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The Indian Aquaculture Magazine

Spirulina Culture

An "Aquatic Gold Mine" for Aqua Farmers

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EDITORIAL


Jaideep Kumar

Just when the outlook for Shrimp Aquaculture in the country for the year 2021 looked promising, with decent prices and enthusiasm among farmers to go for seed stocking, the second wave of Covid-19 in the country triggered panic in the sector again, forcing farmers to resort to premature harvesting. Increase in prices of shrimp and feed, following a massive escalation in prices of major feed ingredients further added to farmers problems.

Meanwhile, MPEDA's e-SANTA, an electronic trading platform designed to connect aqua farmers directly with the buyers, launched this month, looks to be a good initiative that would help shrimp farmers obtain fair prices for their farm produce, without the involvement of middlemen. The farmer registration and crop data captured in the portal also lends traceability to the material procured for exports. In the implementation aspects, the portal is more likely to benefit larger farmers, rather than small to marginal players as there could be practical difficulties for buyers to strike a deal with small farmers, harvesting lesser quantities of material at a time, in terms of logistics. NaCSA should effectively use its field presence to popularize the use of this facility among both farmers as well as the buyers.

We also witnessed MPEDA's pilot phase SHAPHARI Hatchery certification scheme, initiated in May 2020, issuing its first certification to M/s. SVR Hatcheries, East Godavari District, Andhra Pradesh for the production of antibiotic-free seed this month, after successfully completing the mandatory audits. A reliable mechanism to certify disease (mainly EHP) free seeds not just by PCR screening, but by also ensuring that the production process does not permit the entry of EHP pathogen into the hatchery system, should perhaps be the next step towards sustainable shrimp farming in the country.

Another initiative to reckon from the Govt. side is the establishment of a CAA Facilitation Centre at Vijayawada on 18th March 2021. This centre, at India's aquaculture hub is designed to support the sector by simplifying the registration and renewal process of farms, hatcheries and other aquaculture businesses and to control the use of antibiotics and chemicals.

The April 2021 issue of Aquaculture Spectrum brings you articles on **"The importance of antioxidants and immuno-modulators to support shrimp health"** by Martin Guérin et.al., **"Spirulina Culture - An "Aquatic Gold Mine" for Aqua farmers"** by Sachin Onkar Khairnar and Amit Mandal and **"Aquaculture Testing Laboratories in Farms & on Wheels: Change to Counter the Contemporary Challenge"** by Menaga Meenakshisundaram and S. Felix. This issue also features the March-April edition of the SAP Newsletter – **"The Aqua Professional"** along with our regular columns on "Shrimp Aquaculture – Industry Review" by Dr. P.E. Cheran, **"Shrimp Farming Tips"** from Dr. Manoj M Sharma and **"Ornamental Fish"** (Aulonocara) by Dr. V.K. Dey. Details of SPF shrimp broodstock imports and news from across the Indian and global aquaculture sector bring up the rest of the issue.

Jaideep Kumar

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ARTICLE

Spirulina Culture

An "Aquatic Gold Mine" for Aqua farmers

View of a Spirulina Farm

Sachin Onkar Khairnar * and Amit Mandal
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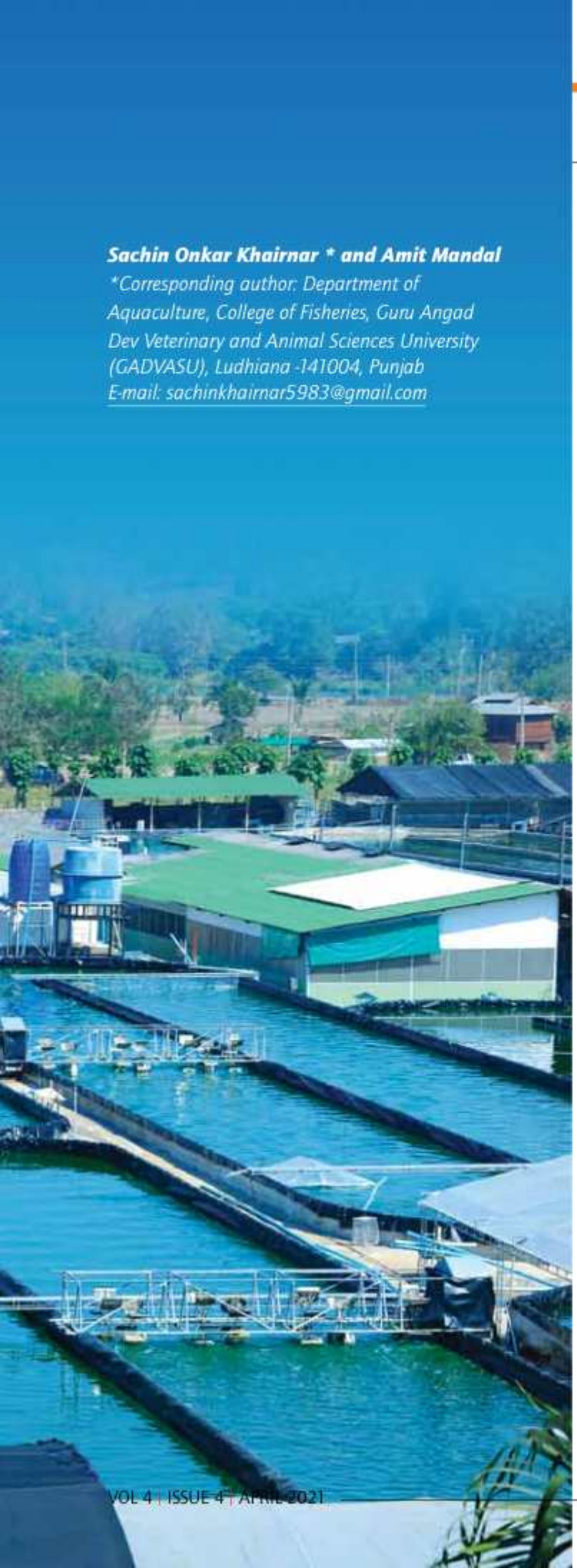

Commercially, *Spirulina* is one of the successfully cultured algal species in the world. Having high nutritional properties, wide-ranging pigments and bioactive compounds make *Spirulina* feasible for its utilization for human consumption as well as in aquaculture. Dietary supplementation of *Spirulina* in fish feeds can partly or fully serve as an effective replacement of high-cost feed ingredients such as fish meal, soybean meal owing to its high protein content (60 - 70%) depending on the fish species. *Spirulina* as a fish feed supplement provides lipids rich in 'PUFAs', or poly unsaturated Omega-3 and Omega-6 fatty acids. It helps to enhance growth, improve the immune system and health of finfish and shellfish in aquaculture due to its antibacterial and antiviral properties. Modified Zarrouk's medium supplemented with molasses, urea could be the cost-effective media for open-air mass culture. In India, an annual turnover of around Rs.1,30,000/- can be achieved from a small-scale *Spirulina* culture unit. *Spirulina* culture will help to mitigate food security issues through utilization of untapped natural resources and also provide livelihood and income generation opportunities.

1. Introduction

Spirulina is a planktonic photosynthetic multicellular, blue-green filamentous Cyanobacteria, which forms massive populations in tropical and subtropical water bodies having high levels of carbonate, bicarbonate and high alkaline pH levels. Based on the idea of utilizing micro algae as an unconventional protein source, several organizations in India are working on the development of systems for the mass culture of *Spirulina*. It is the most commonly cultured micro algae on a commercial scale due to the presence of high-quality protein (60 - 70% dry matter basis) and the essential amino acids. *Spirulina* contains carotenoids (orange), chlorophyll (green) and phycocyanin (blue) pigments in its cellular structure and has been proved to help detoxify the liver. In addition, *Spirulina* also contains bioactive components such as essential fatty acids (linoleic acid and alpha-linolenic acid), phenolic acids, vitamins, minerals and carotenes, which have proven to exhibit antioxidant properties. *Spirulina* is considered as vitamin and mineral "gold mine" as it

is enriched with β-carotene, super antioxidants, iron, and vitamins likeA, B_{12}, E, glycogen and trace elements. Hence, *Spirulina* is called as a green gold mine. Besides, *Spirulina* can also be recognized as "aquatic gold mine" due to its world-wide abundance in the diverse aquatic system as nowadays it is one of the good pharmaceutical drugs in national and international markets for its anti-bacterial, anti-viral, anti-fungal, anti-tumor, anti-cancer properties.

Spirulina can show better characteristics than *Chlorella* with regard to the capacities of growth and carbohydrate synthesis and provides an opportunity for mass culture at the domestic and commercial level. *Spirulina* culture does not require fertile land and can actually benefit from saline conditions. It uses less water per kilogram of protein (approximately 2100 liter/kg protein) than other crops. *Spirulina* requires less energy input per kilo than soy, corn or beef, including solar and generated energy. Its energy efficiency (food energy output kg^{-1}/energy input kg^{-1}) is 5 times higher than soy, 2 times higher than corn, and over 100 times higher than grain-fed beef. Thus, *Spirulina* could serve as an excellent source of plant protein to replace animal-derived proteins in aqua feeds. The small-scale production of *Spirulina* is considered as a potential income-generating activity for households or village communities. *Spirulina* might be also dried and processed for local consumption, especially where poor dietary regimes need to be supplemented. Therefore, *Spirulina* can play an important role in aquaculture as replacement for expensive animal source of protein in fish feed.

2. Application of *Spirulina* in aquaculture

As a dietary Supplement

Spirulina has been successfully used as a dietary protein supplement for fish with significant effect on growth enhancement as compared to basal diets in various food fish species viz., rohu, mrigal, common carp, Nile tilapia, rainbow trout etc. and ornamental fish species viz., goldfish, swordtail, guppy etc. *Spirulina* diet is recognized as the most suitable supplementary feeding to reduce the cultivation time and mortality. Moreover, it also helps to increase the shell thickness of shrimp carapace.

As an immunostimulant

Limited availability of land and water resources is forcing farmers to intensify fish farming. This increase in fish density has put excessive pressure on cultured fish leading to disease incidences. There are potential methods for decreasing the susceptibility of farmed fish to infectious diseases, such as chemotherapy, vaccination and dietary immunostimulants. The administration of immunostimulants could protect against pathogens by enhancing non-specific defense mechanisms in fish and hence immunity against pathogens. Feeding on *Spirulina* helps to improve disease resistance and survival rate in fish. It may have potential use in fish feeds as an antimicrobial agent of pharmaceutical interest. The crude ethanol and methanol extracts of *Spirulina* are effective against various bacterial fish pathogens.

For improving reproductive performance

Presence of eicosapentaenoic acid and arachidonic acid in fish diet plays an important role in enhancing its reproductive performance. *Spirulina* contains abundant linoleic acid and γ-linolenic acid, which are precursors of arachidonic acid that help enhance the reproductive activity in finfish and shellfish through the improvement of spawning, fecundity, fertility and hatching rates. It also increases survival rates of young ones, post larvae and promotes the appetite to attain full maturity.

Colour pigmentation

A variety of natural (plants, bacteria, fungi and algae) and synthetic (b-carotene, canthaxanthin, zeaxanthin and astaxanthin) carotenoids have been used as dietary supplements to enhance the pigmentation of fish. *Spirulina* possess strong concentrations of pigment, particularly carotenoids which have been reported to enhance colouration in many commercial fish species such as yellow tail cichlids, koi carp, rainbow trout etc. The studies on colour enhancement using *Spirulina* in fish diets have reported that the total concentration of carotenoids in the skin gradually increases with *Spirulina* inclusion @ 2.5 to 10%.

In wastewater treatment

In recent years, *Spirulina* has been recommended as a biosorbent that can remove heavy metals from

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aquatic environments. Few studies have successfully used *Spirulina* culture for the removal of nutrients in the wastewater generated from brine, olive oil mills, poultry litter, urban sewage etc. Rearing of *Spirulina* with tiger shrimp facilitates to maintain excellent water quality, even at high shrimp density. Moreover, using of *Spirulina* is reported to remove 92.40% of the ammonia and 50.4% of the nitrate from fish rearing tanks. These studies indicate the potential of using Spirulina to purify aquaculture wastewater, which is very important for intensive fish farming.

3. Culture techniques

Batch culture

To feed larvae and zooplankton, required densities of algal cells are produced through a process called progressive batch culture (transferring small-volume cultures of concentrated inoculum into larger volumes of treated, enriched water). Opening with cells taken from an axenic stock culture (test tubes), microalgae are cultured in an enriched medium through a series of culture jars/bottles of increasing volume. The algae grown in each culture vessel serves as the inoculum for the next larger jars/bottles, until the density of cells required for feeding is reached.

The indoor airlift batch culture can be performed in an aspirator bottle of 20 L capacity. Different types of cultivation media viz., Zarrouk's medium, Modified Zarrouk's medium; Nallayam Research Center medium (Prescribed by Nallayam Research Center, Chennai; referred as NRC) and modified NRC medium are available in the market. In the modified medium, urea and phosphoric acid of NRC medium can be replaced by sodium nitrate and di-potassium hydrogen phosphate (anhydrous) and reducing the concentration of ferrous sulphate heptahydrate. The culture is aerated by using air injection device and the air-flow rate is adjusted to a level that ensures proper mixing of the culture through the upward movement of air bubbles. Urea can be used as a replacement for sodium nitrate, but the urea level should be within the optimum limits (300 - 500 mg/L). If it exceeds, it will inhibit the growth of *Spirulina*.

Outdoor sub culture and mass culture

Outdoor sub culture is carried out in earthen pots by providing vigorous aeration. Required volume of inoculum is supplied to earthen pits from sub culture pots at regular intervals. Outdoor mass culture of *Spirulina* is done in rectangular earthen pits. Inner layer of pit is covered with poly-lining to avoid seepage loss. Ground water should be supplied to the pits without any pathogenic contamination. Manual stirring is required daily for proper mixing of nutrients in water; if possible small wheel aerator can be installed in the pits. Zarrouk's medium supplemented with molasses (0.75g) is provided to maximize the production of *Spirulina* upto 2.94g/liter/day. A new fertilizer media (FM) has been developed for mass production of *Spirulina* consisting Sodium bicarbonate (8g/l), Sodium nitrite (2.5g/l), Sodium chloride (0.5g/l), Magnesium sulphate (0.15g/l), Calcium chloride di-hydride (0.04g/l), single super phosphate (1.25g/l), Potassium chloride/ muriate of potash (0.98g/l) and required amount of pre-boiled tap water.

Animal wastes supply huge amount of nitrogen and phosphorous to act as good nutrients for mass culture of *Spirulina*. *Spirulina* culture using animal wastes requires anaerobic digestion of waste and high dilution of 90 - 95% of the digested waste. The wastes should be added into the digester to settle down the solid particles. The liquid effluent can be used as a source of nutrients and added in artificially constructed ponds to which Sodium nitrite ($NaNO_3$) and Sodium bicarbonate ($NaHCO_3$) are also mixed. Sugar can be used instead of $NaHCO_3$ to reduce the cost of the medium. The use of cheaper nitrogen sources like urea can be used with no effects at pH 8.4 as long as its concentration is below 1.5 g/L.

Light and temperature are the major limiting factors for growth and output of *Spirulina*. Optimum light intensity for *Spirulina* culture is 20-30 thousand lux. *Spirulina* thrives in warm water (32 - 45°C) and can even survive at 60°C. *Spirulina* can be cultivated and grown in both freshwater and seawater medium. Commercial production of Spirulina uses growth medium with sodium bicarbonate as a carbon source which counts for at least 60% of all nutrient costs. The minimum temperature that permits best possible growth in *Spirulina* is about 18°C. Spirulina can tolerate pH fluctuation between 8.3 - 11.0 and salinity between 5 - 15 ppt.

Dry Spirulina powder commonly used as a feed supplement in Aquaculture

Diagram: *Spirulina* Culture Process

Pure Culture	Collect pure culture of *Spirulina* in conical flask or 1 liter bottle. Store the bottle under illuminated condition without any contamination by other microbial spores			
Batch Culture	Batch culture in plastic bottles, glass jars, aspirator jars which are supported with aeration and fluorescent green light (1500 to 3500 lux)			
Sub Culture	Sub culture in earthen pots / glass tank (50 - 100 liters) with vigorous aeration is provided during the entire culture period and regular addition of growth medium as per requirement.			

Mass Culture	Mass culture in cement tanks /earthen pits (10 ft. x 6 ft. x 1.5 ft.) pre-enriched with growth medium and urea. Apply 0.12 gL^{-1} urea as alternative to 2.5 g L^{-1} sodium nitrate ($NaNO_3$) in Zarrouk's medium.
Screening	Manual screening of *Spirulina* using inclined screen. Cleaning of screen with $KMnO_4$ solution before use.
Collection & Sun Drying	After collection, *Spirulina* will be stored in tank and will be dried under open air condition. Oven drying should be avoided to keep the nutritional properties intact.
Grinding	Use of electrically powered grinder to make *Spirulina* powder. Fine powder should be prepared as per the requirement in fish feed industries.
Packaging	Packaging of *Spirulina* can be done using air sealed plastic bag, paper and paper board corrugated box. Vacuum dried and airtight packing will preserve the nutritional qualities upto 3 - 4 years.

Figure 1: Process flow of culture, harvesting and packaging of Spirulina (Source: www. google.com)

4. Harvesting, drying and storage of *Spirulina*

Around five days after seeding, *Spirulina* is ready to harvest the after the filtration process. Inclined screens are 380-500 mesh with a filtration area of 2 – 4 m^2/ unit and are capable of harvesting 10-18 m3 of *Spirulina* culture per hour. After filtering, the collected Spirulina is thoroughly washed in distilled water to remove the traces of salts, contaminants, or culture medium residues. After cleaning, it is squeezed to remove the water content and then it is ready for drying.

Freshly harvested *Spirulina* is at its best in its nutritional values. Fresh *Spirulina* cannot last more than two days, hence it needs to be dried to preserve its nutritional values and to last for a longer duration. *Spirulina* mass is kept inside the kitchen press grater and then pressed into thin strands on a long clean cloth under the sun for quick drying. Electrical or solar-powered drier can be used to speed drying. Spirulina can be dried in the oven at 60°C for 4 hours or at 40°C for 15 - 16 hours. Grinder is used for grounding the dried algae. *Spirulina* is ground and made into soft powder dust which is then packed and sealed for marketing.

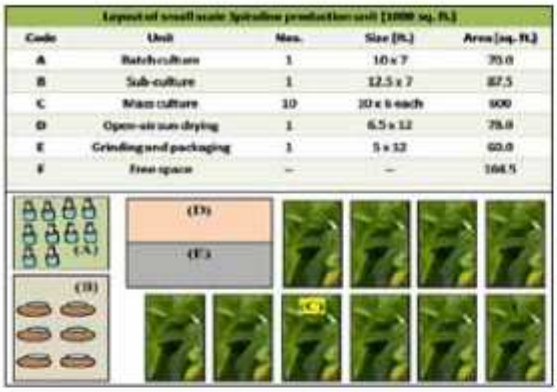

Figure 2. Layout of small-scale Spirulina production unit

5. Cost of production

A small-scale *Spirulina* production unit of around 1000 sft can produce around 2000 kg of wet *Spirulina* biomass from which around 200 kg of *Spirulina* powder can be extracted (Fig. 2). On a daily basis, one earthen pit (60 sq.ft.) can produce 600 g of wet *Spirulina* biomass. Based on this, ten earthen pits can generate 6 - 7 kg of wet Spirulina biomass/day and 600 - 700 g dry powder/day as 100 g of dry powder can be obtained from 1kg wet biomass. The production of *Spirulina* will be around 18 - 20 kg powder per month. The dried *Spirulina* powder fetches around Rs. 750 - 1000/- per kg in the domestic and international market. The preliminary economics for small-scale Spirulina culture unit is tabulated in Table 1.

S. No.	Items	Requirement (nos.)	Price/pc (Rs.)	Total cost (Rs.)
1.	**Fixed capital**			
	Excavation of earthen pits	10	500/-pit	5,000/-
	Poly lining sheet (white colour)	30kg	180/-	5,400/-
	Bamboos (30 feet)	30	300/-	9,000/-
	Green shade net (75%)	01	4,500/-	4,500/-
	Air pump (RS-17000)	01	12,000/-	12,000/-
	Luminous 1 KVA LD1000 UPS	01	14,000/-	14,000/-
	LUX meter	01	3,000/-	3,000/-
	Grinder	01	2,000/-	2,000/-
Sub total				**54,900/-**
2.	**Recurring expenditure (for one year)**			
	Earthen pots (50 L cap.)	06	250/-	1,500/-
	Aspirator bottle	10	250/-	2,500/-
	Harvesting screen	01	5,000/-	5,000/-
	Drying screen	01	7,000/-	7,000/-
	LED light	05	1,000/-	5,000/-
	Zarrouk's medium	-	10,000/-	10000/-
	Urea (50kg)	01	275/-	275/-
	Single super phosphate (50 kg)	01	360/-	360/-
	Packaging material	-	-	3,000/-
	Electricity charges	-	500/-month	6,000/-
	Miscellaneous	-	-	10,000/-
Sub total				**50,635/-**
3.	**Total expenditure**			
	Recurring cost			50,635/-
	Interest on fixed cost (12% per annum)			6,588/-
	Interest on recurring cost (12% per annum)			6,076/-
	Depreciation (20%)			10,980/-
Sub total				**74,279/-**
4.	**Gross income**			
	Sale of Spirulina Powder: 20 kg/month production @ Rs. 850 per kg			17,000/-
	Annual income			2,04,000/-
5.	**Net income** (Gross income – Total expenditure) Rs. 2,04,000 – Rs. 74,279			1,29,721/-
6.	**Monthly income**			10,810/-
7.	**Benefit cost ratio (BCR)**			1.75

Table 1: Preliminary economics for small-scale Spirulina culture unit (1000 sft)

6. Future prospects

Spirulina has huge potential for development, especially as a small-scale production venture for nutritional enhancement, livelihood development and environmental mitigation. In particular, the production and use of Spirulina have many advantages such as an integrated solution for wastewater treatment, small-scale aquaculture production and as livestock feed in integrated farming. In India, Spirulina culture on a pilot scale basis was started in 1976 at Central Food Technological Research Institute (CFTRI), Mysore. A certified one-week residential training programme on '*Spirulina* Cultivation Training and Value-Added Products' is being provided by the Algae Research Institute, Chennai under the banner of Micro Small Medium Enterprises (MSME) Development Institute. To promote mass cultivation of *Spirulina*, there is a need to create further awareness among the farming community and low-cost *Spirulina* production technology based on local resources may prove as an additional income generating source for rural as well as urban masses.

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AQUACULTURE TESTING LABORATORIES IN FARMS & ON WHEELS: CHANGE TO COUNTER THE CONTEMPORARY CHALLENGE

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Introduction

Efficient and profitable farming of fish, crustaceans, and other aquatic organisms in aquaculture production systems depend on optimum environmental conditions in which they can reproduce and grow. As these organisms are reared in water, the major environmental concern within the culture system is water quality. Water available for aquaculture systems could naturally be of low quality, polluted by human activity, but in most instances, the primary reason for water quality impairment in the culture system is the culture activity itself. Manures, fertilizers, and feeds applied to ponds to enhance production only can be partially converted to animal biomass. Thus, at moderate and high production levels, the inputs of nutrients and organic matter to culture units may exceed the assimilative capacity of the ecosystems. If not carried out judiciously, the result often is deteriorating water quality which stresses the culture species; leading to poor growth, greater incidence of disease, increased mortality, and low production. All the wastes from aquaculture systems can cause pollution of receiving waters, and pollution entering ponds in source water or chemicals added to ponds for management purposes can contaminate aquacultural products. Thus, water quality in aquaculture also extends into the arenas of environmental protection and food quality and safety.

Water quality restraints

There are basically four levels of water quality restraints in aquaculture. When one is selecting a site for an aquacultural project, the quality of the source water should be carefully evaluated. Natural water quality may not always be adequate, and treatment may be necessary to correct the water quality issues. For example, if ponds are built on highly acidic soils, water in ponds may also turn acidic for which heavy liming will be required. Water sources also may be highly polluted from anthropogenic sources, and this pollution can have serious effects on production. Investors should consider water quality limitations at a prospective site and estimate the cost of overcoming these limitations. If the cost is prohibitive, the site should not be developed for aquaculture.

Once an aquaculture project commences at a given site, deterioration in water quality in the culture system is usually caused by inputs such as manures, fertilizers, and feeds, which are needed to enhance production. Thought these inputs are essential for production, if not managed well, they also lead to dense phytoplankton blooms, dissolved oxygen depletion, and increased concentrations of toxic metabolites. As water quality deteriorates, water-treatment methods such as aeration, water circulation, and water exchange must be resorted to keep the parameters at optimum levels. Production efficiency however, cannot be maintained at a constant level as production rises. The cost of production normally escalates as production increases, and the most profitable production level is usually well below maximum production levels.

The objective in aquaculture enterprise, as in other businesses, should be to optimize profits and reduce risks instead of merely maximizing production. Unfortunately, many aquaculturists seem to equate high production with good profits. Whereas this is true within a certain range of production, because of increasing costs in maintaining water quality as production increases, many aquaculturists go beyond the plateau in profit. Aquaculturists often fail to use the primary and the most essential step of water quality management to optimize production and reduce risks. Therefore, the need of establishing water quality labs

in the intensive and semi-intensive farms are required to assess the soil and water quality on timely basis. Hopefully, budgetary inventories and subsidies for the establishment of soil, water and microbial quality lab presented in this paper will provide some relief from this malady.

The list of soil and water resource problems on the aquaculture agenda has increased enormously over the past 15 years. Long standing concerns about water and sedimentation have been supplemented with renewed concerns about acidification, infertility, aged soil and loss of soil organic matter. The loss of nitrates, phosphorus, antibiotics and sludges from farming systems to surface water and groundwater has someway supplanted traditional concerns about soil quality. Efforts to address this larger complex of resource problems has been hampered by concerns about tradeoffs. Therefore, continuous monitoring of soil and water quality parameters finds paramount importance in any aquaculture practice. Besides this,there are only few NABL accredited labs in India and prices imposed by the private labs are not affordable by small and marginal farmers. The major players in the industry, especially the international feed companies own their water quality testing laboratory and help the farmers in their network. The large-scale farmers of the state are hesitating to own a laboratory as many find difficult to employ a technical person with a chemistry background to do testing in remote areas. However, Universities and other government agencies are trying their best to help the farmers with their referral labs established across the country. Universities also intend to train a lab technician on these grounds to make the farmers job easy. Under this background, we suggest to have a separate component of soil,water and microbial testing laboratory in the farms more than >2 ha. The budget involved for the operation of the aquaculture testing laboratories at farm complex is dealt here and the fixed cost establishment such as building construction and land lease cost are not included in the budget. A cost-effective budget for the establishment of Soil, Water & Microbial quality testing laboratory in the aquaculture farm are detailed below.

Detailed budget estimate of soil & water and microbial laboratory

I. Equipment required

S.No	Item	Total costs (Rs.)
1	EC Meter & pH Meter	25,000
2	Spectrophotometer (Visible)- Single Beam	85,000
3	Flame Photometer	35,000
4	Macro Kjeldahl Distillation Set	15,000
5	Distillation Water Set	15,000
6	Mechanical Shaker	5,000
7	Electronic Balance	10,000
8	Hot air Oven	13,000
9	Hand Refractometer	5,000
10	Research Microscope(binocular)	15,000
11	Autoclave	20,000
12	Lab Refrigerator	15,000
13	Laminar air flow chamber	50,000
14	Centrifuge	8,000
15	Incubator	20,000
16	Hot Plate	1,500
17	Microbiology Kit	3,000
18	Worktables with cupboard	35,000
19	Voltage stabilizers for Equipment	11,500
20	Miscellaneous (Electrical Fittings, Gas Supply,etc)	10,000
	Total (Rs.)	**3,97,000**

II. Glassware & Apparatus

Item	Nos.	Item	Nos.
Dist. Flask (1 lit.)	4	Pipette (Graduate – 5ml)	4
Glass beaker (250 ml)	10	Pipette (Graduate – 10ml)	4
Glass beaker (100 ml)	10	Pipette (Volumetric – 25ml)	2
Shaking bottle (PP) (100 ml)	10	Pipette (Volumetric – 10ml)	2
Beaker (100 ml) (PP)	10	Funnel (PP) (3 inches)	10
Measuring cylinder (100 ml)	4	Funnel (Glass) (7.5cm)	5
Measuring cylinder (10ml)	4	Reagent Bottle (2 lit.)	4
Measuring cylinder (250 ml)	4	Reagent Bottle (5 lit.)	2
Measuring cylinder (500 ml)	4	Vials with screw cap (15 ml)	25
Measuring cylinder (1000 ml)	2	Glass rod (20cm/6mm dia)	10
Measuring cylinder (25 ml)	4	Glass tube	10
Volumetric Flask (2 lit.)	2	Watch Glass (75 mm)	10
Volumetric Flask (1 lit)	4	Squeeze bottle (500 ml)	4
Volumetric Flask (500 ml.)	4	Burette (50 ml)	4
Volumetric Flask (250 ml.)	4	Burette (25 ml)	2
Volumetric Flask (100 ml)	4	Filter stand (10 holes)	2
Volumetric Flask (25 ml)	15	Burette Stand (PP) (12.5 x 15 x 75cm)	4
Conical Flask (250 ml)	5	Wire gauze	10
Conical Flask (100 ml)	5	Glass bead (6mm) kg	1
Petri plate	20	Gloves (medium)of 100 Nos.	1 pack
Test Tubes	20	Spatula (8 inches) stainless steel	10
Inoculation needle	5	Aluminium foil (Pack)	4
Microscopic slides (Pack)	2	Gram staining kit	1
Spirit Lamp	2	Tissue paper (200 gm role)	10
Cotton role	20	Glass slide boxes	2
Mask	10	Spec's	2
Apron	4	Lab coat	2
Total Cost in rupees			**45000**

III. Consumables(Laboratory Chemicals)

Item	Qty.	Item	Qty.
Ammonium sulphate (500 gm)	1	Agar-agar (250g AR)	2
Acetone (2.5 LAR)	1	Barium chloride (500 g AR)	1
Ammonium acetate (250 g AR)	10	Potassium perchloride (250 g AR)	1
Ammonium Fluoride (500 g AR)	2	Tricalcium phosphate (500 gm)	1
Ammonium molybdate (100 g AR)	2	Ammonium molybdate (500 g AR)	1
Antimony potassium tartarate (100g AR)	2	Sodium cobalt nitrite (100 g AR)	1
Ascorbic acid (25 g AR)	2	Iso-Propyl alcohol (500 ml AR)	1
Boric Acid (500 g AR)	1	Eriochrome black T. indicator (25 g AR)	1
Bromocresol green (5g AR)	2	pH 9.2 (10 packets)	1
Concentrated H_2So_4 (2.5 L AR)	2	Hydroxylamine hydrochloride (100 g AR)	1

Concentrated sulphuric acid (2.5 L AR)	1	Potassium chromate (250 g AR)	1
Darco G 60 (500 g AR)	4	Diphenylamine (100 g AR)	1
Diphenylamine (100 g AR)	1	Silver nitrate (25 g AR)	1
Ethyl alcohol (lit)	10	Sodium Hydroxide pellets 9500 g AR)	2
Ferrous Ammonium Sulphate (500 g AR)	1	Methyl Orange (100 g AR)	1
Filter Paper Whatman No.1 (100 sheets)	1	Amylalcohol (500 ml AR)	1
Filter Paper Whatman No.40 (100 sheets)	1	Ammonium thiocyanate (250 g AR)	1
Glass beads (1.0 kg)	1	Ammonium Hydroxide (500 ml AR)	2
KH2PO4 -Potassium dihydrogen phosphate (500 g AR)	2	Silver nitrate (25g AR)	1
Liquid paraffin (1.0 L AR)	1	Ammonium chloride (500 g AR)	1
Methyl red (10 g AR)	1	Acetic acid (500 ml)	1
Nutrient Agar (100 g AR)	2	EDTA (100 g AR)	2
Orthophosphoric acid (500 ml AR)	1	Sodium chloride (500 g AR)	1
Peptone Broth (500 g AR)	2	YMA agar (500 g AR)	2
Potassium chloride (500 g AR)	2	Tetramethyl diamine diphenyl methane (50 g AR)	1
Potassium dichromate (500 g AR)	1	Phenolphthalein (100 g AR)	2
Potassium permanganate (500 g AR)	2	Buffer tablets pH 4.0 (10 packets)	1
Sodium bicarbonate (500 g AR)	5	Gum acacia (500 g Food Grade)	1
Sodium hydroxide (Pellets) (500 g AR)	2	pH 7.0 (10 packets)	1
Sucrose (500 g AR)	2	Alcohol (500 ml AR)	2
Sulphuric acid (2.5 L AR)	1	Mureoxide (25 g AR)	1
Dextrose (500 gm)	5	Malic Acid (500 gm)	4
Mannitol (500 gm)	1	Yeast extract (500 gm)	2
Beef extract (500 gm)	2	Surgical spirit (500 ml)	2
Magnesium sulphate (500 gm)	1	Manganese sulphate (500 gm)	1
Sodium molybdate (100 gm)	1	Sodium chloride (500 gm)	1
Calcium chloride (500 gm)	1	Ferric chloride (500 gm)	1
Hydrochloric acid (500 ml)	1	D-Biotin Vitamin (100 gm)	1
Formaldehyde (500 ml)	2	Xylene (500 ml)	1
Glycerol (500 ml)	1	Vitamin B1- Thiamine (10 gm)	1
Vitamin B2- Riboflavin (5gm)	1	Vitamin B26-Pyridoxine HCL (10 gm)	1
Potato Dextrose Agar (100 gm)	1	Bromothymol blue indicator (125 ml)	4
Total cost			**Rs.55,000/-**

IV. Miscellaneous Expenses = Rs.25,000 /-

Abstract of Total costs (Fixed and Variable)

S.No	Particulars	Total cost (Rs.Lakhs)
1	Equipment	3.97
2	Glassware and apparatus	0.45
3	Laboratory chemicals	0.55
4	Miscellaneous expenses	0.25
	Total cost	5.22

(Total cost: Rupees Five lakhs and Twenty-two thousand only)

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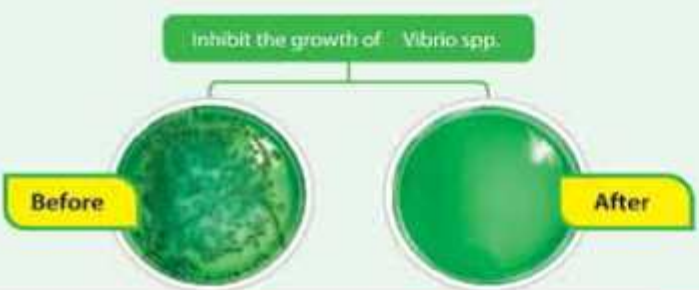
1. WATER QUALITY CONDITIONING

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 g row fast in freshwater or seawater culture farming, even under low oxygen environment



3. DECREASE AMMONIA CONTENT

Prevent the accumulationof 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

(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)

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A Mobile Testing Laboratory

The mobile laboratory is specifically designed for farmers owning/managing farms at multiple locations to assist them to safely and accurately measure water quality parameters at all the locations without having to set up a lab at each location. This can also be used by start-up entrepreneurs who could use this to extend lab services to farmers at different locations close to their farm sites. For a mobile lab, a vehicle such as a Tempo Traveler or its kind costing around Rs. 8-10 Lakhs can be used by spending an additional Rs. 50,000 for compartmentalization inside the vehicle to facilitate lab operations.

Government Initiatives:

With similar objective in mind, the National Fisheries Development Board (NFDB) under PMMSY promote, support and peruse dissemination activities through a network of **"Matsya Seva Kendra (MSK)"** to establish multi-purpose vehicle at different strategic locations across the state by involving reputed service providers having proven track record in fisheries development and technical competence. The major aim of the project is to bring a breakthrough in the extension system through the entrepreneur run and managed MSKs to enhance the fisheries management practices among the fisherfolk. This would help majorly in the following activities of the fishers.

Matsya seva kendra

MSK is a One-Stop-Solution to the State aquaculture industry. It will have the capability to offer complete technical solutions and service for all kinds of aquaculture operations.

Quality Tests & Analysis

a. Soil management
b. Water Quality management
c. Natural Feed management
d. Supplementary feed management
e. Aquaculture Animal Health management

Components of the MSK Unit (suggested by NFDB)

The components when arranged in various costing pattern can be clubbed in capital and operational cost.

Microscopy is an essential part of Aquaculture Lab operations

Sl.No.	Component/Items
1	Laboratory Equipment for water and Soil Testing and Fish Health Management and Tube well
2	Accessories, Furniture, Interior Design etc
3	ICT Tools and its management
4	Two-wheeler and Field Kits
5	Manpower field coordinator/Sales Coordinator/ lab Clinician/Export Service)
6	Recurring Expenses (Maintenance Costs. Travel Costs, Electric Bill etc.)

A. Capital Cost

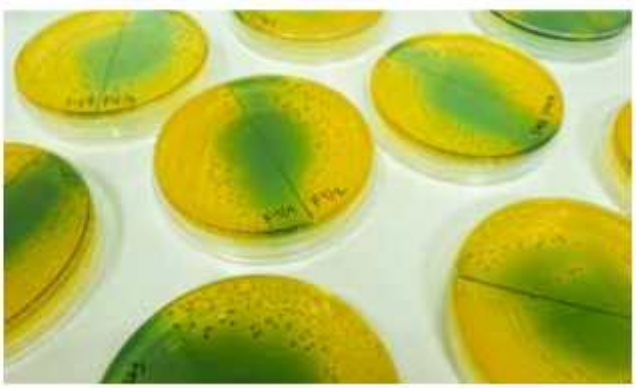
The estimate of the capital cost summed to Rs.18.53 Lakhs. The components included in the capital cost of the MSK are:

- Land, site Development and Building
- Water/Soil Analysis Laboratory Equipment
- Microbiology Laboratory Equipment
- Accessories, Furniture, Interior Design
- ICT tools and its management
- Two-wheeler and field kits

B. Operational Cost

The estimate of the Operational Cost of the MSK was Rs.11.47 Lakhs.The components included:

- Manpower (Field Coordinator/Sales Coordinator/Lab Clinician/Expert Service)
- Recurring Expenses (Maintenance costs, Travel costs etc.)



Microbiological analysis of water quality – Checking Vibrio loads on TCBS agar plates

The above components expressed in financial figures: -

SI.No.	PARTICULARS	AMOUNT (in Rs. Lakh)
1	Land, Site Development & Building and Tube well	3.00
2	Water/Soil Analysis Laboratory Equipment	2.47
3	Microbiology Laboratory Equipment	2.45
4	Accessories, Furniture, Interior Design	1.5
5	ICT tools and its management	2.4
6	Two-wheeler and field kits	1.71
7	Manpower (Field &Sales Coordinators/Lab Clinician/Expert Service)	9.72
8	Recurring Expenses (Maintenance costs, Travel costs,electric bill etc.)	1.75
Total		**25.00**

1. Cost component for the Water/Soil Analysis Laboratory Equipment

SI.NO	Particulars	Qty	Unit	Rate (in Rs. Lakh)	Amount (in Rs. Lakh)
1	pH meter universal indicator	1	No	0.12	0.12
2	Salinity Refractometer	1	No	0.18	0.18
3	EC-TDS Meter	1	No	0.14	0.14
4	DO Meter	1	No	0.25	0.25
5	Flame Photometer	1	No	0.54	0.54
6	Water Bath	1	No	0.12	0.12
7	Hot Air Oven	1	No	0.25	0.25
8	Electronic Balance	1	No	0.1	0.1
9	Secchi Disk	1	No	0.02	0.02
10	Vandthoff Cone	1	No	0.02	0.02
11	Plankton Net	1	No	0.01	0.01
12	Distillation Unit	1	No	0.12	0.12
13	Soil pH cone	1	No	0.05	0.05
14	Soil Moisture/Temperature Tester	1	No	0.05	0.05
15	Glassware	1	Lot	0.25	0.25
16	Chemicals	1	Lot	0.25	0.25
Total					**2.47**

2. Cost Component for the Microbiology Laboratory Equipment

SI.NO	Particulars	Qty	Unit	Rate (in Rs. Lakh)	Amount (in Rs. Lakh)
1	Trinocular Microscope	1	No	0.7	0.7
2	Autoclave	1	No	0.2	0.2
3	Hot Plate	1	No	0.07	0.07
4	Colony Counter	1	No	0.08	0.08
5	Bacteriological Incubator	1	No	0.25	0.25
6	Micro Pipette	2	No	0.05	0.1
7	Laminar Air Flow	1	No	0.5	0.5
8	Agars	1	Lot	0.15	0.15
9	Glassware	1	Lot	0.15	0.15
10	Chemicals	1	Lot	0.25	0.25
Total					**2.45**

3. Cost Component for the ICT tools and its management

SI.NO	Particulars	Qty	Unit	Rate (in Rs. Lakh)	Amount (in Rs. Lakh)
1	Computer	2	No	0.35	0.7
2	Laptop (for field service)	1	No	0.4	0.4
3	Software/App	1	Lot	0.7	0.7
4	Printer	1	No	0.1	0.1
5	Other Accessories	1	Lot	0.2	0.2
6	Maintenance/Misc tools	1	Lot	0.3	0.3
Total					**2.4**

4. Cost Component for Two-Wheeler and Field Kits

SI.NO	Particulars	Qty	Unit	Rate (in Rs. Lakh)	Amount (in Rs. Lakh)
1	Two-Wheeler	1	No	1.00	1.00
2	Mobile Laboratory	1	No	0.11	0.11
3	Mobile Lab Equipment and Instant Dip Kits	1	Lot	0.60	0.60
Total					**1.71**

5. Cost Component for the manpower (Field Coordinator/ Sales Coordinator/Lab Clinician/ Expert Service)

SI.No.	Designation	No.of Staff	Monthly Salary (Rs)	Rate (in Rs. Lakh)	Annual Salary (in Rs. Lakhs)
1	Centre Manager	1	25000.00	3.0	0.7
2	Lab Technician	1	20000.00	2.4	0.4
3	Field Coordinator	1	12000.00	1.44	0.7
4	Sales Coordinator	1	12000.00	1.44	0.1
5	Technical Expert	1	12000.00	1.44	0.2
Total					**9.72**

6. Cost for the Recurring Expenses (maintenance costs. travel costs, electric bill etc.)

This had been proposed for an annual budget of Rs.1.75 Lakhs per year.

At the district level, the proposals received from the applicants will be placed before the District Level Committee (DLC) which shall provide the list of screened beneficiaries and forward it to the State for approval.The total admissible Government subsidy (Central + State) will be limited to 40% of the project cost for general category beneficiaries and 60% of the project cost for weaker sections like Scheduled Castes (SCs), Scheduled Tribes (STS), women and their co-operatives.

Benefits of the implementation of the scheme

The extension system of the state government would be benefitted from the MSKs mainly through the following activities:

- Enrollment of beneficiary hatcheries, seed growers and fish farmers through the online portal of the Department of fisheries
- Support for pond management and monitoring that include water quality analysis,growth and health monitoring through MSK established water quality and fish health laboratory
- ICT enabled advisory services related to inputs, better managed practices and technologies, ponds and fish health management, training and other related activities through MSK established ICT service platform designed exclusively for the purpose
- The MSK system will facilitate identification and mitigation of issues/hurdles/ problems faced midway

by hatcheries, seed growers and fishfarmers at ground level and could also throw up new challenges to be addressed while promoting adoption of improved fish varieties,technologies, processes approaches, etc.

• The MSK would also document and manage data in all the processes in which they would be involved

The various services remitted by the MSKs to the farmer would be: -

- Farmer's enrollment
- Pond monitoring
- Inputs Management
- Output Management and Marketing of Products
- Data Management
- Setup and manage Water Quality, Fish Health Laboratory Services
- Advisory Services with reference to life cycle of species cultured, water quality, health and disease diagnosis
- Providing Services on demand basis, for Government Projects onProduction, Productivity, Disease Surveillance, etc.

Other Benefits:

- Helping to build increased awareness of the importance of the aquatic environment andthe potential of aquaculture
- Provide guidelines to the farmers on farm selection & construction
- Building a profitable relation between aquaculture & non aquaculture systems
- Better utilization of available natural resources to promote sustainable aquaculture
- Facilitating all Aqua linked organization activities for sustainable aquaculture development

Conclusion

Information on the establishment of Soil, Water & Microbial Testing Labs in aquaculture farms have been accrued and this venture is considered as one of the best start-up opportunites in India. The budgetary values presented for various factors can be updated based on the costs at specific regions. The provided information might especially be useful to large farmers who are already into the aquaculture business and also to the fisheries professionals and unemployed educated youth who aspire to pursue a career in aquaculture.

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HENDRIX GENETICS

The importance of antioxidants and immuno-modulators to support shrimp health

Martin Guérin, Goud Dhanunjaya, Maria Mercè Isern-Subich, Waldo G. Nuez-Ortín
Adisseo

In January 2021, the India's Society of Aquaculture Professionals (SAP) organized a seminar to review the challenges and solutions of India's shrimp industry after one year of Covid-19 crisis seriously impacting the whole farming business. The speakers focused on how to overcome diseases successfully through farm practices including traditional approaches, such as lower stocking densities and careful attention to water quality and environmental factors, as well as more recent advances such as multi-stage farming systems to keep a tight control on the environment and the pathogens. All these approaches shared the dual necessity to minimize stress factors that increase the risk of disease, and to keep a tight control on pathogens through biosecurity and prophylaxis.

However, the third pillar in health management strategies, boosting the health and **resilience** of shrimp, was marginally covered. There is much that can be done to prevent disease and support the animal in dealing with the stress associated to production, and this includes the use of functional feed additives. In this article, we address antioxidants and immuno-modulators, both crucial in supporting shrimp health and performance.

Oxidative stress at the base of a weakened immunity

Understanding oxidative stress is key to understanding the role of antioxidants. Shrimp under production conditions is subjected to different types of stress: environmental due to changes in water quality, nutritional due to poor feed quality, disease-related due to the presence and treatment of pathogens, and husbandry-associated due to specific farming interventions. Stress leads to an overproduction of **reactive oxygen species (ROS)** that damage critical cell components and weaken shrimp immunity if the antioxidant defense system is not capable to balance ROS overproduction with efficient ROS elimination. Even hemocytes release high quantities of ROS when killing invading pathogens and those must be eliminated to maintain hemocyte activity, meaning that building an efficient antioxidant system is crucial for an efficient immune response.

Antioxidants

There are different **types of antioxidants** working in synergy to deal with the oxidative deterioration by ROS and support an efficient immune response. Micronutrients such as selenium, manganese, and zinc, besides vitamins E, C, and A, provide co-factors and substrate necessary for the optimal functioning of the antioxidant system. Antioxidant enzymes such as selenium-dependent glutathione peroxidase **(Se-Gpx)**, superoxide dismutase **(SOD)**, and catalase **(CAT)**, participate in the first line of the antioxidant defense system and will deactivate ROS. Non-enzymatic antioxidants such as **glutathione** or **vitamins (C, E, and A)** participate in the second level of defense by capturing ROS escaping the first line. Studies have demonstrated that feeding elevated levels of Vitamin C (2000ppm) increases resistance to stress and bacterial infections over normal levels (100ppm) or no vitamin C added[1]. Likewise, supplementing organic selenium in the form of hydroxy-selenomethionine to low and high fish meal diets boosted the antioxidant enzymatic activity[2] and improved survival of shrimp exposed to stress by high nitrite (Figure 1).

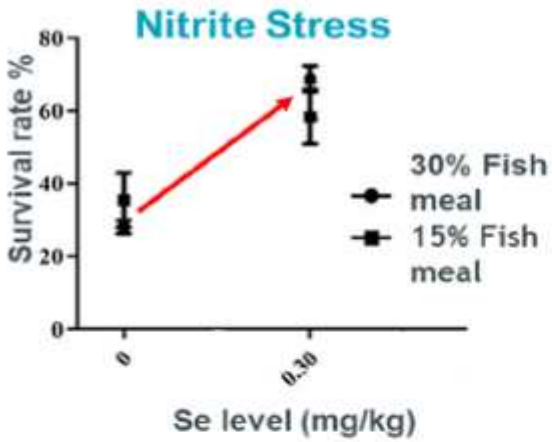


Fig. 1. Effect of organic Selenium (OH-Selenomethionine) on survival of shrimp exposed to a nitrite stress challenge.

Immuno-modulators

Immuno-modulators are often natural compounds that imitate the components of pathogens that activate the innate immunity and amplify different effectors of the immune response. **Beta-glucans** have proved to boost the shrimp immune response by promoting antioxidant activity and hemocyte production, and in consequence by improving survival under disease challenges[3]. **Mannan-oligosaccharides (MOS)** support the immune response in the encapsulation of pathogens, and when combined with beta-glucans, have proved to improve survival of Vibrio-infected shrimp [4]. **Nucleotides**, the building blocks of DNA and RNA, play a key role in metabolic patterns of the immune response, and if deficient, liver function and wound repair may be impaired. When supplemented to the diet of shrimp they have been shown to boost activity of antioxidant enzymes and antimicrobial peptides[5].

Synergy is the key in successful immuno-modulation

Under commercial farming conditions, shrimp are exposed to a multitude of pathogens and causes of stress. The resilience to stress and the immune response are dependent on each other, thus combining well-selected antioxidants and active immuno-stimulants can lead to a more efficient capacity to deal with stress and disease. Adisseo has developed and tested Aquastim S, an immuno-modulator composed of carefully selected and calibrated yeast cell wall extracts, nucleotides, antioxidants and other natural compounds. This health solution aims to achieve a synergistic effect towards the optimization of the antioxidant defense system and immune response mechanisms, translating into enhanced resistance to disease and overall feed performance under commercial conditions.

In a lab trial, shrimp were fed for 21 days three test diets: a basal diet without additive (= **Control**), the basal diet supplemented with 4g/kg of a commercial beta-glucan immuno stimulant (= **Glucan**), and the basal diet supplemented with 4g/kg of Adisseo formulated immuno-modulator (= **Aquastim S**). Then, shrimp were challenged with *Vibrio penaecida* by immersion. After 3 weeks and before infection, shrimp fed Aquastim S had 9% better average body

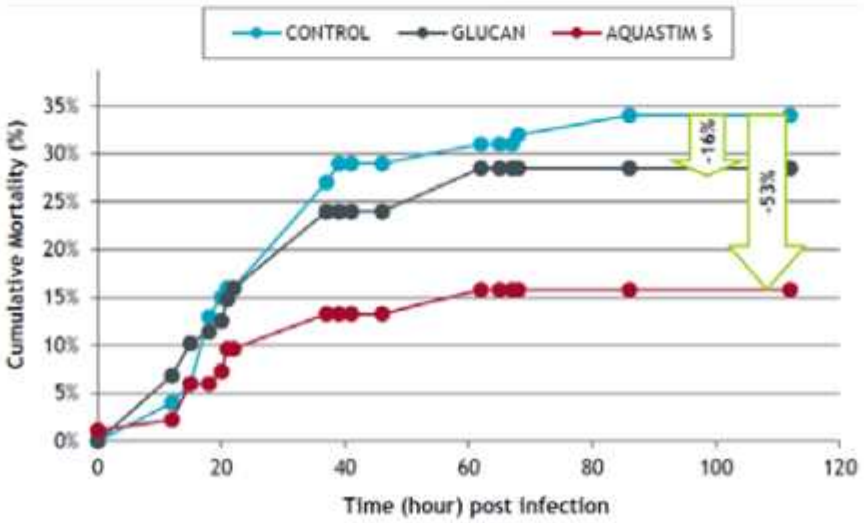


Figure 2. Mortality of shrimp fed 3 test diets (Control, Glucan supplementation, Aquastim S supplementation) and infected with Vibrio penaecidae.

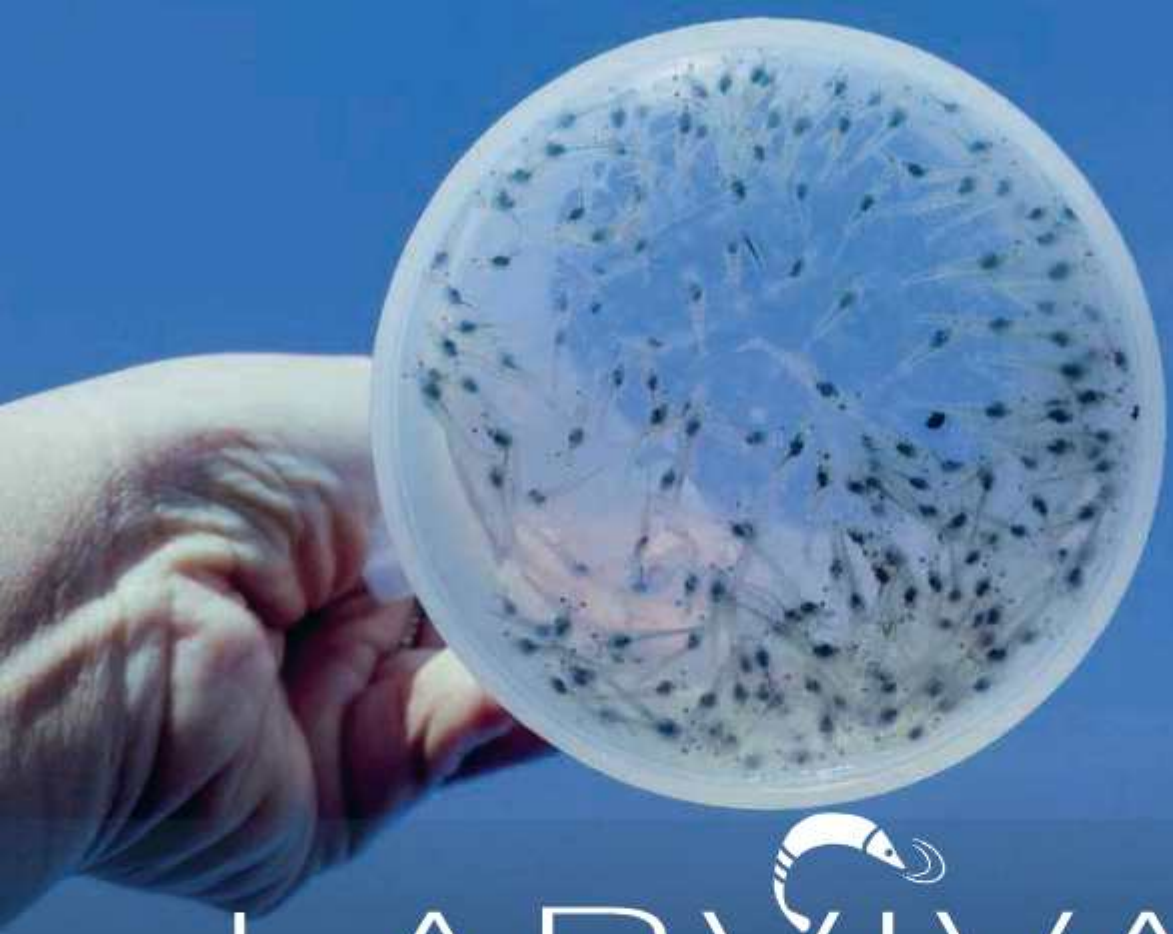
weight than the shrimp fed Control or Glucan feeds. Additionally, Aquastim S improved the hemocyte microbicidal effect by 33% and 84% in unchallenged and challenged shrimp, respectively, in relation to those fed Control, and by 5% and 40%, respectively, in relation to the shrimp fed Glucan. More meaningful to farmers was that Aquastim S reduced mortality induced by *Vibrio penaecida* by 53% in relation to Control, while reduction by Glucans was only 16% (Figure 2).

Aquastim S has also been tested tested under commercial farming conditions in Brazil, as affected by heavy rains as well as IMNV and NHP infections. Results have shown improved revenue by 19% and biomass harvested by 15%, this being attributed to improvements of 5% in survival and of 10% in shrimp weight.

Take-home message

Heavy rains, stocking of new PLs, deterioration of water quality from over feeding, or disease outbreaks in neighboring farms, are unavoidable stress factors that weaken the shrimp immunity and heighten the risk of infection. It is recommended to provide shrimp with extra support based on antioxidants and immuno-modulators to reinforce immunity and further ensure optimal disease resistance and performance. While application can be either at the feed mill or at the farm, dosage and timing of such interventions is critical. Farmers need to follow recommendations from the supplier to achieve maximum efficacy. Application should go in hand with proper farming practices, biosecurity, and prophylaxis. Combination of such antioxidants and immuno-modulators with antimicrobial solutions based on organic acids is proposed as a successful strategy to reduce the severity of infections.

References:[1] Hunter 2000, [2]Guérin 2018, [3]Meena & al. 2012, [4]Solidum & al. 2016, [5]Xiong & al. 2018.



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Manoj M. Sharma

POINTS TO PONDER WHILE REVERTING TO *MONODON* FARMING

Shrimp Farming Tips from Dr. Manoj M Sharma

With profitable vannamei farming becoming a difficult proposition and with the simultaneous introduction of SPF Black tiger shrimp broodstock in India, several farmers are reverting to farming *monodon* this year. I would like to suggest few key points which will help you to get back to farming *monodon*.

1. Black tiger shrimp, *P. monodon* is a species native to India and is one of the first species to be commercially farmed in the country. The initial popular model of scientific *monodon* farming was with low to moderate stocking densities of 8 - 15 pcs/m^2 and an average shrimp production of around 3000 - 5000 kgs/ha.

2. Since the introduction of exotic *P. vannamei* in 2009, shrimp production and pond productivity had increased several folds in the country. However, it has gradually started affecting the carrying capacity of ponds and the production system.

3. There has been a steep rise in farm production in India from 2011 to 2017 but from 2018, the country has witnessed increasing incidences of new and emerging diseases that affected the production and profitability at farm level.

4. Presently, the farmers are in a dilemma whether to continue with *vannamei* farming or to revert to *monodon*. Switching back to *monodon* in today's scenario has its own pros and cons. One of the key factors to be considered is that *vannamei* farming has caused several pathogens and vectors to become endemic to the farming system which may adversely affect the black tiger shrimp when they are reintroduced.

5. The new era black tiger shrimp,now available in India is "Specific Pathogen Free" (SPF) and like *vannamei*, has all the sensitive characteristics of an SPF animal. Therefore, while stocking SPF *monodon* in your farm, you are required to take all essential care and follow all the farming guidelines with complete biosecurity protocols just as you do in *vannamei*.

6. Farmers should take special care during pond preparation and should ensure that the soil is free from EHP and organic loads, especially because Black tiger shrimp is benthic in nature and sometimes also display burrowing behaviour.

7. I recommend a maximum stocking density of 10 - 15 pcs/m^2, and following all the"Best Management Practices" at the farm, as is being done for *vannamei*.

8. Last but not the least, we should be cautious while switching back to *monodon* as a mass exodus to *monodon* farming and a sudden surge in black tiger shrimp production is very likely to affect the international market scenario as the size of *monodon* market is only around 5 percent of the *vannamei* market.

I request the farmer to wait, watch and tread cautiously. Have a successful farming year 2021.

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IMPORT OF SPF *L.VANNAMEI* TO INDIA DURING JANUARY 2021 TO MARCH 2021

S. NO	NAME OF THE HATCHERY	SUPPLIER	DATE OF RECEIPT	QUANTITY RECEIVED
JANUARY 2021				
1	BMR Marine Products Pvt. Ltd - Unit II	SIS; Florida	08.01.21	600
2	Makineedi Hatcheries	SIS; Florida	08.01.21	1160
3	Aquatic Farms Ltd	SIS; Florida	08.01.21	600
4	Royal Hatcheries	SIS; Florida	11.01.21	580
5	Haritha Aqua Hatchery	SIS; Florida	11.01.21	1160
6	Winner Marine Hatchery	SIS; Florida	11.01.21	580
7	Vishal Marine Hatchery	SIS; Florida	12.01.21	380
8	SS Hatcheries	American Penaeid; Florida	12.01.21	600
9	Vaishale Prawn Hatchery	SIS; Florida	12.01.21	500
10	Meenakshi Hatcheries Pvt. Ltd	SIS; Florida	15.01.21	1160
11	Srisailam Shrimp Hatcheries	SIS; Florida	15.01.21	580
12	Sree Gayathri Hatchery	SIS; Florida	16.01.21	600
13	Crystal Aqua Marine Hatcheries Pvt. Ltd	SIS; Florida	16.01.21	580
14	ASR Hatcheries	SIS; Florida	16.01.21	1160
15	Vandayar Hatchery	Kona Bay; Hawaii	17.01.21	600
16	Anuradha Hatcheries	Kona Bay; Hawaii	17.01.21	600
17	Sandhya Aqua Exports Pvt. Ltd	Kona Bay; Hawaii	17.01.21	600
18	Hybrid Ebi Hatcheries Pvt. Ltd	Kona Bay; Hawaii	17.01.21	1200
19	Raj Hatcheries (Bengal) Pvt. Ltd	SIS; Florida	18.01.21	580
20	GK Bio Marine Shrimp Hatchery	SIS; Florida	18.01.21	580
21	Venture Shrimp Hatchery	SIS; Florida	19.01.21	580
22	Sri Mahalakshmi Hatcheries - Vizag	SIS; Florida	19.01.21	580
23	Kings International Ltd	SIS; Florida	19.01.21	1160
24	Aqua Prime International (India) Pvt. Ltd	SIS; Florida	22.01.21	800
25	Sai Marine Exports Pvt. Ltd - Unit II	SIS; Florida	22.01.21	1160
26	Vaisakhi Bio-Marine Pvt. Ltd	American Penaeid; Florida	23.01.21	600
27	CP Aquaculture India Pvt. Ltd -Nellore	Kona Bay; Hawaii	24.01.21	600
28	CP Aquaculture India Pvt. Ltd -Gudur	Kona Bay; Hawaii	24.01.21	600
29	Kailaas Hatchery	Kona Bay; Hawaii	24.01.21	800
30	Om Maritech Pvt. Ltd	Kona Bay; Hawaii	24.01.21	600
31	Anushka Hatchery	Kona Bay; Hawaii	24.01.21	600
32	Shree Kanak Matsya Hatcheries	Kona Bay; Hawaii	24.01.21	400
33	Sree Victory Shrimp Products Pvt. Ltd	SIS; Florida	26.01.21	580
34	Ravi Hatcheries	SIS; Florida	26.01.21	580
35	Padmavathi Hatchery	SIS; Florida	26.01.21	580
36	BMR Exports - Tindivanam	Sea Products; Texas	29.01.21	560
37	Vaisakhi Bio-Resources Pvt. Ltd - Plant II	American Penaeid; Florida	29.01.21	620
38	Saran Saai Hatcheries	SIS; Florida	30.01.21	400
39	Varun Hatcheries	SIS; Florida	30.01.21	600
FEBRUARY 2021				
40	Vaisakhi Bio- Resources Pvt. Ltd	American Penaeid; Florida	01.02.21	620
41	Sri Manjunadha Hatcheries	SIS; Florida	01.02.21	600
42	BMR Exports - Kancheepuram	Syaqua; Florida	06.02.21	1200
43	Wintoss Associates	SIS; Florida	06.02.21	800
44	Sri Venkateswara Shrimp Hatcheries Pvt. Ltd	SIS; Florida	06.02.21	580
45	Sriba Seabase Pvt. Ltd - E.G	SIS; Florida	06.02.21	580
46	Anil Aquatech	SIS; Florida	09.02.21	580
47	CP Aquaculture (India) Pvt. Ltd - Prakasam	Kona Bay; Hawaii	11.02.21	600
48	Blue Shrimp Hatcheries	Kona Bay; Hawaii	11.02.21	600
49	Raj Hatcheries Madras Pvt. Ltd	Kona Bay; Hawaii	11.02.21	800
50	Blue Park Hatcheries (India) Pvt. Ltd	Kona Bay; Hawaii	11.02.21	600
51	Anantha Sai Hatcheries	SIS; Florida	13.02.21	580
52	Venkata Sai Hatcheries	Kona Bay; Hawaii	14.02.21	600
53	Aquatic Farms Ltd	Kona Bay; Hawaii	14.02.21	600
54	Gayathri Hatcheries	Kona Bay; Hawaii	14.02.21	1200
55	Shree Kanak Matsya Hatcheries	Kona Bay; Hawaii	14.02.21	600
56	Sri Venkata Sudha Hatcheries	Kona Bay; Hawaii	14.02.21	600
57	Sree Hatchery	SIS; Florida	19.02.21	400
58	Vijaya Durga Hatcheries Pvt. Ltd	SIS; Florida	19.02.21	600
59	Srinivasalu Hatchery	SIS; Florida	22.02.21	500
60	East Coast Hatcheries	SIS; Florida	23.02.21	380
61	Blue Sea Hatcheries	SIS; Florida	23.02.21	580
62	Sapthagiri Hatcheries	Kona Bay; Hawaii	24.02.21	1200
63	Srinivasa Hatcheries	Kona Bay; Hawaii	24.02.21	1200
64	Sapthagiri Hatcheries - Unit II	Kona Bay; Hawaii	24.02.21	1200
65	Sri Mahalakshmi Hatcheries - Nellore	SIS; Florida	27.02.21	600
66	Lotus Sea Farms	SIS; Florida	27.02.21	580
67	Shenglong Biotech (India) Pvt. Ltd	SIS; Florida	27.04.21	940
68	SVR Hatcheries	Kona Bay; Hawaii	28.02.21	600
69	Srinidhi Biotenologies	Kona Bay; Hawaii	28.02.21	1200
70	Sree Hanuman Hatcheries	Kona Bay; Hawaii	28.02.21	600
71	Coastal Aqua Pvt. Ltd	Kona Bay; Hawaii	28.02.21	1200
MARCH 2021				
73	Shirdi Sai Hatcheries	SIS; Florida	01.03.21	580
74	Golden Marine Harvest	Sea Products; Texas	01.03.21	600
75	Golden Marine Harvest - Unit IV	Syaqua; Florida	01.03.21	600

76	Winner Marine Hatchery	SIS; Florida	02.03.21	580
77	Ananda Foods	Kona Bay; Hawaii	04.03.21	600
78	Avanti Feeds - Unit I	SIS; Florida	06.03.21	1180
79	Sai Lalitha Hatcheries	SIS; Florida	06.03.21	580
80	Ravi Hatcheries LLP	SIS; Florida	08.03.21	720
81	Mas Aqua Techniks Pvt. Ltd - Plant II	SIS; Florida	09.03.21	800
82	Blue Star Marines	SIS; Florida	12.03.21	600
83	BMR Exports - Nellore	SIS; Florida	12.03.21	1180
84	SS Hatcheries - Unit II	American Penaeid; Florida	12.03.21	600
85	Sarada Hatcheries - Unit I	SIS; Florida	15.03.21	580
86	KPR Hatchery	SIS; Florida	15.03.21	1160
87	Vaisakhi Bio-Marine Pvt. Ltd - Unit II	SIS; Florida	16.03.21	1160
88	Meenakshi Hatcheries - Vizag	SIS; Florida	19.03.21	420
89	Krishna Hatcheries	SIS; Florida	19.03.21	580
90	Sea Park Hatcheries Pvt. Ltd	SIS; Florida	19.03.21	1160
91	Vaisakhi Bio-Marine Pvt. Ltd - Unit IV	SIS; Florida	20.03.21	1200
92	Shrimp Improvement System (India) Pvt. Ltd	SIS; Florida	22.03.21	900
93	Prince Aqua Pvt. Ltd	SIS; Florida	22.03.21	580
94	Blue Gold Prawn Hatchery	Syaqua; Florida	22.03.21	580
95	NSR Aqua Farms Pvt. Ltd	Kona Bay; Hawaii	22.03.21	1200
96	BMR Industries Pvt. Ltd	Kona Bay; Hawaii	22.03.21	1200
97	Vyjayanthee Hatcheries	Kona Bay; Hawaii	23.03.21	800
98	NGR Aquatech Pvt. Ltd	SIS; Florida	26.03.21	1200
99	Sripa Aqua Marine Pvt. Ltd - Unit II	SIS; Florida	26.03.21	550
100	Vaisakhi Bio-Marine Pvt. Ltd - Unit II	SIS; Florida	27.03.21	1200
101	Sree Hatchery	American Penaeid; Florida	29.03.21	600
102	Srinivasa Hatcheries - Unit II	Kona Bay; Hawaii	29.03.21	1200
103	Jay Jay Gold	Kona Bay; Hawaii	29.03.21	1000

Source: CAA Website, AQF-RGCA, MPEDA

IMPORT DETAILS OF SPF *P. MONODON* CONSIGNMENTS QUARANTINED AT AQF (JANUARY 2021 TO MARCH 2021)

S. NO	NAME OF THE HATCHERY	SUPPLIER	DATE OF RECEIPT	QUANTITY RECEIVED
JANUARY 2021				
NIL				
FEBRUARY 2021				
NIL				
MARCH 2021				
1	Vaishnavi Aquatech	Moana Technologies, Hawaii	8.3.21	600

Source: CAA Website, AQF-RGCA, MPEDA

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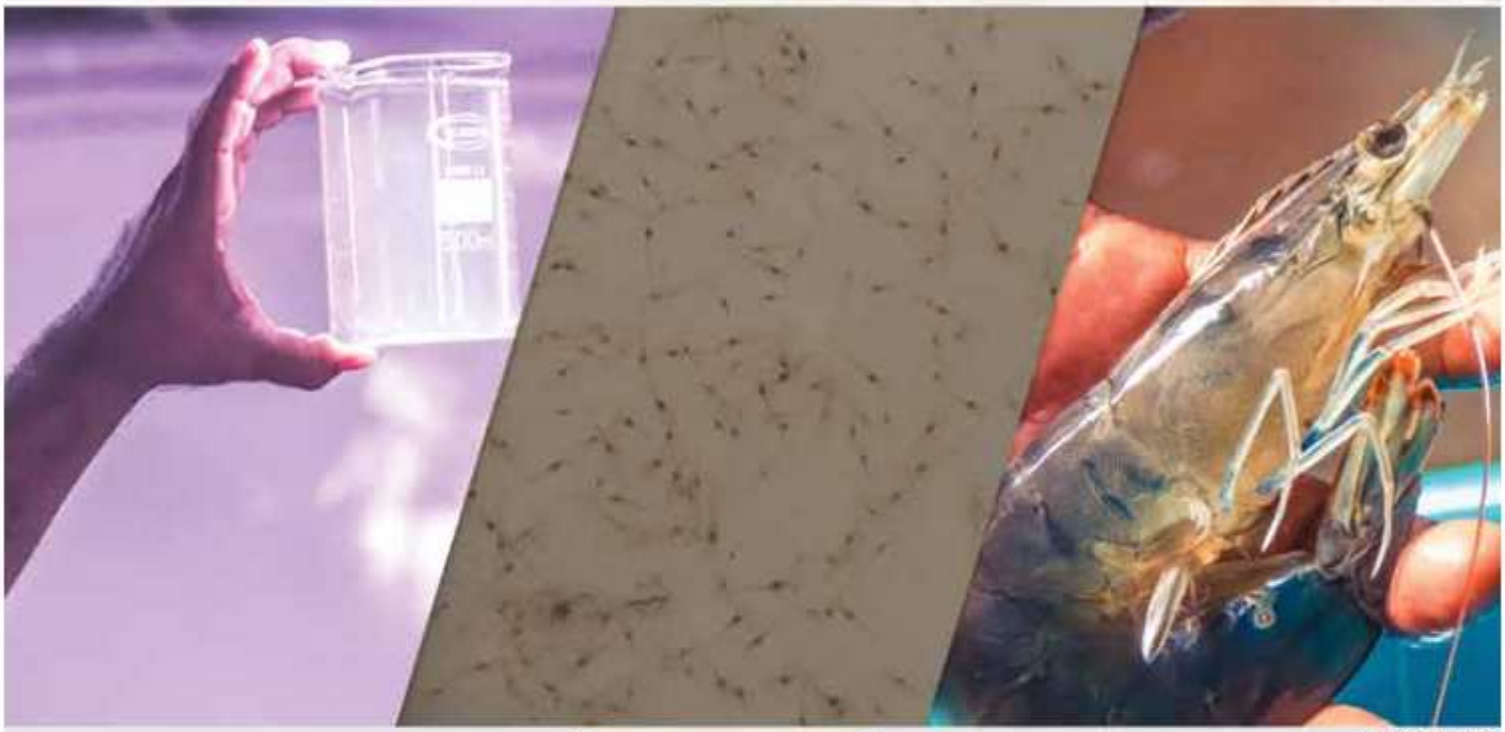

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Shrimp Aquaculture

- Industry Review

Increase in feed prices has pushed the farmers on the backfoot again

Shrimp farmers were in for a shock when feed rates were enhanced this month by all feed manufacturers by around Rs. 2 per Kg in view of the escalation in prices of key feed ingredients such as Soya bean meal and fish meal. This turned out to be a dampener as they were already dealing with a price drop for harvested shrimp and disease issues in farms. We can only hope for things to improve so that they don't impact the overall production this year.

Farm Front

As the second wave of Covid-19 in India escalated towards the end of April 2021, several farmers in **Andhra Pradesh** had resorted to panic harvesting fearing a similar situation of 2020 when prices of shrimp had drastically come down and there were no buyers. This resulted in a considerable drop in farm gate prices, though not to the extent of the previous year. With this second wave of Covid-19 in India being more contagious, several farmers, and employees at the farms contracted the disease during the month. Stocking of seeds in farms also slowed down as several farmers postponed stocking.

In Krishna district farmers in some pockets of Nagayalanka and Koduru are waiting for shrimp prices to improve. In Guntur district, a majority of those farmers who had stocked earlier have harvested at 70 - 60C and are ready for stocking

Vibrio outbreaks were seen during the early part of the season

again. Most are waiting for Covid cases to subside and lifting of the lockdown to commence stocking. In and around Ongole, harvesting continues at fast pace fearing complications due to the pandemic. As the summer peaks, white gut infections and RMS are observed in many areas of Prakasam district and it is particularly severe in the Tanguturu belt. In Nellore only 30 - 40 % ponds are operational which are mostly in the freshwater areas. Excellent survival rates and farm performance have been obtained in the freshwater areas that were harvested during the month, with several ponds even yielding additional biomass of the bonus seeds provided by the hatcheries. Growth had also been normal in many farms.

With the farm gate prices of freshwater fish having come down drastically (as low as Rs. 70 - 80) over the last few months, several fish farmers of Andhra Pradesh are making preparations to switch over to vannamei farming for the coming season and are expected to stock by the end of June and in July. A few farmers are also likely to switch to polyculture like several successful farmers of Losari, Talerevu, Ganapavaram and Mogalturu areas. Here polyculture of vannamei with fish is practised and around 60,000 shrimp seed is stocked along with 5000 fingerlings in ponds of 2 - 3 acres. In this system, only the fish are fed and by the time the fish reach 1 kg size, the shrimp grows to 50C - 40C yielding a biomass of 400 - 500 kg per acre.

It is a matter of concern that inspite of reduced shrimp production from the farms and a fair demand in the international markets, farm gate prices of shrimp in the country have been slashed.

Madhu Talluri, Technical Director of SGS Aqua Solutions, Kakinada, informed that farming operations were currently progressing smoothly, though some farmers continued to face white faeces disease and running mortality issues. While partial harvests are underway in some areas of East and West Godavari districts, farmers, who had already harvested were preparing for the next stocking.

The growth performance of **SPF monodon** appears to be good as a regular weekly growth of 3 - 4 grams are being recorded in several well managed farms. However, farmers are sceptical about the final survival likely to be obtained during harvest. Though data from initial harvests have shown lesser than expected survival and higher FCR, only when regular and planned harvests commence, will the performance of the stocks be exactly known. A matter of worry however, is the widespread incidences of White Faeces disease and protozoan fouling in SPF stocks as well. Generally based on our previous experience with SPF *monodon* and SPF *vannamei*, we had not encountered either white faeces disease, loose shell problems or protozoan fouling atleast in the initial 3 – 4 year period.

In **West Bengal**, farming areas as well as stocking densities have increased this year and seed stocking was carried out within a very short period. However, several farms that were stocked at very high densities had to resort to harvesting at 7 - 10 gm sizes owing to water quality issues and running mortality problems. Operating costs were also escalating as diesel rates had increased and many of the farms were running on generator power. Farmers are unlikely to register profits this crop as the cost of production was much higher with higher land lease rates and higher input costs (particularly feed price). Though some farmers tried partial harvesting, the crop could not be carried forward beyond a week due to running mortality issues. Most of the areas are unlikely to go for second stocking as only freshwater would be available for farming owing to the upcoming monsoons. In areas such as Nandigram, where ponds were stocked initially at low temperatures, slow growth was seen upto 60 DOC and subsequently registered better growth after partial harvesting.

In **Tamil Nadu**, very little stocking has been done in the month of April. It is expected that release of Mettur dam water in Delta districts could trigger stocking to a small extent from the second week of June. Fewer number of complaints have been reported from the field this year concerning slow growth, with "growth line" seeds performing well. "Hardy line" seeds are also doing well with farms recording a higher survival at the end of the crop. Farms that have stocked "hardy line" seeds at stocking densities below 30 pcs/m^2 are reportedly performing better in terms of growth than those stocked at higher densities. Better performance is also reported in ponds stocked at high densities if partial harvesting is done in the middle of the crop.

It is estimated that in **Gujarat**, only around 1 billion vannamei seed has been stocked so far this year, which is around 50% less than the stocking of 2.5 billion seed in 2019. Additionally, around 0 - 55 million SPF monodon seed has also been stocked in different pockets. Majority of the ponds are between 60 - 80 DOC and with the size range between 8 - 12 gm. Few ponds stocked in the late winter are being harvested around 130 days but with lesser growth than anticipated. Almost all areas have experienced white faecal disease but recovered within 5 days to 1 week of treatment. Some farmers are expected to stock again for the second crop once the

Demand for monodon seeds continued to be good in the month of April 2021

Covid-19 severity declines in the state. Increase of shrimp feed prices has further added to the already high production costs prevalent in the state. **According to Saji Chacko**, CEO of Onaway Group, the overall stocking in 2021 is less than fifty percent of the of the seeds normally stocked in the state. Few cases of running mortality in vannamei is also reported.

Hatchery Front

Movement of seeds from vannamei hatcheries have been slow in the month of April as well. However, demand for SPF monodon seed supplied by the two approved hatcheries continued to be high during the month with several farmers from Guntur, Prakasam and Nellore districts opting to stock tiger shrimp seeds. **According to Madhusudhan Reddy**, Director, Saranya group, the hatchery operators were finding it difficult to source oxygen cylinders for their operations as acute shortages were being reported in view of its rising demand for Covid-19 treatment. Several hatcheries have gone in for a brief shut-down owing to the situation. He expected the stocking in farms to improve from the third week of June.

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The awesome Aulonocara

A stunning fresh water fish, native to Lake Malawi is the peacock cichlid, which belongs to the genus *Aulonocara*. They are rapidly growing in popularity in the aquarium hobby for their vibrant colours, constant activity and peaceful nature. *Aulonocara* form local variants as different populations have practically no contact with each other. Due to this, they are known as mysterious fish. They are also known for their tendency to cross-hybridize. Most of the peacock cichlids are small, ranging in size from 8 - 12 cm. While females and young fish are dull gray in colour, the males, as they mature become a stunning shade of iridescent yellow, red, orange, purple or blue. ***Read on to know more .....***

The Yellow Peacock - Aulonocara baenschi

Lake Malawi Butterfly cichlid - Aulonocara jacobfreibergi

In the wild *Aulonocara* feed on micro-invertebrates found hidden in the sand, while in the aquarium they prefer live baby shrimp, micro worms and daphnia. Appropriate water chemistry includes hard water with a pH ranging from 7.8 – 8.4 and temperature consistent at 24°C. They are mouth brooders and it takes almost 18 days for the eggs to develop into free-swimming fry. Though there are more than 20 species described, only a handful of varieties are popular in the hobby which are: *Aulonocara baenschi, A. hansbaenschi, A. jacobfreibergi, A. koningsi* and *A. stuartgranti*.

With brilliant yellow colours, *Aulonocara baenschi*, known as **Yellow Peacock** or Baensch's peacock, is one of the most popular species among peacock cichlids. An elongated high-backed cichlid, they are with large lips and eyes. The pelvic and pectoral fins are elongated. Four color morphs are available to the hobby. The most common one is the blue-yellow morph. A popular, new color morph is all yellow except for the lower half of the head with pale blue stripes. The morph from the Marleri Islands has a blue head. The final variation, the Usisya morph has a yellow body and a blue head. The vertical stripes are very pale on the Usisya form. The maximum size of male is 15 cm while female is 9 cm. Ideal water conditions are pH ranging from 7.5 - 8.8, dH 10 - 25 and temperature 25 - 29°C. They have a life span of 6 - 10 years with proper care. They are omnivores but don't feed them tubifex worms as they cause a disease called "Malawi bloat". They do best in a group of one male with 6 females in a large tank.

A. hansbaenschi, is also known as **Red Shoulder Malawi** or African peacock. In males, the dorsal fin is elongated and pointed. The upper ridge of this fin is white while the rest is body colored. The body is indigo blue with 7 - 9 faint horizontal black stripes and a wide red to orange band just behind the gills. Alternating with the blue scales, there are red to pink scales that are not as numerous as the blue ones. The females have less elaborate fins and are brownish-gray in color. The eye appears larger and the fins are brown or transparent. With water pH ranging from 7.5 - 8.8, dH 10 - 25, the ideal temperature is 25 - 29°C. They can be combined with other medium sized cichlids in aquarium These cichlids are a great choice for beginner aquarists as they make good inhabitants for a community tank and breed readily. They are primarily carnivores and do not damage plants in the tank as other cichlids. They need plenty of room for swimming, so a tank size of 100 gallon or more is best for a group.

A. jacobfreibergi, is known as **Lake Malawi Butterfly cichlid**. These are some of the largest members of the peacock family and can grow upto 9 inches in length. It has a deeply forked tail fin which distinguishes it from other cichlids. Several different color variations are known, although only one is common in the hobby. This has a dark, indigo blue color extending along the lower jaw and to the rear part of the body, while the forehead and the upper back is reddish-brown in color. The females on the other hand are quite drab, being grayish brown in colour with vertical bands and rounded anal and dorsal fins. A peaceful fish that can be combined in a community tank containing other robust fish and keep one male with several females.

The adult male of the haplochromine cichlid, *A. koningsi*, the **Mbenji Peacock** is royal blue in color. The caudal fin has several yellow stripes on a blue background. The general body colouration of female is brownish. It is easily distinguished from its closest relative, *A. stuartgranti*, with the colouration of males especially with a spot on the anal fin and the melanin pattern of the immature male and female. They have six to eight vertical bands as against nine or ten in *stuartgranti*.

A. stuartgranti, known as **Chilumba peacock** or blue peacock Cichlid or Flavescent Cichlid, originated from

Chilumba peacock - Aulonocara stuartgranti

Blue Face peacock - Aulonocara walteri

Pointers

- **The peacock cichlid's color doesn't depend on its mood or its mating status, unlike most of their relatives**
- **You will need a heater if you intend to keep peacock cichlids. Lake Malawi is quite warm year-round.**
- **Peacock cichlids will readily breed in an aquarium environment.**
- **To get the adults into breeding condition, offer protein rich foods like bloodworms and brine shrimp.**

the northwestern coast of Lake Malawi, Chilumba and found along the entire 150 km stretch of the northwestern coast. Along the length of its range, the colour of the breeding male changes from blue to bright yellow and then to black. Their colour becomes more vivid during breeding time. Ideal water conditions are pH ranging from 7.8 – 8.5 and dH 10 – 15 with temperature between 24 - 26°C. They are omnivorous and accept a variety of live, frozen and dried foods. With proper care, this cichlid can live for 12 years or longer.

The males of *A. walteri*, commonly known as **Blue Face peacock** are brilliantly coloured and become deeper blue with the colour extending further down the body during spawning season. Male also exhibits yellow or tan colouration on their upper flanks. They are closely related to *A. jacobfreibergi* and are easy to breed. Males are larger than females and grow upto 4 inches in length. Males can be aggressive to each other, so an aquarium of 4 feet or longer is recommended.

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Dr. V K Dey, has over three decades of experience in diverse sectors of Seafood Industry in Asia-Pacific region. He joined MPEDA in 1979 and has been working in various capacities till 2000. He worked with INFOFISH from 2000 - 2008 as Coordinator, Consultancy Services and is currently attached with Bay Harvest International as their Senior Consultant. While working with INFOFISH, he was involved in several studies related to seafood processing, product development and marketing in the Asia Pacific region and beyond, including preparation of project report for setting up of Aqua-technology Park for Ornamental fish. He has to his credit several articles on Ornamental fish including a compilation of articles published as a book, "Living Jewels" by MPEDA.

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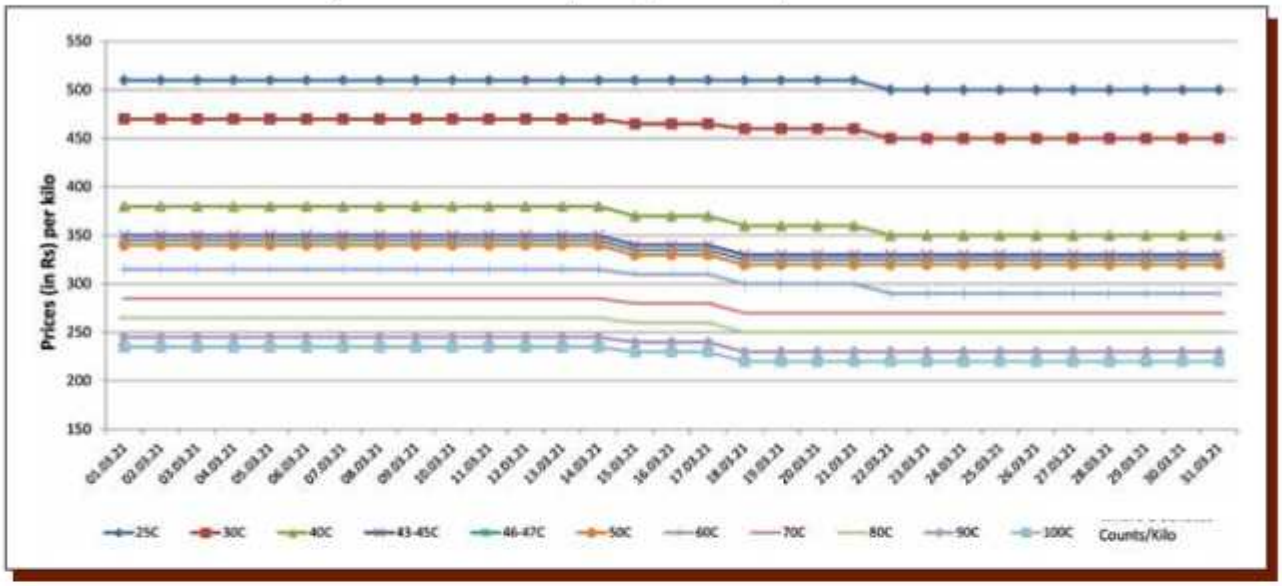
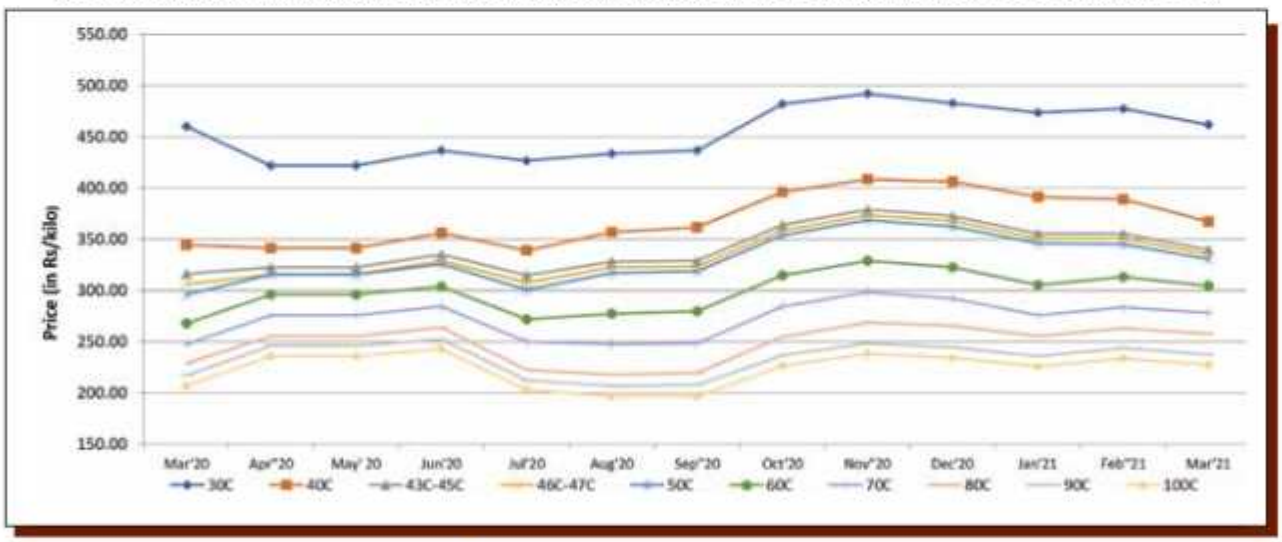
AQUA BRAHMA SHRIMP PRICES

Daily trend in *P. vannamei* prices (March 2021) in Andhra Pradesh



● Where C denotes count/ kilo

Fluctuation in price (monthly mean values) of *P. vannamei* for a period of 1 year (March 2020 to March 2021)



● Where C denotes count/ kilo

● Monthly mean prices for all counts registered a decline in March 2021 against February 2021 prices. While the decline was by Rs. 5/Kg for 70-100C, Rs. 10/Kg for 60C, Rs. 15/Kg for 50C and 30C and Rs. 20/Kg for 40C vannamei. However, within March 2021, the prices of all counts held steady upto the end of the second week and subsequently registered a decline of Rs. 15/Kg for 100-70C, Rs. 20/Kg for 50C and 30C, Rs. 25/Kg for 60C and Rs. 30/Kg for 40C shrimp. Prices continued to remain attractive for the farmers, which encouraged increased seed stocking in many areas.

● The difference between monthly mean prices of March 2020 and March 2021 was substantial for all counts, with February 2021 prices were higher by Rs. 20/Kg for 100, 90 and 40C, by Rs. 30/Kg for 80 - 70C and by Rs. 35/Kg for 60C - 50C. The mean price of 30C was similar at Rs. 460/Kg for both March 2020 and March 2021.

● Seed stocking picked up in all parts of the country, including the states of Andhra Pradesh, Odisha and West Bengal as attractive farm gate prices continued in the month of March 2021. Better stocking was also registered in Gujarat over February 2021.

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THE AQUA PROFESSIONAL

NEWSLETTER OF THE SOCIETY OF AQUACULTURE PROFESSIONALS

MARCH – APRIL 2021

INDEX

1. GUEST EDITORIAL BY R. SRINIVASAN, OUR PAST PRESIDENT

Dear all

Shrimp culture and my career are heading for completion of four full decades. I am reminded of the yester years when we were on the lookout for a pure and pristine brackish water source for a large-scale shrimp farming all over the country. Then came success with high saline and marine waters and the whole approach to shrimp farming and the mindset of farmers changed. Now, successful vannamei farming is going back to low saline and sub soil waters which seems to be far better than open and marine waters. Shrimp farming has come two full cycles. I am personally happy that we all could start the Society of Aquaculture Professionals (SAP) which continues to recognize Professionals in the field of Aquaculture, though in the academic scheme of things we are still unable to call qualified personnel in the field as doctors, except those with a Ph.D.

Shrimp farming has always had a roller coaster ride, be it technically or financially and only those never say die entrepreneurs who sustained bad years ended up as winners. From 2019 onwards, it has been a litmus test for many a stakeholder with poor farm results, profitability and hence, cash flows. The chain is not complete without the allied industry getting back the cash to support farmers as always. The reason for this scenario is that the diseases are continuing unabated and farmers facing increased running mortalities in ponds in spite of their best efforts, reducing survivals and ending up in the red, economically. White feces and EHP continue to trouble the sector, almost in all key shrimp producing regions in both seasons. It is high time for the SPF vannamei broodstock producers to take cognizance of the situation and produce India specific tolerant stocks that can help hatchery operators not taking the brunt as always.

As the whole ecosystem is an inoculum for several diseases, including the dominant white spot and Vibrio related issues, we can bring

about solutions only through broodstock, that are selected to be sturdier than ever, especially for disease (need not always be for growth).

While farmers are struggling with vannamei and profitability, SPF black tigers have come back almost after a decade, but not in full swing as was expected, probably due to its inherent difficulties in breeding, covid restrictions for transportation and cost of broodstock which may be a hindrance, blocking its unlimited supply to the needy.

While shrimp seed is predominantly restricted to production from quality SPF broodstock, input supplies to aquaculture continue to be dominated by unknown suppliers with its quality always being questionable; both by the authorities and farmers, finally showing its impact at the last leg of the supply chain. It is inevitable to ensure supply of only useful and quality certified inputs to hatcheries and farms so that the consumption of shrimps by humans is not put to threat.

We are hearing news of ever-increasing costs of several of the raw materials used in aquaculture including sea freight which has doubled over its cost a year back and likely to further escalate from May 2021. This puts pressure on the entire production chain and discourages the already unenthusiastic farmers from going for large scale farming. As the buyers are also not able to increase the end price for shrimps, it calls for an urgent need to push domestic markets from all ends so that sustainability is not in trouble. Covid spread has given new openings for several online suppliers to explore options to sell seafood, especially shrimp along with mutton and chicken in their list. This encouragement should be taken as a positive development of this Corona season and help this sector take big leaps and grow multifold as planned in the Vision documents by the Indian Fisheries Ministry.

Alongside shrimp, improving production of all other fresh and brackish water fishes also will reduce the pressure on fishing and boost the ever-growing seafood markets of India, which thankfully is blessed with a large young population when compared to many other countries. While talking about the young consumers, I have to hit the button for the same youngsters to come forward and take over aquaculture operations and help the elders of the industry who have made it a lasting and a wonderful sector for the country from its nascent stage 40 years back. My best wishes to all the stakeholders for a successful crop in 2021.

I thank Mr. Jaideep and his team at Aquaculture Spectrum for helping SAP to get our newsletter to a wider audience. Jai Hind.

2. Event Reports

Roundtable with the Ministry of Fisheries on Startups in Fisheries and Aquaculture by Invest India

A virtual roundtable chaired by then Acting Secretary of Department of Fisheries, Shri. Atul Chaturvedi, IAS was held on March 16, 2021. Dr. Arul Victor Suresh, President SAP, also participated in the roundtable. The roundtable explored solutions for startups and innovators in the Indian fisheries and aquaculture ecosystem. Panelists in the roundtable included firms that help startups to establish and grow their business, entrepreneurs who have successfully grown their new ventures, stakeholder representatives and government officials in the ministry.

Invest India (https://www.investindia.gov.in/) is an arm of the Ministry of Commerce that facilitates the promotion of investments in the country. They have sector-specific teams that operate from different government departments to encourage investments in specific sectors. A fisheries/aquaculture specific team headed by Mr. Dharanikanth Koganti organized the Roundtable.

SAP President, in the course of the Roundtable, requested the government to recognize the shortcomings of the existing Pradhan Mantri Matsya Sampada Yojana (PMMSY) and come up with schemes that can help first-time small business owners who will rely on new technologies. Dr. J. Balaji, Joint Secretary, responded that a scheme is in the works to benefit a broad array of investors. In a subsequent email correspondence as a follow up, he identified three areas of technology that can solve key challenges in aquaculture. They are:

• SENTINEL SYSTEMS FOR EARLY WARNING OF DISEASES IN SHRIMP FARMS - An automated water sampler that can screen water for pathogens and alert decision makers when pathogen load is high

• COLLECTION & IN SITU DEGRADATION OF POND SLUDGE - An equipment that collects pond sludge and digests the sludge efficiently either within the pond or the farm

• CARRYING CAPACITY CALCULATOR - A computer model that can estimate how much biomass can be safely held in a pond

SAP has extended cooperation to the Invest India team by organizing a second roundtable that will bring together visionaries, pioneers and successful investors in the business as well as young minds that have the ideas and energy to start new ventures based on innovative ideas and discuss opportunities and challenges in aquaculture investments.

14th Meeting of the BIS FAD 12 Committee on Standards for Fisheries and Aquaculture Products

Bureau of Indian Standards is the National Standard Body of India. The rising demands for standards and quality in products, processes and services have increased the need for BIS to be increasingly involved in setting standards in many sectors. Aquaculture is no exception. When the Food Safety and Standards Authority of India (FSSAI) decided to extend its registration and licensing requirements to manufactured feeds, it stated that the standards set by BIS will be used for the feeds. The Feed Act of the Andhra Pradesh State Aquaculture Development Authority also mostly follows BIS standards.

The standards for aquaculture feeds fall under the Food and Agriculture Committee 12 chaired by Dr. J. K. Jena, Deputy Director General (Fy) of the Indian Council of Agricultural Research. The 14th meeting of the Committee was held on March 24. SAP has been a member in the committee from 2015 when Mr. S. Muthukaruppan was its President. The current President of SAP Dr. Arul Victor Suresh attended the 14th meeting and requested for revisions in the aquaculture feed standards, especially those of the freshwater fish feed, as they are outdated. He also requested formulation of standards for major species like Pangasius that are currently missing. Dr. Jena directed that a task force be created to address the needs. Subsequently, a meeting was held on April 17, which was chaired by Dr. K. Ambasankar of the Central Institute of Brackishwater Aquaculture (CIBA) and more detailed views of the stakeholders were recorded. Written proposals for revised standards were solicited and have been submitted.

3. Announcements

Aqua India 2022

In the meeting of SAP's Executive Committee on April 9, it was resolved that Aqua India 2022, SAP's biennial conference would be held from January 27 to 29, 2022 at Chennai. The theme of the conference would be **"Resilience, Recovery & Resurgence"**. Due to the uncertainties of the pandemic and lockdown, the dates of the meeting are to be reconfirmed in the middle of August.

Aqua Investor Roundtable

The virtual Roundtable bringing together investors, investment facilitators and government agencies to discuss the opportunities and challenges in aquaculture investments, which was to be held by the end of May 2021, has been postponed to a date to be decided later in view of the ongoing Covid-19 pandemic.

ProAqua Lecture Series for Educational Institutions

ProAqua is a lecture series for the benefit of students in aquaculture in leading educational institutions in India. The aim is to take the knowledge and skills of practicing professionals in aquaculture to university level students specializing in aquaculture. The first of the lecture series was to be delivered to the students in the Central Institute of Fisheries Education, Mumbai under the National Agricultural Higher Education Project by the middle of April 2021. The lecture series had a theme of Professional Practice in Aquaculture. In six, 2-hour lectures, every Saturday, key topics related to practices in aquaculture were to be delivered. Just prior to the planned start date, the second wave of Covid-19 pandemic hit the CIFE campus forcing it to close down temporarily. SAP will offer the lecture series when the campus begins to operate again.

4. e-SANTA

Recently SAP was requested by the Hindu Business Line to provide its view on the portal launched by

The Marine Products Export Development Authority (MPEDA) for direct sale of aqua farm products to seafood exporters. The portal is called e-SANTA, the word santa (pronunciation: sŭnta) meaning market in south Indian languages. After studying the idea and its implementation, SAP's president expressed his opinion that e-SANTA is an initiative by MPEDA that should be welcomed by all stakeholders in the shrimp sector. It provides a comprehensive and easy to use tool for shrimp farmers to get fair prices for raising their shrimp in a responsible manner. The built-in registration and crop tracking features make the farming practices transparent and traceable. The transfer of payments from the shrimp exporters directly to the farmers would mean that the farmers will get market prices and in time.

He further said that it is in the interest of all stakeholders in the shrimp sector to learn about e-SANTA and promote it for wider usage. The stakeholders should also be aware that vested interests will try to derail it. Any deficiencies in the system can be corrected as it seems to be based on a robust technology platform. When most of the farmers and exporters use the system, it will be beneficial for the entire Indian shrimp sector. For this purpose, he requested that not just the small and medium farmers who are registered under the National Centre for Sustainable Aquaculture, but all farmers be covered under the scheme.

5. New SAP Members

Chinnadurai Sugumar

Dr. Chinnadurai Sugumar is the Commercial Director for South Asia, EMENA & LATAM for Kemin AquaScience business. He is a qualified animal nutritionist with hands-on experience in Aquaculture. Dr. Sugumar brings with him 17 years of rich experience in the aquaculture and animal feed industry with knowledge of business administration, feed formulation, feed mill, and farm operations. He has been with Kemin Industries since 2007, serving customers in more than 15 countries in South Asia and Asia Pacific countries. From 2007 to 2010 he worked as Product Manager in Kemin India serving customers in India, Bangladesh, Nepal, and Sri Lanka. In 2010, he moved to Kemin Asia based in Singapore as a Product Manager to serve the Asia Pacific market. Between 2010 to 2015, he doubled the business and was nominated for "WW President's Retreat Award" 3 times consecutively. From 2016 to 2017, Sugumar was appointed as "Commercial Lead for Lipid Nutrition" and made Kemin as Market Leader and expert in Lipid Nutrition. In 2018, He was promoted to "Animal Nutrition Platform Manager" for Kemin Asia. From January 2019, Sugumar returned to India to lead Kemin AquaScience business in South Asia based in Chennai. In 2020 he was awarded the "WW Sales Coach award" for his contribution to the Aquaculture business.

Dr. Sugumar is a veterinarian and holds a master's degree in Animal Nutrition from Madras Veterinary College. He completed his Master's in Business Administration and was then awarded a "Certified Marketing Professional" certificate by the Marketing Institute of Singapore and the National University of Singapore. He was a speaker in more than 20 international conferences and more than 10 national level forums. Sugumar has published 5 peer review articles and writes blogs on the LinkedIn page.

T. Geethu Susan Baby

Ms. Geethu Susan Baby started her professional career in the animal health industry with Bayer Pharmaceuticals Private limited in 2017 and is currently working at Elanco India Private Limited as Aqua Product Manager. She did her post-graduation in Sustainable Aquaculture and Management from Nelson Marlborough Institute of Technology, New Zealand (2017). Her dissertation work was done at SPATnz, New Zealand's first greenshell mussel hatchery. She completed her Bachelor degree in Fisheries and Nautical Science from the Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Cochin in 2015, graduating as a rank holder from the Cochin University of Science and Technology (CUSAT).

Anisha V.

Ms. Anisha is one of the first student members of SAP. She is from the Kanyakumari district of Tamil Nadu. She completed her B.F. Sc degree from Tamil Nadu Fisheries University, at Thoothukudi in 2017. She obtained an M.F. Sc degree course (ICAR - CIFE) specializing in Aquatic Animal Health Management in 2019. Developing a passion for the field, she is pursuing a PhD which she will complete in 2022. Her Master's thesis research was on 'Re-engineering of DNA vaccine against *Edwardsiella tarda*'. She is developing an immunodiagnostic method for Tilapia Lake Virus in her Ph.D. research. A nature lover, her extracurricular interests are in visual arts, especially drawing.

Jane Jacob

Ms. Jane Jacob is from Kozhikode, Kerala but spent a large part of her life in Tamil Nadu. After completing her schooling from Hosur, she went on to pursue a B. F. Sc from the Tamil Nadu Fisheries University at the Fisheries College and Research Institute campus in Thoothukudi in 2013-17. She joined the Master's degree program in Aquaculture in ICAR-CIFE, Mumbai in 2017 and graduated in 2019. She entered the PhD program in the same institution in 2019 and is expected to complete it in 2022. Jane Jacob's Master's research was on Integrated Multi Trophic Aquaculture in cages installed in the Dimbhe reservoir at Pune, Maharashtra. She is currently working on developing plant-based products for the bioremediation of aquaculture water.

Her extracurricular interests include public speaking, jogging and playing badminton. She says that the time spent at home during the 2020 lockdown helped her develop an interest in cooking and baking as well.

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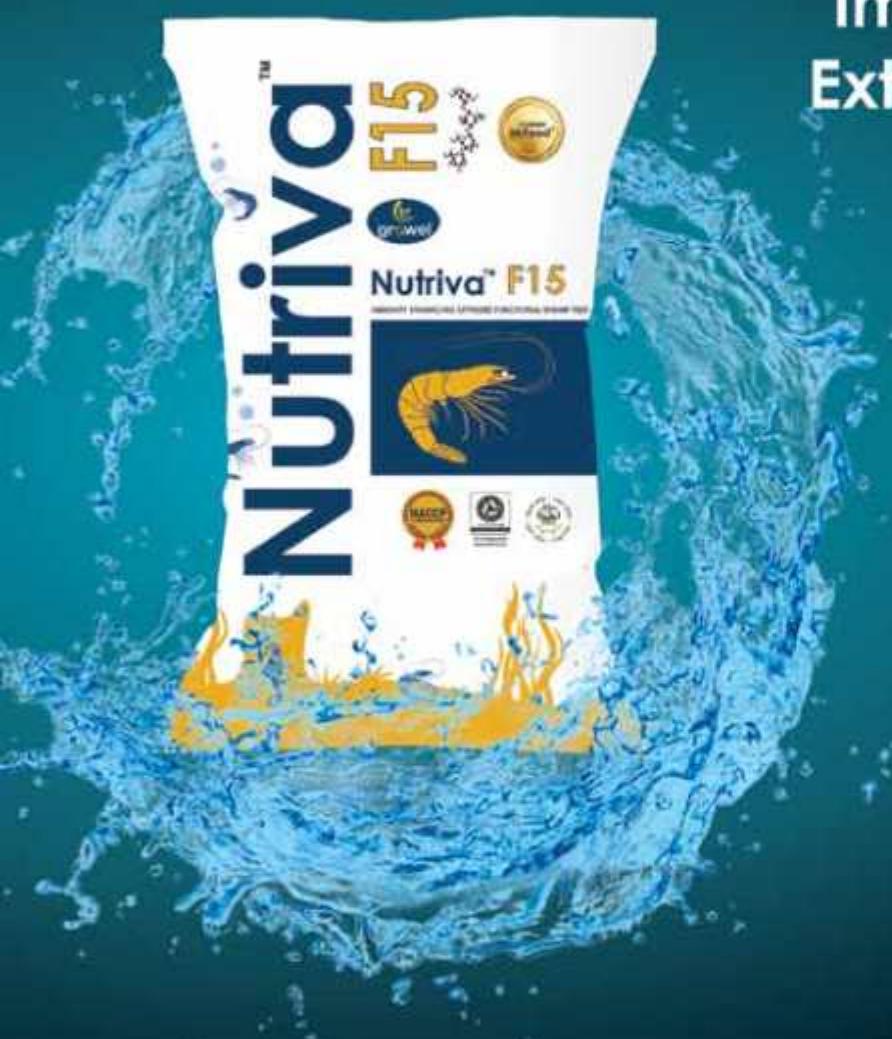

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E-SANTA AN ELECTRONIC MARKET TOOL FOR AQUA FARMERS INAUGURATED

The Union commerce and industry minister, Piyush Goyal on 13 April 2021, inaugurated an Electronic Solution for Augmenting NaCSA farmers' Trade in Aquaculture (e-SANTA), an electronic marketplace providing a platform to connect aqua farmers and the buyers. e-SANTA aims to raise income, lifestyle, self-reliance, quality levels, traceability and provide new options for aqua farmers. The minister, who inaugurated this on a virtual platform, in his address said that e-SANTA would enable the farmers to get a better price for their produce and help the exporters to directly purchase quality products from the farmers enhancing traceability. He added that it would revolutionize traditional aquafarming by providing cashless, contactless and paperless electronic trade platforms between farmers and exporters and also can become an auction platform.

e-SANTA is a completely paperless and an end-to-end electronic trade platform between farmers and exporters. The farmers have the freedom to list their produce and quote their price while the exporters have the freedom to list their requirements and also to choose the products based on their requirements such as desired size, location, harvest dates etc. e-SANTA portal can be accessed through the following link: https://esanta.gov.in/

Source: Current affairs/Swarajya/News Services Division AIR

RESEARCHERS RAISE GRAVE CONCERN OVER WELFARE OF FARMED AQUATIC SPECIES

A group of researchers who found that specialised scientific studies about animal welfare were available for just 84 of the 408 species, systematically examined the scientific knowledge about animal welfare for the entire aquatic animal species being farmed around the world including salmon, carp, and shrimp. Their research revealed that modern aquaculture posed unparalleled animal welfare threats in terms of the global scope and the number of individual animal lives affected. The expansion of aquaculture raised concerns that the industry is moving ahead without sufficient knowledge of the animal life it is growing. The authors emphasised that some aquatic animal species, such as bivalves, may present fewer welfare concerns to begin with and may be a more promising avenue for production.

Source: Fish site

CIFA HOSTS NATIONAL STAKEHOLDER CONSULTATION ON INDIAN ORNAMENTAL FISHERIES

The Central Institute of Freshwater Aquaculture (CIFA) in association with the Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Govt of India (MoFAHD), New Delhi and National Fisheries Development Board (NFDB), Hyderabad organized the National Virtual Consultation on "Indian Ornamental Fisheries 2.0 - The Way Forward" during April 22-24, 2021. The programme was aimed to draw a roadmap for Ornamental Fisheries Development in the country.

The event was inaugurated by Shri. Pratap Sarangi, Minister of State,who called for indigenous manufacturing of aquariums and accessories. Shri. Atul Chaturvedi, Secretary, Department of Fisheries & Animal Husbandry and Dairying, Dr C. Suvarna, CEO, NFDB, Dr J.K. Jena, DDG, Fisheries Science, Dr J. Balaji, Jt. Secretary, DoF, Dr. Saroj Swain, Director, ICAR-CIFA, Dr. Dilip Kumar Former Vice Chancellor, ICAR-CIFE and Dr. V.V. Sugunan, Former ADG, ICAR also spoke during the webinar. Major stakeholders from different key segments of the sector participated in the consultation and shared their respective opinion. The event was steered and guided by the stalwarts, experienced academicians and top policymakers of the sector. The concerns raised by the stakeholders were documented, compiled and subjected to elaborate discussion during the event. A set of draft recommendations were also made, based on the discussions and comments/ suggestions were also welcomed for the same.

Representatives of DoF, MoFAHD presented the PMMS support Schemes for Ornamental Fisheries development. Fisheries experts spoke on 'Enhancing the ornamental fish production and addressing the constraints in marketing' and' Achieving Self-reliance in marketing of Aquarium Accessories'in the technical sessions conducted during the event.

SVR HATCHERIES RECEIVES THE COUNTRY'S FIRST SHAPHARI CERTIFICATION FROM MPEDA

The Marine Products Export Development Authority (MPEDA) has certified SVR Hatcheries, East Godavari District, AndhraPradesh, as the first shrimp hatchery in the country to receive SHAPHARI certification for the production of antibiotic-free seed after successfully completing the mandatory audits. K.S. Srinivas, Chairman, MPEDA, presented the SHAPHARI Certificate to Prathipati Veerabhadra Kumar, Managing Partner of SVR Hatcheries in a virtual programme held on 27 April 2021. Shri. Ramraj, President of All India Shrimp Hatchery Association (AISHA), Shri. Balasubramaniam, Secretary, Indian Prawn Farmers Federation, Dr. Shankar Rao, Joint Director from Department of Fisheries Andhra Pradesh, Shri. K S Pradeep IFS, Secretary MPEDA, Dr. M Karthikeyan, Director MPEDA were the others present during the virtual programme.

The entire process of certification is implemented through a webportal to minimise human errors and to ensure higher credibility and transparency in the scheme implementation. It can be accessed at https://aquacert.mpeda.gov.in

CHILE PROBES DEATH OF TONS OF FISH CAUSED BY ALGAL BLOOM

Chilean authorities in their investigations have found the possible non-compliance by salmon farms that may have led to one of the country's deadliest algal blooms in five years. The bloom has so far killed more than 6,000 metric tons of fish kept in cages along southern Chilean fjord. Though the kill was worrying, it's far less than the 40,000 tons lost in a 2016 bloom. While there can be other contributing factors to the bloom such as low rainfall, deforestation and wastewater from towns, aquaculture is one of the main nutrient producers.

Some 18 salmon farms in the south of Chile, which produces around 26 per cent of the world's salmon, have been affected. It's the latest mass mortality event recorded in the world's second largest producer of salmon.

Source; The Straits Times, Bloomberg and The Hindu

INDIA EMBARKS ON CERTIFICATION OF SHRIMP FARMS AND HATCHERIES

The Indian government has kicked off a new scheme to certify shrimp hatcheries and farms that adopted good aquaculture practices. The objective of this scheme (Shaphari) developed by MPEDA was to instil confidence in India's frozen shrimp produce as export was badly hit in recent months due to rejection of seafood consignments containing antibiotics, container shortages and other factors. The certification was proposed as a market-based tool for hatcheries to adopt good aquaculture practices and help produce quality antibiotic-free shrimp products to assure global consumers.

The Shaphari scheme is based on the United Nations' Food and Agriculture Organization's technical guidelines on aquaculture certification and will have two components – certifying hatcheries for the quality of their seeds and, separately, approving shrimp farms that adopt the requisite good practices. The certification process of hatcheries would be online to minimise human errors and ensure higher credibility and transparency that in turn would help farmers easily identify good quality seed producers. Those who successfully clear multiple audits of their operations shall be granted a certificate for a period of two years. On the whole certified aquaculture products will help exporters to export their consignments to markets under stringent food safety regulations without the fear of getting rejected. The guidelines for certification of farms are under preparation in consultation with stakeholders.

Source: TOI

XELECT
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XELECT LAUNCHES GENEXPERTISE SERVICE FOR TROUT PRODUCERS

Xelect, the company that provides genetic solutions for aquaculture launched a new service for trout breeders called as GeneXpertise on 13 April, 2021. The service is a one-stop genetic broodstock health check for trout producers. The customers would get advice on best genetic practices, a detailed report on the genetic health of their trout population along with guidance on which crosses to avoid and which to make. Prof Ian Johnston CEO of Xelect said that experts would help the customers to develop the trout's genetics roadmap and set the course for years to come. The genetic health and selection suitability of broodstock population will be checked and direct recommendations for the next stripping season will be provided. According to Dr. Tom Ashton, Xelect Director of Operations, GeneXpertise is a very cost-effective way to give broodstock a boost. Though it's clearly not a replacement for full breeding programme services, it allows many producers access to a highly specialised team of experts at the scale that's right for them. The service is really quick – just a few weeks from start to finish.

Xelect have also developed a free online 2 Minute Broodstock Genetic Health Check to help business owners get a sense of how they are doing, and what they should look out for. Full details of GeneXpertise can be found on their website at www.xelectgenetics.com/genexpertise/.

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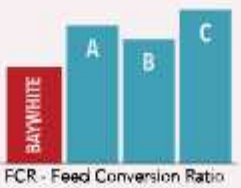

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CIBA DEVELOPS INDIGENOUS FISH VACCINE FOR VIRAL NERVOUS NECROSIS (VNN)

The Central Institute of Brackishwater Aquaculture (CIBA) in Chennai has developed an indigenous vaccine for viral nervous necrosis (VNN), that affects several fish species. The recombinant VNN vaccine, CIBA-Nodavac®was released by Dr. J.K. Jena, Deputy Director General (Fisheries), ICAR in the presence of Dr. S. K. Chaudhari, Deputy Director General (NRM), ICAR and Dr. V. K. Singh, Director, CRIDA in a virtual event held on 27 April, 2021. The vaccine developed by Dr. K.K.Vijayan, Director, CIBA and his team will help to prevent VNN in fish hatcheries and bring down the incidence of VNN in grow-out farms. Dr. M. Makesh, principal investigator of the project explained that the vaccine is safe, efficacious and can be injected to all species of fingerlings and adults susceptible to VNN such as milkfish, grey mullet, mangrove red snapper etc. and prevent vertical transmission in brooders.

Viral nervous necrosis (VNN) is a serious viral disease affecting many marine, brackishwater and freshwater fish causing up to 100% mortality in larval and early juvenile stages. The disease is caused by nervous necrosis virus (NNV). Red-spotted grouper nervous necrosis virus (RGNNV) is the only genotype prevalent in India and most other tropical countries. The disease is transmitted both vertically and horizontally. Infected adults remain as carriers and transmit the virus to offsprings through eggs.

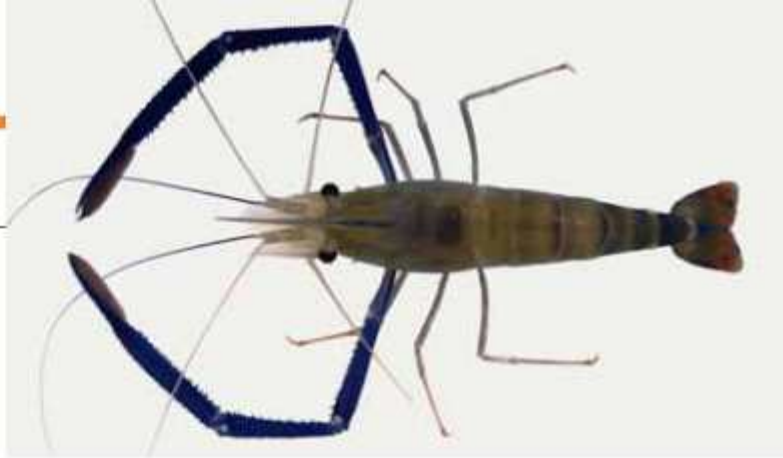
Source:The Hindu/CIBA

TWO NEW NATIVE SPECIES OF SEAWEEDS DISCOVERED IN GUJARAT, DIU AND TAMIL NADU

Marine biologists from Central University of Punjab, Bathinda discovered two new species of seaweed - *Hypnea indica* (after India) and *Hypnea bullata* (after blister like marks on its body). *Hypnea indica* was discovered in Kanyakumari, Tamil Nadu, Somnath Pathan and Sivrajpur in, Gujarat while *Hypnea bullata* was discovered from Kanyakumari and Diu island of Daman and Diu. The research team used an approach combining morphology-based traditional techniques with DNA Sequence-based modern tools for formalizing the species.

The discovery of this two species has been recorded in the journal Botanica Marina. Species of Hypnea contain the biomolecule carrageenan, which is widely used in the food Industry and suggests good prospects for their cultivation in the west and south east coasts of India.

Source: TOI



CIFA TO POPULARISE 'GENETICALLY IMPROVED AND FAST-GROWING STRAIN OF SCAMPI'

The Central Institute of Freshwater Aquaculture had planned on conducting a National Awareness Program on 'Genetically improved and fast-growing strain of freshwater prawn 'CIFA GI Scampi' for higher production and income during May 2021. However, the same has been postponed in view of the lockdown imposed during period for the second wave of the Covid-19 pandemic.

The programme envisaged to create awareness about the 'CIFA GI Scampi' and partner with the potential state fisheries departments in disseminating the improved strain. The major reasons for initiating this program were due to reduction in economic returns from scampi farming, forcing farmers to shift to other fish species such as carps, pangasius, and shrimp (vannamei) or to agriculture; and the lack of availability of quality seeds for stocking. The program is expected to create the much-needed awareness about CIFA GI Scampi' and would serve as a platform to bring out the views of different stakeholders in reviving the scampi farming in India; A road map for disseminating fast growing 'CIFA GI Scampi' would be drafted with the help of potential government/private stakeholders which would also result in boosting carp-scampi polyculture, establishment of scampi brood banks, linking up brood bank, hatcheries, farmers and finally the traders/exporters; and a holistic approach of ensuring supply of quality scampi seed to the farmers would be the outcome to achieve the goals of PMMSY.

The'CIFA GI Scampi'developed by CIFA through years of selective breeding has shown good performance in grow-out ponds with average daily growth of 0.26g/day which was significantly higher than that of farmer's stock (0.17g/day). The financial support available under the Pradhan Mantri Matsya Sampada Yojana (PMMSY)is expected to boost revival of Scampi farming in the country.

The awareness programme proposed to discuss and arrive at a strategy on : Best possible plan for dissemination of genetically improved and fast growing CIFA GI Scampi; Role of state fisheries department in identifying interested farmers and creating awareness about the PMMSY scheme for scampi farming; Creation of satellite breeding centres for scampi in private sector; Establishment of state level scampi brood banks in coastal states for ensuring supply of high quality scampi brooders to hatchery; Revival of scampi hatcheries for seed production; Linking of farmers to the approved hatcheries; Promotion of carp-scampi polyculture in existing carp ponds in all potential states and Role of traders/exporters for ensuring ease, timely and lucrative marketing.

CIBA AND 'WELLGROW FEEDS' TIE UP FOR ESTABLISHING SMALL SCALE INTEGRATED FEED MILL

The Central Institute of Brackish water (CIBA) and "Wellgrow Feeds', Kannur, Kerala signed a MoU on 24th March, 2021, at CIBA, HQ, Chennai to establish an integrated feed mill to process indigenous formulated, functional and grow-out feeds used for farmed species in the West coast. The integrated feed mill initiative is the first of its kind in west coast and would be a boon for small and medium farmers in the region.

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UPCOMING AQUACULTURE EVENTS

AQUACULTURE AMERICA 2021
Date: 11 – 14 August 2021
Location: San Antonio Marriott Rivercenter, San Antonio, Texas, USA

AQUACULTURE CANADA and WAS NORTH AMERICA 2021
Date: 26 - 29 Sep 2021
Location: St. John's Convention Centre, St. John's, Newfoundland, Canada

AQUACULTURE EUROPE 2021 OCEANS OF OPPORTUNITY
Date: 04 – 07 Oct 2021
Location: Madeira, Portugal

WORLD AQUACULTURE
Date: 15 – 19 Nov 2021
Location: Mérida, Mexico

WORLD AQUACULTURE 2020
Date: 05 – 08 Dec 2021
Location: Singapore

AQUACULTURE AFRICA 2020
Date: 11 – 14 Dec 2021
Location: Alexandria, Egypt

AQUACULTURE 2022
Date: 27 Feb – 3 Mar 2022
Location: Town & Country Resort & Convention Center , San Diego, California USA

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