Night time in shrimp farming

Soraphat Panakorn describes night activities at shrimp farms and best management practices to avoid disasters

14 Probiotics reduce mortality and pathology in a standardised AHPND challenge model

Beneficial effects include higher survival and histological signs of hepatopancreas regeneration. By Dang Thi Hoang Oanh, Mathias Corteel and Olivier Decamp

Biofloc Technology

18 Shrimp biofloc technology - efficient and biosecure operation system

Efficient intensive shrimp farming with biofloc technology, says Nyan Tau

20 More on biofloc technology

Insights into BFT and its applications at World Aquaculture 2015

Feed Technology

24 Aqua Feeds 2.0: From Farm to Plate

This second part looks at the challenges with fish meal replacement, nutrition and health, sustainable feeds and environmental impacts and communicating for the future

34 Phyto-genics for better profitability and sustainability

A tool to counter immune system suppression/side effects in the gastrointestinal tract in shrimp fed with low fish meal diets. By Rui Goncalves and Goncalo Santos

37 Yeast cell wall and immunostimulation

Prebiotics in feeds for carp fingerlings improved feed efficiency, growth and resistance to *A. hydrophila* infection. By Ghaffar Ebrahimi and Marcia Villaca

40 Phytonutrient solutions for white shrimp and tilapia farming

Clément Soulet discusses results of experimental challenges in Thailand and Israel

43 Medium chain triglycerides in Vietnamese aquaculture

The potential with shrimp, and pangasius (vaccinated and unvaccinated). By Jan Oppen Berntsen, Nguyen Duc Dung, Pham Cong Thanh, Vo Thanh Tung, Huynh Truong Giang and Tran Thi Tuyet Hoa

Developments

46 Aquaponics as a sustainable solution for Asian aquaculture

This opens up the possibility to harvest fish and vegetables from the same volume of water, say Jason Danaher and Kaitlin Redmond

48 Improving farming practices

Zonal management among small-scale aquaculture operators in Asia

Freshwater Aquaculture

50 A closed hatchery system for the freshwater prawn

Developed in Brazil and adopted by Latin American commercial hatcheries. By Wagner C. Valenti and Dallas L. Flickinger

52 Snakehead farming in indoor RAS

Seminar for new farmers

53 Pangasius in Indonesia

Stepping up competitive edge with AFTA in 2016

Marketing

54 Tilapia is the US consumers' choice

Popular in the US, imports are expected to increase in 2015. By Fatima Ferdouse

Company News

56 PPP in research and training

58 The second shrimp wave in India

59 Shrimp seminars in East Java/ Marine fish hatchery operators meet in Crete

60 Lightner retires and leadership transition for the UA-APL begins

62 Thanks to Algae!/appointment

63 App to give a head start in aquaculture

Events

64 Practical Short Course on Feeds & Pet Food Extrusion



Zuridah Merican

2015 - the good, bad and ugly

'When China sneezes, everyone catches a cold'. The country's clampdown on corruption and big banquets has had varying impact on seafood consumption. Expensive items on the menu are not moving while the cascade has had negative effects on consumer spending. Large aquaculture companies listed on the stock exchange are either reporting lower profits or having difficulty raising new money. The recent GOAL conference showed that Chinese aquaculture is facing very challenging times. The previous year saw huge imports of shrimp into China via the 'grey channel' of Haiphong, Vietnam. This year, it was closed for several months and via the legal channels, importers have to pay import duties and the correct value-added taxes. Despite this, China remains a growing importer and consumer of shrimp and marine fish.

The shrimp industry has seen mixed experiences this year. While China, Thailand, Vietnam and Malaysia are still 'living with' EMS, countries like Indonesia and India have increased production. This has changed the demand supply equilibrium and prices have dropped, dipping to a low of USD 5.60/kg for size 50/60 similar to prices prior to the start of Thailand's EMS crisis in 2013. In the past two years, India increased its processing capacity to meet the new production volumes and today is searching for markets in China and competing with Ecuador. In some countries, the new threat is the microsporidian EHP where shrimp stops growing but continues to consume feed. Added to this, is the white faeces disease or WFD and at the hatchery stage, the zoea II syndrome.

The marine fish industry seems to be stuck in status quo. While the industry tries to expand Asian seabass and grouper farming, there has no been major success. For the former, any significant increase in supply will see a drop in prices. The major bottleneck is in marketing of the fish and in a chilled state, it can only travel so far and last a certain number of days. In grouper farming, survival is still relatively low and in order to cover production costs, the fish has to be sold live for good margins.

In the freshwater fish industry, tilapia seems to be the hero. Vietnam is diversifying into tilapia and with its processing strength, would like to grow a comparable export industry to its pangasius. India has development plans for tilapia. With the strengthening US dollar, these countries are targeting the USA where tilapia has become the 4th largest consumed seafood (see page 54). China is losing its stronghold in tilapia exports to the US due to a multitude of reasons such as smaller sizes, image and pricing.

Aquaculture feeds have faced numerous issues this year as discussed during TARS 2015 in Hanoi. The weakening of all emerging country currencies has increased feed prices within the country (see editorial Sept/Oct 2015). For feed producers, this fire-fighting has seriously impacted profitability. The sustainability issue of fishmeal still continues with IUU problem in Asia. The long term issue remains with the replacement of fishmeal at the same performance and cost.

Recently, there has been renewed interest in the farming of monodon shrimp but selected disease free or high health post larvae has been a major constraint. There is a lot of excitement around Prof Grace Lo, National Cheng Kung University, Taiwan. Working with OSO in Madagascar, she has achieved a breakthrough with WSSV resistant strains. Virus resistant shrimp is just beginning such as the SPR-specific pathogen resistant vannamei shrimp being tested out in a major farm in Malaysia.

Finally, Asian aquaculture has caught up with the 21st century. Indonesian startup eFishery has secured funding to expand its smart fish feeder business. (see news in brief).

OUR MISSION

We strive to be the beacon for the regional aquaculture industry.

We will be the window to the world for Asia-Pacific aquaculture producers and a door to the market for international suppliers.

We strive to be the forum for the development of self-regulation in the industry.



The Aquaculture Roundtable Series
17-18 August 2016

TARS 2016 will be on Shrimp Aquaculture & the New Normal. It will be held from 17-18 August in Phuket, Thailand. For updates, visit: www.tarsaquaculture.com



The best Introducing
BALANCE

SAFE REDUCTION OF LIVE FEED

* Maximize your profits with the proven best balance between live feed and dry diets.



New
FRIPPAK® FRESH
#1 CAR #2 CD #3 CD



*as shown in lab-scale experiments & large commercial culture runs (> 2 billion fry per year) in Thailand, Mexico, Nicaragua and Vietnam. We recommend the use of **SEP-Art** Artemia cysts for pure, fast, easy and environmentally friendly Artemia harvesting.



For more information: www.inveaquaculture.com



Targets set at Vietfish 2015

As they scale up production of the tilapia, Vietnam's producers and exporters are looking at potential markets. Aside from marketing the marine shrimp and pangasius at Vietfish 2015, held in August, tilapia is the latest aquaculture commodity. With regard to the pangasius, the target market is China.

Over two days, VASEP-Vietnam Association of Seafood Exporters and Producers held seminars focusing on market potential and development for the tilapia, China as an alternative market and e-commerce for the pangasius. It also held a shrimp outlook forum.

The Directorate of Fisheries or D-Fish, Ministry of Agriculture and Rural Development has named the pangasius, tilapia, shrimp, lobster and mollusc as target species for the country's aquaculture production. "Tilapia is a relatively new target species for aquaculture," said Duong Long Tri, D-Fish at his booth.

Potential markets for the tilapia from Vietnam

During the seminar on market demand and potential of tilapia in Vietnam, Ta Van Ha, Vasep said "Vietnam's farming of the tilapia in cages and ponds produced an estimated 125,000 tonnes in 2014. This is an increase of 25% of the production in 2013. The development plan is to farm tilapia in 21,000 ha of farming area, in both ponds and cages to produce 140,000 tonnes. In 2020, production is expected to increase to 200,000 tonnes from 25,000 ha of ponds and cages. The volume of exports is expected to be 30,000 tonnes in 2015 and 80,000 tonnes by 2020."

With a population of 90 million, the tilapia has a large domestic market, especially in the large towns. Volumes for live and chilled tilapia are 100,000 tonnes per year and the per capita consumption is 1.1 kg/year. This market is expected to grow annually by 10%. Tilapia is sold at an affordable price of VND 35,000/kg to VND 70,000/kg in local markets. According to D-Fish, Nam Viet in An Giang and Hoang Long Seafood in Dong Thap are already processing tilapia for export. Product forms are skinned and skinless fillet, and frozen whole. Vinh Hoan, a leading pangasius integrator has diversified into tilapia farming in ponds and will set up a hatchery in November.

"Tilapia from Vietnam is already in the US markets at an average selling price of USD 2.7/kg for frozen whole tilapia which is higher than the same product from China at USD 2.3/kg and Taiwan at USD 2.5/kg. In 2014, Vietnam tilapia was sold at USD 2.5 for whole frozen tilapia and USD 4.5/kg for frozen fillet. During the first half

of 2015, the total value of exports reached USD 1.69 million. It was USD 3.2 million in 2014. Markets by volume are the US, Belgium, Netherlands, Germany, Italy and France," said Ha.

In conveying his perspective on global tilapia markets, Carson Roper, consultant, France, said that Vietnam together with Mexico, Columbia and Malaysia are the secondary producers after the primary producers, China, Egypt, Indonesia and Thailand. "The market concern is all about reputation and credibility. Retailers look at the supply chain and an overarching market concern is aquaculture food safety. Therefore, the objective should be to build a brand identity and credibility. In the case of Vietnam, it is also to learn from the pangasius sector."

Exporting to China and E-commerce

China is Vietnam's 4th biggest seafood market representing 8% of Vietnam's total exports. Seafood exports have been increasing from 13% in 2003 to as high as 70% in 2014. The value reached USD 597 million in 2014. "However, 95% of the exports to China comprise shrimp," said Le Hang, Deputy Director at Vasep. "In the first half of 2015, pangasius exports to China reached USD 70.15 million, up by 50.7% when compared with the same period in 2014. As demand in the major markets mainly US, European Union, Mexico, Brazil and Asean is dropping, market diversity is the next step. China also imports pangasius for reprocessing to the US. China is a huge market, full of potential if we know how to tap this market," she added.

"However, the Chinese market does not emphasise on quality and will not pay high prices, which is not good for the branding of the pangasius as a safe food source. The market is not sustainable, as most of the trading activities are cross border. It is an unstable market in volume and price, and bargaining is an obstacle."

Vinh Hoan is a market leader in Vietnam's pangasius industry with hatcheries, farms and processing facilities. In the first nine months of 2015, exports totalled USD 180 million. The company accounts for 15% of Vietnam's total pangasius exports. According to Vinh Hoan, President CEO Truong Thi Le Khanh, "There are opportunities for Vietnam's seafood in China. However to market the pangasius in China it is important to understand market movements and its regulations."

China's seafood market had a per capita seafood consumption of 35.68 kg/year in 2014 and fish consumption was more than 60 million tonnes. Khanh added that the popular pangasius products are fillets (skin on and skin off) and steaks. Demand is increasing, especially in large cities. "However, this is not an easy market to enter, even for a large integrator such as Vinh Hoan. Some of the challenges which Vietnamese companies will face include: lack of understanding on market demands and regulations, unfair competition caused by border trade (the import duty is 17%),



Tony Dang Quoc Tuan, Viet Uc (left) with Diep Thanh Hai, Nutriad. Dang gave an overview on Viet Uc's super intensive shrimp farming in greenhouses at the shrimp outlook forum.



At Vietfish 2015, marketing pangasius fillet, fish meal and oil and collagen drinks

low awareness of markets, unstable markets, competition for low prices and low credibility on food quality.”

Her advice for those interested in the China market is to understand the market. Some 80% of sales are for home consumption and the rest for restaurants, shops and canteens. Fish are usually bought from wet markets, supermarkets and seafood stores. One potential strategy is to look at e-commerce which is picking up fast. The key to success according to Khanh is to ensure food safety and build up a brand. It is also essential to cooperate with importers.

“E-commerce is the pathway to China’s 1.3 billion consumers,” said Xuenwu Shao, Wuhan Lanesync Supply Chain Management. The company started cooperating with Vinh Hoan, 3 years ago. “There has been very little promotion in China for Vietnam’s seafood. In comparison, Norway’s producers have been

promoting Norwegian salmon which is now well known and accepted throughout China.

“On line shopping is popular among the young and will be increasing as customers prefer using the internet. The company’s e-platform promotes the pangasius branding which brings high sales volumes and a leading position in the market. By doing so we managed to increase the percentage of restaurants with pangasius on the menu by 15 to 30%. Promotion is through the media. The type of pangasius dishes increased from 1-2 to 3-4. This trend shows that the market demand will grow more than 3 times.

“Brand promotion is most important and by 2016, we can expect to sell 800-1,000 containers/month. In comparison, in 2014, the quantity of imported pangasius from Vietnam was 250 containers/month.”



Partners in SUPA, Le Xuan Thinh, Vietnam Cleaner Production Centre, Hanoi University of Science and Technology (VNCPC) (third right) Sabine Gisch-Boie, WWF-World Wide Fund for Nature, Austria, (second right) Pham Dinh Phuong (third left) and Nguyen Hoang Thanh, VNCPC (left) with visitors, Uddaraju Ananda Raju (middle right) and Professor C Mohankumar Nair (middle left), Ananda Group, India, Dr Krishna R Salin, AIT, Thailand (second left) and Dr Mai Van Tai, Research Institute for Aquaculture No.1 (RIA1), Vietnam (right).

SUPA (Project Establishing a Sustainable Pangasius Supply Chain in Vietnam) works with small and medium scale pangasius farms to achieve sustainable production practices to supply quality pangasius to European buyers. SUPA issues the certificate on Resources Efficiency and Cleaner Production (RE-CP) for the processing companies to encourage them to save material, natural resources, energy and to reduce environment impact. In production, SUPA encourages farms to assure responsible production with ASC (Aquaculture Stewardship Council) certification.

Funding for Indonesian smart fish feeder startup

eFishery, a smart fish feeder manufacturer based in Bandung, Indonesia has secured pre-series A funding led by Aqua-Spark, a Netherlands based aquaculture investment fund. Indonesian venture capital firm Ideosource also participated in this round of funding. eFishery is tackling one of the largest challenges in commercial aquaculture - feeding which takes up 50-80% of the operating costs. eFishery CEO Gibran Chuzefah Amsi El Farizy said that he recognised the problem when he was a fish farmer and noticed that fish feeding was run inefficiently by labourers and farmers who do not have the technology and knowledge to optimise feeding operations. Aqua-Spark partner Amy Novogratz said, "eFishery has the potential to set a new standard for aquaculture and make the industry more transparent, data-driven, and accountable - all factors that will make businesses in this sector more investment-friendly."

The startup offers automatic smart feeders that use sensors to measure the fish's appetite and dispenses the right amount of feed. The feeders are designed for both small and large scale operations and can deliver real time reports of fish consumption to the farmers' smartphones. eFishery charges subscription fees for the mobile software to monitor feed usage. The two-year old company expects to sell to customers in Thailand, Singapore, India, China, Brazil and Africa. In Indonesia, the products are available in Java, Bali and Sumatra. It will use the funds to scale up its distribution network, engage local partners, and expand its market share aggressively in Indonesia. (source: Tech in Asia)

First hydraulic shrimp harvester in India

Indian aquaculture firm Westcoast Group has imported a hydraulic shrimp harvester for its shrimp farms in Gujarat, reports the Undercurrent News. A first in India, the harvester is a compact, mobile unit driven by a diesel engine. It also has halogen lights for night operations. By introducing this technology, the company has set new benchmarks in fish/shrimp farming. This is a smarter and faster way of handling the harvesting process and ensure high quality shrimp.

"With the shrimp harvester we will be able to cater to many more seafood lovers with much higher quality shrimp than ever produced in India," said Westcoast Managing Director, Kamlesh Gupta.

"With this machine, shrimp are in perfect condition, without any damage during harvesting to their antennae or other appendages. This machine is already helping us process shrimp faster than the previously used manual techniques." He added that during harvesting, shrimp have minimal exposure to air temperature as they are transferred in water from the pond straight into an ice slurry. This ensures product quality, with the freshness of the product being retained to a high degree. Westcoast's brand of seafood includes Cambay Tiger. The company's factories are located in Surat, Diu and Kumta.

New aquaculture research facility in Tasmania

The University of Tasmania (UTAS) has established a new AUD 6.5 million aquaculture research facility at Taroona, the first of its kind in the Southern Hemisphere. Funding came from the Commonwealth and Tasmanian governments, the Australian Seafood Cooperative Research Centre, the University of Tasmania, Huon Aquaculture Group and the Tasmanian-based multinational aquafeed company Skretting Australia.

The experimental research facility is managed by the University's Institute for Marine and Antarctic Studies (IMAS) and will enable collaborative research, particularly on the health and nutrition of the Atlantic salmon. Tasmania's salmon farming is by far the largest aquaculture industry in Australia, and accounts for the bulk of the seafood production in Tasmania.

Facilities available include specially designed systems to control environmental conditions including light, water quality and temperature to examine climate change effects relevant to local conditions. Research will also include development of feeds to optimise the use of marine ingredients, feeds with health and functional attributes and feeds for efficient growth over a range of temperatures. Professor Chris Carter, Head of the Fisheries and Aquaculture Centre said the facility would benefit students specialising in aquaculture and marine environmental studies.

Insects in food and animal feed

The European Food Safety Authority (EFSA) has issued a scientific opinion on the use of insects (such as houseflies, mealworms, crickets and silkworms) as an alternative source of protein in food and animal feed and risks from production, processing and consumption. It identified the potential biological and chemical hazards as well as allergenicity and environmental hazards associated with the use of farmed insects as food and feed. EFSA's scientific experts say that the possible presence of biological and chemical hazards in food and feed products derived from insects would depend on the production methods; what the insects are fed on (substrate), the lifecycle stage at which the insects are harvested, the insect species, as well as the methods used for further processing. EFSA concludes that when non-processed insects are fed with currently permitted feed materials, the potential occurrence of microbiological hazards is expected to be similar to that associated with other non-processed sources of protein.

Data on the transfer of chemical contaminants from different types of substrate to the insects themselves are limited. Possible hazards are associated with other types of substrate, such as kitchen waste, and animal manure. The environmental risk of insect farming is also expected to be comparable to other animal production systems. Existing waste management strategies should be applicable for disposing of waste from insect production. EFSA's opinion is based on data from peer-reviewed scientific literature, assessments performed by member states and information provided by relevant stakeholders.



***Moving Forward With Sheng Long
Cashing In On Tomorrow***

Sheng Long, your professional and trusted aquaculture partner.

We provide the winning combination of high-quality aquafeeds and shrimp larvae along with technical assistance in all aspects for your success.



Night time in shrimp farming

By Soraphat Panakorn

Consider the night activities at shrimp farms for best management practices and success with crops.

Just like any industrialised and biological business, shrimp farming involves a 24-hour work cycle from the day of stocking to harvest. While the farmer sleeps, the micro-organisms and phytoplankton activities continue in the pond. Contrary to the adage that ignorance is bliss, unknown to the farmer a lot of happenings are taking place in the pond at night, and these activities can have major consequences which may be disastrous the next day.

The aim of this article is to show how important it is for farmers to understand the goings-on in the pond at night, followed by some guidelines for the farmers to adopt mitigation measures.

Water parameters

pH

In the shrimp pond pH changes arise from two sources: ions in the water and activities of the phytoplankton. During the night, phytoplankton activity is low and this causes a drop in pH. In turn, ready to moult shrimp immediately start moulting once the pH reaches 8.3 or below.

On the other hand, the lower pH will increase the H₂S toxicity. Furthermore if the difference in pH between day and night readings is as high as 1.0, the stress level of the shrimp is increased and this weakens their constitution.

To stabilise water pH, alkalinity should be 100 ppm or more. The farmer must check pond alkalinity continuously, at least every 3-4 days and improve on the level with the application of lime or sodium bicarbonate at night when shrimp are not moulting.

Temperature

Night water temperatures are always lower than day temperatures. As heat is released slowly from the pond surface, the differential creates temperature stratification which blocks the mixing of oxygen. Low temperature will also cause H₂S to be more toxic to animals.

As temperatures decline, weaker shrimp tend to move to the sludge areas, exposing themselves to toxic gases and pathogenic bacteria. Shrimp also react to lower temperatures by slowing their activity. Shrimp metabolic rates decrease by 10% with each °C drop in temperature.



IT farm in Phuket, Thailand. Long arm aerators pushing streams of water all over the pond can buffer heavy rain effect at night. Powerful spotlights help staff to clearly observe the shrimp activity at night

To minimise the impact of temperature changes, the farmer must continue to run aerators to mix water thoroughly so as to prevent water stratification, and to keep the pond bottom clean with less organic matter by implementing better feed management. They should also avoid feeding at night since shrimp do not feed well at lower temperatures.

Dissolved oxygen

It is common for shrimp farms to encounter shortage of dissolved oxygen (DO) at night when photosynthesis stops. Aeration is the only way to maintain DO levels and these should not be stopped even for a single minute. The shortage of DO at night may cause other problems later on. The optimal DO concentration in the farm is 4 ppm at 4 am and the checking point is 30 cm from the pond bottom and 3 m away from the sludge edge. Insufficient DO could lead to serious H₂S toxicity, release of toxic gases, bloom of pathogenic bacteria, mortality after moulting, and reduced feed consumption. All these are stressful to shrimp.

Usually in a pond that relies on oxygenation from two sources, aeration and phytoplankton, the phytoplankton gives a typical colour to the pond water (brown to green or dark green). DO will be very high during the daylight hours and will drop slowly after night fall and reach the lowest point at about midnight. DO will remain low up to one hour after sunrise, when phytoplankton activity resumes.

PREMIUM Plus
Golden Dolphin

100% PURE BRINE SHRIMP EGGS
金海豚高級豐年蝦卵

SUPER ARTEMIA SDN BHD (482642-V)
No. 3A, Jalan Akitek U1/22, Hicom Glenmarie Industrial Park
40000 Shah Alam, Selangor Darul Ehsan, Malaysia.
Tel: +603-5569 2721 / +603-5569 1998 Fax: +603-5569 2726
Mobile: +6016-201 9977 Email: david.tan@superartemia.com www.superartemia.com

LALSEA[®] BIOREM

SIMPLE GESTURE

BIG DIFFERENCE



LALSEA[®] BIOREM strains have been specifically selected to ensure your pond water's equilibrium through:

- Organic matter degradation
- Ammonia reduction
- Pathogen control
- pH stabilization

LALSEA[®] BIOREM, DIRECT APPLICATION FOR STABLE WATER QUALITY.

With declines in DO at night, shrimp will slow down their activity in order to use less oxygen, hence most of them will touch the pond bottom and those requiring higher DO will try to crawl along the sides of the pond. If DO is good enough at night most shrimp will be swimming all over the pond.

The recommendation is to check DO levels at 4am and provide a spare source of oxygen supply for any emergency. The farmer should frequently check and maintain pond water at optimal DO level. The farmer can also use these rough calculations: each 400 kg shrimp biomass needs 1 HP of aeration. The biomass can be calculated from stocking density, survival rate, shrimp weight and % feed consumed per day.

H₂S toxicity

A level of H₂S at only 0.02 ppm is toxic to shrimp and many other aquatic animals. This is also the minimum level where farmers can smell H₂S. In comparison, toxic levels of NH₃ and NO₂ are 100 and 1,000 times higher. H₂S is present where there is organic matter and water but no oxygen. Thus, a shrimp pond is one of the most likely places for H₂S to be generated. Both fish and shrimp farmers around the world lose crops to toxic H₂S more than other causes. Often they lose all their crops but as they do not know how to deal with this problem, they just accept the mortality as a common occurrence.

Conditions for toxicity of H₂S are low temperature, low pH and low oxygen. Hence, night time is a good time for H₂S build up, creating problems for the shrimp. A slight exposure to H₂S will make shrimp weak and easily succumb to infections or diseases and a strong exposure could lead to sudden death. With additional adverse conditions such as heavy rains, strong winds, malfunctioning aerators, moulting and plankton crash the farmer will experience high shrimp mortality the next morning.

To deal with this toxic gas, the farmer must maintain a stable pH at around 7.8-8.1. It cannot be higher than this as the shrimp will be poisoned by NH₃. Farmers must maintain optimal DO levels always and manage sludge well. Some farmers use some H₂S oxidising bacteria to control H₂S. Many farms with high loads of H₂S will show weak shrimp at night. Thus, night observations are crucial. (For readings of un-ionised H₂S at different pH and temperatures, refer to Boyd, 1990, Water Quality, an Introduction, p217)



A floating light set helps staff working at night

Phytoplankton

During the night, with no release of oxygen from phytoplankton, pH will decrease and there will be lower uptake of minerals compared to during daytime. For moulting, shrimp will use up a high volume of minerals. When minerals in the ponds are limited or low, phytoplankton will not have enough mineral supplies the

Silica+



The minus is the plus!™

THE BIOLOGICAL RESONANCE CATALYST

- 0.33
FCR in SHRIMP

+ 40%
Oxygen in water

- 0.10
FCR in FISH

+ 15%
ADWG in SHRIMP

+ 37%
Survival in FISH



SHRIMP

Small PLUS that makes a BIG Difference

Read our most recent publication on the exceptional results of SILICA+ in juvenile shrimp's growth performance and health conditions (by Dr. Wutiporn Phromkunthong).

From AQUA CULTURE Asia Pacific, Vol.11(3), May/June 2015: 43-46



Aquaculture

Swine

Poultry

HEAD OFFICE:

164, chemin de la Grande-Ligne, Saint-Urbain-Premier (Québec) Canada J0S 1Y0
info@ceresconutrition.com | +1 888 427-7692 | CERESCONUTRITION.COM



Ponds with biofloc provide plenty of well mixed oxygen and water and help prevent most problems occurring at night.

next day, when the sun rises. In such situations, plankton will start dying and on checking the pH, the farmer will discover that it was lower than the previous day by about 0.3-0.5. In this case, the farmer can predict that within two days, there will be a massive plankton crash. The farmer must get ready to manage the situation properly.

In the event that a farmer needs to apply minerals for the shrimp, the application must be done at night. If the minerals are required for the plankton, these should be applied during late morning. Plankton crash is a shrimp farmer's worst nightmare. When a crash occurs, pH and DO levels will suddenly drop. Organic matter in the pond will increase and microorganism populations will bloom within a short time. Large amounts of toxic gases will be released. All these factors seriously affect shrimp health.

To prevent a plankton crash, we need to have the right mineral ratio. It is necessary to frequently check for calcium, magnesium, potassium and other elements. Monitoring and adding

enough minerals will help maintain stable bloom. Beneficial microorganisms that can turn organic matter to inorganic matter could help provide sufficient mineral and nutrition to stabilise phytoplankton bloom. Quick action to respond to any crash is important, especially after heavy rains.

Shrimp behaviour Moulting

Shrimp can moult any time but this is linked to pH. If pH is over 8.3, shrimp will wait until this is lower to start moulting. The ideal pH for moulting is 7-8. This is why shrimp in a pond with phytoplankton colour indicating that pH is a bit higher than 8.3 during the day, will moult at night. When shrimp moult, they will require the oxygen in about double the time. They need about 3-4 hours for the shells to harden. If they cannot accomplish this and the shell is still soft, shrimp will soon die. During moulting, shrimp need to absorb minerals for new shell formation from the water. The farmer then needs to pay attention to alkalinity and minerals at this time.

A drop in feed intake for the afternoon meal, is a sign of moulting. As a guide, we can roughly estimate the interval by measuring shrimp length from the end of the telson to the rostrum in cm. The length of the shrimp in cm indicates the time interval in days between one moulting to the next. For example, if the length of the shrimp is 7 cm, this shrimp will moult again in another 7-8 days.

In this case, the farmer must record the moulting date, and calculate the time for the next moulting. The farmer must also detect the drop in feed, run spare aerators for the night of moulting and ensure the pond is free from H₂S by applying H₂S oxidising bacteria. The farmer should also apply minerals when shrimp moult in the case of high stocking density or low salinity



Innovations in **Water Monitoring**

Automated Systems Ensure Your Fish Thrive

Reduce operational costs and gain better visibility into changing conditions with the Aqua TROLL® 400 Multiparameter Probe and the Con TROLL® PRO Process Controller. Accurate and reliable sensors let you optimize pond conditions to protect your investment and increase your ROI.

- Measure salinity, pH, ORP, optical dissolved oxygen, temperature, level, and more
- Low-maintenance and compact probe
- Integrate with Con TROLL PRO, PLC, or wireless options to automatically run aerators and pumps only when needed, reducing energy costs

Improve feed-conversion ratios, minimize fish stress, and reduce fish disease and mortality with consistent water quality monitoring.

Learn more at in-situ.com/asia-pacific

Contact **Alex Hing** at ahing@in-situ.com to arrange for a demonstration.



Healthy Water. | Healthy Fish. | Healthy Profits.



Light colour fences help with quick detection of intruders.

water or there was already some mineral shortage during the last moult. The alkalinity should be kept at 120 ppm. In the morning after the moult, the farmer must observe shrimp and check water parameters. If some soft or thin shell shrimp or dead shrimp are discovered, or there is a sudden drop of alkalinity of more than 20 ppm or phytoplankton drop (pH drop about 0.3-0.5) from the day before, the farmer needs to apply minerals immediately and also during the next moulting.

Feeding

Shrimp exhibit predator behaviour at night. Shrimp will break from the crowd as they prefer to search for feed independently rather than wait for the feed supply. Feed should be reduced for the night so that shrimp will not feed on feed left over from previous feedings. In this way, the farmer gets optimal feed consumption.

Farm staff

In a farm, keeping awake at night is not easy, especially with the sounds of aerators humming like lullabies, and after a full day of work. Even staff assigned to night duty might find it difficult to keep awake. A farm owner must assign the most reliable, honest and capable person to be a shrimp guardian at night. The person should have all the equipment such as vehicles, radio or mobile phones, light set or spotlight torches with spare batteries, repair tools, weapons to protect themselves and properties, and products duty to be used in an emergency. This person must be free of work during the day, must have enough knowledge on shrimp farming and should be paid special hardship wages.

The night guardian must check shrimp behaviour by observing shrimp in check trays or use a torch to observe shrimp activity. He or she should observe the colour of the light reflection of the eyes of weak shrimp which are paler than those of strong shrimp. However, when using a torch on a pond, the guardian must move the torch slowly. Fast moving light over the water could make shrimp nervous and jumpy, thus increasing stress and weakening the shrimp.

The job of the night guardian is also to check that all aerators are functioning well. The DO meter must be used frequently and randomly to measure DO at night especially when phytoplankton population drops, shrimp is moulting and when there is heavy rain and new water exchange. Checking pH after 21.00 h is also part of the job. A night guardian can gain sufficient experience to undertake the job well after 2-3 months.

Other problems

Farm security

A watch tower with high power spotlight and light colour fencing would help to keep would be intruders away. One effective deterrent is to have fencing under the water at the pond side with barb wire to trap illegal cast nets. Another way to prevent intruders is to have farm staff housing around the farm border.

Accidents

The likelihood of accidents happening is highest at night, especially during bad weather such as heavy rains. To be safe, repair work, must be carried out with two staff working together. Each farm must have a safety protocol and a safety exercise at least twice a year. It is important to check that all equipment are working well.

Farms must have enough equipment for night work such as safety clothes and shoes, helmets, eye glasses, umbrellas, first aid medical sets, spotlights with long electric cords and head lamps. etc. This is to allow staff to work comfortably at night. Most accidents occur at night because of unsafe conditions. It is also important that all in the farm know where to get and how to use equipment

Aerators not running

Since oxygen is crucial at night, malfunctioning of aerators can cause huge losses. Thus repair tools, electric generator sets or spare engines to run paddle wheels in cases of electricity cut offs, must be properly maintained and regularly tested. Farm staff with basic mechanical training is important. At least two or three farm staff should have some training on how to fix general problems with equipment failure. As an encouragement, this group should be remunerated for their skills.

Midnight to sunrise

An important time to keep watch is from midnight to sunrise. Problems with shrimp in the ponds can usually be first detected during this period before the full-scale problem is realised a couple of days later. The weakest shrimp (but still in a good condition) will surface and the farmer can see them. They are surfacing because of some stressful condition.

Heavy rain

Once this occurs, especially at night, there should be immediate action to prevent stress to shrimp. Heavy precipitation such as 30 mm of rainfall will worsen the generally night time bad conditions for water parameters such as DO, pH, temperature and H₂S toxicity. Together with salinity drop, this will cause a phytoplankton crash and low feed consumption the next morning.

Fresh water should be thoroughly mixed, DO and pH should be monitored and stabilised, proper aeration should be provided and lime applied. Applying burnt lime around the sludge area to block shrimp from sinking down to the sludge area will help. Farmers usually do nothing during a rainy night and later, within a week, find some mortality which slowly increases. They fail to take early action and finally end with losses and are forced to harvest. Proactive monitoring at the beginning is most helpful.

The message

These events happening at night are often not 'noticeable by eye' and the neglect is perpetuated when farmers and their staff have the idea that 'it could not be any large problem and we can wait to observe it the next day'. However, with farming conditions such as soil, water, climate and post larvae quality, weakening more than before, many farms experience problems occurring at night. Thus, real time and on time detection and quick handling and management will bring success. If a farmer cannot find a good night guardian, he could play safe by stocking below pond carrying capacity. However, even with this, more attention is needed during nights with heavy rain.



Soraphat Panakorn is Commercial Development Manager, Aquaculture Asia Pacific, Novozymes Biologicals, Thailand. Email: january161975@hotmail.com

filling
the
world's
need for
Artemia

DISTRIBUTORS

Bangladesh

Grace Tone Limited
+880-2-885-7165
shahid.grace@agni.com

China

Best Care Bio-Tech Co. Ltd.
+86-4008-882-883
mx_best@hotmail.com

India

Priyanka Enterprises
+91-99-4964-0666
priyankanr2000@yahoo.co.in

Indonesia

PT Radiance
+62-21-634-7788
shrimpfeed@pt-radiance.com

Malaysia

Lantas Resources Sdn Bhd
+60-17-247-3640
wtb9406@yahoo.com

Philippines

Feedmix Specialist Inc. II
+63-2-636-1627
www.feedmix.com

Vietnam

Vinhthinh Biostadt JSC.
+848-3754-2464
www.vinhthinhbiostadt.com

EZArtemia
Liquid Artemia Replacement Diet

Biosecure - #1 Selling Replacement Diet

ZEIGLER
nutrition through innovation

717-677-6181
www.zeiglerfeed.com
info@zeiglerfeed.com

contains **Vpak**

Product of **USA**

global aquaculture
alliance
founding member

Probiotics reduce mortality and pathology in a standardised AHPND challenge model

By Dang Thi Hoang Oanh, Mathias Corteel and Olivier Decamp

Beneficial effects include higher survival and histological signs of hepatopancreas regeneration.

Early mortality syndrome (EMS) is a result of poor management practices in shrimp farming in Vietnam and several other countries. Here a combination of adverse factors in nutrition, biosecurity, host physiology, and especially microbial management leads to a situation where opportunistic pathogens such as *Vibrio parahaemolyticus* can bloom and dominate the microbiota around and inside the shrimp. When additional virulence factors such as colonisation of the stomach and toxin production are added to this setting, diseases such as acute hepatopancreas necrosis (AHPND) will cause severe losses.

For more than a decade, INVE Aquaculture has been working on the treatment of ‘traditional’ vibriosis. Hence it was a logical step to extrapolate our established pro- and metaphylactic treatments to this new variant of *Vibrio*. When applying Sanolife PRO-2 probiotics in the field, as part of a holistic intervention protocol, a significant amount of empirical data of the beneficial action of *Bacillus* probiotics during shrimp culture has been collected (Lavens et al. 2014). In this study, we measured the effects of Sanolife probiotics in a standardised AHPND challenge model under controlled laboratory conditions.

Animals

Post larvae *Penaeus vannamei* were bred and nursed at the shrimp hatchery and nursery of the College of Aquaculture and Fisheries, Can Tho University. Shrimp stocks were under surveillance for white spot syndrome virus (WSSV) (Lo et al., 1996), yellow head virus (YHV) (IQ2000 YHV/GAV) and AHPND *Vibrio* (Sirikharin et al. 2014) in order to maintain the specific pathogen free (SPF) status of the post larvae.

For this study, post larvae (PL 20-25), with an average body weight of 1 g were used. This is within the age and size range of shrimp most affected by EMS/AHPND under culture conditions. Natural seawater which was sterilised and diluted to 25 g/L (a typical salinity for *P. vannamei* grow-out) was used throughout the experiments.

Bacteria

The bacterial strain used in this study was designated as LTS14. This strain was originally isolated from shrimp diagnosed histopathologically with AHPND in Vietnam in May 2014 and stored at -80 °C in TSB supplemented with 1.5% NaCl and 25% glycerol. The bacteria were identified as *V. parahaemolyticus*, by green colonies on TCBS, conventional API 20E biochemical tests and PCR with LTH primers (Kaysner and DePaola, 2004). Additionally, the isolate was positive on PCR with AP3 primers (Sirikharin et al. 2014). Prior to the study, virulence of LTS14 was extensively evaluated by *in vivo* challenges and compared to other strains. The challenge dose was fine-tuned in order to obtain a reproducible sub-acute LD₅₀₋₆₀ mortality curve (Figure 1).

Challenge

Bacterial cultures were grown for 24 h in TSB supplemented with 1.5% NaCl at 28 °C. Based on the standard curve determined for the strain, the bacterial suspension was diluted in sea water to an optical density corresponding to 10⁸ cells/mL. Shrimp were immersed for 15 minutes in this bacterial culture with continuous

aeration. Both bacterial solution and shrimp were then transferred to aquaria containing sea water, and the bacterial concentrations were reduced to 10⁵, 2x10⁵, 10⁶, 2x10⁶ cells/mL. No water was exchanged until 2 days after the challenge, from which point onwards 20% of water was renewed daily.

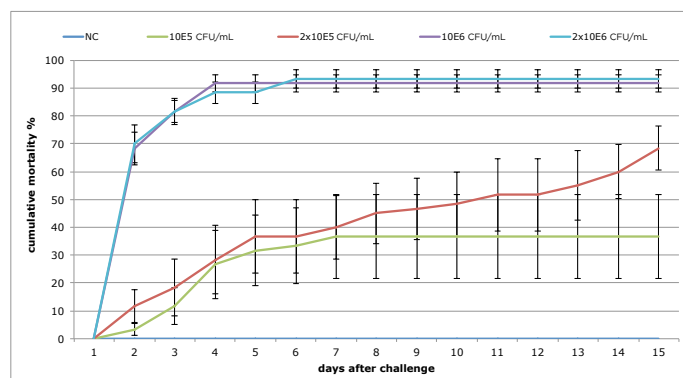


Figure 1. Cumulative mortality curves of the *in vivo* titration of *V. parahaemolyticus* LTS14. Each dose was administered to six replicate tanks with 10 shrimp. Based on this experiment, the dose of 2x10⁵ CFU/mL was selected for further challenges, due to its sub-acute course.

Experimental design

Experimental shrimp were stocked at a density of 30 individuals per aquarium with 30 L of water, continuous aeration was provided and water parameters were held constant at 29±1 °C, pH 7.732, NH₃ <0.1 mg/L and DO 4 mg/L by daily water exchange.

There were five treatments as shown in Table 1. Each treatment was replicated three times.

Table 1. Composition (% inclusion) and proximate analysis (% product) of experimental diets

Treatment description		Challenge with <i>V. parahaemolyticus</i>
Negative control (NC)	-	-
Positive control (PC)	-	+
Antibiotic control (AB)	doxycycline 2g/kg feed	+
Sanolife PRO-2 (PRO-2)	10g/kg feed	+
Sanolife PRO-W (PRO-W)	5 mg/L	+

Feed applications of antibiotics and Sanolife PRO-2 were top-coated with every ration and the Sanolife PRO-W was added to the aquarium water once per day. The dose of Sanolife PRO-2 contained 2x10⁸ CFU *Bacillus* per g feed and the dose of Sanolife PRO-W was 2.5x10⁵ CFU *Bacillus* per mL water. Apart from the NC group, all shrimp were challenged with 2x10⁵ CFU/mL of LTS14, and clinical follow-up was performed for 15 days after challenge.

The evaluation of the treatments was based on statistical comparison of the following:

- severity and time of onset of clinical signs;
- cumulative mortality and
- severity of score on histopathology.

Severity of AHPND clinical signs

Clinical signs such as anorexia, lethargy and pale colouration of the body and hepatopancreas were observed in 75% of the animals in the positive control group as early as 24 h after the challenge. The incidence of anorexia was less pronounced in the AB and PRO-W treatments and was observed only in 25 to 50% of animals in these groups. Less than 20% of shrimp in the PRO-2 group were recorded with AHPND symptoms, and with a significant delay of 72 h after challenge. Representative photos of gross signs are shown in Figure 2.

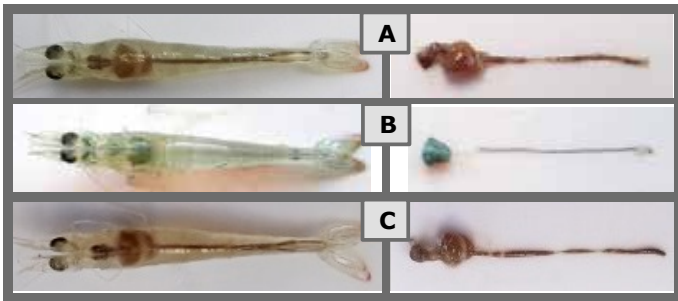


Figure 2. Gross signs 48 h after challenge with 2×10^5 CFU/mL *V. parahaemolyticus* LTS14. (A) negative control (NC) shrimp, (B) positive control (PC) shrimp, (C) PRO-2 shrimp. Gross signs of AHPND: absence of feed in gut, pale discoloration and atrophy of the hepatopancreas can be clearly noted in the PC shrimp. Disease signs were delayed and attenuated in the PRO-2 treatment group.

Reduced mortality

Mortality started in the PC group 1 dpi (days post-inoculation) and reached a cumulative mortality of $52 \pm 10\%$ after 10 days (Figure 3). In AB and PRO-W groups, mortality also started at 1 dpi and cumulative mortality attained $32 \pm 12\%$ and $34 \pm 5\%$ respectively. A delay in mortality of 4 days was noted for the PRO-2 group, with cumulative mortality stopping at $17 \pm 3\%$ after 9 days. The PRO-2 result was significantly lower than the PC, but also still higher than the NC $3 \pm 3\%$.

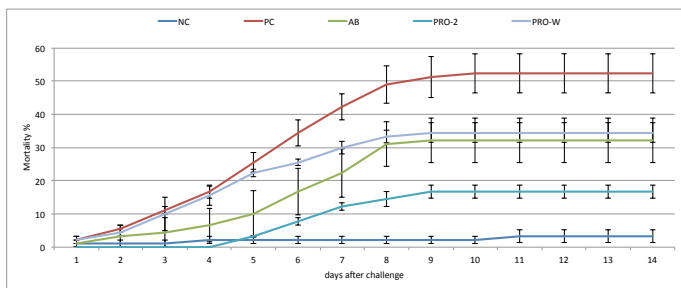
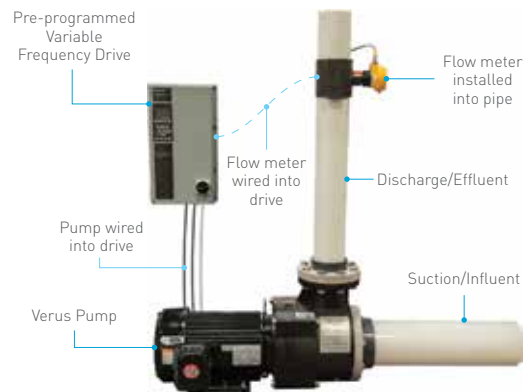


Figure 3. Cumulative mortality curves of treatment groups after challenge with 2×10^5 CFU/mL *V. parahaemolyticus* LTS14. NC: negative control, PC: positive control, AB: doxycycline 2 g/kg feed, Sanolife PRO-2: 10 g/kg feed, Sanolife PRO-W: 5 mg/L rearing water.



PENTAIR AQUATIC ECO-SYSTEMS VERUS 850 PREMIUM EFFICIENCY PUMP WITH CONSTANT FLOW TECHNOLOGY

We know that Variable Frequency Drive (VFD) programming can be challenging, time-consuming and error-prone... That's why we've removed the guesswork; enabling customers to easily upgrade to a proven solution for off-the-shelf control using Constant Flow Technology. Verus with Constant Flow Technology is available in a range of configurations to suit the needs of various applications. Verus with Constant Flow Technology is offered as a plug-and-play kit consisting of a robust, aquaculture-duty Verus pump; paired with a heavy-duty outdoor-rated (IP55) variable frequency drive, and a flow meter.



Verus Pump with Constant Flow Technology.
(Flanges available as optional accessories. PVC pipe not included.)

Unlike conventional pumps that require manual valve adjustments, Verus with Constant Flow Technology is an integrated system that self-adjusts to deliver the user's established flow rate, even as system conditions change.

- Available in ratings from 5 hp to 15 hp; suitable for flow rates up to 850 gpm (193 m³/hr).

For more info, visit PentairAES.com



AQUATIC ECO-SYSTEMS

Phone Orders and Tech Advice: +1 407 886 3939
Online Orders: PentairAES.com
Email: PAES.General@Pentair.com
2395 Apopka Blvd., Apopka, Florida 32703, USA

© 2015 Pentair Aquatic Eco-Systems, Inc. All Rights Reserved.

Histopathology

Representative images of histopathological analysis of shrimp in the different treatments are described in figure 4.

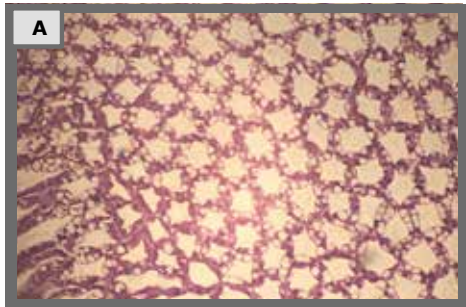
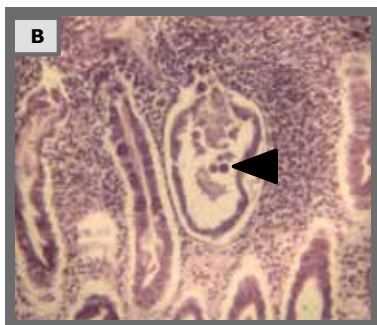
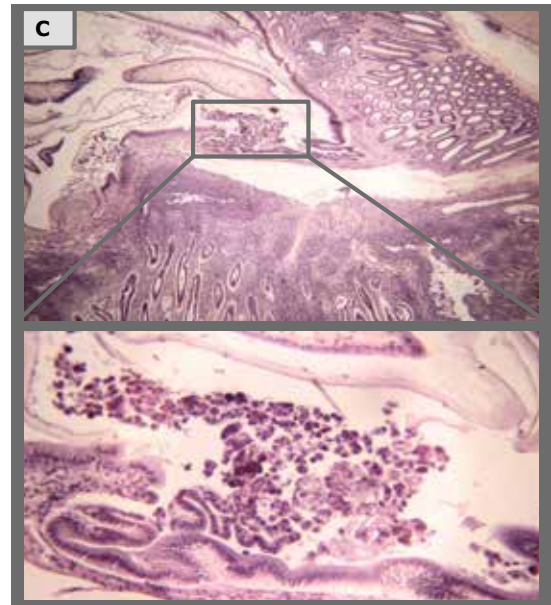


Figure 4. (A) Negative control: normal histology hepatopancreas, with differentiated cell types, notable B-cells with vacuoles.



(B) Positive control (4 dpi): Rounding and sloughing of hepatopancreas epithelium cells due to *V. parahaemolyticus* toxin (arrowhead) in a necrotising tubulus, surrounded by thick haemocytic encapsulation.



(C) Positive control (10 dpi): severe haemocytic infiltration around hepatopancreas tubuli, sloughing of cells out of the hepatopancreas into the stomach combined with loss of cell types (B-, F- and R-cells).

PROTECTING YOUR CROP
with superior and performance-proven probiotics



shapingaquaculturetogether



Microbial selection for hatchery and nursery



Probiotic for grow-out shrimp feed



Probiotic for use in ponds



Unique probiotic wafers for use in ponds



Our probiotic strains are selected to inhibit *Vibrio* and other pathogenic bacteria. Because they produce enzymes, they help the shrimp digest food while keeping both the water quality and the pond bottom at optimal levels. Ultimately, our probiotics will help you produce faster growing and stronger shrimp.



For more information: www.inveaquaculture.com

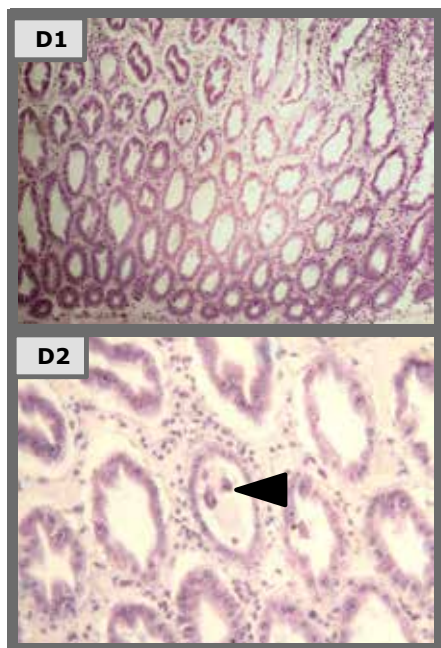


Figure 4. (D) PRO-2 (10 dpi): Rounding and sloughing of hepatopancreas epithelium cells were observed sporadically (arrowhead D2). Epithelium height was reduced compared to NC, but loss of cell type differentiation was less pronounced (mainly less B-cells). Haemocytic infiltration was less profuse, with interstitial space appearing more fibrous.

Reference

Corteel, M. and Decamp, O. 2014. Holistic approach to combat EMS/ AHPND. *Aqua Culture Asia Pacific*, Volume 10 (4), July/August 2014, pp 18-22.

Conclusion

The AHPND challenge model developed and standardised for this study resulted in a mortality curve of the positive control group which reaches its maximum after several days, but does not wipe out all the inoculated shrimp. This pattern of mortality is more in line with AHPND outbreaks observed in shrimp farms. It also offers a better chance for evaluating therapeutic interventions than many reported challenge models employing extremely high bacterial concentrations and hyperacute mortality.

The results of this laboratory study show that Sanolife PRO-2 and Sanolife PRO-W probiotics treatments by themselves have beneficial effects, such as higher survival and histological signs of hepatopancreas regeneration. However, similar to antibiotic treatments, probiotic treatments on their own are not sufficient to completely protect shrimp from diseases. For this, a holistic approach (Corteel and Decamp, 2014) which includes supporting and correcting the rearing system and shrimps health status at all levels during the production cycle is needed.



Dang Thi Hoang Oanh



Mathias Corteel



Olivier Decamp

Dang Thi Hoang Oanh is Head of the Department of Aquatic Pathology, College of Aquaculture and Fisheries, Can Tho University, Vietnam.

Mathias Corteel is R&D Engineer-Health for Inve Aquaculture, Belgium.

Olivier Decamp is Product Manager Farm and Feedmill at Inve Aquaculture, Thailand. Email: o.decamp@inveaquaculture.com

RAISING LIFE



NOTHING IS MORE PRECIOUS THAN LIFE, AND THAT'S THE PHILOSOPHY THAT DRIVES PHILEO.

As global population continues to increase, the world faces a growing demand for food and greater sustainability challenges.

Working at the crossroads of nutrition and health, we are committed to delivering future evidence-based solutions that enhance farmed fish and shrimp health and performance.

In each and every country, our team's progress is led by the most advanced scientific outcomes as well as the field input of experienced farmers.

phileo-lesaffre.com



Shrimp biofloc technology - efficient and biosecure operation system

By Nyan Taw

For sustainable and efficient intensive shrimp farming, consider these three major factors: farm biosecurity, energy efficiency and biofloc technology.

Shrimp farm biosecurity

Farm biosecurity begins with the design and construction of the farm. Historically, the development of shrimp farms started with ponds utilising simple water flow-through systems in the 1980s. Later, reservoirs to treat incoming water before use were established. The main purpose of reservoirs was to have consistently good water quality, mainly with regard to salinity, temperature and pH as well as the presence of the correct species and amount of phytoplankton in the reservoir and the culture ponds. This will reduce stress to shrimp as well as minimise the presence of *Vibrio* from the incoming water. In the early 2000s, prior to the introduction of biofloc systems in Asian shrimp farming, green water was normally used in shrimp ponds or in hatcheries. Before stocking post larvae, there should be a certain level of phytoplankton developed in pond water.

Today, modular systems using reservoirs to treat incoming water and minimising water exchange in the culture ponds provide the biosecurity required to control emerging viral problems (Taw, et al 2002; Taw, 2005; Taw, et al 2007). In fact, the shrimp biofloc system was adapted from systems which utilise low water exchanges. These systems develop phytoplankton first and later a cross over to biofloc colonies. The major differences are with the use of molasses or grain pellets as the carbon source to increase the ratio of carbon: nitrogen (C:N), use of aerators throughout the culture duration and the use of 10% more energy input is to provide the dissolved oxygen required by heterotrophic bacteria within a biofloc colony (Taw, et. al 2004; Taw, 2005; Taw et.al, 2012; Taw et.al 2013; Taw, 2014 and 2015).

As biofloc technology uses zero water exchange, it reduces risks of diseases entering the farm facility through the incoming water. However, in this case, reservoirs, culture ponds, water supply, discharge canals and gates need to have the same level of biosecurity. The practice is to develop flocs in culture ponds. Water from reservoirs is used to compensate for pond water loss from evaporation and to replace water lost through siphoning while cleaning ponds. With a biosecure farm design and construction, a biosecure operating system needs to be in place (Taw et al, 2009; Taw 2010, 2012). Recently, shrimp farms especially in Malaysia are required to have efficient waste water treatment systems before discharging water into the environment. Considering the major challenges faced by farmers today, biofloc technology appears to be the way to go.

Energy efficiency

In intensive shrimp culture systems energy is a major cost factor. An extra one hp used in a pond costs more not only in terms of equipment but also with costs for maintenance, energy and manpower. In Indonesia, Thailand and Malaysia, it is common for one hp of aeration to produce an average of 500 kg of shrimp in conventional intensive systems. However, in biofloc systems, the efficiency can rise to as high as 680 kg/hp (Kopot and Taw, 2004; Taw et al 2012, 2013).

“ Measuring shrimp production is much more accurate using energy input than by pond area (per hectare basis) as pond depths may range from 1.2 to >2.0 m... ”

At the Belize Aquaculture Ltd farm, McIntosh (2000) reported 450-550 kg shrimp/hp of paddlewheel aeration in culture ponds using the biofloc system. With partial harvesting, the efficiency can be at a maximum of 1,124 kg/hp (Taw, et al. 2008, Figure 1). McNeil (2004) reported that pressure differential piping (PDP) which produces slower-rising bubbles could achieve 700 kg/hp shrimp whereas paddle wheel aerators could produce between 400-450 kg/hp. A combination of paddle wheel aerators and PDP has better efficiency (Taw, et al. 2008). Measuring shrimp production is much more accurate using energy input than by pond area (per hectare basis) as pond depths may range from 1.2 to >2.0 m.

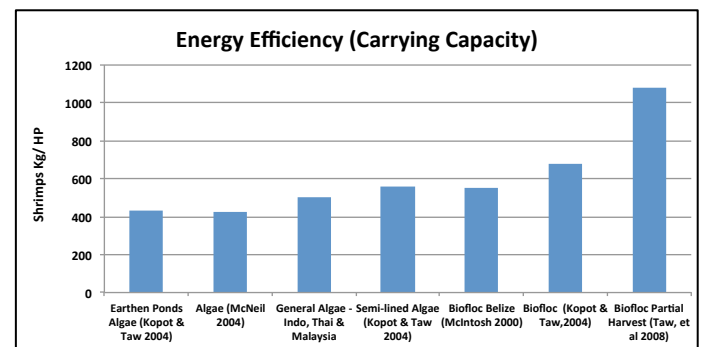


Figure 1. Energy efficiency of shrimp culture in algae and biofloc systems.

In shrimp biofloc technology system, the carrying capacity of the pond has to be determined for efficient and optimum production. This will depend on the size, depth and type of pond and availability of energy input. Another important factor will be the type and efficiency of aerators used. Basically, the farmers need to know the equipment being used. Aeration systems are not meant to increase but rather to maintain the dissolved oxygen (DO) levels in culture ponds, contrary to the perception of many technicians.

Paddle wheel aerators used for shrimp biofloc ponds in Indonesia and Malaysia can create effective water currents reaching an optimum length of 50 m and a maximum of 60 m. For HDPE lined ponds, the current could reach an optimum depth of 1.4 m and a maximum of 1.5 m only (Figure 2 and 3). With this level of efficiency, aerators need to be positioned to create optimum currents to suspend the biofloc colonies, clean pond bottom and direct sludge to the centre of the pond to facilitate siphoning when necessary (Figure 4).

Depending on the targeted stocking density, the number of aerators (energy input) and the correct positioning of the aerators are crucial. In shrimp biofloc systems, only 10% more aeration is needed if compared to phytoplankton system to provide available dissolved oxygen for heterotrophic bacteria. In addition, aeration using air blowers can also be applied.

The basic concept on currents created by aerators is that these currents do not block or cross (horizontal or vertical) so that optimum efficiency of the aerators is maintained. Studies showed that paddle wheel aerators (1 hp) with current flow of 500 m will produce 500 kg shrimp/hp. Shrimp biofloc systems do not need as much aeration as in fish biofloc systems. Excess aeration capacity of up to more than 45 hp/ha with an estimated efficiency of only 250 kg shrimp/hp has been observed in many shrimp farms using biofloc system. Many technicians are not aware that there are limits to dissolved oxygen levels in pond water, regardless of how much aeration is provided. The solubility of dissolved oxygen to saturation point, in waters of different temperatures and salinities was reported by Boyd (2001). Aerating without following any basic concepts on direction or position could lead to lower growth or mortality during operations. With correct positioning of paddle wheel aerators, there should be areas for feeding and resting, and sludge collection within the pond - aspects which are essential for shrimp health.

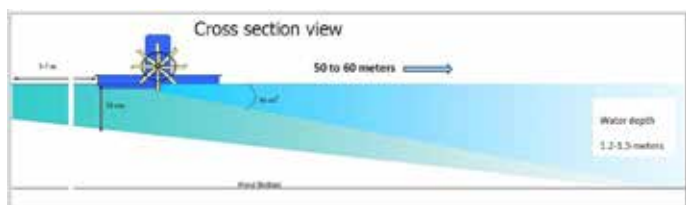


Figure 2. Efficiency of paddle wheel aerators



Figure 3. Paddle wheel aerators in operation

Shrimp biofloc technology

For optimal and sustainable commercial biofloc shrimp culture, HDPE or concrete-lined ponds are basic requirements. High stocking densities of 130-150 post larvae/m² and high aeration rates of 28-32 hp/ha are also essential for a production of more than 20 tonnes/ha. Energy efficiency is 680 kg/hp and can be as high as 1,000 kg/hp with partial harvesting. A maximum production of nearly 50 tonnes/ha has been achieved with stocking density of more than 250 post larvae in small HDPE lined ponds (Taw, 2005; Taw, et al 2008).

Taw (2014 and 2015) gave details for simple operational protocols on shrimp biofloc technology for commercial scale shrimp culture in large ponds. To achieve best results, only specific pathogen-free post larvae should be stocked. Using Imhoff cones for assessment, biofloc volumes need to be maintained below 10 mL/L for full biofloc and 5 mL/L for semi-biofloc systems. Green or brown water is acceptable, but black water is an indicator of abnormal conditions. Grain pellets and molasses supply carbon as needed. Generally, grain applications vary from 15 to 20% of



INSTANT ARTEMIA



- ✓ Ready to feed
- ✓ Vibrio free



INSTANT 1
LIVE INSTANT ARTEMIA
Easy and Consistency



INSTANT E
LIVE INSTANT ARTEMIA
ENRICHED
Enriched with Selco®
(contains Alfalfa)



M-Bryo
FRESH DECAPSULATED
ARTEMIA CYSTS
Intact membrane
and No leaching

www.iandv-bio.com
email: sales@iandv-bio.com

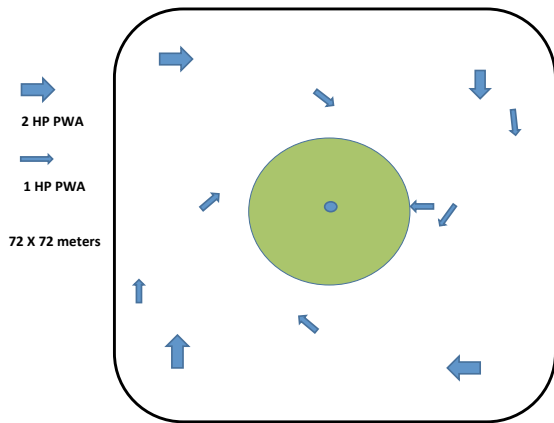


Figure 4. Positioning of paddle wheel aerators in 0.5 ha pond (15 hp/0.5ha)

the total feed used during operations at the early culture stages and increases to 25 to 50% nearer to harvesting. This depends on whether the system is full or semi-biofloc.

Dissolved oxygen concentrations need to be monitored frequently to keep levels higher than 4 mg/L. Particularly in biofloc systems, aerators need to be constantly monitored for malfunctions and repaired or replaced without delay, as the aerators need to operate at least 22 hours a day. The suspended biofloc must be readily available as feed for shrimp. Pelleted grain, a mixture of ground wheat, corn and soy with a protein level between 14 and 18%, and molasses are used to sustain C:N ratios above 15. This provides an inexpensive organic substrate on which bioflocs can develop, in addition to increasing C: N ratio. Shrimp feed could be high (35 to 40%) or low (29 to 30%) in protein. Molasses can be applied two or three times per week at 15-20 kg/ha. In addition to typically used chemicals such as dolomite and lime, kaolin applied at 50-100 kg/ha is required in the preparation of pond water and during operations. Kaolin particles suspended in pond water are thought to become the nucleus of the biofloc community in pond water.

Biofloc technology for biosecurity

Biosecurity or biofloc technology per se cannot prevent or control emerging shrimp diseases such as white spot syndrome virus-WSSV, infectious myonecrosis virus-IMNV or early mortality syndrome/acute hepatopancreatic necrosis disease- EMS/AHPND. With emerging new viral diseases such as EMS/AHPND in

Asia, preventive solutions have become essential for sustainable production in shrimp farming.

Biofloc technology was used in Indonesia without incidences of WSSV when this was a threat to shrimp farmers during the early 2000s (Taw, 2005 and 2011; Taw et al, 2010, 2011 and 2013). In the late 2000s, IMNV outbreaks in Indonesia caused huge losses to Indonesian shrimp farmers, before biofloc technology was adopted. During this time, a small shrimp farm in Northern Bali using appropriate biofloc technology protocols with strict biosecurity did not succumb to shrimp disease (IMNV, Taw and Setio, 2014). In Malaysia, biofloc technology was applied at the Blue Archipelago shrimp farm from October 2011 and since then is operating successfully without any incidence of EMS/AHPND (Taw, et al. 2013 and 2014). Shrimp farming with biofloc technology and disease prevention control was published by Taw (2014 and 2015).

In summary, field experiences has indicated that with strict biosecurity, energy efficiency and applying correct biofloc technology protocols, shrimp farms have much higher probability of efficient and sustainable production.

References are available on request



Nyan Taw, PhD is a consultant for the CRSD/World Bank Project, Vietnam. He was formerly Senior Technical Adviser/General Manager at Blue Archipelago Bhd, Malaysia. Previously he was a Chief Technology Advisor for FAO projects and Senior Vice President at the integrated shrimp farming companies, Dipasena and CPB in Indonesia.
Email: nyan.taw1@gmail.com



ARTICLE SUBMISSION

For details and guidelines
Email: zuridah@aquaaasiapac.com

Lucky Star
福星水產飼料

www.luckystarfeed.net

Revolutionary Hatchery and Nursery Feed for fish & Shrimp

Feed for Benefit

More on biofloc technology

Applications and factors influencing bioflocculation.

Biofloc technology (BFT) in aquaculture is based on the use of bioflocs which are conglomerates of microbes, protozoa and others. The microbial community is used to maintain optimal water quality and to recycle un-utilised feed materials. Here fish or shrimp production is looked upon not as a separate entity in the pond but rather as part of the whole interactive eco-system, made out of the pond's physical features, chemical interactions and a complex biota, and fish/shrimp as its components (Avnimelech, 2015).

The success and efficiency of BFT is based upon a comprehensive philosophy of knowing and controlling the pond system. Among several factors affecting the microbial bioflocs is the air input through aeration. Bioflocs contribute to nitrogen removal and therefore can improve water quality.

During World Aquaculture 2015, Jeju, Korea, the half-day session chaired by Prof Yoram Avnimelech, Technion, Israel Institute of Technology, looked at some research on biofloc in shrimp and fish farming and on some of the uses of BFT in Asia. Several Korean research institutes and universities are active in BFT research and presented their work in other technical sessions.

Three phase BFT system in greenhouse

In-Kwong Jang gave the history of this commercial-scale greenhouse shrimp production system with no water exchange

at the West Sea Fisheries Research Institute, NFRDI, Korea. This was set up in 2009 and since then has produced 3-6 kg/m² Pacific white shrimp, *Litopenaeus vannamei*. In 2013, the system was remodelled to a 3-phase production system with nursery (90 m²), intermediate culture (187 m²) and grow-out (356 m²) tanks. The complex of air lifts and many water-injectors were replaced with venturi nozzles which improved efficiency of water circulation and oxygen concentration.

In 2014, the first trial for the 3-phase system was conducted. Animals were cultured for 53, 60 and 84 days, and production was 2.35, 5.87 and 4.33 kg/m² in phase 1, 2 and 3 tanks, respectively. The second stocking of post larvae to phase 1 tank was made in June after harvesting the first nursery cultured post larvae. Production from phase 1 and 2 in the second round was 4.44 and 5.73 kg/m² respectively. The harvest from phase 3 two months after the first harvest was 4.27 kg/m².

This new 3-phase system can stock and harvest shrimp every two months, producing shrimp six times a year, at a production rate of 4.33 kg/m² of shrimp with 21.3 g average body weight (BW) over 197 days. Each phase is for two months. Although there was no water exchange throughout the culture, water quality parameters were acceptable to growth and survival of the shrimp. Comparing with the previous system, this 3-phase system can enhance production up to two to three times.

Artemia culture with biofloc

Nguyen Van Hoa and the team from the College of Aquaculture and Fisheries, Can Tho University, Vietnam, assessed the possibility of BFT for *Artemia* culture in the Mekong Delta of



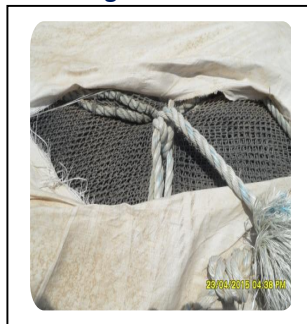
Fish Cage Materials for Sale



National Aquaculture Group - Wishes to find genuine buyer for **FISH CAGE MATERIALS** New & Used (Good Condition) on terms as & where basis. Interested parties are invited to submit their proposal to purchase by indicating type of material & offer buying price. Full detail of material & quantity may be obtained by contacting the below address.

Material is available for inspection at our site located at 175 K.M. Jizan Highway Road (South of Jeddah) Al-Lith-21961, Kingdom of Saudi Arabia.

Fish Cages Nets



Origin : Chile

Fish Cages Bracket



Origin : Turkey

Work Barge (Platform)



Origin : Turkey

HDPE Pipes 355mm, SDR 17



Origin : KSA

For further details please Contact: National Aquaculture Group - Head - Materials Management & Purchase Dept.
Ph: +966 17 732 9999 Ext: 9400 Fax: +966 17 7329000 E.mail: purchase@naqua.com.sa Website: www.naqua.com.sa



Shrimp pond applying semi-biofloc in Bali, Indonesia

Vietnam. There were two treatments using BFT in *Artemia* ponds at salinities of 80 and 100 ppt which were compared with two treatments of traditional culture (control) with the same salinity for 6 weeks. Cassava powder combined with chicken manure were used as a carbon source (C:N>10), and were added to the culture ponds every 3 days to stimulate biofloc development.

Results showed that survival and growth of *Artemia* after 2 weeks of culture were not significantly different among treatments ($p>0.05$) and vary in the range of 65.3-69.7% and total length of 6.7-7.3 mm, respectively. However, the fecundity and *Artemia* cyst yield in the biofloc treatments were higher than in the control, though not statistically different at $P>0.05$.

Biofloc and fleshy shrimp

Most of the reported work on bioflocs has been on the vannamei shrimp. Su-Kyoung Kim and the team at the Department of Aquaculture, West Sea Fisheries Research Institute, NFRDI, Korea looked at the effects of biofloc on growth and immune response of fleshy shrimp *Fenneropenaeus chinensis*. They cultured 400 post larvae (average BW 29.4 mg) and 20 adult shrimp (average BW 15.2 g) in three treatments: biofloc, mixed (50% biofloc) and clear seawater as the control. They also investigated immune activity and the mechanical function of the third maxilliped to collect biofloc in a water column.

The findings indicated that survival rate was significantly different between biofloc and clear seawater ($P<0.05$). Data on final body weight and survival rate of adult showed an opposite trend when compared to post larvae which was explained by the difference with setal morphological structures on the third maxilliped in post larvae and adult. Post larvae have short serrulate setae comprising of a small 'net' structure but, in adults, this changed to long and dense plumose setae. With regard to immune response, the mRNA expression levels of all immune genes in post larvae of the biofloc groups were significantly lower than those in the control group.

Biofloc and glass eel

At the Faculty of Fisheries and Marine Science, University of Brawijaya, Indonesia, research was conducted on BFT for the farming of the glass eel *Anguilla bicolor* for two months. Mohamad Fadjad reported that the biofloc treatments comprised three carbon sources, rice bran flour, sago, and tapioca, and the control was without biofloc. BFT significantly affected eel

survival rate with the highest (82.22%) with rice bran. Growth ranging from 0.48-0.75% BW/day was not significantly different in the treatments, although the tapioca fed group grew faster. Water quality values for ammonia (0.12-0.14 ppm), nitrite (0.03-0.05 ppm), nitrate (3.4-4.2 ppm), and alkalinity (134-142 ppm) were significantly better than in the control treatment. Temperature, pH and dissolved oxygen values were not significantly different between control and biofloc treatment tanks.

Growth and immune response

To study the effect of biofloc on shrimp performance, Cho-Rong Lee and teams from the Department of Marine Life Sciences, Jeju National University, Neo Environmental Business Co and the Department of Animal Life System, Kang Won National University, Korea, conducted a 56-day indoor feeding trial. This was to evaluate the effect of dietary supplementation of biofloc on growth performance, feed efficiency and non-specific immune response of *Litopenaeus vannamei* against *Vibrio harveyi*. They used a fish meal based diet as control and experimental diets had dietary inclusion of biofloc material at 0.5, 1.0, 2.0, 4.0, 6.0 and 8.0% inclusion rates.

Results showed that shrimp fed diets with 4.0% inclusion rates showed significantly higher growth performance than shrimp fed the control diet. However, non-specific immune responses were not significantly affected by dietary biofloc level. The group fed 4% biofloc in diet exhibited significantly higher disease resistance during a *Vibrio harveyi* challenge.

Aeration and nitrogen removal

In BFT culture tanks for fish, aeration intensity input has an important influence on the dissolved oxygen (DO) concentration in the water, settling of flocs and mixing of water. Jong-Heon Jeong, Department of Molecular Biology, Dong-eui University, Korea did a study on how DO levels and water mixing influence inorganic nitrogen compounds removal in BFT systems.

The findings reported that the adequate aeration intensity was 1 L/min to 1.5 L/min air input to maintain a stable low concentration of inorganic nitrogen. On whether changes of pH and inorganic nitrogen concentration could be associated with the DO concentration, experimental regimes were set up at three different DO concentrations (5-6 mg/L, 7-8 mg/L, 9-10 mg/L), and aeration intensity was adjusted to 1 L/min. They found no clear relationship between DO concentration and changes of ammonia and nitrite concentrations.

In Egypt, Ashraf Suloma and team at the Fish Nutrition Laboratory, Animal Production Department, Cairo University investigated the contribution of microbial biofloc to nitrogen removal. They studied the effects of pH, alkalinity, DO, ammonia, organic carbon and water temperature on the water quality and microbial community structure with BFT system. Treatments were conducted in 70 L tanks holding tilapia, fed with tilapia feeds and carbon source. Bioflocs were harvested and analysed. Preliminary results indicated that low oxygen level led to decreased biofloc level, zooplankton abundance, pH and nitrate. Work is still ongoing to sequence the fraction generated from PCR-DGGE (Denaturing Gradient Gel Electrophoresis) analysis.

References

Abstracts and text of presentations at World Aquaculture 2015, Korea. <http://www.was.org/meetingabstracts/default.aspx>
Yoram Avnimelech, 2015. Biofloc Technology—A Practical Guide Book (Third Edition, 2015). The World Aquaculture Society, 2015.



Farming, it's what we do.

"I have used NuPro from Alltech from day one and have seen great results in weekly growth. Recently I switched to Bioplex® organic minerals from Alltech in my shrimp and fish farm. Alltech products are really good quality and gave excellent results, hence I recommend them to others."

— Obul Reddy, Gudivada, Andhra Pradesh



For more information please email
AquaAP@alltech.com or visit
Alltech.com/aquaculture

Alltech®

Alltech.com  AlltechAP  @AlltechAP

Aqua Feeds 2.0: From Farm to Plate

As industry strives to overcome challenges with fish meal replacement, health and environmental impacts, communicating what it is doing is important.



Breakout session: the group discussing challenges and strategies for marine finfish feed sector.

This year, the two-day TARS 2015 (The Aquaculture Roundtable Series) was on Asia's aqua feed industry and discussions focused on innovative approaches to optimise feeds and feeding along the supply chain from broodstock to farm. Experts led discussions on topics covering the state of the industry and science, broodstock and early stage feeding, targeted grow-out feeds, sustainability and health interactions, and innovation and branding to plate. In this report, AAP looks at the presentations in the latter two sessions. This is a follow-up to the report in issue September/October 2015 (see pp on 17-29) which covered the state of the industry and science, early stage and targeted nutrition.

Aquafeeds and responsible aquaculture

At this Aqua Feeds 2.0, **Dr Pedro Encarnaç o**, director, Business Development, Biomin Singapore Pte Ltd focussed on feeds and feeding management to reduce impact on the environment. "Our industry has a list of sustainability challenges which are biological, environmental and occupational; added to this, we have challenges that are related to consumer perception. Specifically, the aquafeed sector's contribution is with feed formulation and feed management to reduce waste outputs from feed. However, this also comes at an economic cost and may affect profitability of aquaculture operations.

"Minimising the impact on the environment by reducing waste is a responsibility of everyone along the supply chain. Feed is a main source of waste in aquaculture. Feed formulations should be dynamic, adapting to fish size, temperature and salinity. Feed millers should use a combination of feed ingredients and additives that best enhance the animal's health and performance but with minimum impact on the environment.

"We can select the proper ingredients to develop a feed that can deliver maximum growth and survival of fish and shrimp, while minimising waste. However, with replacements of fishmeal with animal proteins, we may have adverse effects on the immune systems, such as with the seabream in Europe. Therefore, sometimes we need to look beyond replacements.

"We can use additives to improve sustainability. In a field trial with pangasius production, phytogenics have an effect on the endogenous enzyme production. This improved feed efficiency resulting in increased profitability, by reducing feeding costs (\$/kg fish produced).

Encarnaç o concluded, "Our role is to optimise feed formulation, focus on feed performance and seek innovative feed strategies. Together with this, we also need to improve profit margins and reduce cost per kg of fish produced. Sustainability and ecologically sound fish farming is paramount to secure the future of the industry."

The next step in sustainable aqua feeds

In his presentation on the above topic, **Henrik Aarestrup**, Global Marketing Director, Biomar Group, Denmark recounted, "Until recently, fish was considered healthy natural products. As a 'natural' product, few people would question what the fish feeds on or how it was produced. When they now start to realise that the fish being consumed are farmed, perceptions change. As authorities spent millions to promote 'fish as healthy', we saw an explosion in farmed fish production and consumption in particular for salmon but also for seabass and bream in the Mediterranean, where almost 95% of seabream is now farmed."

Fish is an industrial product

"Now we see a new paradigm arising, where fish from aquaculture is being perceived by consumers as an industrialised food product. This in turn put demands on the aquaculture industry to act in a responsible and sustainable manner. These sustainable practices, however, need to be communicated to the consumers. While a lot of attention has, in the past decade, been focussed on the substitution of scarce marine resources, the new reality requires that aquaculture producers document the traceability and sustainability of every single ingredient utilised in the feed and that every single process in the value chain is performed in a responsible manner."

Aarestrup said concepts such as fish-in-fish-out gained importance in the last decade. Ethics on using fish to feed fish arose. Industry's immediate answer was to research into alternative diets. The next step is when feed producers document the traceability and sustainability of every single ingredient utilised in the feed and that every single process in the value chain is performed in a responsible manner.



From left, Thapanee Temrangsri, Progressus Asia, Thailand, Balaji Nakula, Nagahanuman Feeds, India, Ho Gim Chong, Nutriad, Malaysia, K. Venkata Raju, Avanti Feeds, India, Partha Bandyopadhyay, Biostadt India, Vilas Chandrakant Autade, DSM, India, Dhanunjaya Goud, Lallemand, India and Anuj Tyagi, Avanti Feeds India. Bandyopadhyay led a breakout table on Feeding Today's Shrimp (FTS).

Bright Science means optimal performance

DSM Animal Nutrition and Health is one of the world's leading suppliers of feed enzymes to the global feed industry. We offer the broadest range of feed enzymes developed to unlock the nutritional value of feed ingredients, decrease environmental impact and optimize feed cost.

Learn more at www.dsm.com/aquaculture or contact your DSM representative today.

RONOZYME® HiPhos

RONOZYME® ProAct

RONOZYME® WX

DSM Nutritional Products Ltd
PO Box 2676, CH-4002 Basel, Switzerland
www.dsm.com/animal-nutrition-health

 Follow us on twitter @DSMFeedTweet

HEALTH • NUTRITION • MATERIALS



Thomas Wilson



Ei-Lin Ooi



Diep Thanh Hai, Nutriad, Vietnam



Ramesh Gangatharan, Wenger India who led a roundtable on the aquafeed industry

“ We do not have much choice except to do what our markets demand of us. If the market wants us to reduce fish meal to be ‘sustainable’, then that is what we have to do. The question is how are we going to do that? ” - Wilson

“ When you complete a successful nutritional study on replacement of fish meal you may not be aware of the alternative ingredient’s impact on the animal’s health.. ” - Ooi

“BioMar has been one of the feed producers driving changes in the salmon feed. Fish meal and fish oil content has been lowered by more than 50% in the last decade. Increasingly, mainly vegetable

ingredients, but also processed land animal by products have been introduced. However, this change could have happened even faster, if it was not for certain conservatism among some farmers. We are now using 12-18 different ingredients in a typical diet versus the 5-7 different ingredients used a decade ago and optimisation of diets is now done daily.” Change is so rapid in the recipes that feed millers now print the labels at production instead of preparing standard labels.

Aarestrup provided details on how sustainability is being integrated into feed formulation by the company. “With BASF, we evaluated all the ecological impacts of all of our feed ingredients and transformed these impacts into index figures, which can be used in our recipe formulation software just like the nutritional demands of the fish and the nutritional profiles of each feed ingredient. This way we can make it possible for our customers to make informed choices. We can help them to achieve the optimal

SMART NUTRITION FROM THE START

As the leading source of menhaden fish oil and fish meal, we’re helping animal nutritionists around the world take advantage of the proven benefits of omega-3 fatty acids and the superior amino acid profile of fish protein.

When added to animal feeds, fish oil and fish meal may improve intelligence in dogs and cats, help give baby pigs a head start to a strong immune system, and help improve the reproductive health and performance of livestock.

When used in aquaculture feeds, fish oil and fish meal provide finfish and crustaceans with the essential nutrients they need for optimum growth and development.

FISH OIL FISH MEAL FISH SOLUBLES

OMEGA PROTEIN®
Healthy Products for a Healthy World®
omeganutrient.com 877.866.3423

Sustainable, Traceable, & Environmentally Responsible Products from Omega Protein





Orapint Jintasataporn, Faculty of Fisheries, Kasetsart University, Thailand (left) with Nuttapon Muangsuwan, Charoen Pokphand Foods Public, Thailand



Henrik Aarestrup



Chandrasekar Sankaranarayanan, INVE Aquaculture, India.

balance between feed performance, production economy, and sustainability. We can also help them to perform life cycle assessments on their products and calculate the environmental footprints throughout the whole supply chain.

“Ours and the industry’s focus must move from looking at the sustainability of individual ingredients in the feed to a more complex calculation which involves evaluating the sustainability and health consequences of all ingredients used in the feed and all production processes in the value chain. It is today fully possible to design fish feed according to nutritional needs, production economy, and sustainability at the same time.

“This is a challenging task which will ultimately change the structure of the whole aquaculture industry,” said Aarestrup.

Challenges with replacing fish meal

Dr Thomas Wilson, Aquaculture Nutrition Consultant, Thailand, focused on the formulation strategies to re-balance nutrients, maintain growth and health.

“For more than 30 years, researchers have worked to replace fish meal with alternative ingredients, sometimes with significantly poorer performance and sometimes with complete failure. Useful alternative ingredients to replace fish meal are animal proteins, by products from meat and seafood processing, plant proteins from the edible oil industry, and others such as single cell protein and seaweed. Nevertheless, the feed industry in Asia needs to carry out more work on fish meal replacement for our farmed species,” said Wilson. “We do not have much choice except to do what our markets demand of us. If the market wants us to reduce fish meal to be ‘sustainable’, then that is what we have to do. The question is how are we going to do that?”

BRINGING TOGETHER INNOVATIVE TOOLS FOR CUSTOMIZED AQUAFEED PROCESS SOLUTIONS.

Great things are done by a series of small things brought together. —Vincent Van Gogh

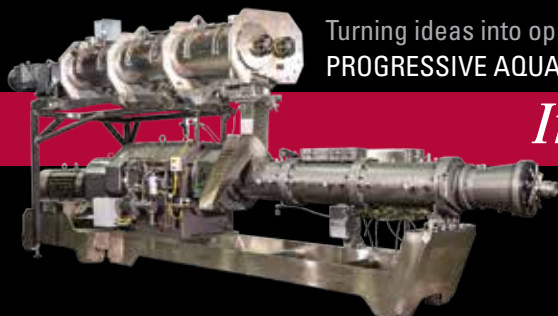
Wenger develops and assembles unique components that allow our clients to meet specific industry and application demands. Whether dictated by raw material availability, species requirements, growth stages or feeding habits, Wenger will tailor a system to meet your specific needs.

The Wenger C²TX Shrimp Feed Extruder – with unique die technology and high shear conditioning – is the superior choice for uniform, high density aquatic feeds down to 0.8 mm in size.

If maximum volume is crucial, the Wenger TX-3000 High Capacity Aquafeed Extruder produces the full range of products – at capacities up to 12,000 kg/hour. Complement the TX-3000 with the High Intensity Preconditioner (HIP) and use higher levels of fish oil or slurries.

We’re ready to help you select the right tools. Contact us now for industry-changing designs backed by the leading name in extrusion.

Turning ideas into opportunities.
PROGRESSIVE AQUAFEED PROCESSING



Imagine the possibilities



wenger.com

BELGIUM TAIWAN BRASIL CHINA INDIA

The industry in Europe has moved on to reducing fish meal with plant proteins in salmon whilst here in Asia, nutritionists are still looking for answers.

Know the ingredients well

"Here in Asia, many alternative ingredients that have been researched on are not available locally but we assume what we buy is the same thing, and we use the NRC book values instead of doing actual ingredient analysis.

"To replace fish meal successfully, study the specifications of alternative ingredients and determine their origin, characteristics, anti-nutritional factors, and industrial methods used in their production. For example, cooking and drying temperatures affect nutrient digestibility and available lysine may be reduced."

Using an example of three 58% protein meat meals and one 48% protein meat and bone meal, Wilson demonstrated the effect of processing on the apparent *in vivo* amino acid digestibility for tilapia.

His advice is that whenever possible, the nutritionist should have data from actual ingredient analysis and only in its absence, use book values. "It is essential that industry shares information about ingredients, and it does not matter if the data are old or whether ingredients are still in use.

Formulators everywhere will benefit from having such information." (See information on Asian Aquaculture Feed Formulation Database (AAFFD) group in Aqua Culture Asia Pacific, September/October 2015, p18).

In addition, Wilson said that in Asia, we also have many species with unknown nutrient requirements. "With grouper, research has been done for several species, and we combine all these data to create a composite requirement for our species. Are all the groupers the same? The answer is probably not!"

"Failure of an alternative ingredient in replacing fish meal may have little to do with the raw material itself, but arises because removing fish meal and using an alternative ingredient leads to several problems. Firstly, this reduces supply of essential nutrients or adds anti-nutrients that have negative effects on the digestive system, hormones, metabolism, physiological or biochemical processes, and health. Secondly, it creates nutrient imbalances and nutrient antagonisms, and lastly, it reduces feed palatability and feed intake. Thus, the feed formulator has to make the adjustments or add feed ingredients/additives to restore nutrient balance, growth, or health," said Wilson.

Challenges with plant meals

Wilson elaborated with an example on tilapia feed formula. He reduced fish meal from 32% to 20%, 10%, 5%, and 0% and substituted protein from soybean meal, canola meal and corn gluten meal, and showed how essential nutrients decrease and anti-nutrients increase.

"Replacing fish protein with plant protein decreased lysine marginally from 6.11% to 5.08% but reduced methionine from 2.31% to 1.36%. At the same time, cysteine increased, but cysteine cannot replace all of the functions of methionine. Adding synthetic methionine (DL-Met) might be best, but today, there are supply issues with methionine, making it an expensive ingredient (around USD 5/kg). We could also blend complimentary ingredients such as soybean meal (low in methionine) with sesame meal (high in methionine) to raise methionine levels. This is the preferred method for shrimp feeds, where leaching of water-soluble amino acids is a concern."

Wilson continued with a discussion on managing anti nutritional factors (ANFs) such as phytate, non-starch polysaccharides (NSPs), saponins and tannins. When feeds contain considerable amounts of phytate, adding phytase is the best solution. Citing phytase research with channel catfish that showed a 2,000 TIU dose took 8 hours to eliminate phytate, he said animals with fast gut passage times might require higher enzyme dosing to be effective.

NSPs interfere with gut viscosity and function and may impair nutrient uptake. Adding enzymes like xylanase is the most cost effective way to reduce the effect of NSPs. Both saponins and tannins reduce feed intake, and saponins increase gut wall permeability as well, so it is preferable to purchase low saponin or low tannin ingredients. If it is unknown whether a particular species is sensitive to saponins, Wilson recommended feeding high saponin feeds, followed by histological analysis of the gut to see if there was any damage.

Sustainable alternative ingredients

Wilson then discussed the pros and cons of fish acid silage, fish solubles and marine protein hydrolysates (MPHs). Research on fish silage showed that different acids such as formic, hydrochloric, sulfuric, propionic produce different qualities and taste of silage, and that excessive hydrolysis would result in high concentrations of free amino acids, which may degrade to ammonia. Fish solubles from seafood processing or fish meal manufacturing are good sources of peptides, free amino acids and nucleotides. Total replacement of fish meal by silage or solubles is not recommended because they are not complete proteins and quality is highly variable.

The advantage of MPH is that they are made from enzyme-digested by-products of seafood (tuna, tilapia, squid and krill) by controlled batch hydrolysis, which gives a uniform and consistent batch-by-batch product. The choice of the right enzymes allows fine-tuning of the peptide profile and creates MPH with a high percentage of di- and tri-peptides.

"As MPHs are made from intact proteins, they have nearly the same amino acid balance as fish meal and can be recommended to replace fish meal at high replacement rates. Furthermore, in addition to improving feed palatability, enzyme digested MPHs from crustacean and fish by-products have been shown to have other important functional benefits, including functional binding



Philippe Tacon, Phileo-Lesaffre Animal Care, France (left) and Ma. Patricia Rico, SanteH Feeds Corporation.



Dang Thi Thuong, Vinh Hoan Corp, Vietnam (right) and Bui Van Canh, Vietnam



From left, Dr Wee Kok Leong, Gold Coin Aqua, Malaysia, Ramakanta Nayak, Nutreco Asia and Chawalit Orachunwong, Charoen Pokphand Foods Public, Thailand.



Marc Campet (centre), led a roundtable for freshwater feeds with David Serene, EWOS Vietnam (right) and Indra Febriantoro, PT Matahari Sakti, Indonesia (left).

properties that improve physical quality of feeds. They also provide free amino acids, low molecular weight peptides and nucleotides to improve growth of larval fish with non-mature digestive systems.

“Aquativ (SPF-Diana Group) was able to obtain a European patent (WO2014114767) for its crustacean protein hydrolysate for maintaining and/or promoting gut health of cultured fish based on research with European seabass, red seabream and olive flounder. The claim included improved performance such as feed conversion ratio, improved growth and survival of fish when fed low fish meal diets with added MPH. Research also confirmed stimulation of intestinal epithelium development, enhanced nutrient assimilation and enhanced resistance to pathogens.”

The take home message is for nutritionists/formulators not to be afraid to try substitutes that are of plant or marine origin. “It

is important that industry in Asia replaces fish meal. The industry in Europe has demonstrated that this can be done with success. Nutritional imbalances of ingredients can be counteracted by supplementation of feeds with functional feed ingredients and functional feed additives.”

Nutrition and health balance

“When you complete a successful nutritional study on replacement of fish meal you may not be aware of the alternative ingredient’s impact on the animal’s health.” With changing ingredients, diet formulations and genetic stocks, understanding the building blocks of nutrition and health is important to ensure health of the animal,” said **Dr Ei-Lin Ooi**, regional technical and research manager at the Aquaculture Centre Asia Pacific, DSM, Thailand.



Your global technology process supplier for the aqua feed industry



ANDRITZ is one of the world's leading suppliers of technologies, systems, and services relating to advanced industrial equipment for the aqua feed industry. With an in-depth knowledge of each key process, we can supply a compatible and homogeneous solution from raw material intake to finished feed bagging.

ANDRITZ Feed & Biofuel A/S
Europe, Asia, and South America: andritz-fb@andritz.com
USA and Canada: andritz-fb.us@andritz.com

www.andritz.com



Mai Anh Tuan (left) and Nguyen Quoc Viet, Behn Meyer Vietnam Co Ltd



Watcharapong Poomongkutchai (right) with Chantana Thuwadaratrakool, Cargill Thailand

“The need to balance nutrition and health was clearly observed in a study with Senegalese sole. At first glance, the replacement of dietary fish meal protein by a mixture of plant protein sources did not adversely affect feed intake, growth or protein utilisation. However, increased vacuolisation and necrosis were observed in the hepatocytes,” added Ooi.

“Fortunately today, the industry has more tools to delve deeper into the effects of ingredients and diets. In a nutrigenomics analysis on the partial substitution of fish meal in diets for the Atlantic halibut, no significant difference in feed conversion ratio (FCR) and weight gain was shown. However, there were indications of down regulation of genes for muscle structure, physiology, lipid transport and metabolism and up regulation of immune related genes and detoxification genes.

“All these underlined the need for nutritionists/formulators to make the link between different components of diets and how they impact health. We need to understand the immune response and survival when animals are exposed to various stressors,” said Ooi.

Nucleotides

As basic building blocks for DNA and RNA, nucleotides are essential for cell growth and physiological function. Their inclusion can also up-regulate leukocytes cell count and increase the survival of tilapia challenged with *Streptococcus inae*. Dose response studies show that nucleotides improve general shrimp immune response by up-regulating of haemocytes, semi- and granular cells and prophenoloxidase of haemocytes. Nucleotides can also improve the vaccination response.

Local regulations should be considered concerning the status of this product in the country of destination. All information only for export outside Europe.

BOOSTED ENZYMES

Olmix keeps innovating in **Algae** and **Clays** to boost the enzymes efficacy in the intestine.



Improved performances



Feed+

www.olmix.com





Serge Corneille



Piyapa Erber (right) with Saisampan Tanmanee, Biomim



Pedro Encarnação

Amino acids and lipids

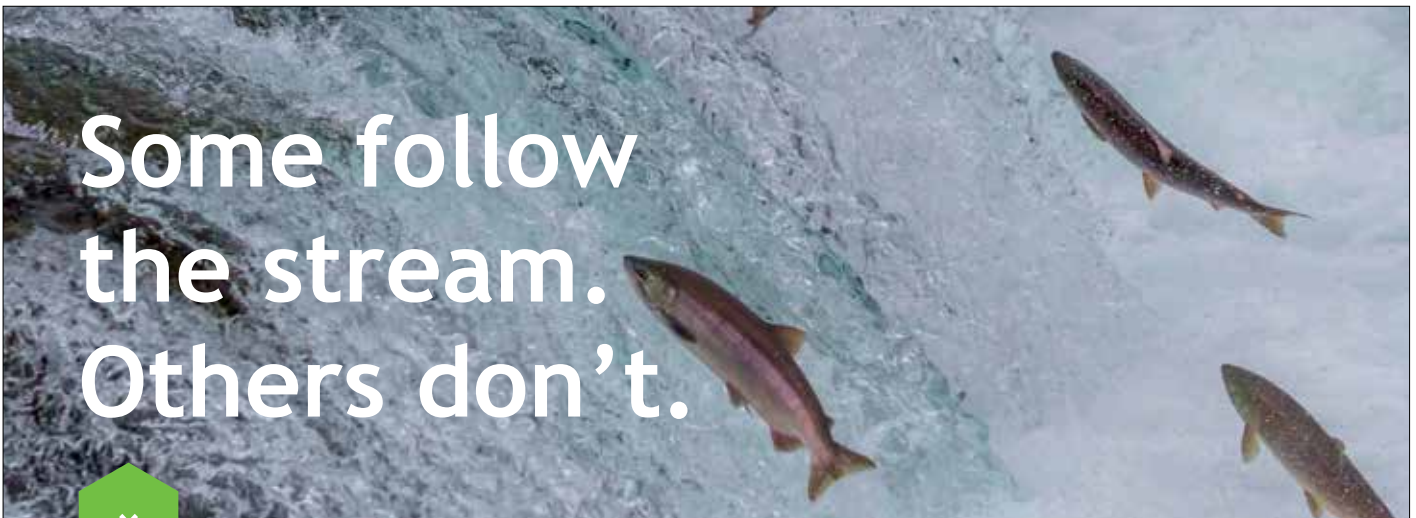
“Arginine (4%) and glutamine (2%) and their combination have been shown to improve antibody response in channel catfish fed for two weeks prior to vaccination against *Edwardsiella ictaluri*. Glutamine is important for the production of cytokines and phagocytosis while arginine is an important precursor for nitric oxide, phagocytosis and cell cytotoxicity,” said Ooi.

“In replacing fish oils with vegetable oils (linseed, soybean oil and a 50:50 blend of these oils) in the gilthead bream, the soy oil group exhibited markedly higher Mx expression (Mx genes are involved in antiviral defences) with poly I:C (synthetic dsRNA) simulation which mimicked a virus infection. In addition, fish fed a vegetable oil blend exhibited a higher prevalence and intensity of parasites when challenged.”

Vitamins and minerals

Aside from the nutritional effects of vitamin deficiency, the interactions between vitamins are also important. A study showed that high dosages of vitamin C (3 g/kg diet) and vitamin E (1.2 g/kg diet) act synergistically enhancing respiratory burst of seabream phagocytes.

Trace minerals have multiple roles, from immune response development (zinc, copper, selenium) to structural integrity of tissue through collagen synthesis (zinc and copper) and gene expression (zinc). Ooi discussed a study which showed how rainbow trout fed zinc and manganese deficient diets had NK cells with reduced cytotoxic activity, but recovered when fed trace mineral sufficient diets.



DISCOVER OUR AQUACULTURE RANGE

Nutriad’s multidisciplinary team of nutritionists, micro-biologists and feed technologists focuses on understanding species-specific problems in fish and shrimp. That is the starting point of true innovation. Our senior aqua feed experts have farm-to-fork insight in the aquaculture food chain. They provide world-wide expertise in formulation and processing of aqua feeds. Nutriad’s aqua additives directly contribute to improved productivity and profitability for producers of (feed for) fish and shrimp.

Interested? Let’s get in touch: visit nutriad.com for your local contact.





From left, Teddy Njoto, PT Matahari Sakti, Indonesia, Dr Daranee Sookying, Gold Coin Specialties Thailand, Mathieu Laissus, InVivo Vietnam and Christopher G. Co, Oversea Feed Corporation, Philippines.

Health assessment

There are different approaches to assess immune responses, ranging from cell characterisation and function, production of antiviral and antibacterial peptides, as well as cytokines and gene expression. Flow cytometry assesses cells by sorting them by size and complexity. Fortunately, current genomic databases have been expanding and available online. Microarrays can be used for differential gene expression analysis whilst the enzyme-linked immunosorbent assay (ELISA) is for immunoassays.

“However, disease challenge is one of the best measures of a total response of the animal’s immune system. Although animal challenge models are useful, it may not be easy to achieve the targeted results. There are factors to consider such as genetic strains of the animal and their resistance level and culture conditions. With regard to the pathogens, we need to know how to culture and maintain virulence and ascertain the dosage. The experimental design is also important to provide valid results, such as the number of animals per replicate and the number of replicates per treatment.”

Ooi’s message is that “a better understanding of the impact of nutritional status on health will help the industry meet the challenges of maximising productivity for the next generation of performance feeds.”

Innovation to plate

Moving away from mainstream aqua feed production, two presentations looked at the aqua feed industry from two different perspectives. How can aqua feed be used to innovate farmed fish to play a larger role in human health. In his presentation, **Dr Serge Corneillie**, Alltech, Japan described the DHA story: Aquaculture’s contribution to human health (for details, see article DHA in seafood for human health, in issue September/October 2015, pp31-35). This was followed by a need for the aqua feed industry to be proactive and communicate to buyers and markets the challenges and efforts of the feed industry to support sustainable aquaculture in Asia.

Corneillie said, “FAO recommends a daily intake of 250 mg docosahexaenoic acid or DHA and as such we can position farmed fish vis-à-vis human health aspects at the consumer level. As the aquaculture industry has been attacked with its farming practices, this is our big chance to show how we can impact human health in a good and sustainable way with using alternatives to fish oil. At the same time, we can add value to farmed fish and brand products.”

Algae and DHA enriched tilapia

On the source of DHA, Corneillie described some recent developments with using algae in yellowtail and tilapia. The trials

indicated that total replacement of fish oil with DHA from algae meal is possible without adverse effects on growth. Tilapia can be enriched with DHA which can be appealing as a premium product.

“Our future is with algae, a sustainable product which will not limit growth of the fish business. However, algae is expensive but the required levels are lower for the same benefits when compared to fish oil. In the case of the yellowtail, diets with 1% algae meal gave the same growth performance in terms of weight gain and feed conversion ratio as fish fed diets with 5% fish oil.

“With the production of tilapia enriched with DHA, trials showed that four diets with varying levels of algae meal (0, 0.2, 0.4 and 0.8%) with DHA levels up to 2.93 mg/g in diets increase weight gain and DHA in fillet. In terms of costs, adding 0.8% algae will increase feed costs from USD 650/kg to USD 770/kg. With a feed conversion ratio of 1.6, the feed cost/kg fillet increases to USD 3/kg fillet from USD 2.44/kg fillet.”

“In the near future, we are likely to be looking at cost/kg fish to cost/g DHA, branding and labeling DHA content in fish products and the production of high DHA fish sticks” said Corneillie.

Communicating what we do

Perspectives on the aqua feed sector through the eyes of the consumer and on what the market expects from the industry was provided by **Marc Campet**, Virbac Vietnam. Campet presented “Growing the aqua feed industry- getting communication right,” on behalf of the author **Anne Laurence Huillery**, Production Coordinator and Sustainability Officer for the leading tilapia producer, Regal Springs.

A perspective from the feed consumer

Regal Springs is a vertically integrated company with an annual production of 100,000 tonnes of tilapia in cage farms in Mexico, Honduras and Indonesia. Production in open water bodies requires the company to be cognisant with environmental impacts of its farming. In the last 5-6 years, Regal Springs has taken a proactive role in the development of sustainable aquaculture.

In Honduras, nearly all its requirements is supplied by a joint venture feed mill and a small feed mill which supplies starter feeds in Indonesia. More than 70% is supplied by toll manufacturing or third party suppliers. As the largest consumer of tilapia feeds in the world, Regal Springs is in a position to guide its feed suppliers to meet the demands of consumer and markets for tilapia fish. The questions from European buyers are no longer limited to farming and processing, and there is a growing interest in the US on issues related to feed. Markets are increasingly aware of

the impact of feed on the final finished products in terms of food safety, organoleptic characteristics and social and environmental sustainability.

The issues raised are categorised as:

- Safety of the finished products (contaminants in feed which remain in fish products such as melamine, pesticides, PCBs, dioxin, prions such as the BSE prion, use of terrestrial animal proteins and GMO ingredients)
- Sustainability and impact on environment. Several life cycle analysis or LCA show that most of the impacts of farmed fish are related with the production of the feed.
- Social responsibility (production of ingredients often involves workers in developing countries, and since this is one segment of the supply chain, little control applies here).
- Transparency in general

Safety and sustainability of ingredients

“With rising prices of raw materials, the possibility of intentional contamination is increasing. Feed mills confront contamination issues daily and need to conduct their own checks on raw materials. On the contrary, although terrestrial animal protein sources are allowed in feed, its use poses an image issue and some markets do not accept its use in fish aquaculture.

“The issue of GMO ingredients could have political or ecological implications. For some ingredients such as soybean meal, it is impossible to avoid using GMO ingredients. Furthermore, we see that markets have negative perception on standard feeds with GMO ingredients,” added Campet. In terms of sustainability of fish meal used, Regal Springs has a strong position with its suppliers. It identifies origin of the fish meal.

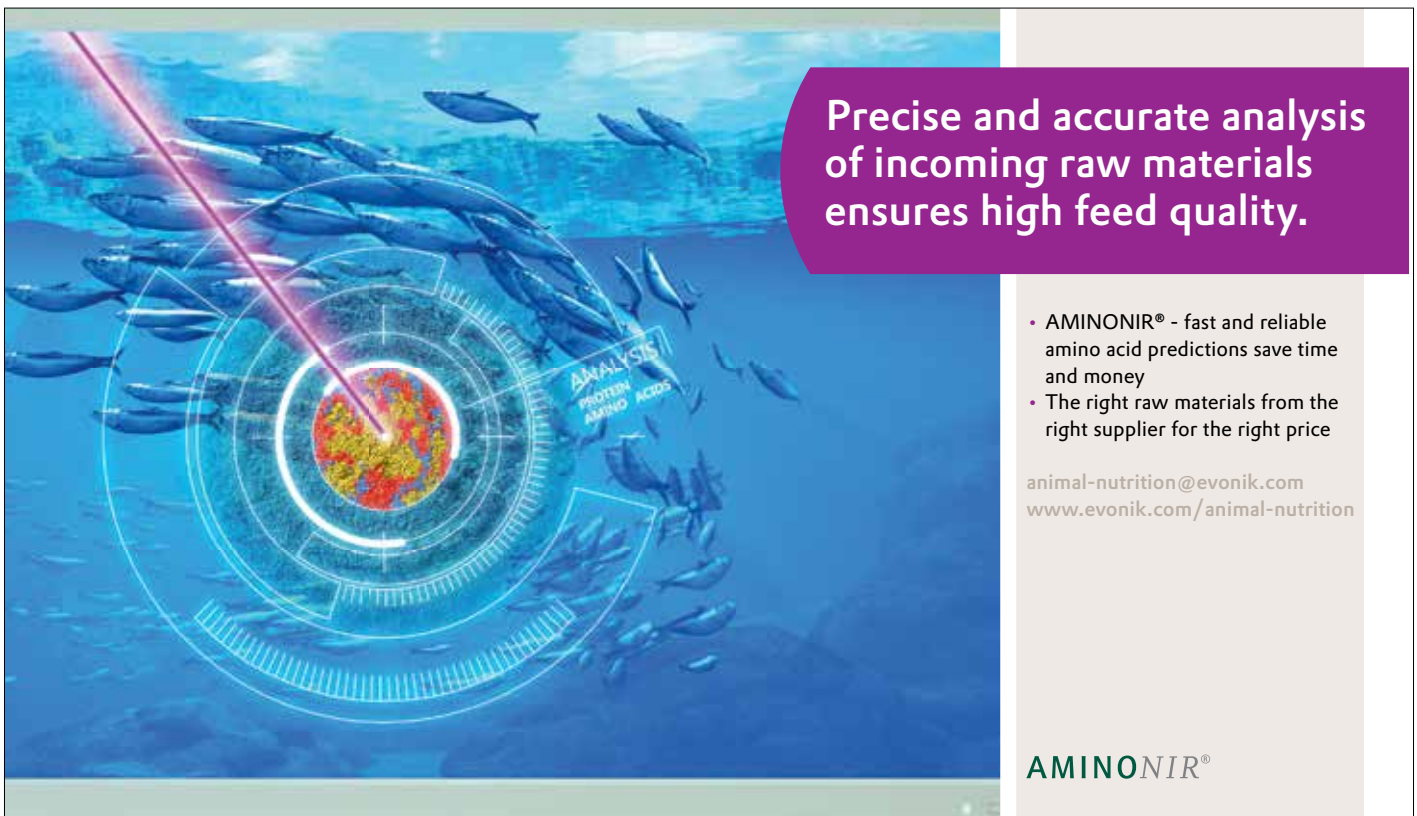
Transparency

Campet said that generally in Asia, feed formulation is not open information. “However in Europe, with regulations on labelling, we can almost decipher the formulation. Can we start to see this in Asia? The message is that feed formulation should be shared with customers, and feed millers should communicate with their customers to provide information on their products.

“The market will always seek more traceability and the feed industry should be prepared. It should be ready with accurate information in a timely manner. With the exception of major feed millers, feed suppliers are not well prepared to answer due to the lack of understanding since the issues are new to them or the information is not available. For ingredients where information is public and there are standards, feed suppliers should be ready to answer queries.”

To move forward, the take home message is that “the aqua feed industry should have better control of the supply chain and have a better understanding of feed issues. The industry must be able to anticipate demands for information and be ready to communicate well. This is the right direction for it to reach the same level of maturity as older feed industries such as for the salmon.”

TARS 2016 will be on Shrimp Aquaculture-The New Normal. It will be held from August 17-18 in Phuket, Thailand. Updates at www.tarsaquaculture.com



Precise and accurate analysis of incoming raw materials ensures high feed quality.

- AMINONIR® - fast and reliable amino acid predictions save time and money
- The right raw materials from the right supplier for the right price

animal-nutrition@evonik.com
www.evonik.com/animal-nutrition

AMINONIR®

Evonik. Power to create.



Phytogenics for better profitability and sustainability

By Rui Goncalves and Gonçalo Santos

A tool to counter immune system suppression or side effects in the gastrointestinal tract in shrimp fed with low fish meal diets.

Global demographic trends show us that the world population is growing and will continue to grow. It is around seven billion today, and by 2050 it will reach nine billion. Additionally it is expected that in developing countries more people will come out of poverty and demand protein rich diets. In developed countries, there is also a trend towards a higher demand in seafood products due to its image as a healthy food. To supply this demand, aquaculture will definitely have an important role, especially considering the stagnation of fisheries output. According to FAO projections, it is estimated that global aquaculture production will need to reach 80 million tonnes by 2050. Nevertheless, doubling aquaculture production needs to be done in a sustainable manner while ensuring the profitability of the industry.

Challenges with aquafeeds

Several trends put contradictory pressures on the aquaculture industry. Reliance upon scarce and costly raw materials, such as fish meal, and the optimal use of alternative ingredients constitute a main challenge in aquaculture. Consumer awareness on environmental impacts encourages producers to improve the production performance through sustainable aquaculture practices. However, the use of less costly protein feed, raw materials and low-nutrient diets results in lower protein digestibility, higher amino acid imbalance and higher carbohydrate and fibre content in feeds. This can lead to inefficient nutrient use, resulting in increased feed usage, greater susceptibility to disease and higher waste outputs which raise production costs and increase the ecological footprint.

Improving gut performance is key

It is no secret that optimum animal performance encompasses a number of factors, including genetic characteristics of the species, quality of the diets, environmental conditions and absence of disease outbreaks. Add to this competitive industry pressure and the need for efficient use and/or replacement of increasingly expensive raw materials—and the picture becomes even more complex. A focus on good gut performance and gut health can help to successfully navigate this large set of considerations and set the foundation for better growth.

Phytogenic feed additives, consisting of herbs, spices, essential oils and extracts have gained considerable attention as an answer to these challenges. The active ingredients, such as phenols and flavonoids, can exert multiple effects in animals, including improvement of feed conversion ratio (FCR), digestibility, growth rate, reduction of nitrogen excretion and improvement of the gut microbiota and health status. Examples of these ingredients with major active compounds are provided in Table 1.

How phytogenics work

Phytogenics may stimulate the digestive secretions, increase villi length and density and increase mucous production through an increase in the number of goblet cells. Additionally phytogenics also modulate the microflora in the gut towards more 'healthy bacteria' and reducing the challenges in the gut. Through different strategies, such as matrix-encapsulation, various phytogenics, such as volatile essential oils can be stabilised and may remain active throughout a greater section of the gastrointestinal tract

(GIT), thus ensuring that positive effects are not only restricted to a smaller section of the GIT.

Table 1. Composition (% inclusion) and proximate analysis (% product) of experimental diets

Name (Botanical name)	Source	Important constituents
Anise (<i>Pimpinella anisum</i>)	seeds	trans-anethole, methyl chavicol, anise aldehyde
Caraway (<i>Carum carvi</i>)	seeds	carvone, limonene
Oregano (<i>Origanum vulgare</i>)	leaves	carvacrol, thymol, p-cymene
Peppermint (<i>Mentha arvensis</i>)	leaves	menthol, isomenthone, limonene
Rosemary (<i>Rosmarinus officinalis</i>)	leaves	1-8-cineol, α - and β -pinene, borneon
Thyme (<i>Thymus vulgaris</i>)	leaves	thymol, p-cymene, carvacrol

Reduced fish meal content vs. feed efficiency

Replacement of fish meal by plant protein, can decrease feed efficiency and suppress an animal's immune system due to less digestible raw materials or side effects in the gastrointestinal tract. Digestarom® (BIOMIN Holding GmbH, Austria), a matrix-encapsulated phytogenic additive, has proven to support animals to overcome these challenges and minimize the negative effects of fish meal reductions and replacements, respectively.

Low fish meal diets for vannamei shrimp

A trial was conducted in collaboration with Ningbo University, China to evaluate the efficacy of Digestarom® P.E.P. MGE as a tool to reduce the level of fish meal in shrimp diets. The treatments consisted of 5 isoproteic diets (40% crude protein) with a positive control diet with 25% fish meal inclusion, and four test diets with two lower levels of fish meal (22% and 19% respectively) with and without Digestarom® supplementation. Each diet was randomly assigned to 5 replicates of 30 juvenile white shrimp (approximately 0.33 g) and fed over 8 weeks.

The results indicated that the reduction in fish meal lowered shrimp performance with the control diet (25% FM) having the best performance. Weight gain, feed conversion ratio (Figure 4), specific growth rate (Figure 5) and protein efficiency improved for shrimp fed the phytogenic additive supplemented diets compared to the lower fish meal, non-supplemented diets.

Analysis of mid-gut ultrastructure by transmission electron microscope indicated that shrimp fed the supplemented diets had an improved mid-gut microvilli structure compared to those fed the lower fish meal diets only (data not shown). The performance improvement of the group given lower fish meal diets supplemented with Digestarom® is an important result as part of a strategy to reduce costs.

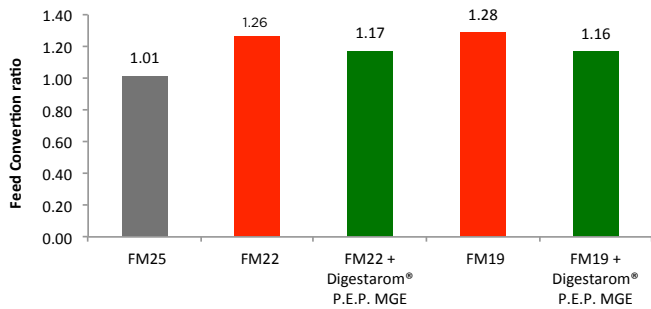


Figure 1. Feed conversion ratio of shrimp fed diets with different levels of fish meal, with and without Digestarom® supplementation (Source: Biomin trials, 2012).

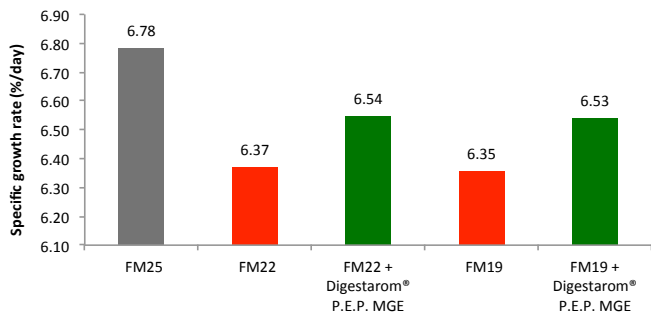


Figure 2. Specific growth rate (SGR, %/day) of shrimp fed diets with different levels of fish meal, with and without Digestarom® supplementation (Source: Biomin trials, 2012).

Effect of phylogenics in commercial diets

A second trial was conducted at Pearl River Aquaculture Institute, China. Here we tested the matrix-encapsulated phytogetic feed additive (Digestarom® P.E.P. MGE) when applied on commercial diets. We observed that the supplementation of shrimp diets with Digestarom® P.E.P. MGE resulted in an enhanced shrimp weight (+14%) and an improved feed conversion (-11%) (Figure 3).

Additionally at the end of the trial shrimp were injected with 0.2 mL of *Vibrio parahaemolyticus* of 5×10^7 ind/mL and mortality time and quantity were recorded every 4 hours. We observed that shrimp fed the phytogetic feed additive had increased resistance against *V. parahaemolyticus* in comparison with the control (Figure 4) and had improved immune parameters and resistance against free radicals (Figure 5). Compared to the control group, mortality of shrimp fed the matrix-encapsulated phytogetic feed additive was maintained at a level around 20% while mortality rapidly increased in the control group.

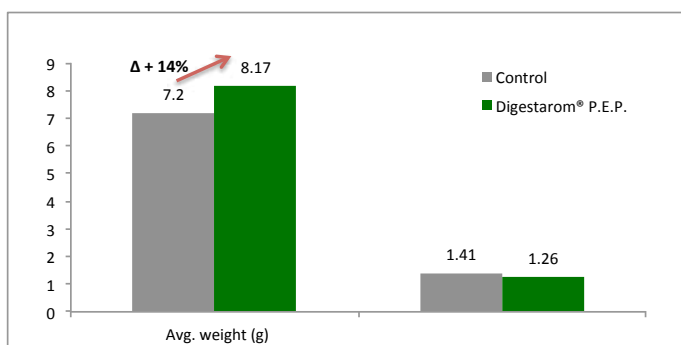


Figure 3. Effect of Digestarom® P.E.P. MGE on white shrimp final weight and feed conversion ratio. (Source: Biomin trials, 2012)

Advanced Feature Extrusion

Engineered Pre-Kill Zones

Optimize Petfood Safety

Food safety is rapidly changing the way the world looks at pet foods. Extru-Tech recently introduced “Advanced Features” to their line of Extruders that provide:

- Best in class design reduces horizontal surfaces and increases sanitation access under, on and around the unit
- Incorporates Advanced Venting Technology (AVT) for suppression of steam and renegade product mist
- Becomes the first line of defense in control/elimination of potentially dangerous pathogens.
- Completed an industry-first scientific validation study proving the kill/lethality step of the Extru-Tech extrusion system design
- All of these advanced features and validation in one extrusion system

With increased focus on food safety, Extru-Tech’s Advanced Feature Extrusion puts you well ahead of previous and current industry standards.

**Contact a system specialist today at
785-284-2153 or visit us online at
www.extru-techinc.com.**



P.O. Box 8
100 Airport Road
Sabetha, KS 66534, USA
Phone: 785-284-2153
Fax: 785-284-3143
extru-techinc@extru-techinc.com
www.extru-techinc.com

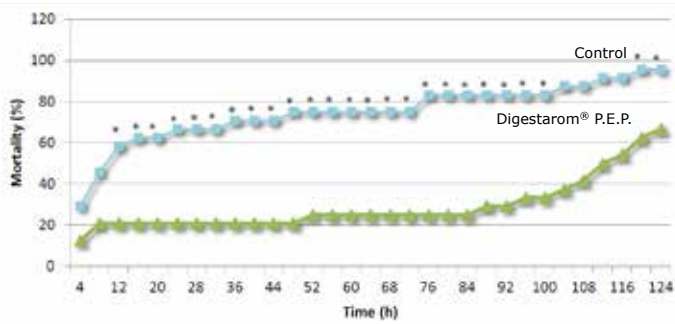


Figure 4. Mortality of white shrimp challenged with *V. parahaemolyticus*. *Indicates a significant difference between treatments ($p < 0.05$). (Source: Biomin trials, 2012)

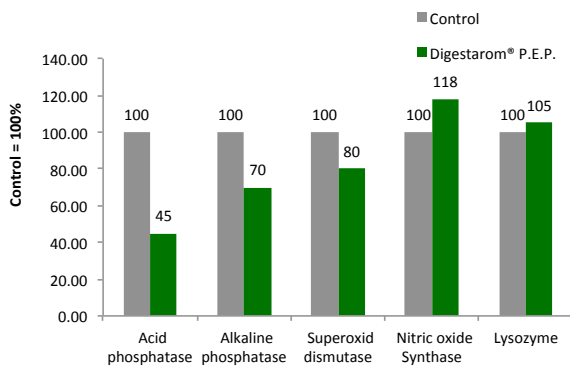


Figure 5. Serum immune parameters of white shrimp after Digestarom® P.E.P. supplementation. (Source: Biomin trials, 2012)

Conclusion

Beyond the clear positive effects of Digestarom® on improving feed efficiency and as a preventive health management tool, nutrient sparing can be a powerful solution to limit nitrogen discharge to the environment. Phytogetic feed additives can decrease ammonia emissions through improved protein usage, thus reducing the loss of nitrogen into the environment. The presented result shows that the phytogetic feed additive Digestarom® can be used as a nutrient-sparing tool for more efficient and cost-effective diet formulation.



Gonçalo Santos and Rui Goncalves (right)

Rui Goncalves is Technical Product Manager and Gonçalo Santos is R&D Manager - Aquaculture, at Biomin, Austria.

Digestarom® P.E.P. MGE

Better digestion for
better feed efficiency

Add the power of PhytoGENICS to your diet:

- A unique blend of herbs, essential oils and functional flavors
- Proven in science and practice
- Tailored to the animal's needs



asiamarketing@biomin.net

digestarom.biomin.net



Naturally ahead

Biomin

Yeast cell wall and immunostimulation

By Ghaffar Ebrahimi and Márcia Villaça

Supplementation of prebiotics improved feed efficiency and growth performance of carp fingerlings as well as their resistance to *A. hydrophila* infection.

With intensification of aquaculture production, the spread of disease is a major problem in the fish farming industry. Until recently, antibiotics were used in the treatment and management of fish diseases. It has also been used to obtain better growth performance and feed efficiency. As a result, the widespread use of antibiotics as a feed additive in aquaculture has been under intensive scrutiny. There are growing concerns over the risks associated with the transmission of resistant bacteria from aquaculture environments to humans, including risks associated with the introduction of non-pathogenic bacteria containing antimicrobial resistance genes and the subsequent transfer of such genes to human pathogens.

On January 2006, the European Union ratified a ban on the use of all sub-therapeutic antibiotics as growth-promoting agents in animal production. Concomitant with the ban on antibiotic growth promoters (AGP), new strategies in feeding and health management have received much attention. The research on prebiotics in fish nutrition is rising in tandem with the increase in demand by consumers for safe products produced according to sustainable practices (Denev et al, 2009).

Protection mechanisms in fish

Fish immune systems play an important role in defending against pathogenic agents. Fish immune systems share some similarities to those found in mammals. Fish, however, rely more on non-specific defense mechanisms than mammals do. The non-specific immune system of fish consists of several key humoral and cellular components that provide innate protection against infection, regardless of the pathogen type. Several studies have demonstrated that immunostimulants are very beneficial to fish immune systems (Denev et al., 2009).

Various mechanisms have been proposed to explain the specific action of immunostimulants in fish, such as selective stimulation of beneficial microbiota as well as improved immune functions, disease resistance, survival, growth performance and feed efficiency.

Beta glucans as yeast cell wall component

The role of beta glucans as immunostimulants have been studied in numerous vertebrate and invertebrate species. The evaluation of cellular and humoral immune parameters was established at phenotypic level by the phagocytic activity of head kidney macrophages and quantification of inflammatory cytokines in spleen and gill tissues by indirect ELISA. Innate immune response, mediated by lysozyme, was reported in several fish species.

ImmunoWall®
Your profit keeper at minimum cost

UNQUESTIONABLE RESULTS AGAINST EMS!

Control 4.5% Survival Rate

ImmunoWall 51% Survival Rate

Studies show Immunowall® is effective in drastically reducing mortality in shrimp *Litopenaeus vannamei* submitted to *Vibrio parahaemolyticus* and *Vibrio harveyi*, also improving growth performance and immunity status.

Research conducted at Kasetsart University – Thailand

ICC
icc@ccbrazil.com.br
Tel: +55 11 3093 0747
www.yeastbrazil.com

Prebiotics are non-digestible functional fibres that beneficially affect the host by selectively stimulating the growth of and/or activating the metabolism of one or a limited number of health-promoting bacteria in the intestinal tract. This works by improving the host's intestine. Beta-glucan is a particulate carbohydrate consisting of glucose and mannose and is the main constituent of the yeast cell wall (YCW). Several studies confirm the potent immunostimulatory properties of betaglucans in many fresh and seawater fish species on pathogen resistance, protection, survival, and fish specific humoral immunity. Strong degranulation of neutrophils was observed in fathead minnow after dietary administration of beta-glucans. In gilthead sea bream, lysozyme activity increased after 4 weeks of feeding the whole yeast cells at a dose of 10 g/kg of diet. Enhanced phagocytic activity (respiratory burst activity and bactericidal action) in the head kidney macrophage was observed in the groups that received dietary immunostimulants.

Immunity and resistance to *Aeromonas hydrophila* infection

Several studies with YCW were carried out in Sari Agriculture University (Ebrahimi, 2011). This is a natural product containing various stimulating compounds such as beta-glucans, complex carbohydrates, mannan oligosaccharides (MOS) and glucomannoprotein complexes, which have been used as feed additives in animal production. Both are components of the yeast cell wall (*Saccharomyces cerevisiae*). Appropriate or low levels of beta glucans were found to be efficient stimulators of non-specific immune functions in fish.

Experimental protocol

Common carp *Cyprinus carpio* fingerlings were obtained from a commercial farm. The fingerlings (n=225, average weight = 11.12 ± 0.55 g) were randomly distributed in 15 tanks of 250 L each and acclimatised to the experimental conditions for 15 days feeding on basal diet. Each group was fed experimental diets (isonitrogenous and isoenergetic) containing different levels of YCW (0, 0.5, 1, 1.5 and 2.5 g YCW/kg diet). Feeding was carried out three times a day until apparent satiation for 8 weeks.

Growth and feed efficiency parameters

Average final body weight (FBW) of each experimental group was determined by dividing total fish weight of each tank by the number of fish. Weight gain, percentage of weight gain, feed conversion ratio (FCR), protein efficiency ratio (PER), feed efficiency ratio (FER), feed intake (FI), protein utilisation (PU), energy utilisation (EU) and survival percentage were calculated for each experimental group.

Haematological indices

The *C. carpio* fingerlings were not fed for 24 hours prior to blood sampling. Three fish from each tank were randomly selected and anaesthetised with 200 mg/L of MS222. Blood samples were taken and the fish carcasses were used for the determination of final body compositions afterwards. Part of the blood samples was heparinised for haematology (haematocrit determination and total white blood cells, WBC), and the rest was allowed to clot for serum sampling. The clotted blood samples were centrifuged at 3000 g for 5 minutes, after which the serum was removed and stored at -80 °C. Before analysis, the frozen samples were kept at room temperature to thaw followed by inverting several times to mix.

The serum sample from each treatment was analysed for glucose, total protein and albumin. Total WBC were counted following the method of Schalm et al. (1975). Haematocrit (HCT) was determined in microhaematocrit tubes. Glucose was

assessed colorimetrically and total protein content was estimated according to the method of Lowry et al. (1951). Albumin was measured based on the method by Wotton and Freeman (1982). Globulin was calculated by subtracting albumin level from total protein. For the albumin/globulin ratio, the albumin value was divided by the globulin value.

Challenges

One day after blood sampling, 10 fingerlings from each replicate previously fed the experimental diets were injected interperitoneally (IP) with 0.1 cm³ of live *A. hydrophila*, ATCC 49040 (1 x10⁸ cells/mL). During this period, mortality of the challenged fish was monitored twice a day for 10 days.

Total bacterial count

At the end of the experiment, six fingerlings were collected from each treatment and their intestinal samples were tested for total bacterial counts.

Better feed efficiency and growth performance

Both feed efficiency ratio and protein efficiency ratio significantly increased (p<0.05) with an increase of the prebiotic YCW levels from 0.5 to 1.5 g/kg diet. The highest protein content (p<0.05) was found in the fish fed a diet containing 2.5 g/kg YCW (Table 1). Haematological parameters and plasma total protein concentration were also significantly higher (p<0.05) in the fingerlings fed diets containing 1.5 and 2.5 g/kg prebiotic in relation to the control (Table 2).

Fish fed the control diet (no prebiotics) contained the highest mean of total bacterial counts. The lowest mean (p<0.05) of total bacterial counts was observed in the fish fed the diet containing 2.5 g/kg of YCW.

Table 1. Growth and feed utilisation by common carp fingerlings fed diets containing different levels of the prebiotic for 8 weeks.

Parameters	Treatments				
	0.0 g/kg YCW	0.5 g/kg YCW	1.0 g/kg YCW	1.5 g/kg YCW	2.5 g/kg YCW
IW(g)	11.16 ± 0.12	11.07 ± 0.13	11.10 ± 0.11	11.13 ± 0.12	11.13 ± 0.17
WGP	317.2 ± 43.1	336.6 ± 32.4	333.8 ± 39.5	371.9 ± 27.5	350.1 ± 14.3
FCR	1.49 ± 0.12 ^a	1.40 ± 0.02 ^a	1.37 ± 0.15 ^a	1.01 ± 0.12 ^b	1.27 ± 0.07 ^a
FI	938.2 ± 40.2 ^a	936.2 ± 70.2 ^a	900.4 ± 32.9 ^a	804.9 ± 19.0 ^b	887.8 ± 60.5 ^{ab}
PI	17.40 ± 0.74 ^b	17.94 ± 1.34 ^b	17.56 ± 0.64 ^b	15.47 ± 0.36 ^a	16.46 ± 1.12 ^{ab}
FER	0.67 ± 0.05 ^a	0.71 ± 0.01 ^{ab}	0.73 ± 0.08 ^{ab}	0.91 ± 0.04 ^c	0.78 ± 0.05 ^b
PER	2.02 ± 0.17 ^a	2.07 ± 0.03 ^{ab}	2.11 ± 0.23 ^{ab}	2.67 ± 0.13 ^c	2.37 ± 0.15 ^b
PU%	29.46 ± 2.73 ^a	30.40 ± 0.29 ^a	31.84 ± 3.90 ^a	40.98 ± 2.63	37.12 ± 2.74 ^b
EU%	24.40 ± 2.36 ^a	25.81 ± 0.35 ^{ab}	26.98 ± 2.83 ^{ab}	34.07 ± 1.81 ^c	29.41 ± 2.14 ^b

IW, initial weight; PWG, weight gain %; FCR, feed conversion ratio; FI, feed intake; PI, protein intake; FER, feed efficiency ratio; PER, protein efficiency ratio; PU, protein utilization; EU, energy utilization.
Means ± SD having various superscript letters in the same row are significantly different (p < 0.05).

Table 2. Total count of bacteria, immunity characteristics and proximate composition of the common carp fingerlings fed diets containing different levels of the prebiotic for 8 weeks.

		Treatments				
Parameters		0.0 g/kg YCW	0.5 g/kg YCW	1.0 g/kg YCW	1.5 g/kg YCW	2.5 g/kg YCW
Total counts of bacteria (log cfu/g intestine)		9.18 ± 0.23 ^c	7.78 ± 0.26 ^b	7.50 ± 0.44 ^b	7.30 ± 0.18 ^{ab}	6.96 ± 0.17 ^a
Immunity characteristics						
Albumin (g/L)		11.5 ± 0.4 ^{ab}	10.70 ± 0.7 ^a	11.3 ± 0.5 ^{ab}	11.5 ± 0.5 ^{ab}	12.1 ± 0.8 ^b
Globulin (g/L)		13.09 ± 0.9 ^{abc}	12.7 ± 0.1 ^a	13.6 ± 0.9 ^{ab}	14.6 ± 0.7 ^{bc}	15.6 ± 0.6 ^c
Albumin:Globulin ratio		0.82 ± 0.08 ^a	0.84 ± 0.12 ^a	0.83 ± 0.09 ^a	0.78 ± 0.07 ^a	0.77 ± 0.08 ^a
Leucocyte (x10 ⁴ mm ³)		2.01 ± 0.04 ^a	2.28 ± 0.01 ^c	2.25 ± 0.02 ^c	2.24 ± 0.03 ^c	2.15 ± 0.02 ^b
Total protein (g/L)		25.4 ± 0.55 ^b	23.4 ± 0.35 ^a	24.9 ± 0.40 ^b	26.1 ± 0.25 ^c	27.7 ± 0.15 ^d
Glucose (mg/L)		1196 ± 2.51 ^a	1201 ± 3.69 ^a	1200 ± 3.60 ^a	1199 ± 3.83 ^a	1195 ± 3.51 ^a
Haematocrit (%)		27.7 ± 0.72 ^a	27.9 ± 0.35 ^b	26.9 ± 0.46 ^a	26.6 ± 0.37 ^a	26.4 ± 0.65 ^a
Total body proximate composition (g/kg)	Initial Values					
Moisture	746.66 ± 6.43	715.33 ± 4.37 ^a	709.07 ± 2.99 ^{ab}	708.72 ± 3.11 ^{ab}	707.51 ± 5.12 ^b	703.93 ± 3.64 ^b
Protein	132.3 ± 3.6	145.18 ± 1.21 ^a	146.57 ± 1.72 ^a	150.79 ± 1.68 ^b	153.21 ± 2.24 ^{bc}	156.40 ± 1.96 ^c
Lipid	82.1 ± 1.91	95.54 ± 1.81 ^a	95.81 ± 1.18 ^a	96.72 ± 1.19 ^{ab}	98.72 ± 1.47 ^b	98.43 ± 1.65 ^{ab}
Ash	26.5 ± 0.53	27.45 ± 0.66 ^a	28.60 ± 0.50 ^a	28.04 ± 3.66 ^a	28.73 ± 0.80 ^a	28.70 ± 0.60 ^a
Energy	6.53 ± 0.7	7.42 ± 0.10 ^a	7.52 ± 0.04 ^{ab}	7.58 ± 0.06 ^{abc}	7.65 ± 0.11 ^{bc}	7.73 ± 0.11 ^c
P:E ratio	20.27 ± 0.56	19.55 ± 0.24 ^a	19.46 ± 0.11 ^a	19.88 ± 0.35 ^{ab}	20.0 ± 0.46 ^{ab}	20.22 ± 0.09 ^b

Means ± SD having various superscript letters in the same row are significantly different (p < 0.05).

The present study revealed that a dietary YCW supplementation from 1 to 1.5 g/kg is capable of improving the feed efficiency and growth performance of *C. carpio* fingerlings as well as their resistance to *A. hydrophila* infection, and YCW levels from 0 to 2.5 g/kg diet revealed no mortality throughout the experiment.

Improving health with beta glucans

Jafar Nodeh (2010) showed that supplementing the diet of the Persian sturgeon *Acipenser persicus* fingerlings with a commercial prebiotic considerably modified the intestinal microflora. The author also reported that *Lactobacillus* (lactic acid bacteria) population in the intestines of fish fed a diet containing 2 g prebiotic/kg was higher than that of other supplemented groups, while total counts of bacteria steadily declined with an increase in the prebiotic levels up to 2 g/kg diet (p<0.05).

It seems that changes in villi morphology and density in the common carp fingerlings fed with the prebiotic are probably one of the remarkable factors involving in the increased potential nutrient capture and thereby, increased feed efficiency.

The increase in WBC (white blood cells) count might be due to stress suffered by fish as a result of daily feeding on beta-glucan. Harikrishnan et al. (2003) also reported increased WBC counts in *C. carpio* after herbal treatment with *Azardicha indica*. The observed increases in the leucocyte and total protein levels as well as lower mortalities resulting from the pathogenic *A. hydrophila* infection appear to be signs of enhanced health status among the prebiotic-fed fish. Moreover, high concentrations of serum proteins including humoral elements of the non-specific immune system are likely to be the results of an enhancement in the non-specific immune response of the fish. The improved health condition in the *C. carpio* fingerlings is probably due to the beta-glucan and MOS components of the YCW.

Glucans can modulate the activity of phagocytes and other components of the innate immune system in fish (Robertson et al., 1994). The administration of glucans in the diet of fish has been shown to improve the respiratory burst activity, phagocytosis, lysozyme value and resistance vs. pathogens in some cultured fish (Ogier de Maulny et al., 1996; Li and Gatlin, 2004). Rodriguez et al. (2007) found that β-1, 3/1, 6- glucans would modify the immune response of *P. vannamei* juveniles, influencing the prevalence of white spot syndrome virus (WSSV) and shrimp survival in ponds. Li and Gatlin (2004) observed that hybrid striped bass fed glucan and/or chitin from brewer's yeast showed extracellular superoxide anion production of head kidney macrophages. This prebiotic supplement also improves fish resistance to *A. hydrophila* infection, thereby acting as a potent immuno stimulant. Notwithstanding, extra dosage of YCW seems to hinder enhancements of feed utilisation and growth of the fingerlings.

Conclusion

Based on the findings of this study, supplementation of YCW at levels of 1-1.5 g/kg was beneficial to fish immune systems, increasing the performance and the survival of *C. carpio* fingerlings.



Ghaffar Ebrahimi, PhD is with the Department of Fisheries, Sari Agricultural Sciences and Natural Resources University, Iran. Email: ghaffar@yahoo.com

Márcia Villaça

Márcia Villaça is Pet and Aqua Technical Sales Manager with ICC Brazil Ltda. She has an MSc in Animal Production. Email: marcia@iccbrazil.com.br

Phytonutrient solutions for white shrimp and tilapia farming

By Clément Soulet

Experimental challenges in Thailand and Israel show enhanced performance and improved resistance to environmental or pathogenic stresses with feed supplementation.

Farmed fish and shrimp contribute to 50% of all the seafood consumed around the world, and this is expected to increase to more than 60% by 2030. With the increasing need for appropriate and high performing feeds for use in aquaculture farms, there has been a significant rise in the demand for compound aqua feed and in particular for sophisticated and well-formulated feed products. Accordingly, feed additives have the potential to add greater nutritional value to aquaculture feed, and enhance aquaculture production.

The Switzerland-based global leader in feed additives for livestock, Pancosma & Associates has recently introduced innovative tools and products targeted for aquaculture nutrition. With years of experience as a pioneer in the field of phytonutrients, including a 100% plant extract-based product which has received zootechnical approval for use in broilers, the company has developed two original feed additives for aquaculture: XTRACT®Fish and XTRACT®Shrimp. These products consist of standardised micro-encapsulated particles, containing carefully selected combinations of bioactive substances found naturally in aromatic plants and spices. These function to enhance health and performance.

These feed additives have the potential to boost the nutritional status of aquatic species and improve their natural defence systems to withstand external challenges, without the need for antibiotics. Consequently, the effect is to limit major economic losses caused by commonly occurring pathogens in aquaculture farms. Both feed additives are produced in a manner which allows them to be mixed with fish oil and top coated onto feed pellets. It can also be added directly into the feed mixtures prior to the extrusion or pelleting process as it has been proven that efficacy is not affected by high extrusion temperatures.

In this article, we report on the investigations on the health and immune enhancing properties of these two feed additives in the Pacific white shrimp *Penaeus vannamei* and in the Nile tilapia *Oreochromis niloticus*, respectively. These studies looked at how the feed additives perform under optimal farming conditions and respond to external challenges.

Performance and disease resistance in shrimp

The major challenges in shrimp farming include optimising parameters of productive performance such as growth rate, final weight and feed efficiency. At the same time, optimal growth conditions limit mortality amidst external stresses and challenges. Among these factors, infection with the *Vibrio* strain of bacteria is a major threat to a large number of farms, and is one of the major diseases affecting aquaculture. In a trial led by a research team at the Chulalongkorn University in Thailand, the effects of the feed additive on overall performance and resistance to *Vibrio*



cholerae in the white shrimp were studied. The results support the role of XTRACT®Shrimp in enhancing immune function and strengthening host resistance in response to pathogen challenge.

Trial protocol

Shrimp post larvae (PL15) each weighing 1 g, were transferred to 10 tanks. Each tank of 0.8 x 0.4 x 0.4 m contained 20 shrimp. There were two treatments: a negative control and feed supplemented with the shrimp feed additive. There were five replicates for each treatment. The negative control consisted of a basal diet comprising fish meal, squid powder, squid liver powder, shell meal, wheat flour, soybean meal, vitamins, and minerals. The supplemented feed was the basal diet in addition to 200 g/tonne XTRACT® Shrimp, mixed with fish oil and top coated at 1.5% onto the pellets. The trial was divided into two parts. Part one evaluated shrimp growth performance over a period of 4 months under optimal conditions. Part two evaluated shrimp performance on exposure to the pathogenic *Vibrio cholerae*.

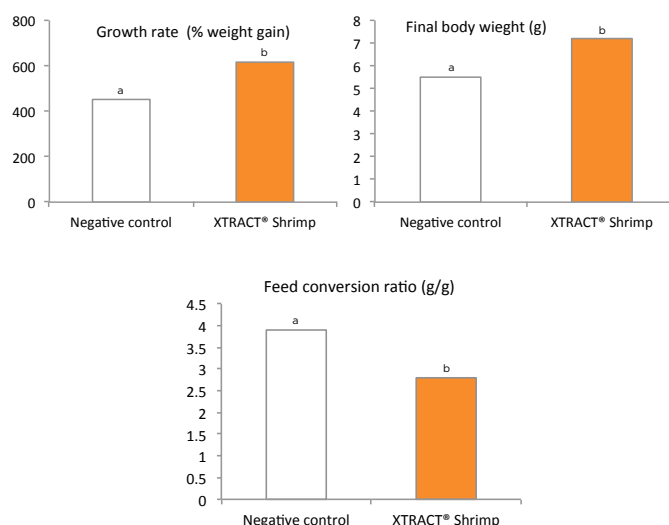


Figure 1. Effects of treatments on shrimp growth and feed conversion ratio. (Letters a, b indicate significant differences at P<0.05).

Optimal conditions

Under optimal rearing conditions, results showed that shrimp fed treatment diets had significantly improved growth rate, which resulted in a higher final body weight ($P < 0.05$, Figure 1). In addition, the feed efficiency of shrimp fed treatment diets was significantly higher compared to shrimp fed the basal diet only ($P < 0.05$). The feed additive also exerted immune-modulating properties as demonstrated by the greater phagocytic activity, which resulted in a reduced mortality rate during this period ($P < 0.05$, Figure 2).

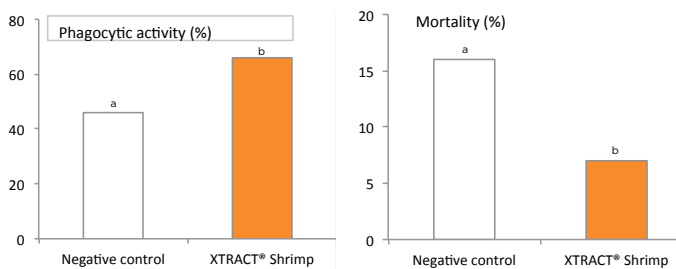


Figure 2. Effects of treatments on shrimp health and mortality. (Letters a, b indicate significant differences at $P < 0.05$).

Challenge with *V. cholerae*

In part two of the trials, shrimp were closely observed for a period of 10 days following the intra-muscular injection of *V. cholerae* at the LD50 dose. Subsequent to pathogen challenge, the group fed feed supplemented with the feed additive showed a reduction in mortality rate that was two fold lower compared to the negative control group (mortality rates of 56.7% versus 23.3%, Figure 3). These results support the role of the feed additive in enhancing the resistance of the shrimp to pathogen infection.



Sampling of haemolymph from ventral sinus to measure phagocytic activity, during the trial carried out at the Chulalongkorn University in Thailand

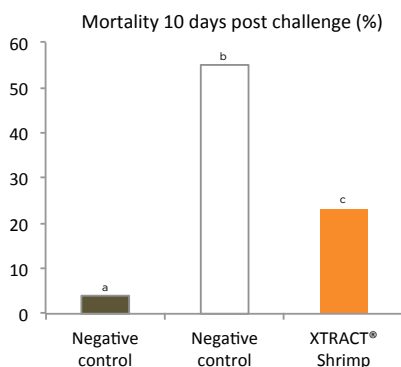


Figure 3. Shrimp mortality (%) after 10-day challenge with *V. cholerae*. (Letters a, b, c indicate significant differences at $P < 0.05$).

Performance and disease resistance in Nile tilapia

One of the critical factors affecting tilapia farming is poor water quality, which negatively affects growth rate, final body weight and feed efficiency. Often such conditions result in high mortality rates. The bioactive components of XTRACT®Fish function to promote improved feed digestion and reduced intestinal inflammation, leading to better nutrient absorption and improved gut integrity and health. As such, the use of this feed additive results in a greater availability of energy for optimal performance of the organism and a reduction in sensitivity towards stress. The AquaVet Wet Lab Facility in Israel conducted trials to study the effects on performance and resistance to environmental stress in Nile tilapia.

Trial protocol

Juvenile tilapia fish, each with a body weight of 0.22 g were transferred to 12 tanks. Fifty fish were allocated to each 80 cm diameter tank with a height of 1 m. Tilapia were fed with either the negative control or the supplemented feed. Each treatment was replicated six times. The negative control consisted of a basal diet comprising fishmeal, de-hulled soybean meal, protein by-products, cereals, and a premix. The supplemented feed consisted of the basal diet with the addition of 200 g/tonne XTRACT®Fish mixed with fish oil and top coated at 1.5% onto the pellets.

Similar to the shrimp study, this trial was divided into two parts. In part one, tilapia performance was evaluated for a period of 3 months under optimal rearing conditions (temperature $> 25^{\circ}\text{C}$, oxygen > 6 ppm, ammonia < 0.5 ppm and nitrite < 0.4 ppm). In part two, the response of tilapia to adverse rearing conditions was investigated.

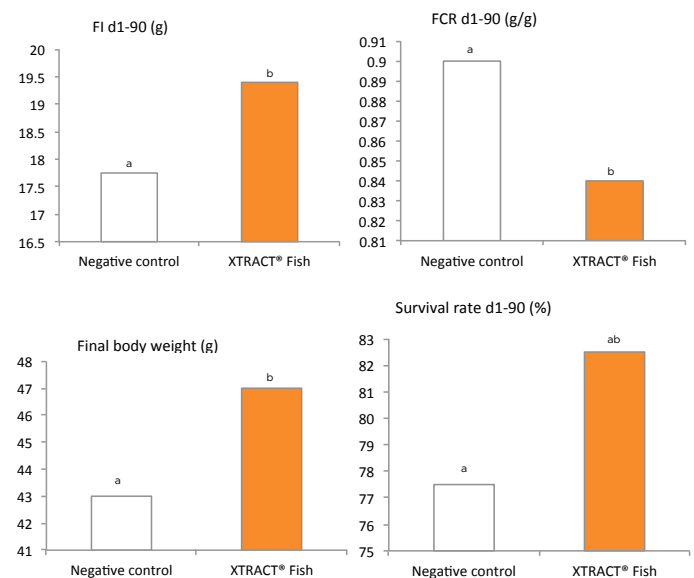


Figure 4. Effect of the treatments on tilapia feed intake, (FI) growth performance, (final body weight) feed conversion ratio and survival under optimal conditions over a 3-month period (Letters a, b indicate significant differences at $P < 0.05$).



Tanks for the tilapia trial at the AquaVet wet laboratory facility, Israel

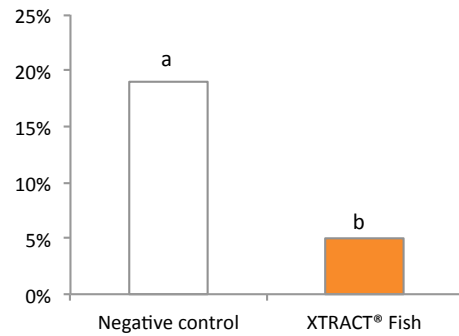


Figure 6. Mortality % at day 30 of the challenge trial

Optimal conditions

Compared to the group in the negative control, tilapia fed feed containing XTRACT®Fish showed a significant increase in feed intake by 9.9% and final body weight by 9.4%. FCR was reduced significantly by 5.7% ($P < 0.05$). Survival rate was higher by 6.4% but was not significantly different from the survival rate of the negative control group.

Adverse rearing conditions

The second part of the trial investigated responses to poor water quality. Within a trial duration of 1 month, rearing conditions were manipulated to simulate poor water quality. The water temperature was decreased from 25 to 17°C, and the levels of ammonia and nitrate were increased from 0.6 to 3 ppm, and from 2 to 5 ppm, respectively. In addition, the water exchange rate per hour was reduced from 100% to 25% (Figure 5). These conditions led to a state of progressive anorexia.

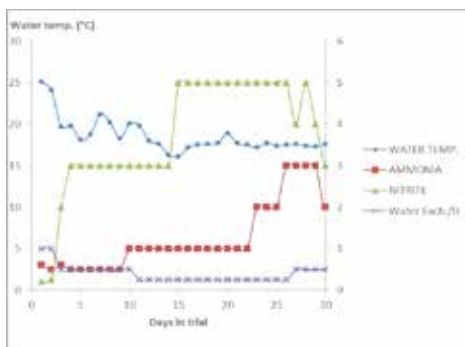


Figure 5. Changes in pond conditions over the 30 day challenge trial



Juvenile tilapia fish fed the supplemented diet and placed in an environment with poor water conditions exhibited a significantly lower mortality rate compared to the negative control. This suggested that the feed additive helps Nile tilapia resist challenging environmental conditions.

Conclusion

Our studies demonstrated how the two feed additives, XTRACT®Fish and XTRACT®Shrimp, improved overall performance and resistance to environmental or pathogenic stress in the white shrimp and the Nile tilapia. These two aquatic species represent the largest potential for commercial aquaculture feed globally. These phytonutrient solutions demonstrated their ability to improve the performance efficiency of fish and shrimp, which has the potential to generate greater financial profit for farmers.



Clément Soulet is Product Manager - Palatants & Aquaculture at Pancosma SA, Switzerland. Clément manages Pancosma's range of sweeteners, flavours, and aquaculture products. Email : clement.soulet@pancosma.ch

**Reach your market and industry
in Asia Pacific**

Advertise in AQUA CULTURE Asia Pacific
contact: zuridah@aquasiapac.com

Medium chain triglycerides in Vietnamese aquaculture

By Jan Oppen Berntsen, Nguyen Duc Dung, Pham Cong Thanh, Vo Thanh Tung, Huynh Truong Giang and Tran Thi Tuyet Hoa

Trials with shrimp and pangasius (vaccinated and unvaccinated) demonstrate the potential of MCT for better growth and health.

Medium chain triglycerides or MCT is composed of medium chain fatty acids esterified with glycerol. Fatty acids of chain length C6 to C8 constitute the raw materials which is processed into MCT. Specific chain length fatty acids have antibacterial functions and as such explains improvements in gut health and improved zootechnical parameters observed when MCT is included in small concentrations in animal feed.

Medium chain fatty acids and glycerides are well-known for their inhibiting effects on bacterial strains and some fat coated viruses (All About Feed, 16 May 2013). In weaned piglets MCT in the feed showed lower number of intra-epithelial lymphocytes (ILE) per 100 enterocytes, an indication of less bacterial interactions with the immune system of the animal. Fewer burdens on the immune system imply less energy needed for the maintenance of the immune system and more energy available for growth.

Through its regulating effect on the microbial population, and its positive effect on the gut health and immune system, MCT helps the animals to maximise the use of available energy in the feed. MCT is digested, transported and metabolised much quicker than regular fats and oils commonly used in animal feeds. MCT stimulates the growth of larger villi and smaller crypt depths. The improvement in the villi/crypt ratio indicates a healthier and more functional status of the mucosa. This positive effect on the gut health leads to enhanced nutrient absorption and better growth and feed utilisation.

MCT in aquaculture

The Belgian company Aveve Biochem has developed a MCT product which has been used in the agricultural industry for almost a decade. This is currently being developed and documented for its use in aquaculture. In Vietnam, PHARMAQ AS, the global leader in health management in aquaculture is promoting the product in the Vietnamese market.

The unique fatty acid composition and the slow release of the medium-chain fatty acids, have a regulating effect on the microbial population in the gastro-intestinal tract of fish and shrimp. The esterification protects the fatty acids from degradation through the stomach and its acidic environment, and is important to maximise the effect of the fatty acids in the upper gut. In the lower gut, the fatty acids are absorbed and contribute to the nutritional value of the feed and energy for the animals.

Table 1. Effects of MCT inclusion at 0.2% and 0.4% in shrimp feeds on growth parameters and mortality.

Parameters	Treatments			
	Negative control	MCT 0.2%	MCT 0.4%	Enrofloxacin 10ppm
Weight gain (g/shrimp)	13.72	14.59	14.38	13.79
Relative weight (gain %)	100	106	105	101
Feed intake (g/shrimp)	16.95	17.79	17.69	17.22
Relative feed intake (%)	100	105	104	102
Feed conversion ratio (FCR)	1.25	1.22	1.24	1.25
Relative FCR (%)	100	98	99	100
Survival rate (%)	82.00 b	88.67 a	89.33 a	83.33 b
Relative survival rate (%)	100 b	108 a	109 a	102 b

Means in the rows with different letters are significantly different at P< 0.05



Netting pangasius for weight sampling. Photo: Pharmaq Vietnam

Normal inclusion rates of MCT in aquatic feeds are 0.1-0.4%. This is done simply by exchanging normally used fish or vegetable oils with the same amount of MCT; 0.1 - 0.2% for fish feed and 0.2 - 0.4% for shrimp feed. Levels are higher in starter feeds and lower for grow-out feeds.

Better health and optimised growth

A trial was conducted at Kasetsart University, Thailand in 2007 with Pacific white shrimp *Litopenaeus vannamei*. A total of 1,680 shrimp with an average initial weight of 4.74 g were used. There were four treatments (with two replicates per treatment) with 420 shrimp per treatment. The duration of the trial was three months. Results in Table 1 showed that the inclusion of MCT in the feed improved the general weight gain and feed efficiency as well as the survival rate during the three months compared to both positive and negative control groups. MCT inclusion rates of 2 g and 4 g per kg were tested versus a negative and a positive control. The use of enrofloxacin as a positive control is rather harsh, but was done to illustrate what the addition of MCT could do for the sustainability of the shrimp industry.

On completion of the three-month feeding trial, 15 shrimp per treatment group were challenged by intramuscular injection with virulent *Vibrio harveyi* (1 mL suspension, 10 x 10⁶ colony forming units (CFU/mL)). The MCT groups showed better survival compared to both negative and positive controls (Table 2).

Table 2. Results of challenge with virulent *V. harveyi*

Parameters	Treatments			
	Negative control	MCT 0.2%	MCT 0.4%	Enrofloxacin 10ppm
Mortality (%) 24 h post challenge	46.7	40.0	43.3	46.7
Relative mortality 24 h post challenge %	100	86	93	100
Mortality (%) 168 h post challenge %	53.3	50.0	43.3	46.7
Relative mortality (%) 168 h post challenge	100	105	104	102

Table 3. Growth, survival rate and productivity of vaccinated and unvaccinated fish fed treatment diets.

	Group	Final weight (g)	Relative growth	Survival Rate (%)	Productivity kg/m ³
Unvaccinated Group M and K	MCT, 0.2% (M)	140.7	107.4%	98.2	22.36
	Negative control (K)	131.0	100.0%	98.4	22.01
Vaccinated Group N and L	MCT, 0.2% (N)	149.6	109.8%	99.5	23.33
	Negative control (L)	136.3	100.0%	99.8	22.42



Feeding pangasius. Photo: Pharmaq Vietnam

Complementary effects to vaccination

In a pangasius (*Pangasius hypophthalmus*) trial at EWOS' O Mon facility in Can Tho, Vietnam in 2012, two fish groups were vaccinated; one of the vaccinated groups was fed MCT while the other group was a negative control. The other two groups were kept unvaccinated, one of the unvaccinated groups was fed MCT while the other was negative control for the unvaccinated MCT group.

A total of 2,000 fish per group was used with five replicates per treatment. The average initial weight of fish was 10 g. Fish were fed 3 mm commercial pellets (EWOS) for the negative control and feed supplemented with 0.2% MCT were fed to the test groups. Vaccination was done after a month and the trial was completed after three months. At this stage, weight of fish fed MCT was significantly higher than the untreated fish (Table 3). Table 4 and 5 show the effects of MCT supplementation on feed conversion ratio (FCR) and specific growth rates (SGR).

Tables 3, 4 and 5 show that the addition of MCT to the feed gave a positive contribution to the production.

Pacific white shrimp trial

In a trial conducted at Can Thó University, Vietnam in 2013, a total of 800 Pacific white shrimp (*Litopenaeus vannamei*) were randomly assigned to 16 experimental tanks of 500 L (50 animals per tank). The experiment had 4 treatments which were supplemented with 0%, 0.1%, 0.2% and 0.4% of MCT respectively, and each treatment were replicated four times. After 30 days of supplemental feeding with MCT, shrimp from each treatment were measured for immunity enhancement and resistance against *V. harveyi* bacteria in an intramuscular challenge (Figure 1, Table 6).



Pacific white shrimp, photo: Pharmaq Vietnam



NEXT ISSUE

January/February 2016

Issue focus: Health & Nutrition

Industry review: Marine shrimp

Functional Feeds, Fish oil Replacements, Harvesting & Post Harvest Technology

Show & distribution: Aqua India 2016, Visakhapatnam, India

Aquaculture 2016, Las Vegas

Deadlines: Articles - November 15,

Adverts - November 22

Email: zuridah@aquasiapac.com; enquiries@aquasiapac.com for details

The addition of small amounts of MCT to aquatic feeds has shown interesting performance improvements both in shrimp and fish when tested under tropical conditions and in tropical species. The use of MCT could be regarded as an aid to promote a more sustainable aquaculture industry.

Table 4. Feed conversion ratio (FCR) of vaccinated and unvaccinated fish fed treatment diets.

	Group	FCR	Relative	MCT Advantage
Unvaccinated Group M and K	MCT, 0.2% (M)	1.22	98.4%	1.6%
	Negative control (K)	1.24	100 %	
Vaccinated Group N and L	MCT, 0.2%(N)	1.21	97.6%	2.4%
	Negative control (L)	1.24	100 %	

Table 5. Specific growth rates (SGR) of vaccinated and unvaccinated fish fed treatment diets.

	Group	SGR (g/day)	Relative	MCT Advantage
Unvaccinated Group M and K	MCT, 0.2% (M)	1.41	102.2%	2.2%
	Negative control (K)	1.38	100 %	
Vaccinated Group N and L	MCT, 0.2% (N)	1.45	104.3%	4.3%
	Negative control (L)	1.39	100 %	

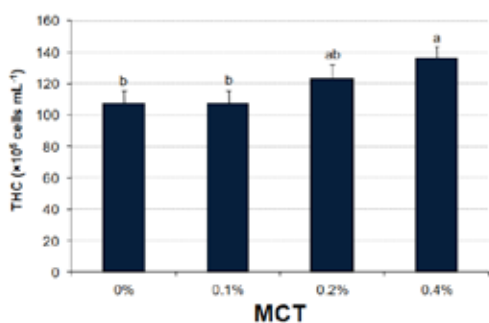


Figure 1. Total white blood cell counts in *L. vannamei* after 30 days supplemental feeding with MCT (Means in bars with different letters are significantly different at $P < 0.05$)

Table 6. The survival rate of *L. vannamei* fed diets supplemented with different levels of MCT for 30 days and then exposed to an intramuscular challenge with *V. harveyi*.

Tank	Bacteria (CFU/animal)	MCT	Survival rate		
			72 h	96 h	120 h
1	Saline	-	100	100	100
2	2×10^5	0%	60	60	50
3	2×10^5	0.1%	90	80	70
4	2×10^5	0.2%	80	80	80
5	2×10^5	0.4%	90	80	80



Jan Oppen Berntsen



Nguyen Duc Dung



Pham Cong Thanh



Vo Thanh Tung



Huynh Truong Giang



Tran Thi Tuyet Hoa

Jan Oppen Berntsen is Director Feed Additives and Technical Equipment at Pharmaq AS, Oslo, Norway. Email : jan-oppen.berntsen@pharmaq.no

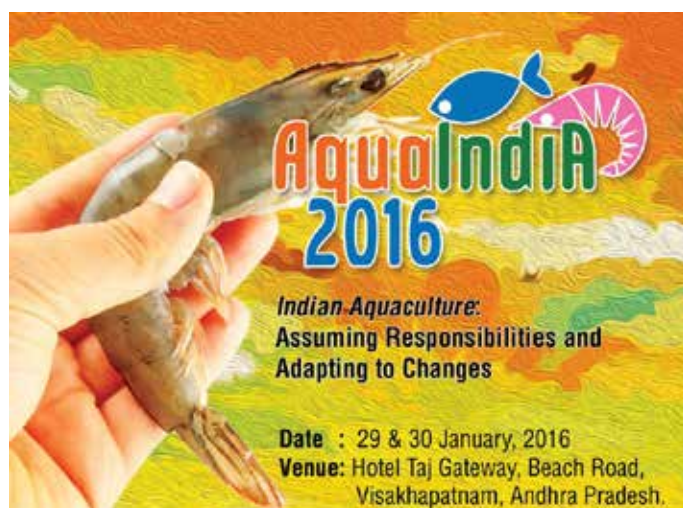
Nguyen Duc Dung is Regulatory Manager at Pharmaq in Vietnam . Email dung.nguyen-duc@pharmaq.no,

Pham Cong Thanh is Country Manager at Pharmaq in Vietnam. Email pham-cong.thanh@pharmaq.no

Vo Thanh Tung is Clinical Development Manager at Pharmaq in Vietnam. Email vo-thanh.tung@pharmaq.no,

Huynh Truong Giang, is lecturer and Vice Head of Department of Hydrobiology, College of Aquaculture and Fisheries, Can Tho University, Vietnam. Email: htgiang@ctu.edu.vn

Tran Thi Tuyet Hoa, PhD is lecturer and Vice Head of Department of Aquatic Biology and Pathology, College of Aquaculture and Fisheries, Can Tho University, Vietnam. Email: ttthoa@ctu.edu.vn



Aquaponics as a sustainable solution for Asian aquaculture

By Jason Danaher and Kaitlin Redmond

It opens up the possibility to get a double crop (fish and vegetables) from the same volume of water in this integrated farming method.



As the world's appetite for fish grows so, too, the necessity for sustainable aquaculture production. As the largest producing region in the world, Asia controls roughly 89% of the industry according to the Food and Agricultural Organization (FAO). Furthermore, it is estimated that the region will need to increase production by 60% by 2030—just to feed Asia alone. Consequently, Asia has a great challenge to produce more fish responsibly while limiting the adverse impacts on the environment.

Today, 80% of the total aquaculture production in Asia is in ponds. This is mainly due to the lower operational inputs that are required compared to other production methods, as well as to the higher economic returns per unit water body. As a result, the diversification and intensification of nurseries for pond production have been growing as market demand for aquaculture products increases. However, as production intensifies, waste generated in the production system requires proper management and treatment. While excess waste is often a problem for farmers, it can be turned into an opportunity with integrated farming methods such as aquaponics.

Integrated farming

The concept of integrated farming is not new. In fact, it is centuries old in Asia. Aquaculture effluent composes of organic matter and dissolved nutrients. Research has shown that vegetable crops respond positively to dissolved nutrients in aquaculture effluent and the potential for improved nutrient efficiency through integrated agriculture systems is high. In freshwater aquaculture, a number of Asia-Pacific countries integrate rice, vegetable and animal farming with fish production. In marine aquaculture, this concept is often referred to as integrated multi-trophic aquaculture (IMTA), where finfish, shellfish and seaweeds are cultured together in an open system, which recycles the nutrient outputs of the different species. Integrated production systems are considered environmentally sustainable because the nutrient output from one production system can provide essential nutrient inputs for another; thus, minimising the environmental impact of nutrients through on-site recovery and recycling.

“ Management of aquaponics systems requires a solid foundation of both aquaculture and horticulture technologies... ”

Intensive aquaculture with plants

Aquaponics is the combined culture of fish and hydroponic vegetable crops in a recirculating aquaculture system (RAS). It has received considerable attention because of the system's capability to culture fish at high density, sustain water quality, minimise water exchange, and produce a marketable vegetable crop. Aquaponics systems utilise dissolved fish wastes, such as nitrogen and phosphorus, as a nutrient source for the hydroponic vegetable crop. The vegetable crop is responsible for the direct assimilation of dissolved fish wastes and products of microbial breakdown and can filter and return a small percentage of the water back to the fish culture with the proper equipment. Aquaponics like other integrated farming systems operate by the principle of nutrient recycling. It is a highly controlled system which requires intensive management and special unique considerations.

Management of aquaponics systems requires a solid foundation of both aquaculture and horticulture technologies along with how to integrate the two together. Aquaponics is first and foremost, an aquaculture system, so important inputs such as fish feed, oxygen, mechanical filtration and biological filtration are critical to the long term sustainability of an aquaponic production system. The fish feed often supplies more than 80% of the nutrients the plants require, but sometimes supplementation of calcium, potassium and iron is necessary. Maintaining a neutral pH 7.0 in the production system ensures that fish, nitrifying bacteria and plants are in an optimal environment.

If solids are properly treated and removed from the production system, the aquaculture system can be linked to existing hydroponic plant production technologies. The three most common methods used to produce hydroponic plants in an aquaponic system are raft, ebb and flow and nutrient film techniques.

In the raft system, plants are floated over the treated aquaculture effluent, allowing the roots to remain suspended in a nutrient solution passing through the trough. Ebb and flow systems inundate the roots of the vegetable crop for a short time with the treated effluent which is then drained off. The plant is supported in an inert, aggregate substrate and the flood and drain cycle is repeated multiple times throughout the day. The nutrient film design has plants positioned in shallow channels and the roots are constantly exposed to a thin film of nutrient solution passing through the channel.





The most common species raised in Asian aquaculture are also among the most popular species for aquaponics. Tilapia is a popular choice among aquaponics beginners because they can handle a wider range of water quality and temperatures and can survive well in a low oxygen and/or high ammonia level environment.

Carps are another common warm water species that can also adapt easily to various environments. Catfish are also a warm water species which grow quickly and have a good feed conversion ratio (FCR). As for plants, any leafy lettuce or herb such as kale, swiss chard, bok choy, basil, watercress and chives will do well in any aquaponic system. Fruiting plants and cruciferous vegetables such as tomatoes, peppers, cucumbers, cabbage, broccoli and squash have higher nutritional demand and require a heavily stocked and well-established system to thrive.

Waste outputs as on-farm resource

Concentrated aquaculture wastes will have to be addressed with new management techniques as producers continue to intensify their RAS. New technologies are not needed to integrate agricultural systems, but the merger of existing technologies

will be required to determine if they can be used for integrated agricultural systems. The dissolved nutrients from RAS should not be thought of as an environmental problem, but should be collected and treated as an on-farm resource for integrating aquaculture with horticulture.

The ability to get a double crop (fish and plants) from the same volume of water and the same nutrient source will become increasingly important in areas where freshwater resources are limited and waste management strictly regulated. Utilising discharged solids and water on-site could further improve farm nutrient efficiency and ease eutrophication of nearby aquatic ecosystems. These new management techniques could improve resource efficiency and provide ecologically sensitive solutions for water management at a local-scale.

Thus, aquaponics is a sustainable best practice for aquaculture farmers who want to increase production while naturally alleviating the negative effects of excess waste effluent. It achieves environmental sustainability through bio-mitigation, which is more affordable for smaller pond operations. It allows for greater economic stability for farmers through product diversification and risk reduction and is also socially acceptable.



Jason Danaher, Ph.D. is with the Fisheries and Aquaculture (Aquaponics) group at Auburn University.

Kaitlin Redmond is from North Carolina State University. She has a B.S. Biology, M.S. Global Innovation Management. Email: PAES.General@Pentair.com

GLOBALG.A.P.
AQUACULTURE
STANDARD VERSION 5

NOW ONLINE

GLOBALG.A.P.

GLOBALG.A.P. AQUACULTURE CERTIFICATION

CARING FOR CONSUMERS

Responsible Sourcing at all Stages of Production

**DOWNLOAD THE
AQUACULTURE BOOKLET**

www.globalgap.org/aquaculture

Improving farming practices

This is part of zonal management among small-scale aquaculture operators in Asia.

Asia is known to be the biggest contributor of aquaculture products to the global market. As the industry expands and intensifies in response to growing market demand, producers face greater challenges because of increasingly virulent disease outbreaks and continued deterioration of the local environment. Many of these shocks and pressures are felt most acutely by small-scale producers.

Against this background, the Sustainable Fisheries Partnership (SFP), an environmental non-government organisation (eNGO), has been awarded a grant from the Walmart Foundation to implement a training program for small-scale producers in the aquaculture zones of China, Indonesia and Thailand. The aim is to train a total of 16,000 small-scale farmers comprising 2,000 farmers in Hainan Province, China; 10,000 farmers in Aceh, North Sumatra, West Java, Central Java, East Java, West Kalimantan and South Sulawesi, Indonesia and 4,000 farmers in Eastern, Central and Southern, Thailand. This is on improved farm practices, post-harvest processing and to introduce the value and basics of the zonal management approach in addressing some of the challenges of an increasingly complex industry.

The project works with shrimp farmers (Indonesia and Thailand) and tilapia farmers (China) on improvements in their own farms and connecting these to the cumulative impacts of all the farms together. Recognising that farmers learn directly from neighbours, the project aims to improve on some of the poorer practices copied from the past and to support the strengthening or development of local groups to manage the quality of water, the farmer's key resource.

It intends to reach at least 8,000 women, specifically targeting women farmers and the wives of shrimp/tilapia farmers who have a role in production management and processing. The implementation is in partnership with a range of local organisations who share the same belief that zonal management is the most efficient way of addressing the significant risks faced by fish and shrimp farmers in Asia. SFP's local partners are industry associations, producer cooperatives, input suppliers, as well as local NGOs. Their involvement is critical as they are familiar with the local situation and have existing relationships with the communities in the aquaculture zones.

The project team has conducted a series of training sessions in Indonesia and China. Field work will start soon in Thailand. Some small-scale producers in the selected regions of Indonesia have had training on zonal management on better management practices (water quality monitoring, disease identification and management) as well as post harvest processing.

All partners will meet to review the training approaches used so far to ensure the next training phase provides the most effective results for farmers. Early indications show that the mix of technical skills and business training is enabling some women to start small-scale businesses selling post-harvest products. Whilst land tenure issues limit the improvements that some small-scale farmers are willing to make in their individual farms, there is interest to reduce risks and improve output by coordinating some management measures such as disease treatment.



Women involvement in the training of best management practices for vannamei shrimp farming in Makassar

An important component of SFP's approach is to engage seafood buyers in improvement projects and all partners are working towards greater market access for the products from these zones. With the progress shown to date by all stakeholders, IDH - the Dutch Sustainable Trade Initiative - has also chosen to support the project. This strengthens work on the ground and enables greater linkage to the market through both SFP's and IDH's networks.

SFP's zonal management

This focus on zonal management is a recognition of the need for an industry-wide response to the continued boom and bust of aquaculture in Asia. The often uncontrollable development of farms have led to rapid deterioration of water quality. The impact is not just for other users, but as a negative feedback loop into aquaculture itself. Even where problems are not significant, there can be costs linked back to production, for example the increased need to treat incoming water before use. Disease monitoring, management and responses need significant improvement across Asia too and SFP is working with many other organisations to develop improved processes to protect and support the sustainable growth of aquaculture across Asia.



Participants of the training on the orientation to best management practices in shrimp farming

A closed hatchery system for the freshwater prawn

By Wagner C. Valenti and Dallas L. Flickinger

A system developed in Brazil and adopted by commercial hatcheries in Latin America maintains stable and suitable conditions for larval rearing.

During the larviculture of the freshwater prawn *Macrobrachium rosenbergii*, the control of nitrogenous waste products, mainly ammonia and nitrite, is a critical production step. These nitrogenous wastes, which can reach toxic levels, are products of the excretion of the larvae and the decomposition of organic materials during the culture process. Open and closed hatchery systems are being used for larval rearing.

Open system

The open system, or flow through method, is the older of the two systems used and is based on the daily replacement of 50 to 70% of the culture water. The replacement water also has the same temperature, pH and salinity of the water that was removed. This method is simple, but has several drawbacks.

Controlling the parameters of the replacement water must be rigorous in order to avoid shocks that can cause stress or even kill the larvae. A steep drop in temperature and pH may cause severe stress to larvae. The level of ammonia peaks in the daily cycle of water use, reaching concentrations of approximately 2 mg/L just before the daily water change, then falling practically to zero after the water change. The larvae are concentrated in high densities when the water level inside the tank is reduced; this results in increased stress and cannibalism which then leads to low survival, decreased productivity and a prolonged larval cycle. Furthermore, this system is not practical when the hatchery is located far away from the coast, due to the large quantity of seawater required.

Closed system

The closed system relies on the constant circulation of water from the culture tank through the biological filter, thus providing a continuous process of nitrification. This ensures low and consistent levels of ammonia and nitrite. Furthermore, this system involves only minimal water replacement. With stable environmental conditions, it provides suitable rearing conditions



One month old juveniles

for the larvae. The efficiency of nitrification increases as water recirculation rates increase. Currently, closed system culture is the preferred choice in freshwater prawn hatcheries globally.

Figure 1 shows one of the models developed at the Centre of Aquaculture- UNESP (CAUNESP), Brazil, which operated with a daily recirculation rate estimated at 24 times of the total water volume. The system comprised of a 140 L larval culture tank with a 43 L biofilter tank filled with 24 L of calcareous substrate (Figures 2). The culture tank and the biofilter were conical in shape and made of fiberglass coloured black. Flat bottom fibre glass tanks also worked well. The turnover rate of the total volume of water in each tank an hour. The water was pumped by airlift, which maintained the oxygen level close to saturation.

Results of six trials showed that the system maintained the temperature, dissolved oxygen, pH, salinity, ammonium and nitrite at stable and suitable levels for rearing *M. rosenbergii* larvae (Table 1). Survival and productivity were about 65% and 60 post larvae/L respectively (Table 2). The larval cycle was short and varied from 24 to 31 days. This system has been introduced in research institutes and has been adapted for several commercial hatcheries in Latin America.

Table 1. Water quality (mean \pm SD) obtained in six selected cultures (L1 a L6).

Culture trials	L1	L2	L3	L4	L5	L6
Temp. (°C)	30.6 \pm 0.8	29.9 \pm 0.3	29.8 \pm 0.5	29.6 \pm 0.4	29.5 \pm 0.6	30.0 \pm 0.4
Dissolved oxygen (mg/L)	6.5 \pm 0.1	5.2 \pm 0.9	5.5 \pm 0.6	6.4 \pm 0.1	6.5 \pm 0.1	4.6 \pm 1.3
Dissolved oxygen (% saturation.)	86.5 \pm 1.6	69.8 \pm 11.0	72.6 \pm 8.9	86.3 \pm 0.9	86.9 \pm 1.1	64.5 \pm 18.6
pH	7.7 \pm 0.1	8.1 \pm 0.2	8.1 \pm 0.2	8.0 \pm 0.3	8.2 \pm 0.3	8.0 \pm 0.3
Salinity (ppt)	12.3 \pm 0.4	12.1 \pm 0.1	13.7 \pm 1.0	12.4 \pm 1.0	12.3 \pm 0.2	12.9 \pm 0.5
N-Ammonia (μ g/L)	56.0 \pm 34.0	48.8 \pm 19.4	92.0 \pm 41.8	52.0 \pm 39.4	49.0 \pm 15.6	121.0 \pm 100.4
N-Nitrite (μ g/L)	26.4 \pm 14.3	39.4 \pm 14.6	25.0 \pm 7.6	36.3 \pm 17.8	67.0 \pm 15.7	51.8 \pm 42.8



Figure 1. Example of closed system developed at CAUNESP-UNESP. The picture on the right shows the biological filter in use. The picture on the left displays the system as a whole.

Tanks

These can be round, square or rectangular concrete, fiberglass or polypropylene plastic tanks. The interior of the tanks should have a smooth surface and rounded angles between all walls including the bottom to facilitate easy cleaning and to prevent the attachment of unwanted organisms. When constructed from concrete, the surface of the tanks should have waterproofing treatment from an inert epoxy resin. For tanks designated for larval rearing, the interior walls must be dark. The size of the tank depending on the desired production, can range from small 50 L containers to being large concrete tanks of 8 to 10 m³. It is recommended that these tanks be located indoors.

In closed systems, the biological filters generally consist of a container that holds substrates to fixate nitrifying microorganisms. The filtration system should be designed in such a way that the water flows across the entire substrate substratum evenly to allow an efficient nitrification process. The materials used as substrates can be gravel from siliceous or calcareous minerals, shells of bivalve and gastropod molluscs or synthetic materials such as polyethylene, polyurethane and polystyrene.

The diameter of the substrate particles is important, because a larger total surface area sustains a larger bacterial biomass. The common suggestion is to use a particle size of about 5-10 mm. The quantity of substrate used in the filter can vary from 4 to 20% of the total water volume in the larval rearing tanks.

Table 2. Performance of the system in six selected cultures (L1 a L6).

Parameters	L1	L2	L3	L4	L5	L6
Stocking density (larvae/L)	91	90	105	106	100	100
Rearing cycle (days)	26	31	25	28	24	24
Survival (%)	65.7	63.6	65.9	62.4	63.9	65
Productivity (post larvae-PL/L)	60	58	70	66	64	65

Table 3. Formula for artificial sea water

Salt	g/100 L of fresh water
Sodium chloride (NaCl)	2760.0
Magnesium sulphate (MgSO ₄ .7H ₂ O)	690.0
Magnesium chloride (MgCl ₂ .6H ₂ O)	540.0
Calcium Chloride (CaCl ₂ .2H ₂ O)	140.0
Potassium chloride (KCl)	60.0
Sodium bicarbonate (NaHCO ₃)	20.0
Potassium bromide (KBr)	2.7
Strontium chloride (SrCl ₂ .6 H ₂ O)	2.0
Manganese (II) sulfate (MnSO ₄ .H ₂ O)	0.4
Sodium phosphate (NaHPO ₄)	0.4
Sodium molybdate (Na ₂ MoO ₄ .2H ₂ O)	0.1

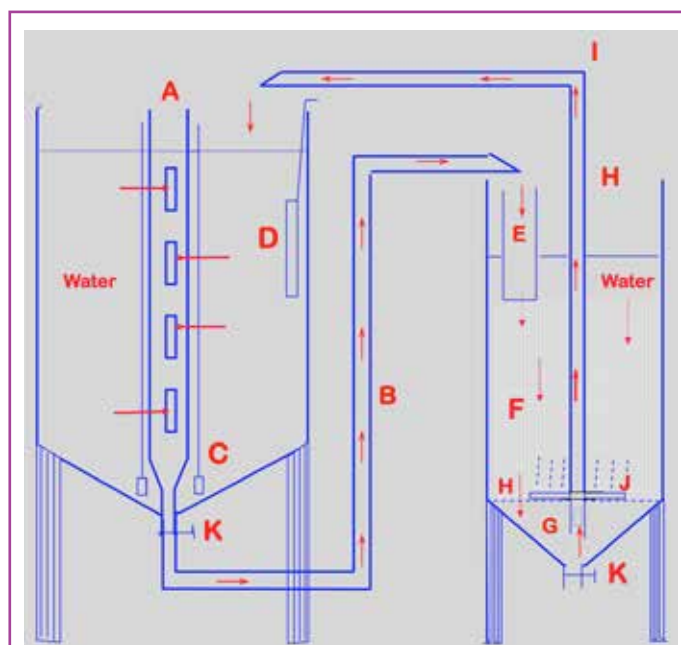


Figure 2. Recirculating system: fiberglass rearing tank (left) and fiberglass biofilter (right). Setae show water way.

A: 2" Pipe with 250 µm screen at windows; B: Rearing tank outlet pipe; C: air diffusers (3x1 cm); D: Heater and Thermostat; E: Mechanical filter (only a pipe provided with 80 µm screen at the bottom); F: Substrate (crushed shells - about 5 mm diameter); G: Nitrified water chamber; H: Fiberglass disk with holes to bear shells; I: Biofilter outlet pipe; J: flexible tubing ring to aerate substrate (it is placed equidistant to walls and central pipe; holes are about 0.5 mm and logarithm distant each other); K: valve

The culture water

Both sea and fresh water is required for larviculture of *M. rosenbergii* to attain a salinity of around 12 ppt. Brackish water can also be prepared with artificial seawater. A formula successfully used for artificial seawater preparation in CAUNESP and economically viable for hatcheries located more than 550 km from the sea is presented in Table 3. For shorter distances though, it is more cost efficient to transport natural sea water.

The fresh and sea waters must be filtered and disinfected before they are used to make brackish water. Filtration removes suspended particles, parasites and predators, all of which can impair larval development. Subsequently, the water goes through a disinfection process with chlorine, ozone or ultraviolet treatment.

To prepare the artificial sea water, gradually add sodium chloride to 20 L of water in a 40 L bucket and stir until it is completely dissolved. Dissolve the magnesium sulphate, magnesium chloride, calcium chloride, potassium chloride and sodium bicarbonate in separate beakers using the amount per 100 L before adding to the main bucket. Add these solutions to the main bucket in descending order of concentration. Transfer the solution to a storage tank containing about 60 L of water, while stirring, and then complete the volume to 100 L in the storage tank. Allow the solution to stand for 24 hours with aeration (air stone should be placed in the centre of the container, near the bottom). Stir vigorously and measure the salinity. The salinity should be about 34 ppt. Weigh the remaining salts and dissolve each separately in beakers containing about 0.5 L of water. Add these solutions to the storage tank and then leave the final solution where aeration is provided for 24 hours before use. For hatcheries operating with large rearing tanks, the brackish water should be prepared inside the tanks.

Simple recirculating systems similar to the one presented in this article are largely used in Latin America to produce post larvae of *M. rosenbergii*. In Brazil, there are currently at least 14 commercial hatcheries in operation. Others are under construction. Each hatchery has the capacity to produce 5 to 40 million post larvae

per year. All of the facilities use recirculating systems which yield results to those presented in Tables 1 and 2. One hatchery is located in the state of Rondônia, which is about 2,500 km from the ocean. There is also a hatchery located in Paraguay, which is a completely landlocked country. Both operate with closed systems using artificial seawater and showed excellent results.



Wagner C. Valenti

Wagner C. Valenti is a WAS Fellow and Dean at Sao Paulo State University. He also is the Head of the Crustacean Sector at Aquaculture Center - CAUNESP. He has worked on *Macrobrachium* culture during the past 35 years. Recently, he has developed indicators to assess sustainability of aquaculture systems. Email: valenti@clp.unesp.br/wcvalenti@gmail.com.



Dallas L. Flickinger

Dallas L. Flickinger is a biologist, Master in Science and currently a PhD student at CAUNESP. Email: dlf3f@mtmail.mtsu.edu



 亚太水产养殖展

 APA Expo

www.apaexpo.com.cn

2016

ASIA-PACIFIC AQUACULTURE EXPO

 Co-located with: The 11th China International (Xiamen) Seafood Expo

Asia-Pacific--the center of world aquaculture industry.

China--Asia-Pacific's leading aquaculture nation.

APA Expo--the sole aquaculture event in Asia-Pacific.

May 26-28, 2016

Xiamen International Conference & Exhibition Center

Fujian, China

Organizers

 China Aquatic Products Processing and Marketing Alliance (CAPPMA)

 Fujian Aquatic Products Processing and Marketing Association (FAPPMA)

 China Great Wall International Exhibition Co. Ltd. (GIE)

Phone: 86-10-88102348, 86-10-85076331

Email: yangp@apaexpo.com.cn, cappmaexpo@126.com



 WeChat: APA Exp



www.apaexpo.com.cn

Snakehead farming in indoor RAS

A seminar to impart knowledge and skill in snakehead culture to new farmers.

A workshop cum seminar was conducted on the snakehead *Channa striata* farming using a recirculating aquaculture system (RAS) in May 2015. This was held at Sepang Today Aquaculture Centre (STAC), Sungai Pelek, Selangor, Malaysia. A total of 20 participants from various states attended the one day seminar.

The seminar was sponsored by the Ministry of Education of Malaysia under the Knowledge Transfer Programme (KTP) with the collaboration of the Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia (UPM). STAC was selected as the industry partner by project leader Dr S M Nurul Amin (UPM) to transfer knowledge to local farmers on snakehead culture from one inch (2.5 cm) to marketable size in indoor RAS. The KTP on snakehead provided the latest technology and skill in the aquaculture industry for the development of a profitable and sustainable snakehead farming in Malaysia.

The markets for snakehead locally and in Singapore have been increasing and the ex-farm price is about USD 8.00/kg. As such, more fish farmers are investing in its farming. However, farming skill and knowledge are lacking among the newcomers. Current problems in snakehead farming are:

- low survival rate of *C. striata* due to cannibalism,
- high cannibalism as juvenile *C. striata* could eat siblings of less than two-thirds of their body length,
- lack of knowledge on culture techniques for the snakehead
- lack of skill among the workers in snakehead farming industry.

Based on the above, the seminar included an exchange of information on culture techniques such as how to reduce cannibalism by feeding fry with floating formulated feed high in crude protein.

In his presentation on the intensive RAS for the snakehead, Khoo Eng Wah, Founder, STAC said, "RAS farming in marine and fresh water fish is getting more and more popular in Malaysia and there are large investments in its farming. This farming method uses high stocking at 1,000 fish/m³ or per tonne of water in rectangular fibreglass tanks. With RAS/aquaponics, we plant the edible fern known as *Stenochlaena palustris* (local name is paku miding) which is a first in Malaysia.

"In the case of nursery culture, we stock fry of 25mm body length. Fry is fed three times/day with a high protein floating formulated feed. We monitor water parameters of the RAS such as dissolved oxygen, pH, alkalinity, total ammonia on a weekly basis. The tanks are covered with plastic netting to prevent jumping and escape of the fish. Fish will grow from 25 mm to 200 mm in 4 months. There is a minimum water exchange and weekly top up at about 10% of water to compensate for evaporation and water used up by the fern. There is no occurrence of parasite or disease during the whole culture period."

Other speakers at the seminar included Professor Aziz Arshad, Professor Salleh Kamarudin, Dr Abu Hena Mustafa Kamal and Dr Mohammad Aminur Rahman who presented on their experiences and knowledge on the biology of the species, nutrition of snakehead and on pond farming techniques of snakehead, respectively.

Training at STAC

STAC was set up in 1996, initially to carry out hatchery and farming of the black tiger shrimp *Penaeus monodon*, and at the same time as a provider of 'hands-on' training on aquaculture. After 2007 the business shifted to supply and installation of RAS for Malaysian, Singapore, Indonesia and Bangladesh clients while the aquaculture training component carries on.

The training courses are conducted monthly. The range of topics include: RAS/aquaponics for fresh water and marine species; farming and breeding of the marine shrimp; fresh water prawn farming and breeding; mangrove crab and soft shell crab production; marine fish (hybrid grouper, snapper and sea bass) farming and hatchery production; bull frog farming and breeding; fresh water fish (marble goby, jade perch, mahseer or empurau and tilapia) farming and breeding; and arowana and ornamental fish farming and breeding.



Khoo Eng Wah (centre) with speakers and participants.

Pangasius in Indonesia

Good production but needs to step up its competitive edge with impending AFTA in 2016.



Photo credit: PT Matahari Sakti

Indonesia's production of the pangasius has been increasing over the last four years. In 2011, production was 229,267 tonnes which subsequently increased to 410,684 tonnes in 2013. South Sumatra contributed 54% to this production (<http://djpb.kkp.go.id>). Production in 2014 was estimated to be 403,000 tonnes and in 2015, the target by the Ministry of Fisheries and Marine Affairs (MFMA) is 604,700 tonnes (Akuakultur Indonesia, 2015).

Pangasius farming in Indonesia is still dominated by small scale farmers, but recently some 8 major integrators have emerged, such as PT CP Prima and PT Expravet Nasuba (Agrina, 2015). This rapid development came about due to support from processors for frozen fillet production and restrictions on imports.

Prior to 2011, imports of pangasius fillet monopolised the local fillet market with almost 75% comprising frozen fillet from Vietnam. Subsequently, MFMA imposed regulations that glazing should not be more than 20%. This constrained fillet imports from Vietnam which usually have glazing levels of 30-35%, according to Saut P Hutagalung, Fisheries Processing and Marketing Division, MFMA.

In an editorial in MS bulletin, a publication of feed miller, PT Matahari Sakti, the issues with the pangasius in Indonesia was listed as poor fillet colour, low prices, high feed costs and an inability to compete with fillet imports from Vietnam. It added that there is a need to find solutions. Although many consumers are not concerned about fillet colour, the opinion is that importers eager to enter the Indonesian market are building perceptions that pangasius should have white meat. The nationalistic stand is that Indonesia's pangasius is tasty, healthy and fulfils market demands.

The call is to build a brand image for Indonesian pangasius such as 'Indonesia Patin', (patin being the Indonesian name for the pangasius). A good marketing strategy was proposed to give more recognition to the fish especially in terms of processing. With the AFTA (Asean Free Trade Agreement) coming into effect in January 2016, local producers wonder whether they can still have a competitive edge.

Competitive edge

The biweekly magazine Agrina, which carried a review on the situation in its September 6, 2015 issue, said that the demand for

the pangasius has been rising but supplies are still limited. The reason for the limited supply is due to low interest among farmers to farm the fish in the first semester of 2014 because of low prices and low margins. Production picked up in late 2014 when prices improved. In February 2015, ex-farm prices rose to IDR 15,500/kg in Java Island and was higher in Medan in Sumatra at IDR 16,000/kg. In August, prices dipped to IDR 14,250/kg. Previously prices reached a low of IDR 12,000/kg, close to the cost of production which is around IDR 11,000 to IDR 11,500/kg.

According to the Catfish Commission (local acronym Komisi Catfish), the total fillet production in 2014 was around 650 tonnes/month. Prices of fillet from Vietnam range from IDR 45,000 to IDR 55,000/kg. In the case of local pangasius, based on a 30% fillet yield and ex-farm price of IDR 13,000 to IDR 16,000/kg, the cost of raw material is already IDR 50,000 to IDR 60,000/kg. Although the upside to local fillet is the low glazing level, the downside is that fillet is yellowish white in colour. As such, the main threats to the local industry are both the price and quality of imported frozen fillets.

The competitive edge of Vietnam's pangasius was reviewed by Thomas Darmawan (AP51, Agrina, 2015), who found that productivity is much lower in Indonesia (70 tonnes/ha versus 400 tonnes/ha in Vietnam). Vietnam's cost of production is lower and the industry has a high level of integration. The processing industry is contributing to current development; however, it is still at its infancy relative to that of Vietnam.

In Indonesia, harvest sizes are 700 g to 1.2 kg per fish after 7-8 months of culture whereas fish of over 1.2 kg are harvested in 6-8 months in Vietnam. Local producers should aim for larger fish of 1-1.3 kg and at 40% of fillet yield, produce 500 g fillets. Producing to market specifications on fillet quality, with no off flavour are some additional issues the local industry has to work at.

References

- Agrina. 2015. Pangasius: ready to compete, Volume 11, No.255, 6 September 2015. pp 14-21.
- Akuakultur Indonesia. 2015. Pangasius farming and farm feeds, No 14, March-April 2015. p15.
- MS Bulletin. 2015. 'What is wrong with Indonesia's pangasius?', Volume 30, April 2015.



Photo credit: PT Matahari Sakti

Tilapia is the US consumers' choice

By Fatima Ferdouse

The affordable tilapia is popular in the US retail and restaurant trade, imports are expected to increase in 2015.



Fresh tilapia alongside salmon and cod

The three 'most preferred' seafood choices of US consumers are shrimp, salmon and tilapia. Shrimp consumption has seen a decline since 2008 because of the rise in average prices, economic downturn and falling disposable income of the average American. However the affordable tilapia has made inroads in the US seafood market, and last year has reached number one position in the US frozen fillet imports list. It showed a 21% share in total imports under this category, according to the import data of the US National Marine Fisheries Service (US NMFS).

Over the years, the tilapia has positioned itself from 6th in 2005 to 4th position in 2013 in the US seafood consumption list. In 2013, US imports of fresh and frozen tilapia totalled 228,900 tonnes and this increased further to 230,645 tonnes in 2014. The import growth persists this year.

In US restaurant menus under the seafood category and in the retail trade, tilapia appears prominently along with the salmon.

A USD billion import market

In 2014, 230,644 tonnes of fresh and frozen tilapia were imported into the US market with an import value of USD 1.11 billion. Supplies from China, the number one in ranking, were stable with more than 75% market share. Imports declined marginally from Indonesia and also from Taiwan (-6%). However, Vietnam and Mexico have been selling aggressively to this market.

During January-June 2015, total tilapia imports increased again by 12.3%, crossing the 100,000 tonnes mark. Total imports of

fresh fillet were stable at 13,445 tonnes and the leading fillet exporters were Honduras, Costa Rica, Colombia and Ecuador. Supplies from Honduras, Costa Rica and Ecuador decreased when compared to that in 2014 but that from Colombia recorded an increase. Import growth of whole tilapia on the contrary, was considerably higher (+22%) against the same period last year, while the rise in frozen fillet supplies was moderate (+7%).

Popularity of the tilapia



Frozen tilapia fillet



Ready to eat tilapia

The tilapia is popular in the US retail and restaurant trade. Tilapia consumption is relatively higher in Orlando, Florida and California. However, its popularity has grown all over the US. Almost every retail chain, small and large, nowadays carries fresh and frozen tilapia fillet at competitive prices next to the most popular salmon fillet. Fresh tilapia fillet is generally imported from Latin America, for which the retail price range from USD 4.99/lb (3.4 lb tray pack at Costco chain of hypermarkets) to USD 6.99/lb (on ice, in Safeway supermarkets) during the summer of 2015. The comparative price of American catfish fillet was USD 6.99/lb at Costco.

Asian supermarkets mostly owned and run by Koreans, sell frozen/thawed whole tilapia which is popular among the Asian and Hispanic households. Frozen tilapia fillet are also widely available in various product forms, ranging from raw frozen fillet to various types of ready-to cook preparations. Breaded or crusted tilapia fillets are the popular ready-to-cook variety.

Table 1. Top 10 U.S. Consumption by Species Chart (adapted from raw data from National Marine Fisheries Service).

	2013		2012		2011	
	Species	lbs	Species	lbs	Species	lbs
1	Shrimp	3.600	Shrimp	3.800	Shrimp	4.2
2	Salmon	2.702	Canned Tuna	2.400	Canned Tuna	2.6
3	Canned Tuna	2.300	Salmon	2.020	Salmon	1.952
4	Tilapia	1.430	Tilapia	1.476	Pollock	1.312
5	Pollock	1.154	Pollock	1.167	Tilapia	1.287
6	Pangasius	0.771	Pangasius	0.726	Pangasius	0.628
7	Cod	0.605	Crab	0.523	Catfish	0.559
8	Catfish	0.566	Cod	0.521	Crab	0.518
9	Crab	0.548	Catfish	0.500	Cod	0.501
10	Clams	0.352	Clams	0.347	Clams	0.331
	Total All Species	14.5		14.4		15.0

Table 2. US tilapia imports for January to June 2014 and 2015 and annually for 2013 and 2014 (tonnes).

	2015	2014	2013	2014
Product type	January-June		Annual	
Whole fresh	454	187	259	375
Whole frozen	19 662	16 028	18 044	15 220
Total, whole	20 116	16 215	42 033	40 246
Fillet, Fresh	13 445	13 490	26 764	25413
Fillet, frozen	77 749	72 451	159 880	164 913
Total fillet	91 394	87 941	186 644	190 326
Total tilapia incl. others	111 509	102 213	228 927	230 644

Source: US NMFS



Whole tilapia in a Korean supermarket

Outlook

US consumers' demand for tilapia has remained relatively stable, even when their disposable income has declined during 2008-2014 as a result of their country's financial crisis. This positive trend is likely to continue in 2015 and also in 2016, as is seen in the increased imports during the first half of 2015. While tilapia fillet is being accepted with increasing demand in the US catering trade, retail demand for whole tilapia and tilapia fillet fresh and frozen, has also advanced moderately. In general, China will remain the main supplier in the frozen fillet market but Vietnam aims to increase its market share which is obvious with data on imports in 2015.



Fatima Ferdouse

Fatima Ferdouse is a consultant on the international seafood trade with more than 30 years of experience in seafood trade and marketing in the Asia Pacific region. She was head of the Trade Promotion Division at Infotech, Malaysia responsible for market information and technical advisory services to the regional seafood industry for 25 years. She is based in Kuala Lumpur. Email: fatimaferdouse@hotmail.com

Tilapia in US: more expected from China in 2015

On target to reach the second highest volume in the last decade, according to reports by Undercurrent News

China's sales of the tilapia to the US are on target to reach the second highest volume in the last decade, according to US NMFS statistics. Up to July 2015, China held 73.8% of the US market share for the first seven months of 2015, with imports at 95,272 tonnes. US imports of Chinese tilapia hit an all-time high at 173,398 tonnes in 2012 but in 2013, imports were only 168,283 tonnes. In 2014, imports were less than in 2012 at 172,566 tonnes.

The continuing growth in the market share of China's processors came at a time when other frozen tilapia exporters experienced drops in sales. For the first seven months of this year, Taiwan's sales volume dropped by 11.3% y-o-y from 7,962 tonnes, Indonesia's dropped by 11.3% from 6,356 tonnes and Thailand's sales dropped by 16.1% from 1,183 tonnes.

Prices down

On the contrary, the overall value of Chinese tilapia imports in 2015 was down to USD 382 million, 9.5% less than in the first seven months of 2014. This demonstrated a drastic drop in prices.

This drop was reported by Undercurrent in July, and was due to the high inventory and slow demand in China's top three markets: US, Mexico, and Russia.

August ex-farm prices in South China were lower than for the same period in 2014, driven by poor domestic and international sales and plentiful supplies. Producers in Hainan, Zhanjiang and Maoming in South China all have lower prices and were holding steady at these levels, according to reports by Seafoodnews.com.

There was an increase in ex-farm prices that started in June, with prices climbing from a low of CNY 7/kg for 800 g live tilapia in June to CNY 8/kg by August. This was still significantly below the prices over the same period in 2014, which was CNY 9.45 to CNY 9.9/kg. These ex-farm prices in CNY/kg for whole, live tilapia of 500-800 g were based on weekly prices provided by various factories of Siam Canadian China.

However, an increase in the raw material price in China does not translate to an increase in selling prices in the US as processors continue to report a downturn in foreign demand and sales. US, wholesale prices for frozen Chinese tilapia have actually fallen in recent

weeks. The report quoted price declines. Urner Barry's price for 3 to 5 oz frozen fillets with shallow skin was USD 2 to USD \$2.10 on July 7 and down to USD 1.90 to USD 2 on August 10.

The market situation is further complicated as farmers were not willing to sell their tilapia at a lower price to processors. Drought and disease plagued some operations in South China where the combination of hot temperatures and lack of rainfall have contributed to disease outbreaks and an increase in fish mortalities. Some farmers tried to sell off some of their inventories, but with little success. Despite the slight ex-farm price increases, some farmers are cutting back on stocking density, in some cases by 20-40%.

As farmers react to prices, the supply will tighten and wholesale prices will increase. The best chance for prices to rise will largely be dependent on overseas demand, particularly from US importers. Furthermore, the impact of the devaluation of the renminbi relative to the dollar in August is yet to be seen. Theoretically, the change should reduce costs. (Source: www.undercurrentnews.com).

PPP in research and aquaculture training



The UARF delegation included U K Viswanadha Raju, Managing Trustee of Uddaraju Ananda Raju Foundation and CEO of Ananda Group (centre left), Professor C Mohankumar Nair, Senior Adviser to Ananda Group (second right) and C Ranga Nadha Raju, Director, Godavari Mega Aqua Food Park, Andhra Pradesh, India (right). AIT was represented by Professor Kazuo Yamamoto (centre right), Dr Anil Kumar Anal (second, left) and Dr Krishna R Salin (left).

Uddaraju Ananda Raju Foundation partners with Asian Institute of Technology for academic and research collaboration on aquaculture and aquatic resource management.

The Uddaraju Ananda Raju (UAR) Foundation, part of the Ananda Group based in Bhimavaram, India, has signed a Memorandum of Agreement (MoA) with the Asian Institute of Technology (AIT) in Bangkok, Thailand. The signing in August was between U K Viswanadha Raju, Managing Trustee of UAR Foundation and Chairman of Ananda Group, and Professor Kazuo Yamamoto, Vice President for Resource Development, representing AIT President Professor Worsak Kanok-Nukulchai.

In the MoA, besides academic and research activities in the fields of fisheries education, aquaculture and allied sectors, AIT will also help UAR Foundation in establishing the Andhra Pradesh Fisheries and Ocean University, a first of its kind university in India as a public-private partnership (PPP) that will be solely dedicated to the fisheries, aquaculture and ocean technology sectors.

UAR Foundation and AIT are already working in joint projects on genetic selection of tilapia and empowerment of farmers, which are underway at the Aquaculture and Aquatic Resources Management (AARM) field of study at AIT's School of Environment, Resources and Development (SERD). The MoA also outlines a plan to develop capacity building program for aqua-farmers in India by organising technical seminars and joint publications targeted at farmers. Activities proposed under the agreement include an annual aquaculture seminar series, opportunities for AIT students to undertake internships at UAR Foundation, and exposure visits for aqua-farmers and entrepreneurs.

AIT is an international institute of higher learning. It is Asia's pioneer institution established in 1959 to help meet the region's growing needs for advanced learning in agriculture, aquaculture and aquatic resource management; engineering, science, technology and management; research and capacity building. AIT's mission is to develop highly qualified and committed professionals who will play a leading role in the sustainable development of the region and its integration into the global economy. AIT is based in Thailand and has affiliated centres in other parts of the world.(www.ait.ac.th)

Uddaraju Ananda Raju Foundation is an initiative of the Ananda Group of companies based in Bhimavaram, Andhra Pradesh, India. It is a non-profitable charitable organisation set up in memory of the group founder, the late Uddaraju Ananda Raju. The Ananda Group is a conglomeration of integrated agri-aqua-based companies engaged in production, processing and export of seafood from India to destinations across the globe. The Foundation undertakes a number of social activities including free distribution of rice to the deprived sections of society; conducting medical camps in villages and distributing medicines to the poor and needy; providing life-saving blood free to those who need emergency assistance from the Foundation's Blood Bank established in Andhra Pradesh; distributing text books and note books to school children; distribution of purified drinking water; managing Bharatiya Vidya Bhavan Schools in five provinces; and engaging in capacity building programmes by organising international seminars and workshops for the development of agriculture and aquaculture sectors in India. (www.anandarajufoundation.org)

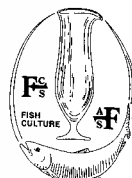
The Foundation is a recognised research centre by India's Ministry of Science and Technology, with research grants for the development of novel aquaculture technologies, and is also an approved Ph.D. Centre for Andhra University, India in fisheries and aquaculture research.



AQUACULTURE 2016

Paris Hotel and Convention Center
Las Vegas, Nevada USA
February 22-26, 2016

**WORLD
AQUACULTURE
SOCIETY**



**NATIONAL
Aquaculture
ASSOCIATION**

CO-SPONSORS



ASSOCIATE SPONSORS

American Veterinary Medical Association
America's Tilapia Alliance
Aquacultural Engineering Society
Aquaculture Association of Canada
Aquaculture Feed Industry Association
California Aquaculture Association
Cattfish Farmers of America
Global Aquaculture Alliance

International Association of Aquaculture
Economics and Management
Latin America & Caribbean Chapter WAS
Striped Bass Growers Association
US Shrimp Farming Association
US Trout Farmers Association
World Aquatic Veterinary Medical Association
Zebrafish Husbandry Association

In Cooperation with California Aquaculture Association

For More Information Contact:

Conference Manager

P.O. Box 2302 | Valley Center, CA 92082 USA

Tel: +1.760.751.5005 | Fax: +1.760.751.5003

Email: worldaqua@aol.com | www.was.org

The second shrimp wave in India

Two decades after its first success, India is once again riding high on shrimp farming.



India had her first wave of shrimp farming back in the early 1990s with the development of the black tiger shrimp, *Penaeus monodon*. Taiwanese feed miller Hanaqua was present in 1992, providing a turnkey feed mill service to an Indian company to produce feed for the black tiger shrimp.

Then in 2009, India formally introduced farming of the white shrimp, *Litopenaeus vannamei* which became its second major farmed shrimp species. Since then, this second wave in shrimp farming has been building up. In 2013, India led the global shrimp market as the biggest shrimp exporting country to the USA. Hanaqua is again ready to participate in the second wave of shrimp farming in 2012 when it was requested by Nexus Feeds Limited to provide Trademark License Authorisation (TLA) in aqua feed technology.

In May 2015, the Hanaqua team and three other specialists from TAC (Taiwan Aquaculture Corps) spent around 10 days on field visits to shrimp feedmills, ponds and processing plants in India. At the same, they also conducted technical presentations. The route covered was from Kakinada and south towards Chennai on the east coast, encompassing the major shrimp farming areas in India. This brief report by Peter Chiang, founder of Hanaqua and TAC specialists, Kelvin Chen, Eddie Chang and Neil Shih, is a summary of some of their findings.

"Not long ago, early mortality syndrome (EMS) disease brought down shrimp production in China and several Southeast Asian countries. However, India was able to stay away from this calamity. Our field observations and discussions suggest some basic reasons for this positive development. It could be due to the farmers' strong consciousness and optimal governmental guidance," said Chiang. These are:

- The set-up of coastal protection belts within 500 metres from high tide lines. Legally, these have been reserved for vegetation, such as mangroves trees.
- Construction of public water supply and discharge canals for aquaculture farms.
- Electrical supply to aquaculture areas.

- The regulation that the highest stocking density should not be more than 60 post larvae/m².
- Limitations on the number of licenses issued to restrict suppliers of shrimp broodstock and in nauplii production.
- A strict quarantine process conducted by the government.
- Restrictions on shrimp hatchery operations via licence management.

"The effectiveness of the above is also attributed to the completeness of the shrimp industry cluster, particularly the sound aquaculture knowledge and practical experience of farmers." added Chiang.

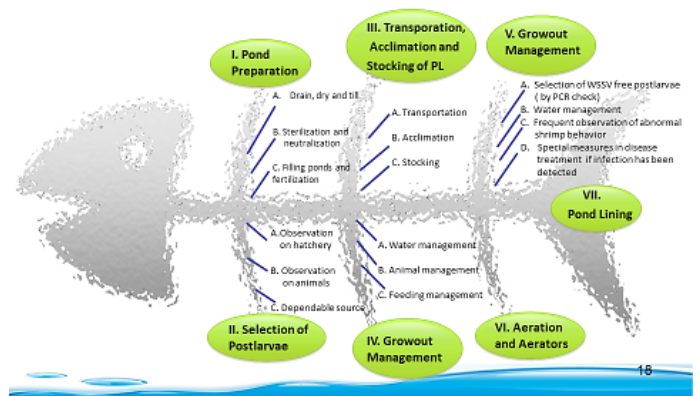
During this trip, several experienced farmers told the Hanaqua team that they were influenced by the 'fish-bone structure for shrimp technology' introduced by the company in 1992. In return for this compliment, the team presented a souvenir of a mini secchi-disc, named 'Friend of Pond Water'. (see below)



India has planned for a total area of 1.19 million ha for aquaculture use. Currently Indian farmers are quite familiar with commercial scale aquaculture practices. There is tremendous opportunity for aquaculture investment in India. Shrimp farming in India is heating up and several investors in the aquaculture industry are riding on this second wave.

Code of Shrimp Farming in Taiwan

1988 – by Dr. Hann-Jin Huang



Shrimp seminars in East Java



The team, from left, Penta Susilo, Jesper Clausen, Carolina Setiawati, Waiso, Olivier Decamp and Wawan Siswanto

In September, INVE AQUACULTURE and their distributor for Indonesia, PT Menjangan Sakti, held seminars in Tuban and Banyuwangi, to review the benefit of selected products and protocols for shrimp production. The seminars were a success, bringing together over 45 shrimp producers from Tuban, and 100 shrimp producers from Banyuwangi.

In Banyuwangi, the seminar was led by Hardi Pitoyo, chairman of Shrimp Club Indonesia (branch Banyuwangi), whilst in Tuban, it was led by a consultant, Agus Saeful Huda. The presentation by Dr Olivier Decamp, Product Manager for Farm and Feedmill and

the ensuing open discussions reviewed protocols to cope with important challenges facing shrimp producers: Vibriosis, slow growth, white faeces, etc. The lively debates were coordinated by Wawan Siswanto, Sales Manager Indonesia, Inve Aquaculture and Waiso, Assistant Sales Manager, Mensa Group.

These seminars were a great opportunity to announce the collaboration between the two companies, but also introduce Carolina Setiawati, Sales Manager Feed Division, Mensa Group and Dr Jesper Clausen, the new member of the Inve Aquaculture Product Management team. (www.inveaquaculture.com)

Top marine fish hatchery operators meet in Crete

INVE Aquaculture held its 2015 edition of its European Customer Seminar in October, at the Hellenic Center of Marine Research (HCMR) in Crete, Greece. The goal of the seminar was to gather the top marine fish hatchery operators in one significant place. Close to 100 participants representing 54 top hatcheries from Norway to France, Spain, Italy, Greece, Turkey, Egypt and the United Arab Emirates. These participants have a total annual fry production of 1.05 billion fry. The venue was chosen because of the two organisations' recent research partnership. It also gave the company the possibility to explain the goal but also the purpose of its new Total Quality approach which is on the importance of quality across the board.

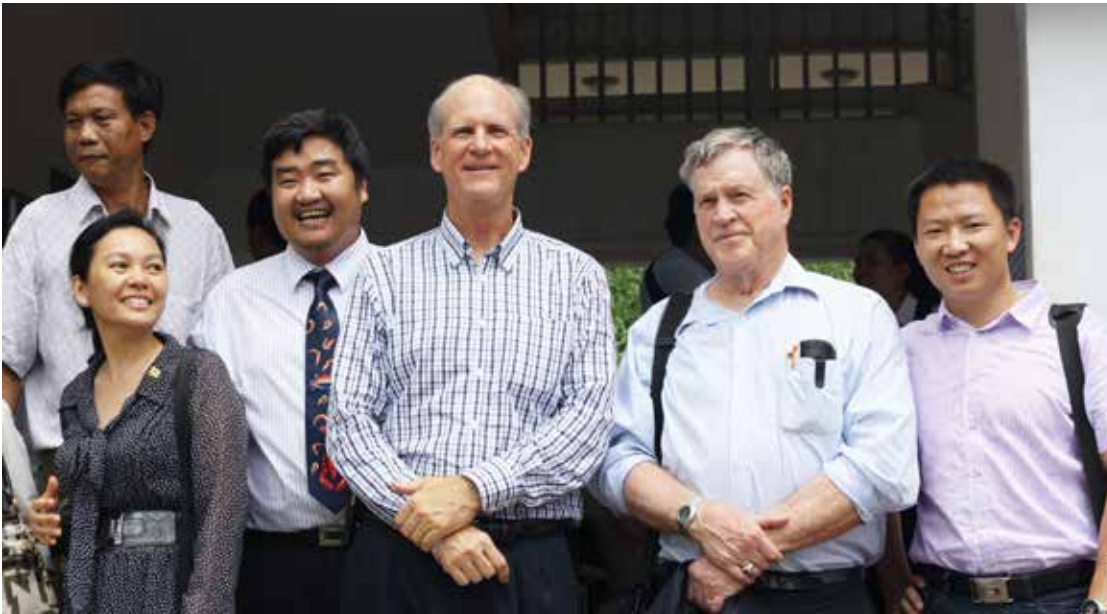
Alessandro Moretti, Product Manager Fish Hatcheries, started the seminar with an overview of the general marine fish market in Europe. Following this, guest speakers. Dr Nikos Papandroulakis and Dr Mylonas Constantinos, two of the highly ranked researchers at HCMR, respectively, discussed their latest findings in hatchery technologies and broodstock management. Dr Katerina Moutou, an associate professor spoke on nutritional needs as well as on innovative tools for improving larval quality such as by focusing on digestibility. Professor George Koumoundouros concluded

the first day with a very specific message for the audience: the importance of juvenile quality in Mediterranean hatcheries. A new vision on fish development came from Professor Dominique Adriaens, a biology professor at Ghent University, Belgium. Adriaens theorised on the possible influences of biology on aquaculture and the importance of evaluating other parameters when it comes to fry quality - something that had never been done before during an aquaculture seminar.

John Stefanis, a former CEO of Selonda who, similar to Inve Aquaculture, is a true pioneer in Mediterranean aquaculture concluded the seminar. He emphasised on the importance of growing the industry and working in both a controlled and professional way. The speakers concluded that fry quality is related to many parameters that should be measurable and manageable in order to improve the performance of the animals in the subsequent stages. All of them were able to get a significant response from the audience.

For Inve Aquaculture, it realised its second goal; to create a platform of interaction amongst the industry leaders. (www.inveaquaculture.com)

Lightner retires and leadership transition for the UA-APL begins



In May 2013, Lightner and the research team at UA-APL identified the EMS/AHPNS pathogen. In June 2013, Lightner (second right), Dr Kevin Fitzsimmons (middle) and Loc Tran (third left) presented details to an Asian audience at a seminar at Nong Lam University, Ho Chi Minh City, Vietnam.

After a long and distinguished career, Dr Donald Lightner has announced his intention to retire from the University of Arizona (UA) and is assisting with the transition to new leadership for the Aquaculture Pathology Laboratory (APL). The University, and especially the College of Agriculture and Life Sciences (CALs) and its School of Animal and Comparative Biomedical Sciences (ACBS), very much appreciate the more than 40 years of service that Lightner has devoted to helping shrimp aquaculture grow into a multi-billion-dollar-a-year global industry.

UA began its shrimp research in the 1970s in Mexico with Resorts International and later Coca Cola, as a way to reinvest profits within Mexico. The shrimp farming industry in tropical countries around the world, and especially Mexico, has grown exponentially since then, much of it based on technologies developed by the university. Lightner was one of the first experts recruited to join the UA team. His training in fish diseases proved crucial in identifying diseases, the pathogens that caused them, and the methods needed to improve shrimp health and successful domestication.

Lightner's work has been widely recognised globally with several major awards including Aquaculture Person of the Year 2013 from the Alliance for Global Aquaculture and a Life Time Achievement Award from the World Aquaculture Society. Lightner and the team of experts he led, built the APL in Tucson into the World Organisation for Animal Health (OIE) Reference Laboratory for shrimp diseases. His team also operates a service laboratory that provides trusted results supporting the world's shrimp farms, hatcheries and shrimp health in farmed and wild environments. "Without Lightner's work, shrimp would not be the ubiquitous food it is today and the fastest growing source of animal derived protein and healthy oils for humans on the planet," says Dr Shane Burgess, CALs Dean. "The trust and esteem that Lightner earned through more than four decades of an illustrious career must not be squandered."

"The School and the College of Agriculture and Life Sciences are fully committed to maintaining this OIE designated World Reference Laboratory and, working with Lightner, have developed a transition plan," reports Dr André-Denis Wright, Director of ACBS. "We will immediately be announcing a global search for a new Director of the Aquaculture Pathology Group."

Dr Kevin Fitzsimmons, the aquaculture extension specialist for Arizona, Director of International Initiatives and Past President of the World Aquaculture Society, explains that although shrimp farming has been only a small niche in Arizona, Lightner's reputation globally is second to none.

"He has been the preeminent expert on shrimp diseases in the world for 40 years. When a shrimp farm anywhere on the planet had unexplained mortalities, a phone call or email stating, 'Tucson, we have a problem,' would arrive the next day," says Fitzsimmons. "Don and/or a member of his team would travel to the farm to collect samples, or samples would be expressed mailed to Tucson for immediate examination. Don's laboratory has kept up with the most recent advances in diagnostics, constantly upgrading their capabilities."

The laboratory in Tucson is also the centre for education in shrimp diseases. Over more than 25 summers, virtually every diagnostician of shrimp disease in the world attended one or more of the short courses that Lightner and his team taught at UA. The Laboratory also hosted a large number of sabbaticals and visiting professors right up to the present with a scientist from Indonesia on a return stay.

The College and the School are pleased to have Lightner's guidance on the transition and will do everything possible to maintain the proud tradition of excellence and world-leading expertise that he brought to UA and the aquaculture industry.

Asia Pacific Aquaculture 2016

**Surabaya
Indonesia
April 26-29
2016**



APA16

ASIA PACIFIC AQUACULTURE
2016

**WORLD
AQUACULTURE
Society**

For more info
on the TRADESHOW
mario@marevent.com

For more info
on the CONFERENCE
www.was.com



Thanks to Algae! and 20th anniversary celebration



Herve Balusson

Olmix celebrated its 20th anniversary in September with the launch of its new identity designed around 'Thanks to Algae!' theme to reflect its commitment in providing solutions from marine biotechnology to produce food without antibiotics.

Held in Brittany, France, the event gathered over 400 customers, partners and distributors of Olmix from all over the world. The group addressed its mission

in feeding the growing world population with healthy food in a sustainable manner.

"Our mission is not only producing more food, but we have to produce safe and wholesome food with less resource. Thanks to algae! We have found the right tool to achieve this mission," said Herve Balusson, Olmix's President and CEO.

Solutions for healthy food chain

Solutions to produce food without antibiotics, pesticides and chemicals were launched at Olmix's Breizh Algae Tour (BAT) 2015 held recently in Paris, France. Olmix has 20 years of experience in extracting essential elements from algae for use as natural sources of nutrition and health for animals, plants and humans. Based on algae, Olmix spends years to develop these solutions for the production of meat, milk, egg, fruits and vegetables, and even for treatment of diseases in humans.

"The next challenge of humanity is a massive proliferation of antibiotic resistant bacteria. With our solutions, we will demonstrate that we can produce food without the use of antibiotics, pesticides and chemicals," said Balusson. Based on 'One Health' concept, Olmix looks at health of humans, animals and plants as the same entity that is intricately related to each other.

"Human health and animal health are alike," said Prof Antoine Andremont, from the Faculty of Medicine Xavier-Bichat University Paris VII. "It has been clear that antibiotic resistant bacteria of animal origin is causing serious human illness. This emphasises that we have to be more prudent in the use of antibiotics both in humans and animal."

With a vision of Olmix's founder Herve Balusson in identifying algae as a renewable raw material with untapped potential, Olmix

brings natural sources of nutrition and health to plants, animal and people for a complete food and health chain, said Daniele Marzin, Olmix's Marketing Director.

This has led Olmix to develop solutions for plant care, animal care and human care that were launched during the BAT 2015. For animal care, Olmix targets to reach 'antibiotic free' production, while improving farmer's profit and animal's well-being.

"This will not be achieved only by nutrition and even more with a single 'miraculous' feed additive. Thanks to algae, Olmix offers a range of solutions to improve the hygiene of the animals, enhance their immune defences, guarantee the digestive welfare, increase the digestive efficiency and fight mycotoxins," she said.

Breizh Algae School

Olmix has inaugurated its school for training new farming practices in producing meat, milk, eggs and plants without antibiotics. Called 'Breizh Algae School,' it is located in the centre of Brittany, which is France's biggest animal production hub. The school trains students, partners and professionals in modern farming techniques that are free of antibiotics, pesticides, and chemical additives.

The courses will be run by leading experts from recognised institutions such as the French Pork and Pig Institute (FIFP), the ISPAIA training institute for the farming and agrifood industries, the French National Institute for Agricultural Research (INRA) and the French Agency for Food, Environment and Occupational Health Safety (ANSES).

More information: Email obiannic@olmix.com (Olivier Biannic)/ marketingasia@olmix.com (Chakrit Ridmontri)



Inauguration of the Breizh Algae School

Appointment Head of Publishing



Nigel Balmforth

Nigel Balmforth has joined 5m Publishing as Head of Publishing. In a specially created role Balmforth is responsible for managing the growth of 5m's publications, which include aquaculture, fisheries and fish biology. He has over 30 years' experience in scientific publishing and has developed highly successful book and journal publishing programmes in fish, fisheries and aquaculture; first with Chapman & Hall and then with Blackwell/Wiley Blackwell. He has been responsible for many new start journals including Fish and Fisheries, Reviews in Aquaculture, Aquaculture International and book series such as the Fish and Fisheries Series, the Fish and Aquatic Resources Series, and the World Aquaculture Book Series. Balmforth can be contacted at nigel.balmforth@5mpublishing.com

App to give a head start in aquaculture

Santeh Feeds Corporation, Philippines launched Tateh AquaBiz in October. This is an app for those interested in aquaculture to give a head start with the business at their fingertips.

Tateh AquaBiz has features to address different aspects of the aquaculture business. In their press release, the company said, "If you do not know what kind of species to farm? AquaBiz can help you choose the right one for you. Clueless as to where to get the stock? AquaBiz points out sources of quality fry, fingerlings and post larvae, and gives you access to aquaculture equipment and inputs suppliers. It also keeps you on top of current market information and the latest weather, tide levels and even dam levels.

"Most importantly, AquaBiz can help you calculate the daily feed requirement for your species, which will help you avoid underfeeding as well as overfeeding that would lead to losses and pollution. With feed accounting for 70% of production cost, it is critical that you know your feed conversion ratio (FCR), and the app's FCR calculator will let you check how much of the feed has actually been converted into fish."

Tateh Aquabiz is currently on the Android platform and will be available to download for free via the Google Play Store.

The instructions on Aquabiz, was provided by the Santeh team during Agrilink 2015 in October 2015 at the World Trade Center in Pasay City.

Santeh Feeds Corporation began manufacturing Tateh Aquafeeds in 1990 and for over 20 years has been at the forefront of the aquaculture business. In addition to its feeds for traditional fish species such as the tilapia, milkfish and shrimp, it has pioneered the production of marine fish feeds (grouper, pompano, seabass and snapper), crustaceans (crab and freshwater shrimp) and of fresh water fish feeds (koi, carp and catfish). In 2012, the company was recognised as the most innovative feed producer in Asia when it won the Asian Feed Miller Award.

More information: Daniel Cabrera, Sales Manager - Luzon (daniel.cabrera@tateh.com) and Dennis Rito, Marketing Coordinator (dennis.rito@tateh.com).



What to look forward to in Aqua Culture Asia Pacific in 2016

Our editorial calendar for 2016 reflects the new trends and technologies in aquaculture in Asia Pacific. These are most relevant to the industry and will help you reach your target audience.

Volume 12 2016						
Number	1 - January/ February	2 - March/April	3 - May/June	4 - July/August	5 - September/ October	6 - November/ December
Issue focus <i>Recent developments and challenges for the next step</i>	Health & Nutrition	Hatchery & Nursery Technology	R&D & Genetics in Fish/Shrimp	Industrialisation & Automation	Biosecurity & Disease Management	Probiotics
Industry Review <i>Trends and outlook, demand & supply</i>	Marine Shrimp	Tilapia	Aqua Feed Production	Catfish	Marine fish	Freshwater Fish/Prawn
Feeds & Processing Technology <i>Technical contributions from feed industry</i>	Functional Feeds/ Fish meal & Fish Oil Replacements	Micro Feeds/Lipid and Fatty acids	Additives/ Probiotics	Extrusion & Processing Technology	Feed Safety/Feed Enzymes	Nutrition & Formulation
Production Technology <i>Technical information and ideas</i>	Harvesting & Post Harvest Technologies	Cage Culture	Recirculation Aquaculture Systems	Sustainable & Responsible Aquaculture	Biofloc & Biotechnology	Aeration Technology
Aqua business Feature articles	Experiences from industry and opinion article covering role models, benchmarking, health management, SOPs, social investments, CSR, ancillary services etc					
Markets	Developments in markets (live fish, product development, market access, certifications, branding, food safety etc)					
Company/Product news	News from industry including local and regional trade shows					
Deadlines for Technical articles	November 15, 2015	January 15	March 15	May 15	July 15	September 15
Deadlines Advert bookings	November 22, 2015	January 22	March 22	May 22	July 22	September 22
Show Issue & Distribution at these events as well as local and regional meetings	Aquaindia 2016 January 29-30 Visakhapatnam, India	Victam Asia 2016 March 29-31 Bangkok, Thailand Asia Pacific Aquaculture 2016 April 26-29 Surabaya, Indonesia	Asia-Pacific Aquaculture Expo May 26-28 Xiamen, China	11th Asian Fisheries & Aquaculture Forum August 3-7, Bangkok, Thailand Vietfish 2016 , August 3-5 Ho Chi Minh City, Vietnam The Aquaculture RoundTable Series, (TARS 2016) August 17-18, Phuket, Thailand	China Seafood & Fisheries Exposition 2016 November 2-4 China	
Show preview	Aquaculture 2016 February 22-26 Las Vegas, USA					

Practical Short Course on Feeds & Pet Food Extrusion

January 31-February 5, 2016
Texas A&M University, USA

This is the 26th Practical Short Course on Feeds & Pet Food Extrusion. The one week course will be held from January 31-February 5, 2016 at Texas A&M University, College Station, Texas, USA. It will be conducted by staff, industry representatives and consultants. The program will cover information on designing new feed mills and selecting conveying, drying, grinding, conditioning and feed mixing equipment. Current practices for production of pet foods, preparing full-fat soy meal; recycling fisheries by-products, raw animal products, and secondary resources; extrusion of floating, sinking, and high fat feeds; spraying and coating fats, digests and preservatives; use of encapsulated ingredients and preparation of premixes, and least cost formulations are reviewed.

The program will include practical demonstration of pet food, vacuum coating, and several others are demonstrated on four major types of extruders - dry, interrupted flights, single and twin screw using various shaping dies. Reservations are accepted on a first-come basis. (More information on programs and application forms: Dr Mian N. Riaz, Director, Food Protein R&D Center, Head - Extrusion Technology Program, Graduate Faculty, Nutrition and Food Science Dept, 2476 TAMU; Email: mnriaz@tamu.edu <http://foodprotein.tamu.edu>; <http://foodprotein.tamu.edu/extrusion>

2015 - 2016

Details on the events below are available online at <http://www.aquaasiapac.com/news.php>
To have your event included in this section, email details to zuridah@aquasiapac.com

November 16-19
South American and Caribbean Aquaculture 2015
Fortaleza, Brazil
Email: worldaqua@aol.com
Web: www.was.org

November 19-21
Taiwan International Fisheries and Seafood Show
Kaohsiung, Taiwan
Email: sonya_chaw@myexhibition.com.tw
Web: www.taiwanfishery.com

November 23-25
Shrimp 2015 India
Chennai
POSTPONED
Web: www.infofish.org
Email: info@infofish.org

November 23-27
Aqua Nutrition AgriSchool
Bangkok, Thailand
Email: agrischools@progressus.asia

December 7-9
International Symposium on Aquatic Product Processing: Cleaner Production Chain for Healthier Food
Can Tho City, Vietnam
Email: [Dr. Le Thi Minh Thuy](mailto:Dr.LeThiMinhThuy)
(ltmthuy@ctu.edu.vn)
Web: http://conference.ctu.edu.vn/introduction.php?conf_id=APP

November 25-28
5th International Symposium on Cage Aquaculture in Asia
Kochi, India
Email: caa5cmfri@gmail.com
Web: www.caa5.net

December 14-16
Middle East & Central Asia Aquaculture 2015
Tehran, Iran
Web: www.was.org

2016
January 29-30
Aqua India 2016
Visakhapatnam, India
Email: contact@aquaprofessional.org
Web: www.aquaprofessional.org

February 22-26
Aquaculture 2016
Las Vegas, USA
Email: worldaqua@aol.com
Web: www.was.org

March 29 - 31
FIAAP Asia, VICTAM Asia, GRAPAS Asia 2016
Bangkok, Thailand
Web: www.victam.com

March 29
Aquafeed Horizons Asia 2016
Bangkok, Thailand
Web: www.feedconferences.com

April 26-28
Seafood Expo Global
Brussel, Belgium
Web: www.seafoodexpo.com/global/

April 26-29
Asia Pacific Aquaculture 2016
Surabaya, Indonesia
Email: worldaqua@aol.com
Web: www.was.org

May 26-28
Asia-Pacific Aquaculture Expo
Xiamen, China
Web: www.apaexpo.com.cn

June 2-4
Middle East Aquaculture Forum (MEAF-16)
Izmir, Turkey
Email: meaf16@meaf.ae
Web: www.meaf.ae/meaf16/

August 3-5
Vietfish 2016
Ho Chi Minh City, Vietnam
Web: www.en.vietfish.com.vn

August 3-7
11th Asian Fisheries and Aquaculture Forum 2016
Bangkok, Thailand
Web: www.afsconferences.net

August 4-6
Asean Fisheries and Aquaculture Conference and Exposition 2016
Bangkok, Thailand
Web: www.aseanfishexpo2016.com

August 17-18
The Aquaculture RoundTable Series (TARS 2016) - Shrimp Aquaculture & The New Normal
Phuket, Thailand
Email: conference@tarsaquaculture.com
Web: www.tarsaquaculture.com



FIAAP Asia 2016

Exhibition and conferences for feed ingredients, additives and formulation

VICTAM Asia 2016

Exhibition and conferences for feed processing technology

29 – 31 MARCH 2016 · BITEC EXHIBITION HALLS, BANGKOK, THAILAND



Asia's premier aquafeed event

Symposium and Summit

- The second ASEAN Feed and Rice Symposium
- The second ASEAN Feed Summit



Specialist conferences

The exhibitions will be supported by their own specialist conferences. They will include:

- FIAAP Asia Animal Nutrition Conference 2016
- Aquafeed Horizons Asia 2016

Contact details

For visitor, exhibition stand space and conference information please visit:

www.fiaap.com or www.victam.com



Co-located with

GRAPAS Asia 2016 www.grapas.eu



Supported by

The Thailand Convention and Exhibition Bureau





CREATES THE VALUE OF PRAWN



Uni-President implements traceability through all sectors along with supply chain. Biosecurity hatchery produces SPF (Special Pathogen Free) and SPR (Special Pathogen Resistant) larvae. Quality program of prawn feed plants was certified by ISO 22000 & HACCP.



• 16-18-20, DT 743, Song Than II Industrial Zone,
Di An, Binh Duong, Vietnam
• Tel: +84-650-3737626 - Fax: +84-650-3790819
• Email: aquafeed@upvn.com.vn



CTY TNHH UNI-PRESIDENT VIỆT NAM
UNI-PRESIDENT VIETNAM CO., LTD.

Establishing a Healthy and Happy Tomorrow

