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Inside ...

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Fish should be treated separately and develop it like it is done for Shrimp culture

Its time for APSADA to Develop, Sustain, Promote and Regulate Aquaculture and Aquaculture Business Operations in Andhra Pradesh

Pond preparation includes several activities that must be carried out before each subsequent crop. There is a huge amount of organic matter accumulation in pond bottom during culture period. These sediments should be removed and treated after every crop. In the pond preparation several steps are involved like drying, tilling, ploughing and soil enrichment by using essential nutrients. The main purpose of ploughing / tilling during the pond preparation is to allow the oxygen to penetrate the bottom of pond and accumulated waste. Ploughing helps soil to absorb more oxygen and oxidize the organic matter in the soil.

Dear Readers,

The May 2025 issue of Aqua International is in your hands. In the news section, you may find news about....

The stakeholders of **fish** culture segment of aquaculture sector feel that fish is not given importance like **shrimp** by the Government at state and central level. They feel that **fish** should be treated separately and develop it like it is been done for **shrimp** culture. It seems there is no separate officer from the Government to educate and to bring awareness among **fish** farmers and to serve **fish** segment of aquaculture sector although Andhra Pradesh is the leading state for fish production. There is a need of further promoting production of variety of fishes and their consumption in the country.

Though the Government of Andhra Pradesh pursuant to the enactment of Andhra Pradesh State Aquaculture Development Authority Act, 2020, these Rules are framed with the objective of enabling the APSADA to develop, sustain, promote and regulate Aquaculture and Aquaculture Business Operations in the state of Andhra Pradesh, its crucial time that APSADA should do effective functioning to fulfil its objectives.

Seaweed farming a game-changer for both economy and environment. Seaweed farming is becoming more popular along India's long coastline. It's creating new income opportunities for coastal communities while also helping protect the environment. Unlike earlier times, more people living along the coast are now turning to this sustainable practice. Marine experts and government agencies are actively promoting seaweed farming as a win-win for both the economy and nature. Dr Grinson George, Director of the ICAR-Central Marine Fisheries Research Institute (CMFRI), said that seaweed farming has strong business potential. He explained that with global demand rising and research showing many benefits, seaweed farming is a great opportunity. The global seaweed market was worth $16.5 billion in 2022. With its long coastline, India is in a good position to benefit from this growing market. CMFRI has developed farming methods like the Integrated Multi-Trophic Aquaculture (IMTA) system, which combines seaweed farming with sea cage fish farming. This method has helped farmers increase their harvests and income. Growing seaweed types like Kappaphycus has proven to be profitable, especially when used in these integrated systems. What's needed to grow the industry is to scale up seaweed farming. There's a need for strong coastal leasing policies and a solid mariculture (marine farming) framework. These will attract investments and help the industry grow faster. Other important steps include: Setting up seed banks and micro-propagation centres to ensure a steady supply of good quality seedlings. Investing in research and development to improve seaweed types and farming methods. Expanding offshore farming. Building stronger supply chains.

Small but mighty: Why bigger isn't always better when farming Tilapia ? Following on from previous research into the viability of mixed-sex tilapia production as an alternative to the commercial norm of monosex cultures, researchers from the University of Stirling's Institute of

Contd on next page

NRS GROUP
Aqua International

Our Mission

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

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

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

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

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

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Aquaculture recently examined the importance of access to smaller, more affordable tilapia for low-income communities in Southeast Asia and Africa. As they note, while initially hailed as an ideal candidate for small-scale subsistence farming, the attitude towards tilapia farming has radically changed over the last 60 years. Production has become increasingly technical and driven by rapid urbanisation and the growth of the middle classes in Africa and Southeast Asia, the demand for larger fish encouraged a shift towards greater commercialisation and monosex farming practices.

Tilapia are easy to produce in simple systems with minimal feed inputs and can become an almost self-replicating subsistence form of food. I think this was an idea that was quite powerful in its time and took off across large areas, but it fell slightly by the wayside as people realised that that type of aquaculture production didn't stimulate much in the way of economic change, explains Dave Little, Professor of Aquatic Resources and Development at the University of Stirling. The fact is that what we have seen casting back over 50 years, it's not really been subsistence-orientated aquaculture that's made big strides in the volumes we see around the world. It's people producing fish for money, he explains.

With exports hit, aqua farmers in Andhra Pradesh turn to domestic markets to sell produce. Huge quantity of shrimp and other seafood products were seen in the markets. At some places, aqua farmers were seen selling the produce directly to avoid losses. In some districts, farmers reportedly sold the stocks to middlemen, who in turn sold them in the local markets at a lesser price. The price of 80-count shrimp was sold at prices ranging between ₹180 and ₹200 per kg, while the 60 to 70 count variety was fetching between ₹225 and ₹250 in the market, said K. Srivalli, a consumer who visited the fish market in Vijayawada. As exports to the U.S. have stopped, there has been a fall in prices in first fortnight of April 2025 with a cascading effect in the local markets as well, said Adinarayana, a vendor.

Aquaculture for feeding the world. India has made impressive gains in adapting aquaculture for the nutritional demands of its population. It is the third largest producer overall, ranking second in the production of prawns. Andhra Pradesh is by far the largest producer with West Bengal, Tamil Nadu and Odisha making sizeable contributions along with Gujarat. Dietary preferences, too, have changed prawns, with their high protein and low fat content, are increasingly in demand both domestically and in the export market. Our aquaculture farms are supported by a network of industries that meet their many requirements, from aqua feed to measures for infection control. Farmers and local entrepreneurs constantly strive to come up with innovative measures that improve the quantity and quality of yield and meet climate change induced environmental challenges.

JAPFA Comfeed India Pvt Ltd launched its Shrimp and Fish feed on 4 April 2025 at an inaugural function held in Bhimavaram, Andhra Pradesh. The company has Vannamei Feed Premium Sinking Fish Feed, Floating Fish Feed, Lyculture Feed and Mash Fish Feed. Mr Ardi Budiono, President and Head of Aquaculture division of JAPFA Group was present on the occasion from Indonesia for the launch of the feed in India. Mr Amiya Dharmapada Nath, Vice President, JAPFA Comfeed India Pvt Ltd said that JAPFA is using advanced feed manufacturing technology for Shrimp and Fish feed. JAPFA Comfeed entered into India in 1996 with supply of feed for poultry and cattle sectors with its head quarter at Pune, Maharashtra. The global headquarters of Japfa Comfeed, a major agribusiness company, is located in Singapore, while its origins and primary operations are in Indonesia as PT Japfa Comfeed Indonesia Tbk.

Biomed Aqua Care Pvt Ltd, a prominent aquaculture healthcare products manufacturing company at Vijayawada inaugurated its new production facilities at Tempalli in Krishna District, Andhra Pradesh. Deputy Speaker of Andhra Pradesh Legislative Assembly Mr Raghu Rama Krishnam Raju inaugurated the newly built facilities on 2 April 2025. Biomed has 35 products, 430 dealers and about 100 team members providing sales and technical services in the country. Its managing director P.V. Krishnam Raju said that, his company works with principles for a sustainable growth in aquaculture sector.

In the Articles section, article titled **"Next-Gen Aquaculture: Combating Vibrio with Smart Diagnostics and Microbial Allies"**, authored by Dr Rahul G. Warke, Dr Gangadhar M. Warke, Ms Milan Satardekar, Ms Chitra Adhangale, Dr Girish B. Mahajan, "Vibriosis has become a challenge for the growth of aquaculture industry, and overall disease outbreaks in the sector cause over USD 9 billion losses annually. They lower survival rates, especially in shrimps and finfish. Sustainable solutions include probiotics and advanced diagnostics like PCR, LAMP and Chromogenic media. New media such as HiCrome Vibrio Agar enable rapid, accurate detection—crucial for early intervention, biosecurity and farm resilience". According to the Food and Agriculture Organization (FAO) - 2024 report, global aquaculture production surpassed wild fisheries for the first time in 2022 reaching a record 130.9 million tons. With 89% of aquatic animal production used for direct human consumption and are a key nutrition source, the sector plays a critical role in combating malnutrition. FAO projects a 10% increase in aquatic animal production by 2032, reaching 205 million tons, and thus highlights the need to boost sustainable practices particularly through its Blue Transformation strategy to meet future nutritional demands and ensure food security by 2050.

Another article titled, **"Pond preparation Methods for Successful Aqua farming"** authored by Mr Vinoth Kumar, Skretting India, Shrimp farming in India started since mid 80s which is well established in costal districts of Andhra Pradesh, Tamil Nadu, Gujarat, Maharashtra, Odisha, West Bengal and other states of India. The white leg shrimp (L. vannamei) is the most farmed species since 2012. India has a long coast line of 8848 kms as well as good water resource (rivers, lakes) which helps us to produce more than 8.5 L MT shrimp, 2 Mn MT fish annually. Best management practices (BMPs) for shrimp farming are a standardized set of farming practices to ensure the environmental and financial sustainability of shrimp farming systems. Pond preparation includes several activities that must be carried out before each subsequent crop. There is a huge amount of organic matter accumulation in pond bottom during culture period. These sediments should be removed and treated after every crop. In the pond preparation several steps are involved like drying, tilling, ploughing and soil enrichment by using essential nutrients.

Readers are invited to send their views and comments on the news, special feature and articles published in the magazine which would be published under "Readers Column". Time to time, we shall try to update you on various aspects of Aquaculture sector. Keep reading the magazine Aqua International regularly and update yourself. Wish you all fruitful results in your efforts.

M.A.Nazeer
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UNI-LIGHT PSB Funtion:

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- Inhibit the growth of *Vibrio* spp.
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BSL Dosage:

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

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

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Seaweed farming, a game changer for both Economy and Environment

Seaweed farming is becoming more popular along India's long coastline. It's creating new income opportunities for coastal communities while also helping protect the environment. Unlike earlier times, more people living along the coast are now turning to this sustainable practice. Marine experts and government agencies are actively promoting seaweed farming as a win-win for both the economy and nature.

Dr Grinson George, Director of the ICAR-Central Marine Fisheries Research Institute (CMFRI), said that Seaweed farming has strong business potential. "With global demand rising and research showing many benefits, Seaweed farming is a great opportunity," he explained. "The global seaweed market was worth $16.5 billion in 2022. With

its long coastline, India is in a good position to benefit from this growing market."

CMFRI has developed farming methods like the **Integrated Multi-Trophic Aquaculture (IMTA)** system, which combines seaweed farming with sea cage fish farming. This method has helped farmers increase their harvests and income. Growing Seaweed types like *Kappaphycus* has proven to be profitable, especially when used in these integrated systems.

"Blue Gold" of the Sea

Dr George called seaweed farming "Blue Gold" because it provides a steady income and reduces the pressure on marine life caused by traditional fishing. He also mentioned that forming **fish farmer producer companies** could give local farmers better market access and fair prices.

Seaweed is used in many industries, such as food, cosmetics and medicine, which opens up many market opportunities. CMFRI's research has also shown that Indian seaweeds can be used to create **nutraceuticals**—natural products that support health - meeting the rising demand for eco-friendly health solutions.

Seaweed also helps the planet by absorbing carbon and reducing methane emissions, making it an important tool in the fight against climate change.

What's Needed to Grow the Industry

To scale up seaweed farming, Dr George said there's a need for strong **coastal leasing policies** and a solid **mariculture (marine farming) framework**. These will attract investments and help the industry grow faster.

Other important steps include:

- Setting up **seed banks** and **micro-propagation centers** to ensure a steady supply of good quality seedlings
- Investing in **research and development** to improve seaweed types and farming methods
- Expanding **offshore farming**
- Building stronger **supply chains**
- Creating and promoting **value-added seaweed products**

With the right support, Seaweed farming can continue to grow and become a major source of income and environmental protection for India's coastal areas.

Stakeholders discuss about aquaculture development in A.P. Fisheries Commissioner office at Vijayawada

A meeting of Shrimp farmers, leading entrepreneurs of Aquaculture sector in Andhra Pradesh was held in the office of the Commissioner of Fisheries, Govt of Andhra Pradesh in Vijayawada which was chaired by Mr Raghu Rama Krishnam Raju, Deputy Speaker of Andhra Pradesh Legislative Assembly, to discuss about promoting domestic shrimp consumption. APSADA Chairman Anam Venkataramana Reddy and Commissioner of Fisheries, Department of Fisheries, Mr Rama Sankar Naik, other officials, exporters and farmers participated.

Mr Chitturi Suresh, MD, Srinivasa Farms Pvt Ltd, gave his views how poultry sector got benefited to promote egg and chicken consumption with promotional activities in

the country.

Mr B. Masthan Rao, Member of Parliament, Rajya Sabha and MD, BMR Group and others shared their views to promote domestic shrimp consumption and to safeguard the interests of aquaculture sector.

Small but mighty: Why bigger isn't always better when farming Tilapia

Although the commercial aquaculture industry tends to favour the production of large tilapia, some industry analysts argue that it's time for a renaissance of smaller fish, which remain important for food security, especially among low-income groups.

Small tilapia tend to be more affordable on a gram to gram basis than big ones. They also tend to be quicker and easier to produce

Following on from previous research into the viability of mixed-sex tilapia production as an alternative to the commercial norm of monosex cultures, researchers from the University of Stirling's Institute of Aquaculture recently examined the importance of access to smaller, more affordable tilapia for low-income communities in Southeast Asia and Africa.

As they note, while initially hailed as an ideal candidate for small-scale subsistence farming, the attitude towards tilapia farming has radically changed over the last 60 years. Production has become increasingly technical and, driven by rapid urbanisation and the growth of the middle classes in Africa and Southeast Asia, the demand for larger fish encouraged a shift towards greater commercialisation and monosex farming practices.

"Tilapia are easy to produce in simple systems with minimal feed inputs and can become an almost self-replicating subsistence form of food. I think this was an idea that was quite powerful in its time and took off across large areas, but it fell slightly by the wayside as people realised that that type of aquaculture production didn't stimulate much in the way of economic change," explains Dave Little, Professor of aquatic resources and development at the University of Stirling.

"The fact is that what we've seen casting back over 50 years, it's not really been subsistence-orientated aquaculture that's made big strides in the volumes we see around the world. It's people producing fish for money," he explains.

The demand for small fish persists

Despite this culture shift resulting in an increased demand for larger, more expensive tilapia, the importance of smaller fish remains for the many people who rely on access to this affordable protein and nutrient-rich food.

"Even in countries where tilapia are [mainly wild caught], such as in Sri Lanka, people may say they want to eat large fish, and if you ask a Sri Lankan in a rural area of the northwest where we did quite a lot of research, they'll say 'yeah, I want a large fish,' but when they put their hand in their pocket, they end up buying smaller fish because that's what they can afford and that's what the artisanal fisheries could provide very, very cheaply," Little explains.

This continued demand for small, affordable tilapia highlights a significant drawback in the widespread adoption of monosex farming practices, which tend to be geared towards the production of large, and therefore more expensive, fish.

Simultaneously, Little's anecdote suggests the value of mixed-sex farming practices, which produce smaller females in addition to larger males, and so can provide poorer consumers with a stable and secure source of food, while also

meeting the demands of other demographics.

Alexander Kaminski, another aquaculture researcher at the University of Stirling, reports similar experiences of consumer preferences differing from producer perceptions in Zambia, where he has investigated the importance of smallholder fish farming as a route to bolstering food security.

"I think everyone just assumes the bigger the better. But no one's really done that analysis to ask who's actually using the fish," he observes.

Big players go small

The impacts of the move towards large-scale, often monosex, farming practices affect more than just the end consumer, as they can also have consequences in other parts of the supply chain. Looking back on his PhD days, when he was involved in the establishment of monosex tilapia hatcheries in Thailand, Little explains the – often exclusionary – nature of these practices.

"I think that the point of inclusive value chains is really important because what we quickly realised when we were setting up joint ventures for monosex hatcheries during the mid-1980s was that these required very large investments. It meant the exclusion of people who until that time had made a business out of producing mixed sex tilapias quite competently and of quite good quality," Little reflects.

In light of this, it could be expected that a return to traditional farming methods, driven by the demand for smaller fish, would favour medium and small-scale producers. Interestingly, this has not been the case, and while the shift towards monosex tilapia favoured large commercial producers over small-scale farmers, it is also these large industry players who are exploring the viability of a return to mixed-sex production, in order to meet the demands of a now underserved demographic.

"I think in Kenya we see something a little bit different. We see Victory Farms starting to produce smaller tilapia, and they said this came about during Covid, when they were just trying to sell fish a bit more locally and realised there was this huge untapped market for these smaller fish," says Alexandra Pounds, a colleague of Little and Kaminski, who researches the importance of small-scale rural fisheries and aquaculture for meeting the food security and nutritional needs of poor communities.

While monosex tilapia farms still tend to beat mixed sex culture in terms of profit margins, this provision of smaller fish by large commercial players could still be a viable strategy, says Kaminski, depending on the goals of a given company. Or perhaps this is simply a method best left to medium- and small-scale producers, who can still provide affordable and accessible food to those who need it.

"The [monosex system] was still the best in terms of margins, but again it comes back to what farmers would like to do. So yes, it's about focusing on the end users but also looping back and getting more information from farmers to try to see which system matches what they want to do and their financial needs," Kaminski says.

Here Kaminski, along with his fellow researchers, highlights the significant knowledge gaps present concerning tilapia farming in Africa and Southeast Asia, where the industry is often a significant pillar of food security. The demand for small tilapia undeniably exists, as it has since the beginning of the industry, but how it will be met in the modern climate, which differs significantly from that of 50 years ago, remains to be seen.

With exports hit, aqua farmers in Andhra Pradesh turn to domestic markets to sell produce

Huge stocks of seafood is up for grabs as prices plummet following tariff hike imposed by the U.S.

Vijayawada, April 07, 2025: Huge quantity of shrimp and other seafood products were seen in the markets on Sunday. At some places, aqua farmers were seen selling the produce directly to avoid losses.

A trader selling shrimp and other seafood at a fish market in Vijayawada on Sunday.

In some districts, farmers reportedly sold the stocks to middlemen, who in turn sold them in the local markets at a lesser price.

"The price of 80-count shrimp is sold at prices ranging between ₹180 and ₹200 per kg, while the 60-70 count variety is fetching between ₹225 and ₹250 in the market," said K. Srivalli, a consumer who visited the fish market in Vijayawada.

"As exports to the U.S. have stopped, there has been a fall in prices for the last three days with a cascading effect in the local markets as well," said Adinarayana, a vendor

Traders were seen selling prawns, crabs and other seafood varieties, which arrived from different places, in the local markets at low prices. Similar situation prevailed in Eluru, Bhimavaram, Narsapuram, Machilipatnam, Avanigadda and other places.

"I raised Vannamei in about four acres and I am ready to harvest the crop. But due to the rise in duty, exports from Andhra Pradesh are badly hit and the prices declined causing huge losses," said a farmer, Srikanth, of Eluru district.

"We cannot store the produce for a long time. But due to the developments in the

international market, exports have been stoppped, creating panic among the farmers and the exporters in the State," said an export agent.

Aquaculture for feeding the world

Prawns require 10-25 grams of salts per litre of water.

India has made impressive gains in adapting aquaculture for the nutritional demands of its population. It is the third largest producer overall, ranking second in the production of prawns. Andhra Pradesh is by far the largest producer, with West Bengal, Tamil Nadu, and Odisha making sizeable contributions along with Gujarat.

Dietary preferences, too, have changed prawns, with their high protein and low fat content, are increasingly in demand both domestically and in the export market. Our aquaculture farms are supported by a network of industries that meet their many requirements, from aquafeed to measures for infection control. Farmers and local entrepreneurs constantly strive to come up with innovative measures that improve the quantity and quality of yield and meet climate change-induced environmental challenges.

The terms prawn and shrimp are often used interchangeably, although they are biologically distinct species. A prized pro-duct is the black tiger prawn, Penaeus monodon. This high-value marine species is grown wherever the conditions are right, and farmers strive to achieve the market-driven demand for 30 or less prawns per kilogram. Like many other aquaculture species, these prawns re-quire a degree of salinity in their pond water: 10-25 grams of salts per litre of water is optimal (sea water has 35 grams of salts per litre).

In low-lying farms, such as in the Midnapore district of West Bengal, seawater is brought into aquaculture ponds during high tide. In coastal Andhra Pradesh and in other places, the groundwater is brackish and is pumped out and mixed with fresh water from rivers and canals.

A typical aquaculture pond is about 150 x 100 metres in size, with a depth of about two metres. After each production cycle of four-six months, the pond is dried in prepare water is emptied, and the for the next harvest. An enterprising farmer, Siva Rama Rudraraju of Bapatla district in Andhra Pradesh, has successfully advocated smaller ponds for better yields of prawns along with better control of pathogens. Smaller ponds help in containing eco nomic losses when disease outbreaks occur, and bac terial pathogens such as Vibrio harveyi are a serious threat. In India, annual losses can amount to 25% of the expected yield. The white spot syndrome virus can be even more damaging in outbreak years.

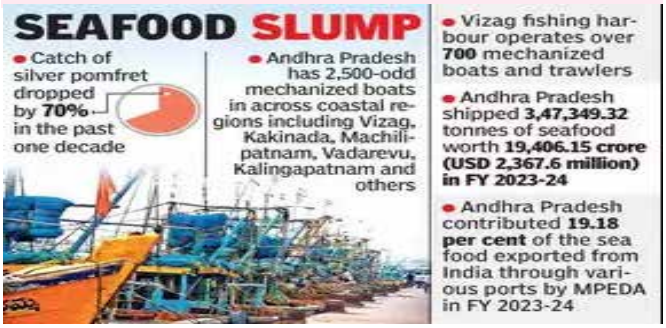
Many laboratories now offer tests for identifying infectious agents, and an infected pond is quickly emptied. However, farmers fear the spread of the pathogens to fearby ponds. Crows are usually fected prawns and drop the culprits, carrying in home. Plastic nets are of ping them as they fly ten used to cover ponds. Sometimes, hunters are employed to cull the crow population.

Our farmers adopted ing pathogens. Probiotics are added to the pond wa-ter. These are Bacillus bacteria that do not harm the prawn but grow faster than the pathogenic species, outcompeting them.

Another clever strategy seryreared prawns that are used as juvenile starters in prawn
cultivation. The Central Institute of Brackishwater Aquaculture (ICAR-CIBA) in Chen-nai has pioneered the development of 'specific pathogen-free prawn broodstock. Grown in biosecure facilities, these are certified to be free of specific high-risk therapy uses bacterioph pathogens. And 'phage brio bacteria. Bacterioph ages that only target Vi ages are viruses that infect and kill bacteria.

Whether developed in the field by experienced driven initiatives, all these farmers or from research-measures have led to a 17% growth rate in India's nual prawn production.

Rising costs, low catch hit Andhra Pradesh's fishing industry hard



Visakhapatnam, March 16, 2025: The fishing industry along the Andhra Pradesh coast is facing a severe crisis, with over 80% of mechanized fishing boats anchored at harbors due to low catch and high operational costs.

A 61-day ban on marine fishing, encompassing all registered mechanized and motorized fishing vessels, is set to begin on April 15 and last until June 14 in Andhra Pradesh. However, most boats have already stopped fishing activities.

According to Satyanarayana Suraida, general secretary of the Visakha Dolphin Boat Operators Welfare Association, the catch of popular fish varieties like silver pomfret and seer fish has declined by 50-60%. This has led to a significant increase in prices, with silver pomfret prices rising by 25-35%.

Due to low catch and low price for prawn, most of the fishing boat operators in Vizag region are incurring losses. Exporters are more focused on Indian farmed Vannamei shrimp, which has demand in other states and abroad. If we get at least Rs 500 or above per kg of brown, white and flower prawn varieties, we will get some profits, Satyanarayana added.

The main reasons for the decline in fishing activities are the escalating cost of diesel and labor charges. Fishermen are struggling to venture deeper into the sea due to insufficient fuel, ice, and other essential commodities. The operational expenses, including labor costs, have surged by 15-25 percent, making it economically unviable for fishing boat operators.

A total of 2,500 mechanised fishing vessels operate across various coastal regions of the state (Vizag, Kakinada, Machilipatnam, Vadarevu, Kalingapatnam and others). Diesel remains a crucial component for the fishing industry to operate fishing boats. Whilst venturing into deep waters to secure substantial catches, fishermen must ensure sufficient diesel reserves (exceeding 8,000 litres), ice, salt, and other vital provisions. The operational expenses, including labour costs, have surged by 15 to 25 percent, rendering such expeditions economically unviable for us, the fishing boat operators said.

Trump blows cost of shrimp

The price of a kilo fell to Rs 40 within hours
Impact on aqua sector In West Godavari District

Bhimavaram, 4 April: The latest decision of US President Donald Trump is not going well for the aqua sector which is struggling due to diseases on one side, falling prices and investment costs on the other. With the increase of foreign duty in America on shrimps imported from India, the respective counts within hours.

Accordingly, the prices of prawns have fallen. In West Godavari district, the price has fallen to a maximum of Rs.40 per kg. Prawns are the third most exported meat products from India. The lion's share of aqua products are exported from West Godavari district in AP. Prawns are cultivated in 1.20 lakh acres in the district. Annual production is 4 lakh tonnes and 3.5 lakh tons are being sent abroad. Out of the total business of Rs.18 thousand crores, foreign transactions are the majority. All the tariffs imposed by Trump came into force from Wednesday, and the impact was on the aqua products here. On Wednesday, the price of 100-count shrimp was Rs.240 per kg, but on Thursday it was reduced to Rs.200. Usually only 40, 30, 20 count shrimp are exported to America. However, on the pretext of retaliatory duty, on all counts a maximum of Rs. Reduced to 30-40. Farmers complained that there was no purchase in some places and traders did not come forward. Not only on the cultivators. Traders say it will also affect the employment of laborers who depend on the aqua sector.

Heartfelt Condolences

Dr Santhanakrishnan, Former Joint Director, MPEDA, is no more.

Dr Santhanakrishnan was a part of the team of MPEDA that was responsible for promotion of Shrimp farming in India under T.K. Nair, the then Chairman of MPEDA. As Joint Director and later as Secretary of MPEDA, he was actively promoting Aquaculture and defending Shrimp farming in the Supreme Court case, said a farmer. I still remember, in early 90s so many Shrimp hatcheries and farms availed subsidies with the effort of Dr Santhanakrishnan. Even I also availed Rs 6 lakhs subsidy for my project, Rs 6 lakhs was very big amount that time. Great soul may rest in peace.

- Said two Hatchery owners

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- ***Vibrio alginolyticus***
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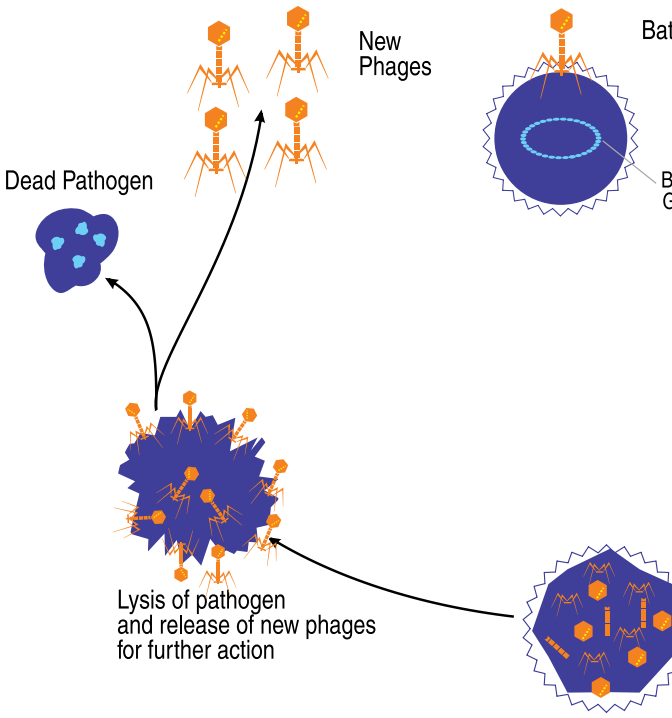

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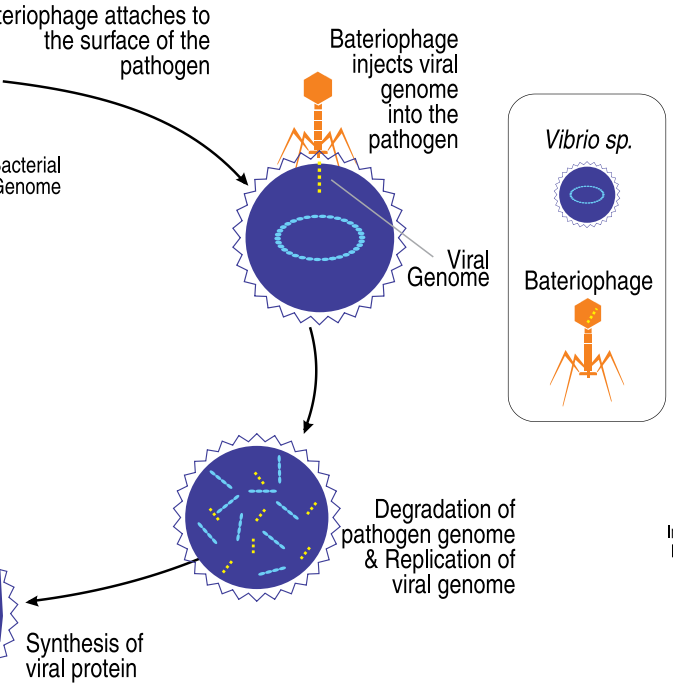

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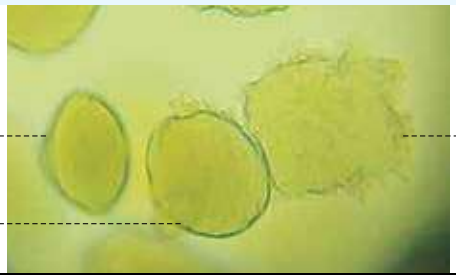
Stages of *Vibrio sp.* colonies infected with Bacteriophages & Progressive Lysis observed on an Agar plate, under Stereo Microscope



Colony 1 in Stage 1: Intact Colony may be infected or yet to get infected.

Colony 2 in Stage 2: Phage infected Colony showing Partial lysis.

Colony 3 in Stage 3: Phage infected Colony Completely lysed, cell contents with multiplied phages spreads out in search of their host.

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JAPFA Comfeed launches its Shrimp and Fish feed

The Indonesia based research oriented JAPFA Comfeed considers Indian aquaculture a potential area for growth and JAPFA is planning to setup its second shrimp feed plant in Andhra Pradesh in 2026 – 2027

Ardi Budiono (center in blue shirt), President and Head of Aquaculture division of JAPFA Group along with others during shrimp feed launching programme at Bhimavaram on 4 April 2025.

Bhimavaram: JAPFA Comfeed India Pvt Ltd launched its Shrimp and Fish feed on 4 April 2025 at the inaugural function held in Bhimavaram, Andhra Pradesh. The company has Vannamei Feed, Premium Sinking Fish Feed, Floating Fish Feed, Lyculture Feed and Mash Fish Feed.

Mr Ardi Budiono, President and Head of Aquaculture division of JAPFA Group was present on the occasion from Indonesia for the launch of the feed in India. "I spent 9 years in India to establish feed for poultry market. Now again I came to India to attend shrimp feed launching function and Indian aquaculture industry is very potential for us," he said. For shrimp and fish feed supply JAPFA is No. 1 in Indonesia. We want to invest in Indian aquaculture sector and benefit the farmers and our company, he said. Our vision is to provide total solution to aquaculture industry, he added.

Amiya Dharmapada Nath, Vice President, JAPFA Comfeed India

Mr Amiya Dharmapada Nath, Vice President, JAPFA Comfeed India Pvt Ltd said that JAPFA is using advanced feed manufacturing technology for Shrimp and Fish feed. JAPFA will create revolution in aquaculture with quality feed manufacturing technology, products and services, and we need farmers support and cooperation, he stated.

JAPFA Comfeed entered into India in 1996 with supply of feed for poultry and cattle sectors with its head quarter at Pune, Maharashtra. The global headquarters of Japfa Comfeed, a major agribusiness company, is located in Singapore, while its origins and primary operations are in Indonesia as PT Japfa Comfeed Indonesia Tbk.

JAPFA Comfeed had initially focused on West Bengal, Odisha, Eastern and Northern Region in the country, and now focusing to expand its business in South India especially in Andhra Pradesh with Fish and Shrimp feed. It has presently its factory at Kharagpur in West Bengal with two lines to manufacture feed for Aquaculture. It has production capacity of 75,000 metric tons and can be extended upto 100,000 MT. The company also has aqua health care products.

JAPFA Comfeed has plans to setup its second Shrimp feed production facilities at Rajahmundry or Bhimavaram surroundings by 2026 – 2027 to give best product and services to aquaculture farmers. JAPFA is not only feed company, but also complete solution based company with seed selection, animal health care products and processing plant in future.

Mr Balaji Surali, Plant Manager, JAPFA Comfeed, Kharagpur, speaking about aqua feed manufacturing quality and assurance said that he has 15 years experience in the industry and has knowledge of choosing best quality raw material. We have 25 years old satisfied customers in poultry, he stated.

Dr Narendra Santika Hartana, shrimp and health manager in JAPFA Comfeed said that he monitors and controls 20 laboratories in Indonesia, and EHP, WSSV and IMNV (It's a significant threat to Penaeus vannamei shrimp aquaculture, causing high mortality rates. IMNV is a double-stranded RNA virus that infects skeletal muscle tissue, leading to white necrotic areas and red discoloration in affected shrimp), he informed.

Dr Erwin, Chief Nutritionist, Mr G. Rambabu, Senior Manager, Sales for South, JAPFA Comfeed based at Bhimavaram, Mr U. Prasanna, Aqua Nutritionist based at Kharagpur, Mr V. Srinivasa Rao, South Head, Sales for Poultry (and now added Aqua division) were present on the occasion.

Gassen Plus

Bon Ammonia and obnoxious Gasses

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

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

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

COMPOSITION:
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BACILLUS POLYMIXA
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Biomed Aqua Care inaugurates its new State-of-the-Art production facilities at Tempalli, near Vijayawada

Top Political dignitaries of Andhra Pradesh took part in the Grand Inaugural Ceremony of Biomed Aqua Care Pvt Ltd new factory

Biomed Aqua Care Pvt Ltd, one of the pioneers in Aquaculture Healthcare market in India for over 20 years, has set up a State-of-the-Art production facilities at Tempalli, Gannavaram, Krishna District, Andhra Pradesh, 30 kms to Vijayawada city. The company hosted a grand inaugural ceremony of the new facilities on 2 April 2025 with Deputy Speaker of Andhra Pradesh Legislative Assembly **Mr Raghu Rama Krishnam Raju** as the Chief Guest.

The event was graced and addressed by special guests **Mr Yarlagadda Venkatrao,** MLA, Gannavaram, **Mr Kamineni Srinivas**, MLA, Kaikaluru, **Mr Datla Buchibabu,** MLA, Muramalla, **Mr Narendra Varma**, MLA, Bapatla.

Dealers and farmers across East, West and Krishna Districts of Andhra Pradesh state graced the event in big numbers and appreciated the State-of-the-Art production facilities created in Biomed factory, and understanding the quality standards that Biomed stood for over the years with its successful growth journey.

Mr Raghurama Krishnam Raju inaugurated the main Admin Block after which he spoke about the cordial relation he has with **Mr P. V Krishnam Raju,** Promoter & Managing Director of Biomed Aqua Care, and how the company has grown over the years. He appreciated the State-of-the-Art facilities in the factory and spoke at length about Aquaculture industry and the immense need for quality players like Biomed in the value chain for Productive Culture for the farmers.

Mr Kamineni Srinivas inaugurated the

P. V Krishnam Raju, Promoter & Managing Director, Biomed Aqua Care Pvt. Ltd.

Today is the happiest and significant day for me with the inauguration of our new production facilities. We started Biomed in a small way in 2006 with four dealers and a few employees, but with a big dream. We worked hard and wish to do the things innovatively with R&D though the growth will be slow with it. Whatever products we manufacture and supply should be truly useful and beneficial to the Shrimp and Fish farmers, and also the dealers should be happy with our products and relationship. Today, we have 35 products, 430 dealers and 100 team members providing sales and technical services all over India. Our company works with principles for a sustainable growth in aquaculture sector, *said Mr P.V. Krishnam Raju, Promoter & Managing Director, Biomed Aqua Care Pvt Ltd in his welcome speech during the inauguration of the factory on 2 April 2025 in the factory premises at Tempalli, 30 Kms to Vijayawada.*

Raghu Rama Krishnam Raju, Deputy Speaker of Andhra Pradesh Legislative Assembly, inaugurating the main Admin Block of Biomed

A View of Biomed corporate office

Kamineni Srinivas inaugurating Probiotic facility and Microbiology Lab in Biomed factory

Yarlagadda Venkatrao inaugurating Corporate Office Block of Biomed

Datla Buchibabu inaugurating Production facilities at Biomed Plant

Narendra Varma, MLA, Bapatla, addressing inaugural function of Biomed

P.V. Krishnam Raju speaking during the inaugural function of Biomed

P. Karthik, Marketing Director, Biomed welcoming

Probiotic facility and Microbiology Lab and admired the efforts being made by the company to bring out the quality inputs to the farmers. Mr Yarlagadda Venkatrao inaugurated the Corporate Office Block, while Mr Datla Buchibabu inaugurated the Production facilities and also spoke about the industry in particular.

Mr Narendra Varma spoke on the occasion and explained about his journey in aquaculture business with hatchery and processing plants.

About the Company:
Biomed Aqua Care Pvt Ltd, formerly known as Biomed Techno Ventures was established in 2003 by **P V Krishnam Raju** with a mission to provide high quality Aqua Health Care products in aquaculture sector. The Company's early days were marked by challenges such as limited resources and small market. However the founder's passion for innovation and customer centric approach helped the company navigate these challenges and establish a strong foothold in the market.

Over the years, Biomed has achieved several significant milestones that have contributed to its growth and success. Some notable achievements of the company include:

Product innovation
The company has developed a range of innovative Aqua healthcare products that cater to the diverse needs of its customers.
Ex: Peptigrow, V-nil, Cryo – PSB, Bio-phage, MPC, Nivaran – WF.

Market Expansion
Biomed has expanded its presence in both domestic and international markets establishing a strong distribution network and partnerships with key stakeholders.
Ex: Marine Technologies

Strong R&D base
Biomed believes that Pond is the laboratory for R&D. The company exclusively allocated 40 acres of aquaculture tanks for doing trials of the new products and this is an ongoing process for the company under the guidance of its Technical Director, **A.V. Durga Prasad**.

Team Biomed developed a strong and dedicated team for technical services and to ensure on time supply of products to the dealers.

Conducting farm edge seminars for farmers and making them aware of problems and suitable solutions for smooth running of culture.

Management Policies & Approach
Under the Young Marketing Director, **Mr P. Karthik's** leadership, Biomed has implemented several key initiatives that have contributed to its consistent growth and made the company stepping into Export market in a strategic way.


Grand Inauguration
Ceremony


Grand Inauguration
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Next-Gen Aquaculture: Combating Vibrio with Smart Diagnostics and Microbial Allies

Dr Rahul G. Warke, Dr Gangadhar M. Warke, Ms Milan Satardekar,
Ms Chitra Adhangale, Dr Girish B. Mahajan*

R&D Director, Microbiology, HiMedia Laboratories Pvt Ltd, Mumbai, India
Chief Managing Director, HiMedia Laboratories Pvt Ltd, Mumbai, India
R&D Manager, Microbiology, HiMedia Laboratories Pvt Ltd, Mumbai, India
Senior Deputy R&D Manager, Microbiology, HiMedia Laboratories Pvt Ltd, Mumbai, India
**Senior Vice President, Microbiology, HiMedia Laboratories Pvt Ltd, Mumbai, India*
**Author for correspondence: 5Dr Girish B. Mahajan, gmahajan@himedialabs.com, M: +91 98216 28179*


Rahul Warke


Dr GM Warke


Milan Satardekar


Chitra Adhangale


Girish Mahajan

"Vibriosis has become a challenge for the growth of the aquaculture industry, and overall disease outbreaks in the sector cause over USD 9 billion losses annually. They lower survival rates, especially in shrimps and finfish. Sustainable solutions include probiotics and advanced diagnostics like PCR, LAMP, and chromogenic media. New media such as HiCrome™ Vibrio Agar enable rapid, accurate detection—crucial for early intervention, biosecurity, and farm resilience".

Introduction: According to the Food and Agriculture Organization (FAO)-2024 report, global aquaculture production surpassed wild fisheries for the first time in 2022, reaching a record 130.9 million tons. With 89% of aquatic animal production used for direct human consumption and are a key nutrition source, the sector plays a critical role in combating malnutrition. FAO projects a 10% increase in aquatic animal production by 2032, reaching 205 million tons, and thus highlights the need to boost sustainable practices particularly through its Blue Transformation strategy to meet future nutritional demands and ensure food security by 2050 1.

Aquaculture facilities represent high-density environments where factors such as the use of live feed, elevated stress levels, and close proximity among aquatic animals facilitate the rapid spread of parasites and bacterial diseases 2. A major contributor to disease outbreaks in aquaculture is the proliferation of Vibrio species, which is a Gram-negative, motile, mesophilic bacteria that are widespread in estuarine, coastal, and aquaculture environments. Their adaptability and presence in diverse aquatic habitats make them a persistent threat to farmed species 3,4. One of the major challenges in aquaculture remains the low survival rate during larval rearing, frequently attributed to bacterial infections such as those caused by Vibrio spp., which are responsible for mass mortalities across a range aquatic species, particularly in Mediterranean aquaculture, posing a significant bottleneck to productivity 4. Consequently, effective monitoring of water quality and microbiological

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indicators throughout the production cycle is essential for the development of sustainable and cost-effective aquaculture practices 1.

Therefore, the objective of this article is to explore emerging strategies against Vibrio threats in aquaculture, focusing on advanced diagnostics and probiotics that support early detection, biosecurity, and sustainable health management.

Pathogenicity and Disease Dynamics of Vibrio spp:

Vibrio-associated diseases represent a major global challenge in both marine aquaculture systems and wild fish populations, contributing to substantial economic losses. The pathogenicity of Vibrio spp. is multifactorial, driven by a complex interconnection between bacterial virulence factors, host susceptibility, and environmental conditions. Clinically, vibriosis in fish is characterized by external skin ulceration, scale drops on the stomach, and caudal fin necrosis (Fig 1). Hemorrhagic septicemia, ulcers, cholera, gastroenteritis, and skin infections are the most common symptoms of vibriosis in humans. Disease onset begins with the critical attachment of Vibrio cells to host tissues, facilitated by adhesins and other virulence determinants, followed by bacterial proliferation and systemic invasion via the bloodstream. Although the host's immune system offers protection, environmental stressors like poor water quality, overcrowding, and salinity or temperature fluctuations can weaken defenses, allowing pathogens to gain the upper hand. This dynamic foster opportunistic infections, enabling Vibrio spp. to establish and disseminate within the host. In shrimp, Vibrio parahaemolyticus strains carrying plasmid-borne pirA and pirB genes are responsible for acute hepatopancreatic necrosis disease (AHPND), a highly virulent condition marked by extensive hepatopancreatic tissue damage and high mortality in early life stages 5.

Economic Impact of Vibriosis in Aquaculture:

Disease outbreaks in aquaculture are estimated to result in economic losses exceeding USD 9 billion annually, accounting for approximately 15% of the global value of farmed fish and shellfish production. Among these, vibriosis remains one of the most economically devastating bacterial diseases, particularly in high-value finfish. In Malaysia, significant outbreaks have been reported in commercially important species such as groupers (Epinephelus spp.) and Asian seabass (Lates calcarifer), leading to elevated mortality rates in both floating fish pens and net-cage culture systems. In Asian seabass farming, vibriosis is estimated to result in economic losses of about EUR 0.19 per kilogram of fish produced, this translates to a 7.06% rise in overall production cost per kilogram of aquaculture species representing a significant negative impact on the profitability of aquaculture operations and limits the potential for sustainable growth in aquaculture6. `

Molecular Diagnostic Tools for Vibrio Detection in Aquaculture

The rise of Vibrio-related diseases like vibriosis and AHPND in aquaculture has highlighted the need for faster and more accurate diagnostics. Traditional methods often lack specificity and speed, especially in detecting asymptomatic infections. Molecular tools now offer a reliable alternative for rapid and precise identification of pathogenic Vibrio strains.

Polymerase Chain Reaction (PCR) is the most widely used molecular method for detecting virulence genes (e.g., toxR, tlh, tdh, trh, pirA/pirB) in Vibrio spp. like V. parahaemolyticus, V. vulnificus, and V. cholerae. It offers high sensitivity, even in low-DNA samples from shrimp, water, or sediment 7. Recent advancements have also introduced Loop-Mediated Isothermal Amplification (LAMP) as a field-friendly alternative to PCR. LAMP assays can be conducted at a constant temperature and do not require sophisticated thermal cyclers, making them ideal for on-site testing in remote aquaculture facilities8. Enzyme-Linked Immunosorbent Assay (ELISA) is commonly used in aquaculture to detect pathogen-specific antigens or antibodies, particularly for viral infections like White Spot Syndrome Virus 9. Emerging tools like biosensors and microfluidic lab-on-a-chip systems are transforming farm-level diagnostics by enabling rapid, portable, and real-time detection of pathogens 10. Additionally, molecular diagnostics can be integrated with chromogenic culture media to form a two-tiered approach which includes enabling initial screening by colony color differentiation followed by genetic confirmation of virulent strains. This combined strategy is particularly effective for detecting AHPND-causing V. parahaemolyticus strains 11.

Advancements in Vibrio Diagnostics: Chromogenic Media-Based Detection

Timely detection of Vibrio species is essential for managing disease outbreaks in aquaculture, given the rapid onset and high mortality of vibriosis. These Chromogenic media use enzyme-specific substrates that produce distinct colony colors, allowing easy differentiation of key pathogens like V. parahaemolyticus, V. vulnificus, and V. cholerae directly from aquaculture samples. This streamlines early screening and enables faster implementation of biosecurity measures 12.

Several chromogenic media have emerged as effective tools for the rapid detection and differentiation of Vibrio species in aquaculture settings. CHROMagar™ Vibrio targets key pathogenic species such as V. parahaemolyticus, V. vulnificus, and V. cholerae, and HiCrome™ Vibrio Agar M1682 offers a cost-effective solution for differentiating pathogenic Vibrio spp., including V. alginolyticus, V. mimicus, V. vulnificus, and V. parahaemolyticus, from food, water, and aquaculture samples, these highly pathogen specific media contains chromogenic substrates and selective agents that support colony differentiation based

Figure 1. Clinical Symptoms of Vibriosis in Shrimps

on enzyme activity, making it well-suited for routine use in hatcheries and diagnostic labs 14. Integrating chromogenic media into routine monitoring boosts early detection and strengthens farm resilience against Vibrio outbreaks, supporting faster, field-friendly, and accurate diagnostics for sustainable aquaculture.

Targeted Diagnostic Tools for Vibrio Surveillance

As Vibrio associated diseases continue to threaten aquaculture productivity, the need for targeted, rapid, and cost-effective diagnostic tools has become increasingly urgent. A Vibrio detection kit: HiVibri-O-Trap Kit (K156) available in the market offers an effective solution for routine surveillance in aquaculture. It identifies key pathogenic species from pond water, sediment, and shrimp tissues using selective chromogenic media for easy visual differentiation. A notable feature of this kit is the inclusion of a chlorine tablet for safe and eco-friendly disposal. With a user-friendly, on-site workflow, it reduces the need for molecular confirmation and supports early disease detection in farms and hatcheries15. Complementing this, some advanced molecular tools allow for sensitive, real-time detection of virulent genes like toxR, tdh, trh, and pirA/pirB, aiding in pathogen load monitoring and outbreak tracking 16 .

The Probiotic Paradigm Shift in Aquaculture:

In recent years, aquaculture has moved from reactive disease treatments to proactive health management, with probiotics emerging as a key strategy. Unlike antibiotics, which can foster resistance and disrupt microbial balance, probiotics offer a sustainable, eco-friendly approach for disease prevention.

Probiotics are live microorganisms that, when administered in adequate amounts, benefit the host by enhancing immunity, improving gut health, and suppressing pathogens. Common probiotic strains used in aquaculture include Bacillus, Lactobacillus, Pseudomonas, Enterococcus, and Saccharomyces. These are applied through feed or directly into the aquatic environment.

Particularly effective in managing diseases like vibriosis, probiotics help reduce mortality, increase survival rates, and enhance stress resilience in high-density systems. As farms shift toward antibiotic-free, bio secure operations, probiotics have become integral to sustainable aquaculture, aligning with both productivity goals and global food safety standards 17.

Conclusion:

As aquaculture continues to expand to meet global nutritional demands, managing bacterial threats like Vibrio has become critical. The integration of rapid diagnostics such as molecular assays and chromogenic media with sustainable tools like probiotics signifies a paradigm shift in aquaculture health management. These innovations not only reduce dependence on antibiotics but also promote early intervention, enhance survival rates, and strengthen farm resilience. Embracing such targeted and eco-friendly approaches is essential for ensuring the long-term productivity and sustainability of aquaculture systems.

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Pond preparation Methods for Successful Aqua farming

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Shrimp Farming in India started since mid 80s which is well established in costal districts of Andhra Pradesh, Tamil Nadu, Gujarat, Maharashtra, Odisha, West Bengal and other states of India. The white leg shrimp (L. vannamei) is the most farmed species since 2012. India has a long coast line of 8848 kms as well as good water resource (rivers, lakes) which helps us to produce more than 8.5 L MT shrimp, 2 Mn MT fish annually. Best management practices (BMPs) for shrimp farming are a standardized set of farming practices to ensure the environmental and financial sustainability of shrimp farming systems.

BMPs include:

1. Pond preparation methods
2. Water quality
3. Removal of organic wastages from pond bottom
4. Fertilization of the pond
5. Biosecurity systems
6. Seed selection
7. Stocking methods
8. Feed management
9. Disease management
10. Harvest methods

Pond preparation methods: Pond preparation includes several activities that must be carried out before each subsequent crop. There is a huge amount of organic matter accumulation in pond bottom during culture period. These sediments should be removed and treated after every crop. In the pond preparation several steps are involved like drying, tilling, ploughing and soil enrichment by using essential nutrients. The main purpose of ploughing / tilling during the pond preparation is to allow the oxygen to penetrate the bottom of pond and accumulated waste. Ploughing helps soil to absorb more oxygen and oxidize the organic matter in the soil.

POND BOTTOM PREPARATION

Two methods are commonly used to clean pond bottom after a production cycle.

1. Pond Drying:

In this method, after the final harvest, the pond bottom is allowed to dry and oxidize, the organic component sleft-over in the pond after the previous culture. The pond bottom should be dried at least 7-10 days until cracks appear to a depth of 25-50 mm. After drying, the waste should be removed

2. Wet Method:

In this process the waste remain after harvest is washed away without drying (flushing the water 2 - 3 times or jet flushing). This method is only applicable during monsoon or rainy season.

Out of above two practices dry method is commonly used.. Sludge removal is required in the ponds stocked with high stocking density or accumulation of high organic matter on the pond bottom or disease outbreak in the previous crop. Thus, the sludge should be completely removed and disposed outside the ponds. After removal of the sludge completely the pond should be ploughed (tilling) thoroughly in both ways (i.e. horizontally and vertically), then the soil is allowed to dry on 2 - 3 sunny days for better oxidation of black soil or organic matter, this allows diffusion/removal of obnoxious gases.

Liming

- After the waste is removed, the pond should be filled with water to flush out fine debris and to check the pH of the water. This water should be left in the pond overnight and then drained / pumped out. This process should be repeated until the pH of the water remains above 7.0. After the final flush, the soil pH should be checked, and lime should be applied immediately.

pH	Ag. lime ($CaCO_3$)	Hydrate lime $Ca(OH)_2$
7.0	0.65	0.33
6.5	0.9	0.45
6.0	1.15	0.58
5.5	1.40	0.70
5.0	1.65	0.83
4.5	1.90	0.95

- The lime is evenly spread over the entire pond bottom with little moisture and up to the top of the dike. It is left undisturbed for 10-15 days. A large proportion of the lime needs to be applied along the feeding areas and on the wet portions of the pond. Finally, the pond should be filled with brackish water up to 30 cm and drained after 3 days

3. Manuring, fertilisation and filling:

- Application of dry cattle dung/ Vermicompost should be done, depending upon the organic carbon content (1.5%) of the soil before re-filling the pond to 100cm.
- Additionally, 15 cm of water should be added daily until the pond water depth reaches 100 cm. Inorganic fertilizer (urea and Single superphosphate) can the applied depending upon the available nitrogen and phosphorous in the soil.
- The fertilizers are dissolved in water and evenly spread over the

Table 1: Amount of Fertilizers to be Applied

Available N2 in soil (mg/100g soil)	Urea to be added(kg/ha)	Available Phosphorus in soil (mg/100 g soil)	Single phosphate to be added (kg/ Ha)
12.5	100	1.5	100
25	50	3	50
50	25	6	25

surface of the water in the pond. The colour of water will become brown with a yellowish hue indicating that the pond is ready for stocking the seed. The pond water will have a Secchi disc reading around 40 cm, stable pH and rich algal bloom of brown colour.

4. Fouling associated with pond bottom and water quality:
External fouling found in the reared shrimp is usually associated with deterioration of soil quality in the pond bottom or the water Quality. The priority, therefore, is to ensure a clean environment for the shrimp to live and grow.

The most used compound for this purpose is triple salt compounds.

Water quality
Water quality is the most important element to achieve a successful crop. The entire culture is dependent on this aspect and to maintain a good water quality, we must adopt following methods.

1. Maintain reservoir for water treatment.
2. Use double layered 60 mesh to avoid unwanted carriers and use 80 mesh below the inlet.
3. Use good quality bleaching powder (35% or 70%) for treatment, do not use any pesticide and insecticide.
4. Use triple salt compounds like **Aqua Care 3D** to avoid pathogens in water.
5. To maintain healthy plankton bloom, apply fermented juices with yeast and apply good quality probiotics like **Aqua Care Control**.
6. Chain dragging is also recommended when healthy bloom has not happened.
7. Use good quality minerals to maintain ionic balance in the water system especially calcium, magnesium, and potassium like **Aqua Care Mineral Balance**.

5. Biosecurity
Biosecurity in shrimp farming involves stocking disease free seed, pond preparation, water screening, prevention of entry of disease carriers, personal hygiene, and sanitation. Biosecurity plays a pivotal role in farming to maintain disease free environment.

1. To control carriers (Burrowing) use crab fencing with good quality nylon & lDPE materials.
2. Use bird fencing to avoid birds and its droppings preferably red and blue coloured threads.
3. Farming area should be clean and maintain sanitization dip at entry and exit areas.
4. Clean farm equipment and utensils regularly with potassium permanganate or any hypochlorite solutions to avoid cross contamination.
5. Maintain personal hygiene of the farm workers.

By adopting all these techniques, farmer can enhance their economic conditions

Proper pond preparation and adherence to best management practices are the foundation for successful aquaculture. Each step ensures optimal conditions for shrimp growth and sustainability. Regular monitoring of soil and water quality, combined with the use of modern technology and biosecurity measures, can significantly enhance productivity while minimizing disease risks. By following these methods, farmers can achieve healthy crops and maximize profitability in shrimp farming

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Advancing Sustainable Aquaculture: The Role and Benefits of Millets as Feed for Fish

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Introduction

Aquaculture, or the cultivation of aquatic creatures including fish, crustaceans, and mollusks, has become an important part of the world food supply. Overfishing, environmental deterioration, and the need for sustainable feed supplies are all issues for the seafood business as demand grows (Jacquet & Pauly, 2007). Millets, a kind of small-seeded grass, have emerged as a viable answer to these problems. The world is commemorating "2023" as "International Millets Year" because the Food and Agriculture organisation and the United Nations have designated 2023 as "International Year of Millets," or IYM2023, to raise awareness about the health and nutritional advantages of millets. The Indian government suggested UN to declare 2023 as the International Year of Millets. Keeping this in mind, millet's participation should be raised in fish farming, where the fish's health is good, or it can acquire nutritious food. This article investigates millets' function and benefits as a sustainable choice for the aquaculture business as well as a nutritious feed source for fish.

Millets: An Overview

Millets, sometimes known as "smart crops," have been farmed for millennia in many parts of the world. They are a group of small-grained, annual cereal grasses that contain numerous unique botanical species. They are drought-resistant and require fewer inputs than conventional staple crops like rice and wheat. The majority of millets thrive on low-fertility soils. Millets such as Pearl millet may be cultivated on sandy soils, while finger millet thrives in saline soils. Barnyard millet flourishes in low-fertility soils where other crops, such as rice, struggle to grow. Many of them are also planted to improve soil quality. In dry-land India, impoverished farmers hold very poor lands. Millets are the only crops that can support agriculture and food security in these regions. They can grow well using farmyard manures and home-made bio fertilizers as nutrients, so synthetic fertilizers are avoided. Chemical fertilizers are not required for their growth, and they are completely pest-free when grown in traditional local landraces and under ecological conditions. These are high in critical elements including fiber, vitamins, minerals, and antioxidants, making them an excellent source of nutrition for both people and animals (Amadou et al., 2013).

- **Millets are rich in proteins, essential amino acids, fiber, and micronutrients**
- **Drought-resistant, require less water, and thrive in marginal soils, making them an eco-friendly feed option**
- **High fiber and antioxidants support gut health and disease resistance.**
- **Cheaper and locally available, reducing dependency on expensive feed components.**

Millets in Aquaculture: The Role and Usage

Millets, a kind of small-seeded, drought-resistant grain, have emerged as a potential and long-term choice in aquaculture. Because of their ability to address both environmental and nutritional issues, their use in this sector has gained growing attention (Cruz-Suarez et al., 1994). Millets provide a twofold benefit by serving as an alternate feed source for farmed aquatic creatures while also diversifying the cropping landscape. The aquaculture industry may reduce its reliance on conventional feed materials such as fishmeal and soy by integrating millets into aquafeed formulations, thereby reducing overfishing and deforestation. This change not only promotes environmental conservation but also helps to sustain global fish output in order to fulfill rising seafood demand. Millets stand out as a useful asset as aquaculture pursues sustainable techniques, demonstrating their potential to revolutionize the industry's feed practices while supporting a more ecologically balanced approach to seafood production (Jayaprakash et al., 2022).

1. **Sustainable Aquafeed:** The use of millet as a sustainable aquaculture feed offers a viable answer to the worldwide aquaculture industry's issues. Aquafeed has traditionally depended primarily on fishmeal and fish oil obtained from wild fish sources. This activity is damaging the ecosystem by declining the available natural fauna and leads to overfishing. Millets provide a plant-based source of protein and energy for fish diets, making them an environmentally beneficial choice. Furthermore, moving millet from human consumption and into fish production might improve food security. Accepting millet as a feed choice represents a gradual transition towards a more balanced and environmentally friendly aquaculture practice (Sunil et al., 2022).
2. **Reduced Pressure on Ocean Ecosystems:** Aquafeed made from millet lessens the demand for fishmeal, which helps to relieve pressure on marine ecosystems.

We can minimize demand for fishmeal obtained from wild-caught species by adding millets into fish diets, relieving pressure on overexploited fish populations and enabling them to recover. This strategy not only helps to conserve ocean species, but it also encourages a more balanced and harmonious connection between aquaculture and the natural environment.

3. **Economic Viability:** Millets are inexpensive to grow because of their resilience and minimal resource requirements (Gupta et al., 2023). This can result in lower feed production costs for aquaculture farmers, increasing the economic feasibility of fish farming operations because feeding and feed-based components account for 50-60% of farm reared animal expenditures.
4. **Nutritional Benefits:** Millets provide a well-balanced nutritional composition that is excellent for a wide range of fish species. They may be processed into high-quality pellets that provide vital amino acids, carbs, and lipids for development and wellness (Simon & Getachew, 2018).

Benefits of Millet-Based Aquafeed

Improved Fish Health: Millets are high in dietary fiber, which assists digestion and supports intestinal health in fish. This can result in fewer digestive diseases and greater general immunity, which can contribute to the survival of farm-raised aquatic animals (Nageswari et al., 2022).

Enhanced Growth Performance: According to research, millet-based diets can sustain comparable growth rates in fish as typical fishmeal-based diets. This lends credence to the claim that millets can serve as a suitable alternative for traditional aquafeed elements. Several studies may provide a proof-based document that connects with good growth in a shorter time period than other traditional techniques of feeding the fish (Nigam et al., 2023).

Diverse Aquaculture Systems: Feed made from millet may be used in a variety of aquaculture systems, including freshwater and brackish water ponds, recirculating aquaculture systems (RAS), and cage cultures and also used in harmony with biofloc based fish farming system to enhance the floc of cultured striped catfish (Pangasianodon hypophthalmus (Nageswari et al., 2022). Because of the availability of diverse nutrients, they may effectively meet the nutritional needs of carnivorous, omnivorous, and herbivorous fishes.

Climate Resilience: Using millet-based feed in aquaculture improves climate resilience (Davis et al., 2023). Millets' capacity to grow in a variety of climates and marginal sites makes them a vital asset in guaranteeing human and animal food security in the face of climate change. Climate resilient aqua farming is currently popular in order to lower the carbon footprint, which promotes sustainable fish production while limiting risks associated with unexpected weather patterns, resulting in a more robust and secure aquaculture system.

Challenges and Future Prospects

While millets have promise benefits as aquafeed, issues such as feed formulation, palatability, and aquaculture sector adoption persist. The incorporation of millets into the aquafeed business poses both obstacles and opportunities for the future. To begin with, a lack of standardized processing processes and information gaps about millet's appropriate inclusion levels in aquafeed might stymie its efficient use. Overcoming these obstacles necessitates extensive research and development to optimize millet-based feed formulations for various fish species and developmental stages. Collaboration among academics, aquaculture practitioners, and feed manufacturers will be critical in addressing these problems, developing new processing processes, and implementing effective quality control procedures. Furthermore, commercial acceptance and customer preferences for fish bred on millet-based diets may influence its uptake. However, the future has a lot of promises. Millets' drought resistance and minimal resource needs are compatible with sustainable aquaculture practices, lowering reliance on conventional fishmeal. Millets are gaining popularity nowadays as an environmentally friendly alternative, reducing pressure on marine habitats and increasing diverse feed sources. By overcoming these obstacles via research, technology, and consumer education, we can build a more resilient and environmentally responsible aquafeed sector that contributes to both food security and environmental sustainability.

Conclusion

The aquaculture business is at a crossroads, where sustainability and resource efficiency are critical. Millets provide an innovative and environmentally beneficial alternative by serving as a sustainable fish feed source. They are a vital actor in influencing the future of aquaculture because to their nutritional advantages, economic feasibility, and favorable influence on ocean habitats. As global seafood consumption rises, the negative consequences of overfishing and resource depletion on marine ecosystems become increasingly visible. Millets, with their nutritional value, climate resistance, and low environmental effect, offer a solution that is consistent with the principles of responsible aquaculture. While processing techniques, customer acceptability, and standardization are all issues that must be addressed, the potential advantages are enormous. Millet-based feeds can help to reduce pressure on ocean ecosystems, enhance food security, and contribute to a more balanced and environmentally sound approach to aquaculture by lowering reliance on restricted marine resources. As we traverse a future marked by changing climates and diminishing resources, the incorporation of millets into aquafeed is an important step towards building a sustainable and resilient global food system.

References can be given..

Coloured Bread Crumbs:
Natural Plant Extracts Based Crumbs for Coated Fish and Shellfish Products

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Highlights

- Coated fish products has very high potential in both domestic and export market.
- Natural extracts can be added to bread crumbs to produce different coloured coated fish and shell fish products.
- Availability of indigenous ingredients is very crucial for the development of coated fish and shellfish industry.

Fish is considered as 'poor peoples rich food' as it provides the essential nourishment, especially quality proteins and fats (macronutrients), vitamins and minerals (micronutrients). Proteins are important for growth and development of the body, maintenance and repairing of damaged tissues and for production of enzymes and hormones required for many body processes. The importance of fish in providing easily digested protein of high biological value is well documented. On a fresh-weight basis, fish contains a good quantity of protein, about 16-22%, and contains all the eight essential amino acids including the sulphur-containing lysine, methionine and cysteine. Fish contributes up to 180 kcal per capita per day, but reaches such high levels only in a few countries where there is a lack of alternative protein foods grown locally or where there is a strong preference for fish (examples are Iceland, Japan and some small island states). More typically, fish provides about 20-30 kcal per capita per day. Fish proteins are essential in the diet of some densely populated countries where the total protein intake level is low, and are very important in the diets of many other countries. Worldwide, about a billion people rely on fish as their main source of animal proteins. Dependence on fish is usually higher in coastal than in inland areas. About 20% of the world's population derives at least one-fifth of its animal protein intake from fish, and some small island states depend almost exclusively on fish. Among the animal's proteins, fish protein is one of the cheapest animal protein sources and it accounts for about 40% of the total animal protein intake of an average person in the tropics (Sadiku and Oladimeji, 1991). However, the protein intake from fish is not uniform throughout the world.

Development of value added product is a strategy to enhance to fish consumption by attracting consumers. Value addition in general, is the process of changing or transforming a product from its original state to a more valuable state. A broad definition of value addition is to economically add value to a product by changing its current place, time, and form characteristics to the market place preferences. Value addition is the enhancement added to a product or service before the product is offered to customers. Value addition can be accomplished in a number of different ways, but for fishery products the most important one is the innovative approach. Innovation focuses on improving existing processes, procedures, products, and services or creating new ones. Often, successful value-added ideas focus on very narrow, highly technical, geographically large markets where competition is sparse. Innovative value-added activities developed on fish processing factories or at research stations are sources of national growth through changes either in the kind of product in the technology of production. By encouraging innovative ideas, adding value becomes a reality. Value-addition should start with intelligent market information on customers and competitors to make sure an opportunity exists. A recipe for success is to begin with a basic commodity and add a healthy dose of ingenuity to create a product desired by consumers that also has a valuable edge on the competition.

Coated fish and shellfish product is one of the important category of product from India, which is manufactured and marketed in domestic as well as export markets. Coated foods are included in the value added products because the process of coating with batter and breadcrumbs increases the bulk of the product thereby reducing the cost element and further enhances the value of the product. Fish balls, fingers, fish portions, fish cakes etc. are the staple breaded seafood products while breaded shrimp, lobster, oyster, scallops etc. cater to a luxury market and are widely used in restaurant trade. Global demand for value added products is increasing and fast Food sector will reach $743,859 million

Fig 1. Natural extract pigment solution for coating bread crumbs (Left to right: Extracts of carrot, beet root, turmeric and spinach)

Bread crumbs coated with natural extracts

Fig.2. Bread crumbs coated with natural extracts (Top to bottom: Bread crumbs coated with extracts of turmeric, beet root, spinach, carrot and bread crumbs coated without any extract)

Fig.3. Shrimp based breaded and battered products with natural pigments

by 2025. Value addition of fish is very poor in India resulting very low value realization. Raw fishery products mainly in frozen form is exported to many countries, where in they reprocess into variety of value added products and re-export to get better value. Although India exports nearly 10% fish produced to different countries, only 5 – 6% of the total export earnings is accounted to value added products (www.mpeda.gov.in). There exists a very good prospects for this high value product from India, provided following measures are taken. Establishment of required infrastructure in both research institutes and in the industry especially cold chain across value chain, value added products line, increasing importance to develop indigenous machineries as most of the machineries used in the Seafood processing industries are very high cost ones which are imported from neighbouring or European countries. Availability of Indian made quality machineries should be ensured through Make in India scheme to cater to seafood industry including coated products sector. Creation of suitable promotion schemes especially for value added products to enhance value realization and regular skill development programs on value added products. Apart from this, development of ingredient sector for seafood processing is another important aspect as most of them are imported currently. Bread crumbs forms one of the important ingredient for coated fish products.

In coated products seafood is coated with another food stuff, normally batter and bread crumbs mainly to enhance acceptability, taste and appeal, improve texture. This acts as a barrier to moisture loss from the product, helps in preserving natural flavor and taste. The coating can also be used as a carrier to enhance nutritional quality by fortification and by coating with natural pigments. Battering and breading forms major components of coated products. Market value for the batter and breader premixes were USD 1265.2 Million in 2018 and is expected to reach USD 2058.2 Million by 2026. They are commonly used in deep-fried foods including seafood and the products prepared with these are light, crisp, and flavorful. They bestow flavor, texture, and color to meat products and enhance the overall cooking process. The demand for the coated product is mainly due to rise in consumption of meat, fish, seafood, and poultry. Apart from this, there is an increasing demand for ready-to-cook meals and processed meat products. Adoption of fast food culture coupled with the rise in the number of fast-food outlets and quick-service restaurants around the globe is another reason for augmenting the growth of this sector. Bunge Limited (US), Associated British Foods (UK), McCormick & Company (US), Kerry Group PLC (Ireland), Cargill, Incorporated (US), Archer Daniels Midland Company (US), Newly Weds Foods, Inc. (US) are the major global players in battering and breading premixes. Continued efforts to incorporate health aspects in these deep-fried food products will be a major driving force to expand its market potential.

Dry breadcrumbs are made from very dry bread which has been baked

or toasted to remove most of the remaining moisture, to a level up to 3 – 6%, and may have a sandy or even powdery texture. They can be used to make a crisp and crunchy coating for fried foods. Japanese style (oriental / panko), home style, cracker meal or traditional type and extruded crumbs are the different types of bread crumbs commonly used. Normally they are either light yellow or dark yellow to orange in colour. Availability of different coloured bread crumbs will enhance the acceptance of these coated fish products among consumers including in children. This will help in enhancing the consumption of fish which is one of the target set by Govt. of India under Pradhan Mantri Matsya Sampada Yojana (PMMSY) (https://pmmsy.dof.gov.in/). Attractive food colour will become a decisive factor in food product acceptance. Colour of the product is the first and foremost sensory attribute perceived by the consumer which play a crucial factor in purchase of food product. The traditional colour of bread crumbs can be altered to attractive green, orange, deep red, yellow using plant extracts like leafy vegetables, carrot, beet root and turmeric. These plant extracts can be extracted using water based techniques without any solvents, hence they will be safe for food applications. They can be sprayed or coated using manual or mechanical devices and dried to a moisture content of less than 10%. These plant extracts applied will be retaining the colour up to a period of 9 months under normal storage conditions and can be used for coating fish and shellfish products to obtain attractive coated products. Apart from imparting colour, these extracts serve as antioxidants which improves the quality of the coated fish products. These different coloured extracts can be prepared using locally available edible plants and vegetables. The know-how for this is readily available with ICAR-CIFT, Kochi, which can be adopted by any industry.

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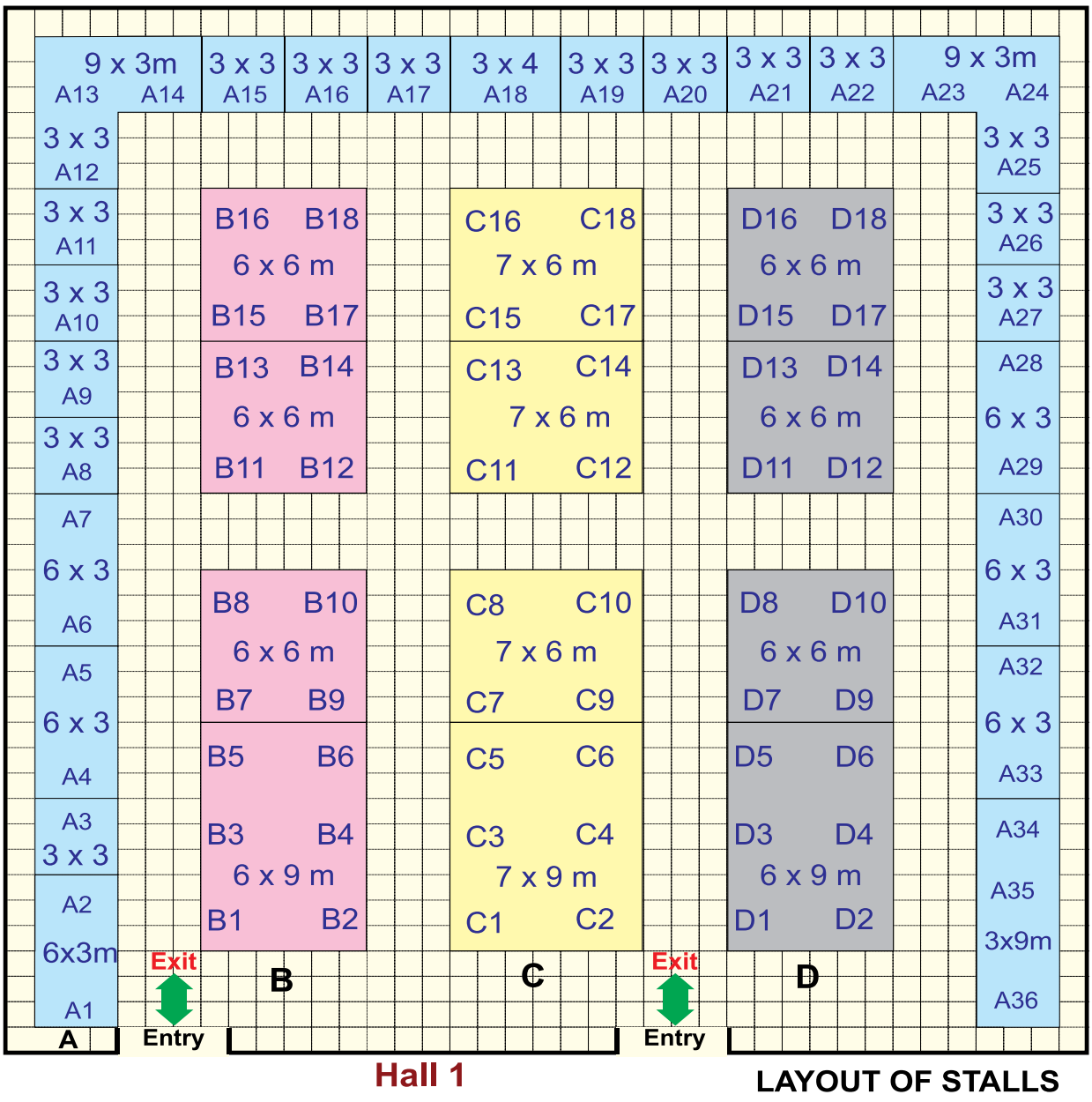

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