

## TFSS part2

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### TFSS 2016, PART 2: Taiwan's innovators & movers in aquaculture

#### ***A showcase technological advances relevant to local and regional markets***

In Taiwan, academia, industry and government agencies strive to have a leading edge in aquaculture technology. This year, they were there at the Taiwan Seafood and Fisheries Show (TFSS 2016) to showcase technological advances relevant to local and regional markets. AAP interviewed several of them for this report. The innovators are moving the industry in Taiwan for the next phase of growth where biotechnology and information technology will play an important role in increasing efficiency and reduce production costs.

#### **Farmed fish complex**

Taiwan's industry has been paving the way for the farmed fish complex, from food to industrial products, utilising every part of the fish. Displays at the booth of the Fisheries Agency, Council of Agriculture, showed that with cooperation among farmers, government and biotechnologist, the tilapia (or Taiwan bream), once a simple food has become a high-tech multi-functional fish species. All parts are used; scale collagen for cosmetics and skincare products, skin for handbags, tail fins for imitation shark's fin, bone for fish food, belly for grilling, scales for artificial cornea and eye for hyaluronic acid. With regards to milkfish, the scale contains two major functional elements; collagen and hydroxyapatite (Hap).

#### **Farmed seafood**

Farmed grouper is a favourite for year-end feasts and wedding banquets. In 2013, the production of various species of the grouper reached 25,000 tonnes valued at USD 221 million (Chu et al, 2013). The export market is very important for producers and 70% of live groupers are exported to China. As local production in China is increasing, reducing demand for Taiwanese groupers, the government is helping to find alternative markets for the fish. High value coral grouper *Plectropomus leopardus* are airfreighted to as far as the US where offer prices are very high. These are niche markets for some producers using proprietary closed culture system.

One positive development is the acceptance of frozen grouper steaks by local consumers. Traditionally, the preference has been for whole fish, live or chilled. One producer is Haishi Frozen Aquatic Products Processing Ltd which focuses on the orange spotted grouper *Epinephelus coioides*, brown marbled *E. fuscoguttatus* and giant grouper *E. lanceolatus* and the fourfinger threadfin *Eleutheronema rhadium*.

Consumers are emphasising more on food safety and producers are meeting demands for quality seafood. Certification programs are Taiwan Quality Food (TQF) and the Traceability system of Taiwan's agriculture products (TAP), which in the case of fish/shrimp farming, ensures that processes at different stages are recorded.

While aquaculture biotechnologists and farmers look at ways to overcome diseases and poor survival rates with better management, seafood processors look at advances to raise processing standards. Anyong Biotechnology says that it has a state of the art processing plant in Mituo, Kaohsiung, with an investment of NTD100 million. Product lines are ISO 22000 and HACCP certified. It has imported a cutting edge freezing technique called 'cells alive system' from Japan which keeps the cells alive and retains the nutrients and freshness of fish at -50°C. This uses electromagnetic fields and mechanical vibrations to prevent ice crystals formation which destroys food texture.

## **Taiwan's Innovators**

### ***Internet of Things***

Quadlink Technology Inc. is a company developing the 'Internet of Thing(IoT)' systems by using sensors, audio/video monitors, cloud and big data technologies to optimise aquaculture and agriculture production and distribution. At its booth, Otto Tsai and his team showed how the company's data application technology in aquaculture is pushing boundaries in fish farming management in Taiwan. This experienced team with members from wireless communication and cloud computing backgrounds has been in business for six years. "We combine talents and technologies from Taiwan, Europe and the United States, focusing on the 'Internet of Things' for precision farming. Our motto is 'For better food and environment', said Tsai.

The Quadlink aquaculture monitoring system powered by solar cell continuously monitors temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen and salinity of pond waters and periodically sends the measured data to cloud and clients in real time. Farmers not only receive the data and alerts, if any abnormal condition happens, at any time and place, but also can observe and analyse the historical data since all the data are stored and secured in the cloud.

"Through this monitoring system, farmers no longer need to stay by the ponds to manually measure the quality of water several times every day. Recently, with rapid and unpredictable climate, the real time alert can minimize the damage to stock with fluctuations in water parameters such as pH and dissolved oxygen. The monitoring system can also work with paddle wheel controllers to move the water only when dissolved oxygen is low or suboptimal to save electricity and operational cost. Similarly, auto feeders are activated only when required, saving on feed cost and reducing impact on the environment from uneaten feed.

After two years of field trials, Quadlink now has clients in Taiwan with various sizes of farms, culturing grouper, eel and shrimp farms and some hatcheries. They are also looking for potential customers in Asia.

According to Tsai, farmers already benefited by getting advance alerts to prevent potential loss, save energy consumption by 30-50%, access to data from the cloud for their day to day management.

Tsai said, “I believe that there is a huge potential for such technology to modernise aquaculture. By adopting the IoT technology, we remove one barrier for the young generation to enter aquaculture. Aquaculture becomes more fun and less labour intensive. The environment of farms and the growing process are precisely monitored and controlled. Eventually the traceability and quality of food is assured. This is what we claim ‘for better food and environment’. Next, we plan to look into the processing, transportation and warehousing segments of aquaculture and agriculture.” ([www.quadlink-tech.com](http://www.quadlink-tech.com))

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Picture: Otto Tsai (second right) and team at their booth explained the technology behind their ‘smart connect products for aquaculture’.

### ***High moisture pelleting system***

Yilan County based **Idah Machinery** holds a record with more than 40 years in the supply of aqua feed processing machinery. The company was started by James Chang in 1972 at a time when demand for fish and shrimp feed was growing, within Taiwan and South East Asia but aqua feed technology was yet to develop in Taiwan. Today, it is proud that it has completed numerous turnkey projects and supplied equipment to major feed mills across the globe. Besides a focus on the aqua feed industry, the company has total solutions for the animal, pet food, textured vegetable protein and wood pellets. It supplies equipment for grinding, pulverising, crumbling to conditioning, pelleting, extrusion and expanding to drying and cooling.

“Our most recent turnkey projects have been in India, where we completed a new shrimp feed mill and added fish feed lines as extension to the shrimp feed mill for The Waterbase Limited. In the Middle East, we have completed new fish feed lines in Saudi Arabia and in Africa and lines for fish feed production for a feed mill in Egypt. Usually for turnkey projects, we discuss with customers about their requirements. We require 3 weeks to one month for operational runs, depending on whether they are pellet mills or extruders,” said Evon Lin, Sales Representative. Lin added that all machinery is manufactured in Taiwan and that Idah provides machinery, spare parts and consultations. Idah was the first to develop fish feed extrusion system in Taiwan but to date, 50% of its customers are in shrimp feed processing.

At the show, the focus was on the top innovation which the Idah team developed in 2014. This is the high moisture pelleting system. Lin explained that usually the drying process will remove 2% or less of water from feed pellets. This means that finished products have less than 10-11% moisture when post extrusion pellets have 12-13%.

“The high moisture process that we have developed means that during the pelleting process, the moisture content is high but the finished product will have 3-5% less moisture after post conditioning. Furthermore, there is little need for binders. The cooker holds the pellets at a longer retention time. The advantage is a smooth surface for the pellets and high water stability. If binders are used the water stability is 2-3 hours,” said Lin.

“The latest design for post conditioners is the vertical post conditioning cooker which is more expensive than the horizontal version, but is more efficient and produces better feed

quality. Operation costs are lower because of better heat exchange. The longer retention time ensures better gelatinisation. We have installed one in a leading shrimp feed mill in India.”

Idah is growing with more projects in 2016 as compared to 2015. However, it is often challenged by low cost equipment manufacturers in Asia.

“To have a competitive edge, Idah ensures the best technical services. We already have a Tech Centre next to our factory, where we train current and future clients on feed processing. Most of our clients are in India and Vietnam and as we strive to be a world leader in feed processing equipment, we target feed mills in the Middle East,” said Lin. (www.idah.com.tw)

#### Picture

[Evon Lin \(right\) with Liang-Chuan Hsu, Senior Customer Service Engineer.](#)

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#### ***Large cages and solar floating systems***

**Sun Rise E&T Corporation** is the leading manufacturer of cages in Taiwan and the second largest globally. It was established in 1995 by Joshua Tung who developed the first HDPE cage for marine fish farming in Taiwan. The made in Taiwan cages, which uses injection technology are exported to 51 countries. In Taiwan, sales began with 20 m diameter cages and are used for the farming of cobia and pompano by Ever Spring Aquaculture, the largest marine fish cage farm in Taiwan (see page 5). Following a damaging typhoon in 2000, the company has been adding new cages and today has 30 cages manufactured by Sun Rise. Sales is also to small farms all over Taiwan. The company has sold almost 400 cages (20 m diameter) to farms in the Philippines. Cage sizes have grown larger to 30-50 m diameter cages for farming of tuna juveniles.

Tung, who is chairman of the company, said, “The breakthrough in 2016, is the export of our 60 m diameter cages to Norway. This is important for us as the Norwegian market is dominated by AKVA, the global leader. This is a very discerning market and our entry proves that we meet their standards. It helped that we use injection technology which fish cage users in Norway are familiar with. Since 2009, we have sold cages to Japan and today, Sunrise has supplied almost 90% of HDPE used in the country. The number is small as Japanese marine fish farms prefer metal cages which they replace every 3-5 years.”

“Our R&D has been systematically and efficiently performed as we seek breakthroughs. We continuously introduce up-to-date technology, developed locally or adopted from abroad, with a view of reducing cost and upgrading quality. Our latest technology is the solar floating system with radar and camera. Solar power is tapped to run the camera and some lights. This is a first in the world, said Eric Tung, Sales Specialist, the second generation in the company.

“We are also investigating the development of a solar system in ponds or dams. We have a two-year project with the Philippines Bureau of Fisheries and Aquatic Resources to

determine whether a 30% coverage will affect fish survival as these panels will block sunlight in the ponds.” Sunrise will continue to target the Norwegian market. Next, it is researching on the mooring systems for loads of 50 tonnes or more as compared to the smaller loads of 20 tonnes common in Taiwan.

“This is the second time we are participating in this seafood and fisheries event. The other important events for us is Japan Seafood and Fisheries Show and AquaNor in Norway”, added the elder Tung. ([www.srise.com.tw](http://www.srise.com.tw))

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[Joshua Tung and Eric Tung with Shinichi Asami, Nippon Kanzai Centre, a Sun Rise cage technology distributor in Japan \(right\).](#)

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### **Probiotics and delivery of anti WSSV vaccine**

Nobel International Biotechnology was established in 2005 as a leader in innovations for the aquaculture and aquarium industry. The company brings to market biotechnology products developed by in-house researchers as well as innovations from research at the National Taiwan University, National Cheng Kung University, National Kaohsiung Marine University and National Pingtung University of Science and Technology. The tagline “always innovation” underlines the drive to actively use technology and product development for aquaculture and aquarium. Nobel’s way is to focus on ‘green’ products following a trend towards organic aquaculture and demand for safe foods.

The company is marketing probiotics and hatchery feed. NBL1 is feed and water probiotics with *Shewanella* bacteria for denitrification of water. NBL2 Pandora Bacteria is a powerful aquatic microbial product and was developed using bacteria from the Kuroshio current, off Eastern Taiwan. NBL 3 is a saline photosynthetic bacteria which reduces ammonia and hydrogen sulphide in water. It also has enzymes to inhibit pathogens. Greensure is an algal extract combined with water-soluble peptides and amino acids to accelerate growth of larval fish and shrimp and stabilize the algae phase in hatcheries.

Professor Ying-Tang Huang, Department of Marine Biotechnology, National Kaohsiung Marine University was at the booth to explain mechanisms of some of Nobel’s bacterial strains for aquaculture.

“Over the years, the NBL team researched several bacteria strains from the marine environment and after separation, laboratory identification and large-scale testing, developed a product called ‘NBL Shewanella’. This is a gram-negative rod-shaped non spore forming bacteria found in the gut of wild aquatic organisms. It has strong denitrification properties and is resistant to 65 ppt salinity. NBL2 is a probiotic to reduce total ammonia and nitrite in water. In addition, NBL2 can combine with  $\alpha$ -ketoglutarate and ammonium to form glutamate.”

Another development which started two years ago is the anti-white spot syndrome virus (WSSV) vaccine. The research was on the delivery of the envelope protein VP28 of WSSV using probiotics. “We cloned the protein to express in *Pseudomonas* bacteria and added to water and feed. *Pseudomonas* was found to be better than *Bacillus*. We tested using ponds farming monodon shrimp in Taiwan and vannamei shrimp in Vietnam. No WSSV infections were recorded. The probiotics has to be added daily for at least 7 days continuously and then at weekly intervals during the whole culture period.

“At the hatchery, the probiotic can be added at 200 ppm for 7 days before stocking into ponds. However, the probiotic must be added into the pond. Our next target is to add the probiotic into feed. An obstacle is converting this into a powder. We will continue to run more trials before commercialising,” added Huang. ([www.nbl.tw](http://www.nbl.tw))

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[Ying-Tang Huang \(left\) and Kuang Chan Lee, CEO \(second right\) with the NBL team, Jia Lun Xu and Chung Chih Chang-Chieh.](#)

## **Movers**

### ***Support farmers with shrimp processing***

The **Grobest Group** is Taiwan’s leading aqua feed producer. It is also one of Asia’s leading multinational companies involved in feed production, hatchery, farming and processing for farmed fish and shrimp. It has 8% of the global shrimp feed market. The integration level of its subsidiaries in several countries in Asia varies. In its feed business, it has four feedmills, in Thailand and China, one in India and in Vietnam, a newly established feed mill in the Philippines and in Malaysia, the feed mill currently under construction will be operational in early 2017. In Thailand, it produces aqua feeds, farms the tilapia and has a fish processing plant. In China, it also has fish processing facilities. Grobest has shrimp hatchery businesses in Thailand, India and Vietnam.”

At its booth, Vincent Lin, General Manager, HQs/Food, explained the new strategy to enter into the farming and shrimp processing segments in some countries and expand on existing ones.

“Grobest is very well regarded as a leader in shrimp feed production. When farmers use our shrimp feed, they are assured that their shrimp are of high quality. We strongly believe that only with good feed can we have good shrimp. By this I mean, shrimp acceptable to consumers; sweet, bright colour and firm flesh.

“Consequently, we are very keen to grow on this strength by expanding into the shrimp processing business. In 3-5 years, we will be building up our shrimp processing capability. In Thailand, we do shrimp processing in two plants, one on contract basis and the other as co-owner. In the future, we expect our own plants in various countries to process shrimp for the US markets, the leading export market for shrimp and for seafood by Grobest. ”

In Taiwan, Grobest has farms producing shrimp but this supplies a limited amount of raw material for the processing and local markets. Lin added, “We will continue to work with

small farms and may also enter into contract farming to have sufficient raw material for the processing plants. We provide technical support from Grobest teams and will be helping farmers to increase farm profitability.”

The shrimp aquaculture industry in Asia continues to show a downward trend in production. How can a company like Grobest, help to bring back production. Jennifer Kuo, General Manager, Animal Health Department said, “The entire industry in Asia is working together with new solutions. We have reformulated our feeds, and ran trials over two years. There are examples of farmers (monodon shrimp farmers in Malaysia and vannamei shrimp farmers in Taiwan), doing well with our feeds and combination of products, as we insist on a change of mindset and changing management protocols. We are optimistic that more will do so in the future. Our solutions are not radical approaches, we merely suggest water and soil management and use of probiotics. We support with technical guidance and monitoring services and consultancy.”

Lin added, “We have different strategies for different systems. Farmers are key, and if we all pay enough attention at the beginning, the chances of success will be higher for all in this industry.” (www.grobest.com)

PIC

Vincent Lin (right) with Jennifer Kuo at their booth, displaying the new focus on shrimp processing in the background.

Cooked vannamei shrimp farmed in Taiwan (left) and monodon shrimp farmed in Malaysia.

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### ***Forte with single screw extruders***

One of the earliest feed equipment manufacturers in Taiwan, Soon Strong Machinery Works, continues to dominate the Asian aqua feed industry. It has new products as pellet mill, extruders, fine pulverizers, board dryer, floating dryer etc for animal and aqua feed production. Soon Strong was started by the father of the current General Manager, Chang Keng Hsu and a partner. The first shrimp feed plant was established in 1989 and five years later, it developed its first extruder. Another major achievement is equipment for flake feeds sold to a company in Thailand in 1989, which is still using the machinery and has 70% of the Asian market for flake feeds

“Over the years, we have had a strong hold in the feed processing equipment market in Asia. We have supplied to 40 feed millers in Indonesia and 30 in Vietnam for the production of aqua, animal and poultry feeds. Our other markets are in Taiwan, Thailand, China, Malaysia, Mauritius and India,” said Jack Hsu, General Manager.

“We continue our long term relationships with aqua feed millers in Indonesia such as PT Matahari Sakti. We began working with them 20 years ago and recently provided

equipment for the expansion of their shrimp and fish feed lines. The company is the only one in Asia producing 500 µ floating fish feeds”.

“Our strong point is single screw extruders which we believe producers in Asia need. Single screw extruders costs half the price of twin screw extruders. We also have been servicing our clients well, even after 20 years. For example, some of extruders and pellet mills are still in use after 15 and 20 years, respectively. Our technical experts are always available to help clients. Unlike manufacturers in China, we still manufacture spare parts for these machinery.”

Ten years ago, Soon Strong started a design company in China where most of the R&D is carried out. However, the production is done in Taiwan as it is important to maintain quality of the equipment by using local raw materials. ([www.soonstrong.com.tw](http://www.soonstrong.com.tw))

## PIC

Jack Hsu and Ken Lee, Sales and Design Engineering Manager. Their participation at TFSS 2016 is to network with local clients and those from Malaysia and the Philippines

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### ***Improving feed efficiency***

**Shiuh Ger** Trading Co Ltd us in the aquaculture and animal production sectors and currently imports natural products from Europe, Asia, America and other continents. The company was set up by Tony Chen, General Manager. This was the second time that the company exhibited at TFSS and the team comprising Gordon Chen, Deputy General Manager and Chia-Hsin Weng, Sales Manager and Veterinarian was there to meet several of their local clients. Aquaculture accounts for 15% of Shiuh Ger’s business. The rest is in the animal production industry.

Shiuh Ger imports products into Taiwan and China. Among the feed additives used for shrimp farming is the nucleotide Vannagen produced by the Swiss company Chemoforma AG. For aqua feeds, it supplies farmers this feed additive for shrimp, threadfin, eel and seabass farming. Another feed additive is Nutrafiro Plus, a combination of two plants (*Yucca* and *Yucca schidigera*), products of US based Desert King International. Nutrafiro Plus is for gut health modulation in tilapia, milkfish and seabass, farmed in freshwater ponds. In both cases, the farmers gives the additives to feed millers to be incorporated into feeds. For larger farms, the company will work directly with the feed millers.

Chen added that in Taiwan, they and other companies are lucky as there is a close working relationship among industry and researchers, where the latter develops products and depend on the industry for its marketing. Shiuh Ger works with the Fisheries Research Institute. Shiuh Ger sees that the potential for further growth in its aquaculture business will ultimately depend on the progress of the aquaculture industry in Taiwan.

“Grouper farming is important for Taiwan and for successful production of the green grouper, farmers tend to use antibiotics for disease treatment. However, our achievement

with these products is that farmers have moved away from using antibiotics. The threadfin is the latest target species as grouper prices have declined 50% from NTD 250/kg in 2015 to NTD120/kg in 2016,” said Chen. “It will be possible to bring down feed costs to around NTD 9000/tonne (USD 280/kg) with a one third partial replacement of fish meal with a combination soya protein, poultry meal and soya bean meal with the addition of feed additives. In the local markets, we plan to develop in house products and have fish meal replacers on trial.”

“We are also looking products for water treatment. We would like to expand into the markets in other parts of Asia too.” ([www.shiuhger.com](http://www.shiuhger.com))

PIC

At the Shiuh Ger Trading booth, from left, Gordon Chen, Tony Chen and Chia Hsin Weng, with Dr Yew-Hu Chien, Professor, National Taiwan Ocean University.

### ***Environmentally friendly fish farming***

**Gemann Enterprises** Inc is a family company established in 1975. It started in the aquaculture trade and gradually moved into the farming of the monodon shrimp with a shrimp farm in Fangliao. Now with more than 40 years of farming experience and with three fish farms in Linbian, Pingtung and Donggang, it is moving into environmentally friendly culture. The reason is to push for traceable products certified under Taiwan’s Traceability Agriculture Product (TAP) for supply to top end restaurants. Jung Fu Chen, founder and General Manager, said, “Specifications on traceability are important and as producers we have a social responsibility for the industry.”

The products displayed at their booth include an aerator, probiotics containing Biozyme *Bacillus* spp at  $10^9$  CFU/mL. Chen added, “My probiotics business is larger than the aeration business at a ratio of 70:30. I learnt how probiotics are used in the animal production industry where they understand its functions in waste management.

“My concept is that probiotics added to fish and shrimp feed can have positive effects such as immunity. Rapid decomposition of the organic matter will reduce harmful substances in the pond. My clients are small farms who top dressed probiotics in their feeds. They farm tilapia *Oreochromis aureus* in seawater (32 ppt salinity) and red tilapia *O. niloticus* in brackishwater ponds. Fillet quality is higher with a yield of 600 g from one kg tilapia and texture is firm.”

The aerator business came about after several years as an AireO2 distributor. The Jet-Mix horizontal aerator is a surface mounted propeller type aerator that distributes air in fine bubbles to maintain an oxygen rich environment in the pond. This design is highly efficient with an excellent mixing and circulation pattern. According to Chen, this is an easy way to maintain biological solids in suspension, eliminates stagnant spots and improves treatment of biological oxygen demand (BOD) at as high as 98%. It is manufactured in Taiwan.

“Ten years ago, we exported products to Indonesia but as we are only 13 in the company, we decided to focus on the business in Taiwan. We also have our own farm here in Kaoshiung producing seabass and red tilapia. However, soon we want to export our aerator products to other markets,” added Chen.

Pic

Jung Fu Chen (left) and son, Chen I-Ting with their multifunction aerator

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