English Monthly from Hyderabad, India

RNI Regn. No. 52899/93

Aqua International

Estd. 1993

Health • Nutrition • Management • Processing

March 2023

Annual Subscription: Rs 800 Foreign $ 100

Inside...

Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 30 Number 11 March 2023

Editor & Publisher
M. A. Nazeer

Editorial & Business Office:
AQUA INTERNATIONAL
NRS Publications,
BG-4, Venkataramana Apartments,
11-4-634, A.C.Guards,
Hyderabad - 500 004, India.
Tel: 040 - 2330 3989, 96666 89554
E-mail: info@aquainternational.in
Website: www.aquainternational.com

Annual Subscription
India : Rs. 800
Foreign Countries : US $ 100
or its equivalent.

Aqua International will be sent to the subscribers in India by Book Post and to the foreign subscribers by AirMail.

Edited, printed, published and owned by M. A. Nazeer and published from BG-4, Venkataramana Apts., 11-4-634, A.C.Guards, Hyderabad - 500 004, India. Printed at Srinivasa Lithographics.
Registered with Registrar of Newspapers for India with Regn. No. 52899/93. Postal Regn. No. L II/ RNP/HD/1068/2021-2023.

NRS PUBLICATIONS
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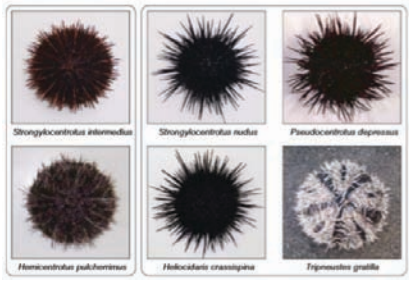

ADVERTISERS' INDEX

Subscriptions for Aqua International, English monthly, should be sent to:
The Circulation Department, Aqua International, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Hyderabad - 500 004, India. Email: info@aquainternational.in

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India Office

Add: No 401 , Dega Towers , Raj Bhavan Road , Somajiguda , Hyderebad , Telangana - 500082
T: +62-21-30027458; 30027459
Contact: Arun Kumar K
E-mail : arunkumar@famsungroup.com
Mob: +91 9901916554

Contact: Shelby
E-mail: lxb@famsungroup.com
Mob: +91 9100436652

U.S.A produces about 120 million MT of soybeans, while India's output 14 million MT

Probiotics, prebiotics, and synbiotics have proven to be the most effective dietary and water supplement replacements for bacterial, viral, and parasite infections in shrimp, as well as disease-controlling agents in the shrimp farming industry. Using prebiotics, synbiotics, and probiotics as an alternative has been shown to improve not only growth but also immune and gut health of cultured species. They are injected into the feeds of culture species in an effort to promote wellness, protect the intestine from harmful microbes, and reduce inflammation.

The March 2023 issue of Aqua International is in your hands. In the news section you may find news about ...

Aqua International organised it's 38th edition of Aquaculture Expo at Balasore, Odisha on February 10 and 11. Minister for Agriculture & Farmers' Empowerment, Fisheries & Animal Resources Development, Govt. of Odisha **Ranendra Pratap Swain** invited the already established entrepreneurs with shrimp processing plants from different regions of the country to come to Odisha state to establish processing units and the state government will extend support to such companies. The Minister asked Aqua International Editor to organize the expo next year also and the government will involve in it and support the event to promote Aquaculture in Odisha state. The chief executive of the expo and editor of Aqua International M.A. Nazeer, said that everybody is concentrating on production and expansion of production, but no one is concentrating on marketing of shrimps. Shrimp production is growing all over the globe and it would be difficult for India if the stakeholders depend only on exports. We need to focus on developing domestic consumption of shrimps and other species in India itself. Like China, India has huge potential for the consumption of shrimps.

As part of its commitment to the global aquaculture industry through consistent leadership, collaboration and support, U. S Soybean Export Council (USSEC) South Asia and Sub Sahara Africa region (SASSA) organized a two days' workshop on Nutrition as a part of the project Aqua Tech Talks at Hyderabad, India on February 21 and 22. The event focused on highlighting and informing key industry leaders about the differentiating advantages of using U. S Soybean Meal as a key protein source ingredient in fish and shrimp feed. USSEC put together a line-up of prolific global experts who educated the audiences about different aspects of fish and shrimp farming along the entire production chain, while emphasizing on the use of good quality feed, latest innovations and technologies like precision feeding to ensure optimum end product output. The speakers also demonstrated the unique attributes of U.S Soybean meal which includes high nutritious value, high protein density, high digestibility and high amino acid profile to yield rapid fish growth.

The U.S. produced about 120 million MT of soybeans last year and exported about 60% of that total in the form of soybeans, meal or oil. India was the largest single market for U.S. Soybean oil in MY 21/22. India produced around 14 million MT of soybeans and will export some meal in the months right after harvest and possibly import meal back later in the year. We have been watching the exports of meal decline significantly over the last 10 years as the local demand for soybean meal has been growing. We expect this to continue and look forward to being a growing and reliable supplier of soybean meal to support India's vision on nutrition and economic growth via its food and feed industry, said Mr Doug Winter, Chairman, USSEC Board in interview to Aqua International editor.

CLFMA OF INDIA elected it's new leadership team on 16 February 2023 for the period 2022-2024 **Following Office Bearers were elected:** Chairman - Suresh Deora, Deputy Chairman - Sumit Sureka, Dy. Chairman - Divya Kumar Gulati, Dy. Chairman - Naveen Pasuparthy, Dy.

Contd on next page

NRS GROUP
Aqua International

Our Mission

Aqua International will strive to be the reliable source of information to aquaculture industry in India.

AI will give its opinion and suggest the industry what is needed in the interest of the stakeholders of the industry.

AI will strive to be The Forum to the Stakeholders of the industry for development and self-regulation.

AI will recognize the efforts and contribution of individuals, institutions and organizations for the development of aquaculture industry in the country through annual Awards presentation.

AI will strive to maintain quality and standards at all times.

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Chairman - Sandeep Kumar Singh, Hon. Secretary - Abhay Shah, Treasurer - Nissar F. Mohammed, Immediate Past Chairman - Neeraj Kumar Srivastava and Executive Director - Chandrika Venkatesh.

A division of Netherlands-based Nutreco, the newly set up high-end facility allows Skretting to further enhance support for its customers and the Indian aquaculture sector. Nutreco is the subsidiary of SHV Holdings NV, a family-owned Dutch multinational. Skretting has been leading the global position in salmon and shrimp with 125 years of expertise and an innovation-driven approach. A news release explains that the firm has manufacturing footprints in 18 countries and produces three million tonnes of feed annually for more than 60 species from hatching to harvest. The facility will be inaugurated by Sanjeev Balyan, union minister of state for fisheries, animal husbandry and dairying, government of India and Michiel van Erkel, agriculture counsellor for India and Sri Lanka, Embassy of the Kingdom of the Netherlands, on 13 February.

Ministers for Aquaculture Peddireddy Ramachandra Reddy, Botsa Satyanarayana and Dr Sidiri Appalaraju have directed officials to complete the establishment of 4,000 fish outlets by the end of March. They addressed Aquaculture Empowerment Committee meeting recently. The decisions taken for the development of the Aquaculture sector, their implementation and future activities were discussed. On this occasion, the Ministers said that Chief Minister Y. S. Jaganmohan Reddy is giving high priority to Aquaculture sector. According to the CM's orders, the government is standing by the aquaculture farmers side and for seed and feed supply, scientific determination of rates and price stabilization. He said that the decision taken by the committee in such matters are giving good results. People should be made aware to Increase local consumption by at least 30 percent of what is produced in the state. He said that the Aqua products in Odisha are sufficient for the local needs and there is no need to depend on the international market. He said that due to this, alternative market opportunities will be improved so that farmers do not suffer losses during market fluctuations.

In the Articles section – **Ecological Engineering for Sustainable Aquaculture: Simple Concept with Greater Impact,** *authored by* Md. Idrish Raja Khan said that Ecological engineering is a concept that applies the principles of species symbiosis along with material recycling and regeneration. The idea is that man-made structures can stimulate and control the environment to produce supplementary energy, after this energy has been generated, humans can use it to sustainably achieve production outputs. In 1962, Howard T. Odum proposed the concept of ecological engineering and defined it as 'environmental stimulation by man using small amounts of supplementary energy to control systems in which the main energy drives are coming from natural sources'. The discipline addresses and quantifies the processes that are involved with the management of wastes as a resource. Such studies consider a variety of complex environmental and social needs, in addition to maximizing short-term profit. Since the 1980s, ecological engineering has rapidly developed in different parts of the globe especially Europe and United States, where it has been used in environmental management.

Proponents of ecological engineering tout its environmental advantages compared to traditional pond aquaculture such as ecological engineering methods only employ halve water use and dramatically decrease nutrient effluents in wastewater. The improved production efficiency increases yields and survival rate while reducing feed inputs. Other downstream benefits include decreased disease incidence and medication use, improved labour efficiency, *etc*. The two main methods of ecological engineering in aquaculture involve building facilities and designing production systems for use on farm sites.

Article titled – **PROBIOTICS, PREBIOTICS AND SYNBIOTICS: FUTURE PROSPECTS FOR SUSTAINABLE VANNAMEI CULTURE,** *authored by* M. Sivakumar and K. S. Vijay amirtharaj Corresponding Author Dr K.S.Vijay Amirtharaj said that Aquaculture is one of the world's fastest-growing sectors, with Asia accounting for about 90% of worldwide output. The production of aquaculture is the only sector of disease outbreaks in many Asia-Pacific nations, which has an impact on both the nation's economic development and the socioeconomic standing of the population. Because of the increasing demand for food, fisheries are being farmed and bred excessively and intensively, which increases the danger of disease. The main challenges that threaten fish aquaculture and decrease its productivity include infectious illnesses, declining water quality indicators and other environmental stressors. There are many alternatives to protect cultured aquatic animals from the impact of pathogens. However, the large loss of aquaculture due to illnesses is an issue that has to be addressed.

Article titled – **Nutritionally balanced feeds for Seabass fish (*Lates calcarifer*),** *authored by* Dr Raghavendrudu said that Asian seabass (Lates calcarifer) has emerged as an important candidate finfish species for aquaculture in many parts of the world. Availability of seed and appropriate feed are the two important prerequisites for development and propagation of aquaculture of any fish species. The Asian seabass (*Lates calcarifer*) known as Pandugappa in Andhra Pradesh and Betki in Bengal is an important candidate finfish species for farming. Seabass is a euryhaline fish, growing rapidly up to 3-5 kg within a growing period of 2-3 years in both freshwater and brackish water environments. For maturation and spawning it migrates to the sea while the post larvae and juveniles migrate to lagoons and backwaters for growing. It is a voracious carnivorous fish.

Seabass attains maturity at the age of 3-4 years at a length and weight range of 60 to 70 cm and 2.5 to 4.0 kg respectively. Males are generally small and in the size range of 2.0-3.0 kg and the males convert into females as they reach a size above 5.0 kg. The fecundity is between 2.1 to 17.0 million depending upon the size of the fish.

Article titled – **Sea urchin culture and its importance** *authored by* Sathiya Kala A Sea urchins are also known as "Sea hedgehog" are typically spiny, globular animals, echinoderms in the class Echinoidea. 950 species live on the seabed, and depth zones from the intertidal to 5,000 metres. Their habitat is rocky floor and coral reefs. Shells are round and spiny, typically from 3 to 10 cm (1 to 4 in) across. Sea urchins have a hard-calcareous shell, covered with a thin epithelium. Spines are found around the shell. These spines helps to protect and trap food. Tube feet are present inbetween the spines which helps in food capture, locomotion and holding on to the substrate. They mainly prey upon algae, fish and barnacles. Their predators include sea otters, starfish, wolf eels, crabs and triggerfish. They can live 15 to 200 years.

M.A.Nazeer
Editor & Publisher
Aqua International

New Leadership Team at CLFMA OF INDIA 2022-2024

Mumbai: CLFMA OF INDIA is a Non-Profit Organization and an Apex Chamber, nurturing "One Voice" of the Livestock Industry.

It was formed in the year 1967 with the objective of helping the promotion of overall animal husbandry, including the promotion of the concept of balanced feeding of animals in accordance with their nutritional requirements for deriving from them maximum output through productivity improvement. It was broad-based to include members from all sectors of livestock production during 2002.

CLFMA has a membership base of around 250 numbers representing Dairy, Aqua, Poultry and other sectors related to the Indian Livestock Industry viz. manufacturers and suppliers of feed additives, raw materials, feed plant and machinery, Laboratory equipment and also breeders, integrators, meat processors and exporters, vaccine manufacturers, animal health, etc.

Suresh Deora, Chairman, CLFMA Office, Sumit Sureka, Divya Kumar Gulati, Naveen Pasuparthy, Sandeep Kumar Singh, Abhay Shah and Nissar F. Mohammed

On 16 February 2023, CLFMA's Election was held in the Extra-Ordinary General Meeting (EGM) and the new leadership team took charge for the period 2022-2024. The outgoing Chairman Mr Neeraj Kumar Srivastava, Managing Director, South Asia and South – East Asia, Novus International, expressed his appreciation and conveyed his best wishes to the new team led by Mr Suresh Deora, Director – S.A. Pharmachem Pvt Ltd, who got elected as the new Chairman of CLFMA OF INDIA for the period 2022 – 2024.

Mr Neeraj Kumar Srivastava outgoing Chairman said that, it was indeed a great pleasure to work with CLFMA as a Chairman and after two years CLFMA has decided to appoint Mr Suresh Deora, who is an accomplished, talented business leader having a vast experience in managing the businesses of Livestock Sector as a whole and is actively involved into Human and Animal Nutritional business.

Mr Suresh Deora, is also the Chairman of Indian Red Cross Society – Mumbai, President and Trustee of KARM, Honorable General Secretary of India – China Chamber of Commerce and Industry. He presides over many education institutes. He is a well-seasoned and networked businessman connected with many industry stake holders including government authorities, BIS, FSSAI, etc and under his Stewardship, we anticipate CLFMA would continue to grow to greater heights.

He thanked Mr Neeraj Kumar Srivastava and CLFMA and said that, it was a great honour to be appointed as Chairman in a renowned association like CLFMA, as it is the single leading voice of the Animal Husbandry Industry. He promised to do his level best to help CLFMA work for the benefit of its members and the industry at large. He added that he was truly honoured and thrilled to carry the great legacy of many distinguished leaders, which has served the livestock industry for more than 5 decades. He promised to do his level best towards building the visibility of CLFMA, its image & reputation and working towards betterment of the livestock industry. He also said that Mr Neeraj Kumar Srivastava's team has done a great job especially with regard to government engagements and conducting relevant seminars during his tenure.

Following Office Bearers were elected for the period 2022 – 2024

1. Chairman: Mr Suresh Deora, S. A. Pharmachem Pvt Ltd
2. Deputy Chairman: Mr Sumit Sureka, Shivshakti Agro (India) Pvt Ltd
3. Deputy Chairman: Mr Divya Kumar Gulati, Nurture Aqua Technology Pvt Ltd
4. Deputy Chairman: Mr Naveen Pasuparthy, Nanda Feeds Pvt Ltd

Contd on Page 20

CLFMA Managing Committee 2022-2024

Uni-President

AQUACULTURE PROBIOTICS EXPERT

Nu Ri
NET 200 g **BSL**

Probiotics for water treatment

1. WATER QUALITY CONDITIONING

Best choice of *Bacillus* spp. that rapidly decompose uneaten feed, feces and other organic substances in pond water, keeps water quality optimal

2. HIGH ACTIVITY OF SPORES

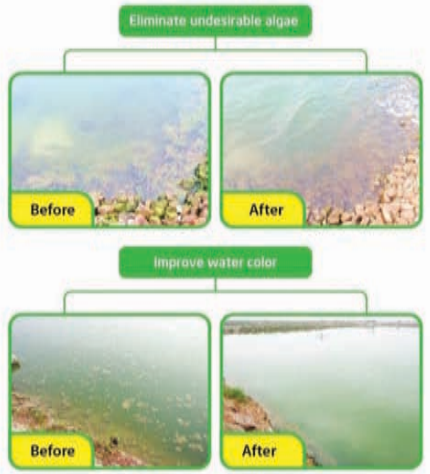
No cultivation is needed. Easily adapt to the changes of surroundings and grow fast in freshwater or seawater culture farming, even under low oxygen environment

3. DECREASE AMMONIA CONTENT

Prevent the accumulation of toxic substances such as NH_3, NO_2, etc.

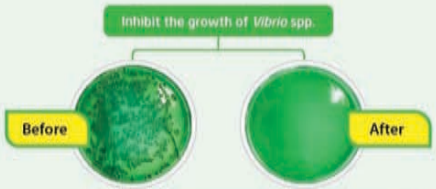
4. IMPROVE WATER COLOR

Improve water color regulate the algae and bacteria balance in water, turning your pond from green to clear



5. ESTABLISH BALANCED POND BACTERIA SYSTEM

Compete nutrition with vibrio and inhibit them to grow. Provide nutrition for probiotics in the pond, to establish a well-balanced farming system.



6. INCREASE AQUACULTURE PRODUCTION

Good quality of water prevents fish/prawn infections, making high profit of production

* COMPOSITION:

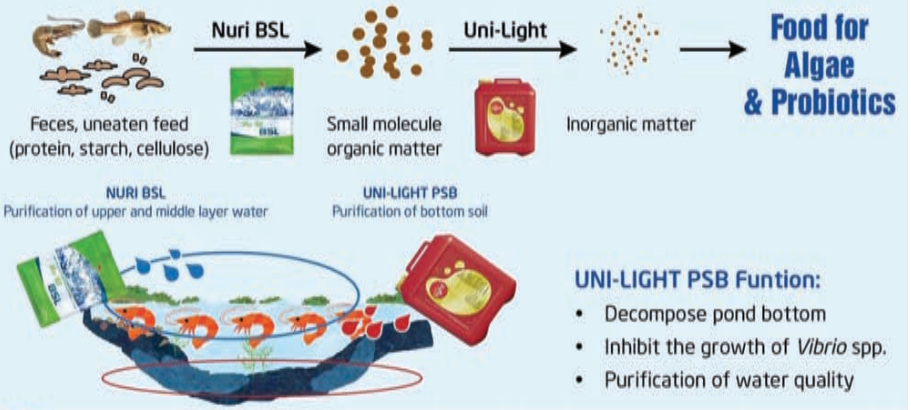
Bacillus spp. > 1x 10^{11} cfu/kg	15%
(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)	
Carrier (rice bran, corn gluten)	75%
Moisture	10%

* STORAGE:

Keep at dry, well-ventilated condition. Avoid direct sunlight exposure and use as soon as possible once opened for best quality.

* DIRECTION OF USE:

No cultivation is needed. Apply Nuri BSL with water-soluble bag near to the working water wheel or pour into the pond evenly. Recommend apply Uni-Light PSB together with Nuri-BSL on sunny day to achieve a clear pond more efficiently.



UNI-LIGHT PSB Funtion:

- Decompose pond bottom
- Inhibit the growth of *Vibrio* spp.
- Purification of water quality

BSL Dosage:

/10,000 m³ Quantity	10 - 30 pl/m² tiger prawn or < 80 pl/m² Vannamei	For >30 pl/m² tiger prawn or > 80 pl/m² Vannamei	For > 150 pl/m² Vannamei
7 days before stocking	800 g - 1,000 g	1,200 - 1,500 g	1,200 - 1,500 g
Day of stocking	300 g - 500 g	800 g - 1,000 g	800 g - 1,000 g
Every 7 - 10 days after stocking	300 g - 500 g	800 g - 1,000 g	3 - 5 days / use 1,000g - 2,000g

****Dosages can be adjusted according to the water conditions and practices.*

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Skretting opens 18.5 million feed facility in Surat, India

Feeding farmed shrimp

A division of Netherlands-based Nutreco, the newly set up high-end facility allows Skretting to further enhance support for its customers and the Indian aquaculture sector. Nutreco is the subsidiary of SHV Holdings NV, a family-owned Dutch multinational.

Skretting has been leading the global position in salmon and shrimp with 125 years of expertise and an innovation-driven approach. A news release explains that the firm has manufacturing footprints in 18 countries and produces three million tonnes of feed annually for more than 60 species from hatching to harvest.

The facility will be inaugurated by Sanjeev Balyan, union minister of state for fisheries, animal husbandry and dairying, government of India, and Michiel van Erkel, agriculture counsellor for India and Sri Lanka, Embassy of the Kingdom of the Netherlands, on 13 February.

Spread over an area of 20,000 m² and built with an investment of €18.5 million, the facility will cater to both shrimp and fish aquaculture. The shrimp cultures will include white tiger and black tiger, while fish cultures will include Indian major carps and high-value fish like snakehead and seabass.

The Mangrol facility has three production lines with a production capacity of 50,000 tonnes per annum. It can produce both extruded-floating and pelleted-sinking feed as per the requirement of the species and customers. There is also adequate land and infrastructure available to increase the production capacity in the future.

"We are thrilled to announce the launch of our state-of-the-art production facility at Mangrol in Surat. We have been meeting the needs of shrimp hatcheries, nurseries and farmers since 2018 in India, and supporting customers across feed-farm-health with our high-quality feed and services. The new facility enables us to contribute our bit to the prestigious Aatmanirbhar Bharat - Make in India initiative, while simultaneously improving the efficiencies for a closer connect with our customers. We will cater to the domestic market and also customers in Bangladesh, Sri Lanka and the Middle East," said Saurabh Shekhar, general manager of Nutreco South Asia.

Skretting's Aquafeed Pellets

The facility is equipped to support both sustainability and feed-to-food safety measures, in the line with the Sustainability Road Map 2025 and Nutrace. As part of their sustainability measures under the Nuterra programme, the premises has systems like rainwater harvesting and effluent treatment plant, among others. The factory also follows their global feed-to-food safety and quality programme Nutrace for end-to-end tracking and traceability with certifies supplier assessments and checks at each critical point.

"The factory is key to achieving our purpose of feeding the future in growth territories of Asia and India. We already have plants in Vietnam, Japan, China and Indonesia to strengthen our presence in Asia and establishing a state-of-the-art production facility at Mangrol, Surat reinforces our commitment to South Asia and Indian markets. Construction of the factory started in September 2020 and the work was completed in just over two years despite the various challenges posed by the Covid-19 pandemic. The facility has also generated local employment opportunities with 120 employees. This is just the beginning in our journey to gain a stronger foothold here," said Jurrien Zandbergen, managing director of Nutreco, Asia.

"We strongly believe that innovation and digitalisation are the future for sustainable development in aquaculture and livestock. That is why we invest €20 million annually on innovation looking for next-gen technologies like bacteriophages that can provide solutions to critical health challenges of aquaculture. At the same time, our digitally enabled solutions like Aqua Sim and Skretting 360 have been responsible for improving production and transforming aquaculture industry in countries like Ecuador. With this facility and our stronger footprints, we only aim to replicate some of these success stories in India as well," said Therese Log Bergjord, Chief Executive Officer, Skretting.

A. P. Govt to set up 4,000 fish outlets by March

Ministers directive to officials in Aquaculture Empowerment Committee meeting

- **CM Jagan is giving high priority to the development of aquaculture sector**
- **Encouragement to increase local consumption of aqua products.**
- **Sell Aqua products through Aqua Hubs in other states. Hold Aqua food festivals in all major cities.**
- **Provide Electricity Subsidy to every eligible aqua farmer.**

Andhra Pradesh Ministers Botsa Satyanarayana, Peddireddy Ramachandra Reddy and Sidiri Appalaraju during Aquaculture Empowerment Committe meeting held in Vijayawada recently.

Vijayawada: Ministers for Aquaculture Peddireddy Ramachandra Reddy, Botsa Satyanarayana and Dr Sidiri Appalaraju have directed officials to complete the establishment of 4,000 fish outlets by the end of March.

They addressed Aquaculture Empowerment Committee meeting recently. The decisions taken for the development of the Aquaculture sector, their implementation and future activities were discussed. On this occasion, the Ministers said that Chief Minister Y. S. Jaganmohan Reddy is giving high priority to Aquaculture sector. According to the CM's orders, the government is standing by the aqua farmers side and for seed and feed supply, scientific determination of rates and price stabilization. He said that the decision taken by the committee in such matters are giving good results. People should be made aware to Increase local consumption by at least 30 percent of what is produced in the state. He said that the Aqua products in Odisha are sufficient for the local needs and there is no need to depend on the international market. He said that due to this, alternative market opportunities will be improved so that farmers do not suffer losses during market fluctuations.

He said that the Centre has agreed to provide subsidized loans under Pradhan Mantri Matsya Sampada Yojana (PMMS) to fish outlets being set up as part of increasing local consumption. They said that we should sell our products through Aqua Hub in the states as well. Aqua food festivals should be organized in prominent cities.

Feed and seed rates under control

The ministers stated that as a result of discussions with seed manufacturers and processing units, the prices of seed and feed have come under control and the prices of aqua products have been prevented from falling. The farmers should also be made aware of the international markets and not prices and ensure that they cultivate in a reasonable area. If there is no understanding of demand and supply, ultimately the farmers will suffer. He said that every complaint received through the toll free number should be resolved promptly.

The zoning survey will be completed by March

Ministers said that the government is providing electricity subsidy to those who cultivate less than 10 acres under Aqua Zone. He said that the government is already giving electricity subsidy to 26,000 connections and said that the survey which is being conducted to determine the area under the aqua zone and non-aqua zone will

be completed by the end of next month. He said that the Aadhaar details of the farmers are being linked in the survey and this will show exactly how many eligible farmers. The ministers said that CM YS Jaganmohan Reddy has directed to provide electricity subsidy to every eligible aqua farmer and the authorities should take action to that effect. Raghuram, Fisheries Commissioner Kannababu, Director of Municipal Administration Praveen Kumar, Special CS, K. Vljayanand and others participated in the meeting.

Gassen Plus

Bon Ammonia and obnoxious Gasses

Shrimp / Fish performs all their body functions and growth in water. Good quality water and proper D.O. levels determines the success or failure. Good quality water, optimum D.O. level is of prime importance for health and growth of Shrimp / Fish.

Irregular water exchange, excess and leftout feed, dead algae, fecal matter, increases the organic load at the pond bottom. Accumulation of such waste absorbs available oxygen, creating anaerobic condition which leads to pollution of pond bottom. Polluted pond bottom and unhealthy environmental conditions triggers the release of toxic gasses like Ammonia, H_2S, Methane, etc, The toxicity of Ammonia, Hydrogen Sulphide, Methane attributed mainly due to unionized form. As the concentration in water increases, ammonia excretion by aquatic organism diminishes and the level of ammonia in blood and in other tissues increases. Ammonia increases oxygen consumption by tissues, damage gills and reduces the ability of blood to transport oxygen, and increases the disease susceptibility. To eliminate / overcome the above problems 'GASSEN PLUS' Yucca Schidigera, it contains Steroidal"Saponin" which help to reduce ammonia and other noxious gasses such as H_2S, Methane, etc., Microbial enzyme "Urease' Production inhibited by Saponin which leads to an increases D.O. and reduction of BODand COD levels.

Bacterial strains such as Bacillus Subtilis, Nitrobactor, Nitrasomonas, rapidly converts ammonia into Nitrates, Nitrites and finally non-toxic Nitrogen. Hydrogen Sulphide converts into Sulphates, Sulphites and finally non-toxic Sulphur, Methane into Non-toxic carbon. This conversion reduces the obnoxious gasses in the pond bottom. Reduction of this gasses improve the D.O. level in the water and bottom.

COMPOSITION:
YUCCA SCHIDIGERA
ALOEVERA
BACILLUS SUBTILIS
BACILLUS POLYMIXA
BACILLUS LICHENIFORMIS
NITRASOMONAS
NITROBACTOR
STABILIZERS

DOSAGE : 1 Kg per Acre or consult your Aqua Technician For Specific Usage & Dosage

PRESENTATION: 500 gms &1 kg

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ANTIBIOTIC FREE,
STEROIDAL FREE.

India identifies 146 potential sea farming sites along its coastline

The newly identified sites form part CMFRI's plans to boost marine aquaculture production – with the sea cages producing up to 2.13 million tonnes of fish each year

Aimed at empowering the coastal population through additional livelihood options, the ICAR-Central Marine Fisheries Research Institute (CMFRI) has envisaged plans to boost mariculture activities across the coastal states of the country.

Announcing the plan at the launch of a 21-day Winter School on mariculture for researchers and academicians at the CMFRI, director Dr A Gopalakrishnan said: "CMFRI has identified and geo-referenced 146 potential sites for sea cage farming within 10 km in the sea from the coast along the Indian coastline, with a production potential of 2.13 million tonnes per year. In these, four sites from Kerala in an area of nearly 1300 hectares." Earlier, the institute had identified 342 potential sites for seaweed farming with a production potential of 9.7 million tonnes (wet weight) in a year.

Up to 3 tonnes of fish production per cage

"CMFRI has developed and standardised indigenous sea cage farming technology suitable to Indian coastal and open waters. On average, up to 3 tonnes of fish could be produced in a 6-diameter cage within a period of 8 months. CMFRI has estimated that farmers could earn an economic return ranging from Rs. 1.5 to 2.5 lakh (approx $1,800 to $3,000) depending on the species grown from each crop," he said.

Dr Kuldeep K Lal inaugurating the 21-day Winter School at CMFRI

Apart from sea cage farming, technologies for seaweed farming and integrated multi-trophic aquaculture (IMTA) – an innovative practice combining seaweed and mussel farming with cage fish farming – have been proved successful by CMFRI for income multiplication and employment empowerment among the coastal people of the country, Dr Gopalakrishnan said.

Citing the status of India's mariculture, the CMFRI director said the current mariculture production from India is less than 0.1 million tonnes per year against a projected potential of 4 to 8 million tonnes. "Successful expansion of inland and brackishwater aquaculture in the country could be capitalised to boost mariculture production in a phased manner," he added.

Dr Kuldeep K Lal, director of ICAR-Central Institute of Brackishwater Aquaculture (CIBA) who inaugurated the Winter School urged scientists to focus on indigenous technologies and local fish varieties that would bring prosperity to the common people. "Developing appropriate technology with good vision will help transform the quality of life of people even living in rural areas," he said.

The 21-day Winter School is aimed at popularising CMFRI's mariculture technologies by imparting training to a diversified group of researchers from different parts of the country. A total of 22 researchers from seven states are attending the programme.

Dr Imelda Joseph, course director of the Winter School, said popularising the mariculture technologies would offer employment opportunities to the coastal community and make way for female empowerment.

Contn from Page 14 :

New Leadership Team at CLFMA OF INDIA 2022-2024

5. Deputy Chairman: Mr Sandeep Kumar Singh, Godrej Agrovet Ltd
6. Honorable Secretary: Mr Abhay Shah, Spectoms Engineering Pvt Ltd
7. Treasurer: Mr Nissar F. Mohammed, Coastal Exports Corporation
8. Immediate Past Chairman: Mr Neeraj Kumar Srivastava, Novus Animal Nutrition (India) Pvt Ltd
9. Executive Director: Ms Chandrika Venkatesh

The other members of the Managing Committee 2022 - 2024 comprises of:

10. Dr Prashant Shinde: Cargill India Pvt Ltd
11. Mr Anil M: KSE Limited
12. Dr Devender Hooda: Huvepharma SEA (Pune) Pvt Ltd
13. Mr R. Ramkutty: Niswin Enterprises
14. Dr Saikat Saha: Evonik India Pvt Ltd
15. Mr Ramakanth V. Akula: The Waterbase Limited
16. Mr Vijay Bhandare: Bhavani Agrovet Pvt Ltd
17. Mr Abhay Parnerkar: Godrej Tyson Foods Ltd
18. Mr R. Lakshmanan: Shanthi Feeds Pvt Ltd
19. Mr Balaram Bhattacharya: Indian Herbs Specialities Pvt Ltd
20. Mr K. Narender Reddy: Natural Remedies Pvt Ltd
21. Dr Anup Kalra: Ayurvet Limited
22. Dr Vijay Makhija: Intervet India Pvt Ltd
23. Mr Jaison John: U. S. Soybean Export Council, Inc

Odisha minister invites entrepreneurs to set up processing units in Odisha; Govt ready to assist them

Aqua International organizes 38th Aquaculture Expo at Balasore, Odisha

Ranendra Pratap Swain, Minister for Agriculture & Farmers' Empowerment, Fisheries & Animal Resources Development, Govt. of Odisha, along with **M.A. Nazeer, Sanjay Mohanty, Sangram Kumar Das, Ms Priyanka Mohanty, Prem Shankar Satpathy, Rajakumar Naik, Swarup Kumar Das, Pratap Chandra Sarangi, Manoranjan Das and Avoy Mohaptra on the stage during the national anthem in the inaugural session of Aquaculture Expo 2023 at Balasore.**

Odisha: Inaugurating Aquaculture Expo 2023, a 2-day Exhibition held in Balasore, Odisha, the *Minister for Agriculture & Farmers' Empowerment, Fisheries & Animal Resources Development, Govt. of Odisha Mr Ranendra Pratap Swain* invited the established entrepreneurs with shrimp processing plants from different regions to come to Odisha state to establish processing units and the state government will extend support to such companies. The Minister asked Aqua International Editor and other associations to submit a list of issues the aquaculture farmers of the state experiencing, and asked the editor to organize the expo next year also and the government will support it to promote Aquaculture in Odisha state.

Aqua International editor M.A. Nazeer, explaining a point to the matured politician and committed Minister for Agriculture and Fisheries, Govt of Odisha Ranendra Pratap Swain.

In his welcome address, Mr M.A. Nazeer, Chief Executive of the Expo and Editor, Aqua International said that the main objective of the Expo is to bring awareness among aquaculture farmers on shrimp, fish and crab culture and various products, technology and services available to get better yield and results in aquaculture farming. The Expo had a wonderful opportunity to aquaculture farmers to update their knowledge on various aspects in aquaculture. The event was an opportunity for buyers and sellers as well in the sector. Companies dealing with manufacture and supply of products and services related to aquaculture sector displayed their products in the Expo.

He brought to the notice of the Minister that Shrimp farming is growing in the state of Odisha. Farmers are struggling a lot to sell their produce - shrimps – and the shrimps at a profitable price. Same is the case in other regions of the country.

Minister Ranendra Pratap Swain lighting the lamp to mark the inauguration of Aquaculture Expo.

Everybody is concentrating on production and expansion of production, but no one is doing anything on Marketing of shrimps. Shrimp production is growing all over the globe and it would be difficult for India if the stakeholders depend only on exports. We need to give focus on developing domestic consumption of shrimps and other species in India itself. Like China, India has huge potential for the consumption of shrimps.

He thanked Aquatic Feed Dealers & Marine Exporters Association, Odisha; Odisha Shrimp Farmers Association, Balasore Chamber of Industries & Commerce and Odisha Aqua Employees Association for the support they extended in organising the Expo.

According to available data, Odisha has an extensive coastline bestowed with rich biological diversity, which accounts for 8% of total coastline of India. Shrimp farming is the major brackish water aquaculture in the state. Odisha occupies fourth place in brackish water shrimp farming area wise and third place

Ranendra Pratap Swain, *Ministerfor Agriculture & Farmers' Empowerment, Fisheries & Animal Resources Development, Govt. of Odisha*

Swarup Kumar Das, *MLA, Balasore Sadar, Odisha.*

MLA, Balasore, Odisha.

Welcome Speech: ***M.A. Nazeer,*** *Chief Executive, AE 2023 and Editor, Aqua International.*

Sangram Kumar Das, *Vice President, Aquatic Feed Dealers Association, Odisha.*

Rajakumar *Naik, Deputy Director, MPEDA, Odisha Region.*

Prem Shankar Satpathy, *Director, Magnum Group.*

Avoy Mohaptra, *General Secretary, Aquatic Feed Dealers and Marine Exporters Association, Odisha.*

production wise, among the coastal states of the country. Out of the thirty districts of the state, nine districts namely Ganjam, Khurda, Puri, Jagatsinghpur, Jajpur Kendrapada, Cuttack, Bhadrak and Balasore are considered as coastal districts. These districts have high density of population i.e, from 300 to 500 per square kilometer.

The Editor requested the Processors and Dealers to help farmers in getting better yield and profitable price to their shrimps. If farmers get profits, the industry will survive and grow well.

There is a need of creating awareness among farmers – in preparing shrimp and fish ponds, water quality, pond management, biosecurity, proper nutrition and healthcare of the species, getting better yield at the end of the crop – harvesting and post harvesting measures, and export of quality produce to overseas. Farmers should not compromise in the quality aspect in culture anytime, he stated.

Others who addressed the Inaugural Session are:

Mr Swarup Kumar Das, MLA, Balasore Sadar, Odisha.

Mr Sanjay Mohanty, President, Odisha Shrimp Farmers Association.

Mr Sangram Kumar Das, Vice President, Aquatic Feed Dealers Association, Odisha.

Mrs Priyanka Mohanty, Director, Falcon Marine Group.

Mr Prem Shankar Satpathy, Director, Magnum Group.

Mr Rajakumar Naik, Deputy Director, The Marine Products Export Development Authority (MPEDA), Odisha Region.

Mr Avoy Mohaptra, General Secretary, Aquatic Feed Dealers and Marine Exporters Association, Odisha gave vote of thanks.

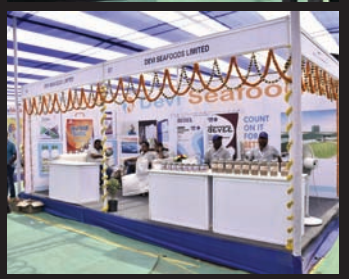
Mr Dattatraya Bhausaheb Shinde, District Collector & Magistrate, Balasore District, Odisha visited the exhibition and interacted with exhibitors on the first day of the expo on February 10.

Sanjay Mohanty, *President, Odisha Shrimp Farmers Association.*

Ms Priyanka Mohanty, *Director, Falcon Marine Group.*

Manoranjan Das, *Member , Aquatic Feed Dealers Association, Odisha.*

A view of Aquaculture Expo 2023 held at Balasore on February 10 & 11

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Expo Chief Executive and Editor, Aqua International, M.A. Nazeer presenting Mementos to Exhibitors at AE 2023 in Balasore on 10 & 11 February.














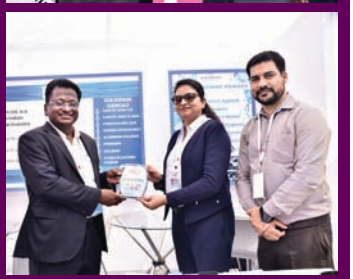




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USSEC organizes 2-day workshop on Shrimp and Fish Nutrition at Hyderabad

Hyderabad, India: As part of its commitment to the global aquaculture industry through consistent leadership, collaboration and support, U. S Soybean Export Council (USSEC) South Asia and Sub Sahara Africa region (SASSA) organized a two days workshop on Nutrition as a part of the project **Aqua Tech Talks**. The event focused on highlighting and informing key industry leaders about **the differentiating advantages of using U. S Soybean Meal as a key protein source ingredient in fish and shrimp feed**. USSEC put together a line-up of prolific global experts who educated the audiences about different aspects of fish and shrimp farming along the entire production chain, while emphasizing on the use of good quality feed, latest innovations and technologies like precision feeding to ensure optimum end product output. The speakers also demonstrated the unique attributes of U.S Soybean meal which includes high nutritious value, high protein density, high digestibility and high amino acid profile to yield rapid fish growth.

Doug Winter, Chairman, USSEC at Aqua Tech Talks Nutrition Workshop 21 & 22 February 2023 organized by USSEC

Mr Doug Winter, Chairman, USSEC inaugurated the session with a talk on Sustainable production practices of US Soy. Mr Regional Director for SAASA discussed the global trends in soybean meal production and supply. Mr Deeba Giannoulis, Head of Marketing & Sustainability, USSEC, SASSA discussed the U.S. Soy sustainability and its relevance to Aquaculture. Mr Chandrasekar Sankaranarayanan, Head Aquaculture Utilization South Asia gave an overview on Asian Aqua Feed industry with special reference to South Asia. Mr Jaison John, Team lead, India, USSEC welcomed.

Other eminent speakers from the international Aqua Nutrition field invited by USSEC presented talks during the workshop and provided the recent technological updates from formulation to processing. Nutritive value of feed ingredients, selection of raw material and the factors for selecting ingredients were discussed in detail by the speakers. Day one focused on topics related to shrimp nutrition and outlined the advantages of using soybean meal with higher inclusion rates in cost effective shrimp feed formulation. Comparison of soybean meal from different sources were also highlighted. Dr Dominique Burau presented a talk on the value of mathematical modelling in formulating sustainable aqua feeds and shared his experiences on precision nutrition. Sessions were followed by panel discussions which were highly interactive as well.

*Panel Discussion - **moderated by Chandrasekar Sankarnarayanan, Head, Aqua Utilization, South Asia, USSEC***

Aqua Tech Talks Nutrition Workshop, 21 & 22 February 2023 at Hyderabad, India

1st Day – 21 February 2023: Workshop: Shrimp Nutrition

Speaker	Session
Chandrasekar Sankaranarayanan, Head Aquaculture Utilization – South Asia, USSEC.	Welcoming remarks and introduction.
Doug Winter, Chairman, USSEC Board.	**Sustainable Production Practices for US Soy.** Listen to an influential grower leader from (the state of Illinois) give a crop production update and illustrate sustainable production practices to lrverage in aquaculture production and marketing.
Kevin Roepke, Regional Director – SAASSA, USSEC.	**Global Trends in Soybean Meal Production and Supply.** Learn about current trends in soybean meal production and supply worldwide and anticipated requirements for the future.
Deeba Giannoulis, Head of US Soy Marketing – SAASSA, USSEC.	**U.S. Soy Sustainability and its relevance to Aquaculture.** Learn about U.S. Soy's Sustainability and the U.S. Soy Sustainability Assurance Protocol – SSAP (pre-recorded).
Chandrasekar Sankaranarayanan, Head Aquaculture Utilization – South Asia, USSEC.	**Overview on Asian Aqua Feed Industry.** Overview on aqua feed industry in Asia with special reference to South Asia.
Dominique Bureau, Professor, Fish Nutrition Research Laboratory University of Guelph.	**Nutritive value of Feed Ingredients: Overview and Limitations.** Learning the composition of common ingredients used in aqua feed formulation and the identification of factors influencing their selection and use.
Matthew Clark, Director, Feed Guys Reseources Pte Ltd, Malaysia.	**Status Comparison of Soybean Meal from different sources and their effective use in Aqua Feed Formulation.** Comparison of soybean meal from different sources and its increased use in aqua feed formulation.
K. Ambasankar, Principal Scientist, Central Institute of Brakish water Aquaculture (CIBA), Chennai, India.	**Emerging Trends in the use of plant based protein & Lipids in Formulating Shrimp Feeds.** Understanding the current scenario in India with increasing cost and limited availability of animal protein and the growing needs of sustainable plant protein.
Panelists in Panel Discussion	Doug Winter, Kevin Roepke, Chandrasekar Sankaranarayanan, Dominique Bureau, Matthew Clark, K. Ambasankar and moderated by Jaison John.
Victor Suresh, Director, United Research (Singapore) Pte Ltd.	**Organizational aspects of Feed Formulation.** An orientation on the landscape of how nutrition and formulation work together, how purchasing and formulation interact and more.
Pierre Fortin, Aquaculture Manager – Techna, France.	**Enhancement of Plant Protein utilization in Shrimp Feed Formulations.** Enhancing the plant protein utilization through biotechnological tools for cost effective feed formulations and for sustainability.
Dominique Bureau, Professor, Fish Nutrition Research Laboratory University of Guelph.	**The value of Mathematical Modelling and Software in the Development, Formulation and Evaluation of Sustainable Aqua Feeds.** Overview of how modeling can be used to develop nutritional specifications and support the formulation of cost-effective and sustainable feeds and assist in the evaluation of those feeds.

Rajaram Vanjiappan, Head of Nutrition & Operations, Grobest Feeds, India.	**Role of Nutrition in Shrimp Health Management.** Sharing of experiences on functional performance of feed in shrimp farming and its importance in disease management.
Chuchai Kanjanamayoon, Aquaculture Technical Manager, USSEC, Thailand.	**Success Stories from Thailand on Increased use of Soybean Meal in Shrimp Feed Formulation.** Tabling the results on the trials with different levels if soybean meal in shrimp feed formulation obtained from field trials in Thailand.
Alberto J.P. Nunes, Professor, Aqua Nutrition, Federal University of Cearaand, Brazil.	**Cost-Effective High-Performance Shrimp Feeds with higher levels of Soybean by products with Krill as a Feed Attractant and Palatability Enhancer.** Discuss the ways and means to increase the usage of soybean meal in shrimp feed formulation while maintaining its attractability and palatability.
Panelists in Panel Discussion	Victor Suresh, Pierre Fortin, Dominique Bureau, Rajaram Vanjiappan, Chuchai Kanjanamayoon and Alberto J.P. Nunes. Moderated and Final Remarks by Chandrasekar Sankaranarayanan.

2nd Day – 22 February 2023: Workshop: Fish Nutrition

Speaker	**Session**
Dominique Bureau, Professor, Fish Nutrition Research Laboratory, University of Guelph.	**Precision Feeding of Aquaculture Species Reared Under Intensive Conditions.** Review of how feeding management of aquaculture species and how production efficiency and profitability can be improved through proper feeding management.
Rajaram Vanjiappan, Head of Nutrition & Operations, Grobest Feeds, India.	**Sustainable Aquafeeds.** Discuss the sustainability of raw material, processing, feed delivery and farming.
Latha Sundaram, Assistant Vice President CPF, India.	**Quality Assessment of Aqua Feed Ingredients.** Importance on the assessment of raw material used in aquafeeds for obtaining better output.
Swamy Haladi, Global Technical Commercial Manager, Trouw Nutrition.	**Management of Mycotoxin in Aqua Feeds.** Need for the assessment of mycotoxin in raw material and the ways to maintain strict quality control of ingredients used in aqua feed formulation.
John Williamson, Huvepharma UK.	**Enhancement of Plant Raw Material Protein Utilization in Fish Feed Formulations.** Importance of the assessment of raw materials used in aquafeeds for obtaining better output.
Dr P. Haribabu, Technical Director, Deepak Nexgen Feeds, Andhra Pradesh.	**Indian Fish Feed Industry – Way Forward.** Need for using formulated fish feeds for successful farming.
Saravanan Subramanian, Global TCM, Trouw Nutrition, Norway.	**Mineral Nutrition.** Role played by different minerals in aquafeed formulation and the minimum requirement of each mineral for better formulation.
Panelists in the Panel Sicussion	Dominique Bureau, Rajaram Vanjiappan, Latha Sundaram, John Williamson, Swamy Haladi, Dr P. Haribabu, Saravanan Subramanian and moderated by Khabibur Rahman.
Kiranpreet Kaur, Director R&D, Fish Health & Nutrition, Akerbiomarine Antarctic AS, Oslo, Norway.	**Functional Ingredients for Fish Nutrition with Special Focus on IMC and Pangasius.** Discussing the needs for using nutrition as a tool for handling diseases and health management of Indian major carps and pangasius widely farmed in India and Bangladesh.
Ramesh Gangatharan, Technical Sales Manager – Asia, ME and Africa Wenger, USA.	**Preconditioning: A Vital Component of Extrusion Processing of Aqua Feeds.** Highlighting the importance of preconditioning process and improved practices.

Matthew Clark, Director, Feed Guys Resources Pte. Ltd, Malaysia.	**Nutrient Value Calculator for Aqua Feeds.** Understanding the importance of nutrient value calculations for effective formulation of aqua feeds.
Biju Sam Kamalam, Scientist, ICAR – Directorate of Coldwater Fisheries, Nainital.	**Innovations in Fish Feed Formulation.** Glimpses of the recent developments in commercial fish feed formulations.
Kumaraguru Vasagam, Principal Scientist, Central Institute of Brackishwater Aquaculture (CIBA), Chennai.	**Emerging Nutritional Concepts and Research Gaps Targeting Next Generation Aqua Feeds.** Analysis of the industry requirements and matching those with research and matching those with research and leveraging that research to support commercial aquaculture.
Panelists in the Panel Discussion	Kiranpreet Kaur, Ramesh Gangatharan, Matthew Clark, Biju Sam Kamalam, Kumaraguru Vasagam. Moderated by Chandrasekar Sankaranarayanan and Final Remarks by Doug Winter, Chairman, USSEC Board.

From left: ***Dr P. Haribabu, Ramesh Gangatharan, A.V.Subramaniam, MD, Deepak Nexgen Feed; Chandrasekar. S, Dr M.V.D. Malleshwara Rao and Jaison John.***

Speech by Mr Kevin

A view of participants along with USSEC Chairman Doug Winter and the Speakers in the two days Nutrition Workshop during Aqua Tech Talks held in Hyderabad, India on February 21 & 22, 2023.

There is a higher demand for high-quality, sustainably-produced food and feed ingredients, driven by consumer consciousness about health and the environment

Doug Winter, *Chairman, USSEC*

The U.S. produced about 120 million MT of soybeans last year and exported about 60% of that total in the form of soybeans, meal or oil. India was the largest single market for U.S. Soybean oil in MY 21/22. India produced around 14 million MT of soybeans and will export some meal in the months right after harvest and possibly import meal back later in the year. We have been watching the exports of meal decline significantly over the last 10 years as the local demand for soybean meal has been growing. We expect this to continue and look forward to being a growing and reliable supplier of soybean meal to support India's vision on nutrition and economic growth via its food and feed industry. Aqua International Editor, M.A. Nazeer had an exclusive interview with Doug Winter, Chairman, USSEC. Excerpts:

About Doug Winter, Chairman, USSEC Board

I was born in Carmi, Illinois, U.S.A on December 25, 1954. I attended elementary and high school in that same town. I received my B.S degree from Southern Illinois University at Carbondale with a major in Agricultural Economics and a minor in Plant & Soil Science in 1977. After graduation, I returned to my family farm and began farming in partnership with my father Norman in 1977. We farmed together until his retirement in 1989. I farmed the operation by myself until 1993 when my brother Richard and myself combined our farming operations to form a 2800 acre operation. We continued our partnership until his retirement in 2014. During that period, we increased the size of our farm to 3100 acres. I have operated Doug Winter farms since then and my current famr size is 3520 acres. The farm size has increased its acre age by a combination of farmland purchases and rental of additional farms from retiring farmers. My wife, Nancy is a certified public accountant operating her own accounting firm, Nancy J. Winter, CPA in Carmi, Illinois. Our daughter Charisse works as the head of digital advertising department of a large healthcare corporation. Our son Neil works managing a food & beverage service operating three retail outlets. I have a nephew and a great nephew who work with me on the farm along with one full-time and one part-time employees.

1. Background Note on USSEC and when was USSEC established

U.S. Soy's vision is to transform nutrition, advance climate-forward solutions, and support progress for people and communities. As farmers, we have a deep commitment and responsibility to nourish the world sustainability.

Soybeans continue to be the United States' number one food and agricultural export. U.S. Soy's combined exports (whole soybeans, meal, and oil) achieved a record value of $ 40.42 billion for the marketing year (MY) 2021/22, up 17% year-on-year, and export volumes reached 71.79 million metric tons (MMT), the second-highest on record (Source: USDA Economic Research Service and Foreign Agricultural Service).

The U.S Soy farmers and industry currently export over 60% of annual soy production. The U.S. Soybean Export Council (USSEC) is the international marketing arm for U.S. Soy. USSEC was formed in 2004 as a joint partnership of the American Soybean Association and the United Soybean Board (the U.S. Soybean Check off Board).

USSEC focuses on differentiating, building preference, and enabling market access for the use of U.S. Soy for human consumption, aquaculture, and livestock feed in 80+ countries internationally. USSEC members represent the soy supply chain including U.S. Soy farmers, processors, commodity shippers, merchandisers, allied agribusinesses, and agricultural organizations. USSEC is funded by the U.S. soybean check off, USDA Foreign Agricultural Service (FAS) matching funds, and industry.

2. Who are the promoters ?

USSEC has 105+ members who represent the entire soy

supply chain including U.S. Soy farmers, processors, commodity shippers, merchandisers, and food and agriculture agricultural organizations. USSEC is funded by the U.S. soybean checkoff, USDA Foreign Agricultural Service (FAS) matching funds, and industry.

3. Head Quarters of USSEC

USSEC world headquarters is in St. Louis, U.S.A. and our international team reaches 80+ countries around the world.

4. What are the objectives of USSEC ? Are you satisfied with the performance/ progress/ results of USSEC in USA and internationally ?

U.S. Soy's vision is to transform nutrition, advance climate-forward solutions, and support progress for people and communities.

Our USSEC objectives are centered around three main pillars of our strategic plan:

1. To differentiate the quality and value of U.S Soy from other nutrition and energy products

2. To elevate preference for U.S Soy in existing and developing global markets

3. To attain market access for U.S Soy through cooperation with a variety of global stakeholders

We strive to do this by delivering world-class performance, acting responsibly, fostering our diversity and trusting in our team. One of our guiding principles is listening to our customers and advocating their needs to the industry.

I have been greatly impressed with the performance and progress of our USSEC global team.

USSEC Chairman Doug Winter and Aqua International Editor, M.A. Nazeer at Hyderabad on February 21.

Domestically in the U.S., we maintain excellent relationships with the U.S farmers and industry.

Internationally, I am amazed at the level of respect USSEC has attained from companies across the food industry, in the animal protein, aquaculture, oil and soy foods sectors.

Our goal is to be a trusted partner to our customers and be an essential enabling solution provider to advance their sustainability and profitability goals.

USSEC's strategic work in emerging economies has helped countries increase and maintain their share of world trade growth, while continuing to position U.S. Soy as a trusted, sustainable source of nutrition and energy in mature and expanding markets worldwide.

5. In how many countries does USSEC have its operations ?

USSEC reaches over 80 countries around the world.

6. Future plans and targets ?

USSEC will continue to collaborate across the global food and agriculture value chain with diverse stakeholders to enable nutrition and food security in the 80+ countries we serve.

As we developed our strategic plan for 2022-25, we factored in three key trends:

- First, there is a higher demand for high-quality, sustainably-produced food and feed ingredients, driven by consumer consciousness about health and the environment. Research from First Insight and the University of Pennsylvania found 75% of Gen Z consumers say sustainability is more important than brand names when making purchases. Gen Z's influence on Gen X caused preference for sustainable brands to increase 24% and display a willingness to pay more for them to increase 42% since 2019.
- Second, the cost of a healthy diet is significantly higher than an energy-sufficient diet, showing significant gaps in our food system's ability to deliver nutritious foods at affordable prices.
- And lastly, as part of healthy, sustainable diets, demand for soyfoods is increasing. USSEC-commissioned research revealed that the sector has grown 3% annually since 2010.

Therefore, we can say that sustainable and efficient value chains and diversification of the food system are critical for healthy diets.

Global poultry, pork, and aquaculture consumption are forecast to grow 17.8%, 13.1%, and 23% respectively by 2030. Global soy foods per capita consumption grew 24% to 2.67 kg in 2020 from 2.16 kg in 2010. As consumers, food companies and countries increase their focus on value, sustainability and transparency, U.S. Soy is strongly positioned to meet global needs as a key source of sustainable protein. USSEC is well poised to deliver solutions that *create long-term value for all our stakeholders - consumers, customers, countries, U.S. Soy farmers and industry.*

We will do this by continuing efforts to bring USSEC resources to markets around the world teaching people about the importance of protein consumption through programs such as Right to Protein; take USSEC programs to more countries and areas within countries that can benefit from the knowledge which can be transferred; and continue to ensure that the sustainability of U.S. Soy is known by importers all around the world who are interested in using low carbon footprint soy ingredients to help the world solve its climate change issues. We have long believed that we will do well when the Customers of U.S. Soy do well – we will continue following that philosophy.

We expect a challenging global environment continuing in MY 22/23 including economic contraction and inflation. Yet we are confident that when companies and countries choose sustainable solutions, collaborate, and advance open trade, together we can create positive impact.

7. What is the size / volume of soybean production in USA and its exports to different parts of the world and to India?

The U.S. produced about 120 million MT of soybeans last year and exported about 60% of that total in the form of soybeans, meal or oil. India was the largest single market for U.S. Soybean oil in MY 21/22. India produced around 14 million MT of soybeans and will export some meal in the months right after harvest and possibly import meal back later in the year. We have been watching the exports of meal decline significantly over the last 10 years as the local demand for soybean meal has been growing. We expect this to continue and look forward to being a growing and reliable supplier of soybean meal to support India's vision on nutrition and economic growth via its food and feed industry.

8. How can USSEC be beneficial to shrimp, fish and other species producers in aquaculture as well as poultry producers and stakeholders?

Aquaculture is the fastest-growing segment of the food and feed industry, according to the United Nations' Food and Agriculture Organization, which estimates that aquaculture production is expected to grow to 109 million metric tons by 2030 — an increase of 32% over 2018. This presents a huge opportunity for U.S. Soy as more aquaculture producers learn about the advantages to using quality soybean meal in their feed formulations. According to the OECD-FAO Agricultural Outlook 2022-2031 report, by 2031 aquaculture is expected to provide 59% of the fish for human consumption.

Over the years USSEC has continued to provide training to fish, poultry, dairy and soy food producers in India.

To affirm USSEC's commitment to shape a growing and sustainable aquaculture industry, USSEC is working in the following ways:

1. **Global Aquaculture Advisory Council** - At USSEC, we believe in multi-stakeholder collaboration and co-creating value. First up, we convene a Global Aquaculture Advisory Council with multistakeholder representation from 11 academia, civil society, industry, public sector, and sustainability certification organizations globally. It helps create a holistic approach of aquaculture that advances sustainable growth across the entire value chain, from farmers to feed companies to seafood companies to consumers. And in our view, the multistakeholder representation also reaffirms the U.S. Soy farmers and industry's commitment to shaping a growing and sustainable aquaculture industry.
2. Second, USSEC spearheaded development of the **In-Pond Raceway System (IPRS)** aquaculture technology in partnership with Auburn Univ. which sustainably optimizes use of natural resources such as water, land, energy, thus protecting the environment, and helping reduce the carbon footprint of aquaculture.
3. USSEC also actively contributed our global expertise to develop the **International Aquaculture Feed Formulation Database (IAFFD)** which enables aquafeed companies to customize and optimize fish feed to best match the specific nutrient requirements by species and life stages for a wide range of fish and crustacean species.
4. We work with the world's leading aquaculture and aquafeed companies sharing technical expertise, industry trends, and collaborating on commercial, sustainability, regulatory, and/or reputational opportunities.
5. We **collaborate** with **Global Seafood Alliance BAP**, support **Global Aquaculture Innovation Challenges** alongside companies like IBM and others, and on other industry opportunities.
6. We plan to continue to do this going forward as well.

9. Who are the key individuals/ Country Team Leads of USSEC globally and in India?

The USSEC website at USSEC.org provides a good listing of all USSEC Team Members. The CEO of USSEC is Mr Jim Sutter who is planning to be in India in May of 2023.

India Team:

- Kevin Roepke, Regional Director - South Asia & Sub-Saharan Africa
- Deeba Giannoulis, Head - U.S. Soy Marketing, South Asia & Sub-Saharan Africa
- Jaison John - India Team Lead
- Chandrasekhar Sankarnarayanan – Head, Aquaculture Utilization, South Asia

10. How is the progress of your new concept 'Nutrition Workshop' under the title 'Aqua Tech Talks' and the symposiums and meetings of Right To Protein?

Soy is highly nutritious and provides all the three macronutrients required for good nutrition, as well as fiber, vitamins, and minerals with minimum saturated fat.

Right To Protein is a nationwide consumer awareness initiative, supported by U.S. soy farmers and the Soybean Export Council (USSEC), that aims to educate consumers on the importance of adequate protein consumption, diverse sources of protein, and catalyze a movement towards better nutrition, health and well-being.

We believe that the 2 programs mentioned are doing very well. Working with Aquaculture producers to help them understand nutrition opportunities and the utilization of the Intensive Aquaculture Feed Formulation Database (IAFFD) and communicating the Right to Protein initiative which is a public health initiative to increase awareness about the importance of adequate and quality protein in everyday diet. The campaign aims to nurture a growing ecosystem that can tackle the problems of food and nutrition insecurity.

We are pleased with the progress and looking forward to partnering to help transform nutrition, advance climate-forward solutions, and support progress for people and communities.

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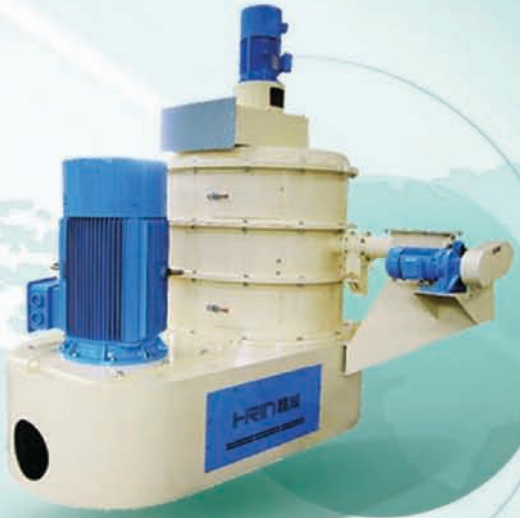

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Ecological Engineering for Sustainable Aquaculture: Simple Concept with Greater Impact

Email: idrish.raja.khan@gmail.com

Md. Idrish Raja Khan
PhD Research Scholar, Department of Aquatic Health and Environment College of Fisheries, Central Agricultural University, Tripura.

Highlight Points

- The concept addresses the processes that are involved with the management of wastes as a resource.
- The improved production efficiency increases yields and survival rate while reducing inputs.
- These techniques address a myriad of ecological concerns from erosion, water purification, pollution reduction, environmental remediation, etc

What is ecological engineering?

Ecological engineering is a concept that applies the principles of species symbiosis along with material recycling and regeneration. The idea is that man-made structures can stimulate and control the environment to produce supplementary energy, after this energy has been generated, humans can use it to sustainably achieve production outputs. In 1962, Howard T. Odum proposed the concept of ecological engineering and defined it as 'environmental stimulation by man using small amounts of supplementary energy to control systems in which the main energy drives are coming from natural sources'. The discipline addresses and quantifies the processes that are involved with the management of wastes as a resource. Such studies consider a variety of complex environmental and social needs, in addition to maximizing short-term profit. Since the 1980s, ecological engineering has rapidly developed in different parts of the globe especially Europe and United States, where it has been used in environmental management.

Proponents of ecological engineering tout its environmental advantages compared to traditional pond aquaculture such as ecological engineering methods only employ halve water use and dramatically decrease nutrient effluents in wastewater. The improved production efficiency increases yields and survival rate while reducing feed inputs. Other downstream benefits include decreased disease incidence and medication use, improved labour efficiency, etc. The two main methods of ecological engineering in aquaculture involve building facilities and designing production systems for use on farm sites. These techniques address a myriad of ecological concerns from erosion, water purification, pollution reduction, environmental remediation, *etc.*

Components of ecologically engineered farm

Eco-slopes

Eco-slopes are used next to fishponds to reduce slope instability and collapse. They are created by using plants and non-living plant materials to make three-dimensional vegetation net that reduces bank erosion. Researchers found that the vegetation emulates the ecological characteristics of wetlands, to purifying the water and regulating subsurface flow. Most studies on eco-slopes have found that they effectively prevent soil erosion, protect pond banks and can intercept and rectify agricultural pollution. Other studies have shown that eco-slopes can significantly improve water quality and reduce the total nitrogen and phosphorous loads.

Eco-ditches

Eco-ditches are ditches that have been sectioned and modified to naturally filter and purify water run-off. Construction of eco-ditches usually involves modifying the bottom and full length of the ditch into sections that contain different aquatic plants or animals that provide ecosystem services for the water in the ditch. Though multiple studies have found that eco-ditches can help ameliorate eutrophication in culture water, the researchers stress that sediments in the ditch need to be drained and treated to prevent pollutant build-up. Researchers also note that the restorative potential of eco-ditches is largely dependent on the plants and animals they contain. Farmers will need to actively manage eco-ditches to make sure they are reaping the full benefits of the design.

Eco-ponds

Eco-ponds are a sustainable way of treating sewage and use aquatic plants, fish from multiple trophic levels and waterfowl to form a complex ecosystem and a complete food chain. The idea is that farmers can position eco-ponds next to production ponds and rely on the natural processes to filter sewage and run-off from aquaculture production. The main eco-pond technique is the high-rate algal pond (HRAP). Multiple studies have shown that HRAPs can successfully manage and regulate water ecosystems. HRAPs remove more nitrogen and phosphorous than conventional wastewater treatment and also have shorter hydraulic retention times than general wastewater treatment.

Eco-floating beds

Eco-floating beds (or biological floating islands) are small masses of plants that sit on top of culture water and assist in water purification. Eco-floating beds rely on the aquatic plants and their root microorganisms to reduce pollutants and remediate eutrophic water. The studies have found that more than 80 types of plants can be used in eco-floating beds, including food crops, vegetables, flowers, perennial herbs and grasses like water spinach (*Ipomoea aquatica*). Ideally, the root systems of the plants should host organic matter, shellfish, snails or other common aquatic organisms. This increases the oxygen load in the water, breaking up biofilm and organic pollutants while providing a dense matrix for water to filter through. Studies suggest that it will see best results if floating beds cover 20 per cent of the water area in the culture pond.

In the current scenario of global aquaculture there are several examples where such approaches has been adopted, taking into the consideration about the sustainability of the aquatic environment.

1. Composite constructed wetland

Constructed wetlands are based on the structure of natural wetlands. They are engineered systems similar to swamps but controlled by humans. A constructed wetland can use the physical, chemical, and biological functions in the system to treat sewage. The composite wetland integrates the advantages of constructed wetlands and has a more efficient and flexible treatment effect. Using composite wetlands to treat aquaculture wastewater has many advantages. First, the composite wetlands can effectively remove TSS, nitrogen, heavy metals harmful drugs particularly antibiotics and other eutrophic substances from aquaculture drainage. In addition, they can also support harvested plants for livestock feed. Studies have also showed that aquaculture discharge exhibited significantly improved water quality after composite wetland treatment, the cyanobacterial blooms were significantly inhibited, and the aquaculture water quality was improved. Over the years the use of wetlands as land-intensive biological treatment systems has been applied to the purification of sewage by substrate filtration, plant adsorption, pollutant sedimentation, and exchange and microbiology oxidation

2. Integrated multi-trophic aquaculture (IMTA)

IMTA aims at the integrated production of aquaculture species of different trophic levels under a circular economy approach, minimizing energy losses and environmental deterioration. Under IMTA production, the uneaten feed and wastes of one species are recaptured and converted into feed, fertilizers, and energy to another species. IMTA can promote aquaculture sustainability, with environmental, economic, and social advantages. There are multiple configurations of IMTA systems, integrating the production of vertebrate and invertebrate species and macroalgae. Cultivated organisms are fed aquatic species, like fish or shrimp, and species extracting the organic and inorganic matter from the water. Species extracting the organic matter may be mussels, oysters, clams, sea urchins or polychetes. These species feed on organic waste, such as uneaten food and feces. Species extracting the inorganic matter, such as macroalgae (e.g., species of the genera Ulva, Gracilaria, Saccharina, Laminaria), capture and use the inorganic nutrient wastes. IMTA allows the creation of more sustainable production systems because wastes of fish/shrimp production are valued as a resource rather than considered a burden or pollution. This contributes to environmental sustainability and a more efficient use of resources, while favoring economic diversification and social acceptability.

PROBIOTICS, PREBIOTICS AND SYNBIOTICS: *FUTURE PROSPECTS FOR SUSTAINABLE VANNAMEI CULTURE*

Email: vijayamirtharaj@tnfu.ac.in

M. Sivakumar and K. S. Vijay Amirtharaj [1]

[1]Assistant Professor and Head incharge
Mariculture Research Farm Facility
Department of Aquaculture,
Fisheries College and Research Institute,
Tamil Nadu Dr. J. Jayalalithaa Fisheries University,
Thoothukudi.

INTRODUCTION

Aquaculture is one of the world's fastest-growing sectors, with Asia accounting for about 90% of worldwide output. The production of aquaculture is the only sector of disease outbreaks in many Asia - Pacific nations, which has an impact on both the nation's economic development and the socioeconomic standing of the population. Because of the increasing demand for food, fisheries are being farmed and bred excessively and intensively, which increases the danger of disease. The main challenges that threaten fish aquaculture and decrease its productivity include infectious illnesses, declining water quality indicators and other environmental stressors. There are many alternatives to protect cultured aquatic animals from the impact of pathogens. However, the large loss of aquaculture due to illnesses is an issue that has to be addressed.

Vibriosis is one of the most prevalent bacterial infections that impacts both freshwater and marine fish species, generating high mortalities and significant economic loss. In the aquaculture sector, disease management has been carried out in a variety of ways employing conventional methods, synthetic chemicals and antibiotics. Many antibiotics and antimicrobials have been used for a long

Highlight Points

- Probiotics is a bacterial-based solution that promotes health by preventing numerous diseases and pathogenic growth, changing host-related microorganisms, non - pathogenic bacteria can also reduce allergies and enhance the immune system.
- Prebiotics - "ingredients of the indigestible diet that are advantageous to the host for selectively boosting the growth and / activity of one or more intestinal bacteria" and significant positive effects on the function of intestinal epithelial cells, including the maintenance of metabolism, promotion of proliferation and differentiation and promotion of a low pH5 of the gut environment, favouring beneficial microbes.
- Synbiotics - combines prebiotics with probiotics in a beneficial way in a dietary supplement. A food that modifies the opportunistic bacterial population of the host species' and improve growth, strengthened immune responses and resistance against disease.

time to treat vibriosis. However, that use antibiotics to treat aquatic animals in aquaculture can result in a number of dangerous issues, including the development of antibiotic-resistant bacterial strains, the presence of antibiotic residues in fish muscles that will have a negative impact on human consumers' health and the occurrence of environmental pollution. Recently, shrimp farmers have had to deal with widespread and inappropriate antibiotic usage for disease prevention and treatment, which has resulted in bacterial resistance in shrimp and put customers' health at risk. Critical opinions on the use of antibiotics have been prompted by consumers' and scientists' concerns about antibiotic - resistant microorganisms and drug residues in meat. As a result, the use of human antibiotics as growth promoters in animal diets has been prohibited. Strict regulations have been implemented to prohibit or limit the use of prophylactic antibiotics in order to reduce their negative effects on aquatic life.

Probiotics, prebiotics and synbiotics have proven to be the most effective dietary and water supplement replacements for bacterial, viral and parasite infections in shrimp, as well as disease - controlling agents in the shrimp farming industry. Using prebiotics, synbiotics and probiotics as an alternative has been shown to improve not only growth but also immune and gut health of cultured species. They are injected into the feeds of culture species in an effort to promote wellness, protect the intestine from harmful microbes and reduce inflammation. The advantages of probiotics, prebiotics and synbiotics, as well as their mechanisms of action, have been identified. These benefits include improved immune responses, increased production of antibacterial agents, changes in the composition of the gut flora, competition for nutrients and binding sites and activities involving enzymes.

Shrimp aquaculture has recently undergone a number of evaluations of professional probiotics, prebiotics and synbiotics, specifically for the activation of innate, humoral and cell-mediated immunity, as dietary and nutritional supplements, environmental capacity builders, growth promoters, and prophylactic against infectious diseases. Additionally, these supplements directly stimulate immunological responses by increasing neutrophils, phagocytes, alternate regeneration mechanisms and lysosome activity.

PROBIOTICS

It is a bacterial-based solution that promotes health by preventing numerous diseases and pathogenic growth in aquaculture. By changing host-related microorganisms, non-pathogenic bacteria can also reduce allergies and enhance the immune system while also enhancing environmental and dietary safety. The primary goals of probiotics are to boost immune function, provide energy, and produce chemicals that prevent infections' cerebral sensing from working properly. Additionally, probiotics can be added to the culture system to enhance water quality and track bacterially-caused infectious diseases. For instance, various bacteria, phages, microalgae, and yeast are typically utilised as feed additives or in aquaculture.

During the process of making, storing and pelleting the probiotic-based diet, probiotics might not survive or develop. If the meal is prepared improperly and under unfavourable circumstances, its effectiveness may be affected. Probiotic microorganisms are beneficial for a variety of reasons, including boosting the economy, promoting healthy digestion and absorption, and reducing the spread of infectious diseases. For instance, aquatic animals, such as *Brevibacillus brevis*, lactic acid bacteria,and *Vagococcus fluvialis*, adhere to the mucosal epithelium of the gastro-intestinal tract and assist the body resist pathogens.

In recent years, shrimp aquaculture has used a number of gram-positive and gram-negative bacterial species as probiotics, including Bacillus species, *Vibrio* species, lactic acid bacteria and several other bacterial species. Probiotic yeasts, probiotic bacteria, including Pediococcus, Lactobacillus, Bacillus, Bacillus, Enterococcus, Micrococcus, Lactococcus, Roseobacter and Pseudomonas (like *Aspergillus oryzae* and *Saccharomyces cerevisiae*).

Selection of probiotics in aquaculture

The primary objective of probiotic administration in the beginning is to maintain or repair a positive connection between friendly and pathogenic microorganisms that constitute fish's gut flora or skin mucus. To make probiotics for marketing, the following procedures should be followed.

- Selected healthy bacteria isolated through selective culture from the gastrointestinal system of healthy aquatic animals.
- solely in the colonies for in vitro evaluations, such as pathogen suppression, pathogenicity to target species,and host resistance conditions

Characteristics of good probiotics

- Non-toxic, non-pathogenic and massive populations of viable strains
- Capable of survival and metabolization
- Under storage and field settings - stable and capable of being viable

Mode of action

- To enhance the digestibility of food in the form enzymes such as alginate lyases, amylases and proteases.
- Also boost the production of nutrients for example, fatty acids, biotin and vitamin B12, which has positive effect on the health of an animal.
- To stimulate feed conversion efficiency, increase live weight gain of fish and shrimp culture and to prevent pathogens, the production of organic acids, hydrogen peroxide, antibiotics, bacteriocins, siderophores and lysozyme.
- Also regulate the immune response of fish.

Mechanism of immune response

- ▶ Phagocytic activity
- ▶ Respiratory burst activity
- ▶ Peroxidase and anti-protease activity
- ▶ Cytokines
- ▶ Lysozyme

Phagocytic activity

Phagocytes, including neutrophils and macrophages, are crucial to the body's antibacterial defence. Through the generation of reactive oxygen species (ROS), such as superoxide anion, hydrogen peroxide and hydroxyl radicals in the respiratory burst, these cells consume and kill the bacteria.

Respiratory burst activity

Fish's innate defence systems include respiratory burst activity, which is significant. Probiotics have been shown to enhance the respiratory burst of phagocytic cells in fish, which is crucial for the defence of non-specific cells.

Lysozyme

Lysozyme is an innate immune system component that plays a crucial part in defensive mechanisms due to its anti-cancer, anti - viral and opsonization characteristics (Jolles and Jolles,1984). It is a crucial bactericidal enzyme of innate immunity and a crucial weapon for fish in the battle against pathogens. Probiotics, which can be obtained alone or in combination, increase the level of lysozyme in bony fish.

Peroxidase and anti-protease activity

Peroxidase enzyme employs oxidising radicals to create hypochlorous acid, which is used to destroy infections. Peroxidase is often produced from the azurophilic granules of neutrophils during the oxidative respiratory burst. The action of the proteases utilised by some bacteria to infiltrate the host is inhibited by the antiprotease activity found in serum, which contains the 1-antiprotease, 2-antiprotease, and 2 macroglobulin. Generally, this activity is high and is unaffected by infection or immunisation.

Cytokines

Small proteins collectively known as cytokines play a crucial role in cellular signalling. They are secreted by cells and occasionally even the producing cell itself. They have an impact on how other cells behave. Chemokines, interferons, interleukins, lymphokines, and tumour necrosis factor are examples of cytokines. The production of pro-inflammatory cytokines like interleukin-1 (IL-1), IL-6, IL-12, tumour necrosis factor (TNF), and interferon-gamma (IFN) as well as anti-inflammatory cytokines like IL-10 and transforming growth factor (TGF) can both be effectively modulated by a variety of probiotics in many different organisms.

Advantages

- Disease control
- Growth promoter
- Improvement digestion
- Improve immune system
- Promoter of reproduction

Modes of application

- Feed + Probiotics - Oral enhances the intestine's healthy microorganisms.
- Water additives - They can expand by absorbing all the food that can be eaten in the water medium.
- Micro - encapsulation has a good effect on the physical characteristics of the water and the health of the shrimp.
- Artemia or microalgae that are alive and probiotic - rich can aid in promoting growth and survival during the nursing stage.

PREBIOTICS

Prebiotics are defined as "ingredients of the indigestible diet that are advantageous to the host for selectively boosting the growth and / activity of one or more intestinal bacteria" can have a positive impact on the host. Short chain fatty acids (SCFAs) - acetate, proprionate and butyrate are produced as a result of the fermentation of non-digestible dietary fibre and carbohydrates. These SCFAs have significant positive effects on the function of intestinal epithelial cells, including the maintenance of metabolism, promotion of proliferation and differentiation, and promotion of a low pH5 of the gut environment, favouring beneficial microbes with a concurrent decrease in the growth and viability of pathogen bacteria. The colon's pH is decreased by the creation of SCFAs, which slows the spread of infections and promotes the development of lactic acid-producing bacteria like Bifidobacterium.

Prebiotics can boost immunity even more by triggering the body's general defences and fostering good bacterial health. The beneficial microbiota helps the host's immunity, protects against dangerous bacteria in the colon and maintains a healthy balance between the microbiota of the digestive and immune systems. Compared to probiotics, there is generally less concern about incorporating prebiotics into diets because they are not living microorganisms; viability of the bacteria during storage and processing is considered to be critical for probiotics to confer their beneficial effects to the host organisms. For example,

- Inulin
- FOS- Fructo oligosaccharides
- MOS- Mannan oligosaccharides
- IMO- Isomalto oligosaccharides
- GOS- Galacto oligosaccharides
- XOS- Xylo oligosaccharides

Prebiotics possess the ability to be metabolized by beneficial bacteria, *Lactobacillus and Bifidobacterium,* producing short-chain fatty acids (SCFAs) and lactate. SCFAs can be absorbed through the intestinal tract to act as a source of energy while lactate acts as a stimulant for gluconeogenesis.

Characteristics of prebiotics

- To be resistant to digestive processes in the upper part of the gut tract.
- To be fermentable by intestinal microbiota
- Selectively stimulate the growth and/or activity of a limited number of the health - promoting bacteria in the gut microbiota.

Mode of action

The immunomodulatory properties of prebiotics are a direct mechanism by which the pattern recognition receptors (PRRs), such as beta glucan receptors and dentin-1 receptors expressed in macrophages, interact with one another. This kind of receptor contact activates signalling molecules like NF-B that stimulate immune cells. As with teichoic acid, peptidoglycan, glycosylated protein or the bacterial capsular polysaccharide, saccharides may interact with PRRs forms of microbial associated molecular patterns (MAMPs) and trigger an immune response. improved development and survival of host species, immune system stimulation and modulation, gut microbiota enhancement, modulation and alteration, antioxidant activity and advantageous alterations in enzyme function.

Mechanism of immune response

- Phagocytic activity
- Respiratory burst activity
- Macrophage
- Lysozyme

Phagocytic effect

Is the process that occurs in the spleen, kidney, head kidney (HK), or other lymphoid organs and possesses the endocytic ability of intracellular phagocytic leukocytes and an active host defence mechanism. By employing microscopy or colorimetric detection to gauge the amount of endocytosed zymosan in phagocytes, it can be seen. Phagocytosis takes place in stages. Toll-like receptors (TLRs) and other PRRs recognise bacteria, which are then consumed by phagosomes, fused with lysosomes, which contain a variety of proteases and killed by proteolysis. Additionally, the immune system as a whole is activated by the antigen processing stages that come after the antigen is presented to T cells.

Macrophages

Significantly contribute to the immune system's ability to connect its innate and adaptive components in order to maximize immune response and eliminate harmful microorganisms. IFN-Macrophages and their direct interactions with MAMPs on bacteria and PRRs on host cells activate both. TNF, IL-1, IL-12, and other inflammatory cytokines are secreted by macrophages that are activated. Cytokines are the main mediators of macrophage activation and can be detected using PCR or ELISA .An enzyme called phosphomonoesterase, often known as acid phosphatase, is responsible for removing the phosphate group from phosphorylated compounds. Acid phosphatase causes phagolysosome macrophages' internal pH to decrease and its internal acidity to increase in activated macrophages or dendritic cells.

Lysozyme

Is an enzyme degrading peptidoglycan in bacterial walls by hydrolyzing β-glycosidic bonds to N-acetylmuramic acid and N-acetylglucosamine. Lysozyme is found in many areas, such as mucus, serum, intestines and eggs of marine animals. Activated macrophages are the primary producers of lysozyme.

Advantages

- Growth parameters
- Immune system
- Microbes of gastrointestinal track

Modes of application

- Feed + Prebiotics - enhance glucose absorption and trace element bioavailability.
- Water additions that are time - specific, boost the immune system and increase disease resistance.
- Micro-encapsulation - Artemia + Pre - boosted larval growth, was of a size suitable for feeding and had a high nutritional content.
- Shrimp larval and post - larval survival was boosted when raw, prebiotic - rich Artemia nauplii were used.

SYNBIOTICS

A dietary supplement that combines prebiotics with probiotics in a beneficial way is referred to as a synbiotic. A food that modifies the opportunistic bacterial population of the host species' digestive system to allow probiotics thrive and survive there. Prebiotics are chosen for their capacity to promote the growth of probiotic bacteria as their primary purpose, whereas probiotics are chosen for their synergistic effects based on their overall advantages to the host. Synbiotics benefit organisms by enhancing their existence as well as introducing "living microbial dietary supplements in the digestive system" by encouraging their development in certain ways and by accelerating their metabolic processes. Synbiotic has a useful impact on organisms by not just improving the existence but also implanting the "live microbial dietary supplements in the digestive tract" through the selective encouragement of the development, and by triggering the activities of metabolism of restricted amount of the health - improving microorganisms, thereby stimulating the welfare of organisms.

Synbiotics organisms

- *Enterococcus faecalis* / MOS, PHB
- *Bacillus clausii* / MOS, FOS
- *Bacillus subtilis* / Chitosan
- *Bacillus subtilis* / FOS

Mechanisms of action

In shrimp aquaculture, it can result in higher yields and better sustainability. When L. vannamei was used as a feed supplement along with the probiotic Bacillus OJ and isomalto-oligosaccharide, it had a considerable impact on the gastrointestinal bacteria and was antagonistic to the White Spot Syndrome Virus (WSSV). In cultured shrimp, synbiotics increased the effectiveness of probiotic bacteria that promote growth. They can also promote competitiveness against bacterial and viral infections and improve digestive enzyme activities in the shrimp gut, as well as immunological characteristics like lysozyme activity, hemocyte generation, respiratory burst activity, phenoloxidase activity and superoxide dismutase activity.

Advantages

- Fish survival rate
- Growth parameters & feed utilization
- Fish digestive enzyme activity
- Fish immune system

Factors affecting the efficacy of synbiotics treatment

The effectiveness of synbiotics is greatly influenced by a range of other extrinsic factors, such as

- Interspecific variation between animals
- Administration regimen
- Dosage

Interspecific variation between animals

The interspecific variation between shrimps is one key factor determining the suitability of the intervention. There is a vast disparity of **indigenous microbiota present in the gut of different individuals**, which would likely affect the efficacy and functionality of the additives.

Administration regimen

The **duration and frequency** of administration should be another factor for consideration. Munaeni et al, experimented with shrimps using different treatment regimens for one month and concluded that the once-daily administration of synbiotics is more effective than the once-weekly or twice-a-week regimens.

Dosage

The dosage of synbiotics also affects the efficacy of the additive. At first glance, health parameters seem to improve with increasing dosage of encapsulated synbiotics. **Nurhayati** and **Yuhana** reported that a combination of 1% probiotics and 2% prebiotics is more effective than when the dose is doubled.

Modes of application

- Feed + Synbiotics - Better growth, strengthened immune responses and resistance against disease.
- Bio-encapsulation of Artemia + Syn - Provide optimal size and nutrients to growing larvae of shrimp.
- Micro-encapsulation of synbiotics - Survival and growth of probiotics bacteria and promote the growth of intestinal micro flora.

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More References can be provided on request.

Nutritionally balanced feeds for Seabass fish *(Lates calcarifer)*

Email: raghavendrudu.gullipalli@nutreco.com

Dr Raghavendrudu
Product Manager Feeds, Skretting Feeds India Ltd, Hyderabad

Highlight Points

- Asian seabass (Lates calcarifer) The nutritional requirements of fish vary with different growth stages and depend upon the feeding habits that change according to the morphology of digesting system.
- Skretting aqua feeds is the global leader in producing aquafeeds across the globe having six Innovation and validation centres across the regions and pioneers in innovating aquafeeds for different aquatic species from Marine hatchery feeds, shrimp feeds, High value fish feeds and having 56 feed mills across the globe with its state-of-the-art manufacturing facilities.

Asian seabass (Lates calcarifer) has emerged as an important candidate finfish species for aquaculture in many parts of the world. Availability of seed and appropriate feed are the two important prerequisites for development and propagation of aquaculture of any fish species.

The Asian seabass (*Lates calcarifer*) known as Pandugappa in Andhra Pradesh and Betki in Bengal is an important candidate finfish species for farming. Seabass is a euryhaline fish, growing rapidly up to 3-5 kg within a growing period of 2-3 years in both freshwater and brackish water environments. For maturation and spawning it migrates to the sea while the post larvae and juveniles migrate to lagoons and backwaters for growing. It is a voracious carnivorous fish.

Seabass attains maturity at the age of 3-4 years at a length and weight range of 60 to 70 cm and 2.5 to 4.0 kg respectively. Males are generally small and in the size range of 2.0-3.0 kg and the males convert into females as they reach a size above 5.0 kg. The fecundity is between 2.1 to 17.0 million depending upon the size of the fish.

In general, most marine carnivorous fish, including seabass require high dietary protein compared to omnivorous and herbivorous species. Therefore, fishmeal is being used as a major protein source in commercial formulations due to its balanced nutrients, essential amino acids and fatty acids, higher palatability and digestibility.

The nutritional requirements of fish vary with different growth stages and depend upon the feeding habits that change according to the morphology of digesting system. Considerable effort has been made in Australia, Thailand, Philippines and more recently Israel, in defining the nutritional requirements of this species in order to improve production. Understanding the nutritional requirements of the candidate species is the first and essential prerequisite for development of cost effective, efficient and eco-friendly feeds.

Diet preparation mainly concentrated on energy nutrient requirement, and it also need micronutrient requirement such as Vitamins as well as Trace minerals

Nutritional requirement in Initial stages (Hatchery or Nursery)

The nutritional requirements of larvae that have a body mass less than few milligrams are not very much understood. Based on the composition of the yolk, live prey and larvae themselves it is assumed that the nutritional requirements of larvae were higher than those of the juveniles. The nutritional requirement is not similar for larvae and juveniles.

Proteins

Protein sources were selected following their amino acid profile and incorporated in micro diet as the only protein source. Fish meal has been used as the main protein source in diet. the profiles of essential amino acids of fish body tissue are generally considered as a good indicator of their amino acid requirements.

Lipids

Lipids included in microparticulate diets come partly from

High Quality Feed
for Barramundi

STELLA B

STELLA B is Skretting's high quality floating feed range designed for Barramundi.

BENEFITS:

- High protein ensures high energy levels
- Formulation rich in quality marine ingredients for high palatability
- Formulated to achieve fast growth and low FCR
- Maintains water quality in the pond
- Functional ingredients support the gut health and enhance the immune system

For any futher information contact our representative

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Unit No. L4 04, SLN Terminus, Survey No. 133, Besides Botanical Gardens
Gachibowli, Hyderabad-500032, Telangana | contact.india@skretting.com
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fish meal or other meals incorporated as protein source and are generally derived from marine sources. Cod liver oil, roe oil, sardine oil or menhaden oil are added as triglycerides in larval diets.

Nutritional factors affecting larval metamorphogemesis

Protein hydrolysate enhances larval morphogenesis. The molecular form of the dietary protein supply, native proteins or hydrolysed into oligopeptides (around 20 amino acids), has probably an indirect effect on morphogenesis. Dietary lipids play an essential role in larval growth and survival. Growth and normal morphogenesis increased as the dietary inclusion of phospholipids and vitamins, particularly vitamin A.

Nutritional requirements for growers

Protein and amino acids constitute the key group of essential nutrients required by Seabass for synthesis of protein and subsequently growth.

Protein

Most of the studies undertaken to examine the requirements for protein in barramundi diets suggest a relatively high protein requirement. Carnivorous/piscivorous nature of the fish. Seabass being highly carnivorous showed a dietary requirement of 45 – 55% protein. The diet energy density and the size of fish used, appear to be the key factors influencing the specific amount of protein required for seabass.

Amino acids

Most of the finfish including seabass show the requirement of the same ten amino acids (arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine tryptophan, tyrosine or valine) as essential.

Lipid

Lipids comprise an important dietary energy source for seabass and are also a source of essential fatty acids. Much work has been devoted to exploring the inclusion of lipids in barramundi diets to increase their energy density. At protein levels of 45% to 50% best growth from barramundi fed diets with 15% to 18% lipid content

Vitamins

It requires vitamin A, B, Riboflavin, Nicotinic acid, Cobalamin, Biotin, Inositol, Vitamin D, E, K and Vitamin C

Nutrient requirement of Seabass

S.No	Nutrient	Requirement in Feed
1	Protein	50-55 %
2	Fat	10-18%
3	HUFA	1.72%
4	Carbohydrate	10-20%
5	Protein energy ratio	128mg protein/KCal

About Skretting

Skretting is a global leader in providing nutritional solutions for aquaculture since 100 years and it has 65 production centres across the globe including India (Surat, Gujarat) and producing more than 20 million metric ton per year on five contents manufactures high quality feeds for various aquatic species from hatchery diets to harvest diets for more than 60 aquatic species and also having 6 aquatic innovation and validation centres in different regions of the globe .

About Skretting Stella B Seabass fish feeds

Skretting aqua feeds is the global leader in producing aquafeeds across the globe having six Innovation and validation centres across the regions and pioneers in innovating aquafeeds for different aquatic species from Marine hatchery feeds, shrimp feeds, high value fish feeds and having 56 feed mills across the globe with its state-of-the-art manufacturing facilities.

Stella B (Seabass fish feed) is a high quality and scientifically nutritionally balanced floating fish feed developed exclusively for seabass species it contains optimal blend of essential nutrients.

Like high inclusion levels of marine proteins, Amino acids, Fats and HUFA as well as immunostimulants Stella B is developed through extensive research and development in Skretting ARC (Norway). Its available from 1mm to 20mm dia pellets for different sizes of seabass Moreover, it caters the need of cage culture as well as rearing ponds. Our quality ensures high digestibility, palatability. And highly bioabsorbable Stella B is the superior quality feed for Seabass and provide consistent quality and performance for Better Feed conversion ratios.

Sea urchin culture and its importance

Email: kala.fin.fish@gmail.com

Sathiya Kala A

ICAR-Central Institute Fisheries Education
Panch Marg, Off yari road, Versova, Andheri (W), Mumbai.

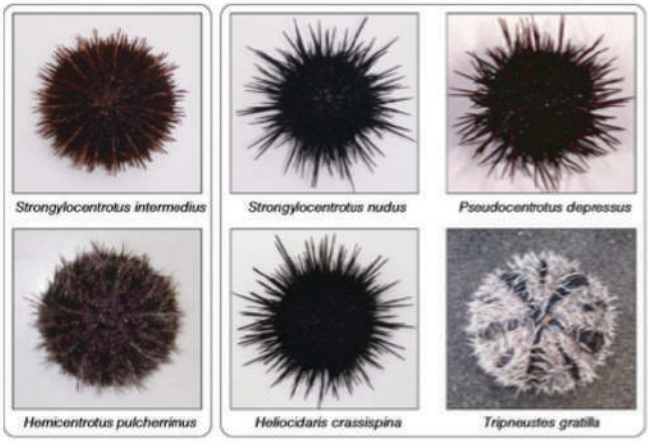
Highlight Points

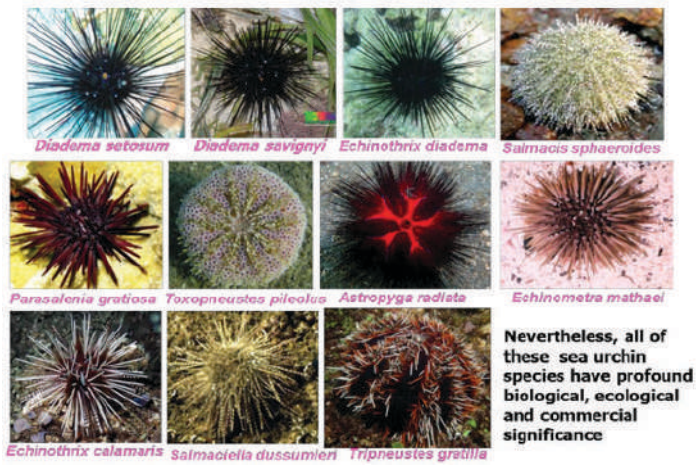
- In recent days, Sea urchin culture is gaining importance as it has many nutrients especially their roe contains important fatty acids, carotenoids and pharmaceutical properties.
- This article is highlighting different steps in sea urchin farming, nutritional value of sea urchin, integration with other culture systems, different diseases occurring during culture practices and conservation and management.

Introduction

Sea urchins are also known as **"Sea hedgehog"** are typically spiny, globular animals, echinoderms in the class Echinoidea. 950 species live on the seabed, and depth zones from the intertidal to 5,000 metres. Their habitat is rocky floor and coral reefs. Shells are round and spiny, typically from 3 to 10 cm (1 to 4 in) across. Sea urchins have a hard-calcareous shell, covered with a thin epithelium. Spines are found around the shell. These spines helps to protect and trap food. Tube feet are present inbetween the spines which helps in food capture, locomotion and holding on to the substrate. They mainly prey upon algae, fish and barnacles. Their predators include sea otters, starfish, wolf eels, crabs and triggerfish. They can live 15 to 200 years.

Commonly cultured sea urchins





Importance of sea urchin

- Sea urchins are captured for their gonad (roe). Sea urchin roe is a high delicacy food in Asian, Mediterranean and Western Hemisphere countries such as Barbados and Chile, and have long been using as luxury foods in Japan.
- The gonads of both sexes are known as roe or "uni" in Japanese.
- The roe is commonly sold as fresh.
- Bioactive substancess are also present in roe, such as polyunsaturated fatty acids (PUFAs) and βcarotene. PUFAs, especially eicosapentaenoic acid and docosahexaenoic acid.
- The world's largest consumers and marketers are Japan, Europe and France.

Food & Pharmaceutical

- Sea urchin roe are culinary delicacies in many parts of the world.
- Poly hydroxylated naphthoquinone pigments, spinochromes & echinochrome A serve as a bactericide and antioxidant.
- They help to maintain a youthful appearance.

As tool

- Spines are used as a bone grafting material.
- Bunches of heavy spines from slate-pencil urchins (*Heterocentrotus* species) were used as abrasion tools for shipbuilding.
- The pencil urchin, effective at controlling filamentous algae.

In science

- Sea urchin as a model organism in developmental biology.
- Oceanography - ocean acidification, temperatures, and ecological impacts.
- The genome of *Strongylocentrotus purpuratus*, was completed in 2006 and established homology between sea urchin and vertebrate immune system-related genes.

Echinoculture

Sea urchins have been overfished to meet the great demand and this decrease in supply have led to way to culture sea urchins. Echinoculture is referred as the cultivation of both Sea cucumber (Holothuroidea) and Sea urchin (Echinoidea). Sea urchins have more value than sea cucumber and has advanced techniques. It can be cultured in two ways, Enhancement of brood stock and rearing resultant larvae/ juveniles to marketable size. Another is enhancing yield and quality of gonads of adults which are wild-caught by providing special natural and artificial diets.

- **Hatchery technology**

Hatcheries in Japan, South Korea, Norway, Ireland, Scotland and British Columbia, Canada are producing sea urchin juveniles on a semi-commercial or commercial scale.

- **Broodstock management**

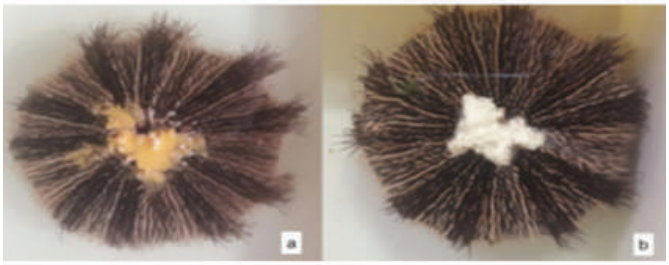
Sea urchins are dioecious. They have external fertilization and spawn during spring season. Their fecundity is around $3.60 \pm 0.83 \times 10^7$ oocytes (mean diameter: 78.4 ± 2.1µm) and males produced approx. $5.60 \pm 1.10 \times 10^7$ spermatozoa. The recommended stocking density is 100 animals/1m3 tanks with a flow-through system. During conditioning period the brooders are given with artificial diets which is high in protein and lipid contents to improve growth and gonad. Because those females fed the natural kelp diet, which presented the smallest gonads. The reproductive timing can be advanced by manipulating temperature and photoperiod in captivity.

- **Hatchery operation**

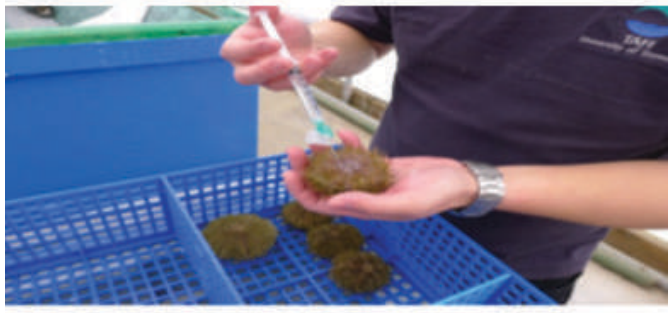
The matured brood stocks are collected from wild. 0.5 M KCl is injected in the coelomic cavity of male and female urchins to collect gametes. Eggs are collected by inverting female urchins over a glass beaker filled with filtered sea water (FSW), while sperms in the most concentrated form are pipetted off the genital pores. Hatching takes place approximately within 10–15 hours. In Japan large-scale culture is practiced where partial water exchange systems and continuous flow-through systems are used.

- **Larval rearing**

Larvae are reared in flat bottomed transparent round tanks with enough aeration to provide water circulation. The initial density is 1.5 larvae/ml, but at the time of settlement it is decreased to 0.8 larvae/ml . The size of metamorphosed juveniles are approximately 0.3 mm. The water temperature is kept at about 18°C throughout larval rearing. Feeding stage starts at 2 days after hatch (DAH) i.e. four-armed pluteus stage. Larvae are supplemented with a cultured phytoplankton (*Chaetoceros calcitrans, Isochrysis galbana*) at concentrations of 4000, 6,000 and 8,000 cells per ml daily, until attaining metamorphic competence within 1 month after fertilization.



Oozing gonad of female and male



Injecting KCl to indcuce ripen sea urchin

- **Early juvenile**

To induce larval settlement in sea urchins, small rocks are placed. When the juveniles reach 3–4 mm size, feeding with the soft seaweeds is done.

➢ **Suspended nursery cages**

Suspended plastic mesh envelopes filled with shell hash substrate conditioned with biofilm prior to stocking. The biofilm provided a natural feed for the seed urchins to graze upon while in the envelopes. Growth was good but recovery was low, as it appeared that many of the tiniest seed urchins had escaped their containers.

➢ **On-bottom nursery**

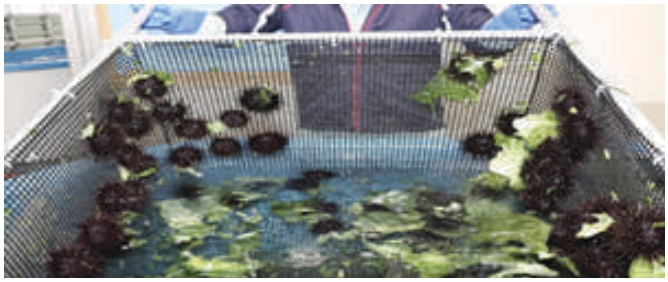
Small urchins less than 10 mm TD are placed into plastic mesh cylinders (50 urchins per cylinder), which were then anchored on bottom by divers. Survival and growth were good overall. It is possible due to site characteristics such as bottom substrates and wave patterns.

- **Grow out culture**

Stable food supply is required in commercial scale grow-out facility. The French developed a prototype of multi-layered grow-out tanks which consist of four stacked, sloping shelves. Hatchery-reared juveniles have been grown in suspended culture in closed recirculation systems southern Ireland. A sea-cage cultivation system of stacking baskets suspended from a ladder-like structure over which a work barge or raft can operate is being developed by Norwegian researcher. High capital and operational costs are inquired in Closed-cycle cultivation. The juveniles of most sea urchin species usually reach to marketable size within the culture period of 1–3 years.

❖ **Farming of sea urchin fed with cabbage**

Japanese developed farming sea urchin fed with cabbage. Wild sea urchins grow well by eating seaweed. But seaweeds will not be available for all the time especially in winter. They decided to utilize cabbages in some seasons. The used vegetables were almost equivalent to seaweed and delicious to sea urchin. sea urchin has high amount of amino acids such as glycine and methionine makes sea urchin more delicious.



(Source: kyodonews.net)

❖ **Sea Urchin Aquaculture with sustainable and commercial System**

Gourmet Marine Ltd., has developed a novel, intensive and land based UrchinPlatter™ System. The UrchinPlatter™ System uses specially-designed cages (Stacks) in a raceway-type tank which efficiently culture sea urchins of any species and size. The system can be used for both farming and roe enhancement in wild stock. Platter™ is the heart of the UrchinPlatter™ System. Rigid feeding surface is formed by keeping feed inbetween two plates, where sea urchins can both attach and consume feed. Stocking density and growth performance are maximized. Commercially, the Platters™ are combined with a perforated cage structure, forming a Stack™. Sea urchins are placed within each Stack™ and consume feed through the perforations in the Holding plate. Feed is replenished on a weekly basis.

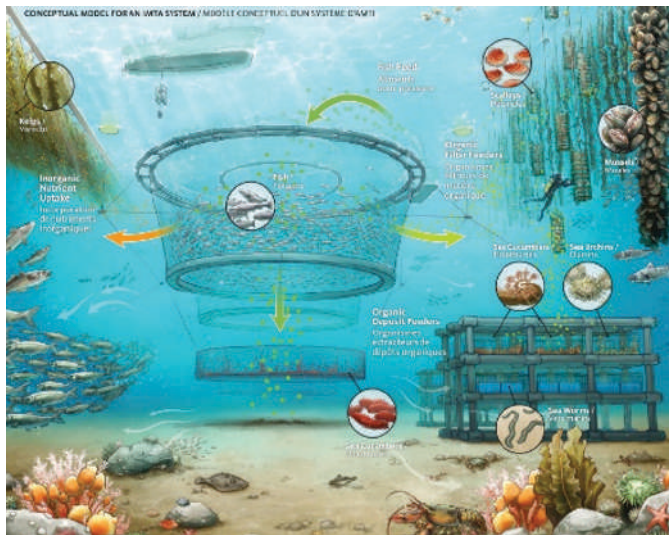
The major advantages are scalable, high Stocking density (50 to 90 kg per m2 for the European Edible sea urchin), high Growth Rate, all around roe Production, market Flexibility, compatible with Natural & Artificial feeds, and farm Biosecurity.

❖ **Sea urchin culture in an IMTA**

The sea urchin, *Paracentrotus lividus* has been cultured in IMTA system with fish *Sparus aurata* and sea weed *Ulva lactuca*. The benefits of culturing *Paracentrotus lividus* in IMTA systems included shortening the growth period to commercial size, enhancing gonadal development and quality and reducing FCR level. P. lividus fed IMTA-

produced U. lactuca exhibited high somatic growth rate (1.4 mm month−1), high gonad somatic index (SGI), and high quality, bright-orange gonads (Shpigel et al., 2018).

Another experiment was done with sea urchin *Paracentrotus lividus* and sea cucumber *Holothuria tubulosa.* The sea urchins were experimented with three feeding conditions with different levels of fish meal supplement. Sea urchin biodeposits, derived from the three experimental diets, were evaluated as the sole food source for the sea cucumbers. The sea cucumber's ability to bio-remediate the sea urchin waste in terms of Absorption Efficiency (AE) and total organic matter leftover was evaluated (Grosso et al., 2020).



Common diseases

Disease	Causative agent	symptoms
Spotting disease	*Tenacibaculum sp.* in spring and summer,	Blackish-red lesions on the test and spine loss
Vibriosis	Vibrio sp.	Reddish color of the peristome in the early stage and a blue-black color in the later stage
"Green Sea Urchin Amoebasis"	*Paramoeba invadens*	Mass mortalities

Other health issues

Sea urchin larvae struggle to digest their food due to ocean acidification.

Constraints

- It requires macroalgae for feeding which is the main factor limits success.
- It also requires 2–4 years for sea urchins to complete aquaculture cycle (from egg to market size).

Management

The management steps are as follows: Localized enhancement including habitat manipulation, seeding and predator control, refinement of artificial diet formulations for juveniles and adults to maximize growth rates and produce good quality gonads, selective breeding in culture, providing suitable settlement substrates that maximize survival at metamorphosis and of the post-larval stages, optimizing grow-out facilities for juveniles and adults either at sea (in containers or 'ranched') or land based, regulations regarding fishing methods, better surveillance of sea urchin density to guarantee a steady flow of raw materials, improved cooperation between fishermen and processors while marketing and selling the sea urchins, more capital needs to be directed towards investing in technology for processing to reduce labour costs and preserve product quality.

References can be provided on request.

Postal Regn. No. HD/1068/2021-2023
Published on 7 March 2023